Submission to the National Schools Resourcing Board Review of the socio-economic status score methodology

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In reference to "similar schools" comparisons of NAPLAN scores for 2009 and 2010, Bonnor reported that "a large number of schools were named and shamed during 2010 [based on their 2009 area-based ICSEA]; their reputations were adversely affected or boosted by comparisons that we now know were inaccurate" (2011, 8 March). It can be assumed that much the same schools (in the private sector) have had their funding under the SES scheme adversely affected or boosted by measures that, I argue, we should now know have been, and still are, inaccurate.

1 Introduction

This submission to the review of the socio-economic status (SES) score methodology (Australian Government Department of Education and Training, 2018) is primarily concerned with a fundamental limitation of the current area-based methodology used to determine the capacity of a school community to contribute to the recurrent costs of the school in the SES scheme[1], ways of assessing that limitation, and a possible alternative methodology for calculating the capacity of a school community to contribute — specifically more direct measures. The fundamental limitation of the current SES scheme's measure is the assumption that the characteristics of individuals (including the individuals who collectively make up a school student population) can the inferred from the characteristics of local areas (the small geographic areas classified as SA1s or mesh blocks) in which students live. Such an inference involves an *ecological fallacy*.

[1] The SES scheme allocates a score to individual private (Catholic and independent) schools derived in the following way. An index has been developed for the scheme based on a weighted average from components of Australian Bureau of Statistics (ABS) Census classifications indicative of occupation, education, household income, and income of families with children. An index score is calculated for each ABS Statistical Areas 1 (SA1s — average population of around 400). Previously the index was calculated for each ABS Census Collection District (CD — average of about 225 dwellings). The home addresses of all students in a school are listed by SA1. The school's score is then the average of the index scores of SA1s in which students live, weighted by the number of students who live in each of the SA1s. Thus a school with students who primarily live in SA1s with high index scores will have a high SES scheme score and receive a relatively low level of Commonwealth funds per student, while a school with students who primarily live in SA1s with low index scores will have a low SES scheme score and receive a higher level of Commonwealth funds per student.

That the SES measure involves (or may involve) an ecological fallacy has been raised as an issue in a research paper prepared for this review (Centre for International Research on Education Systems, 2017). I have also made this argument in two earlier submissions. The first was in 2004 to a Senate inquiry into Commonwealth funding for schools (Preston, 2004, Section 5, pp. 14-21). In that submission I argued explicitly that the area-based SES scheme involved an ecological fallacy (p.19), drawing conceptually from sociological and epidemiology literature (specifically Freedman, 2001), with evidence from Australian Bureau of Statistics (ABS) Census of Population and Housing data on type of school attended by family income for Census Collection Districts (CDs) in the Statistical Local Area (SLA) of Penrith that were scored according to an ABS Socio-Economic Index for Areas (SEIFA) Index of Relative Socio-Economic Disadvantage (IRSED).

The second submission was to the Senate Inquiry into the Administration and Reporting of NAPLAN Testing (Preston, 2010), in which I argued that the Index of Community Socio-Educational Advantage used for 2009 NAPLAN data (ICSEA 1.0) had systematic bias associated with an ecological fallacy. In an attachment to that submission I referred to research papers published by the ABS (Adhikari, 2006; Baker & Adhikari, 2007), which cautioned against using area-based measures based on ABS Census data, such as SEIFAs, where an ecological fallacy may be involved. I draw on both submissions as well as additional material in this submission.

In the following section I go beyond the broad conceptual issue and consider the magnitude of the ecological fallacy and consequent bias in schemes very similar to the SES scheme (notably ICSEA 1.0). In Section 3 I briefly canvass an alternative to the SES scheme, and set out some advantages and disadvantages of both the SES scheme and the alternative. The final section raises the importance of the wider context of the programs of federal funding for schools.

2 Assessing the bias of the ecological fallacy in the SES scheme

An area-based measure (of socio-economic disadvantage/advantage, for example) as a proxy for a measure of the socio-economic disadvantage/advantage of individuals (or, through individuals, of collective organisations such as schools) can be more or less inaccurate, and thus more or less likely to involve an ecological fallacy. Any inaccuracy may be random, or may be systematic and thus biased in a particular direction. The magnitude of random inaccuracy and the magnitude and direction of systematic bias are important. These all need to be taken into account, along with other criteria, when deciding whether or not such a method should be used, replaced by an alternative, or adjusted in some way. Using an appropriate method is especially important when the outcomes are important – such as substantial levels of funding being allocated or not, decisions on education policies made, or schools' reputations unreasonably damaged or enhanced.

In this section assessment for individuals resulting from the ecological fallacy in area-based methods of socio-economic disadvantage/advantage is investigated by outlining a method used in the Australian Bureau of Statistics (ABS) and broadly replicating it for school students. This is followed by an assessment of the magnitude and bias for schools of the ecological fallacy in the Australian Curriculum and Assessment Authority's first Index of Community Socio-Educational Advantage (ICSEA 1.0), based on a comparison with the second version (ICSEA 2.0), which is not area-based. The bias of the SES scheme would parallel that of ICSEA 1.0. The inaccuracies and biases in area-based measures based on CDs or SA1s would also apply to such measures based on mesh blocks.

