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How should government investments be made to improve the socio-economic status of remote Indigenous communities in Australia?
Should the Australian Government consider a change with its existing policy?

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Introduction

On first glance, Australia is justifiably world-renowned for its outstanding political, social and economical achievements. Classified as a High-Income Economy by the World Bank, and ranked number two in the world according to the Human Development Index rankings (which is a combination of life expectancy, school enrolment ratios and GDP per capita), Australia exhibits levels of socio-economic progress that make it the envy of both the developed and developing world (The World Bank Group 2010; United Nations Development Programme 2009). [1] While as much can be said for the vast majority of Australia's population, for the 2.3 per cent of the population known as Aboriginal and Torres Strait Islanders (hereafter referred to as 'Indigenous') the contrast is alarming. A distinct division exists between the Indigenous and non-Indigenous populations of Australia – essentially dividing the country into two separate socio-economic classes, which is the historical product of Indigenous marginalisation from mainstream society.

In light of previous and existing policy failings, this paper assesses whether the government should consider a change in its policy and introduce a new investment strategy designed specifically towards improving the socio-economic status of remote Indigenous communities, with the ultimate aim of reducing the socio-economic that existing between the Indigenous and non-Indigenous population.

A new, unique solution for solving Indigenous disadvantage will be introduced and developed in four separate parts throughout this paper: Part 1 will identify and analyse the existing gap between the Indigenous and non-Indigenous populations, and introduce the focus on remote Indigenous communities; Part 2 will develop a modelling approach designed to create a new government investment strategy towards remote Indigenous communities; Part 3 will analyse the relevant results associated with the model; and Part 4 will establish the appropriate policy implications generated from these results – identifying a new, relevant investment strategy.

[1] A high-income economy is defined by the World Bank as a country with a Gross National Income per capita of $US12,196 or more in 2009; Australia's HDI value is 0.970.

The Data

The data utilised throughout this paper consists of the following demographic variables, obtained from the Australian Indigenous Geographical Classification. When combined, these variables portray an accurate representation of an economic agent's socio-economic status in Australia.

Table 1.1

Data (as labelled in dataset)	Description
POP	Total population
LOW_ENG	Proportion of Indigenous people who speak Australian Indigenous language AND speak English either: not well; or not at all
ELDER_YOUTH_R	The ratio of elders (aged 25 and above) to every youth (aged 15-24) in each community
MAX_EDU_YR8	Highest level of educational attainment: Completion of Year 8 or below
MAX_ EDU_YR12[2]	Highest level of educational attainment: Completion of Year 12 or equivalent
ROOM_DENS	Average number of persons per bedroom
INC_WKLY	Median individual weekly income ($AUD)
HOME_OWN	Proportion of total household that are either fully owned or in the process of being purchased
NO_WEB	Proportion of total households with no internet connection
IND_EMPLOY	Proportion of Indigenous persons (aged 15 years and over) in the labour force who are currently employed
PUBLIC_TRANS[3]	Proportion of total persons (aged 15 years and over) who travel to work via public transport when using only one method of transport
LFpc	Proportion of the total Indigenous population that are in the labour force

Source: ABS 2008

All Parts of the paper required intensive use and analysis of the data listed above, including: performing demographic socio-economic comparisons between different sections of the community (Part 1); constructing a model based on existing demographic characteristics (Part 2); analysing the results of the model (Part 3); and drawing on relevant policy implications (Part 4).

[2] MAX_EDU_YR8 and MAX_EDU_YR12 are mutually exclusive variables – according to the dataset, if the highest level of educational attainment is completed at year 8 or below, then the opportunity to complete higher levels of education at year 12 level or equivalent is eliminated. Conversely, if the highest level of educational attainment is completed at year 12 or equivalent, then it is impossible for year 8 or below to be labelled as the highest level of educational attainment.

[3] Public transport methods include: train, bus, ferry, tram/light rail and taxi.

Part 1: The failure of previous and existing government investment towards the Indigenous population in the modern policy era

Historical failure of government policy from 1967 onwards

The beginning of the modern policy era for the Indigenous population of Australia is marked by the 1967 constitutional referendum, which proposed to: include Aboriginal people in the census; and allow the Commonwealth Government to make laws specifically for Aboriginal people (creative spirits, n.d.).

Subsequently, from 1967 onwards the Australian government initiated countless policies designed specifically to improve the socio-economic status of the Indigenous community, with the view to overcoming centuries of economic, political and social isolation. However, the failure of government programs in the modern era to improve the socio-economic situation of the Indigenous population has been well documented. According to Professor Jon Altman (2000: v), Director at the Centre for Aboriginal Economic Policy Research, there has been 'no automatic positive correlation between (government) funding and improved economic status.' This is in spite of the estimated $2 billion per annum in welfare and special allocations being provided to Indigenous people by the turn of the millennium.

Reasons for this apparent failure in government investment towards Indigenous people can be attributed to several factors, including: the lack of policy/program continuity; failure to implement an overarching, strategic goal or philosophy with each policy; the lack of coordination between the Indigenous Affairs portfolio, State government and Federal government; and most importantly, the assimilationist nature of government policy, which failed to recognise the needs of Indigenous society, its cultural identity, or the significance of their historical marginalisation (Altman, 2000).

Evidence

The lack of economic or social progress of the Indigenous population, which is an outcome of unsuccessful government policy, is proven by the current socio-economic 'gap' that exists between the Indigenous and non-Indigenous communities of Australia.[4] Using data obtained from the 2006 census, the stark contrast in key community demographics is detailed in the following table.

[4] The non-Indigenous community is represented by data according to the national average, a result of the fact that the Indigenous population comprises 2.29 per cent of the total population of Australia

Table 1.2

Demographic variable	Indigenous Ave	Non-Indigenous Ave (national average)	Gap
MAX_EDU_YR8	8.8%	5.8%	3%
MAX_EDU_YR12	12.1%	33.9%	21.8%
INC_WKLY	$278	$466	$188
EMPLOY[5]	84.4%	94.8%	10.4%
HOME_OWN	34.2%	68.1%	33.9%
NO_WEB	53.2%	35.4%	17.8%

Source: ABS 2007a; ABS 2007b

According to the statistics, the Indigenous population experiences a much lower socio-economic level than that of the national average, represented by education, employment, income and economic prosperity[6].

