

Closing the Aboriginal Education Gap in Canada: The Impact on Employment, GDP, and Labour Productivity

Matthew Calver
*Centre for the Study of Living Standards*¹

ABSTRACT

Despite improvements between 2001 and 2011, Canada's Aboriginal population continues to underperform in the labour market. The Aboriginal educational attainment gap is often seen as the major source of these disparities. Using data from the 2011 National Household Survey, projections of Aboriginal population growth, and forecasts of aggregate economic conditions, we estimate the economic impact of closing the educational attainment gap by 2031. We find that the benefits of achieving such a feat could be very large, both for the Aboriginal population and for the country as a whole. Closing the education gap would raise Aboriginal employment by 90 thousand workers, GDP by \$28.3 billion (2010 dollars) and Aboriginal employment income by \$11,236 per worker in 2031. Labour productivity would increase by 0.03 percentage points per year over the 2011-2031 period. Assuming improvement occurs at a constant pace, we estimate that the cumulative gains to Canadian GDP would be as large as \$261 billion (2010 dollars) over the 2011-2031 period.

THE ECONOMIC AND SOCIAL outcomes of Canada's Aboriginal people lag far behind those of the population more generally. This situation is costly not only for the Aboriginal population, but for the country as a whole.

Canada has struggled to keep up with other developed countries in terms of labour productivity performance in recent years. Between 2000 and 2014, labour productivity growth in the Canadian business sector was about 1.0 per cent annually, as measured by GDP per hour. This was far below the

rate of 2.2 per cent annually in the United States over the same period and the rate of 1.5 per cent experienced in Canada between 1980 and 2000.² The low education levels of Canada's Aboriginal population offer an opportunity to improve our labour productivity performance by increasing the human capital of Aboriginal Canadians. Greater levels of educational attainment for Aboriginal Canadians would also boost employment rates. Both higher productivity and higher employment rates increase output.

1 Matthew Calver is an economist with the Centre for the Study of Living Standards (CSLS). This article is an abridged version of Calver (2015) which is publicly available on-line. The author would like to thank Andrew Sharpe, Don Drummond, Bert Waslander, David Johnson, and officials from Aboriginal Affairs and Northern Development Canada (AANDC), particularly John Clement, for comments. The CSLS gratefully acknowledges financial support from AANDC. Email: matthew.calver@csls.ca

2 Author's calculations using data from the CSLS Aggregate Income Trends: Canada vs. United States database, Table 6, available at www.csls.ca/data/ipt1.asp.

Previous research conducted at the Centre for the Study of Living Standards (CSLS) examined the potential economic benefits of eliminating the educational attainment gap. Sharpe et al. (2007) estimated that if the Aboriginal population achieved the same levels of educational attainment by 2017 as observed in the non-Aboriginal population in 2001, this would result in a cumulative increase in GDP of \$71 billion (2001 dollars) over the 2001-2017 period. A follow-up study (Sharpe *et al.*, 2009) estimated that the benefits from closing this gap over a longer period (2001-2026) could be as high as \$179 billion.

This article builds upon these studies to provide new estimates of the benefits of closing the Aboriginal educational attainment gap between 2011 and 2031. The methodology of these previous studies is extended to control for several important demographic characteristics (age, sex, and province/territory). This study also projects improvements in Aboriginal and non-Aboriginal education between 2011 and 2031 based upon recent trends in educational attainment (rather than assuming education levels remain unchanged). Calver (2015) provides breakdowns of the estimated benefits for several subpopulations of interest (sex, province/territory, and Aboriginal identity group).

This article is organized as follows: the first section provides descriptive information on the size of the Aboriginal education gap in 2011 and how it changed since 2001; the second section discusses how education affects individual and aggregate economic performance; the third section documents the educational attainment gap in Canada and how it relates to labour market gaps; the fourth section presents the data and

methodology which are used to estimate the benefits of closing the education gap by 2031; the fifth section presents our estimates; the sixth section concludes.

The Aboriginal Labour Market Gaps

On average, Aboriginal people in Canada are less likely to be working than non-Aboriginal people and, if they are working, Aboriginal people tend to earn lower incomes. We will briefly describe the labour market gaps facing the Aboriginal population based on data collected from the 2011 National Household Survey (NHS).

We define the gaps in both absolute and relative terms. We define the absolute gap facing the Aboriginal population as the difference between the values for the non-Aboriginal and Aboriginal populations. We define the relative gap as the absolute gap expressed as a percentage of the non-Aboriginal value.

Table 1 presents the gaps for the national population aged 25-64 in 2011.³ We restrict attention to this age group to exclude the working age population which is still in school (education is ongoing for this group and many remain out of the workforce). This allows us to avoid some of the differences arising from the fact that the Aboriginal population is relatively young. We also exclude those above retirement age, as many of those above the age of 65 are no longer in the workforce.

The gap between the two populations in terms of employment rates is striking. Only 62.5 per cent of the Aboriginal population aged 25-64 was employed in 2011, 13.3 percentage points less than the 75.8 per cent non-Aboriginal employment rate. This employment rate gap

3 Note that the estimates presented in Table 1 have not been adjusted for differences in characteristics between the Aboriginal and non-Aboriginal populations. Much of these gaps can be explained by demographic and geographic differences between the Aboriginal and non-Aboriginal populations. In particular, the Aboriginal population tends to be younger and more concentrated in rural areas. Aboriginal labour market gaps persist even if many of these observable characteristics are controlled for. See, for example, Pendakur and Pendakur (2011).

Table 1**Aboriginal Labour Market Outcomes and Gaps, Ages 25-64, Canada, 2011**

Labour Market Outcome	Aboriginal	Non-Aboriginal	Absolute Gap (Percentage Points)	Relative Gap (Per Cent)
Employment Rate (per cent)	62.5	75.8	13.3	17.5
Participation Rate (per cent)	71.7	80.6	8.9	11.0
Unemployment Rate (per cent)	12.8	6.0	-6.8	-113.3
Average Employment Income of Full-Year Full-Time Workers (2010; 2010 Constant Dollars)	\$50,928	\$60,296	\$9,368	15.5

Source: Author's calculations using data from the National Household Survey, 2011.

arises because fewer Aboriginal people are active in the labour force and those who are in the labour force are less likely to be working.

The absolute labour force participation rate gap was 8.9 percentage points in 2011: 71.7 per cent of the Aboriginal population was working or seeking work compared to 80.6 per cent of the non-Aboriginal population. While this is a sizeable gap, it is the smallest in relative terms of the four gaps we consider. The Aboriginal unemployment rate of 12.8 per cent in 2011 was more than double the non-Aboriginal unemployment rate of 6.0 per cent.

Lastly, we consider the employment income earned by those who are employed. To avoid some potential differences arising due to the number of hours worked, we restrict our attention to the incomes of full-year full-time (FYFT) workers.⁴ The average employment income of a FYFT Aboriginal worker aged 25-64 was \$50,928 in 2010 compared to an average employment income of \$60,296 in the same category of non-Aboriginal workers. The gap is \$9,368, which is 15.5 per cent of non-Aboriginal earnings from employment. To the extent that this employment income gap reflects differences in labour productivity, it implies that Aboriginal

workers are lowering Canadian labour productivity on average.

The good news is that these gaps appear to be shrinking over time. Table 2 shows how absolute gaps have changed between 2001 and 2011. With the exception of the labour force participation gap, which only shrank 0.3 percentage points, significant improvements occurred. The employment rate gap was reduced by 3.3 percentage points, the unemployment rate gap by 4.5 percentage points, and the FYFT average income gap by \$1,962 dollars.

These diminishing gaps are encouraging, but should be viewed cautiously. Demographic developments and geography may explain some of these improvements.⁵ The samples underlying the Aboriginal and non-Aboriginal populations in the 2001 Census and 2011 National Household Survey have also changed, as a significant number of individuals changed their reported Aboriginal identity between 2001 and 2011. This phenomenon is known as intragenerational ethnic mobility.⁶ If the large number of individuals who reported a non-Aboriginal identity in the 2001 Census and changed their reported identity to Aboriginal in the NHS had

4 Full-year full-time workers are those who worked between 49 and 52 weeks in the previous year and worked 30 hours or more for most of those weeks.

