The National School Nutrition Programme and Educational Outcomes in South Africa

Project for the Research Module in Management and Applied Microeconomics

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January 2023

1. Introduction

Given the large number of severe problems facing the world today, and the scarce resources to solve them, we need to evaluate the solutions to target problems on an effective altruistic basis, and allocate the resources we have in a cost-effective manner. Many studies show that free school lunch programmes are an efficient way to increase educational outcomes such as school performance and years of schooling for disadvantaged children. Education is central to South Africa's long-term development, especially in eliminating poverty and reducing inequality.

Our project focuses on the National School Nutrition Programme (NSNP) in South Africa. We base our analysis on a policy change during the implementation of the NSNP, using a regression discontinuity design to estimate its effect on school-level educational outcomes. We exploit a policy change from 2009 to 2011 which extended the NSNP to public secondary schools of quintile 1-3, respectively. Additionally, we construct a district-level poverty score based on the National Income Dynamics Study (NIDS), in order to have a continuous variable to run our regressions. Our poverty score calculation emulates the calculation of the original neighbourhood-level poverty score used for school quintile classification. Our results show a negative influence on the treated secondary schools. Then we discuss the potential reasons of our results deviating from the majority of research in this field.

2. Literature Review

2.1 The National School Nutrition Programme in South Africa

The National School Nutrition Programme (NSNP), commonly known as the school feeding scheme, was introduced in South Africa by the government in 1994. Aiming to prepare and serve nutritious cooked meals to learners in identified schools on all school days, the NSNP has three objectives: to enhance learning capacity through school meals; to strengthen nutrition education in schools; and to promote sustainable food production initiatives in schools.

Schools are divided into quintiles in this programme, and the quintile in which a school is placed depends on a score that reflects the poverty level of the community where it is located. Schools in quintile 1 are classified as the poorest, and those in quintile 5 are classified as the least poor. The NSNP was aimed to provide meals to all quintile 1-3 primary schools in South Africa, and was extended to quintile 1 secondary schools in April 2009, and quintile 2 and 3 secondary schools were included in 2010 and 2011, respectively (National School Nutrition Programme 2008).

Related papers suggest the following merits of the programme: encouraging regular attendance and punctuality, decreasing gender disparity, addressing micronutrient deficiencies, alleviating short-term hunger in children from poor socio-economic backgrounds (Van Stuijvenberg 2005, Buhl 2010), enhancing learning capacity and improving access to education (Drake 2016, McLaren 2015). Recent work by Mawela and Van de Berge (2020), which collected data through open-ended questionnaires, follow-up interviews and field notes, also indicates that the NSNP is a key lever, especially for children coming from poor households, which improves health and contributes to quality education in South Africa.

2.2 Worldwide free lunch programmes and educational outcomes

The vast majority of papers examined a positive relationship between the ‘free lunch’ programmes and the educational aspects of the program. A study worked by Wilcox (1993) in Honduras shows that the academic performance and mental ability of learners with good nutritional status were significantly higher than those of learners with poor nutritional status, irrespective of the level of family income, school quality and teacher ability. Other studies which indicating that school nutrition programmes have a positive impact on children's nutritional status and educational outcomes have been conducted in Western Zambia (Briggs 2008), China (Fang 2022) and Jamaica (Simeon 1989).

The impact of free lunches on educational outcomes has been studied in the literature using different empirical methods. In the state of South Carolina, Community Eligibility Provision (CEP) provides free lunch to school students, the researchers estimate a difference-in-differences model to identify the treatment effects of the program and find that CEP leads to a slight increase in math test scores (Gordanier 2020). Besides, Peter Hinrichs (2010) utilizes an instrumental variables strategy that exploits a change in the formula used by the federal government to allocate funding to the states, and

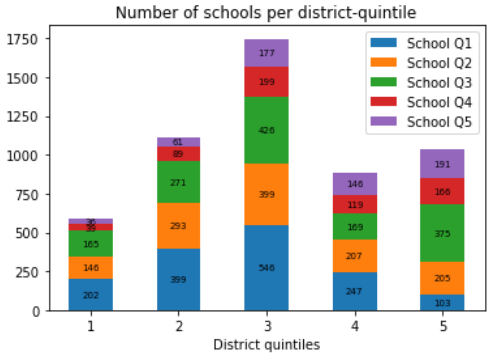
the participations appear to have long-run positive effects on educational attainment. Moreover, study conducted by Jordan and Adrienne (2012) implements the regression discontinuity design (RDD) to explore income differences between schools in the vicinity of the poverty eligibility cutoff. This is a good inspiration for our project, since we need to examine the difference in school-level graduation rates between quintile 2 and quintile 3 schools for 2010, as well as the difference between quintile 3 and quintile 4 schools for 2011. Through our previous research, we found that the schools in quintile 2-4 are all of a similar level, therefore, the RDD experiment is possible if other prerequisites are met.

