Assessing Regional Health and Income Disparities: a case study of Queensland, Australia

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Abstract

Economic Impact Assessment (EcIA) is conducted as a part of Environmental Impact Assessment procedure. While the health funding has increased over the years and numerous mining projects were approved in Queensland (Australia), some regional socio-economic indicators are below state or national levels. EcIA can be used to improve the regional inequalities in health and income. The aim of this paper is to provide a detailed assessment of the regional differences in socio-economic indicators in Queensland using data envelopment analysis (DEA). The economic performance in different regions using key economic drivers such as labour force, education, Gini coefficient, industry diversity and length of road network; and social and health drivers, including the availability of health services measured by the number of healthcare professionals and indicators measuring the health status of the region including premature mortality is analysed.

The analysis shows that the less efficient regions can implement targeted policies to reduce economic and health discrepancies. Integrated EcIA can provide a more accurate planning tool for projects approvals and fund allocation decisions while planning for improving health outcomes and regional development. Policy recommendations are provided.

Key words: Economic Impact Assessment; regional development; data envelopment analysis; health indicators; socio-economic indicators

1. Introduction

While some regional centres have grown rapidly over the past 50 years, other parts of regional Australia have been in decline or have not grown at the same rate as the metropolitan areas. The disparities between the metropolitan areas and regional Australia have widened due to a number of changes including social and economic pressures.

Numerous resource projects including mining are located in the regional Queensland. According to the impact assessments including Economic Impact Assessments (EcIA) more projects in mining supposed to bring more employment and income in the regions. However, regions such as Central Queensland experience a number of issues such as teenage unemployment, jobless families, low educational attainment, indigenous unemployment, high domestic violence (Scearer & Lowien, 2016). Despite the increase in government funding for various services including health care over the years, regional Queensland performs worse than a national average in many indicators including tobacco smoking, obesity, nutrition, alcohol consumption, access, and use of primary care, indigenous health, and child health among others (Queensland Health, 2018).

The aim of this paper is to provide a detailed assessment of the regional differences in socio-economic indicators using economic and health indicators together in data envelopment analysis (DEA). DEA can be included in the EcIA to improve the health outcomes and regional development policies.

2. Literature review

EcIA can contribute to the regional development by evaluating the projects with the largest net social benefits. However, in practice, EcIA has a limited scope with the focus on employment and income without due consideration of overall development at the regional and local levels. While various economic indicators are routinely used in economic impact assessment, the key health indicators, although important for the economy, are typically ignored in the EcIA and in the analysis of regional economic development.

The relationship between health and economic performance is complex. The literature is not uniformed on this issue. Some results are mixed and inconclusive (Lange & Vollmer, 2017). Some suggest that the relationship can work both ways (Barro, 2013). For example, a higher income per capita can lead to better health outcomes, and better health outcomes can improve income per capita.

While a vast efficiency literature exists on the topics of healthcare efficiency assessment and regional economic performance, this literature is somewhat disjointed. Health focused DEA typically is looking at two levels: micro-level such as hospitals (Cantor & Poh 2017; Kohl et al. 2018) and country-level health system efficiency (Adang & Borm, 2007; Alfonso & Aubyn, 2005; Spinks & Hollingsworth, 2009). The regional economic performance literature is mostly focused on regional infrastructure, population of region as inputs and income distribution, employment rate, labour productivity as outputs (Galiniene & Dzemydaite, 2012; Giedrė & Birutė, 2012). The application of DEA to both health and regional economic performance is limited to few papers (e.g. Carrillo & Jorge, 2017; Stefko et al 2018).

In this paper, the model the efficacy of regional development using both health and socio-economic indicators is used. Since many health and socio-economic indicators are correlated, only selected key indicators are used as inputs and outputs in this paper.

3. Data Envelopment Analysis

Combined economic and health efficiency assessment is operationalised using the Data Envelopment Analysis (DEA). DEA is a mathematical optimisation method, originally developed by Farrell (1957), and popularised by Charnes et al (1978). A typical DEA constructs the best practice production frontier, which can be used to evaluate the relative efficiency of different entities, typically called Decision-Making Units (DMUs). The method has been used in numerous fields (health care, banking, manufacturing, etc.) for performance evaluation and decision making at country, region, city, and industry sector-levels.