Programs such as the long-running Disadvantaged Schools Program and Country Areas Program have used area-based measures of disadvantage. However, such measures do not involve an ecological fallacy (beyond a trivial level) because the very large majority of students who live in the relevant areas (or schools located in the areas) are involved in the programs, and the substance of the programs were or are directed to alleviating specific forms of disadvantage.

2.1 Assessing the risk of substantial inaccuracy for individuals (and families) arising from area-based measures of SES

In a research report prepared for the ABS Methodology Advisory Committee, Baker and Adhikari (2007) investigated the relationships between ABS Socio-Economic Indexes for Areas (SEIFA) Index of Relative Socio-Economic Disadvantage (IRSD), and, first, an index for individuals incorporating similar components (SEFI), and second, an index for families incorporating similar components (SEFF) (2007). They concluded:

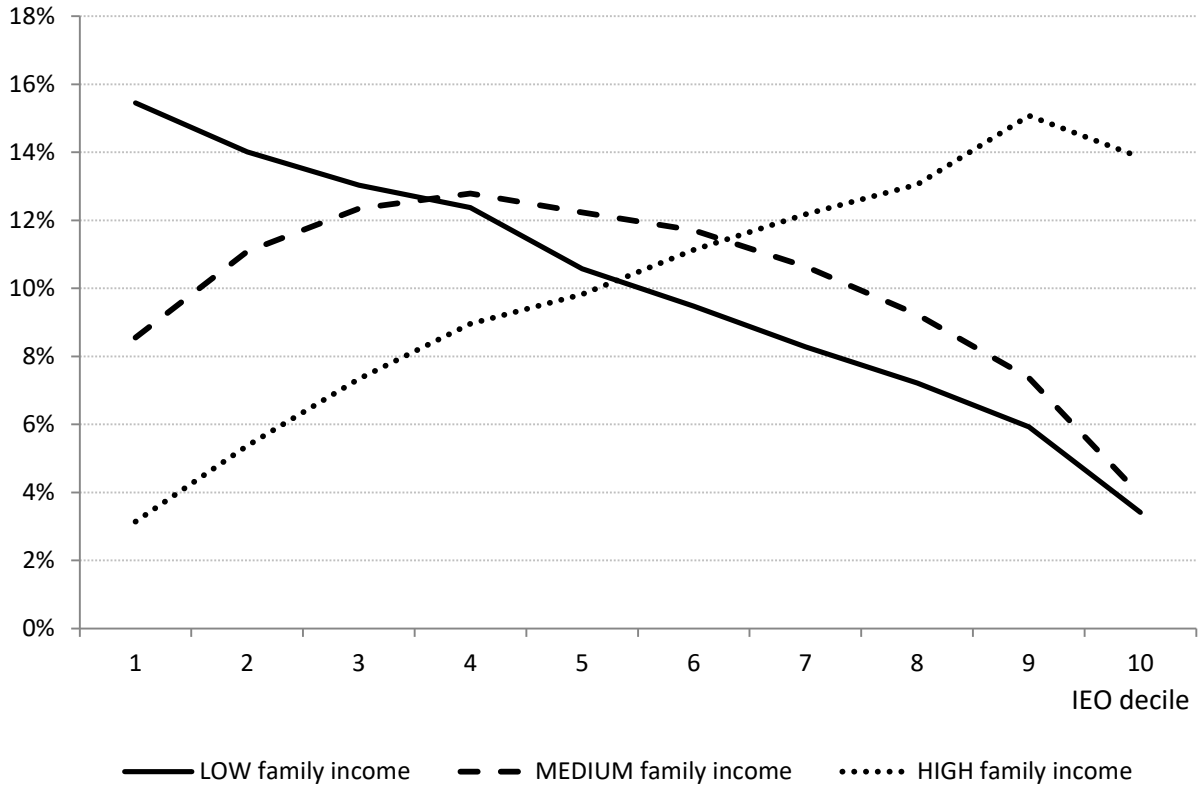
> This analysis shows that using an area level indicator of socio-economic disadvantage will not be a good proxy for the socio-economic status of many of the individuals and families living within that area. Because of this, analyses which use SEIFA indexes such as the IRSD as a proxy for family and individual socio-economic status will be at high risk of an ecological fallacy. (p. 24)

This ABS paper has been referred to in relation to this review (for example, Centre for International Research on Education Systems, 2017, p. 33). Here I apply Baker and Adhikari's method to 2006 Census data on all Australian secondary school students (attending public, Catholic and independent schools), using the SEIFA Index of Education and Occupation (IEO) and students' family incomes (Census classicisation of FINF) divided into approximate thirds (LOW, MEDIUM and HIGH)[2]. The relationships, graphed in Figure 1, almost completely

[2] The ABS customised data on which this analysis and the data in Figures 2 to 5 are based were originally obtained for an investigation into the ACARA area-based Index of Community Socio-Educational Advantage (ICSEA 1.0) in 2010, and thus the SEIFA IEO was selected. More recent data has not been obtained for this submission.

replicate Baker and Adhikari's findings, shown in their graphs 5.1 and 5.2 (pp. 23-24). In their two analyses and mine, around a third (usually more) of those in the lowest (of three) individual or family groups live in the top five SEIFA deciles, and a similar proportion of those in the highest individual or family groups live in the bottom five SEIFA deciles (p. 23 and Figure 1).