3. Data and Variables

3.1 The eligible schools quintiles and poverty scores

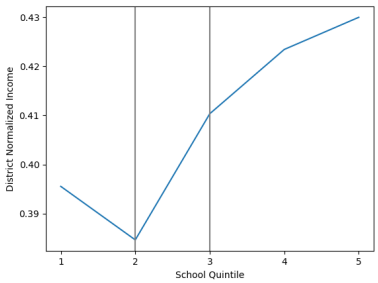
In our project, we will perform a RDD analysis based on the policy change in 2009, to allow children enrolled in secondary schools to benefit from the NSNP with daily free school meals as well. More specifically we will look at the change between 2010 and 2011. Children who have graduated in 2010 in quintile 2 or 3 schools will not have received free school lunches. However, in 2011 children who graduate from quintile 2 schools have received these lunches for a year, while children who graduate from quintile 3 schools have not.

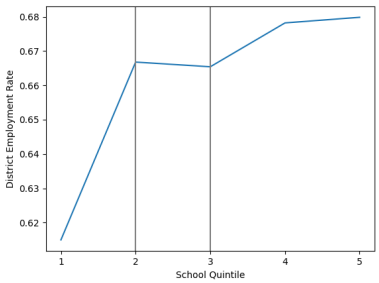
The administrative data which indicates school quintiles sadly does not include an exact formula for the calculation of the quintiles, nor the score that the quintiles themselves are based on. Because of this we need to calculate our own poverty score, along which we will select governmental districts into quintiles. For the calculation of our own poverty index on which we base the district quintile for our RDD approach, we use the National Income Dynamics Study (NIDS) data set. The NIDS is a household panel study conducted between 2008 and 2017 which follows over 28.000 individuals in South Africa spread across more than 7000 households. Among other variables it surveys the economic situation as well as the degree of education which individuals have attained. We are using data from the first wave of the study from 2008. Since the school quintiles were based on the poverty of the neighbourhoods around school, they are thus more fine-tuned, than our district quintiles based on calculated district poverty scores, as shown in the figure.

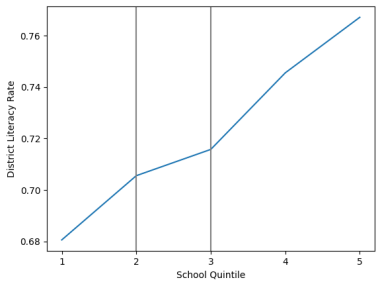


The calculation of the poverty score which school quintiles are based on includes three factors: income, unemployment rate and education level of the community around the school. For the calculation of our poverty score for the districts we are thus relying on corresponding variables from the NIDS data set. Income is calculated as a normalized average for every district. Unemployment rate is similarly straight forward. The level of education is approximated by the literacy rate of the district. For this we determine individuals over the age of 15 with more than six years of schooling functionally literate. Individuals over 15 with six years of schooling or less are functionally illiterate (Aitchison and Harley, 2006).

Figures following show the average scores of these district factors for each school quintiles. Although a drop occurs for quintile 2 schools in terms of district average income scores, which is in line with the mis-classification explained in our section 5 discussion, the overall scores is monotonically increasing with the school quintile.







