Why is the performance of Flemish and French speaking students so different?

A stochastic frontier approach

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1. Introduction[35]

PISA, the Program for International Student Assessment (OECD, 2007) evaluated students' performances of 15 years old children in 57 countries in 2006. In Belgium near 9,000 children participated in the Flemish, French and German Communities altogether. The results presented in Table 1 are average scores for the three tests: mathematics, reading and science. Students in the French Community are far away, 50 points in average, from students in the Flemish Community. With these scores the Flemish Community is among the top OECD countries and the French Community just below the OECD average. Also standard errors are higher in the French Community and indicate high dispersion of results compared with the Flemish Community. The German Community average scores and standard errors lie between those of the other two communities.

Table 1. Average scores by community - PISA 2006

Community	Reading	Mathematics	Science	Mean
Flemish	529.3 (97.7)	550.2 (93.3)	535.5 (87.6)	538.3 (88.5)
French	480.8 (105.1)	499.4 (99.3)	490.5 (100.6)	490.2 (95.9)
German	505.1 (99.6)	520.2 (93.0)	520.6 (94.8)	515.3 (90.4)
Belgium	511.4 (102.8)	530.9 (98.0)	519.6 (94.9)	520.6 (93.8)

Note: Standard deviations in brackets.

The question we address in this paper is simple: which factors can explain the performance gap between the Flemish and French-speaking students? Do they rest on pedagogical, financial, institutional considerations? Our hope is to deduce from this exercise some policy implications. Anticipating on what follows, we show that most of the performance slack cannot be explained with available variables; as a consequence, the way to improve the educational performance of the French community is still unclear.

To explain performance slacks, we rely on a stochastic frontier analysis estimation using students' individual data. Each student test scores are compared with an estimated best practice frontier, which is built taking into

[35] An earlier version of this paper was presented at the 18ème Congrès des Economistes Belges de Langue Française (Perelman et al., 2009).

account students' social background, peer group effects and schools' resources.

There exist a number of studies trying to explain those differences in scores by factors such as autonomy of schools, social origin of the students, size of classes, average spending, etc.[36] All these studies have in common to be unable to explain most of the performance gap between the two Communities. In a recent work Hirtt (2008) provides an interesting answer to that outgoing problem. His objective is to explain the differences in the scores in mathematics for PISA 2006. He does that simply on the basis of a simple regression explaining individuals' scores by social origin, immigration status, multiplicity of tracks, school backwardness and attitude vis-à-vis the PISA questionnaire. He is thus able to explain 25% of the difference between Flanders and the French Community.

This paper belongs to that vein of research. It applies the efficiency frontier approach[37] to PISA 2006, which rests on a wider sample and provides more information than the previous PISA waves. Indeed we have now detailed information on the way students are selected and the degree of autonomy of school management.

The rest of the paper is organized as follows. In section 2 we briefly present the data. Then we measure the degree of performance of each student belonging to the sample and then we try to explain performance slacks. A final section concludes.

2. Descriptive analysis of PISA 2006

In this section we present the main features concerning Belgian schools and students in PISA 2006 focusing on the differences between the three Communities (Dutch, French and German speaking) and between the two main types of schools, General and Vocational (TAP hereafter, TAP for Technical, Artistic and Professional).

The first part of Table 2 gives an overview of the schooling structure as it appears from the sample of students aged 15 in 2006. One discovers that in the Flemish Community, 53.7% of students are in vocational schools (TAP) whereas this proportion falls to 43.5% and 41.7% in the French and the German Communities respectively. In Flanders three quarters of students are in private (mostly catholic) schools whereas this fraction is 59.9% and 50.9% in the French and the German comunities.

The score gap in reading skills is about 100 points between the two types of schools, general and vocational, in the three communities. One finds also an important gap between students attending private schools and those attending state schools, the gap being to the favor of the former. This gap is relatively low in the French Community.

