



Briefing Note: Differences between school decile and equity index

To:	Hon Chris Hipkins, Minister of Education		
Date:	7 October 2021	Priority:	Medium
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Messaging seen by communications team:	No	Round robin:	No

Purpose of report

This report analyses differences between school decile and equity index in general and in Southwest Auckland.

Summary

As part of ongoing work to implement the equity index, you asked for information on the redistributive impacts of past decile recalculations and the potential impact of a decile recalculation in Southwest Auckland (Maungakiekie to Papatoetoe), using 2018 Census data.

The socioeconomic disadvantage at some schools is measured significantly differently by school decile and the equity index. This means that some schools will experience material shifts in operational funding when the index is implemented, though losses can be mitigated by increasing overall funding and through the transition approach. While some schools also experienced significant funding shifts after a decile recalculation, the majority of schools either remained at the same decile or shifted up or down one decile step only.

The equity index measures disadvantage more accurately than school decile. It looks at the circumstances of individual learners attending each school and uses broader, more nuanced information directly related to educational outcomes. Where there is a difference between a school's decile and its equity index, this indicates that decile is either overestimating or underestimating disadvantage in the school. There are three main reasons for this:

- Deciles can be inaccurate if a school's students are not representative of the neighbourhoods they live in
- Deciles are based on five blunt variables that can be inaccurate measures of disadvantage
- Our current deciles are out of date and the socioeconomic status of a region may have changed since deciles were last recalculated

In Southwest Auckland, deciles are overestimating disadvantage for many schools. Analysis in this paper highlights that this is mainly due to weaknesses with decile variables (including

the weighting of the household crowding variable driving decile downwards in this area) rather than change in socioeconomic status since 2013. Our analysis indicates that a decile recalculation would have smaller school funding impacts for Southwest Auckland than the shift to the equity index will have.

Recommended actions

The Ministry of Education recommends you:

- a. **agree** that this report will not be proactively released until after equity index funding decisions have been made and their impacts have been communicated to schools

Agree / Disagree



John Brooker
Group Manager
Education System Policy

07/10/2021



Hon Chris Hipkins
Minister of Education

___/___/___

Background

1. Following advice in December 2020 [METIS 1245184] your office asked us to provide further advice on a range of topics. This report provides analysis on two of those topics: the redistributive impacts of past decile recalculations and the potential impact of a decile recalculation on Southwest Auckland.

What is causing potential losses in funding in Southwest Auckland?

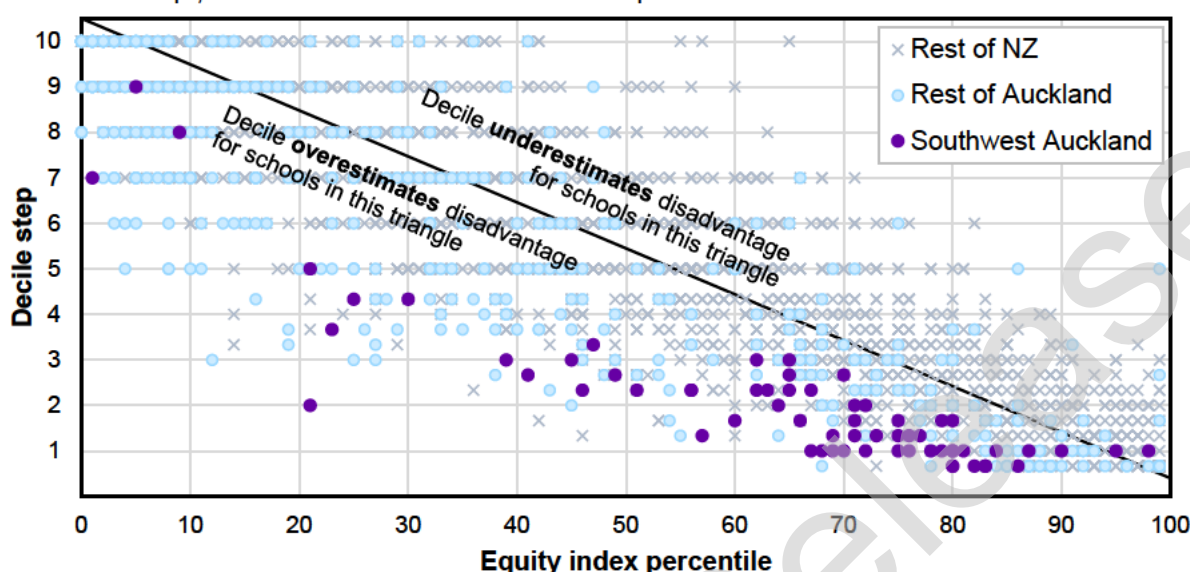
2. The December 2020 report analysed potential funding impacts of the shift to the equity index on different regions. The Southwest Auckland subregion of the Auckland Education Region stood out as it was predicted to lose funding despite being disadvantaged. The Southwest Auckland subregion is mapped in Figure 6 on page 11. It includes Onehunga, Maungakiekie, Māngere, Ōtāhuhu and Papatoetoe.
3. Your office asked for advice on what the impact of a decile recalculation would be on funding for Southwest Auckland and how it compares to the impact of shifting to the equity index. This section alternates between providing this analysis inside the **purple boxes** and providing general analysis on the differences between school decile and the equity index in the main text.