Figure 1. Percentage of Australian secondary students with LOW, MEDIUM and HIGH family incomes in each SEIFA IEO decile, 2006



Source: ABS Census 2006, customised dataset of all Australian Census Collection Districts (CDs) by SEIFA IEO scores and family incomes of secondary school students (approximate thirds: LOW, MEDIUM and HIGH).
Note that there are fewer secondary school students in deciles 10 (7%) and 1 (9%) than the other deciles, which each had 10% or 11% of secondary school students in each of the three income ranges.

It is thus reasonable to assume that Baker and Adhikari's conclusion quoted above would also apply to secondary school students. However, Baker and Adhikari's findings, and mine above, refer to drawing inferences about the characteristics of individuals or individual families from the characteristics of areas. The "high risk of an ecological fallacy" that is apparent in such cases also needs to be evaluated in reference to a methodology where the characteristics of areas are then linked to groups (student populations in individual schools) through the students who live in those areas. Such was the methodology of ACARA's ICSEA 1.0 — and is the methodology of the SES scheme. In addition, analyses need to deal with systematic bias, not only with apparently random inaccuracies. The following section takes up both the scoring of schools and the matter of systematic bias.

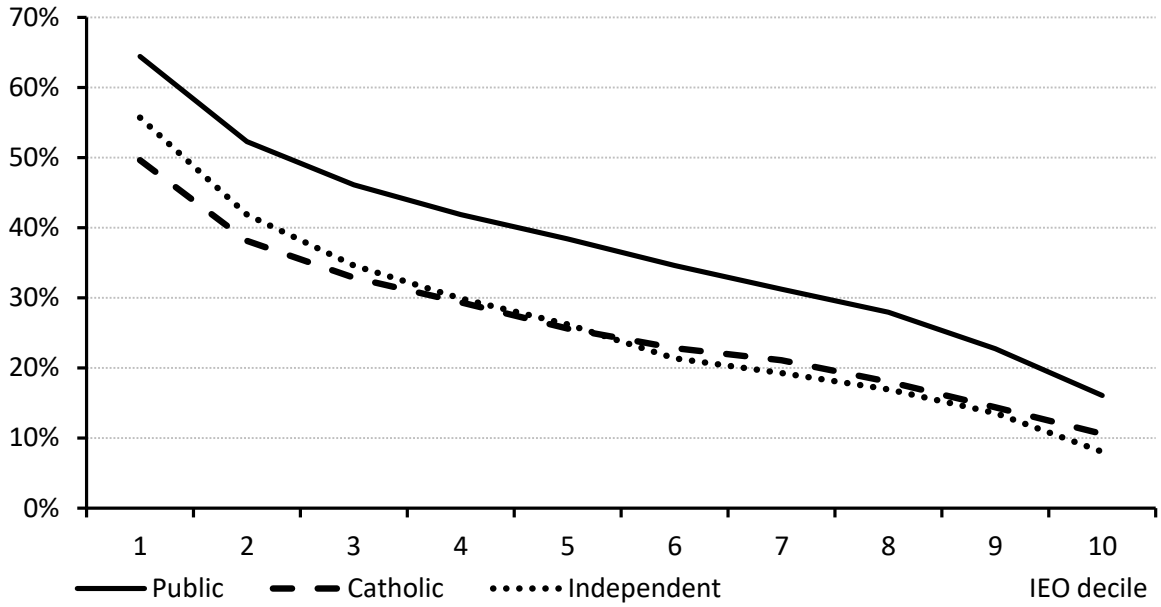
2.2 Assessing the magnitude of bias for schools arising from area-based measures of SES

The analysis in the previous section indicated that the probability of random errors in the SES scheme methodology may be relatively high — especially for small schools and for schools drawing students from lower SES SA1s, because only a small minority of students in them attend Catholic or independent schools (fewer than 20% of students in the lowest socio-economic decile attend private schools). On the other hand, a validation study of the SES scheme methodology before its implementation involving 76 private schools participating in the 1995 Longitudinal Study of Australian Youth (LSAY) found a correlation coefficient of 0.85 between the schools' SES scheme score and a score derived from relevant student family data collected for LSAY. This correlation coefficient was assumed to indicate a strong relationship, and thus to validate the SES scheme methodology (Centre for International Research on Education Systems, 2017, pp. 12-13). However, without an investigation of outliers, the conclusion of validity of the SES scheme methodology remains questionable. Thus an investigation into whether or not the SES scheme has systematic bias against particular schools is required.

