Revisiting The Earned Income Gap for Indigenous Australian Workers: Evidence From A Selection-Bias Corrected Model

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Abstract:

Indigenous Australians perform worse in the labour market than non-Indigenous Australians, particularly in terms of earned income. Improving Indigenous Australians' earnings is paramount to improving their health, living standards and for the "Closing the Gap" targets. Most literature on this issue is now outdated or controls for limited variables. This paper revisits the earned income gap for Indigenous Australians using the standard Oaxaca (1973) decomposition. It also estimates the gap using the Heckman (1979) two-stage method to control for selection-bias and decomposes the gap based on techniques developed by Neuman and Oaxaca (2004) and Reimers (1983). It finds that two-thirds and three-quarters of the earnings penalty experienced by Indigenous men and women working full-time is explained by differences in their endowments, especially education levels, compared to non-Indigenous Australians. The remainder of the earnings gap, being 9.3% for males and 4.3% for females, is potentially linked to discrimination and selection-bias as the Indigenous population have low full-time employment rates. Increasing Indigenous Australians participation in higher education is imperative for reducing the earnings penalty they face. Selection-bias is also important for examining earnings and that whilst it has interpretive problems, it may be a reason in explaining the underlying earnings gap faced by Indigenous workers.

Keywords:

Indigenous Australians, Earned Income Gap, Full-time Workers, Selection-bias Corrected Model, Earnings Discrimination

Australian Aboriginal and Torres Strait Islanders (Indigenous Australians) perform drastically worse in the labour market than non-Indigenous Australians. Only 55.9% of Indigenous Australians participate in the labour market compared to 76.4% of the non-Indigenous population (Australian Bureau of Statistics, ABS, 2014). Indigenous labour force participants are also three times more likely to be unemployed (ABS, 2014). On top of this, Indigenous workers have lower earnings than non-Indigenous workers (Howlett *et al.*, 2015). There are three main reasons why Indigenous Australians perform poorly in the labour market. First, educational differences between the Indigenous and non-Indigenous Australians are still large despite recent improvements. Indigenous Australians are heavily underrepresented in higher education and only 42% of them have completed high school (ABS, 2013; ABS, 2014). Second, based on segmented labour market theory, it is suggested that Indigenous workers are more likely to face secondary labour markets where fewer, less secure employment opportunities exist and where workers receive lower wages (Hunter and Gray, 2016). Finally, Indigenous Australians are subject to discrimination (Booth *et al.*, 2012).

In wake of the disadvantaged experienced by Indigenous people, the Council of Australian Governments (COAG) established the *Closing the Gap* targets in 2008. These targets are a formal commitment by COAG to reduce the gaps in education and employment as well as life expectancy and health among Indigenous and non-Indigenous Australians. Most recent studies on the labour market outcomes of Indigenous Australians have focussed on increasing participation and employment to address the *Closing the Gap* target of halving the gap in employment rates (Commonwealth of Australia, 2016). However, it is also important for COAG and researchers to consider earned income as a measure of labour market disadvantage. Income is a key determinant of health (Australian Health Ministers' Advisory Council, 2015). More generally, an individual's income determines their ability to access

resources and impacts on living standards (Hunter and Yap, 2014). Studies on the earned income of Indigenous Australians are of high importance as they provide an indication of success in the labour market.

There is a small body of literature which has examined the earned income gap for Indigenous and non-Indigenous workers. Early studies used regression analysis to estimate the earnings gap and then decomposition methods to identify sources of the gap (Daly, 1992; Daly, 1995; Jones, 1993). These studies are now outdated due to the age of the data. Jones (1993) and Daly (1992) use data from 1986 and Daly (1995) uses data from 1991. More recent studies on the earnings gap of Indigenous and non-Indigenous workers are based on comparisons between mean earnings and do not decompose the earnings gap (Biddle, 2013; Howlett *et al.*, 2015; Hunter and Yap, 2014). Therefore they have limited explanatory power in explaining the income penalty faced by Indigenous workers.

The findings from this limited literature indicate that Indigenous workers have lower earnings than non-Indigenous workers. For example, Hunter and Yap (2014) report mean earnings gaps of 21% for males and 13% for females. When accounting for the differences in the characteristics of the two populations and the earnings returns for having these characteristics (endowments) using decompositions, the earned income gap shrinks. Daly (1995) found that two-thirds of the mean earnings differences for Indigenous and non-Indigenous men can be explained by differences in endowments. The comparable figure for females is four-fifths. The main endowment factor explaining the earnings difference is differences in the education levels of the two populations. When taking endowment differences into consideration, Daly (1995) reports that Indigenous men and women face an underlying earned income penalty of 9.5 and 3.5%, respectively. Jones (1993) reports an underlying earnings penalty of 19% for males and

8% for females whilst Daly (1992) reports penalties of 7 and 9% for males and females. Whether these findings are applicable to the current labour market is questionable given the date of their data. They were conducted prior to COAG's commitment to improving the wellbeing of Indigenous Australians. Whether more recent studies on Indigenous earnings are accurate is also questionable as they only consider mean earnings.

Another limitation of the research on the earned income gap for Indigenous and non-Indigenous workers is that the studies are based on samples restricted to individuals who are employed. They do not account for the fact that a sample of employed workers is not a random sample, representative of the general population. Birch (2014) showed that accounting for the probability of being employed when estimating the earned income for Indigenous Australians was important. A better understanding of the earned income gap for Indigenous and non-Indigenous Australians could be achieved if studies accounted for differences in the factors associated with the level of engagement in the labour market for the two populations.

The purpose of this paper is to re-examine the earned income gap for Indigenous and non-Indigenous workers. The paper seeks to answer the following three research questions:

- (i) Are there differences in the factors associated with the probability of working full-time and earned income of Indigenous and non-Indigenous Australians?
- (ii) What is the current earned income gap for Indigenous and non-Indigenous workers and how does this compare with earlier studies?
- (iii) Does the earned income gap exist when correcting for the fact that not all of the population works full-time?

