

The potential for including household wealth in a measure of capacity to contribute

Report

Prepared for the National School Resourcing Board

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About CIRES

The Centre for International Research on Education Systems, located at Victoria University, conducts strategic research that identifies how well education systems work, for whom, and how they can be improved to work well for all. The Centre undertakes large-scale survey and policy-related projects covering every state and territory in Australia and every sector of education and training. It also undertakes international comparative research examining the features and performance of education systems around the world.

Executive Summary

The Centre for International Research on Education Systems at Victoria University has been commissioned by the National School Resourcing Board (the Board) to prepare a report examining whether assessment of the capacity of non-government school communities to contribute to the operational costs of their school should incorporate household wealth.

The Board was tasked by Senator the Hon Simon Birmingham to review the socio-economic status (SES) score methodology. This method is used to determine the Commonwealth's per-student base recurrent funding contribution for individual non-government schools.

The current approach to estimating capacity to contribute (CTC) comprises estimating an SES score focussed on families of children attending non-government schools. This approach has previously been criticised for not providing an accurate measure of school community CTC. This is a consequence of the current SES score estimation using area-level data and not considering household wealth. Rather the current estimation method uses data on the income, education levels and occupations of all families within the areas where school families reside.¹

The conceptual argument for using a measure of household wealth when assessing CTC is that if two households are identical on the basis of education, occupation and income, the household with the higher wealth has the higher CTC.

In this context, this report examines two questions. Does the omission of household wealth from a CTC measure, lead to its mismeasurement? Additionally, does currently available data enable the development of an accurate CTC measure that incorporates household wealth?

The definition of household wealth applied in this report comprises net assets (i.e. assets minus liabilities), inclusive of financial and housing assets and liabilities. Superannuation balances are excluded.

A key consideration of including wealth in a CTC measure is data availability. Dollar wealth measures are typically not collected in surveys, or the Census. However proxy measures of wealth are. These proxy measures including house size (i.e. number of bedrooms), housing type, tenure type, number of cars, and the possession of certain household items.

The Australian Bureau of Statistics (ABS) Survey of Income and Housing, 2015-16 (SIH), contains both dollar and proxy wealth measures. As such, it is possible with this one data set to answer the above questions. The SIH uses respondent provided data to estimate household wealth. This survey includes a number of proxy wealth measures are also collected in the

¹ These, and other concerns, are examined in further detail within Centre for International Research on Education Systems, Victoria University (2017).

Census. Furthermore, the SIH contains data on highest educational attainment, occupation and household income.

Three household-level CTC scores have been constructed using the SIH. This construction is limited to the 1,349 households in the SIH where at least one child is attending a non-government school:

- CTC score excluding wealth. This score uses household level data aligning with the current SES score method, comprising the highest household education level, highest occupation (skill level) and equivalised total household income.
- CTC score including reported wealth. This uses the same data as the first CTC score, alongside self-reported wealth (excluding superannuation).
- CTC score including proxy wealth. This uses the same data as the first CTC score, alongside proxy measures that are also in the Census (number of bedrooms, housing type and tenure).

The resulting CTC scores are compared using the ranking of households. The CTC score including self-reported wealth leads to a significant upward average change in the ranking of independent school households, compared to a CTC score excluding wealth. There is a small but insignificant downward average change in the ranking of Catholic households.

The inclusion of a wealth measure based on proxy measures in the CTC score results in insignificant change in household rankings. There is much more change in rankings when comparing a CTC score including reported wealth, to one including proxy wealth. This finding indicates that a proxy measure of wealth is unable to accurately represent dollar wealth with the utilised data. This is likely due in part to proxy wealth measures being unable to capture context. For instance, a four bedroom house in an inner metropolitan location is likely to have a higher value than a similarly sized house in an outer metropolitan or provincial location.

Overall, the inclusion of reported wealth does make a significant contribution to the estimation of a CTC score. The limitation of proxy wealth measures however, used in this analysis, means there is currently not a strong case for the inclusion of wealth, based on proxies, in a CTC score.

In future analysis it would be appropriate to examine whether the larger Census dataset identifies greater differentiation than was found using the SIH with wealth proxies. This may be particularly evident after estimating school-level CTC scores. This data could be combined with important contextual data (e.g. property values), to improve accuracy.

The findings in this report provide some guidance on implications for school funding to individual schools. If reported wealth could be used to generate school CTC scores, the findings suggest Catholic school families would experience a very small reduction in their relative CTC position. Conversely, independent school families would experience a small increase. The distribution of these changes could however vary greatly with and between schools.

Table of Contents

Executive Summary	i
List of Figures	iv
List of Tables	iv
1. Introduction	1
2. Context	2
3. Analytical approach	6
4. Estimating CTC scores with reported and proxy wealth	9
5. Key findings and implications.....	25
References	26

List of Figures

Figure 2-1: Household income and wealth in Australia, 2015-16	3
Figure 3-1: Elements of household wealth	6
Figure 4-1: Distribution of net wealth	10
Figure 4-2: Distribution of proxy wealth score	13
Figure 4-3: Change in household CTC rank based on wealth inclusion	22
Figure 4-4: Change in household CTC rank with inclusion of reported wealth-school sectors.....	22
Figure 4-5: CTC score-rank excluding wealth and rank change including reported wealth	23

List of Tables

Table 2-1: Potential options for including wealth with a CTC measure	5
Table 3-1: Wealth data available in the Survey of Income and Housing and Census	7
Table 4-1: Net wealth in the Survey of Income and Housing, 2015-16.....	9
Table 4-2: Data used to generate proxy wealth score.....	10
Table 4-3: Proxy wealth variables – first eigenvector and eigenvalue	11
Table 4-4: Correlation matrix: proxy wealth measure elements.....	12
Table 4-5: Correlation matrix: proxy wealth measure elements and proxy wealth score.....	14
Table 4-6: Education level and equivalised weekly household income	15
Table 4-7: Occupational skill level	16
Table 4-8: Correlation matrix-elements of CTC score without wealth.....	16
Table 4-9: Correlation matrix-elements of CTC score with reported wealth	17
Table 4-10: Correlation matrix-elements of CTC score including proxy wealth score	17
Table 4-11: CTC scores-eigenvectors and eigenvalues.....	18
Table 4-12: Correlation matrix: components of CTC score without wealth, and resulting CTC score.....	19
Table 4-13: Correlation matrix: components of CTC score with reported wealth, and resulting CTC score.....	19
Table 4-14: Correlation matrix: components of CTC score with proxy wealth, and resulting CTC score.....	20
Table 4-15: Change in household CTC rank with inclusion of wealth-school sectors	21

1. Introduction

The Centre for International Research on Education Systems at Victoria University has been commissioned by the National School Resourcing Board (the Board), to prepare a report examining whether assessment of the capacity of non-government school communities to contribute to the operational costs of their school should incorporate household wealth.²

The Board was tasked by Senator the Hon Simon Birmingham to review the socio-economic status score methodology which is used to determine the Commonwealth's per-student base recurrent funding contribution for individual non-government schools.

The definition of wealth applied in this report comprises net assets (i.e assets minus liabilities). This is a consequence of the current SES score estimation using area-level data and not considering household wealth. Rather the current estimation method uses data on the income, education levels and occupations of all families within the areas where school families reside.

In this context, this report examines two questions. Does the omission of household wealth from a CTC measure lead to its mismeasurement? Additionally, does currently available data enable the development of an accurate CTC measure that incorporates household wealth?

