Are there Regional Disparities in Suicide Rates? Quantifying Suicide Distributions for Queensland, 1990-2007

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Are there Regional Disparities in Suicide Rates? Quantifying Suicide Distributions for Queensland, 1990–2007

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Abstract

The study commences with a question that epidemiology would regard as ‘old’ viz. whether suicide rates are higher in rural areas or urban areas, and turns to applying an economic technique of analysis to studying regional suicide disparities. Several dispersion measures are applied to time series male and female suicide rates, including economic inequality measures and measures from regional studies. Equations are modelled on these dispersion measurements, establishing the sign on the slope coefficients. It is determined whether regional disparities in Queensland lessened, or increased, in the study period. The interpretations relevant to a regional studies literature are discussed. Key words: suicide, regional disparities, measuring dispersion, economic inequality

1 Introduction and Background

This study answers two questions about the spatial distribution of suicide rates using time-series data for Queensland. Initially we ask, ‘Are suicide rates higher in rural areas in comparison to urban areas?’ This question addresses a long-standing issue, returning to this topic because various epidemiological matters are still not settled. However, our main focus is on a second research question: are suicide rates by geographical region converging through time or is there a diverging trend in Queensland? In other words, are regional disparities lessening, or increasing, through time? The test for convergence/divergence here is based on temporal movement towards/away from the weighted mean for all the regions.

We demonstrate that suicide data are amenable to the techniques of descriptive analysis of disparities at the regional level. As yet, these data are simply not analysed with the tools of analysis from the literature. There are also important technical issues in answering this second question empirically, in terms of the literature on measuring inequality and, in particular, the welfare economics basis of inequality measurement. The answer to the second question is also in the genre of three Australian studies which are descriptive analyses of disparities. Those studies are concerned with regional labour market variables (DIXON, SHEPHERD and THOMPSON, 2001; DIXON, 2006; DIXON and MAHMOOD, 2006), following MARTIN’s (1997) application of absolute dispersion and relative dispersion measures to regional unemployment data for the United Kingdom.

This topic could be regarded as misplaced in the present literature, belonging rather to the literatures of epidemiology, psychology or psychiatry, mental health services research, suicide prevention services research etc. However, this study would be misplaced in those literatures. Apart from the relevance of the technical emphases herein, the Discussion section below proposes a case that a study of suicide can belong with disciplines such as regional studies, economics etc. that are concerned with population-level issues. The effectiveness of health/welfare services can be constrained by economic factors underlying spatial inequalities in access. The interpretation of the disparities reported here is also informed by a phenomenon in suicide, described as psychache by SHNEIDMAN (1993).
These points are all considered in the Discussion section where we discuss in a preliminary way the basis by which the phenomenon of psychache may also be subject to regional disparities.

To open up this societal level into the conception of suicide rates is not to deny the level at which individual or clinical responsibility exists. Rather, it is to admit into the social welfare function the possibility of some contemporary aspects in inter-personal utility and inter-personal disutility, as yet poorly understood. To quantify the contribution of such factors in a suicidal outcome is difficult; and yet the general argument that we suggest indicates that the broad fronts where the economic and social trends of nations are addressed ought to be well-informed about suicide trends and the presence of regional disparities.

2 Policy context

It would hardly be thought necessary to justify the ‘usual’ topics in regional disparities, e.g. regional labour market disparities, regional income disparities etc, if one of those topics were under study here.¹ Not so with suicide. The puzzling phenomenon of suicide tends to cause various reactions well before consideration of any policy-relevant, alternative empirical approaches can commence.

Some reactions tend to regard a study of suicide rates as unworthy of space relative to the ‘important’ or conventional topics of economics. In others, there tends to be considerable focus on suicide data being less-than-ideal, a problem that is now well-documented. For others, regional suicide disparities are of no interest because of an implicit stance that suicide is akin to some ‘philosophical constant’ in humanity. Some others may hold another implicit view that empirical work on this topic is simply of no value. Yet others are embroiled in the political climate that is subject to the Global Warming phenomena, a few of whom have adopted a stance that suicide ought not to be discouraged due to humanity’s ‘carbon footprint’. Some readers may also express concern that efficacy with respect to governments intervening into suicide is a misplaced view, and that there is no role for studies informing public policy.

These, and all other, reactions to suicide, and philosophical stances about suicide, can be debated in another forum. For the present, several policy-relevant statements will be made. First, there is a fully developed Welfare Economics argument available now, indicating that suicide prevention is a legitimate objective of government policy (DOESSEL and WILLIAMS, 2010) and whilst there is also increasing knowledge of the prevention strategies internationally that can avert some suicide deaths (MANN et al., 2010), WILLIAMS and DOESSEL (2007a) provide some evidence that the stock of knowledge that can decrease the trend in suicide mortality is extremely limited, relative to other causes of mortality. Second, the suicide rate in Australia has a rising secular trend (DOESSEL et al., 2010a; DOESSEL et al., 2010b), a trend that can be viewed as ‘an outcome’ of poorly understood social, economic and intra-individual forces. Third, suicide is not a trivial cause of death: in 2002 the World Health Organization (WHO)
attributed approximately 1.5 per cent of the global burden of disease to suicide (WHO, 2003). Moreover, it is not just the rising mortality trends due to suicide, but the increase in the amount of lifetime foregone over the twentieth century due to suicide, measured by the Potential Years of Life Lost measure (DOESSEL et al., 2009), that is of concern. Fifth, since Émile Durkheim’s *Le Suicide*, suicide has been regarded as not just a personal act but also as a phenomenon that is a societal outcome. CAMERON (2005) provides a brief exposition of Durkheim’s suicide in the context of economics. Finally, the fact is also simply that national suicide prevention strategies are in place, whether efficacious or not, in many Western countries.

Such are the dynamics that motivate this empirical study. Moreover, apart from the immediate answers provided here to our two research questions, we investigate empirically a ‘bigger thought’, as well. We analyse whether, or not, the world, when conceived of in terms of the set of factors producing suicide rates, is flat and whether, by implication, the forces producing the spatial pattern are temporally constant. Our purpose is captured succinctly by a title hearkening back to Martin’s article, ‘Regional unemployment disparities and their dynamics’ (MARTIN, 1997). Our focus must, of necessity, differ partially from Martin’s and, thus, we allocate space to interpreting the results in our Discussion section.