This paper provides a benchmark for the current state of play for differences in the earned income of Indigenous and non-Indigenous Australians. It will assist with the formulation of policy aimed at decreasing the disadvantages faced by Indigenous workers. This is imperative for meeting the *Closing the Gap* objectives. Given that government spending on Indigenous Australians doubles that of non-Indigenous Australians on a per capita basis, efforts to improve the labour market outcomes and the earned income of Indigenous Australians need to be well directed (Steering Committee for the Review of Government Service Provision, 2014). The paper will also assess whether recent increases in the educational attainment of Indigenous Australians has impacted on their earned income. Last, by estimating the earnings gap corrected for the probability that the populations work full-time, this paper uses an approach to examine the differences in earned income for Indigenous and non-Indigenous Australians that has not been used before. This may provide a new perspective on the reasons for the earnings gap. These results may be beneficial to the international literature on earnings gaps for other disadvantaged populations.

Method and data

This study first examines the factors associated with the probability of working full-time for Indigenous and non-Indigenous Australians. This is based on a model analogous to that on labour supply outlined in Killingsworth (1983) where an individual works full-time if their potential market wage (earned income) is greater than their reservation wage and non-wage income. In its reduced-form, the probability of working full-time (*empft*) can be expressed as:

$$\Pr(empft_j) = \Pr(Y_j\alpha_j + \varepsilon_j) \quad (1)$$

Where, $Y_j\alpha_j$ is a vector of market and reservation wage characteristics and their corresponding estimated coefficients and ε_j is a zero-mean error term.¹ Equation 1 is

estimated using a probit model on separate samples of Indigenous and non-Indigenous males and females.

The study then estimates the earned income of Indigenous and non-Indigenous Australians who work full-time and any subsequent earnings gap using two different approaches. The first approach estimates weekly income (*earnedY*) for separate samples of the population groups, restricted to those working full-time. This can be written as:

$$earnedY_j = X_j\beta_j + \varepsilon_j \quad (2)$$

Where $X_j\beta_j$ is a vector of personal, education, labour market experience and job characteristics and their coefficients.² Equation (2) is estimated using Ordinary Least Squares. Following Oaxaca (1973), the results are then used to decompose the raw earnings gap of Indigenous and non-Indigenous workers into an explained and unexplained component. This decomposition can be expressed as:

$$\underbrace{earnedY_n - earnedY_i}_{\text{raw earned income gap}} = \underbrace{\beta_n(\bar{X}_n - \bar{X}_i)}_{\substack{\text{explained gap} \\ \text{(endowments)}}} + \underbrace{\bar{X}_i(\beta_n - \beta_i)}_{\substack{\text{unexplained gap} \\ \text{(discrimination)}}} \quad (3)$$

Where ‘*n*’ is the non-Indigenous and ‘*i*’ is the Indigenous sample, $\bar{X}$ is a vector of the means for the independent variables included in the earnings model, β is a vector of estimated coefficients of these variables. Non-Indigenous workers’ earned income is treated as the non-discriminatory norm. The explained component of Equation (3) refers to the proportion of the raw earnings gap which can be accounted for by differences in the observable characteristics of Indigenous and non-Indigenous Australians and the earnings payoffs of these characteristics (endowments). The unexplained component reflects differences in the earned income of Indigenous and non-Indigenous Australians which cannot be accounted for by endowments. It can be described as the adjusted

earnings gap or the underlying earnings penalty which may represent discrimination in the labour market.³

The second approach to estimate earned income and any earnings gap incorporates the two-stage selection model developed by Heckman (1979). This model counterbalances the selection-bias of a non-random sample (i.e. the estimation of earned income restricted to samples of full-time workers). Given the large differences in the proportions of Indigenous and non-Indigenous workers employed full-time, this model may be appropriate. The approach uses the results from models to estimate the probability of working full-time (Equation (1)) to estimate the Inverse Mill's ratio (λ). The Inverse Mill's ratio is then included in the earnings model (Equation (2)) to estimate the earnings of full-time workers corrected for selection-bias within the sample. Hence:

$$earnedY_j = X_j\beta_j + \theta_j\lambda_j + \varepsilon_j \quad (4)$$

where θ_j is the estimated coefficient for the selection-bias term.

The results from Equation (4) are then decomposed using two methods. The first method is based on Neuman and Oaxaca (2004), where the earnings differential with controls for selection-bias is decomposed as:

$$\underbrace{earnedY_n - earnedY_i}_{\text{raw earned income gap}} = \underbrace{\beta_n(\bar{X}_n - \bar{X}_i)}_{\text{explained}} + \underbrace{\bar{X}_i(\beta_n - \beta_i)}_{\text{unexplained}} + \underbrace{(\theta_n\bar{\lambda}_n - \theta_i\bar{\lambda}_i)}_{\text{selection-bias}} \quad (5)$$

where $\bar{\lambda}$ is the mean Inverse Mill's ratio.

Using this approach, the raw earned income gap is decomposed to an explained component (endowment differences), an unexplained component (discrimination) and a selection-bias component (differences in the correction of selection-bias associated with full-time workers for the two populations). The adjusted earned income gap is

considered to be the raw earned income gap minus the explained component. Thus, it is the gap which cannot be explained by differences in endowments and may be associated with discrimination or correcting for the probability of working full-time.

The second method to decompose the earnings gap using the results from Equation (4) is based on Reimers (1983). Reimers (1983) argues that the raw earnings gap should be adjusted for selection-bias due to the fact that minority groups that have lower earnings also have lower employment rates because of their lower earnings. As a result, minority groups will be subject to larger selection-bias which offsets their lower earnings. This approach calculates a selection-bias corrected earnings offer for the two populations. This offer is the raw earnings gap minus selection-bias differences. The offer is then decomposed to an explained and unexplained component and the adjusted earned income gap is isolated to purely to unexplained differences. This decomposition can be written as:

$$\underbrace{(earnedY_n - earnedY_i) - (\theta_n \bar{\lambda}_n - \theta_i \bar{\lambda}_i)}_{\text{selection-bias corrected raw earnings gap}} = \underbrace{\beta_n(\bar{X}_n - \bar{X}_i)}_{\text{explained}} + \underbrace{\bar{X}_i(\beta_n - \beta_i)}_{\text{unexplained}} \quad (6)$$