5 For example, the Aboriginal population is relatively concentrated in the western provinces which thrived economically during the oil boom.

6 For an analysis of Aboriginal ethnic mobility, see Caron-Malenfant *et al.* (2014)

Table 2
Changes in Aboriginal Labour Market Gaps, Ages 25-64, Canada, 2001-2011

Labour Market Outcome	Absolute Gap 2001	Absolute Gap 2011	Absolute Change in Absolute Gap, 2001-2011 (Percentage Points)	Relative Change in Absolute Gap, 2001-2011 (Per Cent)
Employment Rate (per cent)	16.6	13.3	-3.3	-19.9
Participation Rate (per cent)	9.2	8.9	-0.3	-3.3
Unemployment Rate (per cent)	-11.3	-6.8	4.5	-39.8
Average Employment Income of Full-Year Full-Time Workers (2010 Constant Dollars)	\$11,330	\$9,368	-\$1,962	-17.3

Source: Author's calculations using data from the 2001 Census and the 2011 National Household Survey.

average non-Aboriginal characteristics, this will have resulted in a reduction in the gap. Furthermore, there are also concerns about selection arising from the replacement of the mandatory long form census with an optional survey.⁷

Even if all of this improvement were real, it is clear that the current level of Aboriginal labour market performance remains unsatisfactory. We will focus on one specific factor, education, which is frequently discussed in policy circles as a major source of these disparities.

Education and Labour Market Outcomes

The link between educational attainment and individual labour market outcomes has been well established in the literature.⁸ The economic benefits of having a more educated population have also been documented at more aggregate levels, particularly in the context of economic development.⁹ Notably, the aggregate national benefits are often found to exceed the total private benefits captured by individuals,

suggesting that there are significant positive externalities associated with education.

Why does education have such a positive impact on individual economic outcomes? There are two major explanations.

The first explanation is that education raises human capital through developing knowledge, cognitive skills (math, literacy, and reasoning) (Ishikawa and Ryan, 2002; Heckman, 2006), and non-cognitive skills (e.g. interpersonal skills, organization skills) (Brunello and Schlotter, 2011). These improvements in human capital make the workforce more productive. This is typically the stated purpose of education.¹⁰

The second explanation is that the role of education is to screen individuals by signaling certain traits or abilities (Spence, 1973; Layard and Psacharopoulos, 1974). This view suggests that the value of a credential is not derived from what individuals have learned in earning it so much as from the evidence it provides of pre-existing attributes which allowed the individual to earn the credential

7 For example, if very high income and very low income individuals systematically underreported in the NHS, and if there are relatively more very low income Aboriginal people and very high income non-Aboriginal people, the income gap may appear to be reduced as a result of the changed methodology.

8 Recent papers which have evaluated the private returns to investments in education include Boudarbat *et al.* (2010), Dickson and Harmon (2011), and Li *et al.* (2012).

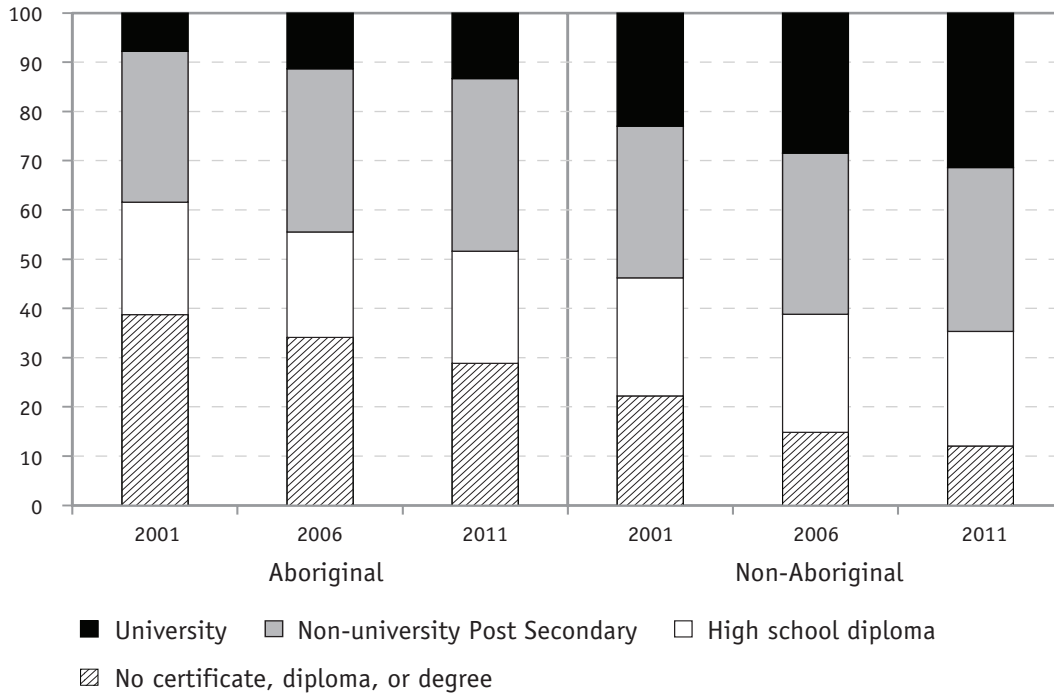
9 See, for example, Barro (2001), Cohen and Soto (2007), Shapiro (2006), and Aghion *et al.* (2009).

10 Hu (2014) analyzes the relationship between cognitive skills and Aboriginal wages and employment using 2012 Programme for International Assessment of Adult Competencies (PIACC) microdata. Hossain and Lamb (2012) find increased human and social capital raise Aboriginal employment incomes.

Chart 1

Highest Level of Educational Attainment, Ages 25-64, Aboriginal and Non-Aboriginal Populations, 2001, 2006, 2011

(per cent)



Source: Author's calculations using data from the 2001 Census, 2006 Census, and 2011 National Household Survey.

(hard work, perseverance, etc.). Under this theory, education is valuable because it assists firms in identifying productive workers. There is some empirical evidence supporting this view of education (Bedard, 2001; Hussey, 2012).

There is likely some truth to both the human capital and signaling approaches to education. Degrees in some fields, such as medicine or engineering, are valued largely for the knowledge and technical expertise

developed through the program, while a general arts education may be valued more as a signal of general ability. Nonetheless, the distinction between these two views is worth considering because the underlying reason that education is valuable is important to forming sound education policy.¹¹

While the signaling and human capital approaches may offer different recommendations regarding how to fix the problem, they

11 If education is valuable purely because it produces human capital, the emphasis should be on improving the quality and availability of Aboriginal education and removing impediments which are preventing Aboriginal students from acquiring these skills. If education is purely a signal, then the actual skills development and quality of education may not be so important. If Aboriginal youth possess the desired traits but employers are not receiving the correct signals, then changes to the education system should be made to address this. On the other hand, if Aboriginal youth are not earning the credentials that provide the correct labour market signals because they lack the desired traits, then the solution is to focus on the underlying social or cultural issues which are not producing these traits among the Aboriginal population rather than changing the education system itself. Eliminating the education gap without fixing underlying problems may be socially undesirable if education is primarily a signal – this would amount to lowering the standards required to earn a credential. This would reduce the quality of the signals, impeding efficient matching in the labour market and worsening average economic performance.

agree as to what the final outcome should look like: Aboriginal individuals should have a similar level of educational attainment to similar non-Aboriginal individuals on average.

Finally, we should note that the benefits of education extend far beyond labour market performance. Education is also associated with better health, reduced crime, political engagement (Lochner, 2011), and better financial decisions (Lusardi and Mitchell, 2013).