The data illustrated in Figures 2 to 5 indicate that such a bias occurs for different broad types of schools (public, Catholic and independent), and differs between low and high deciles of disadvantage/advantage. It is clear from all four graphs that if public schools were included in the SES scheme, then the scheme would be biased against that sector as a whole (but probably biased in favour of some types of public schools such as selective schools — see below) at all SEIFA IEO (or similar) levels for CDs (or SA1s). The evidence for this is that at each decile of advantage/disadvantage, primary or secondary students attending public schools were substantially more likely to come from families with incomes in the bottom third of all students' family incomes (Figures 2 and 4), and less likely to some from families with incomes in the top third of all family incomes (Figures 3 and 5) than students attending Catholic or independent schools.

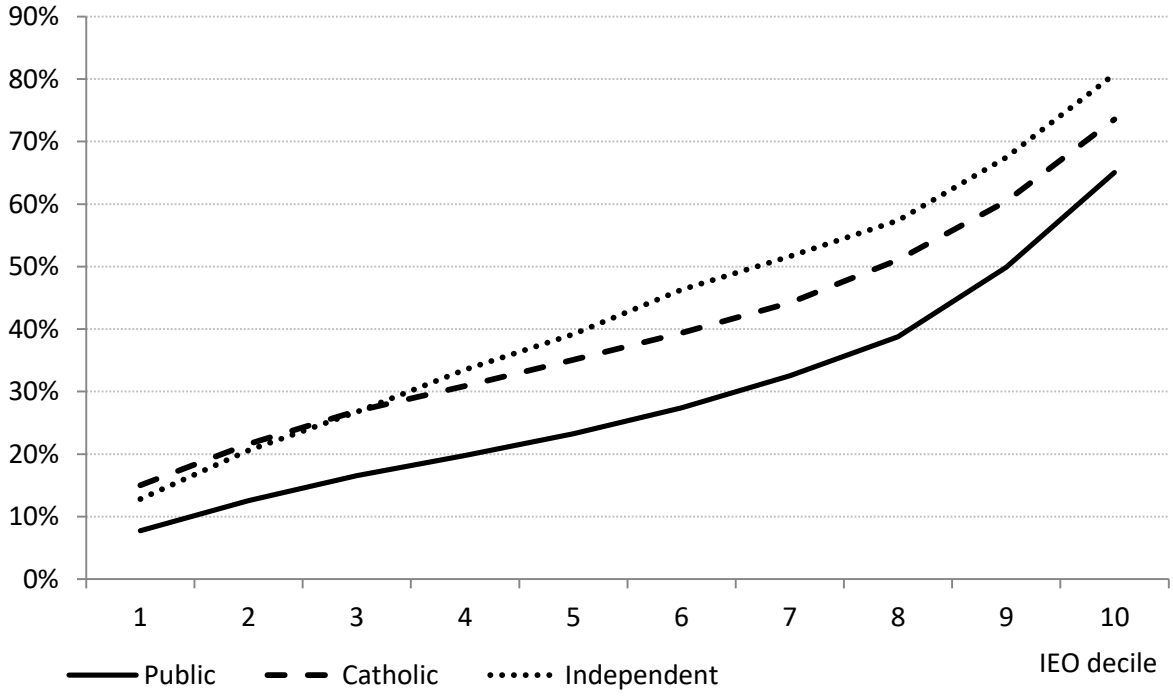
Bias is also apparent between broad private schools types: students attending independent schools and living in lower SES CDs were more likely to come from families with incomes in the bottom third of all students' family incomes, and less likely to some from families with incomes in the top third of all family incomes than students attending Catholic schools. In contrast, students attending independent schools and living in middle and high SES CDs were less likely to come from families with incomes in the bottom third of all students' family incomes, and more likely to some from families with incomes in the top third of all family incomes than students attending Catholic schools. These broad sectoral biases disguise much greater variations in bias within sectors and involving sub-types of schools (often difficult to define and categorise) and individual schools.

Figure 2. Percentage of all public, Catholic and independent primary school students living in each decile of SEIFA IEO disadvantage/advantage* who have LOW^ family incomes, Australia, 2006