2.1 Is the rate of rural suicide higher?

With respect to the first research question, several studies (that, broadly speaking, are of an ‘epidemiological’ kind) are available that report on Australia’s suicide rates by various regional classifications [HETZEL (1971), DUDLEY et al. (1992), CANTOR and COORY (1993), BURNLEY (1994), KRUPINSKY et al. (1994), CANTOR and SLATER (1997), AUSTRALIAN INSTITUTE OF HEALTH AND WELFARE (AIHW) (1998), DUDLEY et al. (1998), CANTOR et al. (1999), WILKINSON and GUNNELL (2000), CANTOR and NEULINGER (2000), PAGE and FRASER (2002), CALDWELL et al. (2004), JUDD et al. (2006), PAGE et al. (2007), MILLER and BURNS (2008), CARRINGTON and SCOTT (2008), PRIDMORE and FUJIYAMA (2009), PHILLIPS (2009), QI et al. (2010)]. Many of these studies find that suicide rates are higher in regional and rural areas than in urban areas.

Because most studies report this result, a consensus or generalisation has formed from this literature. However, further study is warranted. Crucial detail needs to be examined concerning such a generalisation.

On the one hand, there are such studies as DUDLEY et al. (1992) that determine suicide rates in rural areas to be elevated. These co-authors examined New South Wales data, particularly for youth, in the study period 1964-1988. A similar conclusion was reached by BURNLEY (1994) for the period 1980-1991 for New South Wales, and likewise KRUPINSKY et al. (1994) for Victoria. More recently, CALDWELL et al. (2004) examined suicide data collected by the AIHW for 1997–2000 and find suicide rates for males to be also generally
higher in rural areas, more so in the 20-29 years age group while suicide rates for females were generally similar between metropolitan and rural areas.

On the other hand, there are studies such as HETZEL (1971), CANTOR and COORY (1993), and CANTOR and SLATER (1997) finding little evidence of an urban-rural differential in suicide rates. HETZEL’s (1971) study finds in Victoria for the period 1950-1967, the rising suicide rate for males and females was confined to Melbourne. CANTOR and COORY (1993) report no evidence of elevated rural suicide rates in Queensland. CANTOR and SLATER’s (1997) results emphasise the notion that the relationship between suicide rates and geographical location is complex: they find both the lowest, and the highest, rates of suicide in Queensland had occurred in rural areas for 1990–1992.

In another approach, the techniques of spatial analysis, or Geographic Information Systems (GIS), yield further detail. These techniques are applied in two recent studies by QI et al. (2009) (2010) who study the spatial pattern of suicide by gender on Australian Bureau of Statistics (ABS) data for Queensland at the level of Local Government Areas (LGA). The period is 1999 to 2003. QI et al. (2009) and QI et al. (2010) find gender variation in age-standardised suicide mortality at the LGA level, and they also find remote shires having the highest suicide incidence (in Far North Queensland e.g. Cook and Mornington Shires), and other remote shires having the lowest suicide incidence (in South-Western areas e.g. Barcoo and Bauhinia Shires). QI et al. (2009) incorporate some climatic, demographic and socio-economic variables and they report results finding, at the LGA level, suicide associated, not just with harsh environmental conditions, but with harsh social conditions. Maximum temperature, the proportion of indigenous population and the unemployment rate are major determinants of suicide in this study. However, their analysis includes only a few such variables, i.e. rainfall, temperature, the ABS’s Socio-economic Indexes for Area (SEIFA) and demographic variables. The authors suggest future studies ought to incorporate other factors, such as personal and family history of mental health and psychiatric problems, access to local health services, nutrition, religion, alcohol and drug use, and so forth.

It cannot be emphasised enough that there is little uniformity across all studies. The various studies differ in terms of regional classifications employed, measures invoked, procedures applied etc. For example, CANTOR and COORY (1993) developed their own regional classification for the State of Queensland, and they calculated confidence intervals. On the other hand, CALDWELL et al. (2004) analyse Australian data, using the Rural, Remote and Metropolitan Area (RRMA) classification, and calculate z scores. AIHW data apply the Australian Standard Geographical Classification Remoteness Area (ASG, RA) system (AIHW, 2007; AIHW, 2008). It must be noted also that there is no uniformity in location of the study: some are based on Victorian data, some on Queensland data or New South Wales etc. The studies also pertain to varying time periods.
2.2 The temporal trend in regional suicide disparities

In this literature, there is a lacuna regarding the trend and thus, the generalisations that have formed about heightened rates of rural suicide may be too hasty. QI and co-authors indicate that there is much detail in data at a lower level of geographic analysis that is yet to be fully examined. No study has reported, as yet, on the temporal trend in the regional variation around suicide rates.

In quantifying the temporal trend in disparities, this study applies several measures of dispersion to the regional suicide rate data. There is a very good reason for applying several measures of dispersion. A study about regional distributions, dispersion or inequality ought never to derive its conclusion from a single measure, or just a few measures; an explanation is in WILLIAMS and DOESSEL (2006) in the context of the issues of the mental health sector. The appropriate approach to the second research question is to calculate and report various measures of inequality, in a manner akin to sensitivity analysis. Our study applies the standard deviation and the coefficient of variation, the Gini coefficient and the Atkinson measure from the economic inequality literature, as well the measures of absolute dispersion and relative dispersion. The point of multiple measures is discussed further herein.

There follows a Section outlining the empirical method. Another Section presents results and a separate Section initiates discussion. There is a conclusion in the final Section.

3 METHOD

3.1 The data on suicide

The selection of the study area, viz. the State of Queensland at the level of regions, relates to the quality of available data. The Queensland Suicide Register (QSR), which is managed by the Australian Institute for Suicide Research and Prevention, is a comprehensive database of suicide mortality containing information on all suicide deaths by Queensland residents since 1990. The Australian Bureau of Statistics (ABS) also collects suicide data but those data have been subject to various enumeration problems (CANTOR et al., 2001; DE LEO et al., 2006; DE LEO, 2007; DE LEO, 2009) and it is now established that the QSR is the most accurate source of suicide data in Australia (WILLIAMS et al., 2010), and addresses various ABS under-estimation problems. Further details on the QSR are available (DE LEO et al., 2006).