Aboriginal Education

Chart 1 illustrates the educational attainment distributions of Canada's Aboriginal and non-Aboriginal populations aged 25-64 in 2001, 2006, and 2011. Two major facts are evident from this chart. First, the Aboriginal population tends to be less educated. The differences arise largely at the extreme ends of the distribution. Only 12.1 per cent of the non-Aboriginal population lacked any certificate, diploma, or degree in 2011 compared to 28.9 per cent of the Aboriginal population. At the same time, only 13.4 per cent of the Aboriginal population held a university credential compared to 31.4 per cent of the non-Aboriginal population.

The second striking feature is that both Aboriginal and non-Aboriginal education have been rising over time. For example, the bottom category (no certificate, diploma, or degree) fell

from 38.7 per cent of the Aboriginal population in 2001 to 28.9 per cent in 2011.¹²

For assessing overall changes in educational attainment it is convenient to adopt a summary measure. We use average years of educational attainment, reported in Table 3, as our summary measure. We have constructed the number of years of educational attainment for each of twelve distinct educational attainment categories based upon the average number of years of schooling of all individuals (Aboriginal and non-Aboriginal) possessing that credential in 2001.¹³ This measure has been constructed using the Census and National Household Survey Public Use Microdata Files (PUMFs).

In 2011, average years of educational attainment for the Aboriginal population aged 25-64 was 12.7 while it was 14.1 years for the comparable non-Aboriginal population. This amounts to a gap of 1.4 years. This gap is largely unchanged from the gap of 1.3 years observed in 2001, despite the significant increase in Aboriginal educational attainment from 11.9 years to 12.7 over the period. This large improvement in education did not translate into a significantly reduced gap because the non-Aboriginal population experienced a very similar improvement over this period.¹⁴

Considering the educational attainment gaps in 2011 (Table 3), one notices a number

12 Changes in the Census questions regarding education between 2001 and 2006 make comparisons of educational attainment between 2001 and future years questionable. In particular, Statistics Canada cautions that high school completion had been underreported prior to the 2006 Census. This will explain some of the improvement from 2001 to 2006. See Calver (2015) for details.

13 Note that this measure only captures differences in the educational attainment distribution, but there can also be significant differences in terms of years of schooling between the Aboriginal and non-Aboriginal populations within educational attainment categories. Our measure may capture incomplete years or years towards credentials which were never completed. We have also generated similar results using assigned values for each educational attainment category based on the number of years we would expect that one would require to reach a given level of educational attainment (for example, high school would be 12 years). The level of years of educational attainment is lower under this alternative measure, but the estimates of the gaps and how they have changed over time remain qualitatively similar. Nationally, the absolute gap under this alternate measure increased very slightly from 1.28 years in 2001 to 1.30 years in 2011.

14 Note that a year of education at the high school level is not necessarily worth the same amount as a year of university education in terms of labour market outcomes, so the underlying changes in the educational attainment distribution may still have had an impact on the labour market gaps.

Table 3**Average Years of Educational Attainment of the Aboriginal and non-Aboriginal Populations Aged 25-64 by Select Characteristics, Canada, 2001, 2006, 2011**

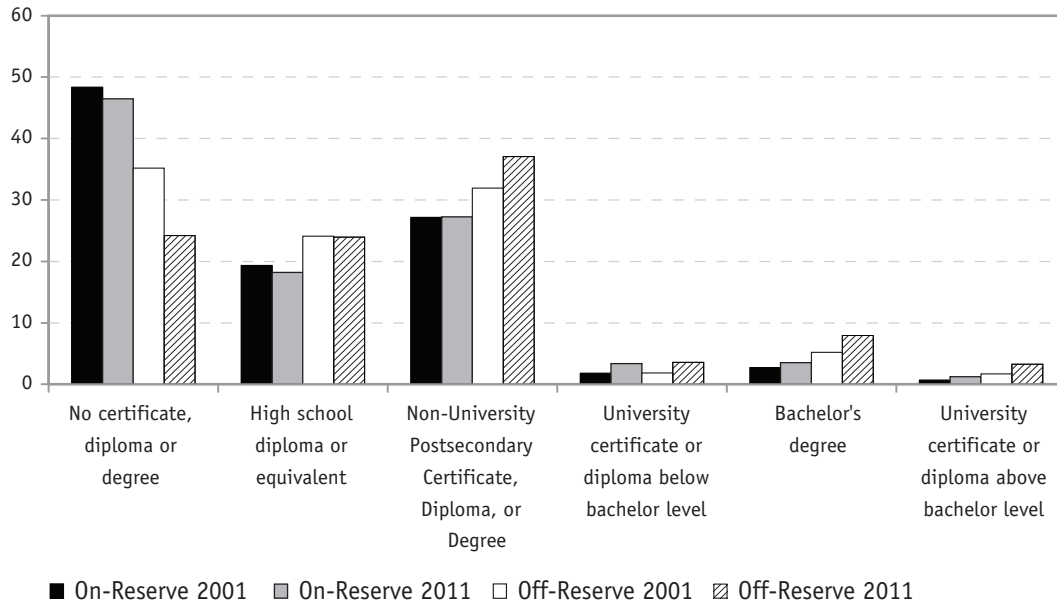
	2001			2006			2011		
	Aboriginal	Non-Aboriginal	Absolute Gap	Aboriginal	Non-Aboriginal	Absolute Gap	Aboriginal	Non-Aboriginal	Absolute Gap
Canada	11.93	13.28	1.34	12.43	13.84	1.42	12.69	14.09	1.40
Newfoundland and Labrador	11.85	12.47	0.63	13.06	13.12	0.06	13.19	13.49	0.30
Prince Edward Island	11.64	12.80	1.16	12.95	13.43	0.48	13.57	13.71	0.14
Nova Scotia	12.25	13.04	0.79	12.40	13.57	1.17	13.32	13.88	0.56
New Brunswick	12.23	12.73	0.50	12.37	13.28	0.92	12.87	13.56	0.70
Quebec	11.91	13.19	1.28	12.77	13.74	0.97	12.78	13.95	1.17
Ontario	12.30	13.45	1.15	12.07	14.04	1.97	13.18	14.29	1.11
Manitoba	11.54	12.97	1.42	12.09	13.52	1.43	12.19	13.80	1.61
Saskatchewan	11.73	12.88	1.15	12.32	13.46	1.13	12.34	13.71	1.37
Alberta	11.89	13.23	1.34	12.52	13.74	1.22	12.45	14.02	1.57
British Columbia	12.01	13.41	1.40	11.85	13.94	2.09	12.80	14.17	1.37
Territories	11.65	13.99	2.34	11.33	14.26	2.92	11.52	14.49	2.97
Female	12.10	13.32	1.22	12.58	13.93	1.35	12.94	14.22	1.28
Male	11.75	13.23	1.47	12.19	13.75	1.56	12.42	13.96	1.54
Ages 25-34	12.04	13.80	1.76	12.42	14.23	1.81	12.66	14.41	1.75
Ages 35-44	12.04	13.39	1.35	12.46	14.02	1.56	12.94	14.37	1.43
Ages 45-54	11.97	13.21	1.24	12.46	13.64	1.18	12.71	13.97	1.26
Ages 55-64	11.26	12.44	1.18	12.21	13.37	1.16	12.41	13.61	1.20
First Nations	11.82	13.28	1.45	12.25	13.84	1.59	12.46	14.09	1.63
Métis	12.21	13.28	1.07	12.70	13.84	1.14	13.11	14.09	0.98
Inuit	11.44	13.28	1.84	11.58	13.84	2.27	11.56	14.09	2.53
Registered Indian Status	11.81	13.28	1.47	12.20	13.84	1.64	12.31	14.09	1.78

Source: Author's calculations using Public Use Microdata Files from the 2001 Census, 2006 Census, and 2011 National Household Survey.

of interesting patterns. The gap tends to be slightly larger for men than for women (1.54 years versus 1.28 years), for the young than for the old (1.75 years for those aged 25-34 vs. 1.20 years for those aged 55-64), and for registered Indians (1.78 years). The Métis (0.98 years) also fare better in terms of the gap than the First Nations (1.63 years) and the Inuit (2.53 years). Geographically, the gaps tend to be larger in the western provinces and in the Territories.