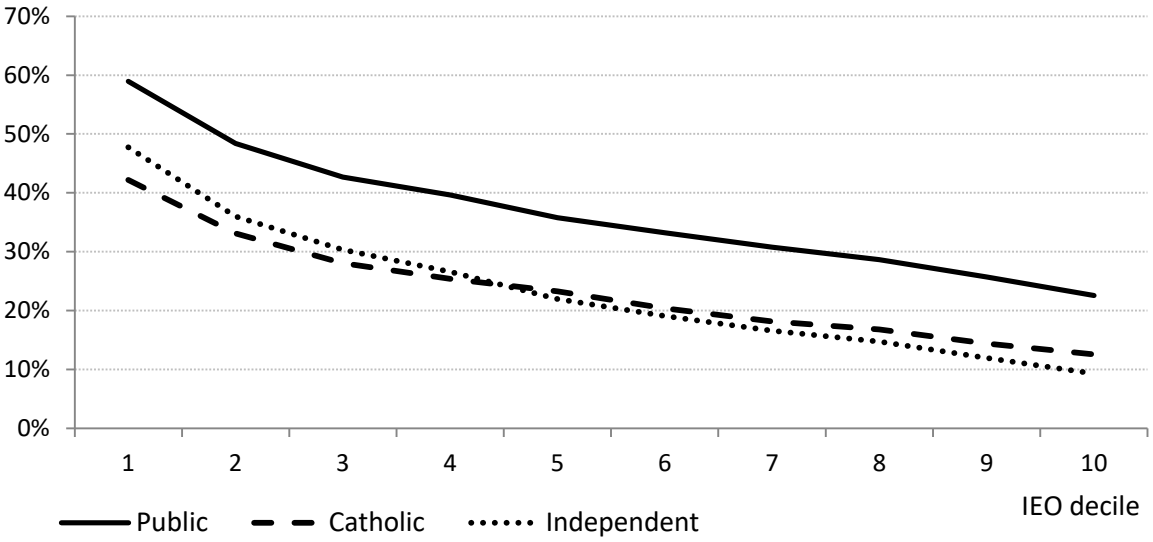
* ABS SEIFA Index of Education and Occupation, all Australian Census Collection Districts
^ LOW family incomes are those in the bottom third of all Australian school students' family incomes
Source: ABS Census 2006, customised dataset of all Australian Census Collection Districts (CDs) by SEIFA IEO scores, and type of school attended and family incomes of primary school students

Figure 3. Percentage of all public, Catholic and independent primary school students living in each decile of SEIFA IEO disadvantage/advantage* who have HIGH^ family incomes, Australia, 2006



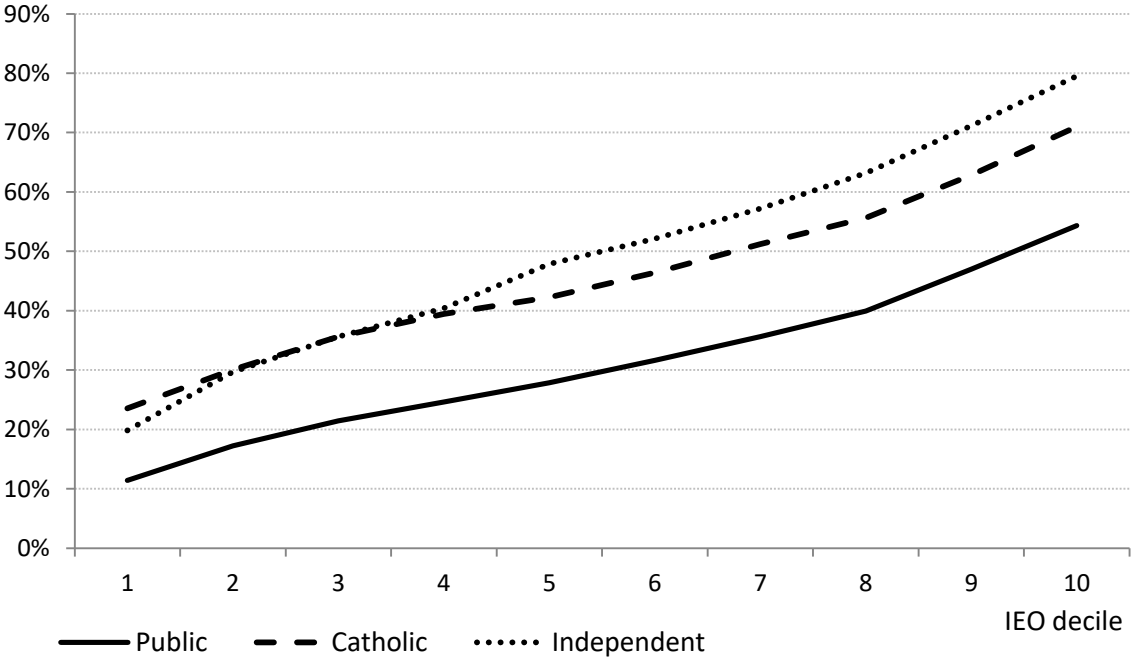
* ABS SEIFA Index of Education and Occupation, all Australian Census Collection Districts
^ HIGH family incomes are those in the top third of all Australian school students' family incomes
Source: ABS Census 2006, customised dataset of all Australian Census Collection Districts (CDs) by SEIFA IEO scores, and type of school attended and family incomes of primary school students

Figure 4. Percentage of all public, Catholic and independent secondary school students living in each decile of SEIFA IEO disadvantage/advantage* who have LOW^ family incomes, Australia, 2006



* ABS SEIFA Index of Education and Occupation, all Australian Census Collection Districts
^ LOW family incomes are those in the bottom third of all Australian school students' family incomes
Source: ABS Census 2006, customised dataset of all Australian Census Collection Districts (CDs) by SEIFA IEO scores, and type of school attended and family incomes of secondary school students