The study period encompasses 18 years from 1990 (the first year of QSR data) to 2007. Between 1990 and 2007, there were 9,393 cases of suicide recorded in the QSR. Of those, 230 cases (or 2.5%) were excluded due to the deceased permanently residing in a country other than Australia (n=15), a State other than Queensland (n=67), having an unknown or no fixed place of abode (n=143)
Table 1: The Average Suicide Rate for Queensland Regions on 18 Years of Annual Rates and for Queensland (Weighted for all Regions), 1990-2007

<table>
<thead>
<tr>
<th></th>
<th>Brisbane City</th>
<th>Outer Brisbane</th>
<th>Coastal</th>
<th>Darling Downs</th>
<th>Mackay-Fitzroy</th>
<th>Western North and Far North</th>
<th>Qld</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Males</strong></td>
<td>22.12</td>
<td>21.84</td>
<td>24.86</td>
<td>21.75</td>
<td>23.14</td>
<td>32.80</td>
<td>23.54</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td>6.61</td>
<td>5.67</td>
<td>7.35</td>
<td>4.79</td>
<td>5.26</td>
<td>6.24</td>
<td>6.55</td>
</tr>
</tbody>
</table>

or being in a long-term institutionalised care at the time of death (n=5). The final database includes 9,163 persons (7,245 males, or 79.1%, and 1,918 females, or 20.9%).

Each suicide case was located within a Statistical Local Area (SLA) based on the residential address, following the 2001 edition of the Australian Standard Geographical Classification (ASGC) (ABS, 2001). Following the ASGC, every QSR case was assigned to a relevant region, each of which is comprised one or more Statistical Division (SD). These regions are Brisbane City (Brisbane City); Outer Brisbane (Gold Coast City A, Beaudesert Shire Part A, Caboolture Shire Part A, Ipswich City (Part in BSD), Logan City, Pine Rivers Shire, Redcliffe City, Redland Shire); Coastal Part A and B (Gold Coast City Part B, Sunshine Coast); Darling Downs and Wide Bay (Moreton SD Bal, Bundaberg, Hervey Bay City Part A, Wide Bay-Burnett SD Bal, Toowoomba, Darling Downs SD Bal); Mackay-Fitzroy (Rockhampton, Gladstone, Fitzroy SD Bal, Mackay City Part A, Mackay SD Bal); Western (South West, Central West, North West); North and Far North (Townsville City Part A, Thuringowa City Part A, Northern SD Bal, Cairns City Part A, Far North SD Bal).

Suicide mortality rates for each of the regions were calculated per 100,000 population for males and females, as well as the total. This calculation is based on the number of identified deaths (from the QSR) for the population residing in that region at time of death and the annual estimated resident population data, as at 30 June for the years between 1991 and 2007. These population data were obtained from the Queensland Regional Statistical Information System (QRSIS). QRSIS is a regional database maintained by the Office of Economic and Statistical Research, sourcing on data collections of the Australian Bureau of Statistics. Regional population figures for males and females for the year 1990 were calculated by assuming the proportional increase in the population figures between 1990 and 1991 as observed in period 1991-1992. Table 1 presents the suicide rates for the regions of Queensland averaged over the 18 years of annual rates and also weighted average for all regions.

Note that the mortality rates reported here are not age-standardised. Annual age data at the regional level which will enable accurate age-standardisation are not available and, in view of the nature of this exercise and the fact that the relatively short study period hardly requires age-standardisation, it was decided that age standardisation would not be undertaken.

The regional pattern can also be depicted visually by the application of some techniques of chloropleth mapping. See the maps in Figures 1 (a) and 1(b).
3.1.1 Some descriptive statistics

Several comments are relevant about the plots in Figure 2(a). First a ‘mixed picture’ for males is apparent. Some regions are characterised by marked ‘swings’ from one year to another (due to low numbers in those regions); there is some suggestion of a rising trend in other regions; and in yet other regions a falling trend appears likely. Second, the graph for the Western region is markedly different from the plots for all the other regions. Third, most regions have quite low rates per 100,000 males, such as Mackay (16.89, 1993; 13.12, 2007), Brisbane City 13.93, 2006; 14.30, 2007), Darling Downs (15.17 1991); Coastal (17.52, 2007); Outer Brisbane (14.99, 1992), Western (16.72, 1993). The highest rates for males occurred in the Western region (47.43, 2001; 47.22, 2004). Fourth, in some regions, the male rates are variable. It may be thought that this is due, in part, to low population; however, in other regions, the plots indicate low rates that are relatively smooth (e.g. the Darling Downs and Coastal). Relatively even, but high, rates through time are found in the North and Far North region.

The ‘picture’ in Figure 2(b) for females is as visually chaotic as it is for males; however the graphs reveal a very different pattern for females from those for males. First, the numeration along on the y-axis for females indicates the
Figure 2: Suicide mortality rates per 100,000 males and females for seven Queensland regions, 1990 - 2007
markedly lower rate of female suicide relative to male suicide. Second, it is
noteworthy that, due to the lower numbers, the female data seem generally sub-
ject to even greater ‘oscillation’ than the variation in the male data. Third, a
‘mixed picture’ for females, like that described above for the male data, is also
apparent. Fourth, the regions for which there are lower rates per 100,000 for
males are not the same regions as those for females and the regions where the
highest rates have occurred do not appear to be the same as for males.

Clearly, further examination of these data is required. Given the focus of the
research question, attention will turn now to determining the relevant approach
to measuring the regional pattern of dispersion and inequality in suicides rates
for the seven regions of Queensland.

3.1.2 Regional dispersion and inequality measures

Various measures of inequality and dispersion are available and can be applied
to these data in order to generate the data sets for statistically modelling the
disparities. The focus here is on the measures that can be applied; the modelling
is described in the next Section.

There is a basic distinction made in the statistics literature between the concepts
of central tendency and dispersion in a data set and the various measures of the
concepts. This distinction is relevant in the present context. Various measures
of the concept of dispersion (or inequality) are available, not only the more
well-known measures such as the standard deviation (SD) and the coefficient
of variation (COV). There is also a class of other measures of inequality or
dispersion that include the Gini coefficient, the Atkinson measure (or Atkinson
index), Theil’s Index of Entropy etc. For details, see inter alia COWELL (1995),
economic welfare, it is vital to recognise the measures that link a social welfare
function to the assumptions underlying the measure being applied.