It is worth mentioning that educational attainment is especially low for the population living on-reserve. Chart 2 compares the Aboriginal educational attainment distributions on- and off-reserve in 2001 and 2011. One sees that the population living off-reserve was much better educated in 2001. Between 2001 and 2011, there were substantial improvements in education off-reserve while education levels on-reserve were relatively stagnant. For example, the bottom category (no certificate, diploma, or

Chart 2
Comparison of Highest Educational Attainment, Total Aboriginal Population
On- and Off-Reserve, Ages 25-64, 2001 and 2011
 (per cent)



Source: Author's calculations using data from the 2001 Census and 2011 National Household Survey.

degree) fell from 35.2 per cent to 24.2 per cent off-reserve, but only dropped from 48.4 per cent to 46.4 per cent on-reserve.

We have established that the Aboriginal population is relatively under-educated, but how does this relate to the labour market outcome gaps? Table 4 shows differences in our four labour market outcomes between the Aboriginal and non-Aboriginal populations conditional upon five levels of highest educational attainment. A number of interesting trends appear. Notice that the participation, unemployment, and employment rate gaps tend to be very large for those in the lowest education categories, but shrink considerably at higher levels of education. For example, the relative employment rate gap was 25.1 per cent for those with no certificate, diploma, or degree but only 1.7 per cent for those with a bachelor's degree. Perhaps surprisingly, this pattern does not hold for the employment income gap. We find that this gap was

largest for those with a bachelor's degree (14.1 per cent), but there was virtually no gap for those with no certificate, diploma, or degree.

Notice that while the absolute gaps are sometimes large between the Aboriginal and non-Aboriginal populations, the differences across education levels within the Aboriginal population tend to be much larger. For example, Aboriginal people holding a bachelor's degree made \$10,594 less than non-Aboriginal people holding a bachelor's degree on average in 2010, but they made \$25,654 more than Aboriginal people with no certificate, diploma, or degree. This suggests that differences in educational attainment explain a substantial portion of the labour market outcome gaps.

What is driving the income and employment rate gaps within each educational attainment category? We will briefly touch upon the most obvious and important contributors which can be easily quantified, although there

Table 4

Aboriginal Labour Market Gaps by Education Level, Ages 25-64, Canada, 2011

Highest Level of Education Attained	Average Employment Income (Full-Year Full-Time Workers, 2010, Dollars)			Participation Rate (per cent)			Employment Rate (per cent)			Unemployment Rate (per cent)		
	Ab-original	Non-Ab-original	Relative Gap (%)	Ab-original	Non-Ab-original	Relative Gap (%)	Ab-original	Non-Ab-original	Relative Gap (%)	Ab-original	Non-Ab-original	Relative Gap (%)
None	38,735	38,919	0.5	54.0	64.2	15.8	42.9	57.3	25.1	20.6	10.7	-92.5
High School or Equivalent	43,563	47,030	7.4	74.1	78.2	5.2	64.8	72.8	11.0	12.5	6.9	-81.2
Postsecondary Below Bachelor's	51,650	53,343	3.2	81.3	85.3	4.7	73.1	80.5	9.2	10.2	5.7	-78.9
Bachelor's Degree	64,389	74,983	14.1	87.0	86.9	-0.1	81.7	83.1	1.7	6.0	4.4	-36.4
University Degree Above Bachelor's	96,032	91,215	-5.3	89.0	86.6	-2.7	85.6	82.5	-3.8	3.7	4.8	22.9
All Categories*	50,230	58,934	14.8	72.4	81.7	11.3	63.4	76.7	17.3	12.4	6.1	-103.3

* Note: While the values for all educational categories are similar to those presented in Table 1, they are not identical. This reflects the fact that the values in this table were estimated using the Public Use Microdata File.

Source: Author's calculations based on the Public Use Microdata File from the 2011 National Household Survey.

could be other relevant factors such as racial discrimination or occupational choices. Note that these factors are relevant for understanding the education gap both through their direct impacts on labour market outcomes given a level of education but also through their impacts on the educational attainment distribution.

Geographic differences between the two populations can generate differences in terms of economic opportunities. Employment rates and incomes tend to be higher in the western provinces, the Yukon, and the Northwest Territories. These are the regions where the Aboriginal population is overrepresented. This geographic distribution may dampen the full magnitude of the gaps.

The Aboriginal population also tends to be much more concentrated in rural areas, which typically offer fewer economic opportunities. 87.2 per cent of the non-Aboriginal population lived in Census Metropolitan Areas (CMAs) or Census Agglomerations (CAs) of 10,000 people or more in 2011 compared to 58.3 per cent of the Aboriginal population (Calver, 2015). This

likely accounts for a significant portion of the poorer Aboriginal labour market performance within an educational attainment category relative to the non-Aboriginal population.

Differences in age are another major source of differences in labour market performance. The Aboriginal population is younger than the non-Aboriginal population. The young tend to lack experience and consequently have more difficulty finding work and receive lower wages. As people approach retirement age, labour force participation rates diminish.

Potential Benefits from Closing the Gap: Data and Methodology

Now that we have examined the education and labour market gaps facing the non-Aboriginal population and some of the underlying demographic and geographic factors, we will estimate the economic benefits of closing the educational attainment gap.

Our exercise will be forward looking, as this is more relevant for policy decisions. We first con-

struct a baseline projection of Aboriginal educational attainment, employment, and income in 2031.¹⁵ We then compare these baseline outcomes to those under alternative assumptions regarding the extent to which the educational attainment gap and the employment rate and employment income gaps within education categories close. These estimates should be viewed as aspirational rather than as predictions of what is realistically feasible. Even our baseline projections assume that Aboriginal education will improve significantly, and it is in our view extremely unlikely that the gap could actually be closed in 20 years.¹⁶

First, we must describe the construction of our baseline projection. This projection represents our expectations of Aboriginal economic and educational outcomes in 2031 if recent trends persist. In order to construct this projection, we must estimate the future Aboriginal population and its educational attainment distribution, employment rates by education category, and incomes given education and employment.

We do not construct population projections. Instead, we use projections from “Population Projections by Aboriginal Identity in Canada, 2006 to 2031” (Malenfant and Morency, 2011) which were produced by Statistics Canada’s Demosim Team based upon the estimated Aboriginal population in 2006. We use the projection which assumes constant fertility and no additional ethnic mobility after 2006. The projected Aboriginal population in 2031 is 1.734 million which was based upon a population of 1.279 million in 2006.

Given that the NHS estimate of the Aboriginal population in 2011 was 1.401 million due in part to continued ethnic mobility, we view this population projection as very conservative.

The population projections are available by province of residence and by age and sex, but we do not possess an age/sex breakdown by province. As such, we assume that the age and sex distribution will be the same as the national distribution within each province in 2031.

To estimate economic outcomes at the national level and growth in real wages, we use economic projections from the Policy and Economic Analysis Program (PEAP) of the University of Toronto’s Rotman School of Management (Dungan and Murphy, 2013). In particular, we rely upon forecasts of GDP (2.6 trillion 2010 dollars in 2031), real wage growth (41 per cent increase from 2010 to 2031)¹⁷, and national employment (20.2 million workers in 2031). We only use the growth rate of real wages to directly estimate the benefits to the Aboriginal population. We assume that the baseline GDP and national employment correspond to those from the PEAP projections when estimating the impacts of closing the gaps on national outcomes.

Our projections of employment rates, educational attainment (9 education categories listed in Table 5), and employment incomes are based upon data in the 2011 National Household Survey Public Use Microdata File (NHS PUMF). All projections are made by age (we consider six age groups: 15-24, 25-34, 35-44, 45-54, 55-64 and 65+), sex, and province/territory of resi-

15 The estimates consider average income of all those with employment income, not just those who work FYFT. Note that this exercise includes the entire working age population (15+), as opposed to those aged 25-64 years, which we considered when illustrating the gaps.

16 If for no other reason, many of those aged 25-44 in 2011 will still be working in 2031. It is unlikely that many of these individuals will return to school.