The second part of Table 2 underlines two key features of the student population: their origin (allochtone/autochtone) and their possible schooling backwardness at 15. One observes first that the percentage of allochtones students, defined as either the student either her both parents born abroad, makes about one quarter in the French Community (24.3%) and is even higher in the German Community (27.7%), in contrast with the low 9.0% among the Flemish students. At the same time, the gap in reading scores between autochthones and allochtones is by far the highest in the Flemish Community: close to 100 points (448.1 versus 537.1). It is only 30 points in the German Community (482.4 versus 513.7).

[36] See Zachary et al. (2002), Lafontaine and Baye (2007), Hirtt (2008), Verschelde et al. (2009), and Vandenberghe (2010), in this volume, among others.

[37] We use in this paper the methodology introduced by Perelman and Santin (2011) to study the performance of Spanish public and private education networks on behalf of PISA 2003 data.

Table 2. Average reading scores - School and student characteristics

Characteristics	Flemish Community		French Community		German Community	
	Part (%)	Score (std)	Part (%)	Score (std)	Part (%)	Score (std)
All	100.0	529.3 (97.7)	100.0	480.8 (105.1)	100.0	505.1 (99.6)
School						
Type						
General	46.3	587.1 (67.6)	56.5	523.9 (90.7)	58.3	540.2 (91.6)
Vocational (TAP)	53.7	478.8 (91.7)	43.5	421.0 (94.9)	41.7	455.4 (88.9)
Authority						
Public	24.6	493.5 (101.8)	40.1	460.6 (104.0)	49.1	474.2 (96.4)
Private	75.4	541.1 (93.3)	59.9	493.4 (104.5)	50.9	534.1 (93.8)
Student						
Origin						
Autochthon	91.0	537.1 (92.9)	75.7	494.0 (103.0)	72.3	513.7 (94.8)
Allochton [1]	9.0	448.1 (108.6)	24.3	440.2 (92.4)	27.7	482.4 (108.3)
Scholar career						
Without backwardness	75.3	554.6 (82.8)	54.2	529.5 (86.1)	58.6	549.7 (80.4)
Backward one year or +	24.7	478.8 (91.7)	45.8	419.9 (95.4)	41.4	440.6 (91.7)

Notes: Special education excluded. [1] Either the student, either her both parents, was born abroad.

As to the score gap between students without and with backwardness, it is the lowest in the Flemish Community where the phenomenon of grade repetition is also the lowest: 24.7% relative to rates above 40% in the other Communities. We now turn to three factors, which are often cited, in scientific work to explain schooling achievement: 1) family background, 2) peer group, and 3) available resources.

Concerning family background PISA 2006 provides a number of data (e.g., parents' occupation, cultural background) that are summarized in a synthetic indicator of Economic, Social and Cultural Status (hereafter ESCS). This individual indicator is used to build at the school level an indicator reflecting the sociocultural level of each school. Those two indicators are presented in Table 3 for each Community distinguishing between private and public schools.

Table 3. Educational inputs: public vs. private schools
Average values by community

	Flemish Community		French Community		German Community	
Educational inputs	**Public**	**Private**	**Public**	**Private**	**Public**	**Private**
Family background (ESCS) [1]						
- of the student	5.43	5.77	5.39	5.72	5.57	5.65
- of the peer group	5.54	5.88	5.50	5.83	5.68	5.76
School resources						
- quality (SCMATEDU) [2]	3.13	2.96	2.64	2.76	2.54	2.23
- hours/week of mathematics	2.80	3.23	3.41	3.49	3.56	3.57

Notes: Special education excluded.
[1] ESCS: Synthetic indicator representing the economic, social and cultural family status based on three type of information: highest occupational and educational level reached by parents and cultural belongs. Rank of variation: 1 to 8.44.
[2] SCMATEDU: Synthetic indicator representing de level of inadequacy of school resources: pedagogical and audiovisual material, computers, software and Internet access, library. Rank of variation: 1 to 5.07.
Source: OECD (2009), pages 340-346.

