"Functioning and regulation of educational quasi-markets"

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FUNCTIONING AND REGULATION OF EDUCATIONAL QUASI-MARKETS

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To Mister G.

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Part 1

Conceptual framework and definitions

Educational quasi-markets constitute a specific form of institutional arrangement, a particular way to organise funding and provision of education. Quasi-markets basically combine two ideas: public funding on a per-pupil basis and free school choice. In other words, quasi-markets form a subtle combination of the public funding principle and the market-oriented, competition-driven approach of educational production.

For several decades the Belgian education system — including primary, secondary and tertiary education — has been primarily based on a quasi-market principle (Le Grand & Bartlett, 1993 Glennerster, 1991). This institutional arrangement can also be found in the Netherlands (James, 1987). But educational quasi-markets are no longer a Belgian or Dutch curiosity. Free choice and market oriented schools are issues of great discussion in many countries, particularly in the United States (Friedman, 1962 ; Clune & Witte, 1990 ; Chubb & Moe, 1990 ; Bowles & Gintis, 1993).

Quasi-markets appeared in different contexts and for various reasons. Recent history suggests that they are becoming more and more popular in western countries. Generalisation and widespread diffusion of quasi-markets is a sufficient reason to analyse them more thoroughly, both theoretically and empirically. Yet there is probably another good reason to focus on quasi-markets. An economic analysis of education must nowadays focus on the educational system *per se*. We need to go into the black-box of the production process of educational services and study how educational inputs are transformed into outputs i.e. human capital.

Human capital accumulation can no longer be presented as merely an individual micro-economic problem with cost-benefit calculation totally determining the outcome (Schultz, 1961 ; Becker, 1964). The propensity of individuals to invest in themselves is still a crucial parameter of human capital production, but more and more observers (Jarousse, 1991), and numerous empirical phenomena suggest that institutional arrangements are decisive too. Institutional choice and regulatory arrangement — like quasi-markets — heavily determine the efficiency of educational systems.

Human capital theory takes for granted that an individual's demand of education will automatically be transformed into real human capital: there is no supply constraint. This optimistic view of human capital production seems less and less relevant. Similarly, education policy can no longer be reduced to the question of choosing the educational budget's size on the basis of an underlying rate of return on educational public investment. The reason for this is probably twofold. First, from a purely logical point of view, the economic analysis of education is bound to incorporate the supply side in its analysis of human capital production which was previously totally centred on the demand side. Second, and more fundamentally, growth of education has revealed itself more and more problematic over the last two decades. A clear symptom of this change is the now generalised use of the word 'crisis' to describe the state of the educational system. Accelerated technological and organisational change have contributed to substantial shifts in labour market demands, creating the qualification mismatch or inadequacy (National Commission on Excellence in Education, 1983). Increased unemployment for low-skilled workers and persisting job vacancy in some highly qualified — and relatively well paid — segments of the labour market is interpreted as a sign of the educational sector's inefficiency. In addition, public finances in most Western countries deteriorated dramatically over the last three decades.

We believe it is important to develop an economic analysis of the educational 'black box': its functioning, regulation and eventually the way it interacts with the rest of the social and economic system.

The discussion is organised as follows. Chapter 1 develops the idea that economic analysis of education needs to go beyond analysing the demand for education (i.e. human capital theory). The supply side of education needs to be fully integrated in the analysis, as presented in chapters 2 and 3. Chapter 2 focuses on the educational production function. It reviews the abundant empirical literature that has been devoted to this subject since the mid 60's. It exposes more recent conceptual developments, mainly those concerning the central role of peer effects in human capital production. Finally, chapter 3 addresses organisational and institutional issues. Quite logically, quasi-markets are analysed herein from both a theoretical and a historical point of view. Chapter 3 also contains a presentation of the specificity of the Belgian educational quasi-market.

CHAPTER 1. THE RENEWAL OF THE ECONOMIC ANALYSIS OF EDUCATIONAL ISSUES

Generally speaking, economic analysis focuses on mechanisms through which individuals interact to produce some allocation of scarce material and human resources. A question of central importance for economists is the nature of the co-ordination mechanisms. The survival and efficiency of a system are fundamentally conditioned by its ability to achieve some level of co-ordination or control of the many individuals and subgroups it contains.

Economic analysis is positive. It aims at understanding existing co-ordination mechanisms, in particular the way individual actions are aggregated inside entities to generate collective equilibrium. It is also normative. Very often, economic analysis aims at evaluating the relative performance or efficiency of different organisational schemes, mechanisms or principles in order to promote the diffusion of the best one.

1. HUMAN CAPITAL THEORY

Originally, economists neglected the analysis of co-ordination problems inside the educational sector. Human capital theory, which is the first contribution to the economics of educational issues, had almost nothing to say about educational systems and the way they function. It is solely concerned with the individual demand for education.

1.1. Private financing of human capital demand

In its first version (Becker, 1964), human capital theory presents a cost-benefit analysis carried out by individuals. Education amounts to an investment which generates a particular form of capital: human capital. This form of capital is non-separable from the individual. Individuals invest time and money in order to create and accumulate this very specific kind of capital. The amount of human capital incorporated in a human being directly reflects both his innate ability and the time he has devoted to his education. From a micro- or a macroeconomic point of view, the level of human capital chosen by agents (individuals or institutions) is the mirror-image of a classical cost-benefit computation. As individuals diverge in terms of ability and monetary endowment, equilibrium outcomes of this model suggest that human capital levels retained will diverge too: high-ability and rich students will opt for longer studies and graduate at a higher level in the educational hierarchy.

1.2. Public financing of human capital demand

Later, a second version of human capital theory appeared. Some economists suggested that human capital production could require public intervention under the form of public financing (Friedman, 1962; Stiglitz, 1974). It is argued that human capital has a semi-public character: it generates strong (positive) externalities (De Villé, Martou & Vandenberghe, 1996). Education provides benefits to society that individuals cannot privately capture and consequently do not incorporate into their optimisation process. There is thus a market failure justifying public funding.

Since the end of World-War II, political choice in the educational sector followed this principle. Note that, in practice, the choice of public financing for education was also accompanied by public production of education. No clear justification of the latter can be found in economic theory.

The argument for public financing of education can be stated as follows. Education generates first of all a personal utility under the form of a net return. If an individual can make a choice without rules or constraints, he will choose the service according to the returns or benefits (financial or socio-cultural) he thinks he will gain either immediately or in the long term. But the benefits of education are not only individual ones. They are also benefits to society. Education develops productive resources beyond what the individual himself or his employer captures. These social benefits are of two kinds. First it is claimed that the higher the average educational level of the labour force, the better information can circulate among productive units, and the more effective are learning and replication processes, the easier becomes the diffusion of innovation. Those benefits are positive externalities linked to the increased cognitive abilities induced by education. In addition education also enhances the individual's capacity to socialise, to be a member of society, thus contributing to social cohesion.

This coexistence of individual and collective benefits justifies calling education a 'semi-public good'. Education is not a pure public good because access to educational services can be restricted and those services can be produced privately.

If the financing and the production of semi-public goods were completely left to private decision-making, this production would be suboptimal from a social point of view. The typical illustration of this problem is the tendency of employers to under-invest in the training of their employees, if this training is not absolutely specific to the company's needs and thus transferable by the employee to other occupations. In such case, the employer might loose the private return on his investment and, as a consequence, tends to reduce training. Although logical from the employer's point of view, it is suboptimal at collective level. In order to circumvent this problem, education and training would have to be partly subsidised.

Another major limitation comes from the fact that the credit market for human capital is imperfect. Human capital is embodied within the individual. In case of loan default, the banker cannot force this individual to restore the accumulated capital. Risk premiums are consequently high and dissuasive. Some public financing of educational investment is consequently advisable.

2. BEYOND HUMAN CAPITAL THEORY

Education policy can no longer be solely based on human capital theory. The reason for this is twofold. From a purely logical point of view, the economic analysis of education is bound to incorporate the supply side in its analysis of human capital production which was previously totally centred on the demand side. This idea is developed in section 2.1. But there are also empirical reasons to this necessity to renew the economic analysis of education. Section 2.2 explains to which extent education revealed more and more problematic over the last two decades.

2.1. The theoretical factor

Human capital theory — be it the pure private financing model of Becker or the public financing model of the others — essentially develops a 'black box' approach to production of education issues.

a) Human capital theory: the black box is neutral

Our point is that none of these aforementioned models precisely explains how exactly an individual or a public investment becomes real. The implicit vision conveyed by these models is that educational systems are 'black boxes' that mechanically respond to their — private or public — clients[1].

One could argue that human capital theory is excessively based on the implicit assumption that schools and teachers do not have objectives of their own. As a result educational institutions are supposed to be passive and not submitted themselves to any constraints[2]. Regulatory challenges derived from human capital theory exclusively reflect the fact that this investment (i.e. the demand for education) is exposed to market failures.

b) The filtering theory: the black box does not matter

Signalling theory (Arrow, 1973; Spence, 1974; Traubman & Wales, 1973; Stiglitz, 1975) is also assuming supply-side neutrality. Competition to get into schools shows who are the most able students and gives a signal to employers and this is the only reason why some connection between education and income is observed.

Very few economists consider today that education is entirely synonymous with filtering (Blaug, 1987). Most of them adhere to the 'weak' version of signalling theory: filtering occurs, mainly at higher education level, but tends to co-exist with the more classical human capital production process. The controversy is not over. Econometricians are still trying to disentangle the two assumptions but with rather limited success so far.

But beyond this controversy the key point as regards to our question is that for the proponents of the signalling theory, the internal aspects of schools are largely irrelevant.

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1 This viewpoint is shared by other social scientists, mainly sociologists, who focus on social stratification, particularly the role of education in status attainment. The primary interest of those works regards the consequences of schooling — the years of schooling being the key independent variable — for occupational and social mobility (Bryk, Lee & Smith, 1990). In their contributions, the organisational structure of school is also conceived as a 'black box' whose internal organisation is not central to the analysis. Neither economists nor sociologists during the 60's offered insight into how the process of schooling actually produces the observed (desirable or undesirable) outcomes.

2 Once public financing is introduced — partly to respond to the aforementioned market failures — the implicit assumption concerning the supply side's neutrality is still made. Human capital formation is still analysed by economists as the result of a cost-benefit analysis wherein the public decision-maker problem is to compare the cost of his investment to expected economic growth or productivity gains (Denison, 1964; Jarousse, 1991 ; Blaug, 1976, 1987 ; Mincer, 1989 ; Psacharopoulos, 1984).

c) Modern vision of education supply

More and more observers (Gravot, 1993 ; Jarousse, 1991) consider today that individuals or governments investing in the educational system will not automatically get 'the best value for money'. Most economists recognise today that production of education services is exposed to asymmetry of information problems, quality control challenges and non trivial co-ordination strains. Human capital production is more than individual effort accomplished by pupils and students who expect some financial return on their investment during the rest of their life cycle. Education is also produced by teachers working inside educational organisations — schools — which are embedded in larger institutional structures. Teachers have some autonomy, make decisions and choices that can heavily influence educational outcome, and are no easy to observe and control. They can be particularly dynamic or lethargic ; they can be devoted to their clients' needs and obey social priorities, or behave selfishly. The way these actors behave depends on numerous variables of which institutional structures and organisational settings — incentives for example — are probably particularly important.

If this is true, the co-ordination problem inherent to education is most likely more complex than creating a price system, influencing the way individuals make a cost-benefit analysis or overcoming capital market deficiencies (i.e. subsidising education with public money). Both demand side and supply side have to be taken into account and be seen as a source of regulatory difficulties. A positive economic analysis of education should at least focus on the outcome of supply and demand interaction. Similarly, a more normative analysis ought to conceive educational policy instruments aimed at co-ordinating both categories of actors.

2.2. The empirical factor

Human capital theory is optimistic. In its colloquial version, it promotes the idea that education is a very powerful individual and social lever. Better educated people and nations will earn more and expand at a faster rate. Public investment in education can reduce income inequality and eradicate poverty. The sufficient condition for this, according to the human capital dogma, is simply to spend more public money on poor people's education. Yet, education did not keep all its promises over the last two decades. In addition, the public finances' crisis has progressively persuaded decision-makers that each dollar or franc of tax receipt ought to be spent more efficiently. Quite logically, those factors (and others) led most observers to the conclusion that supply-side factors deserved greater attention than in the past.

a) Rising income inequalities

It turned out during the late 70's and the 80's that educational expectations formulated during the 60's were over-optimistic (Danziger & Weinberg, 1986). Several socio-economic trends have invalidated human capital theory's claims in its aggregate version. The automatic connection between aggregate education level and economic growth showed its weakness when growth rates and productivity gains began to decline. Income inequality exploded dramatically (Murphy & Welch, 1992) although educational achievement differentials — measured by the highest grade completed — considerably shrunk during the same period (Hanushek, 1992).

As Glazer (1986) suggests, the 70's and the 80's revealed that publicly financed education programs did not succeed in eradicating strong income and socio-economic inequalities. Numerous categorical programs were either totally inefficient or of extremely limited impact. In the US, the implementation of positive discrimination in deprived areas (inner city) via special federal programs (Title 1) did not generate a substantial reduction of income inequality. On the contrary, in the 80's still greater income inequality appeared. Within 20 years, income inequality in the United States has returned to its 30's or 40's level (Goldin & Margot, 1992; Murphy & Welch, 1993). This phenomenon is apparently less spectacular in other OECD countries. Nonetheless, Katz, Loveman & Blanchfower (1993) show that most OECD countries witnessed a significant expansion of income dispersion over the last 20 years. More generous social security transfers and minimum wage protections have simply limited its downwards expansion. Consequently those policies do not seem to tackle the problem in depth.

The reduction of income inequality through education was probably over-ambitious and thus most likely to be disappointing to some extent. Economists and other social scientists have long viewed education as the solution to many social challenges including productivity, inequality, economic growth, health status, over-population and unemployment (Levin, 1994a ; Levin & Kelly, 1994). Expected results didn't show up probably because extra-school parameters have simultaneously evolved in an unfavourable direction.

Factors behind the recent unequalitarian shift in terms of wages and incomes are certainly numerous. The most important one is probably the skilled-biased technological progress which is particularly detrimental to individuals with lower skills (Piketty, 1994). Generally speaking, the dynamics of income distribution is particularly difficult to interpret. The current debate about the college wage premium illustrates this idea. In the United States and the United Kingdom, evidence shows that reward on college education — the private rate of return of education beyond secondary education — grew sharply. The college wage premium (i.e. the **relative** wage bonus higher education graduates get) rose sharply during 1979 and the late 80's in the US. Some observers argue that this is a clear indication that human capital investment keeps its promises. Others, like Levin (1993), argue that a rising college wage premium hides the fact that college graduate males' incomes[3] declined between 1968 and 1987 by about 10 percent in constant (1987) prices. The only reason for the college wage premium rising so dramatically was that there has been an even greater decline of earnings for high school graduates.

Labour market evolution and large-scale economic changes (technical progress, globalisation...) have depreciated less educated workers compared to their better skilled peers. Education's failure to equalise attainments and status is just one of the numerous factors contributing to the current pattern of income distribution.

b) America's temporary decline in educational achievement

Note however that educational outcome *per se* measured by standardised test score differentials also revealed disappointing. Some elementary school programs specially designed for 'at risk' children for example generated encouraging results. Nevertheless, those gains vanish rapidly when these children enter higher levels of the educational process (Glazer, 1986).

Other empirical factors, centred on the educational system's internal performance, have contributed to alter the human capital optimistic prophecy. Hanushek (1986) highlighted a relative decline in American pupils' standardised test scores: the famous SAT scores. The drop began in 1967 and lasted till the mid-80's[4]. More astonishingly, this reversal coincided with a substantial rise of per-pupil expenditure which was essentially due to a significant reduc-

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3 In absolute terms.

4 According to Pelztman (1993), the decline was remarkably pervasive, affecting many different types of students in most grades, in all regions of the United States, in Catholic as well as public schools and even in Canadian schools. The drop was apparent in the results of different kinds of tests covering many subject areas. We have not come across information suggesting that a similar test score decline has occurred in Europe or elsewhere in the world.

tion of the average class-size. This decline also coincided with a slow-down in terms of macroeconomic productivity gains (Bishop, 1989).

In addition, Glazer & Jencks (1986) revealed another educational setback. Between 1972 and 1982, the high school graduation rate dropped from 77,2 to 72,8 percent. Most significant declines were observed in heavily industrialised states: California (–11 percent), New York (–8.4 percent) and Michigan (–8.3 percent). Surprisingly, the most affected sub-group was the population of young white men.

c) Budget constraints

Growing concern about actual return of educational public expenditure has also to do with the crisis of the public finances. The mid-70's coincided with the first big public finances' crisis since the end of World War II. Keynesian economic policies which were implemented during the late 70's and the early 80's, combined with the economic growth slow-down and the rise of real interest rates, led to an explosion of public deficits and gave birth to dramatic public debts. Between 1970 and 1994, most advanced and industrialised western nations (G7 countries) doubled their public debt/GDP ratio: from an average of 40 percent, the latter inflated to 70 percent (The Economist, 1995).

In addition, as the population is growing old in most western countries, retirement costs and health costs are bound to rise significantly over the next decades (Wolfe, 1994). Especially in Europe, this means growing transfers from active population towards elderly people. It will thus become more and more difficult to increase the part of the budget devoted to educational investment (Shoven, Topper & Wise, 1994) unless there are spectacular growth rates and productivity gains.

d) Reinforced expectations

Yet, education is — more than ever — perceived as a vital issue by the vast majority of the population. Expectations are indeed high and exceed the simple willingness to obtain diplomas. In most European countries, persistent (and rising) unemployment has naturally led people to pay more attention to its visible determinants. No or limited education is certainly one of those. Quite logically individuals respond to the unemployment threat by increasing their demand for education. Parents want their children to graduate at a higher level and ask for better schools, more efficient teachers and programs that really prepare their children to meet the future labour market challenges. In addition, generalisation of secondary education — and higher education more recently — have depreciated the relative value of diplomas. This phenomenon could partly explain the users' growing demand for genuine quality (Maroy, 1992) i.e. 'real' knowledge synonymous with efficient schools and accountable teachers.

