

Treating schools to a new administration

Evidence from South Africa of the impact of system-level administration on school performance

6 June 2016

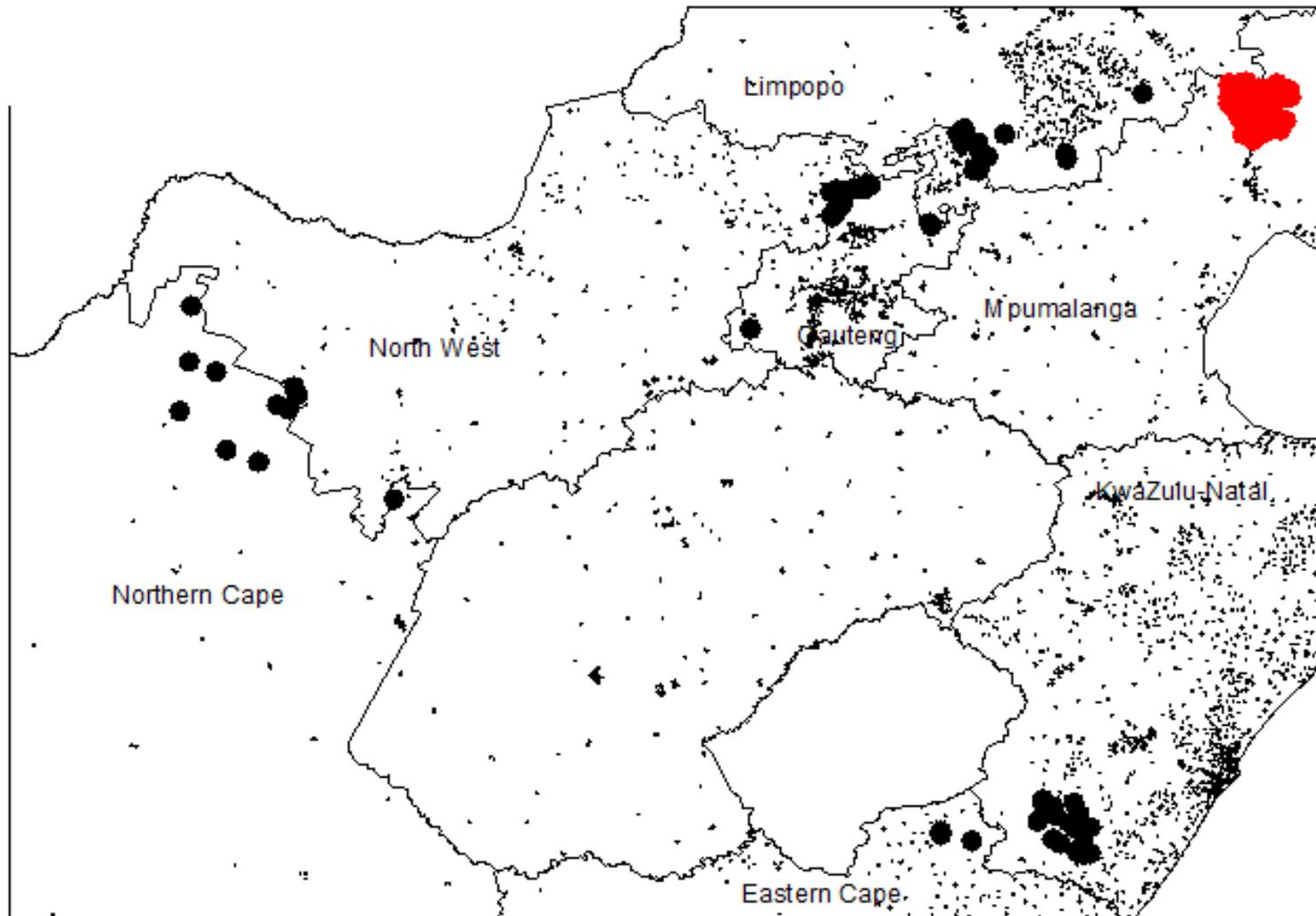
Stephen Taylor
Martin Gustafsson

Department of Economics, University of Stellenbosch
Department of Basic Education, SA government