Inequality measures tend to be applied most frequently to income data. LE
GRAND (1987, 1989), ILLSLEY and LE GRAND (1987) and SILBER (1982,
1983, 1988) are the first scholars to apply inequality measures to health phe-
nomena. The basic notion is that conceiving of the distribution of well-being, in
its broadest definition, incorporates the length of lifetime, or the loss of lifetime.
Two studies (WILLIAMS and DOESSEL, 2009a, 2009b) subsequently applied
inequality measurement to mental health status. These are studies of suicide
which are based on the age distribution of the length of the lifetime foregone.
However those studies have a different focus from the emphasis here. We are
concerned here with spatial inequality in suicide rates per se. However, the
point still stands that the social welfare function is relevant to all exercises in
quantifying inequality.

The Atkinson measure of inequality requires a value for the parameter of in-
equality aversion $\epsilon$ (ATKINSON, 1970). The value of $\epsilon$, in terms of the actual
aversion to regional inequality in suicide in Queensland, is unknown. In this
study, we applied assumed values in calculating the Atkinson Measure, applying the Measure twice, once with an assumed low value for \( \epsilon \) such as 0.2, and again assuming a high value for \( \epsilon \) such as 1.4. The lower value represents an assumption that aversion to spatial inequality at the lower end of the distribution is weak; a higher value represents an assumption that aversion to inequality is strong.

With respect to whether the inequality is increasing or decreasing, it is well known that applying various measures to the same data set may yield different answers. The pragmatic advice to the empirical researcher is not to base a conclusion on a single measure of inequality: the most appropriate procedure is to calculate, and report, a number of different measures of inequality. The different measures may well lead to the same conclusion (which can be thought of as ‘a nice result’). [Such a case can occur. For example, the present authors have studied changing geographical dispersion of psychiatric services in Australia, using four different measures of equality (WILLIAMS and DOESSEL, 2009b).] If ‘a nice result’ does not occur, then all results are still reported and the differences outlined in accordance with the assumption/s of the various measures. Such a research strategy is like a sensitivity analysis.

In addition to these measures, two other specific measures of distribution are applied. These measures are in the regional studies literature, and are generally lesser known, although they are employed in literatures such as labour economics. These are the absolute measure of dispersion (AD) and the relative measure of dispersion (RD). Following the general arguments of, inter alia, THIRLWALL (1966), LEVER (1987), TAYLOR (1991) and MARTIN (1997), let us define an absolute measure of dispersion of the suicide rate (ADSRt) as the differences in regional rates of suicide from the State (weighted) rate in time period \( t \), ie

\[
AD_{SR}^t = SR_{Reg(i)} - SR_{State}
\]

where \( SR_{Reg(i)} \) is the suicide rate in region \( i \) (where \( i = 1, 2, \ldots, n \)) in time period \( t \), and \( SR_{State} \) is the weighted average of those regional rates in time period \( t \).

In the context of unemployment, Dixon gives the following explanation of the absolute measure of dispersion: ‘[absolute dispersion] measures the number of persons in all regions taken together who would have to change their labour market status in order for every region to have the same percentage unemployed as currently prevails for the [population] as a whole...’ (DIXON, 2006, p. 208).

Following DIXON (2006) and MARTIN (1997), the suicide disparity in a region can be written as follows:

\[
\left(\frac{NS_{Reg(i)}}{NS_{Reg(i)}}\right) - \left(\frac{POP_{Reg(i)}}{POP_{State}}\right)
\]

where \( NS \) is the number of suicides and \( POP \) is the size of the population, and also
Table 2: A Summary of Some Measures of Regional Unemployment Dispersion Employed by Various Authors

<table>
<thead>
<tr>
<th>Standard Deviation</th>
<th>Coefficient of Variation</th>
<th>Gini Coefficient</th>
<th>Atkinson Measure</th>
<th>Absolute Dispersion</th>
<th>Relative Dispersion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ANDREWS &amp; KARMEL (1993)</td>
<td></td>
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<tr>
<td></td>
<td>BORLAND &amp; KENNEDY (1998)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>BORLAND &amp; KENNEDY (1998)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Following, inter alia, GLEAVE (1987), GREEN et al. (1996) and MARTIN (1997), an alternative measure, the relative dispersion of the suicide rate (RDSR), can also be defined:

$$ AD_{SR}^t = \Sigma(POP_{Reg(i)}^t/POP_{State}^t)\left|SR_{State}^t - SR_{Reg(i)}^t\right| $$ \[1a\]

Following, inter alia, GLEAVE (1987), GREEN et al. (1996) and MARTIN (1997), an alternative measure, the relative dispersion of the suicide rate (RDSR), can also be defined:

$$ RD_{SR} = SR_{Reg(i)}/SR_{State} $$ \[2\]

and also

$$ = AD_{SR}/SR_{State} $$ \[2a\]

The problem mentioned above in the discussion of the statistical measures (viz. that the measures can give different conclusions about convergence/divergence through time) also exists with these two regional measures. See, inter alia, MARTIN (1997). RDSR has been calculated on QSR data (DE LEO et al., 2006) where instead the term ‘Rate Ratio’ is employed. See Table 4.2 in DE LEO et al. (2006).

Table 2 summarises the use in a number of different studies of five different measures of dispersion (the SD, the COV etc). These studies have involved empirical work on the regional dispersion of unemployment (i.e. not suicide) but Table 2 helps to summarise the nature of the literature on the relevant techniques. It shows that there are some cases in which the authors have calculated several measures of dispersion. It indicates as well that the studies are not inclined to apply all available tests.

Attention turns now to Figures 3 and 4. These Figures present time-series plots of the six measures of dispersion and inequality applied to male and female
suicide rates, respectively. The Figures include just one of the two Atkinson measures here (the $A_{0.2}$) in order to save space and because, on these data, both the $A_{0.2}$ and the $A_{1.4}$ plots are similar. Visual inspection of these Figures indicates that there are similarities and differences across the various measures for both the male data sets and the female data sets. It is apparent in Figure 3 also that four of the dispersion and inequality measures produced more fluctuating measurements post-2000; however it is not possible to investigate the pattern further in this study.