Some schools have an equity index significantly different to their decile

4. Decile and equity index both measure the socioeconomic disadvantage of students at each school relative to other schools. Disadvantage at some schools is measured significantly differently by decile and index. This section analyses the main reasons:
 - a. Deciles can be inaccurate if a school's students are not representative of the neighbourhoods they live in (paragraphs 9–10).
 - b. Deciles are based on blunt variables that can be inaccurate measures of disadvantage (paragraphs 11–24).
 - c. Our current deciles are out of date and the socioeconomic status of a region may have changed since deciles were last recalculated (paragraphs 25–32).
5. We are confident that the equity index is a more accurate measure of disadvantage than school deciles. A difference between a school's decile and equity index therefore indicates that the school's decile is inaccurate and we are either overestimating or underestimating disadvantage at that school.
6. Schools that are measured as more disadvantaged by decile than equity index may lose funding when the index is introduced. Losses in school funding, especially in Southwest Auckland, can be mitigated by increasing total Equity Funding (Figure 3).
7. While there will be some challenging transitions for schools, which can be mitigated through the funding approach, losses in funding reflect that the decile system significantly overestimated some schools' level of disadvantage. Rebalancing will ensure that funding is redistributed to schools that need it even more.
8. School leaver achievement data also aligns with the interpretation that there is a difference in the disadvantage faced by low decile schools in Southwest Auckland, compared with the rest of New Zealand, as shown in Figure 2 overleaf. On average, 59% of decile 1 school leavers achieve NCEA L2 or higher. Results are significantly better for decile 1 schools in Southwest Auckland, where 77% of school leavers achieve L2 or higher.

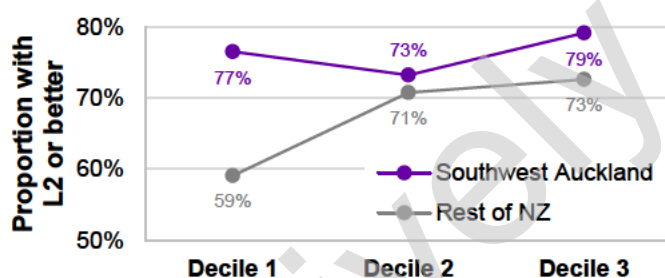
Figure 1: Comparison of decile and equity index percentile for schools

The diagonal black line shows where decile and equity index are equivalent. Schools that are further away from the line have larger differences between decile and equity index. This graph does not show which schools gain or lose funding (this depends on the level of new funding and the funding curve). Deciles 1–4 are each split into 3 decile steps, with about one-thirtieth of schools at each step 1A–4L.



Decile and equity index have different scales, so one needs to be converted to make direct comparisons. Equity index has been converted to percentile, where 0 denotes the 1% of schools with the lowest (least disadvantaged) equity indexes and 99 denotes the 1% of schools with the highest equity indexes.

Figure 2: Proportion of 2019 school leavers who achieved NCEA Level 2 or better



This graph shows that, on average, school leavers at decile 1–3 schools in Southwest Auckland outperform the rest of New Zealand in educational attainment. This suggests that decile overestimates relative disadvantage in Southwest Auckland.

Box 1: What impact might differences between decile and equity index have on funding for Southwest Auckland?

This box analyses the estimated impact of the transition to the equity index on Southwest Auckland and the effect of different levels of additional annual Equity Funding.

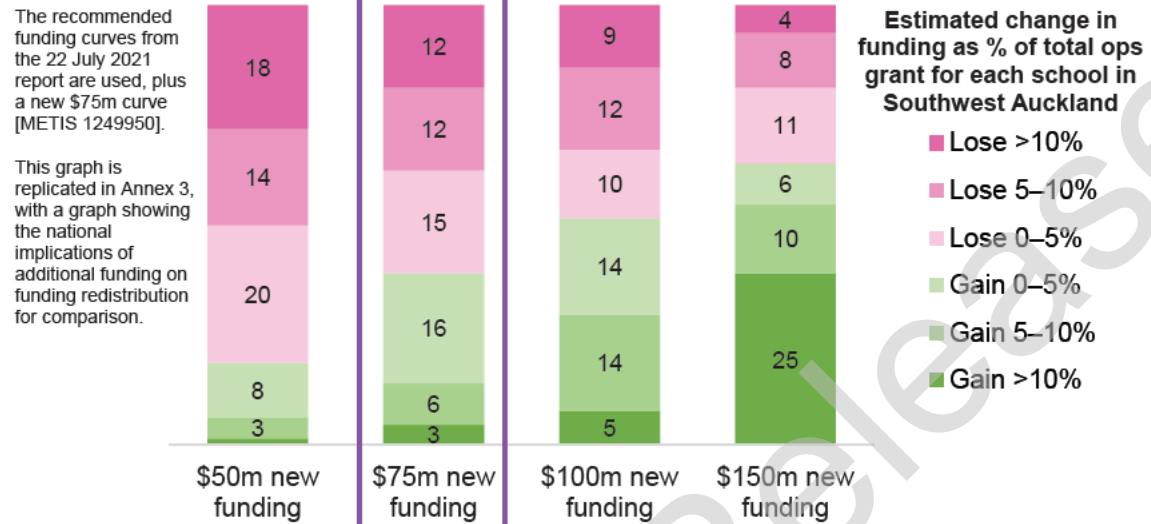
Table 1: Impact of additional funding on per-student Equity Funding for selected regions

Region	Decile system	New system + \$50m	New system + \$75m	New system + \$100m	New system + \$150m
Southwest Auckland	\$586	\$481	\$544	\$606	\$733
Auckland	\$244	\$228	\$255	\$281	\$334
Tai Tokerau	\$345	\$554	\$610	\$665	\$773
New Zealand	\$205	\$267	\$299	\$330	\$393

'Decile system' figures are the average amount of funding a student would receive for TFEA, TARG and decile-weighted portions of SEG and CIG in 2023 under the current system. 'New system' figures represent the funding an average student would receive in Equity Funding in 2023 (including equity portions of SEG and CIG). Recommended funding curves from the 22 July 2021 report are used [METIS 1249950]. Figures are estimates and exclude GST.