Figure 5. Percentage of all public, Catholic and independent secondary school students living in each decile of SEIFA IEO disadvantage/advantage* who have HIGH^ family incomes, Australia, 2006



* ABS SEIFA Index of Education and Occupation (IEO), all Australian Census Collection Districts
^ HIGH family incomes are those in the top third of all Australian school students' family incomes
Source: ABS Census 2006, customised dataset of all Australian Census Collection Districts (CDs) by SEIFA IEO scores, and type of school attended and family incomes of secondary school students

The SES scheme involves scores (and consequent per capita funding levels) for individual schools, and thus more is required than analyses of the bias of area-based measures of disadvantage/advantage involving broad types of schools. The bias involving individual schools is apparent in a comparison between schools' ICSEA scores on the My School website between 2009 (when the ICSEA 1.0 score was area-based) and 2010 (when the ICSEA 2.0 score was largely based on information from parents) (Australian Curriculum Assessment and Reporting Authority, 2018). I inspected the data for around a hundred schools of diverse types and found strong general patterns of change – note here that ICSEA has a median of 1000 and a standard deviation of 100.

For example, scores increased significantly (the majority by more than 50 points, some around 100 points or more) for high fee private schools (except for some whose students lived in especially high SES CDs in 2009, resulting in an ICSEA score of above 1200 that year), and many Catholic country primary schools, as well as public selective schools. Scores also increased substantially in other categories of Catholic and independent schools. Scores fell, some very substantially, in almost all public primary schools and comprehensive secondary schools. However, there was a range in most categories. For example, Islamic schools which drew students for very low SES CDs (ICSEA less than around 970 in 2009) tended to have the greatest gains, some over 60 points, while some other Islamic schools' ICSEA scores fell between 2009 and 2010. I can hypothesise regarding the significant reasons for some particularly large or small (positive or negative) changes in many schools. These reasons involve the nature of local populations (including Indigenous populations in country towns), and the policies and cultures of the particular school and those schools with which it competes. These matters are debatable and hard to quantify, but add to the reasons why area-based methods for determining a school's SES are inappropriate.

The practical impact of using area-based measures for determining the SES of schools is apparent from the "similar schools" NAPLAN results for 2009 compared with 2010. Those schools that were advantaged on the "similar schools" comparison by the ICSEA 1.0 area-based measure (their ICSEA score increased substantially between 2009 and 2010) had much higher NAPLAN scores relative to "similar schools" in 2009 than in 2010, while those who were disadvantaged by the area-based measure had much lower scores relative to "similar schools" in 2009 than in 2010 (Australian Curriculum Assessment and Reporting Authority, 2018; Bonnor, 2011, 8 March). For example, two private schools can be contrasted. They had similar ICSEA scores in 2009 (just over 1100). The ICSEA score of the first fell by 25 points between 2009 and 2010, and year seven reading score ranks relative to "similar schools" increased from equal 18th out of 43 in 2009 to equal 5th out of 58 in 2010. The ICSEA score of the second school increased by 80 points between 2009 and 2010, and year seven reading scores ranks relative to "similar schools" decreased from equal 10th out of 43 in 2009 to equal 30th out of 35 in 2010 (Australian Curriculum Assessment and

Reporting Authority, 2018). In reference to such "similar schools" comparisons of NAPLAN scores for 2009 and 2010, Bonnor reported that "a large number of schools were named and shamed during 2010 [based on their 2009 NAPLAN scores and area-based ICSEA scores]; their reputations were adversely affected or boosted by comparisons that we now know were inaccurate" (2011, 8 March). It can be assumed that much the same schools (if in the private sector) have had their funding under the SES scheme adversely affected or boosted by measures that, I argue, we should now know have been, and still are, inaccurate and biased.

3 Suggestions for assessing the validity of the SES scheme and for developing alternatives

There are a number of initial and straightforward (though largely indirect), ways of assessing the validity of the SES scheme beyond the indications covered in previous section. The first follows from the previous section, and involves analysis of, first, the direction and magnitude of the differences between ICSEA 1.0 and 2.0 for *all* schools, second, the characteristics of the schools of varying magnitude of positive and negative change, and, third, the relationships between private income per capita and the direction and magnitude of change between ICSEA 1.0 and 2.0. The second assessment of the validity of the SES scheme is similar, but more contemporary, and involves a correlation between the current SES scheme score and ICSEA scores, again with an investigation into any relationships between schools' private income per capita and that correlation.

I suggest that an alternative to the SES scheme's current methodology would be an index based on a combination of schools' ICSEA scores (or similar) and private income per capita. The combination of these two measures parallels the components of the current SES scheme index components. The inclusion of the ICSEA score (or similar) lessens the incentive of schools to "reduce private effort", though the degree to which this was ever a significant matter is doubtful, except at the margins (to stay within given bands). In contrast to the earlier methods of funding based on school resources, this method need not allocate schools to a limited number of bands, but would fund in proportion to the index score, and thus not provide a clear incentive for schools to fix fees below a set level.

