THE EFFECTS OF SCHOOL-BASED MANAGEMENT AND STANDARDS-BASED ACCOUNTABILITY ON STUDENT ACHIEVEMENT: EVIDENCE FROM PISA 2006

Ida Camminatiello*(1), Angelo Paletta(2), Maria Teresa Speziale(2)

(1)*Dipartimento di Matematica e Statistica, Università degli Studi di Napoli Federico II, Italy*
(2)*Dipartimento di Scienze Aziendali, Alma Mater Studiorum – Università di Bologna, Italy*

Abstract*: This paper provides new evidence on the simple and interaction effects of School-Based Management and Standards-Based Accountability on student achievement. The data used in the analysis comes from PISA (Programme for International Student Assessment) 2006 survey that assesses the performance in reading, mathematics and science of around 400,000 15 year-old students from 57 countries. We build a Structural Equation Model to investigate the relationship between student achievement and the other latent variables. Our findings indicate that the joint adoption of School-Based Management and Standards-Based Accountability has a significant positive effect on student achievement.*

Keywords*: School-Based management, Standards-Based Accountability, student achievement, structural equation model, PISA 2006*

1.   Introduction

School-Based Management (SBM) and Standards-Based Accountability (SBA) have been central issues in the international education policy debate over the last decade [2].
SBA identifies school accountability systems based on academic standards, which are largely widespread around the world [5]. These systems tend to focus on centralized tests to assess student achievement, usually by setting standards at a state or federal level, as the well-known No Child Left Behind (NCLB) Act in the United States.
SBM is defined as the decentralization of authority from the central government to the school level [3], which identifies the individual school as the primary unit of improvement and transfers

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* E-mail: camminat@unina.it

responsibility and decision-making over school operations to principals, teachers, parents, sometimes students, and other school community members [1]. Currently SBM is one of the key themes of Economics of Education addressed by the World Bank, thus becoming more and more implemented in both developed and developing countries.

The research literature in this interdisciplinary fields can benefit from various traditions of studies (e.g., school accountability, school effectiveness, school improvement, school indicators), which need to be better integrated. In many cases different authors use diverse terms to indicate similar concepts, so highlighting that SBM and SBA can be observed by multiple perspectives and take many different forms within the international education community.

The empirical evidence on the effect of SBM and SBA on student performance has shown some important results that should always represent the foundation of education policy reforms worldwide, but the debate is still hot and needs further investigation.

That having been said, our work intends to contribute to the framework of a recent series of cross-national studies based on PISA and TIMSS (Trends in International Mathematics and Science Study).

In particular, a recent paper, which makes use of a panel dataset constructed from the four waves of international PISA tests spanning 2000-2009, reveals that the decentralization of decision-making and school autonomy affect student achievement negatively in developing and low-performing countries, but positively in developed and high-performing countries [7]. Some other researches find that education systems in which schools have more autonomy experience improved test performance in the cases in which there are mandated external school exit examinations [6, 9, 10, 11].

This evidence seems to prove that the joint adoption of central examinations and school autonomy represents a precondition for the good functioning of decentralized education systems, by reducing the opportunistic behavior of local decision-makers.

Our paper provides new evidence on the simple and interaction effects of SBM and SBA on the student achievement assessed by an international cross-sectional survey. To be precise, the data used in the analysis comes from PISA 2006 survey, the third cycle of PISA, which measures the performance in reading, mathematics and science of around 400,000 15 year-old students from 57 countries.

We build a Structural Equation Model to investigate the relationship between student achievement and the other latent variables.

2.   Empirical Models

In our analysis, student achievement, SBM and SBA are unobservable variables called Latent Variables (LV), each measured by a set of observed indicators usually defined as Manifest Variables (MV), so the most proper statistic methodology is Structural Equation Modelling (SEM). Student achievement is measured by student performance in reading, mathematics and science. The MVs related to the other LVs consist of some selected questions of the "School Questionnaire", answered by the principals.

In order to show the simple and interaction effects of SBM and SBA on student achievement, we build two models by software SmartPLS 2.0 [8]: the first without interaction term and the second with interaction effect.

The model without interaction term consists of three LVs: student achievement, SBM, and SBA,

measured by the MVs described in Table 1. We assume that the LV student achievement depends on the other two LVs. We apply the Partial Least Squares estimation method [12].

The model with interaction term consists of four LVs: student achievement, SBM, SBA, and the interaction effect (SBM*SBA). Using the standardized or centered indicators of two predictor variables, product indicators are then developed by creating all possible products from the two sets of indicators. These product indicators are used to reflect the latent interaction variable. We assume that the LV student achievement depends on all the other LVs. For its properties, we apply the Partial Least Squares Product Indicator approach [4]. As suggested by [4], we assume that each MV reflects its LV.