As the level of additional Equity Funding increases, the funding going to Southwest Auckland increases disproportionately quickly. This is because higher levels of additional funding let the funding curve shift leftward (see Annex 1), giving significantly more funding to schools around the 70th–80th equity index percentiles (see Figure 1).

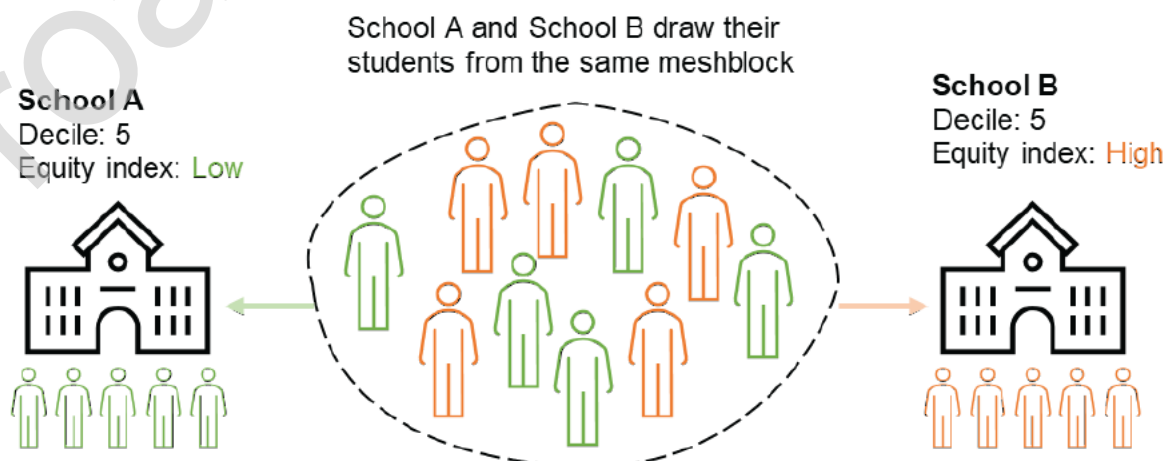
Figure 3: Impact of additional funding on funding redistribution in Southwest Auckland



Deciles are based on neighbourhood information, not student information as the equity index is

9. School deciles are based on data about Census meshblocks, which are areas that typically contain around 50 households. We match student addresses to meshblocks then calculate a weighted average across meshblocks for the school.
10. This means deciles can be inaccurate when students are not representative of the meshblock they live in. This can occur, for instance, when parents exercise school choice unevenly. If the less-disadvantaged and more-disadvantaged families in the same neighbourhood are sending their children to two different schools, then both schools' deciles will be biased, one upward and one downward. This is diagrammed in Figure 4. Note that a low equity index is equivalent to a high decile.

Figure 4: Illustration of how using meshblock information can make deciles inaccurate #1



Box 2: Inaccuracy due to meshblocks and school choice may be driving losses in funding for state integrated schools in Southwest Auckland

The impact of shifting from using neighbourhood information to using student information is likely a key driver of changes in funding for particular schools but is unlikely to explain large changes in funding for a region.

Many of the schools predicted to lose the most funding in Southwest Auckland are state integrated schools. These schools may be drawing students who are, on average, less disadvantaged than others in the neighbourhoods they live in. There may be a selection bias inherent in attending a state integrated school. For example, state integrated schools charge compulsory attendance dues.