Some advantages and disadvantages of both the current SES scheme methodology and an alternative are set out in Table 1. The most important apparent disadvantages of the current SES scheme methodology, in addition to inaccuracy and bias, are the incentive to target higher SES students, and the disincentive to target lower SES students in any given SA1.

Table 1 Some advantages and disadvantages of the existing SES scheme methodology and an alternative direct measure

Current area-based SES methodology		Alternative combination of ICSEA and private income per capital	
Advantages	**Disadvantages**	**Advantages**	**Disadvantages**
Existing methodology	Inaccurate and biased (see above)	Relatively accurate and unbiased (valid)	May require higher levels of auditing (and sanctions for falsification of data) than required for the My School website's purposes.
	Incentive to increase fees, market, and provide scholarships to draw higher SES and higher ability students from lower SES SA1s	Use of existing data collections (efficient)	
	Disincentive for schools to target lower SES students (in given SA1s) and be consistent with values of social justice	Supports schools that target lower SES students.	
	Possible incentive to falsify (or fudge) home addresses.		

My final strong recommendation: If a different method is to be implemented, then no individual school (or group of schools) should stay on a higher level of funding than the method indicates beyond a reasonable transition period during which funding levels are progressively reduced.

4 Importance of the wider context

This inquiry is concerned with the allocation of Commonwealth general recurrent funding within the private sector. However, it remains important to consider the wider context[3] and heed the words of the Interim Committee of the Schools Commission (Karmel Committee) in their 1973 report, *Schools in Australia*:

> There is a point beyond which it is not possible to consider policies relating to the private sector without taking into account their possible effects on the public sector whose strength and representativeness should not be diluted . . . As public aid for non-government schools rises, the possibility and even the inevitability of a changed relationship between government and nongovernment schooling presents itself. (para. 2.13)

[3] This section is based on a recent report of mine, Preston (2018), pp. 15-20.

Even though the Committee so cautioned, it did not recommend any relevant conditions, responsibilities or accountabilities on the private sector - unlike, for example, the integration policy implemented in New Zealand several years later. Largely as a consequence of Commonwealth funding of private schools, the public sector rapidly lost enrolment share after its peak of 79% in 1976 (when 17% attended Catholic schools and only 4% attended independent schools) (Australian Bureau of Statistics, 2017). By the mid 1980s the public sector's share had fallen to 74% (while the Catholic sector share increased to 19% and the independent sector share to 7%), and the Commonwealth Schools Commission reiterated the concerns of the Interim Committee:

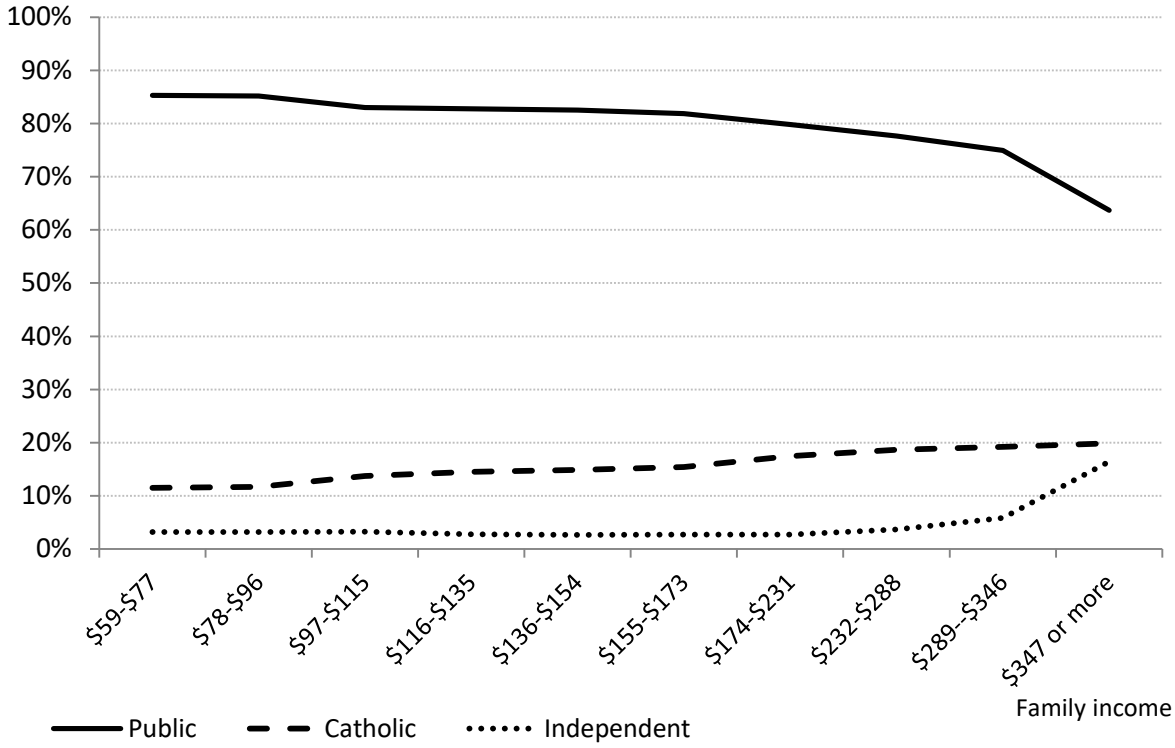
> A continuing significant decline in the government school sector's share of overall enrolment is likely to change substantially the social composition of the student population in government schools, with potentially significant negative consequences for the general comprehensiveness of public school systems. The cumulative effect of these financial, educational and social consequences could, in the long term, threaten the role and standing of the public school as a central institution in Australian society. Such a development would be unwelcome to most citizens and is inconsistent with the stated policies of governments, as well as the major school interest groups, government and nongovernment. (1985, para. 20)