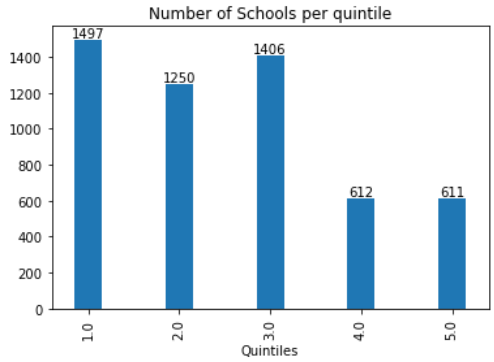
3.2 The school-level graduation rate of NSC

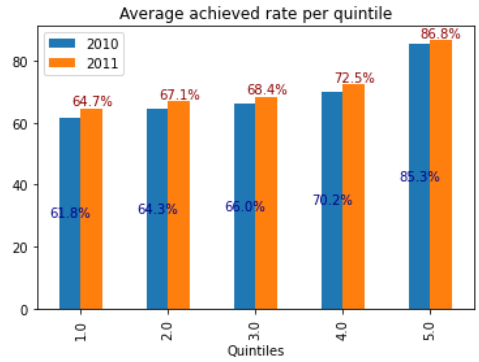
The National Senior Certificate (NSC) examination is an annual event of major public significance in South Africa. This certificate is commonly known as the matriculation (matric) certificate, and is obtained after grade 12. In this project, we use the graduation rate of NSC as the measurement of school-level educational outcomes.

The South African Department of Basic Education provides administrative data with national coverage NSC graduation rate, school quintile, as well as the district as the lowest geographical unit. We also use the SNAP Survey of Ordinary Schools data to fill the missing school quintile and district information in the NSC dataset.

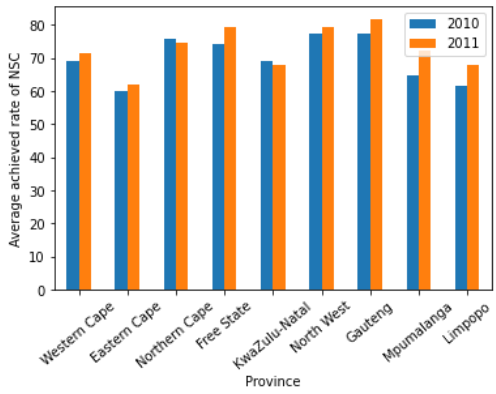
In order to get the school-level NSC graduation rate data with corresponding school characteristics, such as identity number from the national Education Management Information Systems (EMIS) and district code from school location, we conduct data cleaning as follows: First, we keep schools that belong to public and secondary sector level with non-empty graduation rate and valid school EMIS numbers; then we calculate the school NSC graduation rate by averaging the male and female graduation rates; next, we replace invalid school quintile values and missing district information with data from the SNAP survey.

Based on the final dataset of our project, some descriptive information support the feasibility for RDD regression. Our final NSC dataset contains 5509 and 5523 schools in the year 2010 and 2011, respectively. Besides, we compare the school characteristics from these two years to check the consistency, for instance the school quintiles. With 5376 schools being present in both datasets, no school has variety in its quintile levels. The distribution of schools (left side) and the average graduation rate of NSC by five quintiles (right side) are shown as follow.

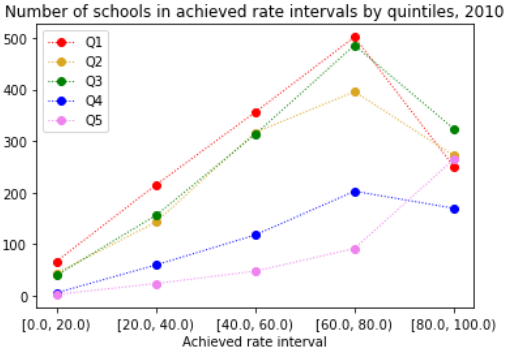


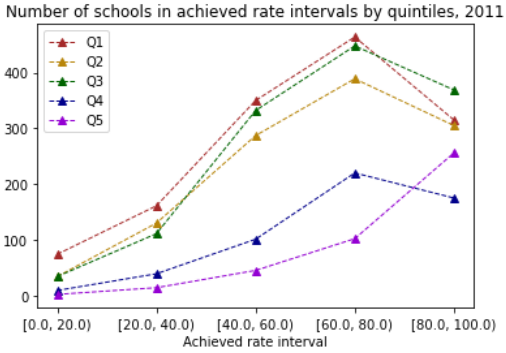


Furthermore, we calculate the average graduation rate for each province in South Africa, shown in the following figure. With 67.1% national average graduation rate in 2010 and 69.6% in 2011, our final data has no significant deviation from the annual report on the NSC examination, with 67.8% in 2010 and 70.2% in 2011 (DBE, 2011).