The variables used for decile may not measure disadvantage accurately

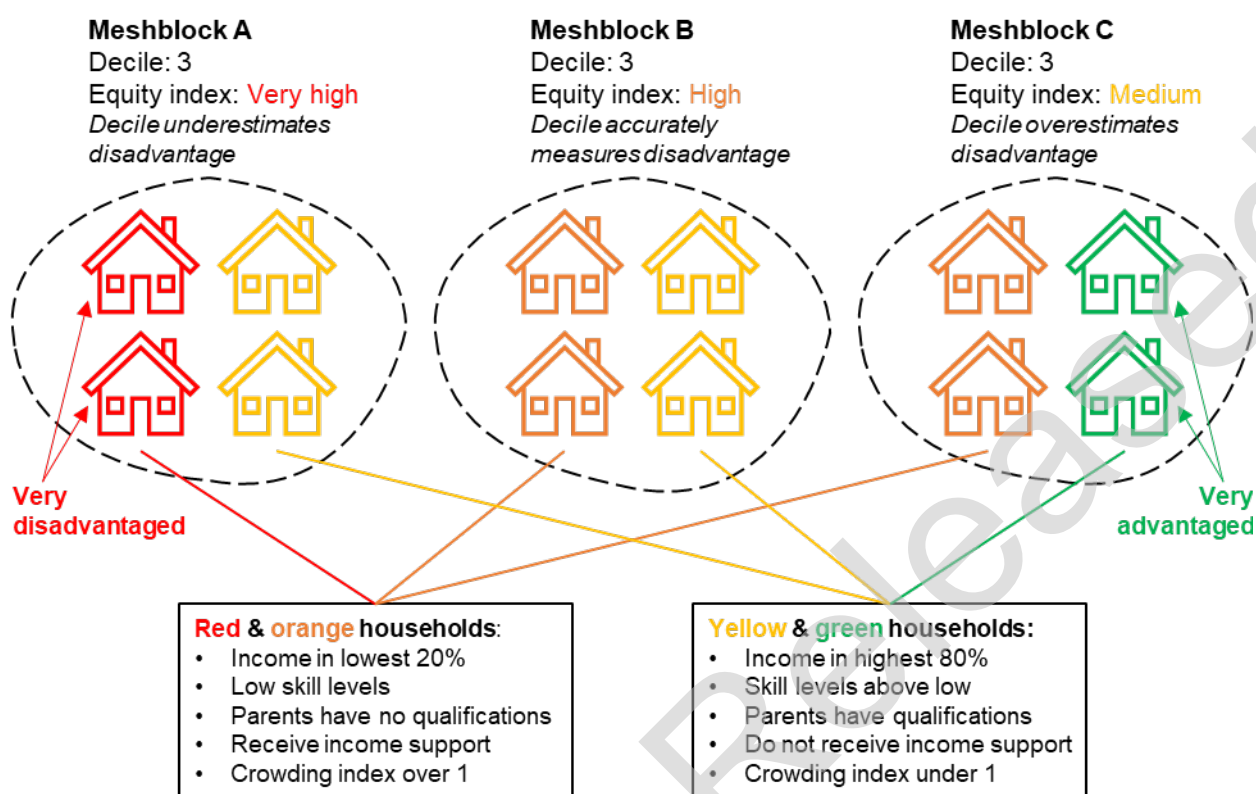
11. School deciles are based on five blunt meshblock variables:
 - a. percentage of households with income in the lowest 20 percent nationally
 - b. percentage of employed parents in the lowest skill-level occupational groups
 - c. percentage of parents with no educational qualifications
 - d. percentage of parents receiving income support benefits
 - e. percentage of households with a crowding index¹ over 1 (includes any house where a single person aged 10 years or older shares a bedroom).
12. Schools are ranked for each variable, then each school's rankings are summed then ranked again to give an overall ranking. Schools are then split into 10 deciles with deciles 1–4 split into thirds to give 18 decile steps for TFEA funding.

The five decile variables give a limited view of overall disadvantage

13. Both decile and equity index are trying to measure the barriers to educational success faced by students at each school. This lets us target resourcing to improve equity.
14. Although the decile variables correlate with overall disadvantage, they miss some information. This can make decile an inaccurate measure of disadvantage for particular schools. It can also make decile inaccurate for particular sets of schools, where a set of schools share some unobserved characteristic.
15. In addition to the limitations due to using meshblock-level information (see paragraphs 9–10), there are three limitations due to the variables used to calculate deciles:
 - a. Each of the five variables is calculated as the proportion in a blunt category (eg income in lowest 20% nationally, or not). Information beyond this binary is lost.
 - b. The five variables cover only some parts of overall disadvantage. Information about other types of disadvantage (eg parent in prison) is not included.
 - c. The five variables are given even weightings. This may overweight or underweight the contribution of some variables to overall disadvantage.

¹ Crowding index = $(0.5 \times \# \text{ children under 10} + \# \text{ children 10 or over} + \# \text{ couples}) \div \# \text{ bedrooms}$

Figure 5: Illustration of how using meshblock information can make deciles inaccurate #2



Each meshblock scores 50% (2/4) on each of the 5 decile variables, thus all have the same decile. This does not capture that Meshblock A has very high disadvantage in 2 households or that Meshblock C has very low disadvantage in 2 households. The equity index does capture this.

16. In Figure 5 above, the red and orange households both score the same on the decile variables. However, the red (very disadvantaged) households in Meshblock A are actually more disadvantaged than the orange households in Meshblock B. This could be for two reasons:
- The red households could have disadvantage that is not measured by the decile variables. For example, history of Oranga Tamariki notifications.
 - The red households could be further beyond the variable thresholds. For example, the red households could be in the 1st income percentile and the orange households are the 19th income percentile.

The equity index uses more, better variables to calculate disadvantage more accurately

17. Equity index improves on decile by using more, better variables and using an algorithm to weight them. Annex 2 lists the variables currently used to calculate the equity index.
- More variables: The equity index uses more variables directly related to educational achievement, getting a more-complete picture of disadvantage.
 - Better variables: Variables with more categories are used instead of blunt binary categories, capturing more information. For example, the equity index distinguishes between more levels of income.
 - Better weightings: A statistical algorithm (regression) calculates how much each variable explains educational achievement rather than arbitrary even equal weightings used for the five decile variables.

The household crowding variable has significant limitations

18. One-fifth of decile is based on the crowding index (any house where a single person aged 10 years or older shares a bedroom). While household crowding is a significant barrier to educational success and does correlate with overall disadvantage, the household crowding variable may not explain one-fifth of overall disadvantage. This may cause decile to overestimate disadvantage in areas where a relatively high proportion of households have a crowding index greater than 1.
19. Moreover, the household crowding variable does not distinguish between different levels of crowding. A two-bedroom household with two parents and five teenagers (crowding index = 3) is treated the same as a two-bedroom household with two parents, an eight-year old and a ten-year-old (crowding index = 1.25); both crowding indexes are over the threshold of 1.
20. While we do recognise household crowding is a barrier to educational success and correlated with disadvantage, a household crowding measure is not included in the equity index. Household crowding is only measured through the Census and no Census data is used in the equity index – the equity index only uses administrative data, to ensure that the index can be updated each year.
21. We do not consider this to weaken the model overall. The equity index includes a large number of variables, covering a wide range of socioeconomic indicators, that are more direct measures of disadvantage and are updated more frequently. Because of the strong relationship between socioeconomic variables, the marginal impact of each additional variable becomes less as more are added. This means that, even if a household crowding variable were able to be included, it would be unlikely to have a significant impact.