Over the four decades from 1976 to 2016 the continuation of these developments has led to the change in enrolment share to 65% in the public sector, 20% in the Catholic sector and 14% in the independent sector. It also led to changes in social mix in the sectors. The combination of these changes between 1976 and 2016 are illustrated in Figures 6 and 7. Nationally the public sector has experienced the combined impact of the large increase in enrolment share of the already very elite independent sector, and the increasing eliteness of the larger Catholic sector. This has tended to leave local comprehensive public schools (primary and secondary) increasingly residualised to a greater or lesser extent. (The expansion and increased SES level of public selective schools have exacerbated the residualisation of many comprehensive public schools – and some comprehensive private schools.)

Policy and funding interventions by governments can initiate, exacerbate, restrain, ameliorate or even turn around dynamics of residualisation. The future is not predetermined – there was some restraint on the residualisation of the public sector as a consequence of initiatives of the Hawke Government in the late 1980s until the late 1990s, as well as more recent changes. And within sectors there will always be diversity.

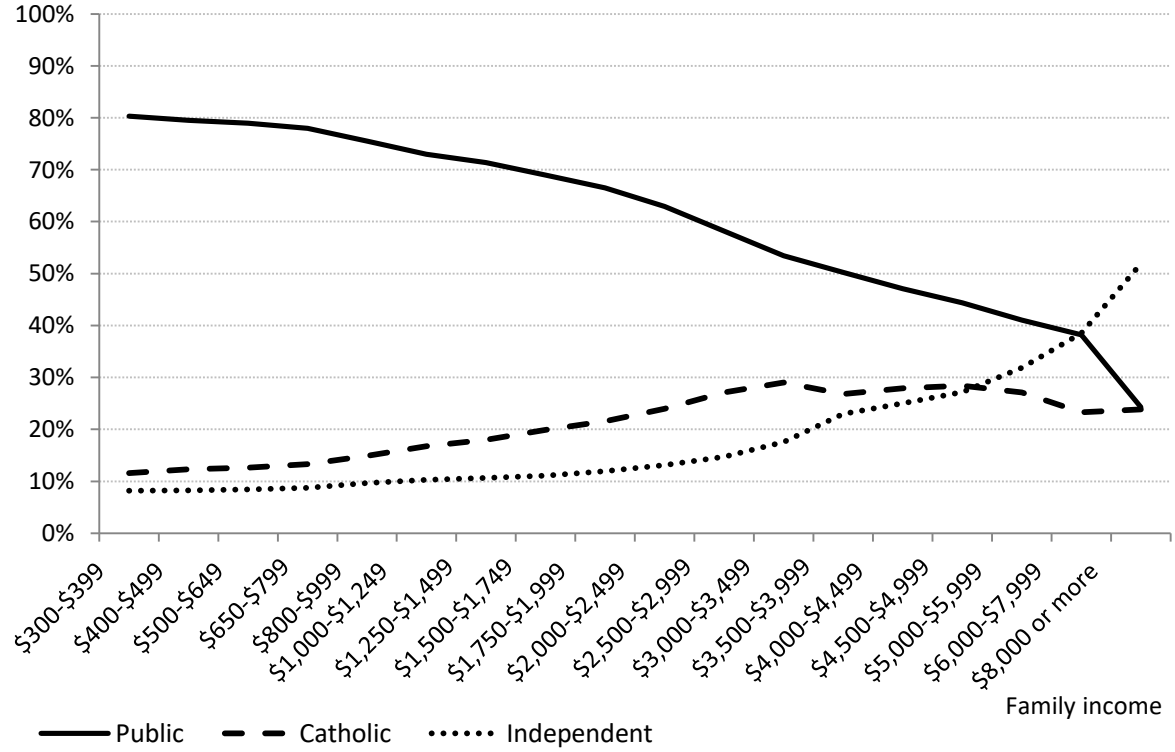
In conclusion, I hope and trust that this review will result in outcomes that are fairer for the schools involved, and, importantly, do not detrimentally affect the quality and fairness of schooling as a whole in Australia.

Figure 6. Percentage of all students in each weekly family income range who attended public, Catholic and independent schools, Australia 1976



Source: ABS Census 1976, customised dataset

Figure 7. Percentage of all students in each weekly family income range who attended public, Catholic and independent schools, Australia 2016



Source: ABS Census 2016, accessed via online tool TableBuilder

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