Next, we compare the different numbers of schools by quintiles in five graduation rate intervals, as shown in the left side figure for 2010 and right side figure with a darker colour for 2011. The majority of quintile 5 schools achieved the best performance in the NSC exam. Additionally, quintile 5 schools account for the least in below 80% graduation rate intervals, while quintiles 1 schools are a relatively large component in these intervals for both years. These descriptive data are in line with the value published in the annual NSC report (DBE, 2011).





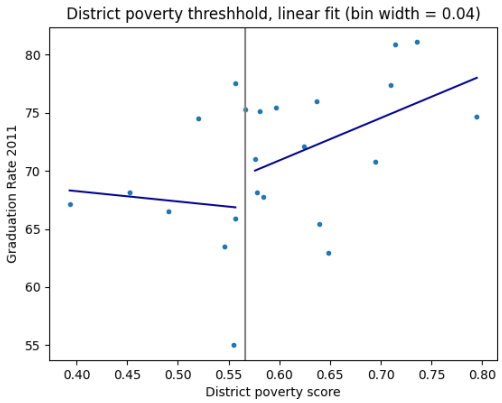
4. Results and Analysis

4.1 Empirical Strategy

4.1.1 Regression Discontinuity Design

Based on the policy change of provision during the implementation of the NSNP, we implement a regression discontinuity design. The dependent variable is the graduation rate, and the exogenous variable is the district poverty score which we calculated based on district income, employment rate and literacy rate using the NIDS data from 2008. We also calculated a school poverty score which includes the actual school quintile and is a poverty measurement at the school level, unlike our district poverty score.

The cutoff for our RDD is between school quintile 2 and 3, numerically the second quintile of the poverty score. Schools under this threshold are deemed treated (quintile 1-2), while schools over it are untreated (quintiles 3-5). We will focus on the year 2011, where students in quintile 2 schools received free school meals, while students in quintile 3 and above do not. It is impossible for students to manipulate school quintiles, however schools who are in higher quintiles usually have higher graduation rates and better students may tend to go to these schools. The figure below graphically demonstrates the validity of our RDD approach, showing a linear fit on either side of the school quintile cutoff. Note that this represents the entire data set and not only data within the bandwidth for the RDD.



Our regressions are based on three different bandwidths, 0.025, 0.04 and 0.08. While larger bandwidths allow for more precise estimates, they also tend to make the linear specification less fitting, which in turn can bias the treatment effect estimates (Lee & Lemieux, 2009). Bandwidths lower than 0.025 proved to be too inconsistent, without a sufficient number of distinct values in the poverty score for the regression.

We compute the regression based on two different specifications. Firstly, a normal OLS regression at the point of discontinuity, the cutoff between the second and third quintile according to the given poverty score:

$$Y = \alpha + \tau \cdot D + \beta \cdot X + \varepsilon \ .$$

Y denotes the educational outcome, the graduation rate, and X is the poverty score, D is the dummy variable which equals 1 if treated and 0 otherwise. τ is the treatment effect, and β is the intercept for the poverty score.

However, using only one regression at the discontinuity assumes that the slope will be the same on either side of the cutoff (Lee & Lemieux, 2009). To remedy this issue, we use another regression model, which allows for different slopes on both sides of the cutoff. It is functionally equivalent to calculating local linear regressions on either side of the threshold:

$$Y = \alpha + \tau \cdot D + \beta_r \cdot X + (\beta_l - \beta_r) \cdot D \cdot X + \varepsilon \ .$$

Here β_r and β_l are the intercepts for the poverty score on the right and left side of the cutoff accordingly. This is reversed in comparison to Lemieux & Lee, since in our case the treated group is on the left side of the cutoff.

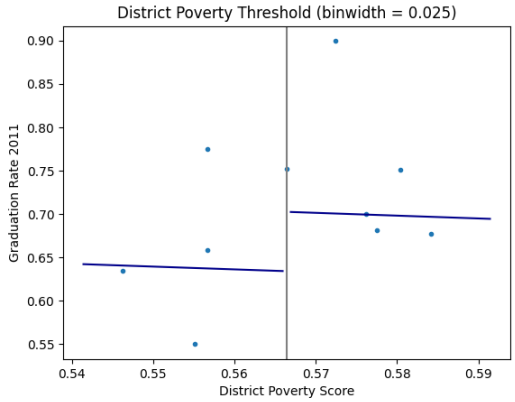
4.1.2 Differences in Differences

We also use a Differences-in-Differences approach to check our results for school quintiles 2 and 3. Due to the lack of public data for the graduation rates before 2010, we cannot check the parallel trends before the policy change for these two quintiles schools. Thus the DiD results are not very reliable. We still added the analysis as an additional check, since schools from these quintiles are very similar in most other regards.