These questions are answered through extensive use of the ABS Survey of Income and Housing, 2015-16 (SIH). The SIH contains both dollar and proxy measures of wealth. Proxy measures of wealth (e.g. number of bedrooms) are important as the Census only contains proxy information. If household wealth is to be inferred from the Census, it must be done using proxy measures.

Structure of this report

The remainder of this report is structured as follows:

- Section 2 provides details of the context for this paper, including criticism of the SES score and its omission of household wealth
- Section 3 outlines the analytical approach applied in this report.
- Section 4 details the SES scores estimated, using different approaches to wealth
- Section 5 identifies the key findings and implications of the analysis.

² The author is grateful for research assistance from Andres Molina, and feedback from members of the NSRB expert panel and the Department of Education and Training staff. All views and errors are those of the author.

2. Context

This section details the context for examining household wealth as a potential factor in measuring CTC. There are two elements to this context. Firstly, previous criticism of the omission of wealth from the current SES score approach to measuring CTC. Secondly, consideration of the growing international literature on the measurement of household resources, and the impetus for measuring household wealth.³

Criticism of the SES score for measuring capacity to contribute

The current SES score estimation approach considers education, occupation and income. Household wealth is not considered as an element of the CTC.

As discussed by the Catholic Education Commission of Victoria (CECV, 2017) this approach contrasts to the means testing undertaken by the Australian Government for various income support payments, which considers both income and assets. The same stakeholder has suggested that the omission of wealth leads to the understatement of the SES of higher income families.

Analysis by CECV (2017) of ABS data identifies that higher income households represent a lower share of total income than they do of total wealth. As such, higher income households with 47.8 per cent of total income have 62.5 per cent of total wealth.⁴ The same analysis identified that household wealth accumulates with age at a faster rate than income (see Figure 2-1).

The analysis findings lead the CECV (2017) to assert that:

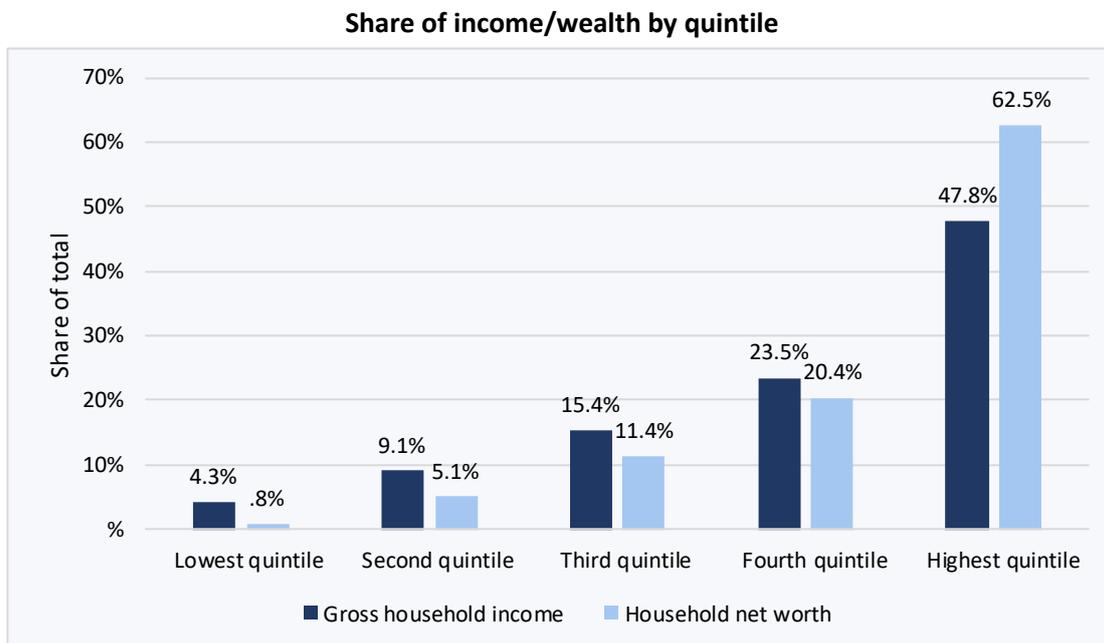
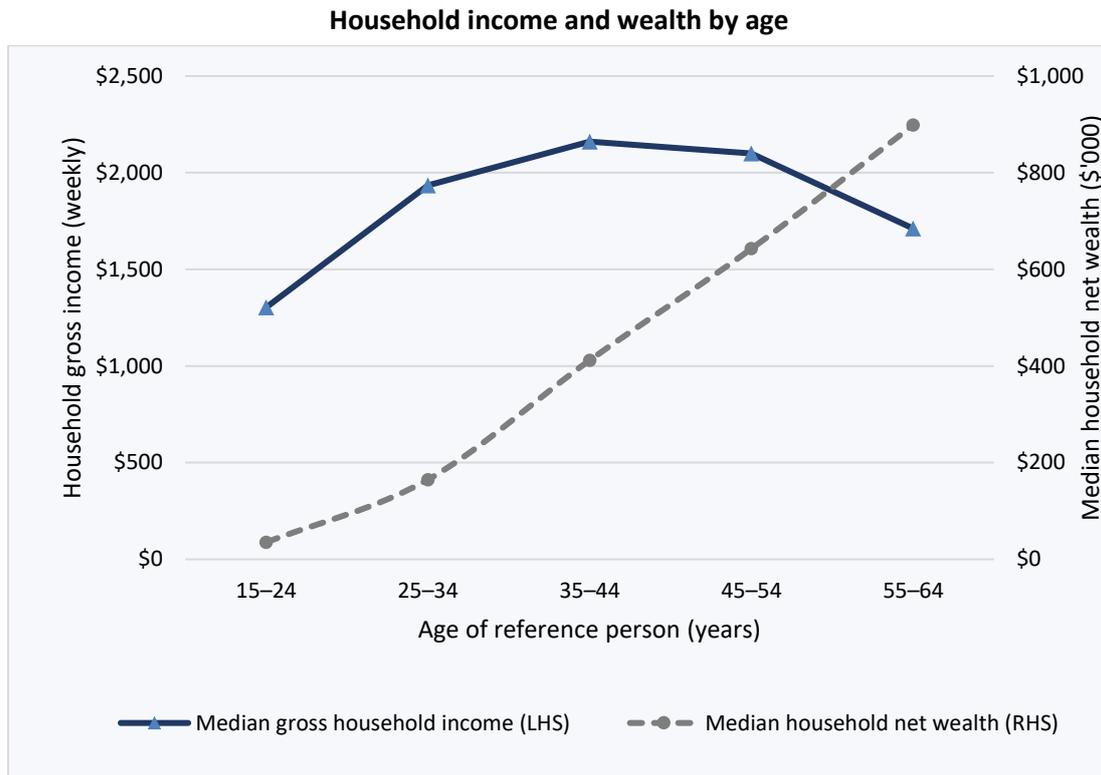
"If household wealth were included in capacity to contribute calculations then high-income households would be expected to contribute more than they currently are (relative to other households)" (Catholic Education Commission of Victoria, 2017, p. 17)

This assertion implies there is a low correlation between household income and wealth, and that the exclusion of household wealth from an SES measure leads to the mismeasurement of CTC.

³ These, and other concerns, are examined in further detail within Centre for International Research on Education Systems, Victoria University (2017).