Table 1. Latent Variables and Manifest Variables.

Latent Variables	Manifest Variables
Student achievement (achiev)	(reading) Student achievement in reading (math) Student achievement in mathematics (science) Student achievement in science
School-Based Management (SBM)	Q12 (SC12Q). Regarding your school, which of the following bodies: A) The school's "governing board"; B) Parent groups; C) Teacher groups; D) Student groups exert a direct influence on decision making about: 1) Staffing; 2) Budgeting; 3) Instructional content; 4) Assessment practices? (SC15Q1) Does your school provide information to parents of students in "national modal grade for 15 year-olds" on their child's academic performance relative to other students in "national modal grade for 15 year-olds" in your school? (SC15Q2) Does your school provide information to parents of students in "national modal grade for 15 year-olds" on their child's academic performance relative to national or regional "benchmarks"? (SC15Q3) Does your school provide information to parents on the academic performance of students in "national modal grade for 15 year-olds" as a group relative to students in the same grade in other schools?
Standards-Based Accountability (SBA)	D16 (SC16Q1) Which statement below best characterises parental expectations towards your school? A) There is *constant pressure* from many parents, who expect our school to set very high academic standards and to have our students achieve them B) Pressure on the school to achieve higher academic standards among students comes from a *minority of parents* C) Pressure from parents on the school to achieve higher academic standards among students is *largely absent* (SC17Q1) Achievement data are posted publicly? (SC17Q2) Achievement data are used in evaluation of the principal's performance? (SC17Q3) Achievement data are used in evaluation of teachers' performance? (SC17Q4) Achievement data are used in decisions about instructional resource allocation to the school? (SC17Q5) Achievement data are tracked over time by an administrative authority?
Interaction effect (SBM*SBA)	All possible products from the two sets of indicators

3. Results

Figure 1 shows the model without interaction term, the proportion of the variance explained by the model, R^2, and the path coefficients, which are both positive. This means that both SBM and SBA positively affect student achievement, but, as the coefficients are standardised, the effect of

SBA, with a path coefficient equal to 0.329, is more important than the effect of SBM on student achievement. However, the model goodness-of-fit measured by $R^2 = 0.167$ is low, so the model needs some improvements.
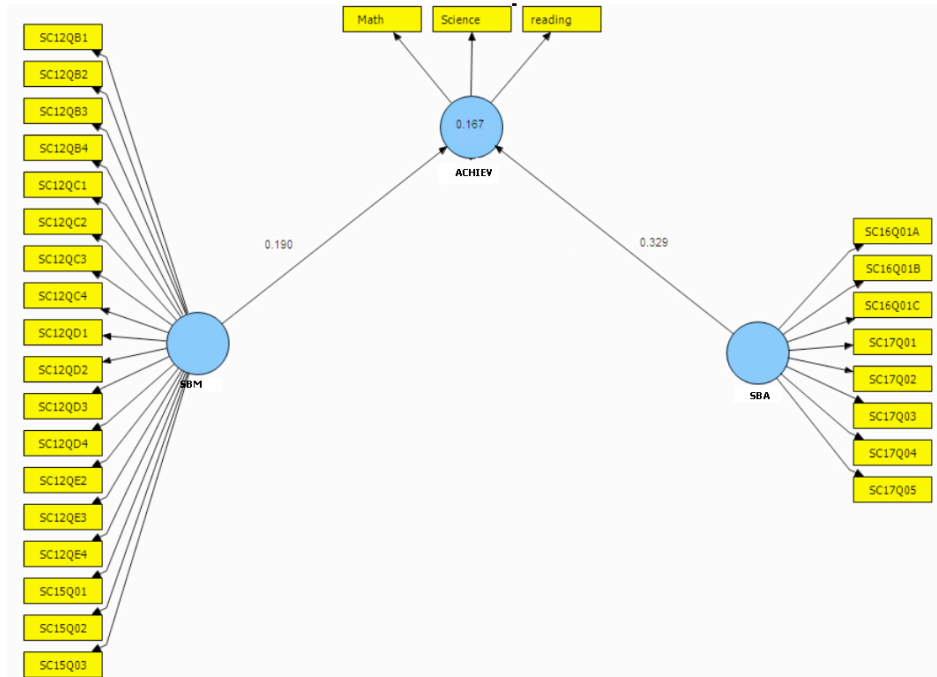

Figure 1. Model without interaction term.

In order to improve the model, we introduce the interaction effect between SBM and SBA and we carry out the model with interaction term.
First of all, as we suppose that each MV reflects its LV, it is necessary to check the unidimensionality of the blocks by means of Cronbach's alpha. Table 2 shows that all the values, except one that is equal to 0.69, are larger than 0.7, so the blocks can be considered unidimensional.