There is no consensus in the literature on which approach is better for decomposing the selection-bias term in the earning function. The ambiguity lies in the fact of where to place the term in the decomposition. Furthermore, there is wide-spread debate on the merits of the Heckman two-stage procedure to correct for selection-bias (see Puhani, 2000 for discussion). The results from the two-stage Heckman model should be treated cautiously as the estimation of the selection-bias correction term is highly subject to model specification in the first-stage of the estimation and is highly correlated with variables included in the second-stage of the estimation. The procedure is often overlooked in earnings studies in Australia. Preston (2001) suggests that there is a

common view in Australian earnings studies that correcting for selection-bias causes more problems than it overcomes.⁴

Neuman and Oaxaca (2004 p.6) also explore more complicated decompositions of Equation (5) which breakdown the differences in selectivity-bias that “require stronger assumptions and perhaps value judgements about what constitutes inequity”. These assumptions may not be appropriate for this study as Indigenous Australians face disadvantages in the labour market that extend beyond discrimination. Given the limitations in methods for decomposing earning gaps from models correcting for selection-bias, only the approaches outlined in Equations (5) and (6) are considered. These results are compared with the standard Oaxaca (1973) decomposition of earnings differentials.

This study draws data from the 2011 Australian Census. The dataset is the most recent and appropriate for this study as it is nationally representative of the Australian population and has a large number of observations for Indigenous Australians. The main limitation of the Census is that data on Indigenous Australians is not made publically available and is only accessible through the ABS’s Remote Access Data Library (RADL). RADL is an online data query service, whereby researchers provide it code which is then run and monitored by the ABS. Researchers do not access to the actual data set. Unfortunately, RADL does not permit the use of sophisticated econometric analysis as it has dated versions of econometric software. RADL also restricts the use of many commands to conduct and test for particular econometric techniques. Another limitation of Census data is that there are only broad measures of many of the variables included in the survey. It is acknowledged that a more extensive study on the earned income gap of Indigenous and non-Indigenous workers could be achieved utilising more recent econometric software, having more flexibility in the options available for using

this software, having access to actual data on Indigenous Australians and having more detailed variables which relate to employment and earnings. Other key data sets, such as the Household, Income and Labour Dynamic in Australia Survey, are not suitable for this study as they do not contain nationally representative samples of Indigenous people. Despite the limitations of using Census data accessed through RADL, this is the only option for an in depth study on earning inequality for Indigenous Australians.

Another limitation of the Census is that questions regarding income do not elaborate on the source of income which may impact on the results. Whilst this cannot be mitigated, its impact is minimised by restricting the employed sample to full-time workers. Howlett *et al.* (2015) note that the main source of income for full-time workers is wages. However a higher proportion of the income of non-Indigenous workers is from other sources, such as investment, whereas a higher proportion of the income for Indigenous workers is from government payments. This paper uses the term earned income rather than wages to avoid any misinterpretations of the dependent variable. It is noted, however, that earned income may still capture income from other sources and as a result the findings in this paper may underestimate or overestimate the earnings gap of Indigenous and non-Indigenous workers.

The data sample is restricted to individuals aged 18 and 64 years. Those missing information on key variables were excluded from the analysis. Overall, the sample comprises of 306,953 males and 318,816 females. Approximately 1.97 and 2.15% of males and females identify as Indigenous. Figure 1 shows that a drastically higher proportion of non-Indigenous Australians work full-time compared to Indigenous-Australians with the full-time employment rates being 50% higher for non-Indigenous Australians. Figure 1 also shows that non-Indigenous males earn 29% more than Indigenous males, whilst non-Indigenous females earn 20% more.

[Insert Figure 1 here]

Empirical results

The results from the estimation of the probability of working full-time are presented in Table 1. Generally, the probability of working full-time is positively associated with living in metropolitan areas, vehicle ownership and education and is negatively associated with having a disability, caring for an individual needing assistance, speaking a language other than English, studying and being a single parent. The presence of children has a negative impact on the probability of working full-time for women. Figure 2 shows there is an ‘n’ shaped relationship between working full-time and the individual’s age.

[Insert Table 1 here]

A striking feature of the results is that the predicted proportions of Indigenous Australians working full-time (holding all other factors in the model at their mean) are much lower than the predicted proportions of non-Indigenous Australians working full-time. For example, Indigenous men and women have statistically significantly lower predicted full-time employment rates than their non-Indigenous counterparts at almost year of age. The largest gaps in the predicted full-time employment rates for the two populations occur between the ages 20 to 50 years (see Figure 2). This is the main age for career advancement, which suggests that there is a need to encourage Indigenous Australians participate in full-time work at the ages it matters the their careers.

[Insert Figure 2 here]

Table 1 also reveals some important links between education and the probability of working full-time. The positive impact of education on working full-time is statistically significantly larger for Indigenous men and women, indicating that policy on improving the education levels of Indigenous Australians should have a positive on their engagement in full-time work. However, Table 1 shows that the only Indigenous men with tertiary level qualifications have predicted probabilities of working full-time which are similar to their non-Indigenous counterparts. Indigenous men with all other education levels have predicted full-time employment rates which are lower than those of non-Indigenous men. These results imply that whilst education has a positive impact on Indigenous men's engagement in full-time work, this does not translate to them having comparable employment rates to non-Indigenous men. There is a need to assist Indigenous men without tertiary level qualifications gain full-time work.

The findings paint a different picture for Indigenous women. Indigenous women with Year 11 or higher levels of education have predicted full-time employment rates that are comparable to non-Indigenous women. As such, it is possible to infer that educated Indigenous women have the same level of engagement in full-time employment than non-Indigenous women.

Finally, Table 1 shows that the positive impact of vehicle ownership on the probability of working full-time is more pronounced for Indigenous workers than non-Indigenous workers. This finding is consistent with Birch and Marshall (2016) and highlights the importance of vehicle ownership for improving Indigenous Australians' labour market outcomes. Promoting access to transportation for Indigenous Australians will have a positive impact on their engagement in the labour force.