4.2 Effect of the NSNP on the Graduation Rate

Table 1 shows our evaluation of the RDD regressions with the district-level poverty score being the exogenous variable, in which the first row shows the effect results on graduation rate. For the normal OLS regressions at all bandwidths, this effect is negative and statistically significant at 5 percent level, and for the two wider bandwidths even significant at 1 percent level. The results from the local linear regressions are ambiguous, with the treatment effect range from -3.207 for the 0.025-bandwidth to 0.933. The result for the smallest bandwidth is significant at the 5 percent level. However, the remaining results are not significant at the 10 percent level.

The difference between the OLS estimates (left side) and the local linear regression estimates (right side) are displayed in the following graphs. While both show a negative treatment effect at the discontinuity, the local linear regressions allow for a better overall fit.



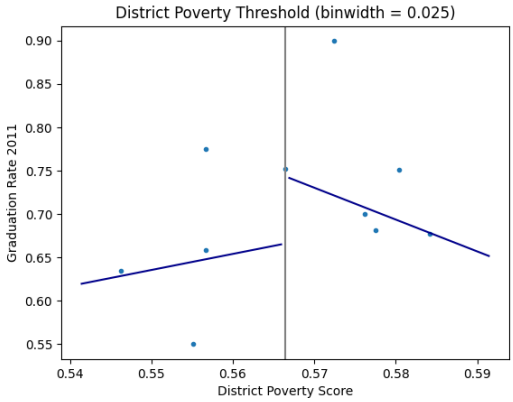


Table 2 shows the results for using the school-level poverty score as the exogenous variable. These results display a small negative intercept for the OLS estimates of the treatment effect, while the local linear regression results are ambiguous again. However none of the results for the treatment effect in this table are statistically significant at the 10 percent level.

If we control for school quintile in our models, the treatment effect increases in every case except for the local linear regression result using the school-level poverty score. For the school level poverty score it even becomes slightly positive in the OLS model. And yet, these results are not significant at the 10 percent level.

Table 1: Effect of Free School Lunches, Using District Level Poverty Score

	OLS				Local Linear Regressions			
Bandwidth	0.025	0.025	0.04	0.08	0.025	0.025	0.04	0.08
Treated	-0.068**	-0.0261	-0.109***	-0.056***	-3.207**	-1.614	0.933	0.166
	(0.030)	(0.030)	(0.024)	(0.012)	(1.243)	(1.231)	(0.923)	(0.207)
District Poverty Score	-0.323	0.363	-1.977**	-0.038	-3.672**	-1.342	-0.823	0.073
	(1.07)	(1.051)	(0.784)	(0.167)	(1.703)	(1.688)	(1.287)	(0.196)
Treated x District Poverty Score					5.525**	2.7944	-1.833	-0.398
					(2.188)	(2.165)	(1.623)	(0.371)
Controlling for School Quintile	No	Yes	No	No	No	Yes	No	No
No. of Observations	2471	2471	2598	3594	2741	2471	2598	3594
R^2	0.016	0.054	0.015	0.013	0.018	0.055	0.015	0.013

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Table 2: Effect of Free School Lunches, Using School Level Poverty Score

	OLS			Local Linear Regressions		
Bandwidth	0.025	0.025	0.04	0.025	0.025	0.04
Treated	-0.002	0.012	-0.020	1.230	0.514	-0.648
	(0.021)	(0.023)	(0.019)	(1.517)	(1.593)	(0.585)
School Poverty Score	1.497	1.976*	-0.137	3.484	2.757	-0.460
	(0.983)	(1.024)	(0.493)	(2.635)	(2.680)	(0.577)
Treated x School Poverty Score				-2.308	-0.942	1.191
				(2.840)	(2.988)	(1.109)
Controlling for School Quintile	No	Yes	No	No	Yes	No
No. of Observations	995	995	1371	995	995	1371
R^2	0.006	0.008	0.001	0.006	0.009	0.002

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Table 3 shows the DiD regression results, which is based on the actual school quintiles. It paints a similar picture as the majority of other studies, which shows a positive treatment effect, with 1.1577, though it is not statistically significant.