⁴ The analysis reported in CECV (2017) used 2013-14 data. This is updated in Figure 2-1 with 2015-16 data.

Figure 2-1: Household income and wealth in Australia, 2015-16



Source: ABS (2017a).

Basis for including household wealth in a CTC measure

A CTC measure is intended to assess the resources available to school communities (e.g. families) to pay non-government school fees. Thus, the concept of CTC is akin to the broader concept of the economic resources available to school communities.

The current SES score approach to CTC is underpinned by elements of human capital:

- Human capital ‘stock’. This comprises educational level and occupation, which represent the resources that can be harnessed to generate funds to pay school fees
- Financial return on human capital ‘stock’. This comprises the income derived from human capital stock.

Recent work by the Organisation for Economic Co-operation and Development (OECD) has explored extending the measurement of household economic well-being from income and consumption, to include wealth. The inclusion of wealth within the measurement of economic well-being is underpinned by an acknowledgement that:

“...for given levels of consumption and income, and everything else being equal, people with greater wealth can be regarded as having a higher level of economic well-being than people with lesser wealth. They have greater opportunities to increase consumption now, if desired, and to use their wealth to generate income and/or finance consumption in the future.” (Organisation for Economic Co-operation and Development, 2013, p. 14)

Extending this argument to the current context, it is feasible for two households to have the same CTC, despite one having a lower income and higher wealth than the other. Wealth is as relevant to the assessment of CTC as the existing components of education level, occupation and income.

The importance of measuring wealth in an assessment of economic well-being is highlighted by the inclusion by the ABS of proxy wealth measures collected in the Census, in two of the ABS Socio-Economic Indexes for Areas (SEIFA)—Index of Economic Resources and Index of Relative Socio-Economic Advantage and Disadvantage. These comprise the per cent of:

- Occupied private dwellings paying rent less than \$215 per week
- Owner occupied private dwellings (with a mortgage)⁵
- Owner occupied private dwellings paying mortgage greater than \$2,800 per month
- Occupied private dwellings with four or more bedrooms.

Within SEIFA these variables are intended to measure the extent that individuals have an adequate and appropriate place to live (ABS, 2018).

As discussed by Duncan, et al (2002), research on the measurement of SES in other contexts, such as public health, has also sought to include wealth.

Options for measuring wealth as part of a CTC measure

Based upon the issues noted above, several options are identified for further consideration in section 3 of this report (see Table 2-1). These options use data within the SIH to examine

⁵ Only in Index of Economic Resources.

the impact of including either reported wealth or a measure of proxy wealth within a CTC score.

Table 2-1: Potential options for including wealth with a CTC measure

Financial element	Detailed proposal	Source
Including reported wealth in the estimation of a CTC measure, alongside other factors.	“A ‘fit for purpose’ measure of capacity to contribute would take into account all of the financial means available to student families to contribute to school costs. This would include both income and wealth.”	CECV (2017), p. 16
	“I do believe it would be reasonable to incorporate some component of asset base.”	Farish (2017), p. 8
Including a proxy wealth score within the estimate of an SES score.	Using measures of proxy wealth, to construct a proxy wealth score.	

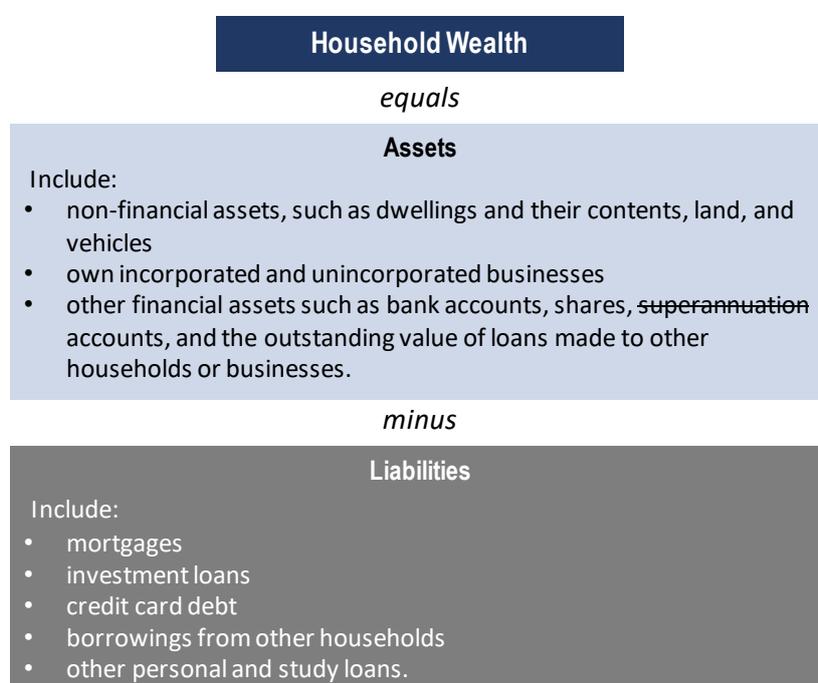
3. Analytical approach

This section details the analytical approach applied in the remainder of the report, alongside the features of the SIH data, and the specific options examined in the remainder of the report for incorporating wealth into a CTC measure.

Defining household wealth

The definition of household wealth applied in this report comprises net assets (i.e. assets minus liabilities), inclusive of financial and housing assets and liabilities (see Figure 3-1).

Figure 3-1: Elements of household wealth



Source: ABS (2017b).

Superannuation assets derived from compulsory employer contributions are excluded from the analysis. These assets cannot be easily accessed until retirement age, with most parents and carers of children attending non-government schools well below this age.

The inclusion of dwellings (i.e. the family home) within the scope of household wealth has been subjected to much consideration. At the outset, the intent has been to capture the full range of wealth. The exclusion of the family home and associated liabilities (i.e. mortgage), would disadvantage renters that have consciously decided to not purchase a house but instead accrue financial assets (e.g. shares and investments).

It is acknowledged that short of actions such as mortgage refinancing, it is not possible for families to readily access their housing wealth to pay school fees. However, housing decisions, alongside the decision to send a child to a non-government school, are typically made several

years in advance. These decisions would generally consider future financial commitments, including expectations of school fee requirements. For this, and the issues identified above, the following analysis includes housing wealth as part of household wealth.

Data considerations

All analyses in section 4 makes use of the 2015-16 SIH microdata (ABS, 2017c).⁶ This dataset comprises data on both measured wealth, alongside proxy wealth measures (see Table 3-1). The ABS Census also contains the proxy wealth measures within the SIH, as well as data on the number of cars operated by a household.

Table 3-1: Wealth data available in the Survey of Income and Housing and Census

Variable	Elements	Survey of Income and Housing	ABS Census
Measured wealth			
Net wealth	Financial assets (exclude superannuation) Housing assets Borrowings	✓	✗
Proxy wealth measures			
Number of bedrooms	None through to 6 or more	✓	✓
Housing tenure type	Owner without a mortgage Owner with mortgage Renter Other	✓	✓
Dwelling structure	Separate house Semi-detached, row or terrace house, townhouse Flat/unit or apartment Caravan, houseboat etc	✓	✓
Number of cars	Number of cars	✓	✗

Source: ABS (2016, 2017c).

The SIH also contains data on highest educational attainment, occupation and household income. The highest educational attainment within a household is used, with seven levels specified.