17 This is an optimistic estimate given historical real wage growth. The compound average annual growth rate over the 2000-2010 period recorded in the PEAP projections was only approximately 0.85 per cent, compared to 1.65 per cent in PEAP projections for the 2010-2031 period.

Table 5**Projected Aboriginal and Non-Aboriginal Educational Attainment in 2031 Based on 2006-2011 Trends, Population Aged 15+**

Highest Educational Attainment	Years Educational Attainment (2001)	Non-Aboriginal				Aboriginal			
		2006 Share (%)	2011 Share (%)	Compound Annual Growth Rate of Share (%)	Adjusted 2031 Share (%) (Projected)	2006 Share (%)	2011 Share (%)	Compound Annual Growth Rate of Share (%)	Adjusted 2031 Share (%) (Projected)
No certificate, diploma, or degree	9.29	23.10	19.45	-3.38	8.81	43.99	38.36	-2.70	18.70
High school graduation certificate or equivalency certificate	12.79	25.79	25.72	-0.05	22.94	21.72	24.45	2.40	33.12
Other trades certificate or diploma	12.92	10.86	10.77	-0.17	9.38	11.33	11.43	0.18	9.99
College, CEGEP or other non-university certificate or diploma from a program of 3 months to less than 1 year	12.06	2.27	2.27	0.09	2.08	-2.8	3.12	2.19	4.06
College, CEGEP or other non-university certificate or diploma from a program of 1 year to 2 years	14.68	8.32	8.67	0.84	9.23	7.78	8.44	1.64	9.85
College, CEGEP or other non-university certificate or diploma from a program of more than 2 years	15.73	6.85	7.40	1.56	9.08	3.92	4.47	2.67	6.38
University certificate or diploma below bachelor level	15.68	4.45	4.42	-0.10	3.90	2.76	2.44	-2.48	1.24
Bachelor's degree	16.42	11.90	13.70	2.86	21.69	4.18	5.45	5.47	13.33
Above Bachelor's	17.44	6.47	7.58	3.23	12.89	1.53	1.85	3.86	3.33
Average Educational Attainment (Years)		13.20	13.46		14.42	11.81	12.08		13.17

Source: Author's calculations based on the 2011 National Household Survey Public Use Microdata File, the 2006 Census Public Use Microdata File and Aboriginal population projections from "Population Projections by Aboriginal Identity in Canada, 2006 to 2031," Statistics Canada, Demography Division.

dence.¹⁸ These projections consider the entire working age population (ages 15+).

The projections of employment rates and employment incomes are very straightforward. The baseline Aboriginal employment rate in 2031 is assumed to be exactly the same as that observed in the 2011 NHS PUMF (for a given age, sex, province/territory, and education).

Similarly, the baseline Aboriginal employment income in 2031 is assumed to be the same as that observed among those employed in the 2011 NHS PUMF (conditional upon age, sex, province/territory, and education),¹⁹ scaled up by the projected national growth in real wages of

41 per cent. We are assuming that real wage growth occurs at a uniform rate across the entire population.

To estimate the educational attainment distribution in 2031, we assume that the population share in each educational attainment category will continue to grow at the compound annual rate observed between the 2006 Census and the 2011 NHS (Table 5). For example, the bottom category of no certificate, diploma, or degree shrank from 44.0 per cent of the Aboriginal population aged 15+ in 2006 to 38.4 per cent in 2011. If this compound average annual growth rate of -2.7 per

18 The territories are combined. Note that our geographic controls assume that individuals do not move when they attain a higher level of education.

19 These projections are quite demanding of the data available to us. Given the limited sample size of the PUMF, one may be concerned about the accuracy of these estimates for smaller subpopulations, but the aggregate estimates which we are considering should be reasonable.

Box 1**Summary of Assumptions**

Given our baseline projections of Aboriginal and non-Aboriginal outcomes in 2031, the scenarios we consider can be summarized by a set of assumptions regarding what happens to the educational attainment gap, the average employment income gap, and the employment rate gap. The assumptions are as follows:

The Educational Attainment Gap

- Projected 2031 gap unchanged: The share of the Aboriginal population in each educational attainment category in 2031 is identical to the projected share of the Aboriginal population in that educational attainment category in 2031.
- Entire projected 2031 gap eliminated: The share of the Aboriginal population in each educational attainment category in 2031 is identical to the projected share of the non-Aboriginal population in that educational attainment category in 2031.

The Average Income Gap (Conditional on Education)

- 2010 gap unchanged by 2031: The average real income of an employed Aboriginal person with a given level of education in 2031 is assumed to equal that of an employed Aboriginal person with the same level of education in 2010, increased at the average rate of real wage growth predicted by the PEAP forecast.
- Entire 2010 gap eliminated by 2031: The average real income of an employed Aboriginal person with a given level of education in 2031 is assumed to equal that of an employed non-Aboriginal person with the same level of education in 2010, increased at the average rate of real wage growth predicted by the PEAP forecast.

The Employment Rate Gap (Conditional on Education)

- 2011 gap unchanged by 2031: The employment rate of an Aboriginal person with a given level of education in 2031 is assumed equal to that of an Aboriginal person with the same level of education in 2011.
- Entire 2011 gap eliminated by 2031: The employment rate of an Aboriginal person with a given level of education in 2031 is assumed equal to that of a non-Aboriginal person with the same level of education in 2011.

cent was applied for the next 20 years, the share of the population in this category would be about 22.2 per cent by 2031. Of course, this approach will produce a set of shares of the population by educational attainment that do not sum to one, so they must be normalized

(after normalizing, the 22.2 per cent becomes 18.7 per cent). We do not calculate the growth rates within each age-sex-province group, but rather assume that the national growth rates for the share in each educational category apply to the entire population.²⁰

²⁰ This is not the most accurate method for projecting the educational attainment distribution. A more appropriate approach would be to construct cohort based projections using a model of the transition rates from one educational attainment category to another over the life cycle.

Once we have our baseline projection, we construct a series of alternative projections, characterized by the assumptions summarized in Box 1. These involve projecting the comparable educational attainment distributions, employment rates, and average employment incomes of the non-Aboriginal population. We estimate the benefits of closing the gaps by comparing what would happen if the projected Aboriginal population achieved the projected non-Aboriginal outcomes.

This brings us to the central assumption of this exercise. We assume that if an individual with a given level of education achieves a higher level of education, then that individual will be expected to achieve the same outcomes on average as the comparable population (in terms of age, sex, and province/territory) which had already achieved the higher level of education. This assumption is strong and is unlikely to hold in reality. In particular, one should be concerned that there may be selection into education or omitted variables which play a role in educational outcomes, but which we fail to take into consideration.

It might be the case that individuals who expect higher returns to education, due to personal characteristics, are more likely to invest in it. For example, if Aboriginal university graduates tend to be harder working or more talented on average than those with only a high school diploma, then they may overrepresent the average returns to education for the general population. This could bias our estimates upwards.

We know of at least one variable which we do not control for which will probably make the returns to education lower than we assume: the fraction of the population living in remote or rural areas. Aboriginal people in rural areas tend to be less educated and have worse labour market outcomes than Aboriginal people living in urban areas. Suppose most of the improvement in edu-

cation occurs in rural areas. If these individuals stay in rural areas, one would expect that they will obtain the returns to education of those in rural areas which will be lower than those of the total population, but our assumption is that these individuals will achieve the returns to education of the total population. One way to interpret our assumption is that migration to urban areas will occur such that the returns to education are equal to those of the general population.

We have estimated the labour market outcomes under all combinations of the assumptions listed in Box 1.²¹ We present the benefits from entirely eliminating each of the three gaps separately, and eliminating all three gaps simultaneously in this article (see Calver (2015) for other scenarios). By comparing the appropriate scenarios, one can estimate the effects of closing the educational attainment gap under various assumptions regarding the employment rate and income gaps conditional upon education.

Once we have estimates of the benefits for the Aboriginal population in terms of employment and average income, we can estimate the impact on the Aboriginal contribution to GDP by multiplying employment by average employment income and then doubling this figure to reflect that only about half of GDP in Canada is earned by workers in the form of employment income.