3.1.3 Data analysis

The purpose of the statistical modelling is to determine the sign on the slope coefficient in the estimated equations. The sign determines whether the regional dispersion or inequality in suicide rates in Queensland is increasing, decreasing or constant for each measure over the study period and answers the second research question with statistical significance. Because male and female suicide behaviour is very different, the total is not analysed because the space is not available for reporting on the total rates.

Equations were modelled on the distributional data generated by applying the six measures discussed above: the SD, the COV, the Gini coefficient, $A_{0.2}$ and $A_{1.4}$, the AD and the RD. All aspects of the inequality data (so obtained) suggest the likelihood that linear and quadratic forms fit these data, i.e. Equations [3] and [4], respectively:

\[ D_{SR(i)}^{R(M)} = \alpha_1 + \alpha_2 \tau + \alpha_\kappa \chi_\kappa + \mu_\tau \]  

[3]
Figure 4: The Dispersion and Inequality Measurement on Female Suicide Rates for the Seven Regions of Queensland, 1990 - 2007

\[ D_{\text{Reg}(i)}^{SR(M)} = \alpha_1 + \alpha_2 \tau + \alpha_3 \tau^2 + \alpha \kappa \chi \kappa + \epsilon \tau \]  

where \( D_{\text{Reg}(i)}^{SR(M)} \) is the regional distribution (so measured by SD, COV, AD, RD, Gini, \( A_{0,2}, A_{1,4} \)) on male suicide rates in Region \( i \); \( \tau \) is time; \( \chi \kappa \) is a vector of pulse dummy variables that may affect \( D_{\text{Reg}(i)}^{SR(M)} \); \( i = 1, ..., 7 \) i.e. the ‘Big 7’ regions of Queensland; \( \mu \) is ‘white noise’, \( \epsilon \) is ‘white noise’; and \( \alpha_1, \alpha_2, \alpha_3, \alpha \kappa \) are the parameters to be estimated. Thus, with seven measures for male and female data, this amounts to estimating fourteen equations in all. Since the impact of institutional and environmental variables is not known, the error term captures those effects. The same steps were then undertaken on the female inequality data sets.

4 EMPIRICAL RESULTS

Given that Goodness-of-Fit results are a necessary, but not sufficient, indicator of the confidence that can be placed in estimated equations, thorough diagnostic testing was undertaken. Five diagnostic tests were applied, testing for serial correlation, normality of the residuals, heteroscedasticity, correct specification (of functional form) and stationarity of the residuals.

Diagnostic testing was undertaken initially on linear time trends, and Ordinary Least Squares (OLS) estimation was found to provide a poor fit. The initial modelling also generated somewhat ‘nonsensical’ results. It became apparent, given the data were very ‘bumpy’ (due to small numbers), that it was appropriate to calculate three-yearly moving averages. This step smoothed the yearly observations. Further diagnostic testing found serial correlation in the AD data set for males, and the AD and RD data sets for females; the insertion of a first
Table 3: Estimated time trends on six measures of dispersion of suicide rates (three-yearly moving averages), Queensland, males, 1990-2007

<table>
<thead>
<tr>
<th>Measure</th>
<th>Standard Deviation</th>
<th>Coefficient of Variation</th>
<th>Absolute Dispersion</th>
<th>Relative Dispersion</th>
<th>Gini Coefficient</th>
<th>Atkinson Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>4.42***</td>
<td>0.19***</td>
<td>23.40***</td>
<td>1.06***</td>
<td>0.10***</td>
<td>0.09***</td>
</tr>
<tr>
<td></td>
<td>(17.02)</td>
<td>(15.24)</td>
<td>(21.64)</td>
<td>(18.32)</td>
<td>(15.65)</td>
<td>(13.90)</td>
</tr>
<tr>
<td>Time</td>
<td>-0.30***</td>
<td>-0.02***</td>
<td>-0.76***</td>
<td>-0.08***</td>
<td>-0.01***</td>
<td>-0.00***</td>
</tr>
<tr>
<td></td>
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<td>34.14***</td>
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<td>74.29***</td>
<td>27.47***</td>
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<td>(p=0.48)</td>
<td>(p=0.15)</td>
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<td>(p=0.46)</td>
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<td>AD-F (t)</td>
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<td>1(0)**</td>
<td>1(0)**</td>
<td>1(0)**</td>
<td>1(0)**</td>
<td>1(0)**</td>
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</table>

Notes:  The inequality aversion parameter of the Atkinson measure which takes two assumed values (0.2 and 1.4) in this exercise.  
a Data in parentheses below the equation coefficients are $t$ statistics; $p$ values are reported for the diagnostic test results.  
b is the coefficient of determination, adjusted for degrees of freedom.  
c $F$ is a test of the joint hypothesis that all coefficients equal zero.  
d Breusch-Godfrey is an LM test for serial correlation.  
e Breusch-Pagan-Godfrey is a test, based in the F-distribution, of the hypothesis that heteroscedasticity is absent from the residuals.  
f Ramsey RESET is an F-test of the hypothesis that the specification of the equation is correct.  
g Jarque-Bera is a $\chi^2$ test for normality of the residuals.  
h AD-F is the Augmented Dickey-Fuller test for stationarity of the residuals, and I(0) indicates that the residuals are stationary.  
i One, two and three asterisks indicate statistical significance at the ten, five and one per cent levels respectively.  
Source: Calculated from Queensland Suicide Register data.

order autoregressive error term AR(1) in these three equations addressed that problem. The implementation of pulse dummy variables addressed the effect of outliers. The Ramsey RESET test indicated that polynomial equations, estimated under non-linear least squares, would improve the performance of all the male equations, and also for some of the female equations.

A set of equations for which the sign on the coefficient can confidently be reported is thereby provided. These results are presented in Table 3 for males and Table 4 for females.