In order that occupation can be used as a categorical variable, the skill levels 1 to 5 attached to occupations are used (ABS, 2005).⁷ Finally, equivalised total household income is used,

⁶ The Basic Confidentialised Unit Record File (CURF) is used.

⁷ Skill levels are described in Appendix 2 of (Australian Bureau of Statistics, 2005). For analysis purposes, skill levels have been reversed in the analysis, such that skill level 1 has been recoded to 5, and skill level 2 to 4, and

which adjusts household income to reflect household composition.⁸ Net wealth and equivalised total household income are used as continuous variables.

Analysis method

In section 4 three different CTC scores are estimated and compared:

- CTC score excluding wealth
- CTC score including reported wealth
- CTC score including proxy wealth.

The estimation of each of these scores uses Principal Component Analysis (PCA) (Dunteman, 1989). This is the statistical technique currently used to estimate the SES score (Farish, 2013).

The key difference from the current SES score estimation in the following analysis is the use of household level data, in place of Statistical Areas Level 1 (SA1) level data. As analysis is at the household level, a combination of binary, categorical and continuous variables are used, differing to the area-level proportions used in the current SES score estimation.

The use of binary and categorical variables means that a 'standard' PCA cannot be applied. Rather, specialised PCA techniques suitable for the binary and categorical structure of the SIH data are used (Kolenikov & Angeles, 2009).⁹

Household weights provided by the ABS are used for all analysis. The sample comprises 1,349 households with children attending either Catholic or Independent schools, representing 786,000 households.

so on. When there is no-one currently employed in a household, a 0 value has been assigned. This means these households are retained in the analysis with 6 levels applied.

⁸ The ABS applies the OECD-modified equivalence scale. This assigns a value of 1 to the household head, 0.5 to each additional person 15 years or older and 0.3 to each child under 15 years (ABS, 2017b).

⁹ The analysis uses Stata 15.1, with the polychoric and polychoricpca Stata ado programs. These programs first standardise/centre data, generate correlation matrices, and then undertake PCA by calculating the eigenvalues, eigenvectors, and associated component scores. In some instances, the correlation matrices were required to be adjusted manually, the eigenvalues and eigenvectors generated using the Stata matrix symeigen function, and component scores manually calculated.

4. Estimating CTC scores including wealth

This section details the estimation of three CTC scores. The first comprises a score using data on the highest education, highest occupation (i.e. skill level) and equivalised total household income. This score is used as a comparator for the scores estimated using wealth information.

The second CTC score uses the same variables as the first, with the addition of net wealth. The third score incorporates a proxy measure of wealth.

The analysis first examines reported wealth, before moving to estimates of proxy wealth scores, followed by developing the CTC scores.

Analysing net wealth

Reported net wealth

The SIH reports net wealth for individual households as a dollar value. This value is estimated by the ABS after collecting an extensive range of data on household assets and liabilities. Among households with children attending non-government schools, there is a median value of \$611,000 and average of \$1.1 million. There are clear differences by school sector attended (see Table 4-1).

Table 4-1: Net wealth in the Survey of Income and Housing, 2015-16

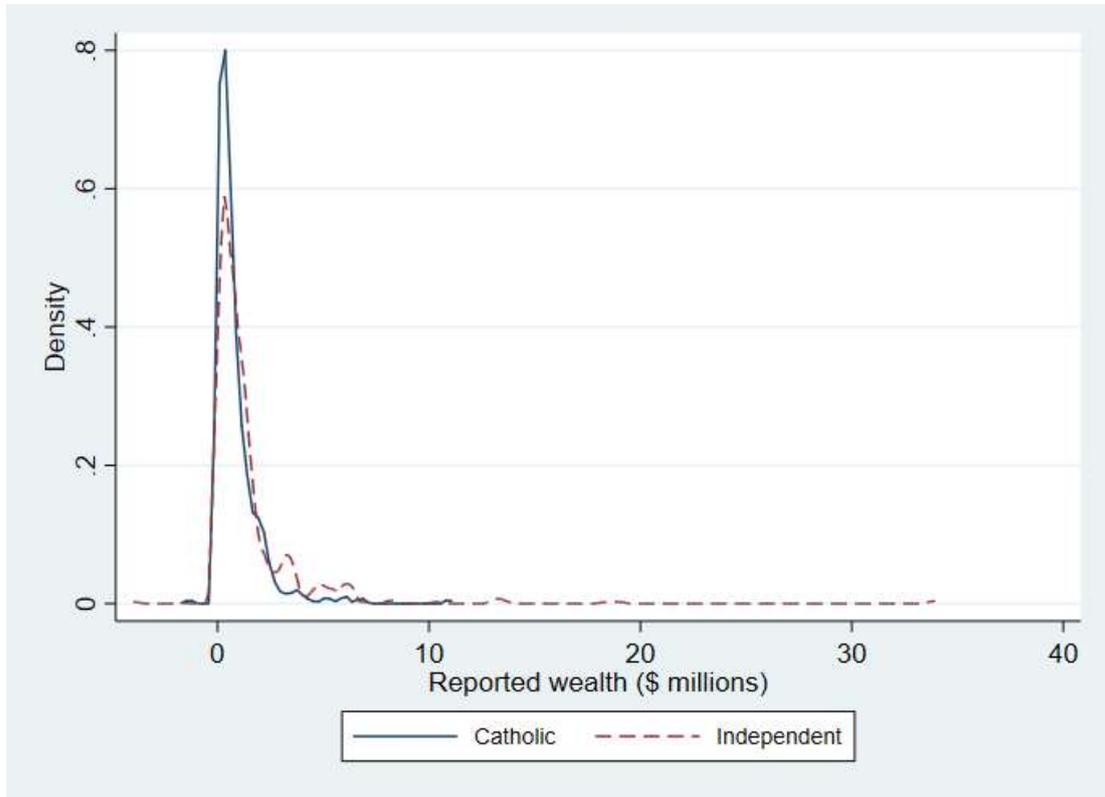
School sector	Median	Average	Standard Error
Catholic	\$531,397	\$847,365	\$58,731
Independent	\$773,400	\$1,418,527	\$146,209
Both	\$611,102	\$1,103,214	\$74,322

Source: Analysis of ABS (2017c). Jackknife replication incorporating all survey data (17,768 observations) was used to estimate standard errors.

The large difference between the median and average values point to a skewed distribution. This skewed distribution is apparent in Figure 4-1, which uses a kernel density graph to report the distribution of net wealth by school sector.¹⁰ This graph highlights a very wide wealth distribution, particularly among households with children attending independent schools.

¹⁰ A kernel density graph is like a histogram showing the distribution of a variable. The key difference to a histogram is that a kernel density graph is smoothed, averaging over variations in the data distribution.

Figure 4-1: Distribution of net wealth



Source: Analysis of ABS (2017c).

Proxy measures of wealth

There are three sets of proxy wealth data available in the SIH. These include housing tenure type, dwelling structure and the number of bedrooms. The tenure type and dwelling structure variables have been turned into binary variables. The resulting averages and standard errors are detailed in Table 4-2.

Table 4-2: Data used to generate proxy wealth score

	Average	Standard Error
Tenure type	%	%
Owner without a mortgage	15.6%	1.3%
Owner with a mortgage	64.4%	1.8%
Renter/Other	20.0%	1.6%
Dwelling structure	%	%
Separate house	91.3%	1.3%
Semi-detached	6.6%	1.4%
Flat/Unit/Caravan	2.0%	0.4%
Number of bedrooms	3.76 bedrooms	0.04

Source: Analysis of ABS (2017c). Jackknife replication incorporating all survey data (17,768 observations) was used to estimate standard errors.