The increases in Aboriginal employment and contributions to GDP can be added to the baseline (PEAP) national projections to estimate the potential impact on the growth rates of Canadian GDP, employment, and labour productivity.

As all calculations occur within age-sex-province groupings, it is straightforward to decompose our estimates of the national benefits by sex, age group, and province. Additionally, we have also estimated the benefits for the three single response Aboriginal identity groups (First Nations, Métis, and Inuit), for those living on-

21 Calver (2015) also examines labour market outcomes under the additional assumption of the education gap half closing.

Table 6
Projected Increase in Aboriginal Employment under Various Scenarios Relative to
Baseline Scenario, 2031
(thousands)

Province	Absolute Change over Baseline					Relative Change over Baseline (%)	
	Baseline (2031 Level)	Employment Rate Gap Closes	Income Gap Closes	Education Gap Closes	All Three Gaps Close	Education Gap Closes	All Three Gaps Close
Newfoundland and Labrador	8.1	0.9	0.00	1.0	1.0	11.7	12.5
Prince Edward Island	0.8	0.10	0.00	0.3	0.2	39.0	26.0
Nova Scotia	13.5	0.8	0.00	1.0	1.3	7.9	9.7
New Brunswick	7.0	1.6	0.00	0.9	2.0	13.0	28.0
Quebec	74.8	6.8	0.00	5.5	11.3	7.3	15.2
Ontario	148.9	10.2	0.00	12.4	17.6	8.3	11.8
Manitoba	109.0	17.0	0.00	15.0	23.6	13.7	21.5
Saskatchewan	87.0	31.1	0.00	11.6	34.8	13.4	40.1
Alberta	135.2	15.1	0.00	15.2	22.2	11.2	16.4
British Columbia	115.0	13.2	0.00	16.1	19.1	14.0	16.6
Territories	27.3	12.0	0.00	11.0	12.3	40.2	45.0
Canada	727.0	108.9	0.00	90.0	145.4	12.4	20.0

Source: Author's calculations based on the 2011 National Household Survey Public Use Microdata File and Aboriginal population projections from Population Projections by Aboriginal Identity in Canada, 2006 to 2031, Statistics Canada, Demography Division.

and off-reserve, and for those with and without registered Indian status.²² We only present the national and provincial results in this article. See Calver (2015) for further breakdowns of the benefits.

Potential Benefits from Closing the Gap: Results

We project that the average number of years of educational attainment of the Aboriginal population will rise from 12.7 years in 2011 to 13.0 years in 2031.²³ Notice that this is an optimistic baseline scenario, particularly at the upper and lower ends of the distribution, as it assumes that improvements will proceed at the high rates

observed between 2006 and 2011. For example, this projection would see the share of the Aboriginal population in the bottom category (no certificate, diploma, or degree) decrease from 38.4 per cent to 22.0 per cent, while the share with a bachelor's degree as the highest level of education would rise from 5.5 per cent to 12.2 per cent. If the educational attainment gap were eliminated (conditional on age, sex, and province), then 10.1 per cent of the population would be in the bottom category and 21.5 per cent would be in the bachelor's degree category.

Table 6 presents our estimates of the impact of closing the gaps on Aboriginal employment.

22 Estimates of the benefits of closing the educational attainment gap for the on- and off-reserve First Nations populations and for the populations with and without registered Indian status were made using several additional assumptions (Calver, 2015).

23 While they are similar, the figures in this paragraph are not quite the same as the projected shares or average years of educational attainment reported in Table 5. The values in Table 5 are projected nationally with no controls for the demographic and geographic structure of the Aboriginal population. In contrast, the figures presented here incorporate our projected age-sex-province distribution of the Aboriginal population in 2031.

Table 7
Projected Increase in Aboriginal Average Employment Income over Baseline Scenario, 2031
(2010 dollars)

Province	Absolute Change over Baseline					Relative Change over Baseline (%)	
	Baseline (2031 Level)	Employment Rate Gap Closes	Income Gap Closes	Education Gap Closes	All Three Gaps Close	Education Gap Closes	All Three Gaps Close
Newfoundland and Labrador	\$68,989	-\$571	-\$5,547	\$9,609	-\$5,685	13.93	-8.24
Prince Edward Island	37,278	10,526	5,761	5,514	13,905	14.79	37.30
Nova Scotia	45,878	898	5,857	8,603	10,626	18.75	23.16
New Brunswick	42,400	2,658	7,984	5,107	14,925	12.04	35.20
Quebec	52,013	-1,388	730	7,337	6,577	14.11	12.64
Ontario	55,287	665	4,241	10,326	14,602	18.68	26.41
Manitoba	49,349	-1,707	3,672	10,600	9,419	21.48	19.09
Saskatchewan	53,101	-3,245	9,160	4,765	10,397	8.97	19.58
Alberta	66,449	-1,431	2,777	19,738	12,740	29.70	19.17
British Columbia	48,228	263	7,624	6,734	14,509	13.96	30.08
Territories	79,061	-6,884	-2,784	22,812	8,152	28.85	10.31
Canada	55,482	-1,063	4,340	11,236	11,623	20.25	20.95

Source: Author's calculations based on the 2011 National Household Survey Public Use Microdata File and Aboriginal population projections from Population Projections by Aboriginal Identity in Canada, 2006 to 2031, Statistics Canada, Demography Division.

Under the baseline scenario, we project that 727 thousand Aboriginal people will be employed in Canada in 2031. If the education gap were eliminated, we estimate that an additional 90 thousand Aboriginal people would be employed. As a point of comparison, closing the employment rate gap within each educational attainment category is estimated to increase employment by 109 thousand. If both the education and employment rate gaps closed simultaneously, we estimate that the total improvement would be 145 thousand workers, a 20 per cent increase over the baseline.²⁴

We estimate that the gains from closing the educational attainment gap would be relatively

larger for certain subpopulations. Geographically, the estimated gains to employment are very large in the Territories (45.0 per cent) and relatively small in Ontario (11.8 per cent) and Quebec (15.2 per cent).

Table 7 contains the absolute improvements in terms of average Aboriginal employment income (of those employed). We estimate that closing (only) the educational attainment gap would raise average employment income by \$11,236 per Aboriginal worker over a baseline of \$55,482 (2010 dollars). This is considerably greater than the estimated benefit of \$4,340 from closing the income gap or the reduction of \$1,063 from closing the employment rate gap.²⁵

24 Notice that the total improvement is not the sum of the improvements from closing each gap separately. This is because there are interactions between closing the two gaps. For example, if the employment rate gap is much larger for those with low levels of education, then closing the employment rate gap conditional on education will have a much smaller effect if the educational attainment gap has been closed.

25 The reader may be wondering why closing the employment rate gap reduces average employment income. Recall that the largest employment rate gaps seem to occur among those with the lowest levels of education. These individuals also tend to earn the lowest incomes. As a result, closing the employment rate gap lowers the average income through a composition effect.

Table 8**Projected Increase in Aboriginal Contribution to GDP over Baseline Scenario, 2031**

(billions, 2010 dollars)

Province	Absolute Change over Baseline					Change over Baseline	
	Baseline (2031 Level)	Employment Rate Gap Closes	Income Gap Closes	Education Gap Closes	All Three Gaps Close	Education Gap Closes	All Three Gaps Close
Newfoundland and Labrador	1.12	0.12	-0.09	0.31	0.04	27.68	3.57
Prince Edward Island	0.06	0.02	0.01	0.03	0.04	50.00	66.67
Nova Scotia	1.23	0.10	0.16	0.35	0.43	28.46	34.96
New Brunswick	0.59	0.18	0.11	0.16	0.43	27.12	72.88
Quebec	7.78	0.48	0.11	1.75	2.31	22.49	29.69
Ontario	16.47	1.34	1.26	4.70	6.81	28.54	41.35
Manitoba	10.81	1.25	0.80	4.12	4.83	38.11	44.68
Saskatchewan	9.23	2.54	1.59	2.18	6.23	23.62	67.50
Alberta	17.97	1.58	0.75	7.96	6.96	44.30	38.73
British Columbia	11.10	1.34	1.75	3.32	5.74	29.91	51.71
Territories	4.32	1.35	-0.15	3.48	2.59	80.56	59.95
Canada	80.67	10.31	6.31	28.34	36.41	35.13	45.13

Source: Author's calculations based on the 2011 National Household Survey Public Use Microdata File and Aboriginal population projections from Population Projections by Aboriginal Identity in Canada, 2006 to 2031, Statistics Canada, Demography Division.