Rationale

- *Skills* not *years* of education NB for economic growth
- Low quality education in many developing countries, including SA
- Lot of experimental studies measuring impact of various resources and interventions
- Critiques of RCTs
 - piecemeal interventions will not make enough of an impact on the gap
 - Replicability at scale by government (Bold, Sandefur, et al)
- We need to understand the contribution of system-level administration and how to create system-level change (RISE)
- Some work explaining improvements in TIMSS or PISA (Bruns)
- But this is near impossible to measure applying standards of the experimental literature
 - SA vs Finland

A rare natural experiment



Methodology

- Boundary changes of 2005 – official transfer 2007
- Provincial education departments fulfil the key administrative functions in SA
- Municipalities do not – the reasons for the changes were not educational
- About 150 experimental schools
- Analyse secondary school leaving exam data (2005 – 2013)
 - Data aggregated at school-level

Data

We focus on mathematics outcomes

Data

Three selection effects at play:

Selection into Grade 12 by not dropping out earlier.

Selection into mathematics.

Migration

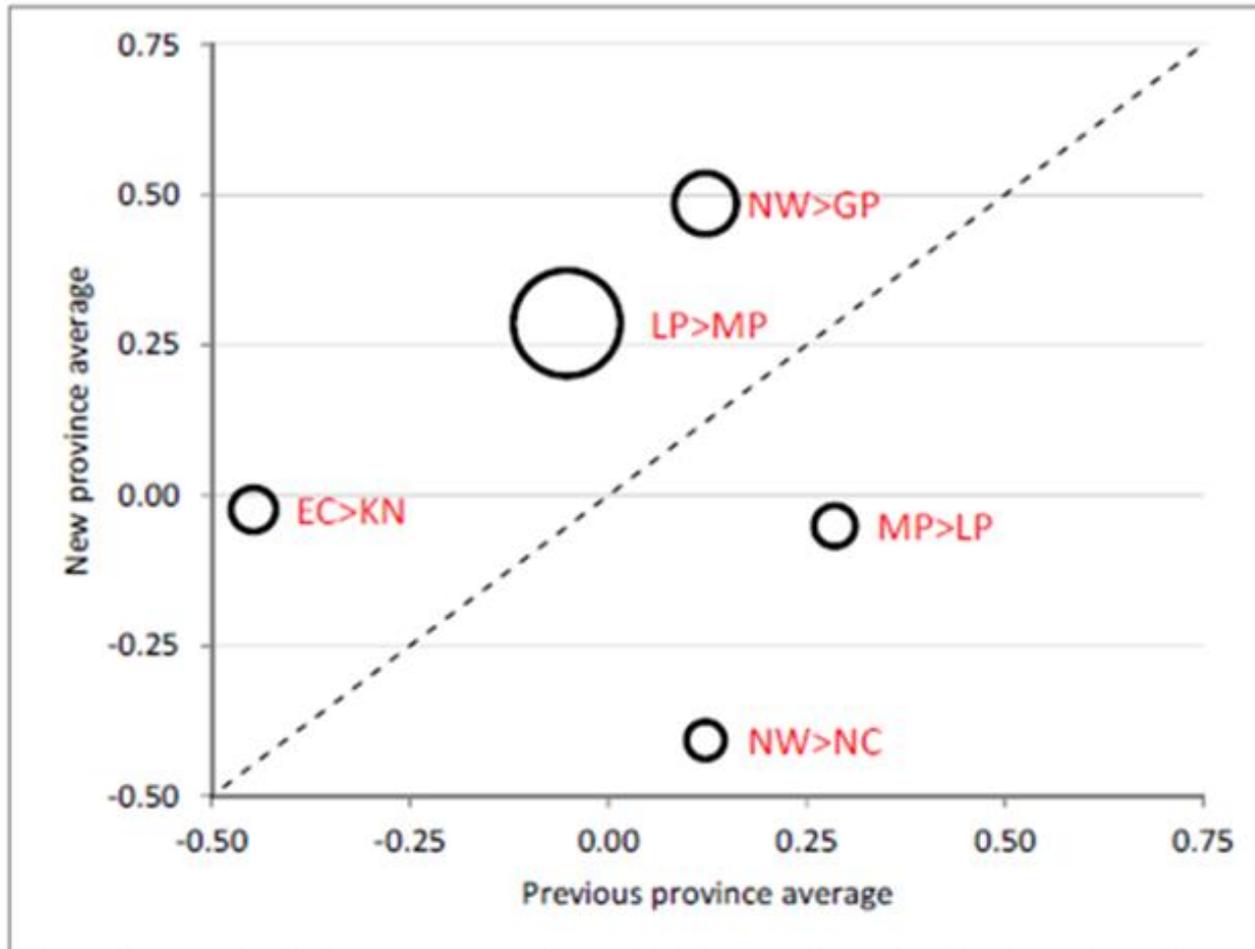
Data

Table 2: Descriptive statistics for the eight indicators for all years

| | Mean values | | | | | | | | | | Std. dev. | |
|---|-------------|-------|-------|-------|-------|-------|-------|-------|-------|------|-----------|--|
| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2005 | 2013 | |
| Schools | 5,628 | 5,609 | 5,579 | 5,600 | 5,585 | 5,616 | 5,628 | 5,602 | 5,456 | | | |
| Switching schools | 158 | 158 | 157 | 155 | 157 | 158 | 158 | 158 | 155 | | | |
| 1. % of mathematics-takers passing mathematics | 55.6 | 41.3 | 42.8 | 47.1 | 46.3 | 46.4 | 45.3 | 50.1 | 55.5 | 28.8 | 27.3 | |