It can be noted that the ESCS indicator of a student and that of his school are consistently higher in private schools than in public schools. On average the ESCS of a student and that of his school are not much different. In contrast at the individual level, one observes wide differences.

School resources are represented by two variables reflecting the quality of the available equipment and the number of hours of mathematics delivered. The first variable is a synthetic indicator of quality labeled SCMATEDU that measures the adequacy of educational equipment with the objectives of the relevant school. It is based on questions addressed to the school managers on the availability of equipments such as libraries, computing facilities, etc. As to the number of math hours it is taken as proxy for the available pedagogical means.

Table 3 shows that the indicator of school resources (SCMATEDU) measuring the quality of equipment is higher in the Flemish Community than in the others. For the math hours, one gets the opposite outcome. The index SCMATEDU is higher in private than in public schools in the French Community; the opposite is true in the two other Communities.

A last word on three characteristics of schools under study: selection policies, autonomy and the skill of teachers. Table 4 gives an overview of these characteristics. First there is more selectivity in Flemish schools particularly in the private ones. In contrast in the French Community, a quarter of public schools and only one tenth of private schools are selective. As to the degree of autonomy and responsabilisation of schools management, it is relatively higher in the Flemish schools particularly the private ones. Finally, we have the qualification of teachers; one finds the most qualified in private schools, specially in the German speaking ones.

Table 4. Other school's characteristics

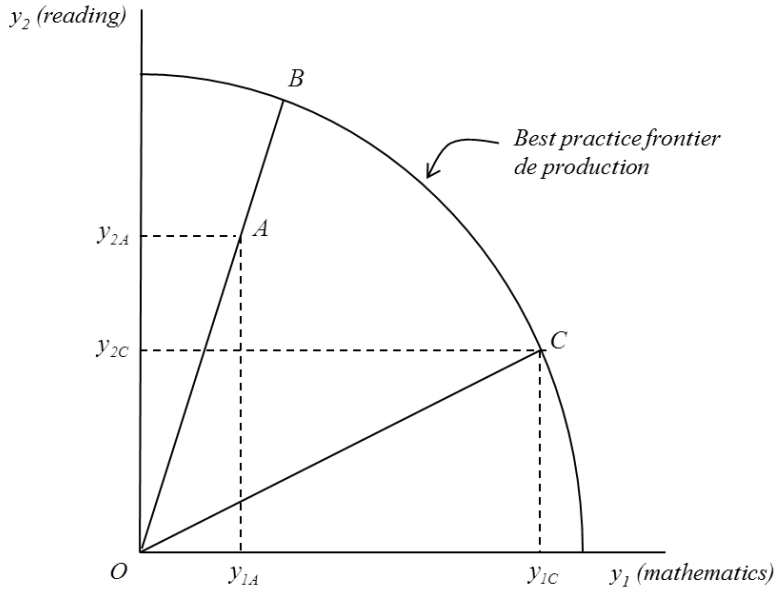
Variables	Flemish Community		French Community		German Community	
	Public	Private	Public	Public	Private	Public
Students' selectivity (%) (SELECT) [1]	30.4	39.0	24.8	8.1	0.0	26.3
School autonomy (RESPRES) [2]	1.658	1.857	1.107	1.114	1.077	1.130
Teachers' qualification (%) (PROP5A) [3]	33.0	38.7	31.8	37.2	38.8	65.4

Notes: Special education excluded.
[1] Students' selectivity (binary variable): SELECT indicates if the school selects students on behalf of previous reported results and potential recommendation letters.
[2] School autonomy: RESPRES is a synthetic indicator corresponding to the level of school autonomy and responsabilisation, e.g. budget and staff management. Rank of variation: 1 to 4.12.
[3] Teachers' qualification: PROP5A indicates the share of teachers with university degree diploma.
Source: OECD (2009), pages 307-310.