Box 3: Impact of household crowding variable on deciles in Auckland

Typically, big families will meet the threshold for household crowding, but these families are not necessarily poor families; however, decile equally weights these variables. We can look at Census area units (see paragraph 31) to understand the impact of the household crowding variable on deciles in Southwest Auckland.

For example, take the Māngere Central area unit in Southwest Auckland. 62 percent of households in Māngere Central had a household crowding index greater than 1 in Census 2013 (when deciles were last recalculated). This is higher than 99 percent of all area units in New Zealand. In contrast, 30 percent of households in Māngere Central had an income in the bottom 20 percent nationally, higher than just 76 percent of all area units. This demonstrates how the household crowding variable plays a relatively large role in driving down deciles in Southwest Auckland.

The household crowding variable also affects deciles in wider Auckland. For example, 51 percent of households in the Auckland Central East area unit had a household crowding index greater than 1 in Census 2013, higher than 97 percent of all area units. Auckland Central East is bordered by Queen Street and partly in the Auckland Grammar zone (Auckland Grammar is in decile 9 but has an equity index equivalent to decile 10).

School decile underestimates disadvantage in rural areas

22. On average, the equity index measures rural areas as more disadvantaged than decile. Table 2 below shows that decile tends to overestimate disadvantage in major urban areas and underestimate disadvantage in minor urban areas and rural areas. Many schools that are measured as significantly more disadvantaged by equity index than by decile are in rural areas or small towns. This is because using student information rather than neighbourhood information in areas with sparse population is a more accurate way to measure socioeconomic disadvantage.
23. As discussed in paragraphs 11–17, there are elements of disadvantage that the decile variables do not measure. There may be elements of disadvantage that are associated with living in rural areas and are not measured by the five decile variables but are measured by the equity index. There may also be elements of disadvantage that are overweighted when calculating deciles (eg household crowding, potentially).
24. Census meshblocks in rural neighbourhoods can be geographically large and relatively heterogeneous, containing both advantaged and disadvantaged families. If the more-disadvantaged families tend to send their children to the local school while the more-advantaged families do not, then the local school's decile will be too high (as discussed in paragraphs 9–10).

Table 2: Decile overestimates disadvantage in urban areas compared to the equity index

	Schools that are more disadvantaged according to decile than equity index	Schools that are more disadvantaged according to equity index than decile
Large urban area (eg Upper Hutt)	56% (751 of 1,339)	44% (588 of 1,339)
Medium urban area (eg Levin)	40% (60 of 151)	60% (91 of 151)
Small urban area (eg Foxton)	40% (119 of 299)	60% (180 of 299)
Rural area	35% (234 of 666)	65% (432 of 666)

Box 4: School decile overestimates disadvantage in urban areas, and this partly explains the shifts in Southwest Auckland

The decile variables and algorithm underestimate actual disadvantage in rural areas or overestimate actual disadvantage in urban areas. This general trend partly explains why the equity index measures Southwest Auckland, an urban area, as having lower relative disadvantage than decile.

Decile and equity index are based on data from different time periods

25. Decile recalculations typically happen every five years, following the Census. The last decile recalculation happened in 2015, based on Census 2013 data. A small number of schools have requested decile reviews since then (nb a school's decile cannot go up following a review).
26. Current equity indexes are based on data from 2017–2019 (equity indexes are averaged over three years to reduce volatility). The equity index is updated yearly, and the version used when it is introduced in 2023 will be based on data from 2019–2021.

27. The relative socioeconomic status of some school communities has changed significantly since 2013. These changes partly cause differences between decile and equity index.

We cannot know the impact of a decile recalculation at individual schools without actually doing one

28. A decile recalculation based on recent data would provide a useful comparator to help understand how much of the differences between decile and equity index are explained by change in socioeconomic status since 2013. However, deciles have not been recalculated following Census 2018, and doing so would require significant work.
29. In September 2019 the Cabinet Social Wellbeing Committee agreed to not recalculate deciles using Census 2018 data [SWC-19-MIN-0122]. Delays in Census 2018 data availability meant it was not possible to recalculate deciles for 2020, and the equity index was planned to be introduced at the start of 2021, so there was no need to recalculate deciles.

As a proxy, we can look at change in an area instead of for a school

30. Instead of doing a decile recalculation, we sought an alternative way to analyse the effect of change in relative socioeconomic status since 2013 on differences between decile and equity index in Southwest Auckland.
31. Using custom data from Stats NZ, we have analysed Census area units (larger than meshblocks) instead of schools. Using the same formula as for school decile, we sorted all area units in New Zealand into deciles for both Census 2013 and Census 2018. The change from 2013 to 2018 in area unit deciles can be used as a proxy measure for the likely change in school deciles in that area.
32. This proxy measure is a useful indicator but it has limitations. It is an average measure across an area unit, making it useful for understanding change in a region but not for particular schools.