| 2. % taking mathematics (SG included) | 58.6 | 57.5 | 57.8 | 52.0 | 52.1 | 49.5 | 45.9 | 44.0 | 41.9 | 23.4 | 22.8 | |
| 3a. Number of passes (SG included) | 28.2 | 22.0 | 24.3 | 23.2 | 22.3 | 20.8 | 17.3 | 19.8 | 23.2 | 31.8 | 30.2 | |
| 3b. Number of passes (SG excluded) | 4.9 | 6.6 | 6.9 | | | | | | | 12.9 | | |
| 4. Average mark | 25.4 | 19.7 | 20.0 | 31.1 | 29.8 | 30.7 | 30.6 | 32.4 | 34.6 | 11.8 | 12.0 | |
| 5. Mark at the 95 th percentile | 46.2 | 48.9 | 49.7 | 58.9 | 56.6 | 57.7 | 56.0 | 59.2 | 62.2 | 16.1 | 16.3 | |
| 6. Number of high-level passes | 1.3 | 2.0 | 2.1 | 4.4 | 3.1 | 3.0 | 2.2 | 2.7 | 3.3 | 5.3 | 9.0 | |
| 7. Mark at 95 th percentile relative to all Grade 12 | 40.5 | 42.6 | 43.4 | 50.4 | 48.5 | 48.7 | 46.7 | 48.8 | 51.0 | 16.0 | 17.7 | |
| 8. Mark at 95 th percentile relative to earlier Grade 10 | 32.2 | 35.3 | 36.7 | 41.9 | 40.1 | 39.9 | 37.1 | 39.5 | 41.9 | 17.5 | 19.3 | |

Note: For indicator 8, which relied additionally on data other than the examinations data, data from 5,624 schools were used, of which 158 were province-switching schools. For indicator 8, 2005 was the year with the lowest number of province-switching schools. Here the school count was 148. Note that standard deviations are at the school, not the student, level.

How much of a treat?



Note: Areas of circles are proportional to the number of schools. The values on the two axes are the average score values, at the school level, converted to z-scores.

Results: Regression models

$$E_{gi,t=2} = \hat{\beta}_0 + \hat{\beta}_1 E_{gi,t=1} + \hat{\beta}_2 \delta_g + \hat{\beta}_3 X_i \dots + \hat{\beta}_n Z_i + \hat{u}_i$$

$$\delta_{g,t=2} = \left(\frac{\bar{E}_{i,p=2,t=1} + \bar{E}_{i,p=2,t=2}}{2} \right) - \left(\frac{\bar{E}_{i,p=1,t=1} + \bar{E}_{i,p=1,t=2}}{2} \right)$$