Employers are more and more demanding too. They believe that a better educated working force is a decisive condition for economic success in a more integrated economy, where technological evolution is constantly accelerating. Reports like the one written by the National Commission on Excellence in Education (1983) argue that a nation is 'at risk' if it does not produce enough students who meet rigorous educational standards. Skill mismatches are constantly reported. It is claimed that school graduates are insufficiently prepared to cope with modern corporate life. Schools and teachers are accused of being inefficient and incapable of adapting their curricula. There is a large consensus that some 'gap' has emerged between the educational system and the economic system. How to fill this 'gap' is a much more controversial issue at the forefront of political debate in most western countries (Levin, 1993).

3. CONCLUSION

Sections 1 and 2 contain evidence that education policy can no longer be reduced to the question of choosing the educational budget's size on the basis of an underlying rate of return on public educational investment. Educational processes can no longer be represented as a simple black box. Human capital accumulation can only be analysed through a complete model of 'supply of and demand for' educational services[5].

In order to fulfil this program, we must consider at least that some technology is at stake. We thus need an analysis of the educational production function, as presented in chapter 2. But we also need to consider the role of the institutional arrangement and the general problem of co-ordinating decentralised decision-makers. Actors involved in educational systems — individuals and organisations like schools — choose their strategy and enjoy some autonomy. These strategies are (or need to be) co-ordinated to some extent. This is typically done by institutions and regulatory mechanisms. The latter will be examined in chapter 3.

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5 For a development of the same idea in a slighty different context, see (De Villé, Martou & Vandenberghe, 1996).

CHAPTER 2. INSIDE THE BLACK BOX

Limitations of the human capital theory and dramatic shifts in the political and economic context have significantly contributed to a renewal in Economics of Education. In the late 60's some economists began somehow to revise the assumption that the black box's functioning was neutral with regard to human capital production. Supply-side Economics of Education appeared first under the form of production-function analysis (Cohn & Geske, 1990). The basic idea underlying this field of research was the 'production possibility frontier' commonly exposed in every undergraduate micro-economics textbook.

1. INSIDE THE BLACK BOX FIRST — PRODUCTION FUNCTION ANALYSIS

1.1. Production function — the concept

Most of these studies — surveyed by Hanushek (1986) and Monk (1992) — are based on a very simple assumption: education corresponds to some technology which has to be identified and efficiently used. Identification necessitates input/output cross-section empirical analysis. Correlation coefficients between all sorts of educational inputs (teacher salaries, class-size, capital expenditure...) and outputs (typically standardised test scores) are computed on a nation-wide scale. Econometric results are supposed to provide a significant international basis for educational decision making. Using the information delivered by the production function analysis, education policy makers and administrators can supposedly choose the most productive 'mix' of inputs. Complementary to human capital theory focusing on the demand side, the production-function stream of work represents thus a first step towards a better understanding of the supply side of the educational process.

1.2. Results

a) Coleman's no school effect conclusion

The first well-known empirical study exploiting the production function idea was carried out by Coleman & al. (1966)[6]. Its most striking result was that a

6 Coleman is not the first to consider what goes on in schools in an input output framework. British economists like Burkhead (1967) carried out production function estimation in

child's educational attainment appears essentially correlated to his socio-economic origin. Additional explanatory variables — essentially schools' input endowment — seem to be of little statistical significance. Coleman and his colleagues did not find the expected positive connection between per-pupil expenditure or average class-size and educational outcome generally measured by standardised test scores, controlling for initial human capital endowment (i.e. value-added measures).

b) Hanushek: no significant input-output relation

This very controversial result triggered off an impressive number of similar studies. In his 1986 survey, Hanushek comments more than 147 papers containing education production-function results over the last two decades[7]. His discussion tends to temper Coleman's very distinct conclusion. Yet, the same central idea remains.

The idea of socio-economic determinism is restated by Hanushek: a child's socio-economic background is of central importance to predict his level of educational attainment. Children whose parents are well-off or better educated get — on average — better academic results. Contrary to Coleman, Hanushek does not question the idea that school matters. Indeed, he concludes that 'some' schools and teachers are systematically more productive than others. Nonetheless he heavily insists on the fact that this observation is not statistically related to the level of inputs with a monetary expression, particularly the per-pupil expenditure.

Principal components of the per-pupil cost are the average class-size and the average wage per teacher which reflects both the compensation scheme's generosity and the distribution of qualification or seniority among employed teachers. Any of those sub-categories can be used as a separate regressor. Table 2.1

the early 60's. American literature also contains numerous studies on school effectiveness from the 20's on, but these are not due to economists.

7 It is worth stressing that cross-section production function analyses are logically more frequent in the USA than anywhere else in the world. The reason for this is twofold. First, education is heavily decentralised in that country. Per-pupil expenditure, teacher salaries... present substantial variance (Cohn & Geske, 1990). Thousands of American districts are indeed financing their educational systems with local property tax and this represents an impressive set of individual experiments that can be used by an econometrician to explore educational technology. Second, standardised test score measures are available on a nation-wide scale. Econometricians can thus use those results to create their dependent variables. In most European countries, education is financed centrally: teacher-to-pupil ratio, wage scales... are determined centrally and this means that variance is extremely limited. Hence, econometric studies must necessarily be carried out at international level. But this raises other difficulties : data is not always available or standardised.

summarises the information gathered by Hanushek. For example, out of 112 studies testing the class-size's impact on educational achievement, 89 conclude to the lack or the absence of statistically significant correlation. Only 9 studies clearly identify positive (statistically significant) coefficients. Similar results appear for the other components of the per-pupil cost or for the per-pupil cost *per se*.

Table 2.1 — Expenditure per-pupil coefficients in 147 production function analyses (Hanushek, 1986)

	Total Number of studies	Statistically significant		Total insignificant or unknown	Statistically insignificant		Unknown sign
		+	–		+	–	
Teachers/ pupils	112	9	14	89	25	43	21
Qualification	106	6	5	95	26	32	37
Experience	109	33	7	69	32	22	15
Salary	60	9	1	50	15	11	24
Total expenditure/ pupils	65	13	3	49	25	13	11

This striking result is as controversial as Coleman's initial statement about the absence of 'school effect'. Since 1986, new estimations have been carried out. Methodological considerations have come to light and have challenged Hanushek's meta-analysis approach (a census-like study). Greenwald, Hedges & Laine (1994) dispute his way of interpreting successive production function analyses and conclude that monetary inputs 'might' have some influence on educational achievements. They basically use a null test hypothesis argument to reject Hanushek's point. They argue that the 147 production function empirical analyses must be interpreted as a set of data randomly sampled. A relatively small proportion of positive and significant coefficients does not represent a sufficient condition to reject the null hypothesis[8].

c) Card & Krueger: earnings are correlated with per-pupil expenditure

Card & Krueger (1992) examined further Hanushek's perplexing conclusion. In their cross-states empirical study, they regressed post graduation wages (earnings) on per-pupil educational expenditure in the state of origin. Contrary to Hanushek, they conclude that higher public expenditure (a proxy for school quality) does matter. They argue that it is synonymous with higher remunera-

8 For a response to this argument see Hanushek, (1994)

tion at adult age. Their statistical models show a positive relation between average per-pupil school expenditure in the state and later earnings.

d) Controversy about Card & Krueger 's results

The debate about education production functions is particularly complex. A first reason is that researchers do not use the same proxy of educational achievement. Some researchers, such as Hanushek, focus on test results while others, like Card & Krueger, exclusively refer to wages. It is true that human capital theory predicts some connection between education achievement, productivity and individual wages. Yet, we know that labour market mechanisms — be they internal or external — have their own rules and interfere with the outcomes of the educational sector.

The second source of difficulty is simply that successive empirical studies come to opposite conclusions despite their relative homogeneity in terms of data and methodology. Concerning the relation between earnings and per-pupil expenditure, recent theoretical work (Hanushek, Rivkin & Taylor, 1995) stresses the potential upward bias affecting regression coefficients when the level of aggregation becomes higher. Card & Krueger (1992) typically use very aggregated data to create their per-pupil expenditure variable. This theoretical point finds some echo in empirical studies using less aggregated data i.e. data collected at school and district levels. Attempts to replicate Card & Krueger's results at that level have not shown similar patterns (Betts, 1995).

Card & Krueger restrict their analysis to mobile individuals i.e. individuals that are no longer living in the state (or district) where they got educated. They assume that observed earnings result from two effects that must be separated. The first one is the state of origin effect (quality of education) and the second is the state of residence effect. The latter potentially reflects regional cost of living differences or regional differences in production technologies. Shifts in demand and supply for different types of human capital can also affect earnings. If no one migrates, the two effects can never be separated with state-wide aggregate data. State economy specific factors are to be confounded with state-specific quality factors such as per-pupil expenditure in high schools. By focusing on migrants, Card & Krueger claim that they manage to identify the sole impact of quality factors.

Yet, Heckman, Layne & Todd (1995) come to the conclusion that this identification strategy is biased. They observe that increases in school quality have not the same effect on the rate of return across all states of residence. More generally, cross state migration is non-random. Estimates of relative state of birth effects consequently depend on particular choices of states of residence. This hints at economic opportunities migrants exploit in the state of destination more than at the quality of education in the state of origin. Heckman, Layne & Todd (1995) also demonstrate that one assumption made by Card & Krueger is false. Earnings equations are not linear in education level. Once linear restrictions are lifted, the coefficient of the school quality variable (per-pupil expenditure) becomes much less significant.

Both results considerably weaken support for the earnings-educational expenditure positive relation.

e) School quality (per-pupil expenditure) and ability in the US

Beyond any particular study, it is important to notice that most production function analyses using US data are potentially exposed to a multicollinearity problem. When using 'gross' educational achievement as a proxy for output (but the same is true of any other proxy), researchers must extract initial human capital endowment to correctly estimate the educational system's net contribution to human capital accumulation. But this human capital endowment also determines the per-pupil public expenditure. Wealthier and more educated parents tend to live together in 'good' districts where more taxes can be raised than in inner-city districts (where their worse-off peers tend to flock). Explanatory variables are thus never perfectly independent or completely exogenous. Since

1.3. Comments

There is apparently no clear and undeniable relation between both expenditure per student and the specific resources they can buy (teachers' degrees and experience, smaller student-teacher ratios...) on the one hand, and student achievement on the other. The only well established result is that socio-economic origin is decisive (Glennerster, 1991 ; Donni & Lejeune, 1994). Schools differ dramatically in 'quality' but this fact cannot be connected statistically or econometrically to rudimentary factors that many researchers have examined. Differences in quality do not seem to reflect only variations in expenditure, class size, or other commonly measured attributes of schools and teachers. Instead, they appear to result from differences between teachers' skills that defy detailed description and empirical causal analysis (Hanushek, 1986).

One could argue that the absence of an indisputable relation between the level of monetary inputs and test scores is due to a threshold phenomenon. Simply said, the input-output relation would only be 'visible' and 'mechanical' when the level of input variance is substantial. Such variance would not exist — on a cross-section basis — in the US[9] or in other western countries. Relative homogeneity of per-pupil expenditure could explain the inconclusive results of most production function studies. In other words, pupil-teacher ratios would vary in a too restricted domain to lead to observable output differentials. Under a certain threshold (25, 30 pupils per teacher?), the observation of output-input correlation would be conditional to contextual, managerial or institutional attributes: typically variables with no immediate monetary expression.

More fundamentally, one could argue that production function research relies upon a too simple conception of the educational black box. Regression techniques are more and more sophisticated but the conceptual background is still very similar to the technological conception of production conveyed by microeconomics textbooks. Because of data availability too, most regressions still focus on test scores/monetary input ratios.

The quite recent 'production efficiency' empirical literature (Fried, Lovell & Schmidt, 1992) bears some conceptual innovation which is worth mentioning here because it partially echoes our own vision of human capital production.

The reader should not mistake the empirical literature on production functions — that abundantly commented above — for that on production efficiency. The former consists 'of passing a function through the middle of a cloud of points': it intends to estimate the 'average' effective productivity of educational outputs. By contrast, production efficiency literature intends to identify the 'best practice' technology. Conceptually the two approaches diverge. To put it simply, they define productivity (input/output ratio) differently. The production function approach is based on the idea that observed productivity fundamentally reflects the nature of technology. In cross-section studies, deviation from the functional relation defined by this technology — the residuals in the least square estimations — is interpreted as random noise. In more dynamic terms, productivity growth is understood to be technology shifts: i.e. technological progress. Developing a slightly different point of view, the founders of the production efficiency theory consider that observed productivity also reflects the level of efficiency of producers. Their assumption

9 The per-pupil expenditure variance is relatively high in the US and takes the form of dramatic interstate variation in teachers' salaries. Yet, Walden & Newmark (1995) demonstrate that controlling for cost of living differences and the level of experience of teachers greatly reduces the apparent variation in salaries across states.

is that observed productivity (input-output ratio) partly varies because agents implement technology more or less adequately. Efficiency is thus a net contributor to productivity. It can be conceptually — and empirically — separated from the technological function[10].

Production efficiency estimations confirm Hanushek's conclusion: some teachers, schools or districts are more efficient than others. Yet, very little is said about the origin of efficiency. From our point of view, further conceptual development is necessary to overcome current analytical — and also political — limitations.

2. INSIDE THE BLACK BOX SECOND — THE NEED FOR AN ENRICHED CONCEPTION OF EDUCATIONAL TECHNOLOGY

The list of variables that can help us re-conceptualise schooling is rather large. We shall focus here on those that have been recently explored either empirically or conceptually and relate somehow to the aforementioned co-ordination problem.

We shall begin in section 3 with the **intra-school organisation** problem: the nature of school administration, the formal and professional organisation of teachers and pupils (schedule, curricula, tracks, evaluation...). Several case studies (Monk, 1992), but also nation-wide empirical research (Hanushek, 1986, 1992) tend to confirm the critical role played by organisational attributes. These attributes echo the way schools are administered internally, how information circulates among teachers and heads of school, the way pupils and teachers interact.

Organisation is thus crucial. But organisation cannot be directly related to the amount of monetary resources made available by the public authority. A 'good' educational organisation cannot be purchased on the marketplace like a teacher with a certain degree or some experience.

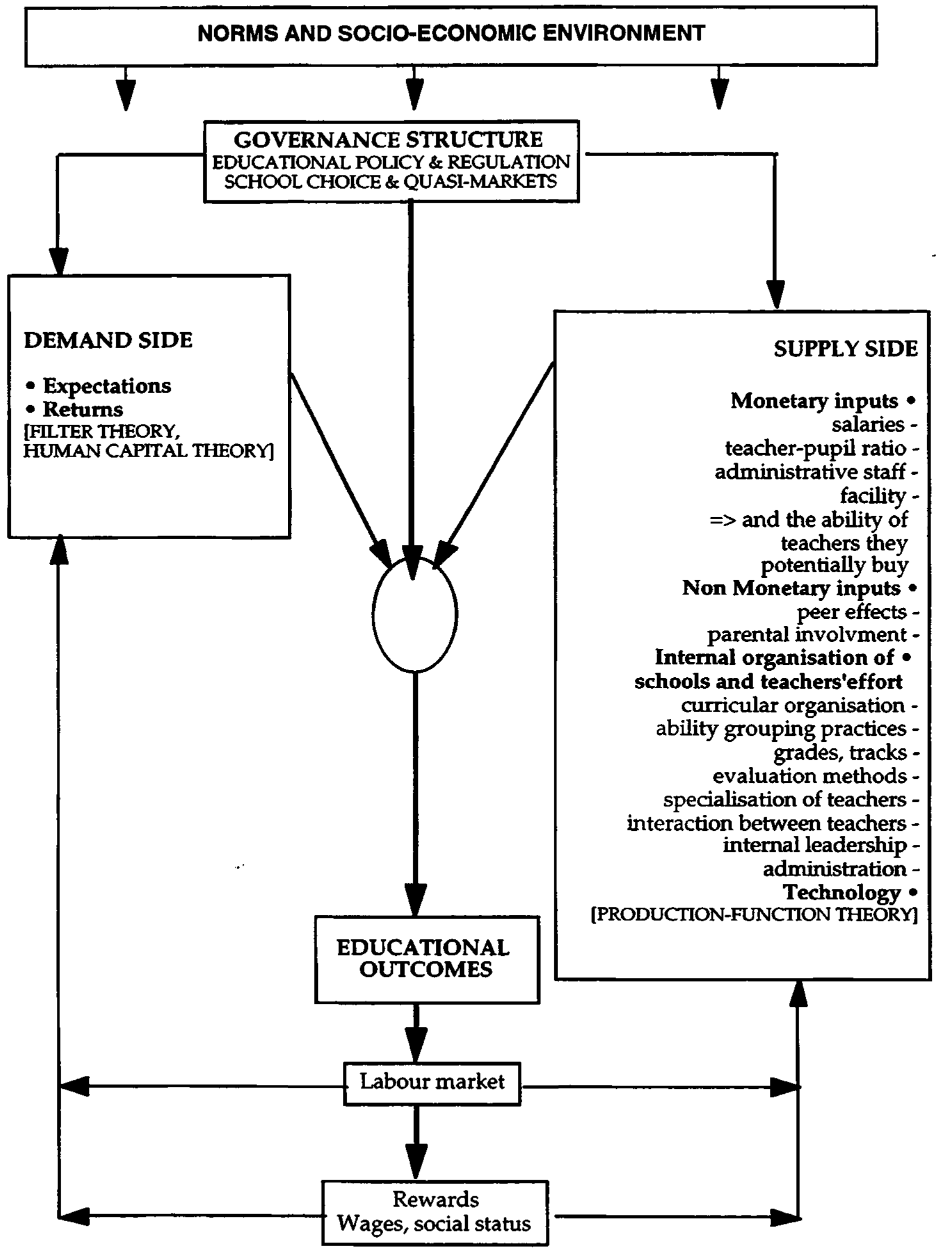
In sections 4 & 5, we will consider the role of inputs. This includes of course teacher salary, class-size, capital expenditure... However, one of the promising ways to renew economic analysis of educational organisations consists of adding **non-monetary inputs** to this list (Monk, 1992; Haveman & Wolfe, 1984). A pupil's achievement could indeed be influenced by variables with no immediate monetary expression: the pupils themselves and their human

10 The reader interested by the production efficiency approach applied to primary and secondary education data should refer to Färe, Grosskopf & Weber (1989).

capital background. Education is one of those services wherein outputs depend partially on the customers as inputs. In addition, the presence of other customers (as inputs) often contributes to the output 'experienced' by each customer individually (Rothschild & White, 1995). Human capital endowment of pupils and their aggregation — the student body composition — apparently condition the productivity of more classical inputs (teacher-pupil ratios, teacher salary, capital, sport and scientific facility...).