- *Education* – The Indigenous population is far more likely to have a lower level of educational attainment. They are more likely to complete schooling at a level no higher than Year 8, and far less likely to have completed Year 12 or equivalent.
- *Employment* – The Indigenous population are over 10 per cent more likely to be unemployed.
- *Income* – The median individual weekly income is $188 higher in the non-Indigenous population, which represents a 68 per cent income gap between populations.
- *Economic Prosperity* – Non-Indigenous households are almost twice as likely to have access to housing and technology, signifying greater levels of economic prosperity compared to the Indigenous population.

International comparison

It can legitimately be argued that the socio-economic gap between the Indigenous and non-Indigenous communities is unavoidable given the historic social, political and economic marginalisation of the Indigenous community. Although government policies have achieved some measures of success via absolute demographic improvements within the Indigenous population, they have been unsuccessful with respect to relative demographic movements compared to the non-Indigenous population (Taylor, 1997).

The extent to which the gap represents a failure on behalf of the government can be measured via international comparisons of socio-economic gaps between the Indigenous and non-Indigenous populations of countries with similar experiences in dealing with minority indigenous populations, detailed in the following table.

[5] EMPLOY refers to *IND_EMPLOY* as well as proportion of all people in non-Indigenous communities (over 15 years) in the labour force who are currently employed.
[6] Economic prosperity in this instance is measured by levels of household ownership as well as the prevalence of household internet access

Table 1.3

Country (*and Indigenous people*)	Average life expectancy gap (years)	Educational attainment gap[7]	Median annual income gap[8]	Indigenous Human Development Index (HDI) gap
Australia (*Aboriginal and Torres Strait Islanders*)	10.6	.176	.095	.184
NZ (*Maori*)	8.25	.233	.043	.139
Canada (*Aborigines*)	5.8	.093	.065	.085
USA (*American Indians and Alaskan Natives*)	6	.036	.046	.061

Source: Statistics New Zealand 2008; Cooke et al 2007

The international comparison identifies Australia as having the highest socio-economic gap, relative to comparable countries, with respect to life expectancy, median annual income and Indigenous HDI. Consequently, Australia's Indigenous population experience the lowest socio-economic outcomes compared to similar Indigenous populations overseas. This clearly marks Australia as having the relatively highest socio-economic gap according to international standards, which unmistakably represents a failure in its policy approach and investment strategy towards the Indigenous population in the modern policy era.

Focus on Remote Indigenous Communities (RIC)

Although it has been demonstrated that a significant socio-economic gap exists between the non-Indigenous and Indigenous populations, this paper will specifically focus on improving the socio-economic status of Remote Indigenous Communities (RIC) across Australia.

In this context, RIC refers to the Indigenous census profiles I obtained and incorporated into the dataset in order to create the model. In order to qualify as a RIC, each Indigenous location had to satisfy two requirements, including:

1. ***Remoteness*** – Each Indigenous location had to be classified as 'very remote', by achieving a score of 10.53[9] or greater, according to the Accessibility/Remoteness Index of Australia (Department of Health and Ageing 2001).
2. ***Indigenous*** – To be classified as an 'Indigenous' community, each Indigenous location had to comprise of at least 75 per cent Indigenous persons[10] out of the total population.

[7] Educational attainment measures were derived via an educational attainment index, which is weighted according to: adult literacy proxy (2/3) and gross enrolment proxy (1/3).
[8] Measured according to 2000 PPP$, whereby an income index score was derived.
[9] The ARIA+ index (Department of Health and Ageing 2001) is measured according to the following criteria: service information; road network; postcode boundaries; population data; and size of service centres. According to the ABS, the index value of 10.53 represents the cut off for the 'very remote' category, which is defined by 'very little accessibility of goods, services and opportunities for social interaction'
[10] According to the 2006 census, Indigenous persons refer to both Aboriginals and Torres Strait Islanders; People not stating their Indigenous status were NOT included as Indigenous persons.

Using these requirements, a total of 83 Indigenous locations[11] were identified across Australia as RIC, with the relevant data (listed in table 1.1) obtained from each RIC and incorporated into the model.

The following table presents the descriptive statistics for all of the variables obtained in the RIC dataset[12].

Table 1.4

Demographic Variable	Mean	S.D.	Median	Lowest	Highest
POP	479	363	344	101	2068
LOW_ENG	0.135	0.125	0.114	0	0.839
ELDER_YOUTH_R	2.67	0.819	2.44	1.25	6
MAX_EDU_YR8	0.191	0.104	0.155	0.015	0.437
MAX_EDU_YR12	0.104	0.066	0.087	0	0.304
ROOM_DENS	1.89	0.431	1.80	1.20	3.3
INC_WKLY	220	23.20	220	176	304
HOME_OWN	0.025	0.050	0	0	0.288
NO_WEB	0.802	0.124	0.820	0	1
IND_EMPLOY	0.895	0.141	0.933	0.066	1
LFpc	0.279	0.100	0.283	0.059	0.494
PUBLIC_TRANS	0.261	0.101	0.268	0.069	0.467

Source: ABS 2008

The low rate of variation amongst median individual weekly income, ranging only $128 from the minimum to maximum income levels across RIC, can be attributed to a high prevalence of welfare dependence, whereby most households earn a similar base rate of welfare (Altman 2000).

Other relevant points of interest include:

- Large amount of variation in the proportion of persons who speak an Australian Indigenous language and speak English poorly, from 0 to 84 per cent;
- High levels of volatility with respect to employment rates, ranging from 6.6 per cent to 100 per cent; and
- The proportion of persons who travelled to work via one method of public transport varied by almost 40 per cent across all RIC.

There are four central reasons as to why the paper focuses on improving the status of RIC:

Reason 1: *RIC require more urgent policy action*

The socio-economic status of the Indigenous population living in RIC is even lower than that of the national Indigenous average. The following table highlights the difference in means for the remote Indigenous population and the non-remote Indigenous population (represented by the Indigenous national average).