Table 3 indicates a negative and statistically significant coefficient on Time in each of the equations for males. The negative sign confirms a declining trend from higher to lower values on these inequality measures. Thus there is a converging regional trend on the measures of inequality applied to the male suicide data. The coefficient on Time² in each equation is low in value in several equations but it is statistically significant in all male equations. Thus, it is not
### Table 4: Estimated time trends on six measures of dispersion of suicide rates in three-yearly moving averages, Queensland, females, 1990-2007

<table>
<thead>
<tr>
<th></th>
<th>Standard Deviation</th>
<th>Coefficient of Variation</th>
<th>Absolute Dispersion</th>
<th>Relative Dispersion</th>
<th>Gini Coefficient</th>
<th>Atkinson Measure</th>
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<th>ϵ = 1.4</th>
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<td>0.16***</td>
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<td>0.06***</td>
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</tr>
<tr>
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<td>-0.03</td>
<td>-0.05***</td>
<td>-0.01***</td>
<td>-0.01***</td>
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<td>-0.01***</td>
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</tr>
<tr>
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<td>Time²</td>
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<td>-</td>
<td>-0.00**</td>
<td>-</td>
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<td>-0.00**</td>
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<td>(5.00)</td>
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<td>0.20***</td>
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<td>0.54**</td>
<td>0.54**</td>
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<tr>
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<td>(p=0.46)</td>
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<td>2.62</td>
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<tr>
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<td>(p=0.30)</td>
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<td>Jarque-Bera (χ²)</td>
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<td>0.64</td>
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<td>10(0)**</td>
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Notes: See Table 3.
Source: See Table 3
spurious to state that, on the basis of the existing study period, the likelihood exists of a turning point towards divergence.

The results in Table 4 for female suicide indicate also negative and statistically significant coefficients on time on these equations. The negative sign on all measures confirms a declining trend and thus a regional trend for female suicide that converges through time. Note that there is little variation in the slope across the inequality measures. The value of the coefficient on $Time^2$ is very low in three equations and, although statistically significant, there is very little evidence in all across all measures to suggest that a turning point towards regional divergence in female suicide.

5 DISCUSSION

In this section, we place emphasis on interpreting the results for a regional studies literature. Although no analysis of the factors in the trends in these disparities is undertaken in this study, some studies are available on some of those factors. For example, a recent study of risk factors in regional suicide on Queensland data, described as ‘ecological’ in the psychology and epidemiology literatures, is MILNER et al. (2011). Apart from the studies cited above by [i.e. QI et al. (2009, 2010); and MIDDLETON et al., 2008; SAUNDERSON and LANGFORD, 1996] in an endnote, a recent, comprehensive study of risk factors is now available internationally (GUNNELL et al., 2010). This is an exercise in spatial epidemiology. Gunnell and co-authors mapped geographically-coded standardised mortality ratios for suicide in 1,113 census ‘tracts’ or areas, which they smoothed using Bayesian hierarchical models. The data are for 15—44 year old males during 1981—1985, 1991—1995 and 2001—2005. Those scholars report changes in the spatial epidemiology of male suicide in England and Wales that are not explained by ‘the usual’ risk factors through time.

The implication of the present results relates to various regional policy objectives. Those objectives are discussed next before our Discussion turns to focus on approaching the phenomenon of psychache (mentioned already) in a regional studies literature.

5.1 Efficacious policy and resource sufficiency

PATAKI and CARPINELLO (2005) provide an overview of various issues in suicide prevention from a public health perspective. This overview is in the context of New York but it is a statement of some available strategies and processes in suicide prevention, as well as various practices. Much work needs to be done to provide evidence-based policy to improve both public health strategies in suicide prevention and also to improve the efficacy of support services. A very thorough review of the studies is now available (MANN et al., 2010).
Despite the fact that effective prevention policy can ameliorate regional disparities in suicide rates, service efficacy is often subject to spatial forces. This problem is seldom studied. In the period of intense risk for the suicidal individual, there is a dangerous passage of time until the ultimate act of suicide. The duration of this time period can be thought of as about equivalent to the period of ultimate danger for life-threatening conditions like myocardial infarction, stroke, road trauma, snake bite etc but the risk of mortality when the threat to life is suicide may well be greater (and thus mortality heightened) if services are ineffectively supplied or inadequately financed. See COOK (2012)

All service supply problems are exacerbated where prevention processes for suicide risk, and critical incident prevention, are insufficient or ineffectacious; and all such problems are subject to regional variation. The financing of services for suicide falls between many ‘cracks’. For example, in the case of Australia, Medicare is Australia’s universal, compulsory health insurance scheme. It is financed from general taxation revenue and an ear-marked tax, and financing private fee-for-service medical and allied health services. IV Despite the existence of Medicare in current times, the available empirical results indicate regional inequality of access to mental health services under Medicare and also that there is statistically significant spatial disparity in the gross prices being paid and received at the level of the region (WILLIAMS and DOESSEL, 2007b; WILLIAMS and DOESSEL, 2009b). These preliminary results suggests relatively intractable movement, during two decades of Medicare subsidies, in alleviating inequality in the private psychiatric services produced and consumed in Australia, at the broad level of the region. Further studies with this type of regional emphasis and in this genre are needed not just for Australia, but internationally, to shed light on the efficacy and financing of suicide prevention services.

The spatial forces that affect service access and availability may also involve managerial, demographic and psychological factors, as well as the typical set of economic forces. In service provision, linkages amongst specialist service providers, education programs, service accessibility and so forth are non-trivial issues and are worthy of further analyses. Such topics are already under investigation, as the large review by MANN et al. (2010) indicates. In all explanatory equations, the inclusion of regionally-related economic variables that are relevant to such exercises is vital. The types of data will includes Medicare rebates of medical services and allied health/mental health services (e.g. for Australia), pharmaceutical benefits, the availability of information about support and prevention services, the availability and price of substitutes etc.

5.2 Equity

Some remarks are necessary in light of the objective of equity. A separate rationale for measuring or quantifying regional suicide disparities relates to equity. Typically, the forces that bring longevity overall to the population of a nation, or region, are not experienced evenly across that population and ‘untimely’ mortality usually occurs with acts of suicide. The quantification of this phenomenon at the ‘societal’ level of perspective is available (DOESSEL et al., 2010) and
regional disparities in suicide are yet another dimension of longevity being experienced unequally. The presence of inequity relates to the tendency for suicide to involve untimely loss of life. A clarification is available in DOESSEL et al. (2009).

It is relevant to keep in mind that equal distributions of suicide rates are not necessarily ‘fair’, and unequal distributions of those rates are not necessarily ‘unfair’. Further discussion of inequity and the distribution of mental health services is available [WILLIAMS and DOESSEL (2009a) and DOESSEL et al. (2010)].