Another form of non-monetary input is the existence of strong school-family ties. In their argument aimed at explaining the particular effectiveness of Catholic Schools in the US, Coleman & Hoffer (1987) indicate that functional communities at the periphery of schools promote greater face-to-face social interaction across generations and, as a result, constitute a form of social capital that facilitates the work of these schools. This idea has also been put forward by Chubb (1988) who claims that all other things being equal, schools in which parents are highly involved, co-operative, and well-informed are more likely to develop effective organisations.

Graph 2.1 — School efficiency: external and internal determinants



3. INTRA-SCHOOL ORGANISATIONAL EFFICIENCY

Several case studies (Monk, 1992), but also nation-wide empirical research (Hanushek, 1986, 1992) tend to confirm the critical role played by intra-organisational attributes. As suggested by Graph 2.1, the technological relation between inputs and outputs is conditional to the presence of organisational assets. These cannot be directly related to the amount of monetary resources made available by the public authority. A 'good' educational organisation cannot be purchased on the marketplace like a teacher with a certain degree or some formal qualification, facilities, textbooks or computers. Although organisation seems to be very important, its clear comprehension and control appear problematic. At least two questions must be answered. The first one relates to the nature of organisation. The second corresponds to its production and diffusion.

3.1. The nature of organisation

a) Administration, mediation, buffering

Schools, like any other form of organisation, require a certain level of co-ordination. This diagnosis seems reinforced by the fact that education is a joint-product. In addition, student learning is a process which occurs over time in a multilevel structure (Bryk, Lee & Smith, 1990). Of course, the importance of external (e.g. bureaucratic) control can considerably limit the intra-school organisation problem. But in any case at least some residual organisational responsibility is given to schools. Intra-school co-ordination supposes some administration. Information must be communicated to teachers and pupils, resources must be allocated.... The school head is typically responsible for co-ordinating resources and ensuring adequate flow of information. He must also establish a certain number of rules that decrease school disruption and increase students' safety. Bidwell (1965) also insists on the 'buffering' role of school administration. One of the most critical roles of the principal is to represent the school and its teachers in the outside world, and simultaneously to protect them from (excessive) parental interference. He has also an important mediation role inside the school when conflicts occur between teachers and/or pupils.

b) Professionalism

Beyond administration, mediation or 'buffering', school organisation essentially amounts to curricular arrangement. The process of learning is actually central to a school's life. It is quite invariably organised by age and grade level.

Contrary to primary education, secondary education also means subject specialisation. This rather specialised learning process is carried out by teachers, and teaching is professional work (Weiss, 1990 ; Maroy, 1992). The work teachers do — to some extent — is like that of other professionals (doctors, lawyers...): it is intellectual, cannot be standardised or reduced to routines, and requires preparation through advanced education. Teachers typically work in isolation from one another, each practising his craft in his own classroom.

This professional component of school life generates a situation where teachers expect to have broad control of their daily task in the classroom. Weiss (1990) judiciously indicates that several crucial domains of educational decisions are left virtually undisturbed by other control mechanisms in schools. The day-to-day practices of instruction, evaluation of pupil performance and maintenance of order are usually left in the hands of individual teachers.

This observation raises questions about the scope of the school organisation idea. Maroy (1992) insists on the fact that schools are generally characterised by a certain level of 'structural looseness'. Co-ordination attempts — be they internal or external — are always limited in magnitude by the presence of professionals who tend to fight to preserve their independence. Maroy argues that the school head and his administrative staff suffer from this underlying conflict. Weiss (1990) insists on the idea that professional control and administrative control — the co-ordination attempts initiated by the school head or more bureaucratic interventions — always coexist inside schools and potentially generate tensions.

3.2. Organisation: random or predictable asset?

Are 'well organised' schools ruled by outstanding — but quite uncommon — principals who manage to find the right balance between co-ordination requirements and delegation to professionals i.e. teachers? Alternatively, do they present distinct organisational — structural — features, combined in a very specific and identifiable manner which ensure a certain efficiency, no matter the personality of the staff in charge? In the first case, organisation is equivalent to the random component of a stochastic equation. In Hanushek's words, organisation defies both description and prescription. If the second assumption prevails, organisation corresponds to a substantial asset.

Cousin (1993), in his survey of the 'effective school' stream of work, argues that the mobilisation of teachers school-wide is indeed correlated to student achievement. What is at stake is essentially the capacity to induce a significant proportion of the staff to partly abandon the grade-classroom-subject reference and structure their work by reference to the whole school. Cousin concludes however that factors permitting this kind of mobilisation are still relatively unknown.

According to Levin (1994b), necessary conditions for a good educational organisation actually correspond to a large extent to the conditions defining efficient firms. Schools should be designed along the lines of productive firms, while taking into account the special nature of educational activities. In brief, the more 'productive' schools Hanushek (1986) presented as 'outliers' could be viewed as schools that have managed to combine some of the fifth organisational attributes set forth by Levin.

a) General requirements for organisational efficiency

First, schools must be clear about what they are attempting to achieve. This supposes that there is a widespread acceptance and agreement by all participants. This objective must be associated with measurable outcomes in order to appraise what the school is doing. Second, teachers and principals must get incentives tied to student success. Incentives can be intrinsic (e.g. a sense of accomplishment) or extrinsic (e.g. financial reward or recognition either by hierarchy or peers). They can be individual or collective but their very purpose is to stimulate effort and increase accountability. Third, schools need systematic information over their overall accomplishment and success. Information must be made available concerning existing pedagogical possibilities, test scores and their evolution. The absence of rapid feed-back can also prevent the implementation of a trial and error innovation strategy. Fourth, schools evolve in a changing environment and must constantly adapt to meet new individual and social demands. Adaptability is thus of great importance to achieve organisational efficiency. Fifth, schools must be able to adopt the most productive teaching technology consistent with budgetary constraints. This includes a wide array of variables.

b) Curricular arrangements: the specialisation dilemma

One of the most important variables is probably the curricular organisation. Teaching is usually organised by age and grade level. Beyond this, program specialisation has become a dominant feature of secondary schools. Staff tends to be highly specialised. Specialisation is clearly a source of extra cost, particularly when schools are small, because it invariably leads to a reduction of the pupil-teacher ratio (Vandenberghe, 1993a). Besides, specialisation can raise human resources difficulties when re-organisation or simply cross-subject or cross-grade work must be accomplished. Specialisation becomes problematic when it hampers interactions between teachers and students (Bryk, Lee & Smith, 1990). Education is a joint output involving several subject matters that must be properly articulated. Hence, a minimal level of co-ordination among teachers who are individually responsible for different subject matters seems crucial. On the other hand, staff specialisation enhances the capacity of the school to deliver highly diversified educational services, adapted to the needs of significantly different pupils. Whether specialisation is beneficial to students is more and more questioned (Grisay, 1993). It seems indeed that formal specialisation promotes academic efficiency very unevenly across the different groups: specialisation does not seem to be very profitable to disadvantaged pupils.

c) Scheduling

Further, scheduling arrangement might also be very important with regards to productive efficiency and budget constraints. In most educational systems, costs also directly reflect the number of hours spent in class by teachers and pupils both weakly and annually. Economics of student time should therefore also be studied. In the first instance, increasing instruction time might be perceived as a natural way to augment achievement. Further reflection indicates however that this measure can interfere with student's effort decisions. External increases in time allocation of students to classroom learning can lead to reduced effort for that activity (Levin & Tsang, 1987). The underlying argument is that some substitution occurs between 'imposed' classroom attendance and 'voluntary' work or effort by the student. In addition, increasing instructional time should be confronted with other valuable uses of resources. There are indeed many alternatives for improving student achievement: retraining existing teachers, spending time on co-ordination and curriculum improvement school-wide or even district-wide, increasing the use of new technologies such as computers, exploiting cross-age and cross-grade peer tutoring possibilities,...(Levin, 1989)

d) Teaching contents

Finally teaching contents and methods *per se* are decisive. Levin (1994b) argues that schooling programs for at-risk pupils for example consist of approaches that are inappropriate for maximising student educational results. The typical approach that is used nearly invariably amounts to — expensive — remediation. In the US it consists of repetitive exercises (worksheet filling). In

Belgium, it essentially takes the form of grade repetition which is also very costly as schools are financed on a per-pupil basis. The immediate effect of grade repetition is indeed to inflate the total enrolment-size and thus the size of the education budget (Delvaux & Vandenberghe, 1992; Vandenberghe, 1993b). Remediation is usually synonymous with drill and repetitive exercises whose only observable consequence is unfortunately that 'at-risk' students or grade-repeaters get further and further behind mainstream students.

3.3. How to create organisational assets and diffuse them?

To define and implement the appropriate balance between professional autonomy and co-ordination procedures for example in a particular school is a first non-negligible challenge. Its reproduction and dissemination system-wide is another one.

In the US, several school renovation programs for at-risk pupils are currently experimented. There is the accelerated schools project promoted by Professor Levin from Stanford or the one sponsored by the John Hopkins University (Slavin, Madden, Karweit, Dolan & Wasik, 1990). These programs aim at a gradual dissemination of educational practices that have proved particularly adapted to at-risk pupils' needs. They reflect a bottom-up attempt to reform an educational system which tends to contrast with the top-down European tradition. First results seem very promising. However, the key point is to appreciate the 'survival' prospect of those results once their very enthusiastic, skilled and dynamic promoters disappear or are forced to delegate because, almost by definition, their capacity to control their project is limited beyond a certain level of development.

Traditionally, economists argue that the generalisation of 'good' organisational features heavily depends on a nexus of incentive and co-ordination mechanisms (Laffont, 1992; Milgrom & Roberts, 1992). In other words, a regulatory principle is necessary to organise individual actions and orient independent decision-makers towards a certain end. Information circulation is important but most economists apparently believe that 'effort' is more important. The new theories of regulation (Baron, 1989) tend to focus on effort incentive problems. Several external incentive mechanisms are studied by this literature. Some rely on output-based remuneration or promotion schemes defined by the regulator. Other regulatory approaches are more of the market type. In both cases however, organisational efficiency is 'produced' or at least heavily buttressed by an external mechanism.

We shall adopt this point of view hereafter. Chapter 3 will extensively discuss the relation between external regulatory principles and school organisation.

4. MONETARY AND NON MONETARY INPUTS

Monetary inputs entitle communities and states to buy resources. A certain per-pupil expenditure can buy facilities, books, labs or computers. The higher the per-pupil expenditure, the smaller the class size and/or the higher the salary that can be offered to teachers. If the labour market for teachers is competitive, this means that better young teachers can be selected. More money also means that older ones can benefit from lifelong learning. 'Good' teachers are apparently essential to good education. Most studies indeed conclude that quality of teachers is fundamental to educational outcomes[11].

In brief, our point of view — which is illustrated by Graph 2.1. — is that more monetary resources 'potentially' lead to more human capital. We insist however on the fact that the relation is not mechanical. We have argued in section 3 that intra-school organisation enhances the productivity of monetary inputs. The point we put forth here is that organisation and money cannot accomplish everything regarding education. A large body of recent research stresses the importance of non-monetary inputs: social interactions. These social inputs, if properly mobilised, can considerably buttress human capital production and usefully complement what monetary input and organisation can do.

4.1. Peer effects or contextual effects

In the school context, these social interactions are called 'peer' effects — some people also use the term 'contextual' effects. By social interaction, we refer to the idea that the knowledge a child assimilates during a school year depends directly on the characteristics or actions of his comrades. In other words, education is one of those numerous human activities characterised by social spillovers. The spillover argument is particularly easy to understand when social cir-

11 The relation between wages and quality of teachers is not so immediate as our assertion might suggest. Ballou & Podgursky (1992) explain that wage rises fail to attract better teachers if labour markets for teachers are imperfect. In the short run for example, higher salaries that are not targeted to young teachers tend to convince older teachers to differ retirement which limits the number of jobs available and tends to orient more able candidates towards other professions. In the long run, problems might arise if filtering procedures are absent. More able candidates might not be guaranteed access to the job if hiring decisions are taken in a situation of asymetric information and never reconsidered. This again might dissuade them from applying.

cumstances become extreme. Some schools indeed concentrate violent teenagers which are confronted with drug addiction, parental violence, or teenage pregnancy problems. In those school 'normal' learning and teaching activities are systematically compromised, no matter the individual's (be it a pupil or a teacher) ability or willingness.

The incorporation of social interaction as a determinant of the production process — e.g. human capital accumulation — while not new from the perspective of sociology, is relatively recent in the context of economic theory (Brock & Durlauf, 1995). The concept is far from being specific to educational problems. Recent empirical evidence, highlighting the importance of social interaction, has been developed in several contexts: teenager pregnancy, drug addiction, inter-generation and ghetto poverty (Jencks & Meyer, 1987; Corcoran, Gordon, Laren & Solon, 1990 ; Dynarski, Schwab & Zampelli, 1989 ; Evans, Oates & Schwab, 1992). Case and Katz (1991) provide evidence that the probability of social ills in one neighbourhood increases with the prevalence of the same ills in adjacent neighbourhoods.

In the educational context, Coleman & al. (1966) were the first to defend the social interaction idea. Most observers retained their controversial conclusion that objective attributes (monetary inputs) of school have little impact on achievement. The latter' s most significant determinant is simply the student's socio-economic background. It is less known that Coleman and his co-authors also insisted on the importance of peer characteristics. Since Coleman, several empirical studies have come to the same conclusion: the quality of social interactions heavily influence educational achievement (Summers & Wolfe, 1977 ; Henderson, Mieszkowski & Sauvageau (1978) ; Duncan 1994 ; Dynarski, Schwab & Zampelli, 1989).

4.2. Parental involvement

We should also mention that parental involvement is the other form of social interaction significantly influencing educational outcomes. This involvement can take the form of home-learning. In general parents influence their child's learning through transmitting norms and some specific behaviours which contribute directly to learning. Several studies have shown that parental expectations for their children's achievement and the importance parents place on education are positively related to academic outcomes (Weiss, 1990). Econometrically speaking, this observation directly echoes the results obtained by the first production-function estimations (Coleman, 1966) and largely corroborated by further empirical work: achievement in the school system is largely correlated to the socio-economic background of parents. Parental participation in their children's home learning is positively related to parental social class.

Direct school-family ties is another form of parental involvement. Coleman & Hoffer (1987) argue that parental involvement is significantly correlated with pupil achievement. Involvement includes: classroom visits, consultation with teachers and organisation of parent-school activities. Yet, it seems important to note that the intensification of this interaction is inherently problematic. Teachers are professionals thinking that actual school operations, professional knowledge, pedagogical management and evaluation decision must remain in their hands. The control of education remains with professionals and a certain mismatch between home and school priorities is inevitable.

4.3. Retrospect

The whole idea of peer effects and parent-school ties echoes what Weiss (1990) calls the personal-collective conceptualisation of schools. By contrast with the rational-bureaucratic perspective which has been dominant over the 60's and the 70's, the recent interest for peer effects for example reflects the idea that schools are 'small societies' in their own right.

The bureaucratic perspective has dominated both research activities and reform efforts during the last three decades. Ensuring efficiency and equality of opportunity has meant offering specialised services and a very large array of courses and academic tracks inside secondary schools. This approach supposes very specialised staff and a lot of formal norms prescribing almost all aspects of school life. Most Western countries have attempted to reform secondary education by reference to this rational-bureaucratic model. In Belgium, we have experienced the 'renovation' of secondary school. France has had its 'réforme du Collège'. In the US, progressive urban reformers sought to create comprehensive High Schools. A similar move has been observed in the UK. All those reforms have proceeded from the same vision. Efficient and equitable schools must ensure some formal division of labour into specialised tasks, defined teacher roles by subject matter and type of students. Specialisation and ability grouping is thought to be the best way to serve a large number of students with various backgrounds.

Yet, in viewing schools as a 'rational' production process — remember that production function literature developed by economists conveyed the same vision of schools — this perspective has undervalued personal and social aspects of school life. By contrast, our focus on peer effects is a synthetic way of reflecting the idea that effective schooling probably supposes a certain level of specialisation and 'rationalisation' but which should not be emphasised at the expense of intense 'informal' interactions.

5. PEER EFFECTS: CONCEPTUAL STATUS AND REGULATORY IMPLICATIONS

The purpose of this section is essentially to bring some precision about the conceptual status of peer-effects. We will also try to define the nature of the co-ordination problem attached to the peer-effect idea.

5.1. Peer effects and the concept of externality

Conceptual and political challenges raised by the idea of peer effects should not be underestimated. From a theoretical standpoint, peer effects (or contextual effects) amount to externalities (spillovers). The underlying idea is that social interaction of better educated individuals produces collective benefits of various kinds. This notion has been extensively popularised by human capital theory. Education has traditionally been conceived by economists as a source of (positive) externality. The more educated a worker, an employee or a staff member, the higher his productivity **and** his colleagues' productivity. In most public finance textbooks, education is also synonymous with richer social, cultural and political life, better public health, less crime. The same idea is present in the new economic theory of endogenous growth (Lucas, 1988).

Yet, the peer effect concept bears some innovation with regard to the concept of externalities as it has been traditionally presented and exploited by human capital theory. First, peer effect is an externality that operates **during** the production of human capital and not only later, when individuals as adults get involved in socio-economic life. Indeed, human capital — under the form of domestically produced endowment or innate ability — exists prior to formal education delivered by schools and professional teachers. Second, and more essentially, peer effects are **local**. Combined with the idea that human capital endowments diverge, this means that the basic co-ordination problem is to control the **allocation** of individuals between entities (schools, firms, districts, neighbourhoods...). Human capital theory has traditionally put forward the idea that the major co-ordination problem is to convince each individual to choose the right level of human capital investment. This vision is still valid. The higher the human capital attainment, the higher the social benefit. However, the social planner's problem is probably more complex than simply making sure that each individual decides to accumulate the right level of human capital (Weale, 1992).

Social interaction is a local phenomenon and takes place in bounded entities that are separated from each other. Individuals attending classes somewhere in the educational system possess different human capital endowments. Some originate from well-off families while others come from poor families, have parents with no or poor educational records. When grouped in a particular school or classroom, what level of externality do they benefit from? The question would be senseless in a world of permanent and boundless social interaction. In that very unrealistic situation, each individual would permanently be exposed to the sum of externalities dispersed by the rest of mankind. Real life is slightly different. A 'rich' individual attending a school and generating some (positive) externality in that particular school is 'lost' for the other schools. Externalities conveyed by individuals are almost by definition spatially limited. Their diffusion is not universal. In most situations, it is limited by the size of the entities they choose (or are obliged) to live in.