Results: Regression models

| Dependent variable → | Mark at 95th percentile relative to earlier Grade 10 | | | |
|-------------------------------|--|--------------------|--------------------|--------------------|
| | A | B | C | D |
| Constant | -0.564*** (-16.31) | -0.564*** (-16.30) | -0.494*** (-10.24) | -0.494*** (-10.24) |
| 2005 value | 0.640*** (54.30) | 0.640*** (54.25) | 0.642*** (54.39) | 0.641*** (54.20) |
| Provincial diff. (δ) | 0.585*** (3.09) | 0.540** (2.53) | | |
| Is EC>KN (13) | | | -0.244 (-1.24) | -0.245 (-1.24) |
| Is LP>MP (75) | | | 0.233*** (2.75) | 0.231*** (2.73) |
| Is MP>LP (13) | | | -0.504** (-2.52) | -0.516*** (-2.58) |
| Is NW>GP (28) | | | 0.379*** (2.70) | 0.377*** (2.69) |
| Is NW>NC (10) | | | -0.136 (-0.60) | -0.137 (-0.61) |
| Is near LP>MP (20) | | | | -0.197 (-1.02) |
| Is near MP>LP (13) | | | | -0.197 (-0.92) |
| Is near NW>GP (28) | | | | -0.034 (-0.25) |
| Is EC 2005 | 0.066 (1.35) | 0.064 (1.32) | -0.059 (-1.21) | -0.059 (-1.21) |
| Is GP 2005 | 0.156*** (3.85) | 0.154*** (3.81) | 0.091* (1.76) | 0.093* (1.78) |
| Is KN 2005 | 0.359*** (11.22) | 0.358*** (11.17) | 0.293*** (6.39) | 0.293*** (6.38) |
| Is LP 2005 | 0.448*** (13.46) | 0.450*** (13.54) | 0.374*** (7.90) | 0.375*** (7.91) |
| Is MP 2005 | 0.445*** (9.79) | 0.441*** (9.70) | 0.396*** (6.99) | 0.407*** (7.11) |
| Is NC 2005 | -0.196** (-2.46) | -0.197** (-2.48) | -0.262*** (-3.04) | -0.261*** (-3.04) |
| Is NW 2005 | 0.192*** (4.16) | 0.190*** (4.07) | 0.124** (2.15) | 0.125** (2.16) |
| Is WC 2005 | -0.074 (-1.53) | -0.076 (-1.57) | -0.138** (-2.38) | -0.137** (-2.37) |
| Is quintile 5 | 0.111*** (3.08) | 0.111*** (3.08) | 0.106*** (2.94) | 0.105*** (2.91) |
| Is quintile 4 | -0.014 (-0.44) | -0.014 (-0.45) | -0.017 (-0.55) | -0.018 (-0.59) |
| Grade 12 enrolment / 100 | 0.367*** (8.69) | 0.370*** (8.76) | 0.363*** (8.59) | 0.364*** (8.61) |
| ...above squared | -0.048*** (-3.57) | -0.048*** (-3.61) | -0.047*** (-3.49) | -0.047*** (-3.51) |
| N | 5228 | 5228 | 5228 | 5228 |
| Adjusted R ² | 0.498 | 0.498 | 0.499 | 0.499 |

Remains significant if outcome is 2010, 2011, 2012

Distance up to 30km

Lower for other indicators

Note: *** indicates that the estimate is significant at the 1% level of significance, ** at the 5% level and * at the 10% level. Values in brackets next to coefficient values are t-values. Values in brackets next to switching categories are number of schools with the required data for use in the models. For the 2005 province dummies, Free State is the reference.