[11] The complete list of RIC and its corresponding State or Territory is listed in Appendix A
[12] The complete dataset is listed in Appendix B

Table 1.5

Demographic variable	Remote Indigenous Communities Ave	Indigenous Ave (Non-remote)	Gap
POP	39775	455030	415255
MAX_EDU_YR8	19.1%	8.8%	10.3%
MAX_EDU_YR12	10.4%	12.1%	1.7%
INC_WKLY	$220	$278	$58
IND_EMPLOY	89.5%	84.4%	5.1%
HOME_OWN	2.5%	34.2%	31.7%
NO_WEB	80.2%	53.2%	27%
ELDER_YOUTH_R	2.7	4.9	2.2
LOW_ENG	13.5%	2.3%	11.2%
ROOM_DENS	1.9	1.3	0.6

Source: ABS 2008; ABS2007b

In terms of education, the population in RIC is more likely to complete schooling at a lower level and less likely to complete Year 12 or equivalent. Remote Indigenous households also receive, on average, 26 per cent less income than their less-remote counterparts. Most significantly, RIC are far behind the national Indigenous average in terms of the following measurements of economic prosperity:

- Households are 27 per cent more likely to have no access to the internet;
- Home ownership is over 30 per cent less prevalent; and
- The elder to youth ratio is almost half the number of the Indigenous average, which results in a "very high economic burden for Indigenous people" in remote communities (due to the increased burden of raising young people that accompanies a high level of youth dependency) (Altman, 2000: 10).

Interestingly, RIC experience a 5.1 per cent higher average employment rate compared to the Indigenous average. However, this is attributed to the presence of Community Development Employment Projects (CDEP) in most remote communities, which actually inflates the employment figures by classifying unemployed individuals as employed (Taylor, 2002). Consequently, I will treat employment in RIC as a variable below that of the national Indigenous employment average, therefore requiring more urgent policy action.

Reason 2: improving the status of RIC is crucial to closing the 'gap' between the Indigenous and non-Indigenous population

The 83 RIC that monopolise my focus comprise an almost disproportionately high 9 per cent of the total Indigenous population. As a result, improving any outcomes within this segment of the population will have a large impact on the overall status of the total population. According to John Taylor (2002), a Senior Fellow for Aboriginal Economic Policy Research, the influence of the remote Indigenous communities has drastically increased over time, with the Indigenous population in remote areas growing by over 23 per cent since 1981. This increase is set to continue, with population projections from now until 2016 indicating a rising Indigenous population in remote areas across Queensland and the Northern Territory.

Reason 3: Focus on RIC minimises policy mistakes of the past

The focus on RIC will recognise the specific needs of the Indigenous community, erasing the assimilationist policy mistakes of the past and establishing a new era of Indigenous sensitive government policy.

Reason 4: Test 'myth' that remote communities in general are incapable of improving its socio-economic status

In spite of the socio-economic disadvantages (illustrated in table 1.5), the Indigenous population remain rooted in RIC in order to maintain their Indigenous 'continuity, identity distinctiveness and cultural survival' (Altman, 2000: 8). As such, government policies directed towards RIC must acknowledge the status quo and accept the fact that the spatial context of the Indigenous population is unlikely to change.

However, there is enough proof to suggest that the status quo will not pose any significant problems towards improving the socio-economic status of RIC. Evidence that remote communities can indeed experience higher levels of socio-economic success is detailed in the following table, which highlights the difference in means between the sample of RIC and a sample of 19 remote non-Indigenous communities.[13]

Table 1.6

Demographic variable	Remote Indigenous Communities Ave	Remote Non-Indigenous Communities Ave	Gap	National Ave
MAX_EDU_YR8	19.1%	8.4%	10.7%	5.8%
MAX_EDU_YR12	10.4%	21.9%	11.5%	33.9%
INC_WKLY	$220	$634	$414	$466
EMPLOY[14]	89.5%	97.4%	7.9%	94.8%
HOME_OWN	2.50%	42.2%	39.7%	68.1%
NO_WEB	80.2%	42.1%	38.1%	35.4%
ELDER_YOUTH_R	2.7	6.2	3.5	4.9
ROOM_DENS	1.9	1.1	0.8	1.1

Source: ABS 2008; ABS 2007a

According to the table, remote non-Indigenous communities exhibit relatively higher and more successful indicators of socio-economic success compared to RIC. Not only are they 12 per cent more likely to complete schooling at Year 12 or equivalent, but remote non-Indigenous households also receive, on average, 188 per cent more weekly income than RIC.

[13] Remote non-Indigenous communities are classified as: same remoteness criteria as RIC (of 10.53 or greater); and an Indigenous population of less than 25 per cent of the total population. Remote non-Indigenous communities with a population greater than 4 standard deviations away from the population mean of RIC were NOT included in the sample.

[14] EMPLOY refers to *IND_EMPLOY* as well as proportion of all people in remote non-Indigenous communities (over 15 years) in the labour force who are currently employed.

In terms of economic prosperity, remote non-Indigenous outcomes are far more favourable with respect to the following:

- Households are almost twice as likely to have access to the internet;
- Home ownership is almost 40 per cent more prevalent; and
- The elder to youth ratio is more than double the number of RIC, limiting the degree of economic burden.

Significantly, such is the success of remote non-Indigenous communities that they also compare favourably with, and even greater than, the national average in terms of income, employment and measures of economic prosperity (including levels of household internet access as well as the elder to youth ratio) — displayed by the last column in the table.

Consequently, I can now focus towards developing and analysing my model for RIC with the view that a new government investment strategy can practically and realistically create higher levels of socio-economic success within remote communities.

Part 2: Methods & Modelling Approach: Creating a model that identifies a new government investment strategy

The aim of the model is to develop a more effective government investment strategy that will determine how government investments should be made to improve the socio-economic status of remote Indigenous communities across Australia. The model has been developed and adapted from the relevant literature, focussing on the three demographic variables that provide the building blocks of an economic agent's socio-economic status. Furthermore, to make the model applicable towards a government investment strategy, each of the variables chosen can be directly affected via government intervention. Consequently, the dependent variables I obtained from the dataset that will be tested in the model include (NB: the actual measurement for each independent variable in the models is represented by *italics* in accordance with the dataset from table 1.1 in Part 1):

- Individual median weekly income (*INC_WKLY*);
- Indigenous employment *(IND_EMPLOY)*; and
- Highest level of educational attainment (*MAX_EDU_YR8; MAX_EDU_YR12*)[15].