Table 2. Cronbach's alpha.

	SBM	SBA	Interaction term	Student achievement
Cronbach's alpha	0.69	0.83	0.93	0.85

Figure 2 shows the model with interaction term, the proportion of the variance explained by the model, R^2_{int}, the path coefficients, their bootstrap mean (in round brackets) and their p-values (in square brackets) calculated by bootstrap resampling. The model goodness-of-fit measured by $R^2_{int} = 0.510$ is considerably improved.

Therefore, we observe the interaction effect size, computed as $f^2 = \left(R^2_{int} - R^2\right)/R^2_{int}$, remembering that an effect size of 0.02 is regarded as weak, an effect size between 0.15 and 0.35 as moderated, and an effect size higher than 0.35 as strong. Since the effect size, $f^2 = 0.67$, is very strong, the model with interaction term is highly preferable.

Looking at the path coefficients, we can see that all the coefficients are positive, so the SBM, the SBA, and their interaction effect have a positive influence on student achievement. In particular, as the coefficients are standardised, we can state that the interaction effect is the most important driver for student achievement, with a path coefficient equal to 0.571, while the simple influence of SBA (path coefficient: 0.112) and SBM (path coefficient: 0.042) is considerably weaker.

For assessing the significance of parameter estimates, resampling procedures are used. The bootstrap procedure ensures that the path coefficients are stable. In fact, the bootstrap means of path coefficients are close to the estimations obtained on basic sample; the Standard Error of the bootstrap estimates for the path coefficients is low.

Considering that the path coefficient of the interaction term is significantly higher than the others and the path coefficient of SBM is low and has a p-value equal to 0.11, we can state that only the joint adoption of SBM and SBA can lead to a relevant improvement of student achievement.
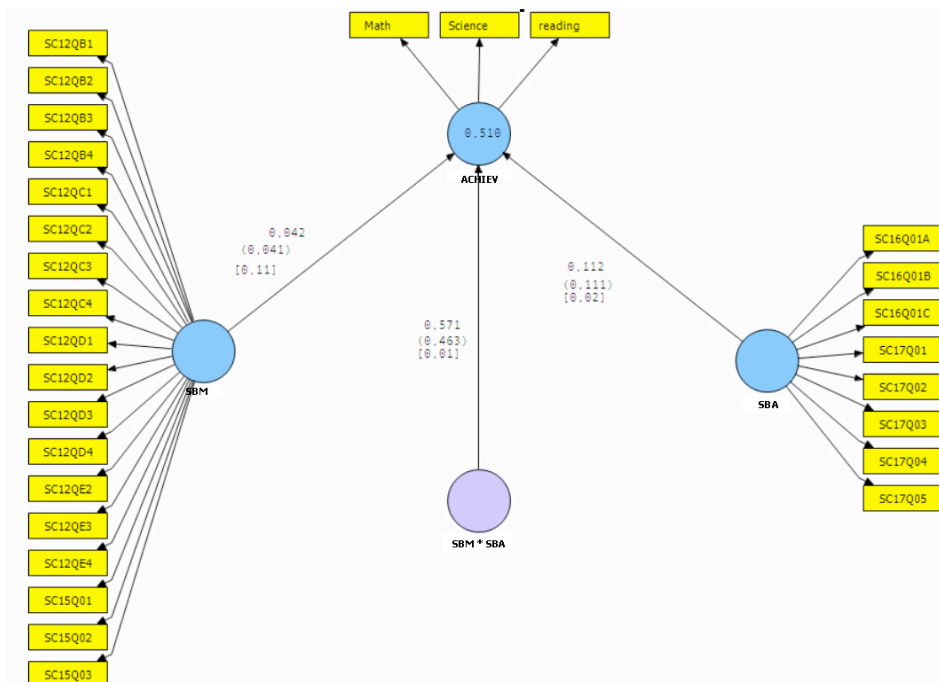

Figure 2. Model with interaction term.

4.   Conclusions

Our analysis, based on the dataset of PISA 2006 survey, leads to the following result: the separate adoption of SBM and SBA seems to have a positive effect on student achievement, especially in the case of SBA, but their joint application has a much stronger impact.

Though the model with interaction term is fairly good (usually R^2 are not high for SEM), further research could be developed based on the datasets of PISA 2000, 2003, 2006, and 2009. The identification of others LVs that can affect student performance and the introduction in the block of SBA of an additional MV related to central examinations, could help to improve the model.

Furthermore, considering in our research the distinction between developing and developed countries could lead to new findings. Lastly, this paper adopts a reflective scheme as suggested

by [4], but it could be interesting to use a formative scheme by a two-step construct score procedure [4]. The implementation of a formative scheme, where each LV is generated by its own MVs, could improve the model goodness-of-fit.

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