Table 3: Differences-in-Differences Results

Treatment	-2.6892**
	(1.0712)
Post	1.0960
	(1.0805)
Treatment x Post	1.1577
	(1.5148)
No. of Observations	3656
R^2	0.0036

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

We are not quite sure, how the negative treatment effect comes to pass so consistently in our RDD approach. Contrary to this our DiD finds results which are more in line with the literature. We expected the treatment effect of our RDD to be positive and the literature on free school lunches usually finds positive treatment effects. We believe it could be an issue with the construction of our data as a combination of a district level poverty score and school level graduation rates. There could also be issues with the data from the National Income Dynamics Study that we used. An interesting outlier in the data is, that the average district income is lowest for quintile 2 schools, even lower than for quintile 1 schools. For other indicators the school quintiles rank in ascending order, like one would expect. We will discuss further possible reasons of the deviation in the next section.

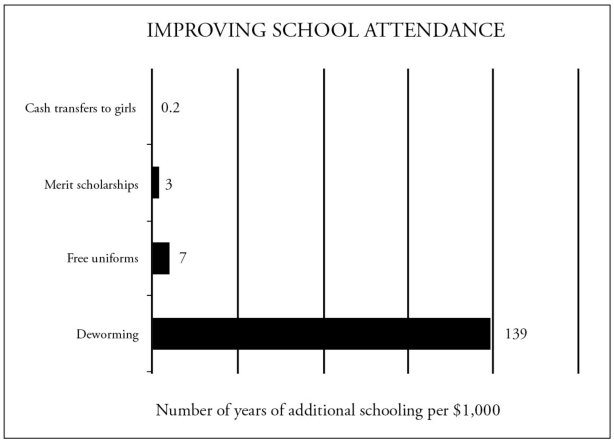
5. Discussion and Conclusions

5.1 Food hygiene and de-worming

There are some factors we need to consider during the implementation of NSNP, which may deviate our regression results. One essential factor is the condition of food hygiene. According to the NSNP Safety Directory issued by the Department of Basic Education in South Africa, personal hygiene and basic kitchen hygiene are important to prevent food contamination from surfaces, equipment and volunteer food handlers. In 2011, 1700 outbreaks of foodborne diseases among learners of primary and secondary schools were reported (Statistics South Africa, 2014). foodborne disease infections are associated with poorer academic performance, lower memory and IQ test scores, and lower school attendance.

Failure of food hygiene may be caused by both objective and subjective reasons. Many schools have food hygiene concerns due to inadequate funding. If schools implement NSNP, higher expenditures will be required for the increasing usage of electricity and disinfection equipment. However, the available resources of most schools involved in NSNP are usually inadequate to support the proper implementation of food hygiene systems, such as the lack of refrigerators and clean water, as well as the inadequacy of kitchen space and cooking facilities. Absent hygiene conditions will lead to food spoilage and increase disease, for example, gastrointestinal distress and parasitic infection. Another reason focuses on the food handlers' knowledge, awareness and attitude toward food hygiene. It is important for schools to provide regular training for food handlers on food hygiene practices, although studies have revealed that most of the NSNP food handlers lacked them. In an interview, only 22% of Eastern Cape food handlers stated that they had been trained (PSC, 2008), which is in line with our data, showing that Eastern Cape has the lowest average NSC graduation rate, only 60.7% in 2010 and 62.2% in 2011. Besides, studies also found that some voluntary food handlers, while having knowledge of food safety and hygiene, did not always practice what they knew. These reasons discussed above will cause foodborne disease infection and have negative effects on the expected results of NSNP.

Due to the high level of parasitic infection in South Africa, special attention should be given to food hygiene during the implementation of NSNP. Methods to address infectious diseases in schools contain ensuring the availability of adequate infrastructure, training knowledgeable and skilled food handlers, as well as de-worming, an impressively cost-efficient trial program. The previous implementation evaluation of NSNP found that there was no micronutrient supplementation, deworming, or nutrition education as defined in the aims of the programme. In Kenya, deworming reduced a chronic problem in schools, absenteeism, by 25 percent (Miguel and Kremer, 2004). According to Givewell, the cost efficiency of helping children avoid intestinal parasitic infections globally is $82 a disability-adjusted life-year (DALY), making it the most donated health intervention in the world, and a promising example of effective altruism. Additionally, in the context of education, the estimation differences between programs with measurable positive impacts are enormous (MacAskill, 2015). Deworming schoolchildren yields an additional 139 years of school attendance per $1,000, which does much better than providing cash rewards to girls who stay in school or providing free primary-school uniforms. Based on the cost-efficiency of de-worming, it has become part of the NSNP since 2015 (DBE, 2015), and the CGF stipulates that 0.5% of the funding received should be spent on de-worming (National Treasury, 2015).