Closing all three gaps is estimated to raise average employment income by \$11,623.

Geographically, the increases in average employment income from closing the educational attainment gap are relatively large in Alberta (29.7 per cent) and the Territories (28.9 per cent), although they are estimated to be surprisingly low in Saskatchewan (9.0 per cent).

Table 8 combines the estimates underlying Table 6 and Table 7 to estimate the impact of closing the gaps on the Aboriginal contribution to GDP (estimated as employment multiplied by average employment income multiplied by 2). The baseline Aboriginal contribution to GDP is projected at \$80.7 billion (2010 dollars). If the educational attainment gap were fully closed, this would significantly increase by an estimated \$28.3 billion. For comparison, we estimate that closing the employment rate gap would raise the Aboriginal contribution to GDP by \$10.3 billion while closing the income gap would

increase it by only about \$6.3 billion. The total benefits could be as large as \$36.4 billion if all three gaps were eliminated.

The estimated relative benefits from closing the educational attainment gap are estimated to be the largest in the Territories by far (80.7 per cent), but are also very large in Alberta (44 per cent) and Manitoba (38.2 per cent). Even in provinces where the benefits are relatively small, such as Quebec (28.5 per cent) and Saskatchewan (23.6 per cent), they are still substantial.

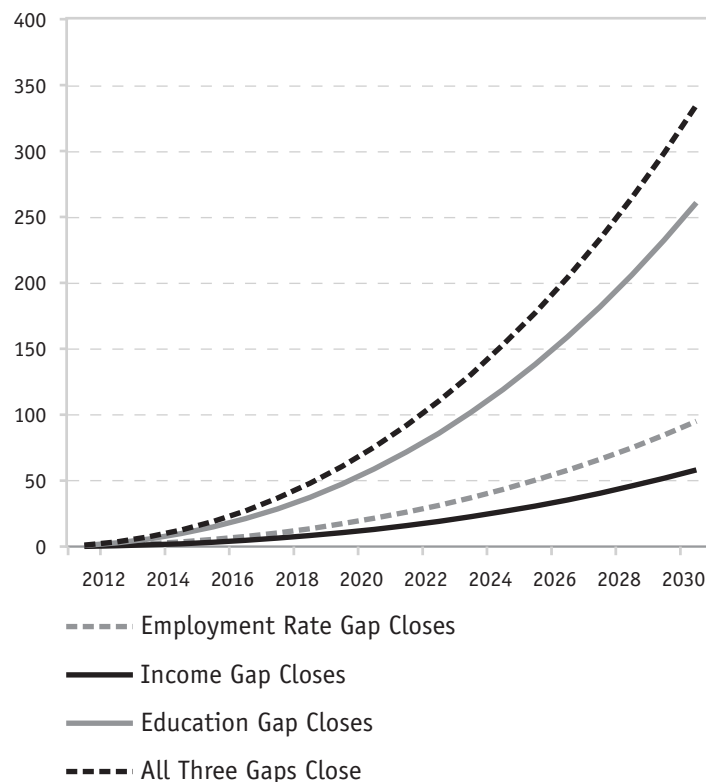
These improvements would benefit not only the Aboriginal population, but the Canadian economy more generally. Applying these improvements to the projected national economic outcomes from the PEAP, we estimate the impact on growth in Canadian employment, GDP, and labour productivity (Table 9). Since the only changes in employment and GDP are those associated with the Aboriginal population, the changes in national employment and GDP are exactly the same as those

we have already discussed (Tables 6 and 8). These changes to employment and GDP result in changes to labour productivity nationally. Of course, the impact on aggregate labour productivity is much smaller than that on Aboriginal employment income because Aboriginal people make up a relatively small segment of the labour force. Nonetheless, closing the educational attainment gap would have a non-negligible impact on aggregate labour productivity, raising it by \$820 or about 0.6 per cent of the baseline labour productivity of \$129,781.

Our baseline projections indicate that employment will grow at a compound annual rate of 0.78 per cent, GDP at a rate of 2.17 per cent, and labour productivity at a rate of 1.38 per cent between 2011 and 2031. If (only) the educational attainment gap was closed, we estimate that these growth rates would increase by 0.0224 percentage points, 0.0549 percentage points, and 0.0320 percentage points respectively. These increases may not sound very large, but one needs to keep in mind that only 4.3 per cent of Canada's population reported an Aboriginal identity in the 2011 NHS.

How much is an increase in annual GDP growth of 0.0549 percentage points worth?²⁶ Chart 3 presents the gains as a result of this increase from 2011 to 2031. All figures are undiscounted. The cumulative value of eliminating the educational attainment gap is \$261 billion (2010 dollars). Even closing the gap half-way would result in very large benefits of \$130 billion (Calver, 2015), which is larger than the benefits of \$95 billion from closing the employment rate gap or \$58 billion from closing the employment income gap. Closing all three gaps could have a total economic impact as large as \$335 billion over the 20-year period.

Chart 3
Estimated Cumulative Gains to Output from Closing the Aboriginal Education, Income, and Employment Rate Gaps (Billions of 2010 dollars), Canada, 2011-2031



Source: Author's calculations based on the 2011 National Household Survey Public Use Microdata File and Aboriginal population projections from Population Projections by Aboriginal Identity in Canada, 2006 to 2031, Statistics Canada, Demography Division. No discounting has been applied in these calculations.

Conclusion

While the economic disparities between Canada's Aboriginal and non-Aboriginal populations in terms of employment rates and employment incomes appear to have been shrinking since 2001, sizable gaps remain. Relatively low levels of educational attainment can explain a significant portion of these labour market gaps, suggesting that there could be large economic gains from further investments in improving Aboriginal education. We have

²⁶ Note that in performing this calculation, we are assuming a very specific path in terms of how the benefits will occur over time (constant growth). There is no reason to think that this is the correct growth path, we are only using it to provide a ballpark estimate as to what the cumulative benefits could be.

Table 9**Projected Aggregate Employment, GDP, and Labour Productivity Outcomes with Closure of Aboriginal Education, Income and Employment Rate Gaps, Canada, 2031**

	2011	Baseline (2031)	Employment Rate Gap Closes	Income Gap Closes	Education Gap Closes	All Three Gaps Close
Aggregate Levels, Increase over Baseline						
Employment (thousands)	17,300	20,220	109	0	90	146
GDP (billions of \$2010)	1,707	2,624	11	7	29	37
Labour Productivity (Output per Worker) (\$2010)	98,661	129,781	-188	312	820	861
Implied Compound Annual Growth Rates (CAGR) (per cent), 2011-2031						
Employment	-	0.78	0.81	0.78	0.81	0.82
GDP	-	2.17	2.19	2.19	2.23	2.24
Labour Productivity	-	1.38	1.37	1.39	1.41	1.41
2011-2031 CAGR Relative to Baseline (percentage points increase)						
Employment	-	0.0000	0.0271	0.0000	0.0224	0.0361
GDP	-	0.0000	0.0200	0.0123	0.0549	0.0704
Labour Productivity	-	0.0000	-0.0074	0.0122	0.0320	0.0335

Source: Author's calculations based on the 2011 National Household Survey Public Use Microdata File and Aboriginal population projections from Population Projections by Aboriginal Identity in Canada, 2006 to 2031, Statistics Canada, Demography Division.

quantified the potential value of these benefits for both the Aboriginal population and Canada as a whole and confirmed that they could be substantial. In particular, we have estimated that eliminating the Aboriginal educational attainment gap in Canada by 2031 could raise the growth rate of labour productivity by 0.03 percentage points over the 2011-2031 period and the growth rate of employment by 0.02 percentage points. These increases in labour productivity and employment would result in a cumulative increase in GDP of \$261 billion (2010 dollars) between 2011 and 2031.