5.2. Peer effects: allocation of individuals is more than a social choice problem. It influences the production of human capital

Allocation of heterogeneous individuals between strictly delimited entities thus becomes a critical issue. Characterisation of socially optimal economic situations must incorporate that issue. Should individuals interact in homogeneous local entities or should they live in heterogeneous entities? This question can be raised in the context of formal education (i.e. production of human capital) but also in any other situation where some production is at stake, be it material or immaterial, economic, intellectual or cultural... *A priori*, this problem must be treated in both market and centralised economies.

Allocation of individuals with different characteristics between schools, neighbourhoods, or firms is traditionally presented as a social choice problem reflecting individual or collective (sometimes subjective) preferences. Education, several observers assert, lies at the intersection of two sets of competing rights (Levin, 1991). The first is the right of parents to choose the experiences, influences, and values to which they expose their children. The second is the right of a democratic society to use the educational system as a way of reproducing its most essential political, economic, and social institutions through a common schooling experience.

The peer effect idea is interesting in the sense that it brings some economic argument into this delicate debate. Allocation of heterogeneous individuals relates to 'productive' efficiency problems: the production of human capital is directly affected by the way heterogeneous individuals are allocated. A social objective consisting of maximising the total stock of human capital can be compromised if individuals are inappropriately allocated among schools. The same is true with an egalitarian objective aiming at equalising educational achievement. The cost of this policy is potentially influenced by the way peer effects are allocated among schools.

5.3. Controlling the allocation of individuals: a principal-agent problem?

The idea that education output is influenced by technological variables and behavioural variables echoes the notions of moral hazard or adverse selection, commonly analysed by the new theory of regulation (Baron, 1989; Laffont & Tirole, 1993; Milgrom & Roberts, 1992). For a long time, economic theory has simply presented firms under the form of a production function or (its dual) cost function, acting as constraints in the profit maximising program. This simple vision seems realistic when the firm counts very few employees. It is much less plausible when it comes to large-scale enterprises, with several divisions and thousands of workers. Given their huge size, firms are confronted with major co-ordination problems. Most of the time, owners (or managers) must design incentive schemes so that the individuals they employ conform to their profit maximising objective (Holmstrom & Tirole, 1989).

A firm's co-ordination challenge amounts to find control or incentive procedures through which collaborators (agents) adopt the decision — or transfer the information — that fits best the manager (principal)'s priorities. This problem is not trivial. Objectives of parties involved diverge and information is potentially asymmetric (i.e. the principal is *a priori* less informed than his agents and he does not observe his effort) and costly (i.e. to put supervisors behind each employee results in extra costs). These two characteristics are basic to the principal-agent problem.

Although we shall not develop this idea here, some analogy with educational systems exists. The co-ordination of teachers acting as professionals (agents) by the head of school (principal) is, to some extent, equivalent to a principal-agent problem. The head of school might pursue a different objective than his teacher. Given the importance of the teacher's autonomy at classroom level, the latter might possess information that is unknown to his principal.

When it comes to peer effects, we think that the analogy is no longer relevant. A social planner who would want to mobilise peer effects in a certain way (mixing or segregation of individual types) could be confronted with a preference-incompatibility problem ... among agents. If individuals are sensitive to peer effects (i.e. are aware of their importance), they are also sensitive to allocation of relevant human characteristics among entities. The desire of 'rich' individuals to segregate from the 'poor' in order to maintain local externality at its highest level can be challenged by the desire of 'poor' people to benefit from this externality. Some co-ordinating mechanism must exist to ensure minimal compatibility between conflicting individual preferences.

Just like with moral hazard, the problem is to control individual behaviour. But the nature of the problem is different. What is at stake here is not a priori to obtain effort but bilateral acceptance of a certain type of interaction implied by the coexistence of individuals with different characteristics. Peer-effects are local externalities. They raise a co-ordination problem that basically consists of finding ways to make sure that decentralised decision-makers (schools, teachers, parents in the school context) properly internalise their existence.

CHAPTER 3. THE CENTRAL ROLE OF INSTITUTIONS: THE CASE OF EDUCATIONAL QUASI-MARKETS

Educational output, apart from each individual's propensity to invest in himself, is heavily conditioned by the educational system's functioning. Our central point so far is that the supply side of the educational process can no longer be represented as a simple black box. At least do we have to consider that some technology is at stake. In addition, empirical studies and theoretical reasoning suggest that this technology would be much more productive if some qualitative inputs — organisation and peer effects (local spillover) — are properly and adequately mobilised. Finally, we would like to put forward a third major parameter: the institutional arrangement.

Referring to Graph 2.1 (chapter 2, section 2) which describes our general conceptual framework, we still need to talk about the general environment in which schools are embedded. We shall pay more attention to the **institutional setting** in which schools are embedded: their governance structure. Schools are subject to external control. This control can be bureaucratic in the sense that schools must comply to some formal rules. When schools are publicly funded, national or local governments attempt to influence schools. Most of the time they rely on control over procedures: teachers must possess some diplomas, pupils must attend school on a regular basis, facilities must respect sanitary and safety measures, a certain curriculum (program) must be covered... (Weiss, 1990). Administrative or bureaucratic control of that sort can be more or less important, leading to various levels of decentralisation. In addition, it can be accompanied or replaced by other forms of control. The most frequent one is parental choice.

Actors involved in educational systems — individuals and organisations like schools — have their strategy, make choice, have some autonomy. Traditionally, individual methodologists like economists assume they maximise some utility function. The whole idea of institutions is that those strategies are not implemented in a vacuum. Every educational system presents some fundamental rules that heavily condition the nature of individual behaviour, the sort of social interaction to-among individuals.

Several variables can exert an influence on educational outcomes. Social norms and deep-rooted values can influence the way parents, pupils and teachers conceive the pupil-teacher relation or the way selection should be done for example. Society can be more or less egalitarian and this can heavily influence representations and consequent practices. The political process along with the general evolution of the economy is another source of external influence. The total amount of public money devoted to education depends on voters' preferences or scarcity of economic resources. There are market-based pressures on public budgets that influence the resources allocated to public education (Weiss, 1990). The labour market's functioning determines the relative attractiveness of the teaching profession, the profile of those who decide to make a career in education and the duration of their stay (Murnane, 1990).

Those are examples of external mechanisms that somehow influence the functioning of schools. All of them deserve some attention. But our priority in this chapter and in the rest of our thesis goes to the **institutional setting** in which schools operate and act as an external governance structure that strongly determines the internal organisation of schools and the allocation of monetary and non-monetary inputs.

1. INSTITUTIONS

The concept of institutions designates large-scale mechanisms or general rules on which individual actors have no direct control, because they are the result of political aggregation or historical and cultural tendencies. Institutions — which should not be confused with the concept of organisation — have always been central in economic theory (Alchian & Demsetz, 1972 ; Milgrom & Roberts, 1992). Some ambiguity exists however because most economists tend nowadays to focus on a very particular institution: markets. What most economists actually look at is the capacity of those very decentralised co-ordination systems (i.e. price systems) to co-ordinate individual decisions made either by autonomous individuals or organisations like firms (Akerlof, 1970 ; De Villé, 1990 ; Simon, 1991).

Several other institutional mechanisms exist however. Central planning procedures have been analysed by economists in parallel with market mechanisms (Hurwicz, 1973). Voting procedures in democratic countries is another example of an institution that has been extensively studied by economists specialised in social choice theory (Arrow, 1963).

Economic institutions (markets and prices, property rights...) play a fundamental role in the functioning of modern economies. They heavily determine their relative performance. This is most likely the case for educational systems too. Institutions are important. Yet, it is worth underlying that they are by definition incomplete. Most institutions influence organisations and individual behaviour inside those organisations, but do not prescribe them totally. The argument is quite similar to the one we have developed around the idea of educational technology. Total prescription is not realistic. Our assumption about educational systems is that they correspond to a subtle balance between three major ingredients: technology (including monetary and non-monetary inputs), decisions made by individuals or organisations, and institutions.

In the line of the economic theorizing briefly exposed above, we intend to focus here on co-ordinating properties or potentialities of educational institutions. Our intention is to analyse a very particular institution: quasi-markets.

Quasi-markets are just one educational institution among a large set of possibilities. Briefly said, they can be defined by the combination of school choice and public (per-pupil) financing (Le Grand & Bartlett, 1993). In fact, they correspond to the 'voucher' idea initially promoted by Friedman (1962).

2. THEORETICAL FOUNDATIONS: QUASI-MARKETS AS A RESPONSE TO 'NON-MARKET' FAILURES

We have already indicated that over the last 50 years choice of public financing for education was also accompanied by public production of education, generally under the form of a monopoly. The latter came under heavy criticism in the late 1970's both from a theoretical and an empirical point of view. One of the answers given by the governments was precisely to introduce quasi-markets.

2.1. Nonmarket failures

Market failures (see chapter 2, section 1.2) provide the rationale for nonmarket (i.e. government) remedies. Yet the remedies themselves (government financing and particularly production) may fail (Wolf, 1979). Since the late 70's a growing number of analysts (mainly economists and political scientists) claim that incentives influencing entities acting for or constituting 'government' may lead to outcomes that diverge substantially from what is socially preferable. The whole argument put forward by Wolf and his colleagues is that it may be hard to construct 'visible hands' (typically administrative mechanisms governing public provision of services and goods) that effectively turn nonmarket vices into public virtues. This argumenent was supported by some empirical evidence. During the last 3 decades, production of public services turned out to be more and more problematic. Rising costs, undue power and control of information by bureaucrats or bias against innovation became a distinct source of concern for governments. Gradually, one discovered that the correct implementation of public priorities through government agencies (hospitals, schools, public utilities, defence departments...) had to be treaded as a problem in its own right.

2.2. Responses to nonmarket failures: incentive contracts and quasi-markets

The (first theoretical and then practical) response to this growing evidence was twofold. During the 1970's and 1980's we first witnessed a renewed interest in the regulation of public monopolies and oligopolies (Laffont & Tirole, 1993). Traditional regulatory theory largely ignored incentive issues. This approach considerably evolved with the development of Principal-Agent literature[12] highlighting the problem of implementing public goals when asymmetry of information and asymmetry of objectives are combined. This line of research led to the identification of contractual arrangements providing the right incentives to decentralised public agencies. In the educational sector, an illustration of this approach is the growing interest for output-based financing schemes (Murnane & Cohen, 1986).

The other source of innovation as regards to the 'implementation' problem was precisely the idea that market-like mechanisms could be introduced in the public sector in order to boost its quality, economy and efficiency. By allowing — properly informed — parents to choose their school, governments would force these schools to be more accountable — to their clients — and make a better use of their resources. Several studies have suggested that a lack of effort or accountability could considerably alter the performance of educational systems. Several researchers (and also activists) consequently promote free-choice in order to create competitive pressure and stimulate efficiency (Chubb & Moe, 1990 ; Bowlse & Gintis, 1993).

3. EDUCATIONAL QUASI-MARKETS: HISTORICAL AND SOCIO-CULTURAL ORIGINS

From an historical point of view, quasi-markets seems to emerge for reasons that do not necessarily reflect the nonmarket failure argument. Remember that our reasoning about quasi-markets is largely inspired by our observation of the Belgian situation. For several decades the Belgian education system — inclu-

12 Cfr our brief presentation in chapter 2, section 5.3.

ding primary, secondary and tertiary education — has been primarily based on a quasi-market principle (Le Grand & Bartlett, 1993 ; Glennerster, 1991). This institutional arrangement — which can also be found in the Netherlands (James, 1987) — is actually a response to a philosophical and institutional conflict between the Roman Catholic Church and the secular State. Both institutions have historically claimed their right to control education and other semi-public services, but neither of them has been in a position to impose its conception. If the religious and philosophical context is certainly the origin of the Belgian or Dutch quasi-market, growing secularisation suggests that its current *raison d'être* is to ensure free choice for parents and students. Glenn (1989) notes that the emphasis in debates since the late 50's has focused more on the rights of parents to control education than those of the Church and the State. Sociological studies carried out both in Belgium and the Netherlands (Billiet, 1977) tend also to suggest that religious and philosophical feelings play a decreasing role in parental choice. Curriculum, discipline, competence of teachers, quality of the social environment come first when parents are asked to justify their selection of a school.

Yet, educational quasi-markets are no longer a Belgian or Dutch curiosity. Free choice and market oriented schools are issues of great discussion in many countries, particularly in the United States (Friedman, 1962 ; Clune & Witte, 1990 ; Chubb & Moe, 1990 ; Bowles & Gintis, 1993). Quite surprisingly, the US still maintain a system of attendance zones — the 'zoning' regulation — which amounts to imposing a public school on the basis of each family's residence. New-Zealand and Australia have abandoned the 'zoning' principle during the 80's (CERI, 1994). Several European countries — where public education traditionally offers little or no parental school choice — are heading towards increased school choice. Radical reforms towards quasi-markets were introduced in the United Kingdom during the late 80's and in Sweden in the early 90's (Miron, 1993). In other European countries such educational reforms are at the forefront of political debate.

Justifications for these recent market-oriented reforms certainly differ from those that have prevailed historically in Belgium and the Netherlands. In the United Kingdom for example, the conservative party, author of the Education Reform Act of 1988, presented quasi-markets as a crucial necessity to fulfil requirements imposed by citizens' interests i.e. efficiency and accountability. As explained in the previous section, quasi-markets apparently are aimed at solving 'government failure' problems: poor educational achievement by international standards, low accountability of teachers, excessive red-tape (CERI, 1994).

Quasi-markets thus appeared in different contexts and for various reasons. We have mentioned the case of countries where religious schools progressively gained public support under the form of free access and equal financing on a per-pupil basis. During the last two decades, quasi-markets have evidently been adopted by governments seeking alternatives to public monopolies or quasi-monopolies to produce and deliver public services.

Glennerster & Le Grand (1995) argue that recent quasi-market shifts in the UK reflect the necessity for decision-makers to retain allegiance (i.e. votes) of the middle class. The latter still wants free access and public funding partly for the traditions of equity they symbolise[13]. Simultaneously, members of the middle class expect something more in terms of public services but are increasingly reluctant to pay additional taxes. The only possible way for governments to square the circle is by offering more for the same amount of tax. And more in this case means 'choice'. Middle class families are indeed increasingly unprepared to accept 'consumer insensitive' treatment by doctors, hospitals or teachers. They are also more and more reluctant to accept systematic socio-economic mixing when health or education is at stake, possibly because the socio-economic gap is widening. Choice is thus a logical answer to the middle class' demands. As explained by Bartlett, Propper, Wilson & Le Grand (1994) education and health are the main services enjoying the new quasi-market status in UK. This is not a surprise as voters give high preferences to these services.

In the US, the corresponding phenomenon might be the white flight to suburbs combined with the local character of public goods such as education. By choosing to settle in middle-class-homogeneous districts, taxpayers manage to limit transfers to the poor (blacks) and consequently gain more from their taxes.

4. QUASI-MARKETS, MARKETS AND BUREAUCRATIC CONTROL

Educational quasi-markets can be conceptualised as being somewhere between two well-known forms of educational systems and, correspondingly, two common co-ordination principles: the market, on the one hand, and the hierarchic control on the other hand, often synonymous with bureaucratic control.

Very few educational systems still operate like markets. Some exceptions exist, particularly in third-world countries where private education is still the rule for thousands of pupils at elementary and secondary level. James (1993) indicates

13 Cynics would suggest that this preference for public funding of education simply means that it is still cheaper than self-finance.

however that most 'private' schools are non-profit organisations, ruled by religious communities, that manage to limit their costs (and tariffs) essentially because they can rely on volunteers. In most Western and/or industrialised nations, tertiary education is the last sector where a market-like mechanism is still important (James, 1993). The two countries that still have a large totally private tertiary educational system are the United States and Japan.

The most common and prevalent regulation *modus operandi* is still the hierarchical or bureaucratic model. Local decision-makers (teachers, principals) are supervised by public administrators (managers) who thus centralise some part of the decision Administrators and managers are supposed to ensure co-ordination: they symbolise the external co-ordination principle, the governance structure of the system. This does not mean that the educational system is totally centralised. Like all complex organisations, hierarchic educational systems are characterised by a certain balance between decentralisation and centralisation (Milgrom & Roberts, 1992).. Invariably, educational systems throughout the world delegate some responsibilities to schools and — inside those organisations — to the individual teacher. We have seen in chapter 2 that the latter has indeed immense responsibilities e.g. handling the classroom on a daily basis, choosing teaching methods, sometimes evaluating too.

Obviously, most hierarchic educational systems are under the political responsibility of ministers and elected representatives. Those systems are subject to democratic control or 'voice' mechanisms (Hirschman, 1970). This control can be local if the educational system is organised and funded on a local basis like in the US districts. It can be more distant if the system operates on a nationwide basis as it is often the case in Western Europe. Democratic control formally exists in both cases, but 'public choice' theoreticians like Chubb & Moe (1990) argue that it is particularly inefficient when communities become very large. Democratic control, elections and referendum would then just be a sort of legitimating process for the professional 'bureaucrats' who really control and influence education.

No matter their singularities, most public education systems tend to work like big administrations or corporations. Their co-ordination relies to some extent on both central control and top-down instruction flows. Exit threat and competitive pressure do not play a major co-ordinating function.

5. QUASI-MARKETS AS HYBRID INSTITUTIONS

5.1. Market-like regulation and government regulation

Quasi-markets are hybrid institutions. From a theoretical point of view they tend to combine several sorts of control and co-ordination principles. Both administrators and clients potentially exert some control over schools. Existing quasi-markets tend to concretise that idea.

The whole idea of a 'voucher' scheme is to entitle all families, even those with little or limited income, to choose the school that fits best their values or their child's needs. Quasi-markets incorporate the idea of an exit-like regulation mechanism. Yet, a 'voucher' scheme does not eliminate the administrator's or government's role. Although the voucher approach represents a shift from government regulation of educational services to the marketplace, that market generally consists of schools that have to meet particular conditions in order to be eligible to receive vouchers.