The vast majority of the sample in this analysis, are home owners with a mortgage, and living in a separate house. The average number of bedrooms is 3.8.

A correlation matrix of these variables is reported in Table 4-4. The relationships are consistent with expectations. The strongest positive relationship (0.69) is between separate house and the number of bedrooms. The strongest negative relationship (-0.87) is between a flat/unit/caravan and the number of bedrooms.

The first eigenvector and eigenvalue calculated from the correlation matrix, are presented in Table 4-3. The eigenvector signs and magnitude are consistent with expectations. There is a positive eigenvector value for the number of bedrooms and owners (with and without a mortgage). Conversely, there are negative values for where the dwelling structure is semi-detached is a flat/unit/caravan, or renters.

The eigenvalue of 3.94 (56%), indicates that the first eigenvector represents 56 per cent of the variance within the seven proxy wealth variables.

Table 4-3: Proxy wealth variables – first eigenvector and eigenvalue

Variables	First eigenvector
Number of bedrooms	0.3797
Tenure: Owner without a mortgage	0.2784
Tenure: Owner with a mortgage	0.2780
Tenure: Renter/Other	-0.4763
Dwelling structure: Separate house	0.4732
Dwelling structure: Semi-detached	-0.2016
Dwelling structure: Flat/Unit/Caravan	-0.4578
Eigenvalue	3.9382 (56%)

Source: Analysis of ABS (2017c).

The eigenvectors, in conjunction with standardised values of the original variables, are used to calculate a proxy wealth score. This score was then standardised to have an average of 100 and standard deviation of 15.

The three sets of peaks in the distribution of the resulting proxy wealth score highlights the influence of binary variables (see Figure 4-2). More significantly, the differences between sectors for net wealth presented in Table 4-1 is not apparent in the proxy wealth score, with the average and median values near identical for both sectors.

Interpretation of the proxy wealth score is supported by examining the correlation between the original variables and the resulting proxy wealth score (unstandardised). This correlation analysis is reported in Table 4-5. The analysis shows that the proxy wealth score increases with the number of bedrooms, along with whether the tenure type is owner, and whether the respondent is living in a separate house. Other variables are negative, with the strongest negative relationship represented where tenure type is renter/other.

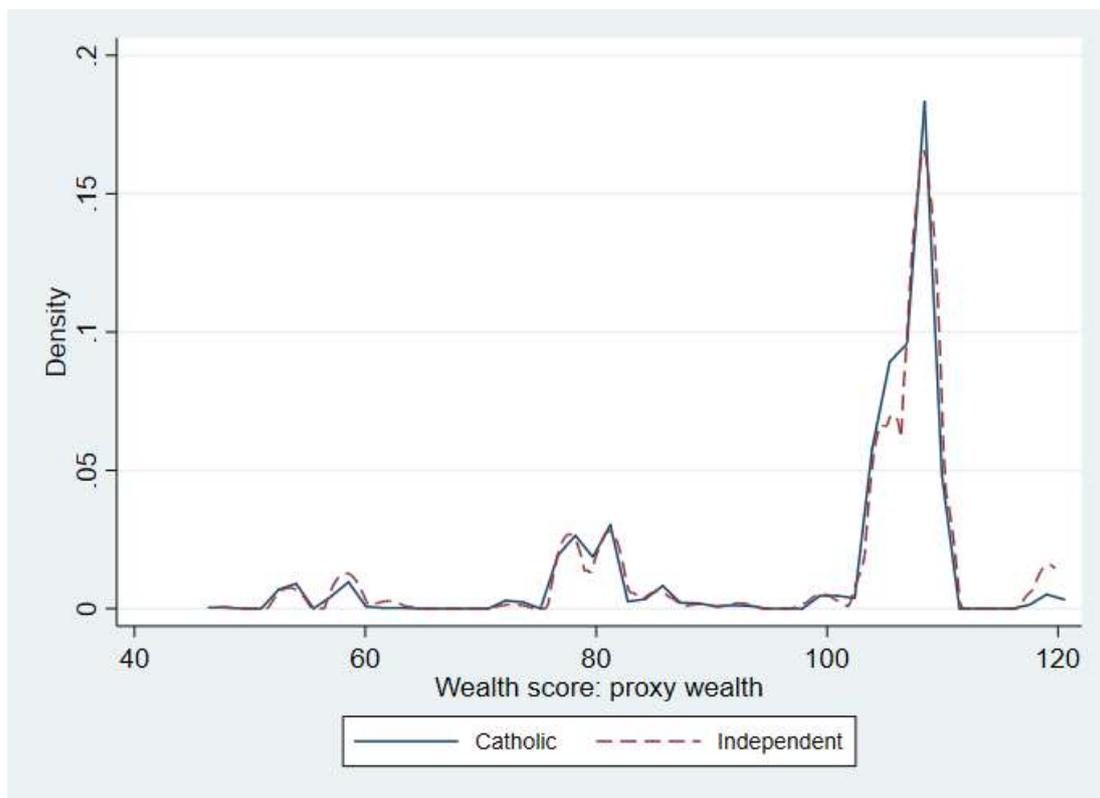
Table 4-4: Correlation matrix: proxy wealth measure elements

	Number of bedrooms	Tenure type: Owner without a mortgage	Tenure type: Owner with a mortgage	Tenure type: Renter/Other	Dwelling structure: Separate house	Dwelling structure: Semi-detached	Dwelling structure: Flat/Unit/Caravan
Number of bedrooms	1						
Tenure type: Owner without a mortgage	0.1534	1					
Tenure type: Owner with a mortgage	0.1994	-1	1				
Tenure type: Renter/Other	-0.3912	-1	-1	1			
Dwelling structure: Separate house	0.6866	0.1783	0.4754	-0.6052	1		
Dwelling structure: Semi-detached	-0.5383	-0.0954	-0.3974	0.4947	-1	1	
Dwelling structure: Flat/Unit/Caravan	-0.8686	-1	-0.5199	0.6737	-1	-1	1

Note: There are negative one values present in Table 4-4 where it is not possible for there to be a correlation within a variable set (i.e. tenure type or dwelling structure).

Source: Analysis of ABS (2017c).

Figure 4-2: Distribution of proxy wealth score



Note: Average = 100, standard deviation = 15.

Source: Analysis of ABS (2017c).

Developing a household-level CTC score including wealth

Building upon the above analysis, three household-level CTC scores are constructed using the SIH. This is limited to 1,349 households where at least one child is attending a non-government school:

- CTC score excluding wealth. This score uses household level data aligned with the current SES score method, comprising the highest household education level, highest occupation (skill level) and equivalised total household income. It is developed to provide a comparator to CTC scores incorporating wealth.
- CTC score including reported wealth. This uses the same data as the first CTC score, alongside self-reported wealth (excluding superannuation).
- CTC score including proxy wealth. This uses the same data as the first CTC score, alongside proxy measures that are also in the Census (number of bedrooms, housing type and tenure).