5.2 Quintile targeting system

Given limited budgets in South Africa, an accurate quintile targeting system to identify the eligible schools is also a critical factor in the implementation of NSNP. A study found that geographic targeting is the most common form of targeting for school nutrition programmes in developing countries (Bundy et al., 2009). The NSNP uses a combination of geographic and poverty-based targeting, the quintile system.

The quintile system was introduced by the National Norms and Standards for School Funding (NNSSF), in which the National Poverty Distribution Table specifies the percentage of poor learners per quintile per province, and is used to identify the NSNP eligible quintile 1-3 schools and guide the budget allocation. Each quintile contains 20% of all learners nationally, but not 20% from each province. To rank schools into national quintiles, the Provincial Education Department (PED) will assign to each school in its province a school poverty score and produce a "resource targeting list", that will allow the PEDs to sort all schools from poorest to least poor. According to the NNSSF and Government Gazette, the "resource targeting list", which includes school EMIS numbers, the poverty score of each school, and the national quintile in which each school is situated, is sorted on the conditions at the school and the poverty of the community served by the school. Two equally weighted factors will be used to rank the schools: (a) The physical condition, facilities and crowding of the school. (b) The relative poverty of the community around the school, which in turn depends on the individual or household advantage or disadvantage with regard to income, employment, and level of education.

National poverty distribution table

	National quintiles					
	1 (poorest)	2	3	4	5 (least poor)	Total
Eastern Cape	28.2	21.7	19.7	17.4	13.1	100%
Free State	19.7	22.0	18.9	21.8	17.6	100%
Gauteng	12.7	15.4	19.3	23.0	29.6	100%
KwaZulu-Natal	20.9	22.2	21.1	20.2	15.4	100%
Limpopo	28.1	24.7	23.9	15.6	7.6	100%
Mpumalanga	25.3	22.4	21.0	18.7	12.7	100%
Northern Cape	22.3	22.6	21.6	20.6	12.9	100%
North West	23.5	23.4	18.7	17.0	17.3	100%
Western Cape	9.5	13.6	16.9	22.1	37.9	100%
South Africa	**20%**	**20%**	**20%**	**20%**	**20%**	**100%**

Figure above shows the National Poverty Distribution Table in South Africa in 2010 and 2011. It is not surprising that the national quintile distribution is identical in these two years. In fact, the government report notes that, for the sake of ensuring stability in the rankings, the schools are not easily moved from one quintile to the other even if enrolments change over the years. Additionally, the way the poverty of communities, and therefore also schools, is measured would change slightly with the proposed policy changes, but any change would occur slowly, so no school's position on the "resource targeting list" would change suddenly. Our project's data is consistent with this argument, as the valid school quintile values from the NSC dataset are the same in 2010 and 2011.

The quintile system is very useful as it has allowed resources to be targeted to support schools in the communities that are in most need. However, there are some discussions around the disadvantages of the quintile system, which may explain the potential deviation of our project's regression results.

One major critique of this targeting approach pointed out that the classification of some schools does not appear in line with the poverty level of the communities in which schools are located. According to the implementation evaluation of NSNP conducted by JET Education Services, even though the NSNP meals are reaching the intended beneficiaries in general, the current quintile system is excluding some poor learners from programme benefits, due to the criteria for classifying or targeting schools only considers school physical condition and its community resources, instead of taking into account the learners' social context. In other words, there are some needy learners from low socio-economic backgrounds attending quintile 4 and 5 schools that do not provide NSNP meals (DBE, 2014). For example, in Western Cape, all the learners in Thandukulu School come from Khayelitsha, meaning that they travel from a quintile 1 area to a quintile 4 school. As a consequence, some provinces (Gauteng, KwaZulu-Natal, Northern Cape and Western Cape) are providing meals to selected learners attending quintile 4 and 5 schools. But it may exclude the children attending quintile 4 and 5 schools in other provinces also who are in need of school meals. Hence, the evaluation of the quintile targeting system suggests that, apart from the school-level poverty of the area surrounding the school, it's also necessary to consider the individual-level poverty, i.e. the socio-economic status of the parents of the children attending the school.