In the UK, the 1988 reform meant free school choice (with an underlying voucher financing formula) but also common national curriculum i.e. much more regulation at the same time as competition was introduced[14]. Reinforced regulation took also the form of central evaluation and certification. Schools in the UK compete on how best to deliver a standard product that is independently tested with exams set at regular intervals. In countries like Belgium or the Netherlands, quasi-markets appeared when private schools (generally that affiliated on religious grounds) managed to get subsidies from the State. James (1993) indicates that this came at a cost. Private, non-profit schools usually pay a price in terms of loss of autonomy as subsidies increase. The regulation requirements may be imposed simultaneously with the subsidies, but, generally, they are gradually added when dependency towards public funds is instituted. In brief, government funding usually means government regulation. Quasi-markets, be they recent like in the UK or Sweden or rather old like in Belgium or the Netherlands, obey this very general rule. They manifest a market-like regulation approach. Individuals decide when to attend classes and where public money must go. In other words, 'clients' decide which schools can survive and which must disappear. Simultaneously, one observes that public administrators use their discretionary power to impose their will to schools (Ball, Bowe & Bewirtz, 1994).

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14 This point has been suggested to us by H. Glennerster.

5.2. The range of regulatory requirements

The range of regulatory requirements can be significant. Among major areas of regulation are those of curriculum content, wages, pension schemes or tenure requirements, admission standards for teachers and/or pupils, and evaluation and certification criteria (Levin, 1990). In addition, the central administrator still decides on the voucher's size i.e. the level of per-pupil educational expenditure. It can also allow or prohibit schools from charging tuition. Existing quasi-markets tend to diverge along those lines.

A distinction can be established between government regulations depending on what they apply to. Many government regulations apply to educational **inputs** rather than **outputs**. In the Dutch system for example, 'private' schools must comply to central rules concerning teacher numbers and salaries, required credentials when hiring or awarding tenure, hiring priorities.... Schedule, work hours and other conditions of work are centrally determined. Rigid restrictions on schools' ability to fire teachers also exist. Sometimes, the regulator also imposes decision-making rules. Schools are required to be 'democratic', 'representative' and 'participatory' in order to qualify for subsidy (James, 1993). The regulator can also impose a representative of the government on the board of directors. Both requirements represent a kind of 'social control' usually justified by the importance of public funds at stake.

The case of the UK illustrates a new tendency among regulators. Instead of increasing the control on inputs, the regulator announces his intention to regulate schools by introducing a direct control of outputs.

The UK 1988 reform has apparently considerably relaxed the control over the use of inputs. Schools in the UK for example have now complete control over the salary budget which contrasts with the situation in the Netherlands where number of teachers per-pupil and salaries are totally controlled by central bureaucrats. The 1988 Education Reform Act diminished the administrative control over schools. Schools were allocated a budget they could spend as they thought adequate for the purposes of the school, and were also given the power to appoint, discipline and dismiss staff (Levacic, 1994).

These developments have been presented by the government as reducing bureaucracy and enhancing school autonomy. They have been accompanied by a considerable extension of the central government's control' over outputs. The latter imposed a national curriculum, standardised tests and the publication of tables of (gross) results.

National curriculum is the most common way to control output. It can consist of a core of courses that is imposed to each school with or without prescriptions concerning teaching methods or textbooks. Effective control of outputs is not an easy job. The introduction of a national curriculum does not seem to be a sufficient condition to prescribe teaching contents. In practice, the implementation of such a curriculum appears conditional to the presence of national exams which students must take on leaving school. The UK and New-Zealand organise these exams.

6. BELGIUM

Belgian schools operate on a quasi-market principle in the sense that the system is competitive and publicly funded on a per-pupil basis. Since 1959, an article of the Constitution emphasises that parents are allowed to choose the school their children attend. The State makes this right effective by providing a public school, by subsidising an existing one, or by providing free transport to the school of choice.

Strictly speaking, their are four organisational forms of schools receiving full taxpayer funding on a per-pupil basis. Education is provided by schools under the central government control (the French-Speaking Community and the Flemish Community governments since 1988), provincial government control, local government control (the municipalities), and 'private' ('free') schools (Toma, 1996). The latter were historically set up by the Roman Catholic Church and are now essentially controlled by Non-Profit Organisations, with limited cross-coordination, wherein non-religious staff is more and more dominant given the reduction of the number of nuns and priests.

All public schools — central, provincial and municipal government schools — and 'approved' private schools receive full public funding for their operating costs. Some discrimination in favour of public schools persists concerning capital but it tends to disappear gradually. Since 1959, government funds have been allocated to schools on a per-pupil basis, and all schools, public or 'private', receiving public money are not allowed to charge tuition.

Shools also have to conform to program requirements. Regulation however is confined to the list of subjects taught and language used. Except in schools under government control (at most 25% of the market), regulation cannot deal with methods of instruction (Toma, 1996). This is not necessarily the case in

Sweden or in New Zealand (Wylie, 1995)[15]. Regulatory requirements concerning curricula, teaching methods, evaluation and admission standards are almost non-existent. Schools are relatively free to define the contents of their programs. Evaluation — including the possibility to impose grade repetition — as well as certification are decided upon at the school level. In practice this means that the variance among graduates of a certain type is potentially high. By contrast, in the Netherlands evaluation criteria are partly fixed by central commissions. Finally it is worth stressing that no procedure or incentive exists to ensure that admissions are non-selective and non discriminatory.

In Belgium the regulator used his regulatory power to centralise remuneration (wage) policies, pension schemes, tenure conditions... Referring to our previous discussion, one can say quite unambiguously that regulation in Belgium applies exclusively to educational **inputs**. Unlike the new system in the UK, heads of schools have no or little liberty of action on how to spend their resources. Schools do not control salary levels. Teachers are not paid at school level, but directly by the Ministry of education. Heads of schools cannot decide upon the relative importance of salary budget (by opting for more capital-intensive technologies for example). Like in the Dutch system, the Ministry of Education defines required teaching credentials which schools must respect when hiring or awarding tenure. Hiring priorities are defined centrally and limit the capacity of heads of schools to employ young teachers when enrolment is declining... Schedule, work hours and other conditions of work are centrally determined too.

Schools in the UK theoretically compete on how best to deliver a standard product that is defined by the government. Schools have a lot of freedom concerning the choice of means to achieve that end. In Belgium, by contrast, schools have less elbow room concerning the use of their inputs. This might *a priori* be interpreted as a source of bureaucratic inefficiency, a channel through which competition is bridled. Yet, schools are less constrained in terms of output. Schools compete on how best to deliver a product that is potentially less standardised than in the UK. The set or regulatory requirements concerning output is indeed relatively loose. The latter's characteristics are thus probably defined by the decentralised interaction of supply and demand.

15 For a good survey of school choice arrangements in OECD countries see CERI (1994) and Glenn (1989).

7. CONCLUSION

To conclude this brief overview of quasi-markets, we can say that quasi-markets are hybrid institutions. They systematically combine several sorts of control and co-ordination principles. Both administrators and clients potentially exert some control over schools.

The range and the nature of regulatory requirements can vary significantly. Real quasi-markets represent a continuum of differences regarding the kind of regulation that is imposed to schools in competition. Some countries like the Netherlands and undoubtedly Belgium accumulated regulatory requirements concerning the use of inputs. The UK and New-Zealand, where quasi-markets are more recent, tend to relax these requirements and promote school-based management of resources (Wylie, 1995). Nonetheless these countries impose national curricula and organise central exams at regular intervals.

From our standpoint, the key issue is to determine whether the coexistence of two regulatory principles — competition and administrative or bureaucratic regulation — echoes some logical and empirical necessity. Is their some reason justifying this hybrid situation and if so which form should it take? Part 2 and Part 3 will assess this question, in very general terms, through theoretical analysis. Our first aim is to abstract from the particularities of existing quasi-markets and focus on the idea of competition which — from our standpoint — is central. We will essentially try to evaluate the capacity of competition in quasi-markets to generate efficiency and the kind of regulatory approaches that could improve its functioning. Part 4 will mark a clear come back to more empirical considerations. It will be devoted to an empirical evaluation of the quasi-market's efficiency — as it operates in the French-Speaking Community of Belgium for more than forty years now.

Part 2

Quasi-markets functioning

What follows is a theoretical exercise aimed at developing an economic analysis of an educational system where the educational output, apart from each individual's propensity to invest in himself, is heavily conditioned by the educational system's functioning. We retain from Part 1 of this research that the supply side of the educational process can no longer be represented as a simple (and neutral) black box. At least do we have to consider that some technology challenge is at stake i.e. only properly combined inputs lead to some output. In addition, empirical studies and theoretical reasoning suggest that this technology would be much more productive if some qualitative inputs — organisation and peer effects — are properly and adequately mobilised. Finally, we put forward a third major parameter: the institutional arrangement which consists of combining public financing and free choice i.e. competition among schools.

Internal organisation of schools will be identified hereafter with teacher effort. This might be perceived as over-simplified. Indeed, we have seen in Part 1 that internal organisation of schools is a very complex issue wherein numerous variables are at stake (administration, curricular arrangements, scheduling, tracks....). Our choice to focus on teacher effort is partly motivated by our desire to keep things tractable in a highly formalised setting. More fundamentally, is it motivated by our intention to primarily evaluate the capacity of a competitive mechanism to induce effort inside an educational system. Our belief is that effort-prone teachers is a necessary — though not sufficient — condition to get well-organised schools. Note that effort can be understood both in a restricted or large sense. It might simply mean the necessity to stimulate individual effort and increase accountability. In a larger sense, the notion of effort might also echo the whole idea of coordination across grade and subject matters. In that case effort can reflect a teacher's difficulty to overcome fear of team-work and evaluation of his work by his colleagues.

We have decided to focus here on the peer effects which operate like local social-spillover. The central role of peer effects in our model echoes several empirical studies[1]. It also reflects a conceptual shift: the rational bureaucratic model dominant during the 60's and the 70's, synonymous with a functional division with teaching labour into specialised tasks, has been

1 Economists (Henderson, Mieskowski & Sauvageau, 1978 ; Summers & Wolfe, 1977 ; Hanushek, 1986 ; Dynarski, Schwab & Zampelli, 1989 ; Duncan, 1994 ; Evans, Oates & Schwab, 1992), sociologists (Coleman, 1966, 1988 ; Jencks & Meyer, 1987 ; Willms & Rodenbush, 1989) and pedagogues (Slavin, 1987, 1990 ; Grisay, 1993 ; Gamoran & Nystrand, 1994)

progressively replaced by a more communal view of educational problems. From this relatively new standpoint, educational efficiency is also conditional to an adequate mobilisation of social, non-monetary inputs.

Finally, our interest for quasi-market is fundamentally motivated by the current trend in terms of institutional settings with regard to education. More and more western countries have educational systems characterised by free school choice and per-pupil public financing.

How do quasi-markets operate when peer effects are present? What does free parental choice actually mean? How do suppliers (schools) behave? And, more essentially, what is quasi-market's efficiency when peer effects matter? Those are the essential questions that will be explored hereafter.

Chapter 4 summarises the empirical information available about peer effects and school choice. Chapter 5 presents formally the basic ingredients of the model. We start with a general presentation of our model. The incentive (accountability) problem and also the peer effect (local social spillover) idea are exposed formally.

Chapter 6 identifies and discusses the optimal organisation of a quasi-market. The point is to analyse the decision that would be made by a social planner totally devoted to maximising the social well-being. The objective is to identify the ideal (or first best) situation. We will see that the presence of a social spillover does not mechanically prescribe the nature of the coordination problem: at least two other dimensions are decisive. The first one is the way this spillover is produced by the aggregation of individuals. The second one is the way this spillover interacts with the other components of the human capital production function.

Chapter 7 aims at confronting this first best to the functioning of 'real' quasi-markets. The question is to determine whether some 'gap' or 'wedge' logically appears. This amounts to determining the quasi-market's degree of inefficiency and explaining its origin(s).

CHAPTER 4. WHAT DO WE KNOW ABOUT PEER EFFECTS AND QUASI-MARKETS?

Human capital production inevitably takes place in classrooms where pupils are together and interact. In turn, these classrooms are part of a school where pupils tend also to interact. Educational output is probably heavily influenced by the characteristics of the members of the school community (peers). This is true of numerous situations of economic and social life. For example, public security of an urban area is not only a function of police inputs (number of police officers, frequency of patrols), it is also fundamentally affected by each inhabitant's propensity to commit crime. Similarly, school result is not entirely determined by the number of teachers, their experience or the presence of books, labs and sport facilities. It is also influenced by the characteristics of pupils. Section 1 will review the empiriral work addressing this issue.

The second topic at the heart of our reasoning — treated here in section 2 — is the quasi-market institutional option. Quasi-markets are based on a free choice idea. Is choice a 'good' thing for education? Is it synonymous with accountability (maximal effort by suppliers)? Does it lead to dramatic school segregation? Those issues have always been heavily debated by proponents and opponents of extended parental choice (Levin, 1991). Activism around educational choice is particularly frequent so that it is sometimes very difficult to interpret results and conclusions, even when published by scientific journals.

1. PEER EFFECTS

Characteristics of individuals can influence gross output through two channels. First, educational attainment of a pupil is directly influenced by his human capital endowment i.e. what he receives from his parents corresponding to their contribution to education. As almost every empirical study suggests, low achievers generally originate from low income families and have parents with a poor educational record (Glennester, 1991 ; Donni & Lejeune, 1994). But there is a second channel through which characteristics of individuals influence the output. A child's attainment can indeed be influenced by the characteristics or behaviour of his classmates and schoolmates. This is basically the peer group effect idea initially identified by

Coleman (1966) in the educational context. This phenomenon has been extensively documented in several areas including urban security and crime, drug addiction and teenage pregnancy (Jencks & Meyer, 1987; Corcoran, Gordon, Laren & Solon, 1990).

1.1. How do peer effects work ?

Most researchers come to the conclusion that peer effects exist. But the question of their ***modus operandi*** is still largely debated. Some works known as 'micro-economics of the classroom' help us understand the potential link between ability grouping practices and educational output. Mullingan (1984) develops a queuing model to explain how low-ability pupils manage to catch a teacher's attention by forcing their more able classmates to wait longer before moving towards the next topic. The whole idea is that pupils interact by mobilising the teacher's — limited — time budget. This time budget tends to be a public good exposed to congestion. For a given curriculum, a teacher is expected to be more frequently interrupted by low-ability pupils while the more able pupils keep silent. Low-ability pupils can represent the whole classroom (segregation[2] case) or simply a portion (desegregation[3] case). In the first case, the whole classroom has to share the teacher's unit of time. In the second case the same unit of time is devoted to a portion of the total classroom. Low-ability pupils receive more time when they have more able classmates but this comes at a cost for the latter: the curriculum they eventually cover is less important. The net result — i.e. the existence of a positive spillover — depends upon each type of pupil's sensitivity to teaching support.

Note that there are other explanations of peer effect phenomena. Some sociologists and pedagogues (Hallinan, 1990 ; Hallinan & Williams, 1990) talk about 'behavioural' contagion: high-ability pupils act as 'models' for their classmates. Their willingness to learn helps the teacher establish a 'learning' climate, favourable to the knowledge-transmission process.

In his survey of experimental studies testing the impact of various schemes of ability grouping, Slavin (1987, 1990) concludes that the latter have *per se* very limited effects on educational achievement. Yet, Oakes, Gamoran & Page (1992) argue very judiciously that the real issue at stake is the curriculum differentiation process: a direct corollary of 'real' ability grouping prac-

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2 Often referred to as the 'tracking' (in the US) or 'streaming' (in UK) option

3 Some people use the word 'mixing '.

tices. In other words, Slavin neglects some part of the reality because the experimental studies — typically what he looks at — neutralise the curriculum variable. Quite invariably, Hallinan (1990) observes in her work that non-supervised ability grouping routines lead to dramatic differentiation of curricula.

Along this line of reasoning, peer effects would simply correspond to the implementation of programs and teaching contents structured along ability grouping practices. If the classroom is entirely composed of low-ability pupils, the teacher tends to significantly lessen the complexity of his teaching contents and both his demands and his expectations. On the contrary, if the classroom is composed of 'gifted' pupils he seems invariably inclined to become more demanding and revise his expectations upwards. This very troublesome empirical observation has led several 'liberal' pedagogues to question the opportunity of greatly personalised curricula. Uniform programs and contents wrongly assume that all pupils are identical. But personalised curricula often lead to excessive differentiation, practically synonymous with unrestrained classification and implicit ranking (Grisay, 1993).

To mix 'bright' and 'dumb' pupils, consequently generates curricular adjustments. Dahllöf (1971) describes this process as follows :

> "In the comprehensive classes the bright pupils reach the same level of objectives in the same effective time as their counterparts in the positively selected classes. Having done this they must wait in some way or other for their slower peers in the steering criterion group. This waiting time may be filled by other types of work (...) so-called enrichment exercises (...) more difficult from a formal point of view (...) but of the same general type as in the common core. With regard to fundamental learning, enrichments of this type very soon become overlearning with no further gain. The pupils in this area of the ability distribution may be busy, and certainly do not cause any disciplinary problems, but they are not learning anything more of substantial value in the curriculum unit under treatment. Otherwise bright pupils in comprehensive classes would excel pupils in positively selected classes in elementary curriculum units. "

Dahllöf's description seems to confirm the idea that ability mixing entails curricular adjustments that are favourable to low-ability pupils and unfavourable to high-ability pupils. Successive interruptions caused by less able pupils tend to add up and, eventually, come at a certain cost for their more able peers. A teacher's time-budget is indeed limited. This loss can be partially compensated if the 'more' able pupils are associated with the teaching process. In the US, this phenomenon is called 'peer tutoring'. Apparently, this kind of exercise tends to improve final results: pupils get a better understanding of subjects when they have the opportunity to expose it to their peers. Limitations must be mentioned however. Teachers must indeed be cautious about excessive 'status' differentiation inside their classrooms (Cohen & Lotan, 1994). This is possibly why peer tutoring works better when it amounts to cross-age or cross-grade tutoring.

1.2. Peer effect measurement

Several empirical studies have attempted to 'measure' the peer effect phenomenon. The issue has been addressed by economists (Henderson, Mieskowski & Sauvageau, 1978 ; Summers & Wolfe, 1977 ; Hanushek, 1986 ; Dynarski, Schwab & Zampelli, 1989 ; Duncan, 1994 ; Evans, Oates & Schwab, 1992), sociologists (Coleman, 1966, 1988 ; Jencks & Meyer, 1987 ; Willms & Rodenbush, 1989) and pedagogues (Slavin, 1987, 1990 ; Grisay, 1993 ; Gamoran & Nystrand, 1994).