- c. the other reasons for differences between decile and equity index analysed in this report are more likely to explain the changes in Southwest Auckland (ie weaknesses with the decile variables and algorithm, see paragraphs 9–24).

The redistributive impacts of past decile recalculations

33. Decile recalculations typically happen every five years and cause moderate disruptions in funding. About one-third of schools gain funding, one-third lose funding and one-third maintain funding. A few schools experience large changes in their decile but most stay the same or experience relatively small shifts up or down one decile step.
34. Figure 7 shows the distribution of step changes in the 2015 decile recalculation. This interacts with decile-based funding formulas (see Figure 8) to cause funding changes (see Figure 9). Although about two-thirds of schools gain or lose funding, most of these shifts are relatively small. A change of one decile step has a larger impact at lower deciles, where the TFEA funding curve is steeper.

Figure 7: Distribution of change in decile step for all schools in 2015 decile recalculation

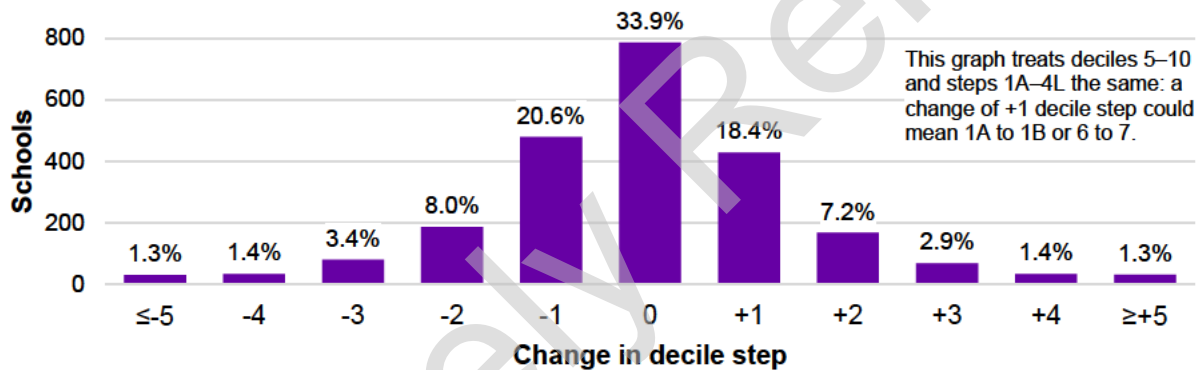
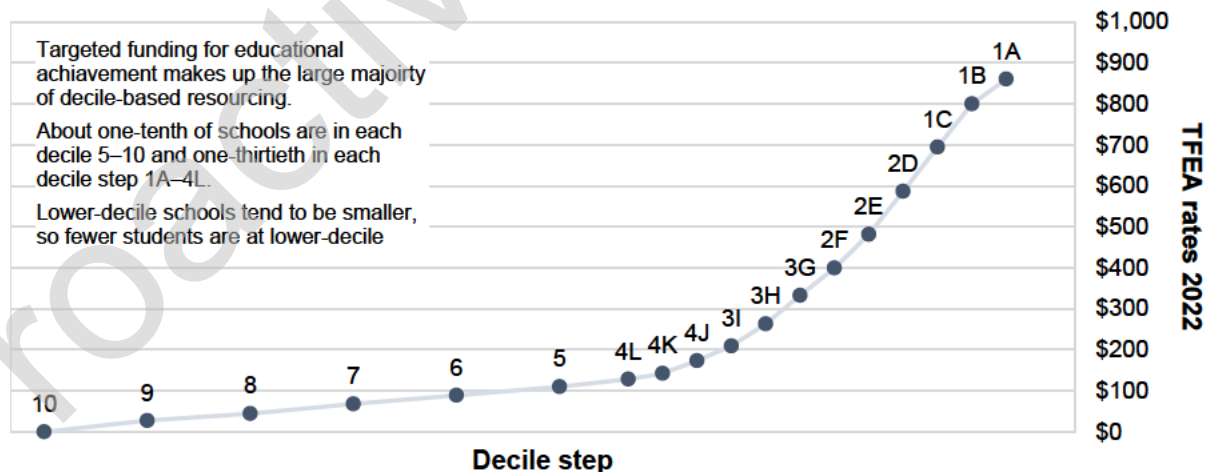