Table 4-5: Correlation matrix: proxy wealth measure elements and proxy wealth score

	Proxy wealth score	Number of bedrooms	Tenure type: Owner without a mortgage	Tenure type: Owner with a mortgage	Tenure type: Renter/Other	Dwelling structure: Separate house	Dwelling structure: Semi-detached	Dwelling structure: Flat/Unit/Caravan
Proxy wealth score	1							
Number of bedrooms	0.5586	1						
Tenure type: Owner without a mortgage	0.3724	0.1534	1					
Tenure type: Owner with a mortgage	0.7018	0.1994	-1	1				
Tenure type: Renter/Other	-0.9480	-0.3912	-1	-1	1			
Dwelling structure: Separate house	0.7670	0.6866	0.1783	0.4754	-0.6052	1		
Dwelling structure: Semi-detached	-0.6360	-0.5383	-0.0954	-0.3974	0.4947	-1	1	
Dwelling structure: Flat/unit/Caravan	-0.6115	-0.8686	-1	-0.5199	0.6737	-1	-1	1

Note: There are negative one values present in Table 4-4 where it is not possible for there to be a correlation within a variable set (i.e. tenure type or dwelling structure), or there are no observations (i.e. owner without a mortgage, and being in a flat, unit or caravan).

Source: Analysis of ABS (2017c).

Household-level CTC score excluding wealth

The first CTC score (excluding wealth) is developed using highest education level, occupational skill level and equivalised weekly household income. The averages and standard errors of each variable are reported in Table 4-6 and Table 4-7. As there is a distinct order to both the education and skill level variables, these are used as categorical variables within the PCA.

The correlation matrix for the education, occupational skill level and equivalised weekly household income variables is presented in Table 4-8. The correlation coefficients indicate a stronger relationship between equivalised weekly household income and occupational skill level, than with education level. This is expected, as occupational skill level relates to the occupation currently being worked in. As such, occupation may not be indicative of educational attainment.

The eigenvector and eigenvalues are reported in Table 4-11, with the eigenvalue of 1.99 (66%) indicating the first eigenvector represents 66 per cent of the variance within the three variables. The three eigenvector values range between 0.54 and 0.65, indicating that each is important.

Table 4-6: Education level and equivalised weekly household income

	Average	Standard Error
Education level	%	%
Left at or below year 9	1.2%	0.4%
Year 10, 11 & Cert I/II	4.5%	0.9%
Year 12	8.2%	1.0%
Certificate III/IV	20.4%	1.6%
Advanced Diploma/Diploma	14.5%	1.3%
Bachelor Degree	29.3%	1.8%
Postgraduate	22.0%	1.6%
Equivalised weekly household income	\$1,511	\$79

Source: Analysis of ABS (2017c). Jackknife replication incorporating all survey data (17,768 observations) was used to estimate standard errors.

Table 4-7: Occupational skill level

Skill level	Qualification level for skill level	Percentage	Standard Error
Unemployed/Not in Labour Force		7.3%	1.0%
Skill Level 5	Certificate I or compulsory secondary education	3.7%	0.6%
Skill Level 4	Certificate II or III	11.0%	1.2%
Skill Level 3	Certificate IV, or Certificate III including at least 2 years OTJ training	13.0%	1.3%
Skill Level 2	Associate Degree, Adv. Dip or Dip.	10.5%	1.0%
Skill Level 1	Bachelor degree or higher	54.7%	1.5%

Source: Analysis of ABS (2017c). Jackknife replication incorporating all survey data (17,768 observations) was used to estimate standard errors.

Table 4-8: Correlation matrix-elements of CTC score without wealth

	Education level	Occupational skill level	Equivalised weekly household income
Education level	1		
Occupational skill level	0.5828	1	
Equivalised weekly household income	0.2812	0.5970	1

Source: Analysis of ABS (2017c).

The overall importance of each variable to the component score is identified by the correlation coefficients in Table 4-12. In line with expectations, all coefficients are positive, with the strongest correlation found for occupational skill level, followed by education level. It is notable that equivalised weekly household income has the smallest coefficient. This indicates that education and occupational skill level explain a considerable amount of the variance within the component score.

Household-level CTC score including reported wealth

The correlation matrix for the elements of a CTC score, including reported wealth, is presented in Table 4-9. The strongest relationship (0.61) is between equivalised weekly household income and reported wealth.

The eigenvector and eigenvalues are reported in Table 4-11. The inclusion of reported wealth alters the eigenvector values of the other variables, with the first eigenvector representing 59 per cent of the variance within the four variables. Each eigenvector value is positive, with the highest value found for occupational skill level.

Reported wealth is strongly related to the resulting component score (see Source: Analysis of ABS).

Table 4-13), and diminishes the role of educational attainment. Hence, reported wealth has a higher correlation with the resulting component score than educational attainment. The importance of equivalised weekly household income is also higher in a CTC score that includes reported wealth.

Table 4-9: Correlation matrix-elements of CTC score with reported wealth

	Education level	Occupational skill level	Equivalised Weekly Household Income	Reported wealth
Education level	1			
Occupational skill level	0.5828	1		
Equivalised Weekly Household Income	0.2812	0.5970	1	
Reported wealth	0.1374	0.4391	0.6077	1

Source: Analysis of ABS (2017c).

Household-level CTC score including proxy wealth

The third CTC score that is developed includes the proxy wealth score documented above. The correlation matrix for the four elements is reported in Table 4-10, indicating a low correlation between the proxy wealth score and the other three variables.

The eigenvector and eigenvalues are reported in Table 4-11. The inclusion of reported wealth alters the eigenvector values of other variables, with the first eigenvector representing 51 per cent of the variance within the four variables.

Table 4-10: Correlation matrix-elements of CTC score including proxy wealth score

	Education level	Occupational skill level	Equivalised Weekly Household Income	Proxy wealth score
Education level	1			
Occupational skill level	0.5828	1		
Equivalised Weekly Household Income	0.2812	0.5970	1	
Proxy wealth score	0.0896	0.2238	0.0466	1

Source: Analysis of ABS (2017c).

The inclusion of the proxy wealth score does not alter the other ‘no wealth’ eigenvector variables, with the proxy wealth eigenvector value also relatively low at 0.21. Applying the

SEIFA method of retaining only variables with an eigenvector absolute value of at least 0.3 would actually see the proxy wealth score removed, pointing to its lack of significance (ABS, 2018).

Occupational skill level is the most important variable influencing the resulting CTC score. The least important being the proxy wealth score itself (see Table 4-14). The correlation of the proxy wealth variable with the relevant CTC score, is less than half that of the reported wealth variable (0.3 compared to 0.68).

Overall insights

The above analysis finds that reported wealth is an important contributor to a CTC score, and that proxy wealth is not. As identified in Table 4-11, reported wealth has a high correlation with a resulting CTC score. Furthermore, it is more important than educational attainment in contributing to the CTC score. In contrast, a CTC score generated using proxy wealth, proxy wealth has a low eigenvector value and correlation with the resulting CTC score. This finding indicates that with the data used in this analysis, proxy wealth does not provide a suitable alternative to reported wealth in the development of a CTC score.

Table 4-11: CTC scores-eigenvectors and eigenvalues

	No wealth		Reported wealth		Proxy wealth	
	Eigenvector	Correlation ^a	Eigenvector	Correlation ^a	Eigenvector	Correlation ^a
Educational attainment	0.5363	0.7654	0.4044	0.6403	0.5221	0.7512
Occupation (skill level)	0.6457	0.9262	0.5661	0.9196	0.6414	0.9219
Household income	0.5435	0.6562	0.5442	0.7695	0.5222	0.6344
Reported wealth			0.4689	0.6796		
Proxy wealth score					0.2078	0.3006
Eigenvalue ^b	1.99 (66%)		2.35 (59%)		2.03 (51%)	

Notes: ^a Correlation with resulting component score. ^b Value in brackets is percentage of overall variance explained.