The results from the estimation of earned income are presented in Tables 2 and 3. They are consistent with many Australian studies (see Preston, 2001 for a review). Earned income is positively linked to living in metropolitan areas, marriage, education, working overtime, public sector employment and working in higher ranked occupations. Earned income also increases with labour market experience, albeit at a diminishing rate. Earned income is negatively associated with having a disability, not speaking English at home, working in small businesses and varies across industry of employment.⁵

[Insert Table 2 here]

[Insert Table 3 here]

The results show that the predicted log of earned income in almost all cases is lower for Indigenous workers than it is for non-Indigenous workers by various characteristics. This implies that when holding all other characteristics at their mean, Indigenous workers with a particular characteristic, such as Year 12 education, have lower earnings than non-Indigenous workers. It indicates that there is an extent of earnings inequality for Indigenous people.

The earning returns to labour market experience are statistically significantly higher for non-Indigenous workers, than Indigenous workers. This implies that over their lifetime, the accumulated earnings of Indigenous workers would be lower than that of non-Indigenous workers. This finding may reflect the typical jobs Indigenous Australians are employed in which have limited career growth. Policy may be needed to encourage employers to reward Indigenous workers for their job tenure or to encourage their career development.

In all cases the selection-bias correction term is statistically significant, suggesting that the correcting for selection-bias is important. The estimated coefficients for the term are negative suggesting that the unobserved factors which have a positive impact on the probability of working full-time have a negative impact on the earnings of full-time workers. Negative selection-bias correction terms are common in the few Australian studies which use the two-stage Heckman model (Preston 2001). Birch (2014) indicates they may be negative because factors such as family commitments may have a positive impact on decisions to work full-time but then have a negative impact on earnings when individuals juggle balancing full-time work and taking care of a family. Most of the estimated coefficients in the earnings model are smaller with controls for selection-bias, which may indicate that studies which do not control for selection-bias overestimate earnings returns. The estimated coefficients for the selection-bias correction term are also significantly larger for Indigenous workers, reflecting the lower full-time employment rates of the population.

Finally, the relationship between education and earnings has produced some intriguing results, particularly when controlling for selection-bias. When controlling for this, the earnings premiums associated with education are lower for Indigenous workers than non-Indigenous workers.⁶ To the extent that correcting for selection-bias is valid, the findings suggest that Indigenous workers are penalised in terms of earnings by educational attainment. Again this may be due to the types of jobs Indigenous Australians work in. It may also reflect discrimination, as educated Indigenous Australians do not reap the same rewards in terms of earnings as the educated non-Indigenous population. Additionally, it may be associated with the quality of the educational attainment for Indigenous Australians. Hughes and Hughes (2012) suggest that Indigenous students are concentrated in schools with poor teaching and some Indigenous students who complete vocational education are illiterate and innumerate.

Furthermore, when controlling for selection-bias, there are no significant differences in the earned income of Indigenous male and female workers with lower levels of education. Hence, Indigenous men and women who have completed high school (Year 12 schooling) have the same level of earned income as those who have not completed Year 10. This finding is inconsistent with human capital theory which posits that an additional year of schooling yields higher earnings. It raises doubt on whether recent increases in Indigenous Australians' educational attainment driven from the *Closing the Gap* target of improving the proportion of Indigenous Australians with Year 12 education has had a positive impact on their earnings. The results also highlight the importance of encouraging Indigenous Australians to complete post-school qualifications and participate in the workforce as a means of improving their earned income.

However, the strength of the findings regarding education when controlling for selection-bias are questionable, given the noted flaws and limitations of the Heckman two-stage method.⁷ Without controls for selection-bias the earnings returns to education for Indigenous workers are comparable with non-Indigenous workers. The returns to education for lower educated Indigenous female workers are more consistent with human capital theory.

Of central importance to this study is how the earned income of Indigenous workers fares with that of non-Indigenous workers when taking into account differences in their characteristics. The results from various the decompositions are presented in Table 4. Indigenous males who work full-time earn 26.5% less than non-Indigenous males. For females, the difference is equal to 18.1%. These raw gaps are very similar to those in Daly (1995). It seems that there has been no progress in closing the raw earnings differences among the two populations in the past 30 years.

[Insert Table 4 here]

Considering the findings from the standard Oaxaca (1973) decomposition first, 65% of the earned income gap for Indigenous and non-Indigenous males can be accounted for by differences in their endowments. Around 76% of the gap for females is due to endowment differences. The majority of this explained earned income gap is associated with differences in educational attainment for the two populations. Educational attainment differences contribute to around 50% of the explained earnings differential. These findings are again very similar to Daly (1995). Differences in Indigenous and non-Indigenous Australian's education levels are the key factor explaining observed earnings differentials.

When adjusting for differences in the endowments, Indigenous men and women have earned income penalties of 9.3 and 4.3%. This may indicate that there is a degree of earnings discrimination for Indigenous workers. The penalty may also be due to Indigenous Australians working in secondary labour markets, other job characteristics linked to earnings, such as trade union membership or differences in the productivity, all of which cannot be accounted for in the data set. The higher earnings disadvantage experienced by Indigenous men compared to Indigenous women implies that these issues are more prevalent for men. There may be a larger degree of homogeneity among Indigenous and non-Indigenous women working full-time (i.e. they work in similar types of industries, occupations or jobs) and a larger disparity in the types of jobs worked by Indigenous and non-Indigenous men. Alarming, the earned income penalties parallel those produced in Daly (1995). Policy efforts to improve the education and employment outcomes of Indigenous Australians have not translated to a reduction in the earnings discrimination which they face.

The results from the Neuman and Oaxaca (2004) decomposition based on earnings models corrected for selection-bias are very similar to the standard Oaxaca (1973) decomposition. Hence, 61 and 72% of the earnings gap can explained by endowments, for males and females, respectively. The inclusion of selection-bias controls has minimal impact on the size of the explained proportion of the earnings gap. The adjusted earning penalty using the Neuman and Oxaca approach (2004) (i.e. only taking the explained proportion of the earnings gap off the raw earnings gap) is 10.2% for Indigenous men and 5.0% for Indigenous women. This penalty can be explained by discrimination (or other unexplained factors) but may also be due to selection-bias.

The results from the Reimers (1983) decomposition which corrects for selection-bias in the raw earning gap produces very different findings. Under this approach, the raw earnings gap corrected for selection-bias for Indigenous and non-Indigenous men is 18.9%. For women, correction for selection bias in the raw earnings gap accounts for the entire earnings gap.