DEA models can take either an input or output orientation. Following the literature on regional efficiency, an output-oriented DEA model is selected for the analysis (Schaffer et al 2011). The output-oriented DEA maximises output whilst holding inputs constant. We frame the local government areas (LGAs) in Queensland as DMUs for the analysis.

To account for the susceptibility of nonparametric frontier analysis to extreme values and uncertainty due to sampling variation, a bootstrap technique was used (Schaffer et al. 2011).

4. Case study: Queensland LGAs, Australia

Despite being the third largest economy in Australia, Queensland has below average Gross State Product per capita compared to other states of Australia (ABS 2019a, b). Furthermore,

Queensland lags national average in many socio-economic indicators including employment and life expectancy (ABS 2019c).

According to ABS (2016) census, health care and social assistant industry was the highest employee in Queensland. The mean wages in 2015-16 in Queensland were $56,936 that was just below national average of $59,559. However, Queensland LGAs were not uniform in income distribution and premature mortality (average annual ASR[1] per 100,000) (Figure 1).

Total premature among Queensland LGAs with the lowest mortality being in Isaac Shire (169) and the highest in Aurukun shire (998), averaging at 369 in Queensland.

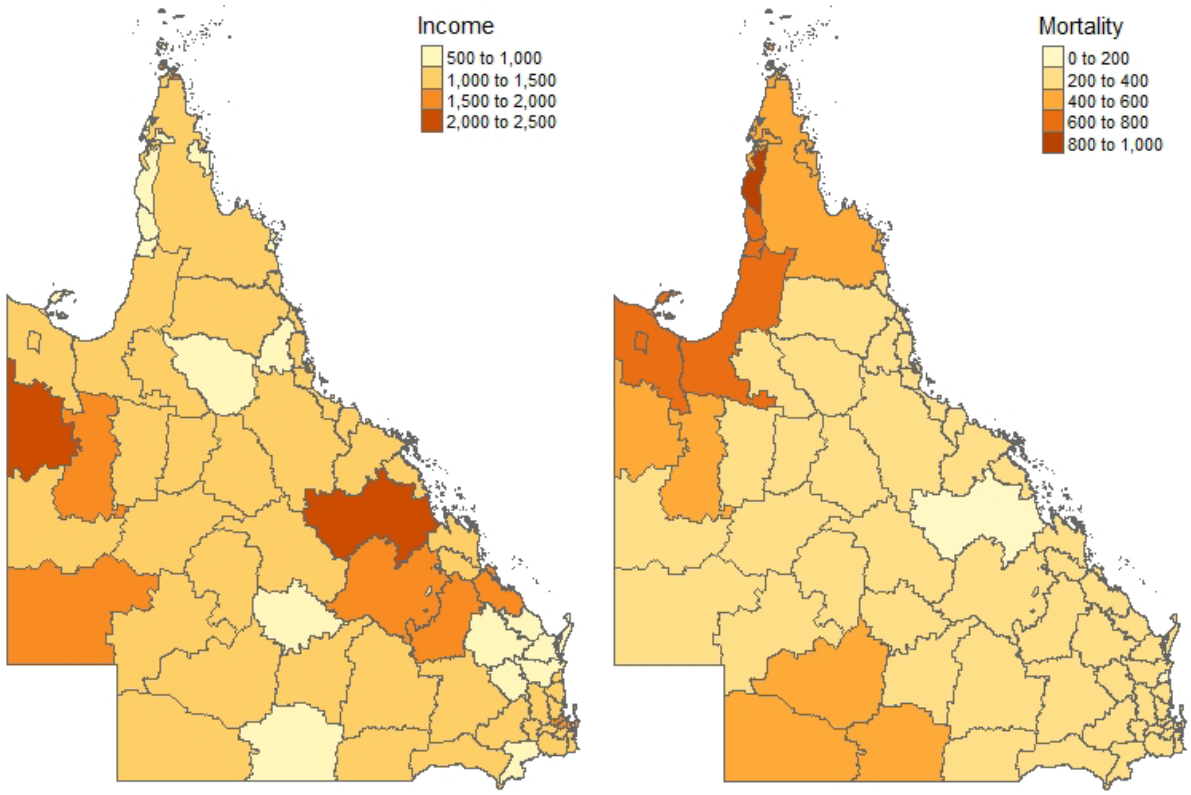

Figure 1. Income and mortality disparity in Queensland.