3. Measuring the inefficiency of 15 year old

The methodology[38] used here allows for simultaneously measuring the distance of each student' practice relative to the best practice and for explaining those distances on the basis of factors that are more or less exogenous. Figure 1 illustrates these concepts in a simple setting with two outputs. We assume in this example that there are two decision units, students A and C, who start with the same level of resources to produce two outputs y_1 and y_2, which represent scores in math and in reading respectively. C is efficient because his scores put him on the frontier whereas A is inside the frontier and his level of efficiency is given by the ratio OA/OB where B is the best practice score he should aim at and A is his actual score.

Figure 1. Best practice educational frontier



[38] Battese and Coelli (1995)

To construct the best practice frontier and calculate the degree of inefficiency, we consider 3 outputs and 4 inputs, being the decision unit the student belonging to the sample of PISA. The 3 outputs are the scores in mathematics, reading and science, and the 4 inputs are the ESCS of the student, that of his school, the quality of resources (SMATEDU) and the number of math hours per week.

As expected, the first two inputs have a dominant effect. We obtain for each student an index of efficiency; we have calculated the mean value of these efficiency scores for each community. They are presented on Table 5.

The observed means are those of Table 1, those of PISA 2006. Focusing on the French and the Flemish Communities we have a difference of 48.1 points. Going from the observed scores to the ideal ones, those consistent with the best practice, we obtain a difference of 7.4 (634.5-627.1) and thus an efficiency gap of 40.7 (96.2 – 136.9) to the benefit of Flanders. Note that the ideal scores in the two Communities vary to the extent that the educational technology is not linear. The efficiency gap between the two Communities is smaller than the observed scores gap as the best practice frontier of the French Community is below that of Flanders. In other words, a part of the observed gap (7.4/48.1), namely about 15%, can be explained by this difference in best practices.

We still have to explain this gap of 40.7 points (6.8% of efficiency). This is the objective of next section. But first note that the standard deviations of observed scores which reflect the inequity of our educational system are quite higher than the standard deviations of "ideal scores". In other words, if Belgium could end up on the best practice frontier, its educational system would turn more equitable.

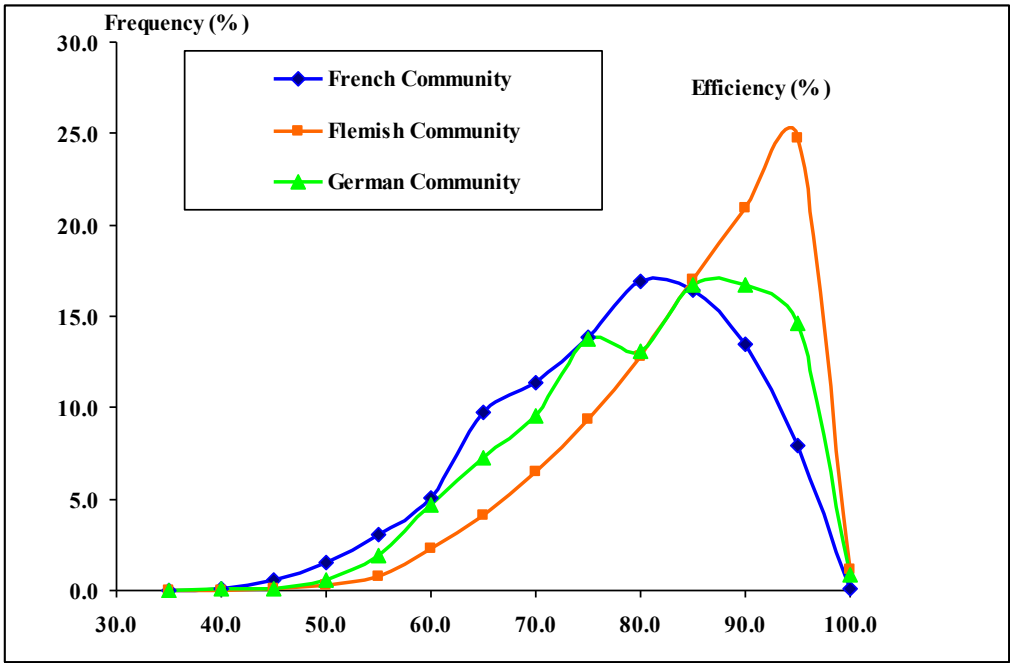
Table 5. Average efficiency scores (mathematics, reading and science)