Adding school fixed effects

| Dependent variable → | A | B | C | D |
|---------------------------------------|--|--------------------|--------------------|--------------------|
| | Mark at 95th percentile relative to earlier Grade 10 | | | |
| Constant | -0.223*** (-19.17) | -0.211*** (-15.32) | -0.211*** (-15.32) | -0.211*** (-15.32) |
| Period (<i>P</i>) | -0.002** (-2.50) | -0.017*** (-3.69) | -0.017*** (-3.68) | -0.017*** (-3.68) |
| Provincial diff. (δ) | -0.261 (-1.31) | -0.289 (-1.42) | | -1.069 (-1.23) |
| Interaction of δ and <i>P</i> | 0.175*** (6.27) | 0.170*** (5.98) | | 0.022 (0.19) |
| Is EC>KN | | | -0.031 (-0.14) | 0.247 (0.78) |
| Is LP>MP | | | -0.158* (-1.67) | 0.094 (0.42) |
| Is MP>LP | | | -0.377 (-1.61) | -0.632** (-2.02) |
| Is NW>GP | | | -0.183 (-1.13) | 0.469 (0.84) |
| Is NW>NC | | | 0.485* (-1.88) | 0.517** (-2.00) |
| Interaction of EC>KN and <i>P</i> | | | -0.015 (-0.46) | -0.020 (-0.47) |
| Interaction of LP>MP and <i>P</i> | | | 0.092*** (6.94) | 0.087*** (2.87) |
| Interaction of MP>LP and <i>P</i> | | | -0.002 (-0.06) | 0.003 (0.07) |
| Interaction of NW>GP and <i>P</i> | | | 0.079*** (3.50) | 0.066 (0.89) |
| Interaction of NW>NC and <i>P</i> | | | 0.075** (2.09) | 0.076** (2.09) |
| Is EC 2005 (<i>EC</i>) | | -0.225*** (-7.40) | -0.225*** (-7.36) | -0.225*** (-7.36) |
| Is FS 2005 (<i>GP</i>) | | -0.044 (-0.89) | -0.044 (-0.89) | -0.044 (-0.89) |
| Is GP 2005 (<i>GP</i>) | | 0.036 (1.01) | 0.036 (1.01) | 0.036 (1.01) |
| Is KN 2005 (<i>KN</i>) | | 0.046* (1.93) | 0.046* (1.95) | 0.046* (1.93) |
| Is LP 2005 (<i>LP</i>) | | -0.100*** (-3.96) | -0.095*** (-3.68) | -0.095*** (-3.67) |
| Is MP 2005 (<i>MP</i>) | | -0.005 (-0.11) | 0.010 (0.22) | 0.012 (0.28) |
| Is NC 2005 (<i>NC</i>) | | 0.003 (0.03) | 0.003 (0.04) | 0.003 (0.04) |
| Is NW 2005 (<i>NW</i>) | | 0.131*** (2.89) | 0.146*** (3.13) | 0.146*** (3.13) |
| Is WC 2005 (<i>WC</i>) | | -0.037 (-0.79) | -0.037 (-0.79) | -0.037 (-0.79) |
| Interaction of <i>EC</i> and <i>P</i> | | 0.020*** (3.22) | 0.021*** (3.36) | 0.021*** (3.36) |
| Interaction of <i>FS</i> and <i>P</i> | | -0.013 (-1.54) | -0.013 (-1.54) | -0.013 (-1.54) |
| Interaction of <i>GP</i> and <i>P</i> | | -0.004 (-0.62) | -0.004 (-0.62) | -0.004 (-0.62) |
| Interaction of <i>KN</i> and <i>P</i> | | 0.014** (2.50) | 0.014** (2.48) | 0.014** (2.48) |
| Interaction of <i>LP</i> and <i>P</i> | | 0.045*** (7.88) | 0.042*** (7.24) | 0.042*** (7.24) |
| Interaction of <i>MP</i> and <i>P</i> | | 0.048*** (6.26) | 0.047*** (6.08) | 0.047*** (6.07) |
| Interaction of <i>NC</i> and <i>P</i> | | -0.037*** (-2.87) | -0.037*** (-2.88) | -0.037*** (-2.88) |
| Interaction of <i>NW</i> and <i>P</i> | | -0.011 (-1.41) | -0.011 (-1.44) | -0.011 (-1.44) |
| Interaction of <i>WC</i> and <i>P</i> | | -0.019** (-2.35) | -0.019** (-2.36) | -0.019** (-2.36) |
| Grade 12 enrolment / 100 | 0.332*** (20.51) | 0.359*** (22.12) | 0.358*** (22.10) | 0.358*** (22.09) |
| ...above squared | -0.061*** (-13.46) | -0.067*** (-14.90) | -0.067*** (-14.87) | -0.067*** (-14.87) |
| N | 49313 | 49313 | 49313 | 49313 |
| Number of schools | 5624 | 5624 | 5624 | 5624 |
| R ² overall | 0.041 | 0.026 | 0.024 | 0.025 |