The point is that the first step in determining the presence and nature of inequity is to determine the pattern of equality or inequality. If a trend in regional suicide disparities is not converging, it is appropriate to discuss whether, or not, there is inequity. Regional differences in a health/welfare variable (such as the suicide rate) indicate that the provision of health services (such as suicide prevention services) should reflect the difference in health/welfare variable; otherwise, there will be an inequity in the provision of services.

5.3 Conceiving of disparities, and trends, in psychache

It is relevant now to place the analysis of suicide in a wider perspective. First, it is important to recall (as pointed out in the Introduction) that suicide in Australia is subject to a rising secular trend. It may be useful to conceive of this secular trend, and the regional pattern as described here, as ‘outcomes’ of poorly understood social, economic and intra-individual forces. But this general statement is not ‘all that we can say’. This is because of the work of Edwin Shneidman (1919—2009), the founding father of what is now called ‘suicidology’. One of Shneidman’s contributions is a statement of ‘psychache’, the ‘cause’ of suicide. Consider the following statement from SHNEIDMAN (1993):

Nearing the end of my career in suicidology, I think I can now say what has been on my mind in as few as five words: Suicide is caused by psychache (sī-kāk, two syllables). Psychache refers to the hurt, anguish, soreness, aching, psychological pain in the psyche, the mind. It is intrinsically psychological – the pain of excessively felt shame, or guilt, or humiliation, or loneliness, or fear, or angst, or dread of growing old, or of dying badly, or whatever. When it occurs, its reality is introspectively undeniable. Suicide occurs when the psychache is deemed by that person to be unbearable. This means that suicide also has to do with different individual thresholds for enduring psychological pain (SHNEIDMAN, 1993, p. 51)

Although Shneidman came to this perspective after decades of clinical experience with people at risk of suicide (and survivors of suicide attempts), the detail of the notion of psychache is informed by neurobiological aspects of suicide. [MANN (2005) provides a relatively non-technical account of this technical
literature. It is also important to note that ‘psychache’ is not synonymous with ‘depression’, or any other mental health disorder. Mental illness, substance abuse, job loss or relationship breakdown, aggressive or impulsive personality traits, a sense of despair, access to methods of suicide (guns, medications, rope, knives etc.) and so forth are to be understood as precipitating factors (or pre-conditions) to the ultimate act of suicide, the immediate cause of which is psychache. Such factors (as mentioned above), inter alia, are the forces that intensify the psychache (or human pain) that lead to the deadly act.

Is psychache but a part of a more general phenomenon? We begin with a brief argument that a general concept, emotional violence, is a factor in the development of psychache.

Physical violence, whether it be at an individual level (e.g. inter-spousal, or domestic, violence, robbery with violence, assault etc) or at a social level (communal riots, football violence etc) is invariably accompanied by a counterpart, emotional violence. (Emotional violence may have a long-term temporal characteristic, in that memories of it may haunt victims for decades.) For example, bullying, irrespective of location (school, workplace, cyberspace), often involves some physical violence, but emotional violence is its complement.

A stark and tragic example of this problem was recently observed in media reports about the persistent and cruel workplace bullying of a nineteen-year-old young woman, Brodie Panlock, at a restaurant in Hawthorn, Melbourne, which resulted in her suicide in 2006. The effect of people’s bad behaviour is not always tangible. Moreover, physical violence is more easily captured on film and television and by photography than emotional violence, and it is more easily measured (e.g. the police force weighs the seriousness of physical violence) than emotional violence.

By implication we consider whether regional and temporal variation in emotional violence can occur, and/or people’s ability to endure it. The eminent sociologist, Peggy Thoits (one of the few scholars who study emotions at the societal level), has determined empirically that there is non-uniformity in the societal distribution of stress experiences, mental health problems, coping strategies and social support in the general adult population (THOITS, 1989).

What Thoits is concerned with is, in effect, a ramification of ‘bad behaviour’ that affects not just victims but perpetrators as well. There are other similar effects from misplaced attitudes and values that can unglue ‘the social glue’ e.g. selfishness, self-centredness, self-promotion and self-adulation can ultimately (in the long-run) impose damage to others. To neglect these ingredients of social glue (or social capital) is to abandon the habits and practices of having concern for others. There is also The Golden Rule and The Silver Rule (the principle of non-maleficence i.e. causing others minimal harm). Abandoning these is, relatively speaking, to abandon ‘goodness’, and so forth. CAMERON (2005) describes the effect of ‘bad behaviour’ (of any type) as ‘interpersonal violation’ (p. 46).
In a subsequent publication, CAMERON (2009) considers the economics of hate. He analyses behaviour in which haters and victims maximise utility in the context of scarce resources in particular situations. In such situations where hate forms, the negative social capital can even increase the productivity of a group. VII Hate is at the extreme degree of emotion in a spectrum of hostility. We conjecture that rude and hurtful behaviour in relationships can culminate in ‘emotional violence’, which is subject to regional disparities and temporal trends. It is possible that there is an ultimate lethal effect for some individuals of the habits and attitudes in ‘emotional violence’, and that there is a location-based effect. In part social, in part economic, in part historical, in part institutional, the ultimate impact of this modern tendency is that some people commit violence against themselves, including cutting, self-mutilation etc, with the polar case being self-inflicted death or suicide. In some regions or areas, the impact is more severe than in others and psychache is worse in some areas than others. Thus, suicide rates are subject also to regional disparities.

It is an empirical matter as to whether ‘emotional violence’ and/or psychache are markers of the modern era: is there an increasing secular trend? Are there regional disparities? Answering these questions a posteriori is unlikely on available data; and yet various disparate literatures can enable the conceptualisation of some answers and some a priori evidence.

Perhaps it is virtually impossible to discuss this perspective without inviting criticism about ‘conflating conjecture and facts’. This comment reflects the acerbic stance that Clark takes (CLARK, 2007) towards GREIF’s (2006) analysis of the role of institutions in the development of the modern economy. VIII The suggestion here is that emotional violence also can become institutionalised.