5. Outputs, inputs and contextual variables

Past studies of region-specific efficiency have indicated that per capita income to be an appropriate indicator to reflect economic performance. This study focuses on income distribution and specifies Gini coefficient as an output to represent the income disparity of a local government area. The Gini coefficient is widely used to measure the inequality in income, education, and age. Income inequality in particular is detrimental to health. The Gini

[1] Age standardised rate (ASR)

coefficient is measured on a scale of 0 to 1, with zero indicating complete equality and 1 indicating maximum level of inequality (Horn, 1993). Selecting an indicator that reflects the health of population was largely restricted by the unavailability of complete LGA-level health outcomes data. However, the premature mortality data has been available and was used as an output indicator to represent health of the population. The paper uses output-oriented, variable returns to scale DEA model, which maximises outputs whilst holding the amounts of inputs constant. Since the mathematical model represents a maximisation problem, this paper follows the approach used to transform undesirable outputs (Zhu, 2003) by maximising the reciprocal of Gini coefficient and premature mortality indicator in the analysis.

On the input side, for each LGA this study uses the length of road network as a proxy for the level of infrastructure endowment, labour force, percent of full-time participation at secondary education at age 16 and the number of healthcare professionals.

To account for heterogeneity in geographical regions, this study includes a set of contextual variables to obtain a robust efficiency comparison among LGAs including an industry diversity index, index of relative socio-economic disadvantage, the proportion of elderly (65 years and over) population and the population density. The study also includes two variables – the share of mining and agriculture employment in total employment, which reflect the competitive industries in Queensland.

6. Results

The LGAs are assumed to maximise the outputs of income equality and health outcomes using the quantity (labour force), quality aspects of labour (secondary education), health investments (health care professionals), and existing capital stock represented by the length of road network. Figure 2 illustrates the spread of Queensland LGAs by bias-corrected technical efficiency scores. An LGA is regarded as efficient if one or more LGAs having similar or worse levels of inputs are able to generate higher level of outputs (income equality and improved health outcomes). These LGAs are dark-shaded. The light-shaded LGAs are less efficient. This would invariably highlight the regions where the government intervention is needed.

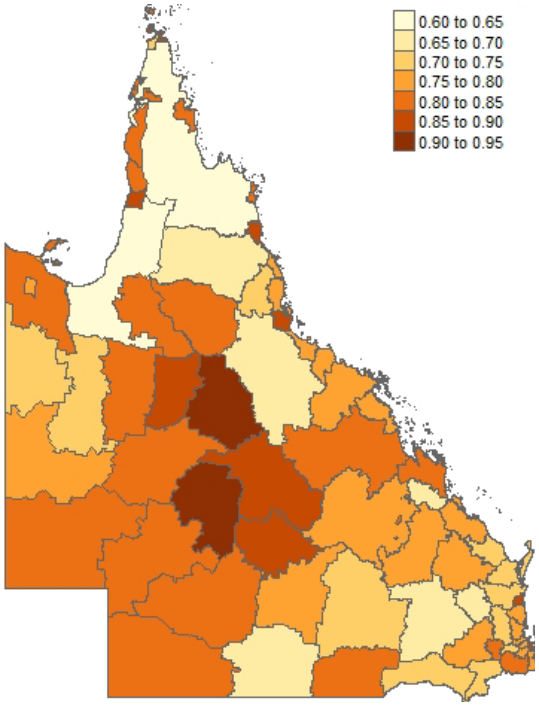

Figure 2. Queensland LGAs by bias-corrected technical efficiency scores.