Accounting for endowment differences in the selection-bias adjusted earnings gap, the Reimers (1983) decomposition shows that Indigenous males have earnings which are 2.6% *higher* than the earnings of non-Indigenous males. Indigenous females have earned income which is 13.8% *higher* than their non-Indigenous counterparts. The validity of these findings lie in the merit of using the Heckman two-stage method for estimating earnings and Reimers's (1983) method for decomposing earnings models corrected for selection-bias. The findings should be interpreted cautiously. The results imply that when correcting for selection-bias in the earnings offer, Indigenous Australians have higher earnings than their non-Indigenous counterparts. This is potentially plausible given the very low full-time employment rates of the population. In recent years, there has been increased demand for Indigenous workers, due to quotas in

the public sector and private sector employment programs (Department of Employment, 2016; Elks, 2016). If demand for Indigenous workers outweighs the supply it may result in Indigenous workers having higher earnings. It has been suggested that companies committed to achieving particular levels of Indigenous employment have not been able to find enough suitable candidates (University of Western Australia, 2011). The relatively large earnings premium for Indigenous women using the Reimers (1983) decomposition may indicate that the shortage of Indigenous workers is more prevalent for females.

The results from the Reimers (1983) decomposition may imply that discrimination occurs for Indigenous Australians trying to find work as opposed to their earnings, given that they have higher earnings after correcting for their lower full-time employment rates. Booth *et al.* (2012) found that discrimination among Indigenous and non-Indigenous workers occurs in securing of work.

Despite the alternative approaches for decomposing the earnings differential a very clear conclusion can be drawn from this analysis. That is, around two-thirds and three-quarters of the earned income gap between Indigenous and non-Indigenous men women can be explained by differences in endowments, particularly education. The explained component of the earning gap does not vary considerably when correcting for selection-bias. The remainder of the earned income differences may be due to discrimination or potentially selection-bias issues. It is possible to infer that by improving the full-time employment rates of Indigenous Australians, issues regarding selection-bias will be narrowed and a clearer picture of the underlying earnings gap experienced by such workers can be established. Moreover, improving the education levels of Indigenous Australians should have a positive impact on reducing the ‘surface’ earning gap and in turn will hopefully provide a deeper understanding of any earnings penalty.

Discussion and conclusion

This paper has estimated the earned income penalty for Indigenous Australians employed full-time. An understanding of this is of importance as it provides an indication of whether Indigenous Australians are discriminated in the workplace. Improving the earned income of Indigenous Australians is imperative to improving their living standards and for reaching the *Closing the Gap* targets. To date, the literature on earned income gap of Indigenous and non-Indigenous workers is limited.

The paper sought to answer three questions: (i) whether there are differences in the factors associated with employment and earnings for Indigenous and non-Indigenous Australian, (ii), what is the current earned income gap for the two populations, and (iii) does this gap vary when correcting for the fact that not all of the population works full-time.

The paper found that there were noticeable differences in the factors associated with the probability of being employed full-time and earnings of Indigenous and non-Indigenous Australians. Indigenous Australians have lower predicted employment rates than non-Indigenous Australians by many of the variables considered in the analysis. Only highly educated Indigenous men have predicted full-time employment rates that are similar to those of non-Indigenous men. There are fewer disparities in the predicted full-time employment rates for Indigenous and non-Indigenous women by education level. The impact of education and vehicle ownership on working full-time is also more pronounced for the Indigenous population.

Indigenous Australians also have lower predicted earned income than non-Indigenous Australians by most characteristics. Their earnings returns to labour market experience

and education (when controlling for selection-bias) are considerably lower than the non-Indigenous population.

The paper found that Indigenous workers have lower mean earnings than non-Indigenous workers. Using the standard Oaxaca (1973) decomposition, around two-thirds and three-quarters of the earning differential for males and females could be explained by endowments differences, particularly education differences. Indigenous men have an unexplained earned income penalty of 9.3% and Indigenous women have an unexplained earned income penalty of 4.3%.

When estimating the earning gap using Neuman and Oaxaca (2004) and Reimers (1983) decompositions, the paper found that correcting for the fact that not all of the population works full-time only had a limited impact on the explained component of the earned income gap. However, when taking this into account in the raw earnings offer for Indigenous and non-Indigenous Australians, the paper found that Indigenous Australians have earned income that is higher than non-Indigenous Australians.

The findings in this paper are not without their weaknesses. There are large limitations in using Census data accessed through RADL. A more advanced study of the earnings gap between Indigenous and non-Indigenous Australians could be possible if data on Indigenous Australians from the Census was accessible outside of RADL and researchers had actual access to the data. The study would also be improved if RADL had more recent software packages and allowed for new packages to be added. The study is also limited as it is based on earned income not wages and salaries. Given that the sources of earned income for Indigenous and non-Indigenous Australians vary, it is possible that the actual earnings gap between the two populations may be smaller or larger than the results generated from this study. For a true understanding of the

earnings gap, there needs to be data collected on the wages Indigenous and non-Indigenous Australians on a national scale. The Census also has limited questions on job characteristics which may explain earnings differences as factors linked to segmented labour markets and career opportunities. Lastly, the use of selection-bias corrected earnings equations are not without opponents and decomposing such terms in earnings equations is also associated with interpretation problems.

Despite these limitations there are a number of key implications from the study. First, it is clear that improving the education of Indigenous Australians is paramount to reducing the earned income gap they face. There are large differences in the proportion of Indigenous workers with bachelor and higher degrees compared to non-Indigenous workers. Policies aimed at increasing the education of Indigenous Australians will translate to closing the earned income gap if educational improvement is directed at increasing higher education qualifications. The paper found that there are earnings and employment rewards for Indigenous Australians who complete tertiary education (although the earnings awards may be less than at of non-Indigenous Australians). Given the importance of higher education in determining labour market outcomes, COAG may consider further increasing efforts to improve Indigenous participation in education beyond high school. Currently, *Closing the Gap* targets addressing education are only aimed at improving high school completion rates. COAG should consider a target to close or reduce the gap in higher education participation.