Source: Analysis of ABS (2017c).

Table 4-12: Correlation matrix: components of CTC score without wealth, and resulting CTC score

	Education level	Occupational skill level	Equivalised weekly household income	CTC score: Without wealth
Education level	1			
Occupational skill level	0.5828	1		
Equivalised weekly household income	0.2812	0.5970	1	
CTC score: Without wealth	0.7654	0.9262	0.6562	1

Source: Analysis of ABS (2017c).

Table 4-13: Correlation matrix: components of CTC score with reported wealth, and resulting CTC score

	Education level	Occupational skill level	Equivalised weekly household income	Reported wealth	CTC score: With reported wealth
Education level	1				
Occupational skill level	0.5828	1			
Equivalised weekly household income	0.2812	0.5970	1		
Reported wealth	0.1374	0.4391	0.6077	1	
CTC score: With reported wealth	0.6403	0.9196	0.7695	0.6796	1

Source: Analysis of ABS (2017c).

Table 4-14: Correlation matrix: components of CTC score with proxy wealth, and resulting CTC score

	Education level	Occupational skill level	Equivalised weekly household income	Proxy wealth score	CTC score: With proxy wealth
Education level	1				
Occupational skill level	0.5828	1			
Equivalised weekly household income	0.2812	0.5970	1		
Proxy wealth score	0.0896	0.2238	0.0466	1	
CTC score: With proxy wealth	0.7512	0.9219	0.6344	0.3006	1

Source: Analysis of ABS (2017c)..

Assessing and comparing CTC scores that include wealth

There is no ‘ideal’ method for directly comparing the three different CTC scores. This is because the scores are standardised (average=100, standard deviation=15), and are not directly comparable. Rather, a more appropriate approach is to examine the change in household CTC rankings between the three approaches.¹¹

The household ranking when reported wealth is used in a CTC score is a median of 10 places (0.7%) lower than a CTC score excluding reported wealth. There are similar median movements by school sector, but there is far greater variability among independent school families (average increase in rank of 16 places) than Catholic school families (average reduction in rank of 4 places) (see Table 4-15 and Figure 4-3).

Among independent school families, 10 per cent moved 136 or more places higher or 72 places or more lower, compared to 89 places higher or 81 places lower among Catholic school families (see Source: Analysis of ABS .

Figure 4-4).

There is also a long ‘tail’ of households that see an increase in their CTC score, with 5 per cent of households moving between 182 and 551 positions) (see unbroken blue line in Figure 4-3).

Analysis of data on households experiencing a material change in CTC rank, following introduction of reported wealth into the CTC score, provides little guidance on the implications of this analysis for school funding (see Source: Analysis of ABS .

Figure 4-5). This is because significant upward and downward changes in household CTC ranking, when reported wealth is used in the CTC score, occur at all ranks of the CTC score, where wealth is excluded.

Inclusion of the proxy wealth score results in much less variability in the change in rank between sectors (median = 17 positions up; average = 2 positions up), reflecting the earlier findings that the proxy wealth score is less discriminating than reported wealth.

Table 4-15: Change in household CTC rank with inclusion of wealth-school sectors

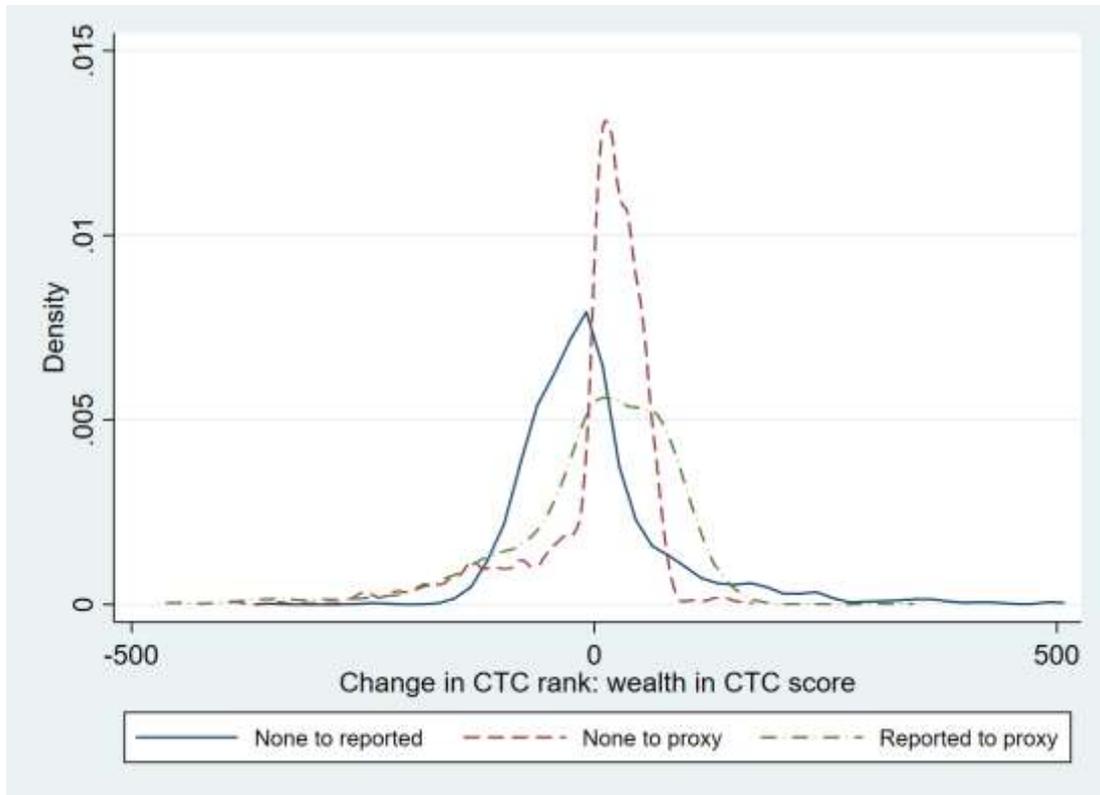
School sector	Change in rank: Reported wealth			Change in rank: Proxy wealth		
	Median	Average	S.E.	Median	Average	S.E.
Catholic	15 ↓	4 ↓	3.4	16 ↑	3 ↑	3
Independent	3 ↓	16 ↑	5.4	17 ↑	1 ↑	3
Both	10 ↓	5 ↑	5	17 ↑	2 ↑	2

Note: The change in rank is from the ranks in a CTC score omitting wealth.

¹¹ A similar approach was used by the Australian Council for Educational Research (ACER) in Department of Education, Training and Youth Affairs (1999). ACER compared rankings of a school-level SES index from LSAY for 76 non-government schools, to the SES scores generated in preliminary SES score estimation.