Summary of fixed effects regressions with different endpoints

| | B | C | | | | |
|---|---|--|--|--|--|--|
| | <i>Inter- action of δ and P</i> | <i>Inter- action of EC>KN and P</i> | <i>Inter- action of LP>MP and P</i> | <i>Inter- action of MP>LP and P</i> | <i>Inter- action of NW>GP and P</i> | <i>Inter- action of NW>NC and P</i> |
| 1. % of mathematics-takers passing mathematics | P00000 | N00P0P | 000000 | 000PPN | P000PP | N000P0 |
| 2. % taking mathematics (SG included) | 00NNNN | P0NNNN | N0PPPP | 00PPPP | 0000NN | P00000 |
| 3. Number of passes (SG included) | | 000000 | 000PPP | 000000 | P00NNN | 000000 |
| 4. Average mark | 0000PP | N0000P | N00000 | 000NNN | P000PP | 000000 |
| 5. Mark at the 95 th percentile | 00PPPP | 00000P | 00PPPP | 00000P | P000PP | 000000 |
| 6. Number of high-level passes | | 000000 | N00000 | 000000 | 0000PP | 000000 |
| 7. Mark at 95 th percentile relative to all Grade 12 | P000PP | 000000 | 00PPPP | P000P0 | P0000P | 0000PP |
| 8. Mark at 95 th percentile relative to earlier Grade 10 | PPPPPP | 000000 | P0PPPP | N00000 | 0000PP | 00PPPP |

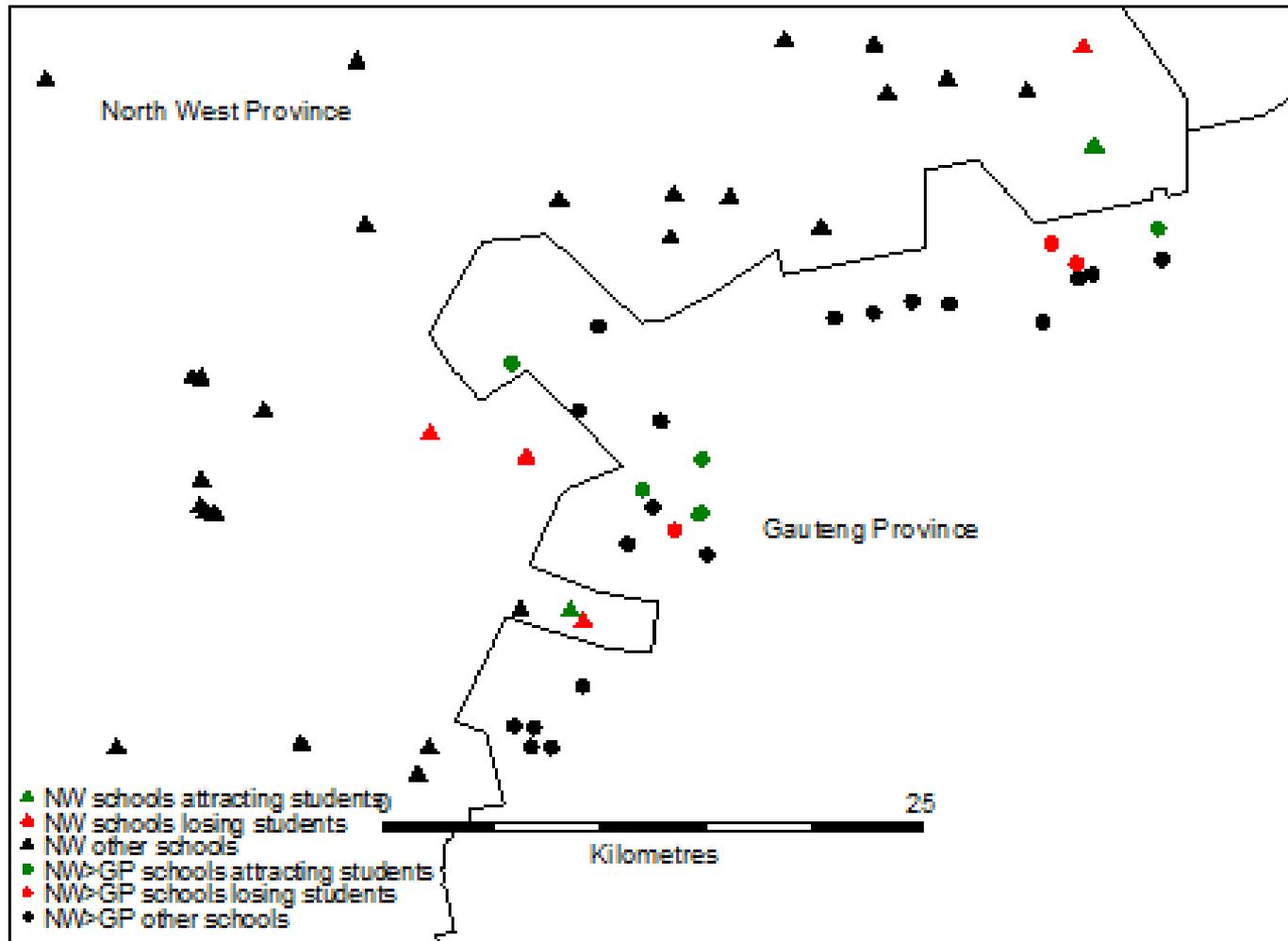
Note: Each string of six characters reflects the direction (negative or positive) of a coefficient, where that coefficient is statistically significant at least at the 10% level. The first of the six characters reflects the results if the fixed effects model spans the years 2005 to 2008, the second if the years are 2005 to 2009, and so on, up to the sixth character, which reflects the 2005 to 2013 model. The character 'N' refers to a statistically significant negative coefficient, 'P' a statistically significant positive coefficient, and '0' a statistically insignificant result.