Second, the findings suggest that the unexplained earned income gap for Indigenous men and women is remarkably similar to that produced in studies from three decades ago, such as Daly (1995). It is possible that Indigenous Australians have experienced relatively no improvement in earnings discrimination despite the government's efforts to improve their wellbeing. Indigenous Australians may still face secondary labour

markets. Policy needs to be directed at assisting Indigenous Australians into better paid jobs and careers. There is a need to promote the employment of Indigenous Australians primary labour markets. This may be achieved by offering more incentives to employers with Indigenous employment programs. There is also a need to ensure that Indigenous Australians are rewarded the same as non-Indigenous in terms of their human capital. There may be merit in policymakers setting recommendations to employers what the earned income should be for individuals with a particular level of education and labour market experience. There may also be merit in policymakers in providing more advice to Indigenous Australians on what to do if they feel discriminated against in terms of earnings. Finally policy needs to be directed to improving the quality of education for Indigenous Australians. This may include setting higher minimum requirements for the completion of an educational attainment. Given the limited variables in the Census that can explain segmented labour markets and earnings discrimination, there is a real need to future data sets to capture more information on the types and level of employment, trade union membership and career advancement opportunities that Indigenous and non-Indigenous workers face.

Finally, the results from the estimation of the earned income gap correcting for selection-bias in the raw earnings offer indicate that Indigenous Australians may have higher earned income than non-Indigenous Australians. Undoubtedly this result is questionable given the ambiguity on how to decompose earnings models which correct for selection-bias and the controversies and critiques of the estimation of the selection-bias correction term. Nonetheless, the results do provide evidence that the discrimination faced by Indigenous Australians may impact on their participation in the labour market but not on their earnings. Policies aimed at improving Indigenous Australians chances of finding full-time employment will have a positive impact on

reducing potential selection-bias and therefore will provide a clearer picture of the earning disadvantage of Indigenous Australians.

To conclude, it appears that Indigenous Australians still fare worse in the labour market in terms of earned income. Revisiting the issue of the earning income gap shows little improvement in underlying earnings penalty experienced by Indigenous men and women in recent decades. However, the findings in the paper indicate that this may not be purely due to discrimination but also may be linked to the lower full-time employment rates of the Indigenous population. There is a need for much more research on the earnings penalty faced by Indigenous Australian workers. Studies should be conducted with every new Census to examine any progress at improving Indigenous Australians' earnings inequality.

Notes:

¹ The probability of working full-time is argued to be a function of the individual's disability status, care to someone needing assistance, location, language skills, age, student status, family type, presence of children, education level, and vehicle ownership. Information on these variables is available from the authors.

² See Table A1 for a description of the variables.

³ The unexplained component may also relate to differences in the productivity which cannot be accounted for by observable characteristics such as work effort (Preston, 2001).

⁴ An alternative approach to the Heckman two-stage method would be to use an Instrumental Variable (IV) approach where the decision to work full-time is instrumented using a variable correlated with working full-time by uncorrelated with earnings. This paper does not attempt an IV approach due to data limitations.

⁵ For space reasons, the results for job characteristics are not reported but are available from the authors.

⁶ There are no statistically significant differences in the returns to education for the two populations based on interaction terms between variables for controlling for Indigenous status and education levels. This is likely to be due to the very small sample of Indigenous Australians, resulting in high standard errors, which produce the insignificant differences.

⁷ The selection-bias correction term was estimated using alternative variables in both the probability of working full-time and earnings model. Under the alternative specifications, the term was similar, in terms of size, sign and significance. The results from earnings models were also similar under alternative specifications of the term. This may be due to the fact that there are only limited variables in the Census that are sensible to estimate employment decisions and earnings. As such, there is a degree of similarity in the models estimated using alternative controls.

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Appendix:

Table A1 Descriptions of the Variables Included in the Analysis on Earnings^(a)

Variable	Description	Males		Females	
		Non-Indigenous	Indigenous	Non-Indigenous	Indigenous
<i>Dependent Variable:</i>					
earnedY	Natural logarithm of personal weekly income	7.113	6.848	6.935	6.754
<i>Independent Variables</i>					
disab	Disabled	0.003	0.008	0.003	0.001
ndisab	Omitted category: not disabled	0.997	0.992	0.997	0.990
metro	Lives in metropolitan areas	0.608	0.291	0.639	0.293
rural	Omitted category: lives in non-metropolitan areas	0.392	0.709	0.361	0.707
marr	Married/defacto relationship	0.664	0.529	0.577	0.483
nmarr	Omitted category: Not married/defacto relationship	0.336	0.471	0.423	0.517
noteng	Does not speaks English at home	0.177	0.074	0.190	0.088
english	Omitted category: Speaks English at home	0.823	0.926	0.810	0.912
hdegree	Masters or PhD education	0.077	0.019	0.105	0.038
bach	Bachelor's degree education	0.177	0.051	0.258	0.117
diploma	Diploma education	0.089	0.049	0.125	0.112
cert	Certificate education	0.306	0.325	0.156	0.253
year12	Year 12 education	0.163	0.190	0.177	0.193
year11	Year 11 education	0.048	0.070	0.050	0.066
year10	Year 10 education	0.098	0.198	0.103	0.164
unqual	Omitted category: less than Year 10 education	0.041	0.097	0.027	0.057
exp	Potential labour market experience	22.730	19.750	21.148	20.594
exp2	Potential labour market experience squared	667.314	540.877	609.354	572.890
Sample size		300,921	6032	312,007	6858
Full-time employed sample size		183,033	2359	99,801	1508
Note: ^(a) Unless continuous variable, variable =1 if true, otherwise =0. Means are for full-time workers. The model also includes controls for job characteristics.					