The following models explain and measure the determinants for income, employment and education on a community level basis, therefore demonstrating the most effective way that government investments can influence the socio-economic levels of RIC.

Prior to creating the model, I performed two tests to ensure improved accuracy and effectiveness of the data. Firstly, I completed a multi-collinearity test for the entire dataset, eliminating variables from the model that exhibited correlation levels of at least 60 per cent, in order to minimise the inflation of estimates.[16] Secondly, I filtered the dataset – eliminating all outlying RIC that exhibited levels of income, employment or education at least four standard deviations away from the mean, according to a 99 per cent confidence interval.[17]

The model was then specifically developed according to each independent variable as follows.

Income

Modelling Approach

According to Leichenko (2003), the general model to account for variation in income across American Indian Tribal Areas should incorporate locational, structural, individual, demographic, and social capital characteristics, with the dependent variable equalling per capita income, estimated in log form, according to the following equation:

[15] *MAX_EDU_YR8* and *MAX_EDU_YR12* are mutually exclusive variables – according to the dataset, if the highest level of educational attainment is completed at year 8 or below, then the opportunity to complete higher levels of education at year 12 level or equivalent is eliminated. Conversely, if the highest level of educational attainment is completed at year 12 or equivalent, then it is impossible for completion of year 8 or below to be labelled as the highest level of educational attainment.

[16] The cut-off of 0.6 in the was established according to the size and quality of the dataset

[17] From an initial sample of 86 RIC, removing all 1 per cent two-sided outliers filtered the sample down to 83

Income (median weekly) = f(location-specific factors, structural factors, individual factors, demographics, social capital)

In order to explain income variation in remote Indigenous communities across Australia, I adapted the model by utilising relevant independent variables uncovered by Leichenko (2003) as well as my own variables obtained through the dataset.

Locational factors involve the quality of transport infrastructure (*PUBLIC_TRANS*) as well as geographic location, represented by a state dummy variable (*NT_DUMMY* and *QLD_DUMMY*.[18] **Structural factors** (which provide a link between the community's economy and the national economy) incorporates the community level unemployment rates (*IND_EMPLOY*), while **individual factors** include the highest level of educational attainment (*MAX_EDU_YR8; MAX_EDU_YR12*). **Demographic factors**, however, incorporate my own variables that are more relevant than those detailed in the literature. These include: total population (*POP*), whereby the population level is a determinant for the size of the community level internal market, which can determine community level income levels; and the proportion of the population participating in the labour force (*LFpc*). Finally, **Social capital**, represented by the presence of collective economic activities, is positively associated with the level of connection and trustworthiness within the community, which can be difficult to quantify. To circumvent this issue, the ratio of elders to youths in each community (*ELDER_YOUTH_R*) can act as a proxy for social capital, whereby the number of elders is positively correlated with the level of trustworthiness.

Now, after converting the dependent variable — *INC_WKLY* — into log form due to the fact that it represents an absolute number, the appropriate model explaining variation in income for each remote Indigenous community in Australia is represented as follows:

$$\mathrm{Log}\big(INC\_WKLY_i\ \big) = \alpha_0 + \alpha_1 PUB\_TRANS_i + \alpha_2 NT\_DUMMY_i + \alpha_3 QLD\_DUMMY_i + \alpha_4 IND\_EMPLOY_i + \alpha_5 EDU\_YR8_i + \alpha_6 ELDER\_YOUTH\_R_i + \alpha_7 LFpc_i + \varepsilon_i$$ [19]

Specification Tests

The income model was tested in accordance with similar steps performed by Leichenko (2003), which included:

1. Estimation of the model via the ordinary least-squares method
2. Tests for heteroskedasticity (White test)
3. Tests for auto-correlation (Durbin-Watts test)

[18] Two state 'dummy' variables were used to measure any jurisdictional effects: Northern Territory = 1, other states = 0; and Queensland = 1, other states = 0. These two states were chosen as dummy variables for the model, because the location of the 83 RIC utilised in the model were heavily weighted towards NT (42 RIC) and QLD (20 RIC)

[19] Variables eliminated from model due to multi-collinearity conflict: *YR_12* and *POP*; For all models in the paper, epsilon represents the error term, and the subscript 'i' indicate observations for each RIC.

Employment

Modelling Approach

A conclusive study performed by DeSimone (2002), on the relationship between illegal drug use (marijuana and cocaine) and employment, offers a compelling explanation of variations in employment.

According to the study, the general model for employment can be represented by the following linear approximation of the employment equation:

E = α0 + Dα1 + Wα2 + Yα3 + Xα4 + ε

While the dependent variable, E, represents the employment rate, each independent variable in the employment equation can be represented as follows: D = drug use (marijuana or cocaine); W = wage income; Y = non-wage income; and X = endogenous variables.

Similar to constructing the income model mentioned above, in order to explain variations in employment in remote Indigenous communities across Australia, I adapted the above model by utilising the independent variables established by DeSimone (2002) as well as my own variables obtained through the dataset.

The ratio of elders to youths in each community (*ELDER_YOUTH_R*) was used as a proxy for **Drug use** in each community, whereby the number of youths is positively correlated with the prevalence of drug use. Drug use in this model refers to drugs that are common in Australian remote Indigenous communities, including marijuana, glue and petrol. The variables **wage income** and **non-wage income**, mentioned separately in DeSimone's model, are combined to include all income received by members of each community (*INC_WKLY*). Finally, the **exogenous variables** in equation can be represented by relevant variables detailed in the literature as well as my own variables, including: educational attainment (*MAX_EDU_YR8; MAX_EDU_YR12*); geographic location, represented by a state dummy variable (*NT_DUMMY* and *QLD_DUMMY*); internet access (*NO_WEB*), which is a determinant for people employed over the internet/self-employed via the internet; and household ownership (*HOME_OWN*).