Summary of fixed effects regressions with different endpoints

| | B | C | | | | |
|---|---|--|--|--|--|--|
| | <i>Inter- action of δ and P</i> | <i>Inter- action of EC>KN and P</i> | <i>Inter- action of LP>MP and P</i> | <i>Inter- action of MP>LP and P</i> | <i>Inter- action of NW>GP and P</i> | <i>Inter- action of NW>NC and P</i> |
| 1. % of mathematics-takers passing mathematics | P00000 | N00P0P | 000000 | 000PPN | P000PP | N000P0 |
| 2. % taking mathematics (SG included) | 00NNNN | P0NNNN | N0PPPP | 00PPPP | 0000NN | P00000 |
| 3. Number of passes (SG included) | | 000000 | 000PPP | 000000 | P00NNN | 000000 |
| 4. Average mark | 0000PP | N0000P | N00000 | 000NNN | P000PP | 000000 |
| 5. Mark at the 95 th percentile | 00PPPP | 00000P | 00PPPP | 00000P | P000PP | 000000 |
| 6. Number of high-level passes | | 000000 | N00000 | 000000 | 0000PP | 000000 |
| 7. Mark at 95 th percentile relative to all Grade 12 | P000PP | 000000 | 00PPPP | P000P0 | P0000P | 0000PP |
| 8. Mark at 95 th percentile relative to earlier Grade 10 | PPPPPP | 000000 | P0PPPP | N00000 | 0000PP | 00PPPP |

Note: Each string of six characters reflects the direction (negative or positive) of a coefficient, where that coefficient is statistically significant at least at the 10% level. The first of the six characters reflects the results if the fixed effects model spans the years 2005 to 2008, the second if the years are 2005 to 2009, and so on, up to the sixth character, which reflects the 2005 to 2013 model. The character 'N' refers to a statistically significant negative coefficient, 'P' a statistically significant positive coefficient, and '0' a statistically insignificant result.

Was migration driving the effects?