Tables

Table 1 Results from the Estimation of the Probability of Working Full-Time

Variable	Non-Indigenous Males			Indigenous Males			Non-Indigenous Females			Indigenous Females		
	Coefficient	Standard Error ^(a)	Predicted empft	Coefficient	Standard Error ^(a)	Predicted empft	Coefficient	Standard Error ^(a)	Predicted empft	Coefficient	Standard Error ^(a)	Predicted empft
<i>Personal</i>												
disab ^{(b)(c)}	-1.173	0.238***	8.099%	-1.296	0.115***	5.791%	1.221	0.027***	4.191%	-1.004	0.128***	3.010%
ndisab ^(omitted)			62.999%			39.091%			30.591%			19.310%
assist	-0.215	0.008***	53.536%	-0.231	0.058***	28.710%	-0.225	0.007***	23.264%	-0.218	0.049***	13.683%
nassist ^(omitted)			61.936%			37.010%			30.664%			18.983%
metro	0.063	0.005***	62.127%	0.087	0.041**	38.519%	0.034	0.005***	30.678%	0.043	0.041	18.829%
rural ^(omitted)			59.727%			35.219%			27.778%			17.683%
noteng ^(c)	-0.279	0.006***	52.455%	-0.374	0.057***	24.944%	-0.177	0.006***	24.901%	-0.021	0.061	17.497%
english ^(omitted)			63.455%			38.144%			30.801%			18.045%
age ^{(b)(c)}	0.130	0.001***		0.066	0.010***		0.102	0.001***		0.088	0.010***	
age2 ^{(b)(c)}	-0.001	<0.001***		-0.001	<0.001***		-0.001	<0.001***		-0.001	<0.001***	
student ^(c)	-0.750	0.008***	35.424%	-0.275	0.060***	27.267%	-0.588	0.008***	14.964%	-0.165	0.054***	18.570%
nostudent ^(omitted)			64.624%			37.067%			32.664%			22.670%
singfam ^(c)	-0.294	0.010***	50.302%	-0.402	0.056***	24.069%	0.085	0.008***	32.163%	-0.082	0.047*	16.485%
nosingfam ^(omitted)			61.802%			38.169%			29.163%			18.588%
kids ^(c)	0.087	0.006***	63.498%	0.051	0.040	35.465%	-0.843	0.006***	13.662%	-0.448	0.043***	12.140%
nokids ^(omitted)			60.198%			37.388%			39.662%			23.540%
<i>Education</i>												
hdegree ^{(b)(c)}	0.675	0.014***	67.588%	1.359	0.189***	68.916%	0.862	0.015***	48.528%	1.141	0.128***	47.546%
bach ^{(b)(c)}	0.584	0.119***	65.588%	1.128	0.114***	62.710%	0.721	0.013***	42.428%	1.165	0.088***	47.864%
diploma ^{(b)(c)}	0.497	0.013***	62.488%	0.745	0.103***	49.716%	0.590	0.014***	37.828%	1.057	0.087***	43.546%
cert ^{(b)(c)}	0.501	0.110***	63.388%	0.767	0.058***	50.216%	0.468	0.014***	32.828%	0.814	0.071***	32.546%
year12 ^{(b)(c)}	0.278	0.012***	55.288%	0.610	0.064***	44.316%	0.382	0.013***	29.428%	0.787	0.074***	31.846%
year11	0.289	0.015***	55.688%	0.349	0.058***	34.216%	0.310	0.016***	27.028%	0.468	0.088***	21.146%
year10 ^(b)	0.230	0.012***	53.688%	0.342	0.058***	33.616%	0.256	0.014***	24.828%	0.377	0.070***	17.546%
unqual ^(omitted)			45.088%			20.616%			15.628%			6.864%
<i>Cars</i>												
car1 ^(c)	0.114	0.010***	53.647%	0.156	0.051***	29.644%	0.196	0.011***	29.070%	0.373	0.055***	20.391%
car2 ^{(b)(c)}	0.379	0.009***	63.367%	0.635	0.053***	44.144%	0.245	0.010***	30.670%	0.575	0.056***	26.791%
car3 ^{(b)(c)}	0.462	0.009***	66.067%	0.772	0.055***	53.644%	0.309	0.011***	33.170%	0.636	0.061***	29.691%
nocar ^(omitted)			49.167%			23.744%			22.170%			9.991%
constant	-2.511	0.299***		-2.162	0.177***		-2.414	0.031***		-3.161	0.194***	
Mean empft			60.824%			39.108%			31.987%			21.990%
Chi ²	56383.97			1333.70			44049.56			997.170		
Pseudo R ²	0.140			0.165			0.113			0.138		

Notes: ^(a) * refers to statistical significance at the 10% level, ** 5% level and *** 1% level. ^{(b), (c)} There are statistically significant differences in the estimated coefficients for Indigenous and non-Indigenous males and females at the 10% or higher level, respectively.

Table 2 Results from the Estimation of Weekly Earnings, Males

Variable	Non-Indigenous						Indigenous					
	Coefficient	With λ Standard Error ^(a)	Predicted earnedY	Coefficient	Without λ Standard Error ^(a)	Predicted earnedY	Coefficient	With λ Standard Error ^(a)	Predicted earnedY	Coefficient	Without λ Standard Error ^(a)	Predicted earnedY
<i>Selection-bias</i> $\lambda^{(b)}$	-0.168	0.007***					-0.205	0.051***				
<i>Personal</i>												
disab ^(b)	-0.095	0.024***	7.019	-0.309	0.022***	6.804	-0.274	0.123**	6.576	-0.495	0.111***	6.357
ndisab ^(omitted)			7.114			7.113			6.850			6.852
metro	0.067	0.002***	7.140	0.071	0.002***	7.141	0.080	0.023***	6.904	0.090	0.023***	6.911
rural ^(omitted)			7.073			7.070			6.824			6.821
marr	0.070	0.003***	7.136	0.087	0.003***	7.142	0.069	0.024***	6.880	0.107	0.022***	6.898
nmarr ^(omitted)			7.066			7.055			6.811			6.791
noteng ^(b)	-0.124	0.003***	7.011	-0.149	0.003***	6.991	-0.140	0.044***	6.718	-0.221	0.039***	6.643
english ^(omitted)			7.135			7.140			6.858			6.864
<i>Education</i>												
hdegree	0.424	0.008***	7.380	0.474	0.008***	7.396	0.398	0.094***	7.224	0.567	0.085***	7.311
bach	0.332	0.007***	7.288	0.377	0.007***	7.299	0.279	0.073***	7.107	0.429	0.063***	7.173
diploma	0.210	0.007***	7.166	0.248	0.007***	7.170	0.172	0.066***	7.000	0.286	0.060***	7.030
cert	0.110	0.006***	7.066	0.153	0.006***	7.075	0.023	0.049	6.851	0.133	0.041***	6.877
year12	0.077	0.006***	7.032	0.092	0.006***	7.014	-0.042	0.049	6.786	0.051	0.044	6.795
year11	0.016	0.008**	6.972	0.036	0.008***	6.958	-0.006	0.054	6.820	0.049	0.053	6.793
year10	-0.001	0.007	6.955	0.017	0.007**	6.939	-0.048	0.043	6.780	0.003	0.041	6.747
unqual ^(omitted)			6.956			6.922			6.828			6.744
<i>Experience</i>												
exp ^(b)	0.033	0.000***		0.039	0.000***		0.027	0.003***		0.030	0.003***	
exp2 ^(b)	-0.001	0.000***		-0.001	0.000***		-0.000	0.000***		-0.001	0.000***	
constant	6.234	0.011***		6.056	0.008***		6.277	0.091***		5.979	0.054***	
Mean earnedY			7.113			7.113			6.868			6.868
Adjusted R ²	0.381			0.379			0.362			0.358		