Most researchers come to the conclusion that peer effects exist: the higher the proportion of high-ability pupils, the higher everybody's achievement. In other words, the higher the ability-mix of classmates, the higher will be the local social spillover a pupil will benefit from. More precisely, most researchers accept the conclusion that low-ability children benefit from the presence of their more able peers. The reverse and symmetric effect is sometimes put to doubt. Summers & Wolfe (1977) conclude for example that more able children are not affected by the presence of less able comrades. This conclusion does however not resist to more accurate achievement tests as those carried out by Dahllöf (1971).

Willms & Echols (1992) using Scottish data estimate that the peer effect[4] ranges from 0.15 to 0.35 of a standard deviation. This suggests that a child with national average ability moved from a school where the mean ability is one-half of a standard deviation below the national average to a school where the mean ability is one-half of a standard deviation above the national average, has an expected attainment about one-quarter of a standard deviation higher. This is a substantial effect. This result was already present in previous studies: first in Coleman (1966), then Henderson, Mieskowski & Sauvageau (1978). It is also to be found in more recent studies (Duncan, 1994 ; Link & Mulligan, 1991 ; Dynarski, Schwab & Zampelli, 1989 ; Leroy-Audouin, 1995).

4 Also called contextual effect.

1.3. Is peer effect re-allocation a zero-sum or a positive sum game?

Very few empirical studies have tried to answer this question. Henderson, Mieskowski & Sauvageau (1978) stress that the peer effect variable (measured by the average entry-level Intelligence Quotient (IQ)) does not vary with the level of pupils' own first recorded IQ. The authors consequently retain an additive specification where the peer effect is specified as a quadratic function. The negative (significant) coefficient for the mean class IQ squared suggests that the quadratic function is concave. Combined with the additivity result, this observation leads the authors to draw a very distinct conclusion:

> "(...) a mixing of weak and strong students within a given population will enhance performance of the overall student population. Although the strong students will loose as result of the mixing, the concavity of the peer group effect will ensure that the decrease in the achievement of strong students relative to a stratified classroom situation will be smaller than the gain of the weak students though the loss may be substantial."

A more recent study, focusing on primary education, (Leroy-Audouin, 1995) concludes that low-ability children are more sensitive to peer effects than their more able counterparts. This result seems to be confirmed by a more recent study carried out by Gamoran & Nystrand (1994)

> "(...) One can also compare the high, low and heterogeneous categories to see that tracking provides an advantage to students in high-track classes, compared to similar students in untracked schools, but that low-track students suffer an even greater loss."

Nevertheless, to illustrate more complex and intricate questions it is worth noting that several studies conclude that the idea of social spillover suffers some limitation when multiracial mixing is at stake (Winkler, 1975; Brooks-Gunn, Duncan, Klebanov & Sealand, 1993). In the American context, young black men apparently need racial homogeneity to be successful at school. In other words, they benefit from their 'high achieving classmates' only if those are black men or black women (Duncan, 1994 ; Link & Mulligan, 1989).

2. QUASI-MARKETS AND CHOICE

Quasi-markets — as they have been defined in Part 1, chapter 3 — represent a particular institutional arrangement wherein school choice is central. Yet, other institutional settings allow some form of school choice. The school choice debate thus transcends the case of quasi-markets (Economics of

Education Review, 1992). We shall first (section 2.1) examine the results of studies which address the consequences of school choice at large. We will then (section 2.2) examine the case of school choice in the few quasi-markets that exist around the world.

2.1. School choice and efficiency

Glenn (1989) claims, at the end of his multi-country investigation (France, Belgium, the Netherlands, Canada, UK, and Germany), that the case for choice-driven efficiency is weak. In his view, the danger of extended segregation dominates any other benefit. He underlines the crucial role played by some regulatory requirements in order to limit the propensity of choice to generate segregation.

The first econometric studies aimed at estimating the impact of choice on education both in terms of effort and segregation were carried out in the US (Chubb & Moe, 1990 ; Lankford & Wyckoff, 1992; Hoxby 1994a, 1994b, 1995a). This situation is somewhat paradoxical because the US have no real 'voucher' or quasi-market system[5]. The empirical studies we mention here use highly complex techniques to estimate the impact of choice. They are all relatively recent and, most likely, directly echo the quite controversial debate that currently mobilises a lot of people in the US. Indeed some want to introduce 'vouchers' in order to overcome the current crisis. Others strongly oppose this approach because they see the current 'zoning' system as a minimal requirement to avoid further racial and socio-economic segregation.

Most observers agree that parents can choose their school in the US. They can do so by opting for the 'right' district (Murnane, 1986). Residential mobility is high in the US so that, by and large, parents have the opportunity to decide where to send their children. But this sort of choice is very much constrained. Some parents must live in a particular district simply because their employer is there. School choice through residential mobility is also heavily influenced by real estate markets. Real estate prices tend to reflect the 'quality' of the local public school. Indeed, real estate agents frequently use SAT scores (standardised test results) to justify the price of their product. In that sense, families pay implicit school premiums when they want to settle close to a 'good' public school. Choice is thus wealth-contingent. It is true that a kind of 'virtual' educational market exists in the US, but it is most likely extremely segmented.

5 More than 85% of US pupils attend public schools at elementary and secondary level. This figure is relatively constant since the end of world-war II.

Hoxby (1994a) has investigated the impact of 'choice' in the US very thoroughly, on the basis of impressive nation-wide data. In addition, her work has acquired some reputation and is considered by US researchers as a major benchmark. She seems to conclude that the larger the choice opportunities, the better educational outcomes. In addition, more choice would not lead to more segregation or pernicious sorting.

The year of reference in Hoxby's study is 1980. Pupil performance (the dependent variable) is estimated alternatively by educational attainment (highest grade completed by age 24), hourly wages on the labour market, and test scores (Armed Forces Qualification Test).

The most important independent (or explanatory) variable is public school enrolment concentration. It consists of a measure of the degree to which schooling in an area is controlled by few large districts. It is the parallel to industry concentration and is measured by a Herfindahl index based on enrolment share. Geographical reference zones are the Standard Metropolitan Statistic Areas (SMSAs). Those areas are significantly larger than districts but also significantly smaller than states. A typical area with a high concentration index is Alaska. Inversely, east-coast SMSAs show relatively low concentration indexes i.e. parents can *a priori* choose among several districts within those SMSAs.

Hoxby's underlying assumption is that this concentration index is a good proxy for educational choice opportunity. Voucher plans have not yet been adopted on a state-wide scale in the US. But Hoxby argues that is it already possible to estimate the effect of easier parental choice. Indeed, variation in the ease of choosing among public schools already exists because metropolitan areas differ greatly in their public school enrolment concentration. Her underlying vision of the districts is the Tiebout (1956) local public good model. Clubs (districts) potentially compete in a cost minimising or quality maximising manner in order to attract inhabitants. The higher the concentration, the lower the easiness of choice and the lower the potential for 'sound' competitive pressure.

Other variables she has retained essentially control the usual 'background' characteristics: sex, ethnicity, family composition. Ability is approximated by the educational record of the parents: the parents' highest grade completed. 'Quality' of education is controlled by both the per-pupil expenditure and the average class-size, while the local wealth is incorporated in the regression under the form of the average per-capita income.

The main result is a positive relation between concentration of enrolment in public schools and lower educational attainment (grade completed by age 24) of public school pupils. Changing a metropolitan area from twenty equal-sized school districts to one school district makes its public school pupils complete half a year less education. Hoxby insists on the fact that per-pupil spending and pupil-teacher ratios have no significant effect on pupil achievement. In other words, the local market's structure would be the dominant causal effect. This result is confirmed by the second regression using hourly wages as dependent variable. A 0.95 increase in the Herfindahl index of public school enrolment concentration lowers wages by approximately 13 percent. Finally, the Armed Forces Qualification Test results are only weakly significant.

In addition, Hoxby's results suggest that the effects of public school enrolment concentration appear to be spread rather evenly over the distribution of pupil performance. In other words, public school enrolment concentration does not affect the standard deviation of pupil performance — both educational attainment and test scores — within the metropolitan area.

Hoxby concludes that less concentration *causes* better educational achievement with no increased sorting or segregation. Those results tend to contrast with Glenn's conclusion and several other studies. Critics would certainly notice that the only really standardised measure of achievement that she used (the Armed Forces Qualification Test) appears much less significant than the others. The relation between concentration — i.e. urban structure vs. rural structure of SMSA's to a large extent — and both highest grade completed and hourly wages can reflect several phenomena: enrolment share of districts is just one of them.

If pupils attend school in big urban areas and work in those areas afterwards what do we really measure when we observe that they earn higher hourly wages? Firms in big urban areas are probably offering higher hourly wages because the local economy is relatively more dynamic[6] or simply because the cost of living is higher. The 'signalling' phenomenon is probably more frequent in very dense urban areas and this could partly explain an inhabitant's

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6 Our argument is simply that several factors potentially contribute to the dynamism of a local economy. The average level of human capital is just one of them and it is potentially independent from the others.

propensity to stay longer at school. Equivalently, employers could be more demanding in areas where the average qualification is higher. Teenagers could partially incorporate this fact in their choice of education.

Generally speaking, one could also argue that hourly wages are an imperfect proxy of human capital achievement[7]. The productivity of an individual — and his corresponding wage — is not exclusively determined by his own human capital (i.e. cross derivatives are not nil). If this is true, unless matching of human capital levels is perfect, the hourly wage of an individual mirrors the performance or several schools — the one attended by the individual himself and those attended by his colleagues — and different generations of teachers. Indeed, firms usually mix pupils of various ages coming from different schools located in different states or regions, especially in the US.

2.2. School choice, efficiency and quasi-markets

Quite surprisingly, countries like Belgium or the Netherlands, where implicit[8] 'vouchers' and quasi-market mechanisms exist, have not been extensively studied by economists and statisticians. Research aiming at evaluating in a quasi-market framework the effects of school choice is very limited. Reasons for this are probably twofold. First, 'old' quasi-markets were adopted by countries confronted with a serious religious and philosophical conflict. Quasi-markets were not explicitly aimed at stimulating quality or enhancing user-oriented service delivery. Most of the time they were simply the logical consequence of an institutional conflict opposing the State to Church. In addition, it has long been taken for granted that the only major educational challenge in western countries was to reduce educational cost directly supported by individuals and simultaneously to expand participation rates. Both conditions have been perfectly fulfilled by educational quasi-markets.

Second, recent quasi-market reforms (UK, New-Zealand or Sweden...) are probably too recent. Attempts to evaluate their effects are possibly premature. Some exceptions must be mentioned however. Unfortunately, most of them tend to focus exclusively on the segregation problem (Willms & Echols, 1992 ; Karsten, 1994 ; Waslander & Thrupp, 1995). Very little attention has been devoted to the overall efficiency of 'new' educational quasi-markets.

7 See our discussion of Kard & Krueger's results in chapter 2, section 1.2.

8 Parents do not receive a real voucher, but the right to send their children to any school they choose...being perfectly aware schools are financed on a per pupil basis.

According to Karsten (1994), ethnic segregation has increased between 1986 and 1992 in the Netherlands, mainly in big cities. In New-Zealand, evaluation of 'dezoning' experiments reveals that parents rapidly exploit their new opportunities (Waslander & Thrupp, 1995). Well-educated families are apparently more mobile than others. 'Successful' schools tend to be those with a 'good' socio-economic profile.

Willms & Echols (1992) argue that 'designated' and 'chosen' schools potentially diverge along two dimensions: the intensity of the type 'A' and type 'B' effects. Type A effects include contextual (or peer) effects and exogenous influences from social and economic factors. Parents interested in maximising their child's attainment would particularly be concerned by this type of effect. Type B effects reflect the relative efficiency of teachers and heads of school when factors (theoretically) beyond their control have been excluded. Willms & Echols use Scottish data to estimate their model. They conclude that type A effects are dominant. Parents choose schools that have high-social intake, and high unadjusted[9] levels of attainment.

9 In the sense that the initial level of human capital is not incorporated into the calculus.

CHAPTER 5. THE MODEL

Our model is specific in two ways. First, it is aimed at analysing the efficiency of a particular way of generating parental or student choice: quasi-markets. None of the studies mentioned above treats this institutional option *per se*. Second, this model focuses simultaneously on the accountability (or incentive) problem and the allocation problem raised by the peer effect argument. We will begin in section 1 with a non technical presentation of the model. The development of the formal apparatus follows. Section 2 presents the quasi-market, its schools, the characteristics of the population and the school choice mechanism. The human capital production function is exposed in section 3 while section 4 develops the social utility function.

1. GENERAL PRESENTATION

1.1. Incentive and allocation problems

The incentive problem consists of ensuring that teachers make a proper use of their inputs. Several studies have suggested that a lack of effort or accountability could considerably alter the performance of educational systems. Several researchers (and also activists) consequently explore the opportunity to introduce output base plans (Murnane & Cohen, 1986) or to expand free-choice in order to create competitive pressure (Chubb & Moe, 1990; Bowlse & Gintis, 1993).

The concern for allocation of pupils with varying human capital endowment refers to some extent to the fear of segregation expressed by many observers of free-choice mechanisms (Levin, 1991; Clune & Witte, 1990). It also refers to recent models introducing a peer effect variable in production functions (rueckner & Lee, 1989 ; Schwab & Oates, 1991; de Bartolome, 1990). Although empirical identification of peer effects is not something new (Coleman, 1966 ; Henderson, Mieskowski & Sauvageau, 1978 ; Summers & Wolfe, 1977 ; Link & Milligan, 1991), systematic treatment of the concept by theoretical literature has occurred relatively recently (Arnott & Rowse, 1987; Durlauf, 1994 ; Nechyba, 1996). This line of research has stressed the sensitivity of normative results — the desirability of desegregation vs. segregation — to the specification of the production function with peer effects. Bénabou (1993, 1994a, 1994b, 1996a) incorporates that question into his analysis of schools and cities and identifies the necessary condition for segregation to be dominated by desegregation in terms of social optimality.

As already explained, we think it is important to analyse the accountability and the peer effect issues simultaneously. Consequently, our educational production function incorporates both an effort variable and the peer effect (local social spillover) component. Our central question is simply to determine whether quasi-markets (free and unrestricted school choice) can solve the incentive (accountability) problem and simultaneously guarantee an optimal allocation of pupils.

1.2. Five basic assumptions

To carry out this program we believe it is appropriate to make five basic assumptions. The first one is that parents do not have the same human capital or do not offer the same socio-economic environment to their offspring. As part of human capital is produced within the family, pupils will vary in human capital endowment when entering the educational system.

The second assumption evidently corresponds to the existence of peer effects (local social spillover) inside the educational system.

The third assumption is that suppliers (schools) are non-profit organisations — by nature or legal compliance — that actually maximise the utility of a representative teacher. This representative teacher is sensitive to the aggregated characteristics of his pupils. In other words, the level of peer effects enters into his utility function. He wants to maximise the level of this local social spillover in his school or classroom simply because this is synonymous with greater comfort. We think this assumption is legitimated and reinforced by the very nature of the teacher-pupil relation. Contrary to other services, education necessitates a very long interaction between demand and supply. Production of knowledge usually takes several months or years. It requires a minimal co-operation from the pupil. Education might be the sector of the services industry where the word 'inter-action' is the most meaningful. Even health care provision does not require such a strong mutual involvement.

Our fourth assumption is that 'clients' (parents and pupils) are maximisers. Since schools are financed with public money, in making their choices, parents and pupils take into account only human capital outcomes. Children choose the school that provides the highest achievement in human capital acquisition. Parents, if choosing on behalf of their children, follow the same objective. In this precise sense, they are altruistic. Their maximising behaviour also means that they must also be sensitive to peer effects. They want to benefit from them or accumulate them in order to maximise educational attainment. Coleman (1988) uses the term 'social capital' to indicate that peer effects are a major asset for production.

Combined with the third assumption this means that peer effects may be considered as an endogenous variable of the economic model. They are part of the optimisation program of individuals (both parents and teachers). There is no contradiction between economic and sociological approaches. Social variable do not precede economic analysis. In this case they do not have to be treated as exogenous parameters (Montgomery, 1991 ; Arrow, 1994).

The fifth assumption is that individuals (teachers, parents, pupils) incorporate peer effects in their optimisation program, but ignore their own influence on the quality of peer effects. A family with low human capital wants to attend a 'good' school but doesn't care about the resulting decrease of peer effects. Similarly a family with high human capital that disregards a school because of its social composition does not care about the further deterioration its absence will entail. Similar arguments can be developed with the individual teacher's decision. In that context, we think it is necessary to pay attention to both the recruitment strategies of schools and the way parents make their choice. We believe this approach is fundamental when allocation of pupils is decentralised as it is the case on a quasi-market.`

2. PARENTS, PUPILS, DOMESTIC EDUCATION AND SCHOOLS

The quasi-market consists of a geographical area of limited size (a district or an urban area...) where two schools of equal size (standardised to 1) are of free access to all children living that area. Transport costs are nil or at least uniform for all inhabitants. The total number of children is 2. Families have one child. Parents are of two types. Some have a high level of human capital ($ß^h$) and the others have a lower one ($ß^l$). The two types' proportions in the total population (2) are respectively Ω and $(1-\Omega)$. Parents transmit human capital to their children. If parents have unequal human capital levels so are the endowments of their children. For simplicity of exposition[10] we assume

[10] For a more sophisticated treatment of domestic production of human capital see Borjas (1992).

that the ratio of parental human capital and domestic human capital production[11] is equal to 1. Thus, children are either of type $ß^h$ (high human capital endowment) or of type $ß^l$ (low human capital endowment) to the proportions of Ω and $1-\Omega$. Proportion of type $ß^h$ children ('rich' in terms of human capital endowment) in school 1 is R_1 while the corresponding proportion of type $ß^h$ children in school 2 is $R_2 = 2\Omega - R_1$.

Table 5.1 – Quasi-market structure (proportions)

	Proportion(number) of children/pupils		
Initial Human Capital Endowment	$ß^h$ (high)	$ß^l$(low)	Both types
School 1	R_1	$1-R_1$	1
School 2	$R_2 = 2\Omega - R_1$	$1-R_2 = 1-2\Omega + R_1$	1
District	$2.\Omega$	$2.(1-\Omega)$	2

Bounds on R_1 (and simultaneously on R_2) are given by expression (5.1).

(5.1) $0 \leq \Omega \leq 1$

$\text{Max}\ \{0, 2\Omega-1\} \leq R_i \leq \text{Min}\ \{1, 2\Omega\}$; i=1,2

with

- $0 \leq R_i \leq 2\Omega$ if $\Omega \leq 1/2$
- $0 < 2\Omega-1 < R_i \leq 1$ if $\Omega > 1/2$

Parents maximise their utility which is the sum of [I] disposable income (income minus tax financing the educational system) and [II] expected (discounted) human capital attainment of their child in school i. In that sense, parents are altruistic. As the tax level financing education is beyond their control and as access to education is free of charge, the only decision variable is the school i=1,2 they select for their child. Those demand-side assumptions will be developed in chapter 7.