Figure 8: TFEA per-student funding rates excluding GST 2022

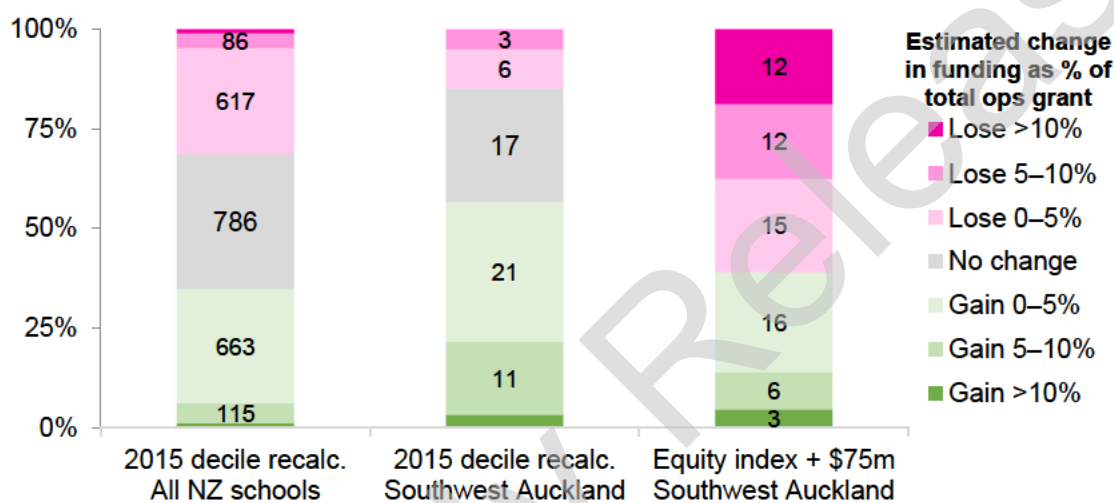


Box 6: Impact of the 2015 decile recalculation on Southwest Auckland

Shifting to the equity index will have a much larger redistributive impact on Southwest Auckland (and on New Zealand) than a decile recalculation. Negative impacts can be significantly mitigated by increasing total Equity Funding.

Figure 9 shows the impact of the 2015 recalculation on all schools (first column) and those in Southwest Auckland (second column). For reference, it also shows the estimated impact of the shift to the equity index on Southwest Auckland assuming \$100 million in additional Equity Funding (third column), which is the same as in Figure 3 on page 5.

Figure 9: Funding impact of 2015 decile recalculation and 2023 shift to equity index



Annexes

Annex 1: Equity index distributions and recommended funding curves

Annex 2: List of variables used in the equity index

Annex 3: Impacts of additional funding on funding distribution

Annex 1: Equity index distributions and recommended funding curves

Figure 1: Distribution of schools across the equity index

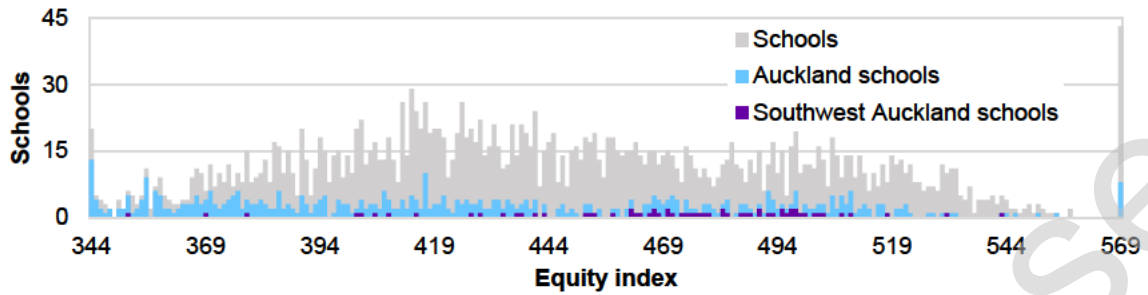


Figure 2: Distribution of total school rolls across the equity index

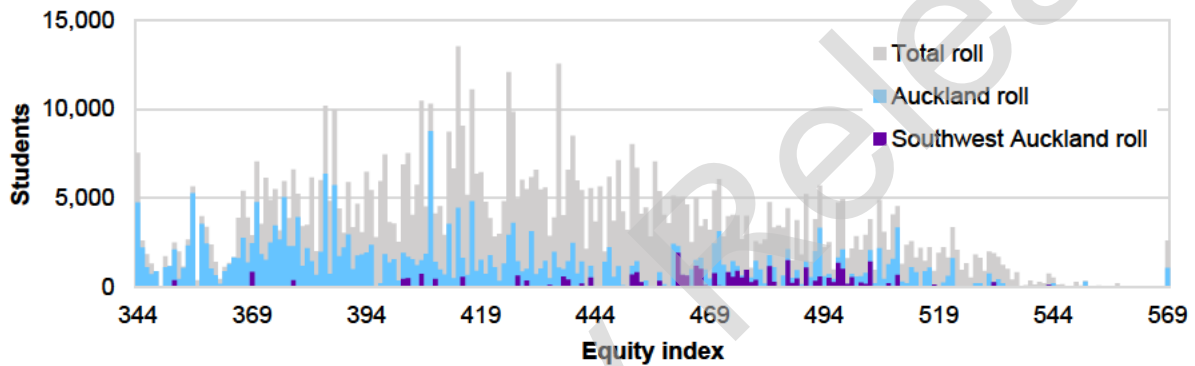
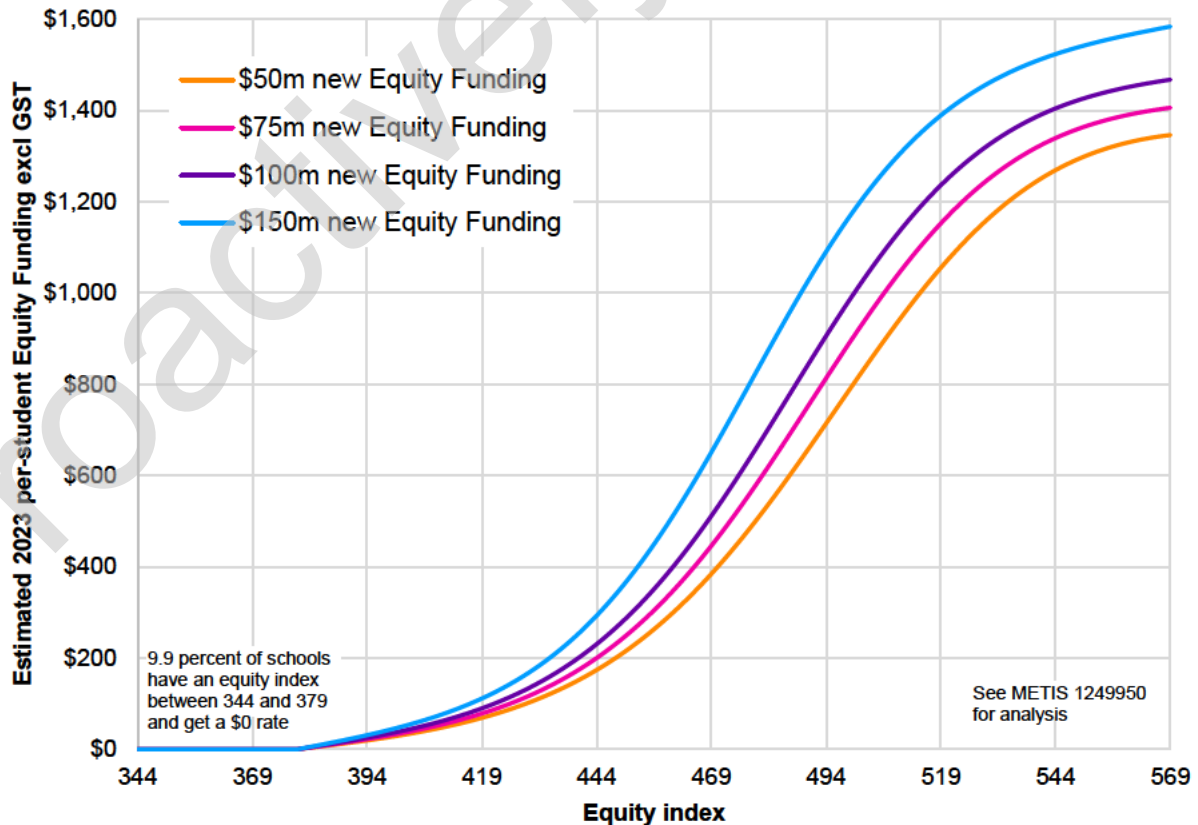