Notes: ^(a) * refers to statistical significance at the 10% level, ** 5% level and *** 1% level and the models control for job characteristics. ^(b) There are statistically significant differences in the estimated coefficients for Indigenous and non-Indigenous men at the 10% or higher level.

Table 3 Results from the Estimation of Weekly Earnings, Females

Variable	Non-Indigenous						Indigenous					
	Coefficient	With λ Standard Error ^(a)	Predicted earnedY	Coefficient	Without λ Standard Error ^(a)	Predicted earnedY	Coefficient	With λ Standard Error ^(a)	Predicted earnedY	Coefficient	Without λ Standard Error ^(a)	Predicted earnedY
<i>Selection-bias</i> $\lambda^{(b)}$	-0.097	0.005***					-0.245	0.053***				
<i>Personal</i>												
disab	-0.122	0.025***	6.814	-0.217	0.025***	6.719	-0.248	0.129*	6.508	-0.501	0.118***	6.258
ndisab ^(omitted)			6.936			6.936			6.756			6.759
metro	0.100	0.003***	6.971	0.108	0.003***	6.974	0.094	0.027***	6.820	0.112	0.026***	6.833
rural ^(omitted)			6.871			6.866			6.726			6.721
marr	0.016	0.003***	6.942	0.011	0.003***	6.934	0.019	0.024	6.764	0.040	0.024*	6.775
nmarr ^(omitted)			6.926			6.923			6.745			6.735
noteng ^(b)	-0.103	0.004***	6.852	-0.117	0.004***	6.840	-0.156	0.043***	6.612	-0.198	0.042***	6.573
english ^(omitted)			6.955			6.957			6.768			6.771
<i>Education</i>												
hdegree	0.453	0.011***	7.185	0.504	0.011***	7.204	0.458	0.095***	7.168	0.687	0.082***	7.238
bach	0.338	0.010***	7.070	0.384	0.010***	7.084	0.179	0.083**	6.889	0.415	0.066***	6.966
diploma	0.199	0.010***	6.931	0.235	0.010***	6.935	0.119	0.078	6.829	0.331	0.063***	6.882
cert	0.102	0.010***	6.834	0.130	0.010***	6.830	-0.018	0.070	6.692	0.160	0.058***	6.771
year12	0.112	0.010***	6.844	0.133	0.010***	6.833	-0.028	0.069	6.682	0.139	0.060**	6.690
year11	0.059	0.011***	6.791	0.078	0.011***	6.780	0.026	0.072	6.736	0.129	0.069*	6.680
year10	0.046	0.010***	6.778	0.064	0.010***	6.764	0.000	0.061	6.711	0.093	0.058	6.644
unqual ^(omitted)			6.732			6.700			6.710			6.551
<i>Experience</i>												
exp ^(b)	0.032	0.000***		0.033	0.000***		0.016	0.004***		0.020	0.004***	
exp2 ^(b)	-0.001	0.000***		-0.001	0.000***		-0.000	0.000***		-0.000	0.000***	
constant	6.059	0.013***		5.932	0.011***		6.301	0.130***		5.799	0.071***	
Mean earnedY			6.935			6.935			6.754			6.754
Adjusted R ²	0.373			0.371			0.364			0.355		

Notes: ^(a) * refers to statistical significance at the 10% level, ** 5% level and *** 1% level and the models control for job characteristics. ^(b) There are statistically significant differences in the estimated coefficients for Indigenous and non-Indigenous women at the 10% or higher level.

Table 4 Decomposition of the Earned Income Gap^(a)

	Males			Females		
	Decomposition Method			Decomposition Method		
	Oaxaca (1973)	Neuman and Oaxaca (2004)	Reimers (1983)	Oaxaca (1973)	Neuman and Oaxaca (2004)	Reimers (1983)
Raw Earned Income Gap:	0.265	0.265	0.265	0.181	0.181	0.181
Explained Component:	0.172	0.163	0.163	0.138	0.131	0.131
Percent of Raw Earned Income Gap Explained:	65.07%	61.37%	61.37%	76.34%	72.41%	72.41%
<i>Personal characteristics</i>	12.02%	11.20%	11.20%	20.02%	20.08%	20.08%
<i>Education</i>	44.60%	43.26%	43.26%	51.27%	49.53%	49.53%
<i>Experience</i>	17.35%	18.11%	18.11%	-2.16%	-1.74%	-1.74%
<i>Job Characteristics</i>	26.03%	27.03%	27.03%	30.87%	32.13%	32.13%
Unexplained Component:	0.093	0.026	0.026	0.043	-0.138	-0.138
Selection-Bias Component:	^(b)	0.076	0.076	^(b)	0.188	0.188
Selection-Bias Corrected Raw Earned Income Gap:	^(b)	^(b)	0.189	^(b)	^(b)	-0.007
Adjusted Earned Income Gap:	0.093	0.102	0.026	0.043	0.050	-0.138

Notes: ^(a) Grouped endowment difference percentages are expressed as a proportion of total endowments. ^(b) Not included in the model.