Community	Observed	Frontier	Distance to the frontier	Average efficiency
Flemish	538.3 (88.5)	634.5 (39.9)	96.2 (57.8)	84.4 %
French	490.2 (95.9)	627.1 (46.1)	136.9 (63.1)	77.6 %
German	515.3 (90.4)	637.7 (33.6)	122.4 (66.6)	80.4 %
Belgium	520.6 (93.8)	632.5 (41.6)	111.8 (63.3)	81.8 %

Note: Standard deviations into brackets.

Figure 2 illustrates the distribution on efficiency scores (on the horizontal axis) for the three Communities. The most efficient students with scores above 97.5 % are located on the extreme right. They comprise 55, 2 and 7 individuals in the Flemish, French and German Communities respectively.

Figure 2. Efficiency scores distribution



4. Determinants of efficiency slacks

As already mentioned our methodology allows us to calculate the efficiency of each student and to explain it. More explicitly we want to explain as much as possible the observed gaps with respect to the best practice frontier on the basis of selected variables. These variables have been introduced for the first time in PISA 2006; they pertain to the selection policy of each school, its degree of autonomy, the qualification of its teaching staff. They have been introduced in our model along with variables related to the origin, the birth place of the student and that of his parents, the gender, a possible backwardness, the type of school (general or vocational ; private or public, Flemish, French or German).

We are first interested by the regression coefficients, their sign and their degree of significance. They are given in Table 6.[39] Allochtones do not do as well as autochtones and girls are outperformed by boys. Being backward hurts efficiency as well.

[39] We estimated another model in which the community dummy variables, French and German, were crossed with other variables. However, out of some marginal variations the results presented in Table 6 were confirmed.

Table 6. Explanatory factors of students' efficiency

Variables	Estimation		Effect on efficiency	
	Parameter	(t-ratio)	CFR-CFL	CGE-CFL
Student				
Girl	- 0.036	(0.005)***	- 0.1%	- 0.1%
Born abroad	0.004	(0.008)	-	-
Mother born abroad	- 0.020	(0.006)***	- 0.2%	- 0.2%
Father born abroad	- 0.038	(0.008)***	- 0.5%	- 0.4%
Scholar career				
Without backwardness	Reference		-	-
Backward one year	- 0.106	(0.005)***	- 1.1%	- 0.8%
Backward one year or +	- 0.235	(0.012)***	- 0.8%	- 0.9%
School				
Student selection	0.008	(0.004)*	- 0.1%	- 0.1%
Autonomy	- 0.003	(0.005)	-	-
Teachers' qualification	0.011	(0.015)	-	-
Share of girls	0.009	(0.009)	-	-
Type of education				
General	Reference			
Technical and artistic	- 0.092	(0.006)***	0.7%	0.8%
Professional	- 0.243	(0.008)***	0.4%	0.4%
Authority				
Public	Reference			
Private	0.017	(0.006)***	- 0.1%	- 0.3%
Community				
Flemish	Reference			
French	- 0.090	(0.006)***	- 5.1%	-
German	- 0.051	(0.009)***	-	- 2.6%
Intercept (Reference)	0.241	(0.020)***		
Total effect on efficiency			- 6.8%	- 4.0%

Notes: The parameters are estimated simultaneously with distance function parameters. The reference category corresponds to the intercept.
***, **, and *: significant at the 1%, 5% and 10% level, respectively.
Number of observations: 8595.