To explore regional discrepancy, the study compares the mean technical efficiency for various LGA categories (cities, regional councils, and shires). According to the results, efficiency appears to be the highest in shires followed by cities. Shires also recorded the highest variation of efficiency. Regional councils performed the worst in general.

An important part of that analysis is to understand the factors that influence the efficiency discrepancy among regions. This study used Simar and Wilson's (2007) second algorithm (with 2000 replicates) to regress bias-corrected efficiency scores against a set of contextual variables in the second-stage analysis (Table 1). The results showed that industry diversity affects economic fairness and health outcomes negatively. In other words, less diverse or specialised LGA regions tend to be more efficient achieving a fairer distribution of income and improved health outcomes.

The share of mining employment in the total employment had a negative effect on efficiency of LGAs. It appears that having a large mining share in total employment negatively influences the efficacy of lessening income disparities and health outcomes. This could be due to relatively higher wages of mining compared to other sectors. The proportion of elderly population (65+ years) also had a statistically significant (at 1% level) negative influence on efficiency. Finally, the population density had a statistically significant (at 1% level) positive impact on the LGA efficiency.

Table 1: Bootstrap truncated regression results

Variable	Coefficients
Intercept	-1.2976***
Industry diversity	-0.0837***
IRSED (Socio-economic disadvantage)	0.0002
Mining share in total employment	-0.4443**
Agriculture share in total employment	0.1318
Proportion of elderly population (65+)	-0.0068***
Population density	0.0006***

'*', '**' and '***' denote statistical significance at 10%, 5% and 1%, respectively.

7. Summary and discussion

Reduction in regional health and income inequalities is one of the major concerns of policy makers. Despite a series of funding and reforms to the national education system, health and employment programs, there has been little change in regional inequality (Walker, 2018). This paper uses a novel approach to analyse regional disparities in socio-economic indicators with the focus on health and income distribution. Typically, health and socio-economic indicators are reported separately in health and EcIA without analyses of their interconnections. The results of this paper illustrate the necessity of inclusion health indicators in the analysis of regional economic development.

The results showed that some inefficient LGAs are located in a close proximity to the most efficient regions. Therefore, these regions will be able to achieve the highest possible improvements in terms of health and income equality if appropriate policies are designed. For example, policies aiming at increasing occupational and geographical mobility can assist in reduction in unemployment and therefore income inequalities. Those policies can take a form of encouraging businesses to offer apprenticeships to unemployed to acquire new skills as well as work-place training. An important part of geographical immobility of labour is housing affordability. Policies aiming at increasing housing affordability especially in mining LGAs would encourage more labour mobility among the regions. Contrary to the literature that links industrial diversity to economic development, the results showed that the higher industry diversity was somewhat associated with lower regional efficiency in terms of achieving a fairer distribution of income and improved health outcomes. Industry diversity seemed to have not a straightforward relationship with regional efficiency. At low levels of industry diversity, the efficiency was not affected but with higher diversity, the efficiency was falling down.

Not surprisingly, though, the LGAs with higher mining share of total employment had lower efficiency of delivering income equality and health outcomes. While mining tends to pay much higher wages than other sectors, with the prevalence of fly-in/fly-out mode of mining operations, the majority of those wages are spent outside the mining LGAs, thus reducing the opportunity for local businesses to sustain.

The challenges accessing health services, affordable housing, education and lack of employment opportunities in remote LGAs are associated with higher rates of mortality and morbidity in these areas. Income inequality contributes to these outcomes. Policies directed to the improvement of access to health services including more equitable resource allocation, the use of telehealth services and incentives to medical graduates to work outside the major cities can reduce the health inequality in regional Queensland.

The proportion of elderly population (65+ years) negatively influenced the efficiency. It means that the higher the proportion of elderly persons was in the region, the less the region was efficient. Finally, the higher was the population density the higher was the regional efficiency.

The results indicate that EcIA can be used in a more sophisticated way to improve the regional planning and projects approval process to benefit broader communities.

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