Subsequently, using the level of employment (*IND_EMPLOY*) as the dependent variable, the appropriate linear model explaining variation in employment for each remote Indigenous community in Australia is represented as follows:

$$IND\_EMPLOY_i = \alpha_0 + \alpha_1 INC\_WKLY_i + \alpha_2 NT\_DUMMY_i + \alpha_3 QLD\_DUMMY_i + \alpha_4 NO\_WEB_i + \alpha_5 EDU\_YR8_i + \alpha_6 ELDER\_YOUTH\_R_i + \alpha_7 HOME\_OWN_i + \varepsilon_i$$ [20]

[20] Variables eliminated from model due to multi-collinearity conflict: *YR_12*

Specification Tests

The employment model was tested in accordance with similar steps performed by DeSimone (2002), as well as my own adaptation, which included:

1. A Logit transformation for the dependent variable[21], then estimation of the model via the ordinary least-squares method
2. Tests for heteroskedasticity (White test)
3. Tests for auto-correlation (Durbin-Watts test)

Educational Attainment

Before I discuss the modelling approach, it is important to note that both variables for educational attainment are mutually exclusive (see footnote 15 above). I will assume, for the purposes of this paper, that completion of Year 8 or below is universal across all RIC, primarily for legal reasons whereby children in Australia are legally required to attend school until the age of 16. Accounting for a higher drop-out rate in RIC, I have made the cut off for universal schooling in RIC at Year 8 or below. Subsequently, a trade-off exists between *MAX_EDU_YR8* and *MAX_EDU_YR12*, whereby completion of school at Year 8 or below decreases the rate of completion at Year 12 or equivalent. Conversely, completion of school at Year 12 or equivalent decreases the rate of completing Year 8 or below as the highest level of educational attainment.

Modelling Approach

This approach involved the creation of a model that accounts for variation in the highest levels of educational attainment in remote Indigenous communities across Australia: completion of schooling at a Year 8 level or below; and completion of schooling at a Year 12 level or equivalent.

Constructing the education model involved the integration and adaptation of several models obtained from the relevant literature. According to Kelley & Evans (1996), **family size** (*ROOM_DENS*) is an important indicator of educational attainment,), whereby smaller families generate higher educational outcomes because each child receives greater levels of investment, while the level of **economic growth** can be measured by the level of individual income (*INC_WKLY*) and internet access (*NO_WEB*).

However, Sammons (1995) argues that differences in educational attainment can be attributed to relevant background factors of students, including **fluency in English** (*LOW_ENG)* and parents' **occupation status** (*HOME_OWN*).[22]

Furthermore, the investigation into educational outcomes in the Philippines by Maligalig et al (2010) identified the **employment status** of each household (*IND_EMPLOY*) as a key determinant of educational attainment. While finally, the review by Lynskey & Hall (2000) into the relationship between cannabis (drug use) and educational attainment indicated that cannabis use

[21] A Logit transformation of the dependent variable (*IND_EMPLOY*) was performed due to the fact that it represents proportional figure.

[22] *HOME_OWN* denotes parents' occupational status, because it was also used as an independent variable to explain the Indigenous employment rate for the employment model illustrated above.

(*ELDER_YOUTH_R*) amongst students increases the level of poor school performance and reduces the level of educational attainment.

In order to explain variations for the highest level educational attainment in remote Indigenous communities across Australia (for both Year 8 or below and Year 12 completion), I adapted the models explained in the literature and used my own relevant variables (*NT_DUMMY* and *QLD_DUMMY*) obtained from the dataset.

The relevant model that explains the variation for completion of Year 8 or below incorporates the same independent variables that are used to also explain any variation for completion of Year 12 or equivalent. Subsequently, the same model can be used to measure both dependent variables for educational attainment in RIC, which is represented according to the following equation:

$$MAX\_EDU_{YR12_i}/MAX\_EDU\_YR8_i = \alpha_0 + \alpha_1 ROOM\_DENS_i + \alpha_2 NT\_DUMMY_i + \alpha_3 QLD\_DUMMY_i + \alpha_4 NO\_WEB_i + \alpha_5 IND\_EMPLOY_i + \alpha_6 ELDER\_YOUTH\_R_i + \alpha_7 HOME\_OWN_i + \alpha_8 LOW\_ENG_i + \alpha_9 INC\_WKLY_i + \varepsilon_i$$ [23]

Specification Tests

The model for educational attainment was tested using the same specification tests as the employment model listed above.

[23] Both dependent variables (*MAX_EDU_YR8 and MAX_EDU_YR12*) can be substituted into the left hand side of the equation. Subsequently, both these variables were tested using the same equation.

Part 3: Results

After completing the modelling approach and specification tests outlined in Part 2, I obtained the following results – identifying all the relevant independent variables, significant at a 90 per cent confidence interval, that have a considerable influence in determining variation within the income, employment and educational attainment models.[24]

Income

Table 3.1

Dependent Variable: **INC_WKLY_LOG**
Method: Least Squares
Date: 08/23/10 Time: 16:18
Sample: 1 83
Included observations: 83
White Heteroskedasticity-Consistent Standard Errors & Covariance

	Coefficient	Std. Error	t-Statistic	Prob.
C	2.254445	0.036083	62.47873	0.0000
MAX_EDU_YR8	-0.102480	0.044120	-2.322775	0.0229
ELDER_YOUTH_R	0.010163	0.004242	2.395914	0.0191
IND_EMPLOY	0.005171	0.024990	0.206928	0.8366
LFPC	0.168857	0.057826	2.920072	0.0046
NT_DUMMY	0.005046	0.013150	0.383735	0.7023
PUBLIC_TRANS	0.078059	0.042146	1.852106	0.0679
QLD_DUMMY	0.017955	0.012818	1.400818	0.1654

R-squared	0.370125	Mean dependent var	2.341001
Adjusted R-squared	0.311337	S.D. dependent var	0.044383
S.E. of regression	0.036831	Akaike info criterion	-3.673512
Sum squared resid	0.101742	Schwarz criterion	-3.440370
Log likelihood	160.4507	Hannan-Quinn criter.	-3.579849
F-statistic	6.295899	Durbin-Watson stat	1.572639
Prob(F-statistic)	0.000008		

Although the results of the Durbin-Watson auto-correlation statistic are indeterminate, I will assume that there is no auto-correlation within the model and therefore proceed with the interpretation of my results (Pindyck & Rubinfeld, 1991: 144). According to the regression output, the following explanatory variables have the most considerable effect and greatest influence on median individual weekly income:

- *MAX_EDU_YR8:* the proportion of the population whose highest level of educational attainment was Year 8 or below;
- *ELDER_YOUTH_R:* the ratio of elders to youths in each RIC;
- *LFpc:* the proportion of the Indigenous population that participate in the labour force; and
- *PUBLIC_TRANS:* the proportion of the population who travel to work via public transport.