Given the very high potential benefits of improving Aboriginal education compared to current Aboriginal education spending levels, further investments in Aboriginal education are warranted.²⁷ However, we have not considered how the gap could actually be closed in practice

or how much this may cost. Further research is necessary to identify the most cost-effective approaches to realizing the benefits associated with improved Aboriginal education. Drummond and Rosenbluth (2013) note that many First Nations schools remain underfunded when compared with similar non-Aboriginal schools in terms of costs and needs. It seems reasonable to expect that Aboriginal students will require at least the same level of funding as comparable non-Aboriginal students if we are to expect similar outcomes. Utilizing existing funds in the most efficient way and addressing other social factors which may ultimately be contributing to the educational attainment gap will undoubtedly be important components of the solution. A better understanding of the causal relationships between social conditions, Aboriginal education, and labour market outcomes is needed.

27 Aboriginal Affairs and Northern Development Canada spent \$1.55 billion on First Nations elementary and secondary education from 2011-12, plus \$200 million on education infrastructure on-reserve (Drummond and Rosenbluth, 2013).

While we believe that the estimates presented in this report represent an improvement over the previous estimates produced by the CSLS, better estimates are possible. The limited sample sizes in the NHS Public Use Microdata Files are somewhat problematic for accurately estimating the economic benefits for smaller subsets of the population. Using a data source with a larger sample would be preferable if possible.

While generating our estimates, we found that controlling for demographic and geographic features had a significant impact (Calver, 2015). However, we were not able to control for one very important characteristic which differs between the Aboriginal and non-Aboriginal populations: urban/rural status.

The methodology utilized to project educational attainment in 2031 is admittedly quite crude. We recommend that future estimates should adopt a cohort based projection approach and should use trends within each age-sex-province category rather than applying the national trends universally.

Lastly, the scenarios we have considered in which the gaps have closed by 2031 have been very unrealistic. In particular, we assume that closure will happen across the board for all age groups, even for those who are already above the age of 30. This is extremely unlikely to occur in practice. More nuanced scenarios can be developed.

References

- Aghion, P., L. Boustan, C. Hoxby, and J. Vandenbussche (2009) "The Causal Impact of Education on Economic Growth: Evidence from US," Unpublished Working Paper.
- Bedard, K. (2001) "Human Capital versus Signaling Models: University Access and High School Dropouts," *Journal of Political Economy*, Vol. 109, No. 4, pp. 749-775.
- Boudarbat, B., T. Lemieux, and W. C. Riddell (2010) "The Evolution of the Returns to Human Capital in Canada, 1980-2005," *Canadian Public Policy*, Vol. 36, No. 1, pp. 63-89.
- Barro, R. J. (2001) "Human Capital and Growth," *American Economic Review*, Vol. 91, No. 2, pp. 12-17.
- Brunello, G. and M. Schlotter (2011) "Non-cognitive Skills and Personality Traits: Labour Market Relevance and their Development in Education and Training Systems," IZA Discussion Paper No. 5743.
- Calver, Matthew (2015) "Closing the Aboriginal Education Gap in Canada: Assessing Progress and Estimating the Economic Benefits," CSLS Research Report 2015-03, June, www.csls.ca/res_reports.asp.
- Caron-Malenfant, É., S. Coulombe, E. Guimond, C. Grondin, and A. Lebel (2014) "Ethnic Mobility of Aboriginal Peoples in Canada between the 2001 and 2006 Censuses," *Population*, Vol. 69, No. 1, pp. 29-53.
- Cohen, D. and M. Soto (2007) "Growth and Human Capital: Good Data, Good Results," *Journal of Economic Growth*, Vol. 12, No. 1, pp. 51-76.
- Dickson, M. and C. Harmon (2011) "Economic Returns to Education: What We Know, What We Don't Know, and Where We Are Going—Some Brief Pointers," *Economics of Education Review*, Vol. 30, No. 6, pp. 1118-1122.
- Dolton, P. and A. Vignoles (2000) "The Incidence and Effects of Overeducation in the UK Graduate Labour Market," *Economics of Education Review*, Vol. 19, No. 2, pp. 179-198.
- Drummond, Don, and Ellen Rosenbluth (2013) "The Debate on First Nations Education Funding: Mind the Gap," Working Paper, School of Policy Studies, Queen's University.
- Dungan, Peter and Steve Murphy (2013) "Policy and Economic Analysis Program, Long Term Outlook for the Canadian Economy: National Projection through 2040," Policy and Economic Analysis Program, November.
- Heckman, J. J. (2006) "Skill Formation and the Economics of Investing in Disadvantaged Children," *Science*, Vol. 312, No. 5782, pp.1900-1902.
- Hossain, B. and L. Lamb (2012) "The Impact of Human and Social Capital on Aboriginal Employment Income in Canada," *Australian Economic Papers: A Journal of Applied Economics and Policy*, Vol. 31, No. 4, pp. 440-450.
- Hussey, A. (2012) "Human Capital Augmentation versus the Signaling Value of MBA Education," *Economics of Education Review*, Vol. 31, No. 4, pp. 442-451.
- Hu, M. (2014) "The Effect of Cognitive Skills on Aboriginal People's Employment Outcomes," Master's Thesis, Department of Economics, Dalhousie University, <http://www.collectionscanada.gc.ca/obj/thesescanada/vol2/NSHD/TC-NSHD-54010.pdf>.

- Ishikawa, M. and D. Ryan (2002) "Schooling, Basic Skills and Economic Outcomes," *Economics of Education Review*, Vol. 21, No. 3, pp. 231-243.
- Layard, R., and G. Psacharopoulos (1974) "The Screening Hypothesis and the Returns to Education," *Journal of Political Economy*, Vol. 82, No. 5, pp. 985-998.
- Li, H., P. W. Liu, and J. Zhang (2012) "Estimating Returns to Education using Twins in Urban China," *Journal of Development Economics*, Vol. 97, No. 2, pp. 494-504.
- Lochner, L. (2011) "Non-production Benefits of Education: Crime, Health, and Good Citizenship," National Bureau of Economic Research Working Paper No. 16722.
- Lusardi, A. and O. S. Mitchell (2013) "The Economic Importance of Financial Literacy: Theory and Evidence," National Bureau of Economic Research Working Paper No. 18952.
- Malenfant, Éric and Jean-Dominique Morency (2011) "Population Projections by Aboriginal Identity in Canada," Catalogue No. 91-552-X, Demosim Team, Statistics Canada, <http://www.statcan.gc.ca/pub/91-552-x/91-552-x2011001-eng.htm>.
- McGuinness, S. (2006) "Overeducation in the Labour Market," *Journal of Economic Surveys*, Vol. 20, No. 3, pp. 387-418.
- Pendakur, K. and R. Pendakur (2011) "Aboriginal Income Disparity in Canada," *Canadian Public Policy*, Vol. 37, No. 1, pp. 61-83.
- Shapiro, J. M. (2006) "Smart Cities: Quality of Life, Productivity, and the Growth Effects of Human Capital," *Review of Economics and Statistics*, Vol. 88, No. 2, pp. 324-335.
- Sharpe, Andrew, Jean-Francois Arsenault, and Simon Lapointe (2007) "The Potential Contribution of Aboriginal Canadians to Labour Force, Employment, Productivity and Output Growth in Canada, 2001-2017," CSLS Research Report 2007-04, November.
- Sharpe, Andrew, Jean-Francois Arsenault, Simon Lapointe, and Fraser Cowan (2009) "The Effect of Increasing Aboriginal Educational Attainment on the Labor Force, Output, and the Fiscal Balance," CSLS Research Report 2009-03, May.
- Spence, M. (1973) "Job Market Signaling," *Quarterly Journal of Economics*, Vol. 87, No. 3, pp. 355-374.