Critics also believed that the current quintile ranking system does not work effectively due to the long-standing poverty and inequality in South Africa. A study found that the schools in the middle of the quintile system spectrum often looked similar. Indeed, an analysis of National Income Dynamics Study (NIDS) datasets shows, in the aspect of educational expenditure by household income quintile, neighbourhood and learner characteristics by school quintile, and school characteristics, there are very limited differences between quintile 1 to 4 followed by a large gap between these quintiles and quintile 5 (Branson, Lam and Zuze, 2012). Spaull (2013) pointed out that the current schooling system consists of underperforming schools comprising quintile 1-4 schools, and our data confirmed this critique with a similar average graduation rate among quintile 1-4 schools in both year 2010 and year 2011. Besides, a study revealed that mostly disadvantaged schools may assign to quintile 2-4, which may need the same or even more resources than quintile 1 schools (Motala and Sayed, 2009). Differences in terms of a school's characteristics between quintile 2-4 and often between quintile 1-4 do not appear to be very large. This indicated that schools with very similar resource deprivation may be receiving widely differing amounts of financial assistance, since the quintile system is also a reference of the school budget funding allocation, which may lead to the expected impact deviation during the NSNP implementation.

Due to the unavailability of the school poverty score data, in our project, we use the NIDS survey data to calculate district-level school poverty scores, in order to find the margin schools for RDD regression module. Based on the discussion above in this subsection, both inaccurate calculations for poverty scores and indistinguishable differences within quintile 1-4 schools could lead to biases in our regression results.

5.3 NSC graduation rate

In this project, we use the school-level graduation rate of the National Senior Certificate (NSC) as a measurement of the educational outcome relating to the NSNP policy change. According to previous research, the South African education system almost single-mindedly focuses on the NSC, since it is the only nationally standardized, externally set, and independently moderated exam in the school system. As a result, the NSC exam is seen as a relatively trustworthy indication of actual achievement. However, discussion around the measurement and the concept should not be ignored in the evaluation of social science experiments. Should the NSC graduation rate seen as an accurate indication of the educational outcome in South Africa?

Disputes arose due to the calculation of the NSC graduation rate, a ratio consisting of two numbers, the number of passes as a fraction of the number of candidates. The ratio can be improved by changing either or both of these quantities, and evidence has confirmed that these statistics are particularly misleading. Given that the NSC graduation rate is the proportion of Grade 12 learners that pass the NSC exam, its calculation does not take into account those learners who never make it to Grade 12. Data revealed that of 100 learners that start school, only 50 will make it to Grade 12, and 40 will pass the NSC exam. In the period 1999 to 2003, fewer learners were given the opportunity to write the exam whereas the number of passes stayed about the same, which lead the graduation rate to go up by manipulating the number of candidates. Furthermore, since passing the NSC exam can be achieved with a variety of different subject combinations (some easier than others), it is also possible to increase the graduation rate by encouraging learners to select easier subjects.

In short, while the NSC graduation rate has been increasing in recent years, this measurement is flawed in reflecting national education achievement to some extent, because it does not take into account the widespread drop-out pre-Grade 12 and the fact that more learners are opting for easier subjects. Hence, its improvement can be achieved by restricting opportunity or compromising quality, or both.

5.4 Conclusions

Through our RDD analysis, we find that the policy change of the NSNP that extendedly provide free lunch meals to secondary schools in South Africa has a negative effect on the school graduation rates. Although our results are inconsistent with most previous studies, the negative results may be caused by the inaccurate classification of the school quintiles. There are some issues with our exogenous variables. The district-level poverty score is likely too different from the actual neighbourhood-level poverty score for the NSNP. For the school-level poverty score, the effects are less negative than those with the more general district-level poverty score. Previously mentioned issues with the school quintile system such as quintile selection being dependent on the neighbourhood around a school instead of the school attendees themselves, as well as the potential manipulation of the NSC exam

results may also explain our results deviation. Beside, the NSNP eligible schools that receiving free meals may fail to ensure a good food hygiene condition, which in turns leads to foodborne disease infections among students and negatively influence exam performance.

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