The coefficients of these significant variables demonstrate a positive correlation with the level of income, with the exception of a negative correlation exhibited by educational attainment of Year 8

[24] A 90 per cent confidence interval was chosen as the p-value in accordance with the size and accuracy of the data.

or below — indicating that a failure to achieve a level of education higher than Year 8 will have a detrimental effect on income levels.

Employment

Table 3.2

Dependent Variable: **IND_EMPLOY**
Method: Least Squares
Date: 08/23/10 Time: 16:25
Sample: 1 83
Included observations: 83
White Heteroskedasticity-Consistent Standard Errors & Covariance

	Coefficient	Std. Error	t-Statistic	Prob.
C	0.504280	0.906641	0.556207	0.5797
MAX_EDU_YR8	-0.488693	0.618487	-0.790143	0.4319
ELDER_YOUTH_R	0.002353	0.076792	0.030645	0.9756
HOME_OWN	0.898670	1.130131	0.795190	0.4290
INC_WKLY	-0.001803	0.003536	-0.510016	0.6115
NO_WEB	0.783461	0.350941	2.232460	0.0286
NT_DUMMY	0.089125	0.161572	0.551610	0.5829
QLD_DUMMY	0.440495	0.184713	2.384748	0.0196

R-squared	0.176953	Mean dependent var	0.821376
Adjusted R-squared	0.100135	S.D. dependent var	0.535836
S.E. of regression	0.508301	Akaike info criterion	1.575931
Sum squared resid	19.37771	Schwarz criterion	1.809072
Log likelihood	-57.40114	Hannan-Quinn criter.	1.669594
F-statistic	2.303538	Durbin-Watson stat	2.117321
Prob(F-statistic)	0.034989		

After accepting the null hypothesis of the Durbin-Watson auto-correlation statistic, I have established that no auto-correlation exists within the model (Pindyck & Rubinfeld, 1991: 144). Therefore, the results observed in the employment model account for two significant independent variables that are the most influential determinants for the rate of Indigenous employment, including: the proportion of total houses with no internet connection *(NO_WEB)*; and the geographical location of the RIC – Queensland *(QLD_DUMMY)*. Both variables demonstrate a positive correlation with the level of Indigenous employment, whereby an increase in each variable is expected to result in an increase in the Indigenous employment rate, on average.

Interestingly, a lower level of internet connection is associated with a higher level of employment, which is the opposite of the expected relationship. A suggestion for this relationship could be that those households with access to the internet choose to sell Indigenous items (paintings, musical instruments) over the internet as their primary source of income, but this does not satisfy the criteria of employment. Therefore households with internet access do in fact earn a living, yet are not officially classified as employed.

Educational Attainment

Highest level of educational attainment: completion of Year 8 or below

Table 3.3

Dependent Variable: **MAX_EDU_YR8**
Method: Least Squares
Date: 08/23/10 Time: 13:18
Sample: 1 83
Included observations: 83
White Heteroskedasticity-Consistent Standard Errors & Covariance

	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.541457	0.553203	-0.978767	0.3309
ELDER_YOUTH_R	0.079264	0.044818	1.768585	0.0811
HOME_OWN	0.165791	0.578128	0.286772	0.7751
INC_WKLY	-0.002349	0.001454	-1.615431	0.1105
IND_EMPLOY	-0.004836	0.242816	-0.019916	0.9842
LOW_ENG	0.707243	0.285599	2.476353	0.0156
NO_WEB	-0.122670	0.301526	-0.406831	0.6853
NT_DUMMY	0.241587	0.088758	2.721859	0.0081
QLD_DUMMY	-0.000759	0.083796	-0.009063	0.9928
ROOM_DENS	0.021690	0.090099	0.240731	0.8104

R-squared	0.371646	Mean dependent var	-0.687612
Adjusted R-squared	0.294178	S.D. dependent var	0.307503
S.E. of regression	0.258343	Akaike info criterion	0.243525
Sum squared resid	4.872098	Schwarz criterion	0.534951
Log likelihood	-0.106282	Hannan-Quinn criter.	0.360604
F-statistic	4.797403	Durbin-Watson stat	1.710848
Prob(F-statistic)	0.000049		

Similar to the income model, the results of the Durbin-Watson auto-correlation statistic for the educational attainment model for Year 8 or below are indeterminate (Pindyck & Rubinfeld, 1991: 144). However, I will assume that there is no auto-correlation within the model and therefore proceed with the interpretation of my results.

According to the results, following explanatory variables are the most important determinants for the highest level of educational attainment being at a Year 8 level or below. These variables, each of which exhibits a positive correlation with the dependent variable, include:

- *ELDER_YOUTH_R:* the ratio of elders to youths in each RIC;
- *LOW_ENG:* the proportion of Indigenous people who speak an Australian Indigenous language BUT speak English either not well or not at all (have a low English proficiency); and
- *Geographic location:* the jurisdiction of the RIC — Northern Territory;

While an increase in the proportion of elders in a RIC is an appropriate explanation for the completion of Year 8 or below, an increase in low English proficiency is also positively correlated. Whilst this appears counter-intuitive, an appropriate explanation suggests that as levels of English proficiency decrease, an individual is less likely to achieve schooling at a higher level such as Year 12 or equivalent, and more likely to finish schooling at a lower level of Year 8 or below.