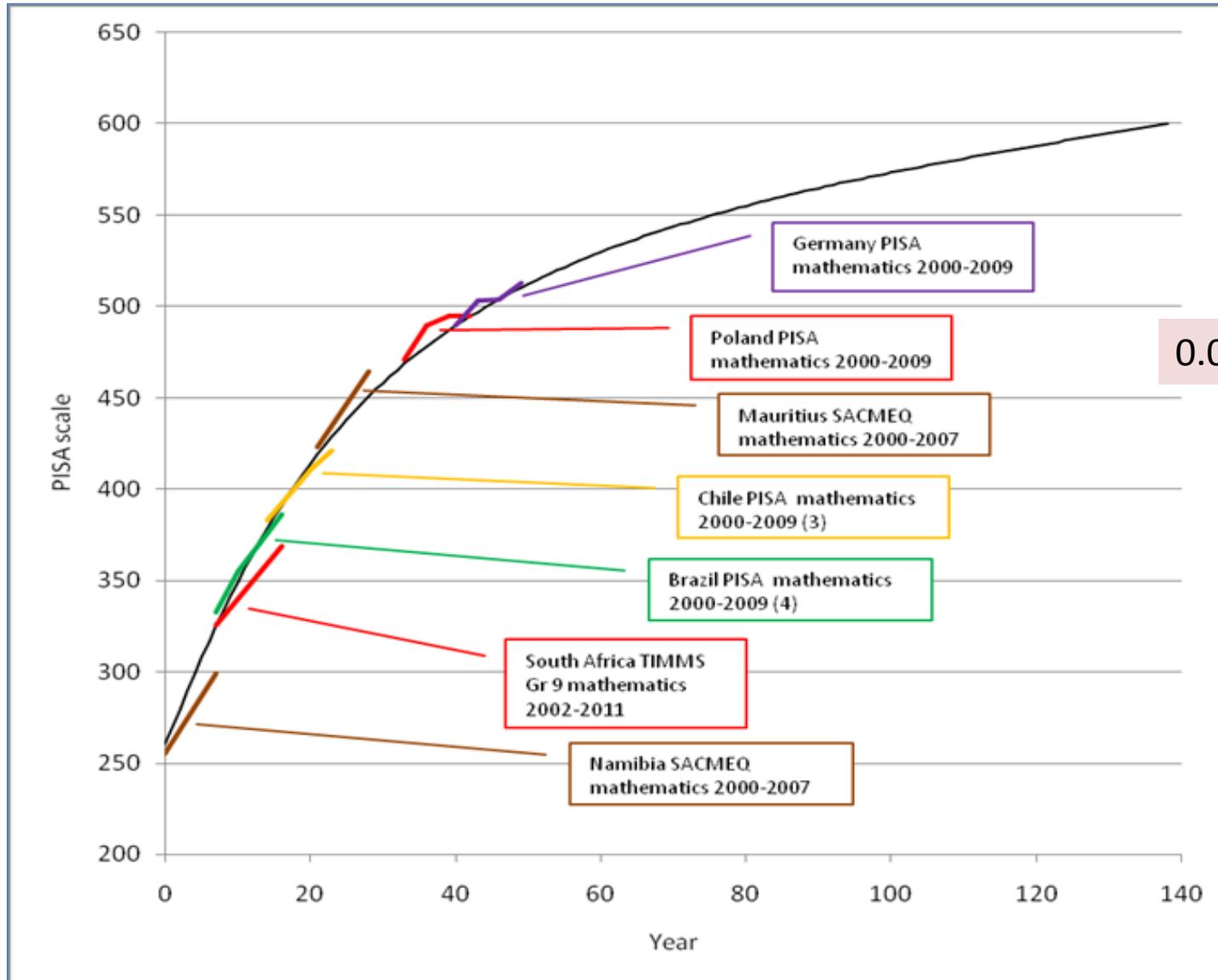


Note: Only schools remaining in North West and which moved to Gauteng are marked. Schools which were in Gauteng in all years are not marked.

How meaningful are these effect sizes?

- Overall, around **0.07** SD annually if translated to student-level standard deviations

Best possible trajectories



0.08 SD per year

What explains the administration effect?

- **Our analysis cannot say with empirical certainty**
- **Average public funding** per student virtually the same across provinces, so explanation not here.
- More efficient use of non-personnel funds, especially for educational materials
- Brokering of pacts between stakeholders, including teacher unions, schools and communities
- Better monitoring and support to schools from officials
- Fixed term contracts for Gauteng management

Implications

- “What interventions?” is only part of the question
- Rather, “Who intervenes”
 - Link to coach-specific effect in RCUP
- But, replicating the “who” is harder than the “what”
- Strong focus on improving administrative functionality could be an effective way to effect large-scale change