Finally, an economic parody is invoked (since two of us are economists) concerning some modern emphases, which we shall name as ego-nomics. One may conceive of egonomics as a body of attitudes and behaviours ill-defined, as yet, in the scholarly literature, though known, by no name in particular, anecdotally and via the media. Its body of thought, attitudes and behaviours are in place at the community level and the national level. It causes ‘dysfunction’ at various social levels. Its ethical mores contribute to modern emotional violence and related phenomena. It is conceivable that suicide rates are heightened by alienating behaviours and social habits: varying degrees of emotional violence are entailed. In some circles it is recognised as ‘bad behaviour’. Specifically, some economic and social trends implicitly convey a ‘message’ to various individuals that ‘You count; but I don’t count’.

Egonomics is in stark contrast to the etymology of economics, viz. the Greek oikos + nomos. IX In egonomics and economics are the emphases of two different ‘worlds’, involving two contrasting sets of economic and societal arrangements, are emphasised in egonomics and economics. XI Arguably, egonomics can pervade the national or regional oikos.

To make this contrast is to sharpen the mind for conceiving of the meaning of time series data on regional suicide disparities: in such data conceal the thoughts and comments of individuals who were once members of our society. It is con-
ceivable that there are some emphases that have been overlooked in the present foci of attention that have come to dominate our nations, our economics and our universities. One may do well to consider MCCLOSKEY’s (2010) statement about ‘the blinding force of ideology in economic thinking’ (p. 46) in this context. One is also reminded of John Maynard Keynes (1883—1946) who eloquently expressed the type of problem that can arise: ‘Madmen in authority, who hear voices in the air, are distilling their frenzy from some academic scribbler of a few years back.’

Nevertheless, accumulating knowledge about suicide is a relatively neglected exercise, and is subject to much misplaced belief. Also, with respect to its source, there is Joel Mokyr’s opening sentence in his The Enlightened Economy... emphasises the place of knowledge: ‘economic change in all periods depends, more than most economists think, on what people believe’ (MOKYR, 2010). Mokyr’s argument is as relevant to the ‘big’ issues of economics, like economic growth, as it is to other issues, such as regional suicide disparities, and the patterns in psychache and emotional violence. Clearly, several disparate literatures can inform this argument: the relevant disciplines are not just those that have conventionally studied suicide.

6 CONCLUSION

This empirical study answers two questions: ‘are suicide rates higher in rural areas in comparison to urban areas?’ and ‘are suicide rates by geographical region converging through time or is there a diverging trend?’ The answers to both questions are reported here for male and female suicide data as the suicide rates are so different for males and females. Male suicide is highest in remote areas whilst female suicide is highest in coastal regions and inner metropolitan areas. The second question elaborates on the answer to the first question by determining the temporal trend towards the weighted mean across all regions and reports statistically significant results on seven measures of dispersion and/or equality. Although a converging regional trend is found on all measures applied to the male suicide data, the hypothesis that a turning point towards divergence occurred during the study period cannot be rejected on present data. A converging regional trend is found also for female suicide rates. However, there is very little evidence across all measures to suggest that there has been a turning point towards a diverging temporal trend across the regions.

This study demonstrates that ‘the world’, when conceived of in terms of the set of factors producing suicide rates, ‘is not flat’, and that the forces producing the spatial pattern of suicide rates are also not temporally constant. Attention has been given in the Introduction and Background section, and in the Discussion section, to matters of interpreting this result. A further clear conclusion of this study is that there is as yet more work to be done.
References


Notes

An early-ish example of the former is MARTIN (1997) and, of the latter, BOROOAH et al. (1991).

Durkheim identified four types of suicide. It can be said that Durkheim placed or ‘located’ the four types of suicide ‘within a grid of social regulation’ (CAMERON, 2005, p. 232). From this perspective, the central reason that any type arises, as Cameron states, is that the individual ‘is unable to integrate his or her needs adequately with those of society’ (p. 232).

To our knowledge, there are only two earlier studies internationally that apply the tools of geography to the phenomenon (MIDDLETON et al., 2008; SAUNDERSON and LANGFORD, 1996).

Australia’s Medicare has three components: provision of hospital services at zero prices to ‘public patients’ treated at ‘recognised public hospitals’; subsidies for in-hospital and out-of-hospital medical services and allied services, provided by private fee-for-service (FFS) medical practitioners and allied health service providers; and the Pharmaceutical Benefits Scheme.

CAMERON (2009) documents the word ‘emotional violence’ was used in a 1982 song, ‘Leave in Silence’ by Depeche Mode. Its earlier use is unknown to the present authors.

The Golden Rule, ‘Do unto others as you would have them do unto you,’ is known almost universally by several versions e.g. ‘Treat others as you would want to be treated yourself’, ‘And as ye would that men should do to you, do ye also to them likewise’ and so forth. Wikipedia provides a ‘potted account’ of it as a social more but this is not the forum for the spiritual problems of humanity. SPITZER (2009) explains its place in the mores also.

Hatred, malice and malevolence are synonyms. Various nuances in meanings are discussed (CAMERON, 2005).

This is a reference to CLARK’s (2007) scathing criticism (the penultimate statement is on p. 742) of GREIF’s (2006) attempt to show that ‘institutions are a fundamental driver of all economic history, and of all contemporary differences in economic performance’ (p. 727). Give that we seek to do so for the ‘smaller’ issue of suicide, we can but take comfort in the fact that we are in good company.

This message is implied in the high correlate of suicide, viz. unemployment, such as reported by LESTER and YANG (1997).

The reference here is to the roots in the Greek, viz. oikos meaning the household which was the unit concerned with social sustainability, i.e. the extended family members, the slaves, the house, the farmland and all property, and nomos which refers to principles of managing and management.

Contrasting The Golden Rule and The Silver Rule, SPITZER (2009) draws a stark comparison between ‘obligation to avoid harm’ and ‘the aspiration to optimise the good of one’s neighbour’ [SPITZER (2009), p. 89](Spitzer’s emphases). The former is The Silver Rule and is narrow i.e. internalising negative externalities only.

There are measurement difficulties. Existing data are less-than-ideal or not available at all, whilst the state of modern data collections on well-being is, according to SHERGOLD (2011), such that the phenomena that are the easiest to measure are preferred that which is the most important to measure. In the competitive research climate, the availability and suitability of data for some topics and not others affects the emphases in research. And some topics are always neglected.
A conceptual and empirical economic argument about this point is in WILLIAMS and DOESSEL (2007).