Highest level of educational attainment: completion of Year 12 or equivalent

Only one variable proved significant for this model – the NT state variable. Therefore, the model does not adequately explain the determinants for completion of Year 12 or equivalent as the highest form of educational attainment, rendering this variable superfluous for the purposes of this paper. As a result, I will not take into account any results or policy implications associated with educational attainment for Year 12 or equivalent. However, these findings are consistent with developmental economic theory, which places a far greater emphasis on the outcomes of primary education over secondary education.

The results obtained from the above models indicate that the highest level of educational attainment at Year 8 or below is associated with lower socio-economic outcomes, such as a decrease in English proficiency and lower levels of income. Therefore, as will be discussed in greater depth in Part 4, the completion of Year 8 or below results in less favourable outcomes than the completion of Year 12 or equivalent for the purposes of improving the socio-economic status of RIC.

Part 4: Policy Implications

While the results obtained in Part 3 identified all of the independent variables that have a significant correlation in the income, employment and educational attainment models, in Part 4 I will illustrate the specific policy implications that are associated with each model. In doing so, I will illustrate how and where government investments should be directed to improve each of income, employment and educational attainment, which are essentially the 'building blocks' for the socio-economic status of any economic agent. Consequently, government investments that are specifically targeted towards each of the three demographic variables will heavily influence the socio-economic status of RIC.

The policy implications for each model were determined via a **marginal effect at means test**[25], which recognised the significance and marginal impact of each relevant independent variable that was identified in Part 3. Subsequently, I could account for an accurate depiction of the policy effects, allowing me to identify how government should direct their investments to improve the socio-economic status of RIC by improving each of the following demographic variables:

Income

Using the income model from Part 2, after accounting for the average level of median individual weekly income for RIC, the change in income levels after increasing each of the significant independent variables by 10 per cent above its mean value is illustrated in the table below.

Table 4.1

Adjusted independent variable	Median individual weekly income ($)[26]
Mean (no adjustments)	218
Completion of Year 8 or below (MAX_EDU_YR8)	230
Elder to Youth Ratio (ELDER_YOUTH_R)	220
Indigenous labour force participation rate (LFpc)	221
Travel to work via public transport (PUBLIC_TRANS)	219

The results of the marginal effects at means test indicate that the explanatory variables have a relatively weak influence on median individual weekly income. If the government were to alter their policy and direct investment towards a 10 per cent increase in the elder to youth ratio, the Indigenous labour force participation rate, or the rate of public transport use across each RIC, income levels will not increase by more than a few dollars per week. [27] The most potent variable for income appears to be education. If the government invested in education so that the highest level of educational attainment at Year 8 or below increased by 10 per cent, weekly income levels would increase by an average of $12.

[25] The marginal effect at means test involved varying each of the significant dependent variables by 10 per cent above its mean value, one at a time, and measuring its effect on the dependent variable by comparing this figure to its average value.

[26] All figures adjusted according to the fact that the median individual weekly income model is represented in log form.

[27] Policies and investments aimed at increasing the elder-to-youth ratio may involve something less direct as the other independent variables, such as: improving health facilities and health access for the elderly community; improving aged care facilities; or any other policy that might decrease the mortality rate.

From a policy perspective, investment towards the explanatory variables in the income model is relatively ineffectual, because it offers almost minimal returns on that investment. Even in the case of the most potent variable – educational attainment at Year 8 or below – a 10 per cent investment only offers a 5.5 per cent return. However, because of the relatively low income base experienced by RIC compared to the rest of the population, this may be viewed as a successful policy investment in some quarters.

The relatively weak policy influence on income levels is effectively attributed to factors not explained by the model. Most especially, the low variation of income levels already existent in RIC across Australia, which is the product of a welfare dependent society (as mentioned in Part 1). Consequently, income levels tend to remain fairly consistent, irrespective of government-driven changes to the relevant variables displayed in the income model.

Employment

Using the employment model from Part 2, after accounting for the average level of Indigenous employment in RIC, the change in employment levels after increasing each of the significant independent variables by 10 per cent above its mean value is illustrated in the table below.

Table 4.2

Adjusted independent variable	Indigenous Employment (%)[28]
Mean (no adjustments)	68.1
Households with no internet connection (NO_WEB)	70.1
Geographical location – Queensland (QLD_DUMMY)[29]	75.2

This model does not give the government many policy options targeted towards improving Indigenous employment. We can effectively rule out any investments aimed at increasing the number of households with no internet connection. Not only is this relationship both unexpected and questionable (as explained in Part 3), but such a policy is in direct conflict with current government policy designed to achieve total internet connection across Australia and is therefore not a viable option.

A relatively more potent variable can be attributed to a jurisdictional effect. More specifically, a RIC that resides within the state of Queensland causes the Indigenous employment rate to increase by over 7 per cent. While the government cannot implement a policy to relocate RIC to Queensland in order to improve employment, these results suggest that the state plays an important role at achieving higher levels of employment. Consequently, an effective government policy may be to increase their cooperation with the state governments, utilising their knowledge of specific local conditions and incorporating valuable aspects of the more successful state policy as part of the overarching federal government policy.

[28] All figures adjusted according to the fact that the Indigenous employment model is represented as a logit calculation.

[29] To test for the marginal effect of the Queensland state dummy, the 'mean' Indigenous employment value was calculated with NT = 1, QLD and other states = 0; while an increase of the Queensland state variable switched the dummies so that QLD = 1, other states = 0.

Despite the existence of a small yet successful policy effect, the overall lack of direct and highly influential government policies on employment levels is the result of inherent problems within the employment model for RIC, including: absence of an economically consistent definition of full employment; the welfare dependent society of RIC; and inflated employment figures for RIC due to the presence of CDEP (mentioned in Part 1).

Educational Attainment

The results for this model illustrated in Part 3 indicate that the completion of Year 8 or below as the highest level of educational attainment, achieved at the expense of completing Year 12 or equivalent, is associated with negative education outcomes for RIC. Subsequently, government policy should be directed towards facilitating an educational outcome whereby fewer students complete schooling at Year 8 with the aim of fostering educational attainment at a higher level, such as Year 12 or equivalent, in order to generate more positive socio-economic outcomes.