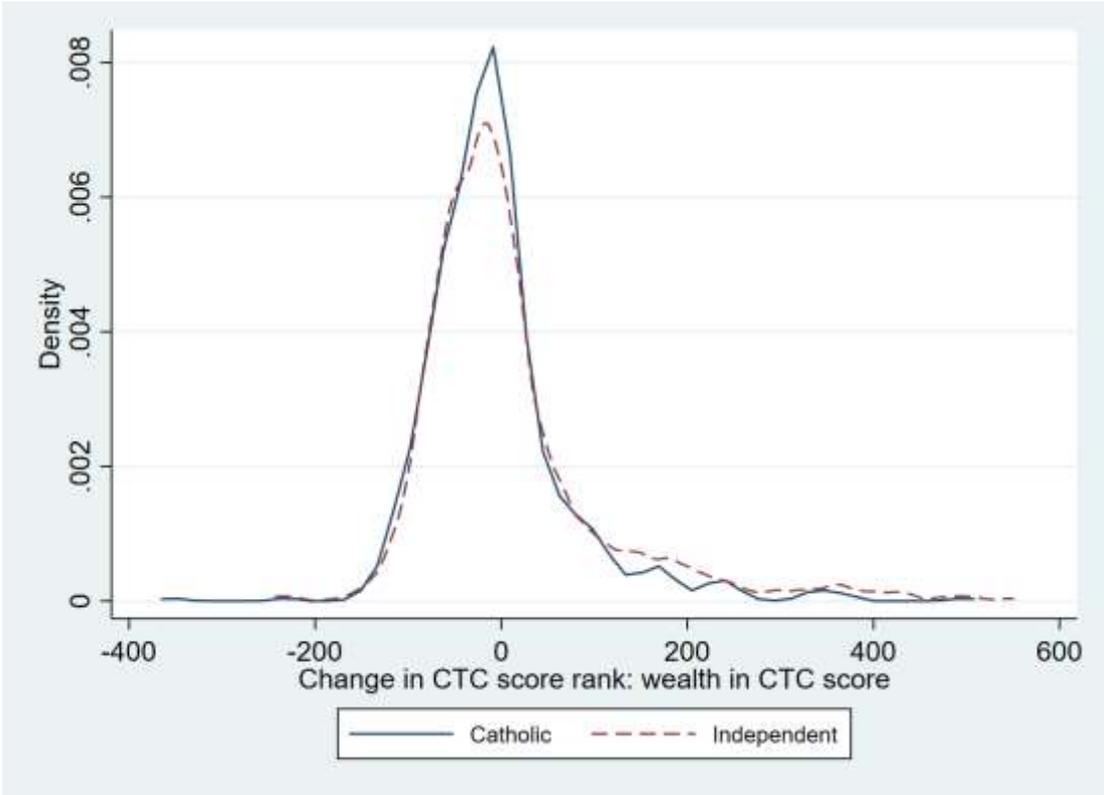
Source: Analysis of ABS (2017c). Jackknife replication incorporating all survey data (17,768 observations) was used to estimate standard errors.

Figure 4-3: Change in household CTC rank based on wealth inclusion



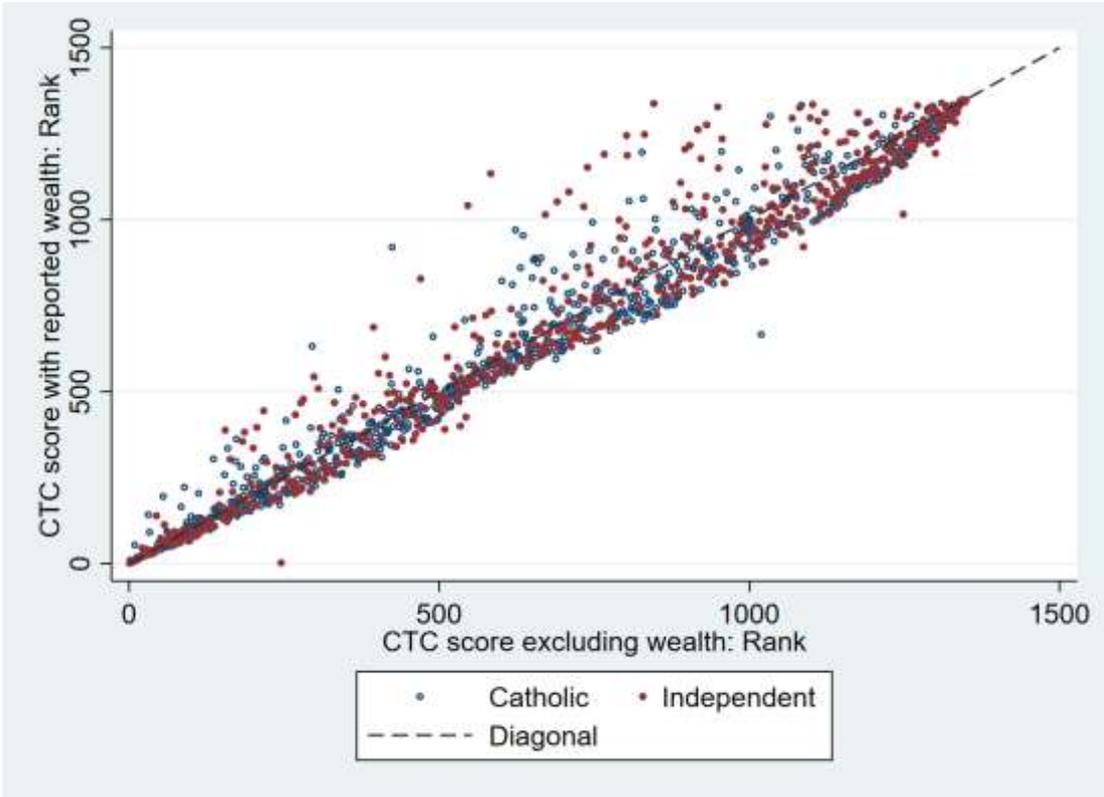
Source: Analysis of ABS (2017c).

Figure 4-4: Change in household CTC rank with inclusion of reported wealth-school sectors



Source: Analysis of ABS (2017c).

Figure 4-5: CTC score-rank excluding wealth and rank change including reported wealth



Source: Analysis of ABS (2017c).

5. Key findings and implications

The analysis in this report finds that household wealth, as measured in the SIH with reported wealth, leads to material change in a CTC score. This is compared to a CTC score omitting any measure of wealth. The inclusion of wealth in a CTC score is consistent with international practice, which argues for the inclusion of household wealth in the estimation of economic well-being, in conjunction with data on income and consumption.

The inclusion of wealth based on proxy measures in a CTC score leads to less change in CTC rankings, when compared to a CTC score omitting wealth. This is because the proxy wealth measures are unable to capture the breadth of reported wealth. At face value, the current findings using proxy wealth data, available in the SIH, do not make a strong case for the inclusion of wealth (based on proxies) in a CTC score.

A key omission in the current analysis however, is location and its implications for household wealth. Housing value, which is a large component of household wealth, varies greatly across Australia, and even within the same city.

While the inclusion of reported wealth in a CTC measure is considered important, the household wealth data required for this purpose is not currently available on a population wide basis at the individual household level.

These limitations may be able to be overcome. An examination of whether household wealth can be accurately imputed using available income and other data such as the proxy measures included in this analysis, could be undertaken. This could also draw upon data collected by the Australian Taxation Office, alongside data on property values held by State and Territory Governments. This data, when combined with Census data, may be able to provide an accurate representation of household wealth.

The findings in this report provide some guidance on implications for funding provided to individual schools. If reported wealth (or an accurate proxy) could be used to generate school CTC scores, the current findings suggest Catholic school families would experience a very small reduction in their relative CTC position. Conversely, independent school families would experience a small increase. The distribution of these changes could however vary greatly with and between schools.

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