3. THE EDUCATIONAL PRODUCTION FUNCTION

Human capital attained by a pupil j = h,l in school i $K_i(ß^j, L_i, e_i)$ at the end of the period is positively influenced by three variables: [I] initial human capital endowment ($ß^j$), [II] peer effects (L_i) and [III] teachers' efforts (e_i).

11 Kremer (1995) mentions a 60 percent intergenerational transfer rate in the United States.

(5.2) $K_i(ß^j, L_i, e_i) = F(ß^j, L(R_i, ß^h, ß^l)) + e_i(E_i, L(R_i, ß^h, ß^l))$

where

- $i = 1,2$; the school index
- $j = h,l$; the initial human capital endowment index;
- $L(R_i, ß^h\ ß^l)$ corresponds to the peer group effect (the non-monetary input);
- $e(E_i, L(R_i, ß^h\ ß^l))$ represents the effort that can be obtained with a certain level of per-pupil expenditure i.e. the monetary input (E_i) and the peer effect i.e. the non-monetary input ($L(R_i, ß^h, ß^l)$).

We retain a semi-additive specification in expression 5.2. The term $F(ß^j, L(R_i, ß^h, ß^l))$ aggregates the contribution of human capital endowment and the mechanical contribution of the peer effect to a pupil $ß^j$'s gross human capital achievement. We assume that $F_L'^j > 0$.

Note that the second term $e(E_i, L(R_i, ß^h, ß^l))$ also incorporates the level of peer effect i.e. a teacher's capacity to produce additional human capital is positively influenced by the level of peer effect. This more indirect contribution is conditional to the teacher's propensity or willingness to transform that input into human capital — i.e. effort. B oth a direct and an indirect contribution of peer effects to human capital production seem plausible. Some analysts argue that children benefit automatically from the presence of more able classmates and schoolmates (Jencks & Meyer, 1987). However, some other specialists suggest that the *ex post* measurement of peer effects simply reflects teachers' willingness and ability to cope with heterogeneity (Hallinan, 1994). Both hypotheses will be retained simultaneously in our presentation. Occasionally, we will simply indicate how our general results are affected when one hypothesis prevails.

The effort component $e(E_i, L(R_i, ß^h, ß^l))$ directly adds itself to this first term. Teaching effort and human capital are thus supposedly commensurable. The additive specification also means that we *a priori* exclude cross effects between the two terms. In non technical words, this means that each pupil, no matter his human capital endowment, uniformly benefits from the teacher's effort[12].

12 Justification for this could be that the teacher can organise some egalitarian allocation of his effort so that each pupil in his classroom — no matter his endowment — finishes the school year having achieved the same progress. By contrast, an egalitarian allocation is more difficult to imagine for peer effects that mechanically and directly influence achievement. By definition, this phenomenon is beyond teachers' control. This argument justifies that

In order keep notations as simple as possible, we will use hereafter $L(R_i)$ instead of $L(R_i, ß^h, ß^l)$. We will also use $F^h(R_i)$ instead of $F(ß^h, L(R_i))$ and $F^l(R_i)$ instead of $F(ß^l, L(R_i))$[13]. Without loss of generality we will also suppose that $\Omega \leq 1/2$ so that the bounds on R_i are that $0 \leq R_i \leq 2\Omega$.

3.1. Peer group effects and costs-benefits of heterogeneity

Peer group effect term $L(R_i)$ captures the non-monetary channels through which children accumulate human capital in schools. It represents the quality of social and pedagogical interaction in school i. Note that the term 'peer' does not refer here to pupils with the same human capital endowment but to **classmates** and **schoolmates**.

Conceptually, $L(R_i)$ amounts to a social spillover. This spillover should be considered hereafter as a production factor[14] in its own right: the higher $L(R_i)$ the higher the human capital acquired by each pupil in the classroom, all other things being constant.

As already mentioned in the introduction, it is important to realise that the question of the 'production' of a certain level of L must not be confused with the issue of its final impact on each pupil's achievement. Each pupil attending a particular school (marginally) **contributes to** the production of the peer effect level characterising his school. The formal transposition of this first idea is that L is a function of individual human capital endowments $(ß^h, ß^l)$. Bénabou (1996a, 1996b) uses a CES specification: $L(R_i) = [R_i . ß^{h\,\partial} + (1-R_i) . ß^{l\,\partial}]^{1/\partial}$. This is a convenient way to illustrate the idea that L is 'produced' by the combination of individual human capital endowments $(ß^h, ß^l)$.

Simultaneously, each pupil **benefits from** this peer effect. The formal translation of this second idea is that the human capital production function for individual $(ß^j)$ — see equation 5.2 — contains both the capital endowment $(ß^j)$ and the peer effect level $L(R_i)$.

A different way to expose the same idea is to use the local public good analogy (Tiebout, 1956). A certain level of peer effect in a school or classroom

human capital endowment $(ß^j)$ and the peer effect term $(L(ß^j))$ interact non-additively. Indeed, empirical studies support the idea that pupils do not benefit uniformly from peer effects (Leroy-Audouin, 1995).

13 Subscript h stands for high-ability and subscript l for low-ability.

14 Social capital as suggested by Coleman (1988)

can be seen as a 'local' public good. It is produced by the members of the community with the particularity that individuals contribute with their human capital endowment instead of money or labour. But in turn, each individual benefits from this good in an unrestricted — though not necessarily uniform — way.

Analytically, we will suppose here that $L(R_i)$ is continuous and twice differentiable in R_i. The level of $L(R_i)$ is positively influenced by the proportion of type $ß^h$ pupils ($L'_{R_i} > 0$). Strictly speaking it is also positively influenced by the level of human capital endowment $L'_{gj} > 0$. But remember that we have decided to fix exogenously the level of human capital endowment in this model.

Yet, the most important characteristic of the peer effect function is its **shape**. Does the presence of an additional type $ß^h$ pupil in school 1 generate a social and teaching-climate improvement that more than offsets the negative consequences of the presence of an additional type $ß^l$ pupil in school 2?

In the terms discussed in chapter 4, one of the general problems raised by the presence of peer effects is indeed to determine whether their reallocation — which necessarily supposes the replacement of type $ß^h$ pupils by type $ß^l$ pupils — is a positive-sum game for the system as a whole[15]. Further developments will reveal that the answer to this general question is **partly** conditioned by the sign of the second order derivative $L''_{R_iR_i}$: i.e. the curvature of the peer effect function.

3.2. Teacher utility and effort

Effort level $e(E_i, L(R_i))$ in the production function (expression 5.2) refers to the utility of a representative teacher as stated in expression (5.3).

15 It should be clear that for a given school or classroom, the reduction of R_i is always a source of loss and, symmetrically, the increase of R_i is source of gain.

(5.3) $V_i = E_i + L(R_i) - \Pi(e_i)$
$V_i \geq \overline{V}$
with
- Π continuous and twice differentiable: $\Pi_e > 0$, $\Pi_{ee} > 0$ indicating that the disutility of effort Π is a convex function;
- $\Pi(e_i)=0$ when $e_i=0$; suggesting that the disutility function is bounded downwards[16];

V_i is the representative teacher utility function: it is additive and has three components. First, the per-pupil expenditure E_i. The higher that expenditure, the higher a representative teacher's utility. The second element corresponds to pedagogical comfort derived from the aggregate human capital endowments of the school population. We assume this comfort to be correctly reflected by the level of peer effects $L(R_i)$. The third element is the disutility entailed by the level of effort $\Pi(e_i)$. The effort function is convex.

Teachers must get a certain utility level ($V_i \geq \overline{V}$) to accept to stay in a particular school. $\overline{V}$ can be interpreted as the utility level that those teachers would get if accepting a job outside the educational sector.

As effort is exclusively synonymous with disutility, teacher's will *a priori* fix it a zero.

4. SOCIAL UTILITY FUNCTION

The normative criterion we use here is the actualised value of aggregate human capital coming out of school 1 and 2, minus educational expenditure (expression 5.4). This social utility function (W) reflects a concern for nation-wide or community-wide wealth accumulation[17]. It can be seen as human capital investment decision that must be taken by a social planner.

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16 We assume that the participation constraint cannot be satisfied if the per-pupil endowment E_i is nil. This particularly means that the absence of effort (e_i=0) is never a sufficient condition to ensure participation: some (positive) level of per-pupil cost is necessary to keep teachers at the school .

17 We realise that this is a somewhat specific social utility function. Other versions could have been selected, leading to different results. Hoxby (1995b) or Laffont & Tirole (1993) for example incorporate the producer's surplus into the social utility function. We have discarded this option simply because we believe that the end (human capital production) is more important than the means (teachers and schools).

(5.4) $W = (K_1 + K_2) - (1+\lambda).T$

such that

- $K_1 = R_1.[F^h(R_1)+ e_1] + (1-R_1). [F^l(R_1) + e_1]$; the actualised monetary value of human capital produced by school 1;
- $K_2 = (2\Omega-R_1).[F^h(R_2) + e_2] + (1-(2\Omega-R_1)).[F^l(R_2) + e_2]$; the actualised monetary value of human capital produced by school 2;
- $T = E_1 + E_2$, the educational budget (or two times the average tax as the population's size is 2) equal to sum of per-pupil expenditure in school 1 and 2;
- $\lambda > 0$ is the distortion effect of taxation;
- W the aggregate social welfare;

Note that we implicitly assume that the (actualised[18]) monetary value per unit of human capital is unitary and constant[19]. Given our assumptions (incentive problem and peer effect) it is obvious that both the level of effort delivered by a representative teacher and the allocation of pupils between schools play a central role. Efficiency requires [I] the participation constraint to be binding ($V_i = \overline{V}, \forall$ i) — we will talk hereafter of the no-surplus condition or of perfect accountability — and [II] allocative efficiency. To be efficient, representative teachers must produce as much output as possible with a given set of resources. It is the no-surplus condition. To achieve allocative efficiency, the quasi-market (or any other educational institution) should also provide the most appropriate set of resources: here the correct per-pupil expenditure and the 'mix' of children optimising the use of peer effects in the human capital production process[20].

18 Incomes generated by the generation attending formal education amount to future earnings by definition, while public spending on education is contemporaneous.

19 We will discuss this assumption in chapter 6, section 4.

20 As it is also well known, productive efficiency does not correspond to Pareto-efficiency (Milgrom & Roberts, 1992). A reallocation of resources from type j=h to type j=l might enhance surplus W (see expression 7.4). But it will not automatically be Pareto superior. This policy could indeed leave type j=l families less well off.

CHAPTER 6. SOCIAL OPTIMUM A PLANNER WOULD RETAIN (FIRST BEST ANALYSIS)

This chapter aims at describing and discussing the first best outcome. The exercise is indicative. It must help us define a benchmark that will prove very helpful when analysing the functioning of quasi-markets with a duopoly model (see chapter 7). What follows aims at defining the best educational arrangement that one would adopt in a world where all decision variables are controlled by a central planner totally devoted to the social or collective interest.

1. GENERAL PRESENTATION OF THE OPTIMUM

In this chapter, we assume that this planner decides on the level of per-pupil effort (e_i) and on the allocation of pupils between school 1 and school 2 (R_i). We also suppose that the per-pupil expenditure (E_i) is automatically adapted to fulfil the participation constraint (see [I] and [II] in expression 6.1).

$$(6.1)\quad \text{Max}_{R_1,e_1,e_2}\ W = R_1.[F^h(R_1)+ e_1] + (1-R_1).[F^l(R_1) + e_1] +$$

$$(2\Omega-R_1).[F^h(R_2) + e_2] + (1-(2\Omega-R_1)).[F^l(R_2) + e_2]$$

$$- (1+\lambda).(E_1+E_2)$$

such that

[I] $E_1 \geq \overline{V} + \Pi(e_1) - L(R_1)$

[II] $E_2 \geq \overline{V} + \Pi(e_2) - L(2\Omega-R_1)$

Maximising W requires saturating the participation constraints in expression (6.1). This stems from the fact that effort levels e_i have a strictly positive influence on W. Note that the saturated participation constraint defines the per-pupil cost function E_i (expression 6.2) i.e. the relation between monetary input and effort $e_i(E_i, L(R_i))$. The higher the reservation utility $\overline{V}$ the higher the per-pupil cost; the higher the peer effect $L(R_i)$ the lower this per-pupil cost and, finally, the higher the effort delivered, the higher the same cost.

(6.2) $E_i = \overline{V} + \Pi(e_i) - L(R_i);\ i=1,2$

1.1. Necessary and sufficient conditions

Expression (6.1) can be presented as the sum of school 1 and school 2 **surpluses:**

(6.3) $\text{Max}_{R_1,e_1,e_2}\ W(R_1,R_2,e_1,e_2) = S(R_1,e_1) + S(R_2,e_2)$

such that

- $S(R_1,e_1) \equiv R_1.[F^h(R_1) + e_1] + (1-R_1).[F^l(R_1) + e_1] - (1+\lambda)[\overline{V} + \Pi(e_1) - L(R_1)]$
- $S(R_2,e_2) \equiv R_2.[F^h(R_2) + e_2] + (1-R_2).[F^l(R_2) + e_2] - (1+\lambda)[\overline{V} + \Pi(e_1) - L(R_2)]$
- $R_2 = 2\Omega - R_1$

The **necessary** condition for an extremum $(\hat{R}_1, \hat{e}_1, \hat{e}_2)$ is that all the first-order partial derivatives be zero ($W'_{R_1} = W'_{e_1} = W'_{e_2} = 0$).

(6.4) $W'_{R_1} = S'_{R_1}(R_1,e_1) + S'_{R_2}(R_2,e_2).[\partial R_2/\partial R_1]$

$= S'_{R_1}(R_1,e_1) - S'_{R_2}(R_2,e_2) = 0$

as $\partial R_2/\partial R_1 = -1$

(6.5) $W'_{e_1} = S'_{e_1}(R_1,e_1) = 0$ as e_1 appears exclusively in $S(R_1,e_1)$

Given the specification of $S(R_1,e_1)$, $\hat{e}_1$ is such that:

(6.6) $(1+\lambda)\Pi'_{e_1}(e_1) = 1$

(6.7) $W'_{e_2} = S'_{e_2}(R_2,e_2) = 0$ as e_2 appears exclusively in $S(R_2,e_2)$

Given the specification of $S(R_2,e_2)$, $\hat{e}_2$ is such that:

(6.8) $(1+\lambda)\Pi'_{e_2}(e_2) = 1$

Expressions (6.6) and (6.8) lead to the conclusion [I] that effort must be identical in both schools and [II] its level is independent of other decision variables. Hence $\hat{e}_1 = \hat{e}_2 = \hat{e}$. Combined with the third term of expression (6.4) this observation means that $\hat{R}_1 = R_2 = \Omega$

First-order conditions generate values $\hat{R}_1$ and $\hat{e}$ defining a stationary point $\hat{W}$. If d^2W is positive definite, $\hat{W}$ is a minimum, while if d^2W is negative definite $\hat{W}$ is a maximum. In determining the positive or negative definiteness of d^2W, we must look at the determinant of the hessian matrix and its successive principal minors. The **sufficient** conditions for an extremum (minimum, maximum) can be stated as follows (Chiang, 1984)[21]:

(6.9) $$\hat{W} \text{ is a} \begin{cases} \text{maximum} \\ \text{minimum} \end{cases}$$

$$\text{if } \begin{matrix} |H_1| < 0; |H_2| > 0; |H_3| < 0 \\ |H_1| > 0; |H_2| < 0; |H_3| > 0 \end{matrix}$$

Second-order conditions simplify dramatically given our specification of W. We have indeed assumed [I] separability in R_i and e_i. and [II] separability in e_1 and e_2.

21 $$|H| = \begin{vmatrix} W''_{R_1R_1} & W''_{R_1e_1} & W''_{R_1e_2} \\ W''_{e_1R_1} & W''_{e_1e_1} & W''_{e_1e_2} \\ W''_{e_2R_1} & W''_{e_2e_1} & W''_{e_2e_2} \end{vmatrix}; \; |H_1| = |W''_{R_1R_1}|; \; |H_2| = \begin{vmatrix} W''_{R_1R_1} & W''_{R_1e_1} \\ W''_{e_1R_1} & W''_{e_1e_1} \end{vmatrix}; \; |H_3| = |H|$$

(6.10) $W''_{e_1e_2} = W''_{e_2e_1} = 0$ as W in expression (6.3) is separable in e_1 and e_2

(6.11) $W''_{R_1e_1} = W''_{R_1e_2} = W''_{e_1R_1} = W''_{e_2R_1} = 0$ given the separability between effort and R_i in expression (6.3)

In addition, W's specification in expression (6.3) immediately reveals that $W''_{e_1e_1} = -(1+\lambda)\Pi''_{e_1e_1}(e_1) < 0$ because we have assumed that the disutility of effort is convex ($\Pi''_{e_ie_i} > 0$). For the same reason, $W''_{e_2e_2} = -(1+\lambda)\Pi''_{e_2e_2}(e_2) < 0$. The determinantal criteria thus become:

(6.12) $|H_1| = W''_{R_1R_1}$

(6.13) $|H_2| = W''_{R_1R_1} \cdot W''_{e_1e_1}$ with $W''_{e_1e_1} < 0$

(6.14) $|H_3| = W''_{R_1R_1} \cdot W''_{e_1e_1} \cdot W''_{e_2e_2}$ with $W''_{e_1e_1} < 0$ and $W''_{e_2e_2} < 0$

Hence, the positive or negative definiteness of d^2W is exclusively determined by the sign of $W''_{R_1R_1}$.

1.2. Conditions for convexity or concavity of $S(R_i, e_i)$

Previous developments have led to the conclusion that the positive or negative definiteness of d^2W is exclusively determined by the sign of $W''_{R_1R_1}$ (expressions 6.12, 6.13, 6.14). This section aims at computing this second order partial derivative and identifying the factors influencing its sign and, by extension, the segregation vs. desegregation choice. Let us demonstrate that we can exclusively focus on the second-order partial derivative of school i's surplus, $S(R_i,e_i)$.