To illustrate the policy implications aimed at decreasing the rate of completing educational attainment at Year 8 or below, the marginal effect at means test will calculate the change in value of the dependent variable if the government were to vary each of the relevant independent variables by 10 per cent below its mean value.

Highest level of educational attainment: completion of Year 8 or below

Using the general educational attainment model (Year 8 or below) for all RIC from Part 2 – after accounting for the average level of educational attainment in RIC, the change in Year 8 or below educational levels after decreasing each of the significant independent variables by 10 per cent below its mean value is illustrated in the table below.

Table 4.3

Adjusted independent variable	Highest level of educational attainment: Year 8 or below (%)[30]
Mean (no adjustments)	36.7
Elder to Youth Ratio (ELDER_YOUTH_R)	30.3
Low English proficiency (LOW_ENG)	30.6
Geographical location – outside Northern Territory (QLD_DUMMY)[31]	30.8

The marginal effects at means test indicate that all explanatory variables have a similar marginal impact on the completion of Year 8 or below as the highest level of educational attainment. Should the government initiate a policy aimed at decreasing the elder to youth ratio by 10 per cent, or invest towards improving English proficiency among those who speak an Australian Indigenous language (through decreasing low English proficiency by 10 per cent), then the highest level of educational attainment at Year 8 or below will decrease by just over 6 per cent, which results in a

[30] All figures adjusted according to the fact that the educational attainment model is represented as a logit calculation

[31] To test for the marginal effect of the Northern Territory state dummy, the 'mean' Indigenous employment value had NT = 1, QLD and other states = 0; while a decrease of the Northern Territory state variable switched the dummies so that QLD = 1, other states = 0

trade-off in the form of a 6 per cent increase in completing a higher level of educational attainment.[32]

Furthermore, the jurisdictional effect is equally as potent. A RIC that resides in the Northern Territory (represented by the mean value) will cause the educational attainment rate for Year 8 or below to increase by just fewer than 6 per cent. This infers that there are greater education outcomes outside of the NT. Subsequently, an effective use of policy would be an increased cooperation with the state government in order to: identify the education problems in NT and utilise their local knowledge in order to develop a state specific policy that improves overall education levels in RIC across Australia.

After illustrating the new model for government investment, the subsequent policy that I believe the government should adopt in place of its existing policy is outlined as follows:

1. ***Treat each community in isolation***
2. ***Identify the demographic variable/s in need of improvement – one of income, education and/or educational attainment.***
3. ***Using the model, allocate government investment towards the specific factors that have the greatest marginal impact on the demographic variable/s being targeted***

[32] Policies and investments aimed at decreasing the elder-to-youth ratio may involve: incentives to increase the birth rate (such as the baby bonus); and/or improving health access and health facilities for infants and early childhood in order to lower the infant mortality rate.
Even though the elder-to-youth ratio is also a significant variable under the income model, it will only be used as a policy variable under the educational attainment model as it exhibits a greater degree of potency.

Conclusions

It is important to recognise that this paper does not make any claims about uncovering any definitive solution to solve the socio-economic problems of RIC. Rather, it offers a fresh modelling approach aimed at guiding future government investment strategy in a different direction to that of the past, in order to overcome the failings of previous and existing government policy. By illustrating the fact that government investments are not being put to their most effective use, the model (and subsequent policy implications) indicates how and where these investments should be directed. But crucially, this is essentially a guideline designed to establish a new approach that will improve the socio-economic status of RIC in order to more effectively deal with the gap between the Indigenous and non-Indigenous population.

Most notably, the new policy direction introduces a methodical and calculated process that identifies the significant variables requiring investment in order to influence the socio-economic indicators of income, employment and education in RIC across Australia. Whilst this represents the biggest shift from previous policy initiatives, future policy should be guided by the recognition of the diversity of the Indigenous population. As such, Indigenous issues need to be tackled on a micro level, whereby different aspects of the community should be treated in isolation (such as remote versus urban) in order to account for their vast differences. Furthermore, focusing on improvements in socio-economic outcomes by specifically targeting these key areas of income, employment and education, the new policy approach will subsequently create positive externalities towards improved health outcomes such as life expectancy as well as the self-assessed health of the Indigenous population (Booth & Carroll, 2008).

In light of the new approaches, guidelines and policy implications, two issues surrounding this paper remain definitive – the disadvantages of the Indigenous people can no longer continue without significant action; and the government must immediately consider a change with its existing policy.

WORD COUNT: approximately 6600 words (excluding headings, tables, footnotes and appendices)

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Appendix A

Full list of Remote Indigenous Communities

Table A.1

State	Remote Indigenous Location[33]	Total
NT	Amoonguna; Ampilatwatja; Anmatjere; Areyonga; Haasts Bluff; Hermannsburg; Iwupataka; Kintore; Laramba; Mutitjulu; Papunya; Tapatjatjaka; Willowra; Yuelamu; Yuendumu; Maningrida; Milikapiti; Minjilang; Nauiyu Nambiyu; Nguiu; Palumpa; Pirlangimpi; Thamarrurr; Wadeye; Warruwi; Barunga; Beswick; Kalkarindji; Lajamanu; Minyeri; Ngukurr; Yarralin; Angurugu; Galiwinku; Gapuwiyak; Milingimbi; Ramingining; Umbakumba; Yirrkala; Ali Curung; Alpurrurulam; and Elliott District;	42
QLD	Arukun; Injinoo; Kowanyama; Mapoon; Napranum; New Mapoon; Pormpuraaw; Umagico; Lockhart River; Coen; Boigu; Badu; Hammond; Mabuiag; Mer; Saibai; St Pauls; Warraber; Yorke; and Doomadgee;	20
WA	Bardi; Beagle Bay; Bidyadanga; Djarindjin; Bayulu; Fitzroy River; Yungngora; Papulankutja; Warburton Community; Balgo; Kalumburu; Mindibungu; Mulan; Warmun; and Jigalong;	15
SA	Yalata; Indulkana; Kaltjiti; Mimili; and Pukutja;	5
NSW	Goodooga	1
Australia		***83***

Source: ABS 2008

[33] The name of each Indigenous location is correct according to ABS 2006 Census data.