As to the main characteristics of schools, a selection policy fosters performance but with rather low significance (only 10%). Autonomy, skill of teachers and the gender ratio have no significant effects. Private schools do better than public schools and the students of vocational schools (TAP) have lower scores than the others.

Finally, unexplained performance slacks between the communities remain. The dummies "French Community" and "German Community" are associated with negative effects that are significant. Namely, most of the difference between the Flemish and the French Communities cannot be explained.

The last columns of Table 6 presents a decomposition of the efficiency gap between the Flemish Community on the one hand and the French and German Communities on the other hand. This gap amounts respectively to 6.8% and 4.0%.[40] Of that gap the above explanatory variables only explain 1.7% and 1.2%, which means that the dummy "Community" explains most of the gap.

[40] These effects are estimated taking into account the observed differences across communities for each characteristic.

In the comparison between the two Communities, some variables increase the efficiency gap and others diminish it. For example, schooling backwardness and father's origin are variables that contribute to reduce the gap while the choice of options increases it.

5. Conclusions

Trying to explain the differences in performance among Belgian schools is a difficult and risky endeavor. One cannot avoid being struck by the gap in average performance between the Flemish and the French Communities. Most of this gap remains when some variables such as private/public, nationality, vocational/general are introduced. It is then tempting to construct variables that contribute to reduce the gap but that basically reflect the dichotomy Flemish/Walloon. We do not want to resort to this statistical trick. One is then left with the key question: what makes Flemish schools perform better than French speaking schools?

The two regions are different in many respects: their language to start with, the rate of unemployment, the cultural life, the growth rate, the values and the expectations, the political leanings. The Flemish seems to be more dynamic and optimistic, more conservative and trusting the market than the Walloon. Can these and other characteristics explain the educational performance gap? Quite probably but we are here outside of the expertise of economists.

References

Battese, G. E., and Coelli, T. J. (1995), "*A model for technical inefficiency effects in a stochastic frontier production function for panel data*", Empirical Economics, 20, 325–332.

Hirtt, N. (2008), "*Pourquoi les performances PISA des élèves francophones et flamands sont-elles si différentes ?*" (http://www.skolo.org/spip.php?article452).

Lafontaine, D. and Baye, A. (2007), "*Au-delà du palmarès : Quels enseignements tirer des enquêtes internationales comme PISA ?*", 17ème Congrès des Economistes belges de Langue Française, Nos Régions en Europe, CIFOP, Charleroi, 225-245.

OECD (2007), PISA 2006. Science Competencies for Tomorrow's World, Paris.

OECD (2009), PISA 2006, Technical Report, Paris.

Perelman, S., and Santin, D. (2011), "*Measuring educational efficiency at student level with parametric stochastic distance functions: an application to Spanish PISA results*", Education Economics, 19(1), 29-49..

Perelman, S., Pestieau P., and Santin, D. (2009), "*Pourquoi les performances des élèves flamands et francophones sont-elles si différentes ? Une analyse par la méthode des frontières stochastiques*", 18ème Congrès des Economistes Belges de Langue Française, Quel Etat pour quelles performances économiques, Commission 2, CIFOP, Charleroi, 213-227.

Verschelde, M., Rayp, G., Schoors, K. and Hindriks, J. (2009), "*Analyse des disparités régionales d'éducation en Belgique*", ", 18ème Congrès des Economistes Belges de Langue Française, Quel Etat pour quelles performances économiques, Commission 1, CIFOP, Charleroi, 71-87.

Vandenberghe, V. (2010), "*Inter-regional educational discrepancies in Belgium. How to combat them ?*", Re-Bel e-books, 6, forthcoming.

Zachary, M. D., Dupriez, V. and Vandenberghe, V. (2002), "*Comparaison internationale de l'efficacité et de l'équité des systèmes d'enseignement de base au moyen de l'enquête TIMSS*", in De la Croix, D., Docquier, F., Minguet, Ch., Perelman, S. and Wasmer, E. (eds.), Capital humain et dualisme sur le marché du travail, De Boeck, Bruxelles.