Figure 3: Recommended funding curves for three levels of additional funding



Annex 2: List of variables used in the equity index

Variable	In parental model	In non-parental model
Child Youth and Family (CYF) notification	✓	✓
CYF investigation	✓	✓
CYF family group conference	✓	✓
CYF placement	✓	✓
CYF Youth Justice (YJ) notification	✓	✓
CYF YJ investigation	✓	✓
CYF YJ family group conference	✓	✓
CYF YJ placement	✓	✓
Proportion of life on benefit	✓	✓
Proportion of life overseas	✓	✓
Number of home changes	✓	✓
Number of non-structural school changes (eg not primary to secondary)	✓	✓
Number of simultaneous home and school changes	✓	✓
Father's education level	✓	
Mother's education level	✓	
Father's community service	✓	
Father's proven charges	✓	
Father's custodial sentence	✓	
Mother's community service	✓	
Mother's proven charges	✓	
Mother's custodial sentence	✓	
Father's first-tier entitlement benefit amount	✓	
Father's second-tier entitlement benefit amount	✓	
Father's self-employed income amount	✓	
Father's wage and salary income amount	✓	
Mother's first-tier entitlement benefit amount	✓	
Mother's second-tier entitlement benefit amount	✓	
Mother's self-employed income amount	✓	
Mother's wage and salary income amount	✓	
Ethnicity	✓	✓
Age of mother at birth	✓	
Age of mother at first child	✓	
Number of siblings at birth	✓	
Age of father at first child	✓	
Continent of birth		✓
Migrant status		✓
Age at visa approval		✓

1. The overall equity index model comprises a pair of models, one for children who are linked to parents and one for children who are not linked to their parents.
2. There are no interpretable weightings for these variables because they are correlated with each other.
3. The list of variables may grow over time as more sufficiently good-quality data becomes available.

Annex 3: Impacts of additional funding on funding redistribution

Figure 1: Impact of additional funding on funding redistribution nationally

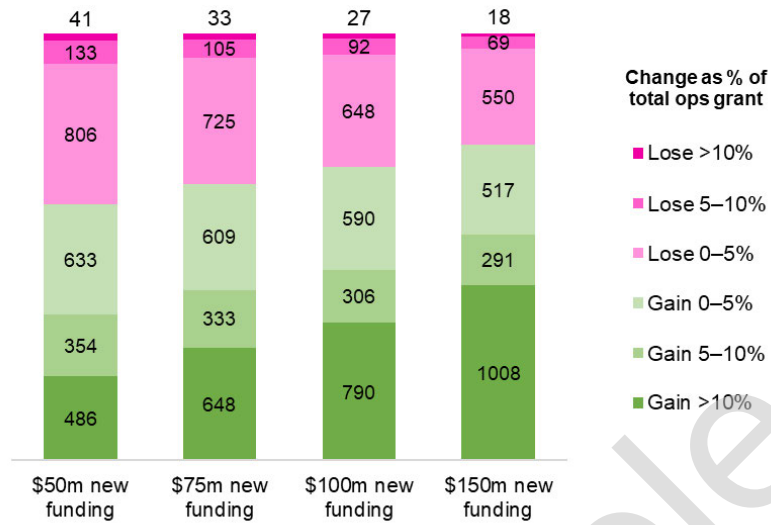


Figure 2: Impact of additional funding on funding redistribution in Southwest Auckland