(6.15) $W'_{R_1} = S'_{R_1}(R_1,e_1) - S'_{R_2}(R_2,e_2)$

Hence

(6.16) $W''_{R_1R_1} = S''_{R_1R_1}(R_1,e_1) - S''_{R_2R_2}(R_2,e_2).[\partial R_2/\partial R_1]$

$= S''_{R_1R_1}(R_1,e_1) + S''_{R_2R_2}(R_2,e_2)$ as $\partial R_2/\partial R_1 = -1$

In expression (6.16), the sign of $W''_{R_1R_1}$ is totally prescribed by the second-order partial derivative of an individual school's surplus $S''_{R_iR_i}(R_i,e_i)$, i=1,2. Let us now compute this expression. We do it for school 1 but we could have done it for school 2 without loss of generality[22].

(6.17) $S'_{R_1}(R_1,e_1) = F^h - F^l + [R_1.F''^l_{LL} + (1-R_1).F'^l_L + (1+\lambda)].L'_{R_1}$

(6.18) $S''_{R_1R_1}(R_1,e_1) = 2.[F'^h_L - F'^l_L].L'_{R_1} +$

$[R_1.F''^h_{LL} + (1-R_1).F''^l_{LL}].(L'_{R_1})^2 +$

$[R_1.F'^h_L + (1-R_1).F'^l_L + (1+\lambda)].L''_{R_1R_1}$

As peer effects are increasing with the proportion of type β^h children ($L'_{R_1} > 0$), expression 6.18 indicates that concavity of $S(R_1,e_1)$ is conditioned by:

[I] $F''_{\beta L}$; which represents the interaction between human capital endowment and peer effects (first term[23] of expression 6.18). The value of that cross derivative answers the question: who benefits more from higher peer effects? If there is complementarity ($F''_{\beta L} > 0$), the type β^h pupils benefit more. And a strong complementarity pleads in favour of socio-economic segregation. Inversely, substitutability ($F''_{\beta L} < 0$) indicates that peer effects are more profitable to type β^l, and this is an argument in favour of desegregation.

[II] F''^j_{LL}, j = h,l; this term (second term of expression 6.18) corresponds to the slope of peer effects' marginal productivity. We expect F''^j_{LL} to be negative. Peer effects, like any other input, have a decreasing marginal productivity beyond a certain threshold.

[III] $L''_{R_1R_1}$; the concavity of the peer effect factor *per se* (third term of expression 6.18).

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22 To keep notations as simple as possible, we skip the argument R_1 in function F^j and its derivatives. We do the same for the peer effect term L.

23 $F'^h_L(R1) - F'^l_L(R1) \cong F''_{\beta L}$, especially if $\beta^h - \beta^l$ is of limited magnitude.

2. OPTIMALITY

If $S(R_1,e_1)$ is convex[1], the optimal allocation of pupils corresponds to the corner solution $R_1^* = 2\Omega$. Maximal segregation is socially optimal. In contrast, if $S(R_1,e_1)$ is concave the social optimum requires perfect desegregation: $R_1^* = \Omega$. Expression 6.18 reveals that concavity of the peer effect function ($L''_{R_1R_1} < 0$) is not the sufficient condition to proclaim that total desegregation is socially desirable.

Segregation can be optimal if, for example, L is 'weakly' concave, peer effects' marginal productivities are almost constant ($F''_{LL} \cong 0$) and human capital endowment is a complement of peer effects ($F''_{ßL} > 0$) i.e. more able children benefit more from a better social environment than their less able comrades. By contrast, if the peer effect is concave ($L''_{R_1R_1} < 0$), if simultaneously pupils with a low human capital endowment $ß^l$ are more sensitive to peer effects than others ($F''_{ßL} < 0$) and the marginal productivity of peer effect is decreasing ($F''_{LL} < 0$) then perfect desegregation is necessarily optimal.

2.1. Particular cases

If the peer effect operates mechanically and is not an argument of the teacher's effort function, the term $(1+\lambda)$ in the third part of expression (6.18) vanishes. The weight of term $L''_{R_1R_1}$ is consequently reduced. When $L''_{R_1R_1}$ is negative (positive) this logically means that the benefit (loss) from desegregation is of lower magnitude. If the peer effect operates only through the effort function, partial derivatives F'_L, F''_{LL} are nil and expression (6.18) becomes:

$$(6.19) \quad S''_{R_1R_1}(R_i,e_i) = (1+\lambda).L''_{R_1R_1}$$

Concavity is totally determined by the sign of second-order derivatives of peer effect function ($L''_{R_1R_1}$). Suppose now the educational production function is additive:

$$(6.20) \quad K_i(ß^j) = ß^j + L(R_i) + e_i(E_i,L(R_i));\ i=1,2$$
$$i = 1,2;\ j = h,l$$

1 We could have equivalently chosen to discuss the concavity of school 2's surplus.

Cross derivative $F_{\beta L}$ vanishes (i.e. $F_L'^h = F_L'^l$). Second order derivative F_{LL} disappear too so that expression (6.18) simplifies dramatically:

$$(6.21) \quad S''_{R_1R_1}(R_1,e_1) = (2+\lambda).L''_{R_1R_1}$$

Hence, concavity is also totally determined by the sign of second-order derivatives of peer effect function ($L''_{R_1R_1}$). $S(R_1,e_1)$ is concave and perfect mixing optimal. If the peer effect operates mechanically and is not an argument of the effort function the conclusion is still valid. The only factor influencing the concavity of $S(R_1,e_1)$ is the peer effect function L. If the peer effect operates only through the effort function, this result is still valid as expression (6.18) reduces to expression (6.19) again.

2.2. Optimal effort and optimal allocation of pupils

As stated by expressions (6.12) to (6.14), the positive or negative definiteness of d^2W is exclusively determined by the sign of $W''_{R_1R_1}$. If it is negative (concavity in R_1 over W' s domain) the stationary point identified by the first-order conditions $\hat{W}$ is a global[25] **maximum**. Maximisation implies to choose $R_1^*=\Omega$. This means that total desegregation of types must be achieved. Each school must concentrate the same proportion of type β^h pupils. If we refer back to the first order conditions, maximisation also implies to fix effort such that $(1+\lambda)\Pi'_{e_i}(e_i) = 1$ (expressions 6.6, 6.8). This result is almost standard. Effort must be chosen so that (actualised) marginal disutility of effort is equal to its marginal return in terms of human capital.

$$(6.22) \quad \begin{aligned} R_1^* &= R_2 = \Omega \\ e_1^* &= e_2^* = e^* \end{aligned}$$

By contrast, if $W''_{R_1R_1}$ is negative (convexity in R_1 over W's domain), first-order conditions define a global **minimum**. The social planner will retain the corner solution $R_1^* = 2\Omega$, $R_2(R_1^*) = 0$ synonymous with maximal segregation of types. He will still impose effort level $e_1^* = e_2^* = e^*$ as e_i and R_1 are independent.

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25 The maximum (minimum) can be said global if d^2W is negative (positive) definite everywhere i.e. not only in $\hat{W}$. We know that d^2W's negative (positive) definiteness is totally prescribed by the sign of $\Pi''_{e_ie_i}$ and $W''_{R_iR_i}$ (expressions 6.12, 13, 14). We have assumed that $\Pi''_{e_ie_i}$ is negative on $[0,+\infty[$. Hence the sufficient condition for $\hat{W}$ to be a global maximum (minimum) is that $W''_{R_iR_i}$ is negative (positive) over R_i 's domain.

2.3. Optimal per-pupil expenditure

If social optimality requires desegregation ($R_1^* = \Omega$) then both schools get the same non-monetary input endowments. As they are also required to produce the same effort, they logically receive the same amount of money per pupil.

$$(6.23) \quad E_1^* = E_2^* = E^* = \overline{V} + \Pi(e^*) - L(\Omega)$$

By contrast, if social optimality is synonymous with segregation ($R_1^* = 2\Omega$) then school 1 with the higher non-monetary endowment must receive a lower per-pupil amount of money than school 2. In other words, segregation, if justified, goes along with some level of 'positive discrimination'. Per-pupil expenditure must be higher in schools concentrating principally type $ß^l$ pupils and, by contrast, systematically lower in schools mainly composed of type $ß^h$ children[26].

$$(6.24) \quad E_1^* = \overline{V} + \Pi(e^*) - L(R_1^*)$$
$$E_2^* = \overline{V} + \Pi(e^*) - L(2\Omega - R_1^*)$$
with
$$R_1^* = 2\Omega$$
thus
$$L(2\Omega) > L(0)$$
hence
$$E_1^* < E_2^*$$

3. ALLOCATIVE EFFICIENCY (DUAL APPROACH) AND CONCERN FOR EQUITY

Every output maximising problem (primal) can be equivalently treated as a cost minimising problem (dual). We have assumed so far that the regulator wants to maximise output for a given level of monetary input. We now suppose he wants to minimise the cost per-pupil of producing a certain quantity of human capital. We will consider two cases. In the first one, the social planner wants each child to benefit from the same effort delivered by his teacher. This objective can reflect a certain conception of justice: the social planner wants each child — whether he has high or low human capital

26 We will discuss this issue again in part 3, when comparing the centralised and decentralised approach of educational finance.

endowment — to benefit from the **same** teacher effort. By the end of the school year, the same value must be added to each child through teacher effort. We will also consider a second case, wherein the social planner's conception of justice implies to equalise opportunities[27]. Practically speaking, this objective could mean that each child must come out the of the educational system — imagine it consists of primary or secondary education for example — with the same human capital. Subsequent differentiation in terms of social and professional success would then principally be attributed to each individual's personal responsibility (effort...) and not to the lack of educational justice (Roemer, 1996).

3.1. Equal teacher effort

Suppose the social planner wants each teacher to deliver effort $k=e_1=e_2$. His cost minimisation problem can be stated as follows:

(6.25) $\text{Min}_{R_1}\ C(k,R_1) = E_1(k,R_1) + E_2(k,R_2)$

with

- $E_1(k,R_1) = \overline{V} + \Pi(k) - L(R_1)$
- $E_2(k,R_2) = \overline{V} + \Pi(k) - L(R_2)$
- $R_2 = 2\Omega - R_1$

Note that, according to our first best hypothesis (perfect information and control by the social planner) participation constraints are systematically saturated. The extremum (defined by the first-order condition) is such that:

(6.26) $C'_{R_1} = L'_{R_2}(R_2) - L'_{R_1}(R_1) = 0 \Leftrightarrow \hat{R}_1 = \Omega$

If $C(k,R_1)$ is concave in R_1 we can conclude that this extremum $\hat{C}$ corresponds to a maximal cost. If this is the case, segregation is socially optimal. Inversely, this extremum is a minimum if $C(k,R_1)$ is **convex** in R_1. In that situation segregation is inefficient. Expression (6.27) states that $C''_{R_iR_i}$ will have the opposite sign of $L''_{R_iR_i}$. Hence if $L''_{R_iR_i}$ is negative, desegregation is socially desirable because the overall cost will be minimised.

(6.27) $C''_{R_1R_1} = -\left[L''_{R_2R_2}(R_2) + L''_{R_1R_1}(R_1)\right]$

27 This conception of justice seems to be the prevailing one in western liberal democracies for both liberal (socio-democrat) and conservative public opinions.

3.2. Equal *gross* outcome or equality of opportunity

If the social planner's objective is to achieve equality of *gross* achievement ($\overline{K}$) at a minimal cost, the problem can be re-stated as follows. Note that we again use the idea that participation constraints are saturated.

$$(6.28)\quad \text{Min}_{R_1}\, C(\overline{K},R_1) = E_1(\overline{K},R_1) + E_2(\overline{K},R_2)$$

with

- $E_1(\overline{K},R_1) = R_1.[\overline{V} + \Pi(e_1^h(\overline{K},R_1)) - L(R_1)] + (1-R_1).[\overline{V} + \Pi(e_1^l(\overline{K},R_1)) - L(R_1)]$

- $E_2(\overline{K},R_2) = R_2[\overline{V} + \Pi(e_2^h(\overline{K},L(R_2)) - L(R_2)] + (1-R_2).[\overline{V} + \Pi(e_2^l(\overline{K},R_2)) - L(R_2)]$

- $R_2 = 2\Omega - R_1$

The per-pupil expenditure in school 1 (E_1) appears now under the form of a linear combination. Yet, effort — and the per-pupil expenditure that is necessary to finance it — vary now with the pupil's type. Type $ß^h$ pupils require less effort to achieve $\overline{K}$ than their type $ß^l$ comrades. The same is true for school 2's per-pupil expenditure. Using the semi-additive specification of the production function (see expression 3.2), we can replace effort levels in school 1 in (6.28) by:

$$(6.29)\quad e_1^h(\overline{K},R_1) = \overline{K} - F^h(R_1)$$
$$e_1^l(\overline{K},R_1) = \overline{K} - F^l(R_1)$$

And similarly for effort levels in school 2. Per-pupil average expenditure $E_1(\overline{K},R_1)$ in expression (6.28) simplifies and becomes:

$$(6.30)\quad E_1(\overline{K},R_1) = \overline{V} - L(R_1) + R_1.\Pi(\overline{K} - F^h(R_1)) + (1-R_1).\Pi(\overline{K} - F^l(R_1))$$

A similar expression can be computed for per-pupil expenditure in school 2. Like in section 1, we can focus on the sign of $E''_{R_1R_1}(\overline{K},R_1)$ to determine the concavity (convexity) of $C(\overline{K},R_1)$. After some algebraic developments we find that the second order derivative is :

$$(6.31)\quad E''_{R_1R_1}(\bar{K},R_1) = -2.[\Pi'^{h}_{e_1}.F'^{h}_{L} - \Pi'^{l}_{e_1}.F'^{l}_{L}]\,L'_{R_1}$$

$$+ R_1.\Pi''^{h}_{e_1e_1}(F'^{h}_{L}.L'_{R_1})^2 + (1-R_1).\Pi''^{l}_{e_1e_1}.(F'^{l}_{L}.L'_{R_1})^2$$

$$-(L'_{R_1})^2.[R_1.\Pi'^{h}_{e_1}.F''^{h}_{LL} + (1-R_1).\Pi'^{l}_{e_1}.F''^{l}_{LL}]$$

$$- L''_{R_1R_1}\,[1+ R_1.\Pi'^{h}_{e_1}.F'^{h}_{L} + (1-R_1).\Pi'^{l}_{e_1}.L'_{R_1}]$$

This expression has the same structure as expression (6.18). We know, by assumption, that the disutility of effort is increasing ($\Pi'_{e_1}(e_1) > 0$) and convex ($\Pi''_{e_1e_1}(e_1) > 0$). Using this last assumption we can also say that $\Pi'^{l}_{e_1} > \Pi'^{h}_{e_1}$ in the first term of expression 6.31. Hence, the sign of $E''_{R_1R_1}$ is determined by:

[I] $F''_{ßL}$; which represents the interaction between human capital endowment and peer effects (first term of expression 6.31). If there is complementarity ($F''_{ßL} > 0$), the type $ß^h$ pupils benefit more. And a strong complementarity pleads in favour of socio-economic segregation in order to minimise costs. Inversely substitutability ($F''_{ßL} < 0$, i.e. $F'^{l}_{L} > F'^{h}_{L}$) indicates that peer effects are more profitable to type $ß^l$, and this is an argument in favour of desegregation in order to a minimise cost.

[II] F''_{LL} ; this expression (third term of expression 6.31) corresponds to the slope of peer effects' marginal productivity. As previously, we expect F''_{LL} to be negative. Peer effects, like any other input, have a decreasing marginal productivity beyond a certain threshold.

[III] the sign of $L''_{R_1R_1}$ (fourth term of expression 6.31). Just like in section 1.2. if the peer effect input is concave in R_1 ($L''_{R_1R_1} < 0$), $E_1(\bar{K},R_1)$ is **convex** and cost minimisation of the educational policy requires perfect desegregation.

From a theoretical standpoint, results derived in this section are similar to those of section 1.2. Their interest is twofold. First, they confirm the importance of non-monetary inputs and the need for an efficient allocation of those resources whatever the social planner's exact objective. If peer effects really enter the production function through teachers' effort, they must be properly used (the no-surplus condition must be fulfilled). As their — direct or indirect — productive contribution is local by nature[28], they must also be properly allocated between entities. Second, these results have some interesting empirical implications. It actually stresses the influence peer effects can exert on the monetary cost of local public services — see Bradford, Malt & Oakes (1969) for an early exposition of that idea. Unequal allocation of non-purchasable inputs (here peer effects) will cause unequal monetary input requirements — although efforts made by agents (here teachers) are equivalent. This result is particularly important if one aims at interpreting efficiency measures based on (monetary) input-output ratios — see Hanushek (1986) for a review of those studies. It can also help us explain average cost differences between educational systems or between different sections[29] of a particular system.

4. IS THE PAYMENT PER UNIT OF HUMAN CAPITAL CONSTANT?

When defining the objective function of our social planner (W) — see chapter 5, section 4 —, we made a crucial assumption: we supposed that each unit of human capital K would generate the same marginal income. Usual production theory would lead to the conclusion that marginal productivity of human capital is decreasing. Such a conclusion reinforces the pro-desegregation argument.

Yet, another crucial point in this discussion is most likely the impact of current technical progress. A growing body of economic literature indicates that technical progress is skill-biased in the sense that it improves high-skill workers' productivity (and thus wage) more than that of their less-skilled colleagues (Piketty, 1994 ; Murnane, Willett & Levy, 1995). This argument finds some echo in the rise of income inequalities and College-educated workers' wage premium during the 80's. The marginal return to skill could thus be increasing. An extreme version of this argument is the one developed by Kremer (1993) with his O-ring production theory. The idea he sets forth is that more and more production functions show low substitutability of low-skilled and high-skilled workers. His example is that of the Space Shuttle. It has thousands of components, but exploded because only one of them malfunctioned: the O-rings of its external boosters. High-quality components

28 A type $ß^1$ child's contribution to a learning climate is necessarily limited spatially. By choosing to (or being) register(ed) in a particular school, he deprives another school from the resources he represents.

29 We particularly refer here to the difference in pupil-teacher ratio characterising vocational vs. general secondary education. The former generally consumes more teacher per pupil than the latter, and simultaneously tends to concentrate the less able kids. For a presentation of the Belgian situation, see Delvaux & Vandenberghe (1992).

produced by high-skilled workers can in no way be replaced by low-quality and less skilled ones. This lack of substitutability potentially leads to production functions which exhibit increasing returns to the skill.

CHAPTER 7. QUASI-MARKET EFFICIENCY: HOW DO QUASI-MARKETS WORK (SECOND BEST ANALYSIS)?

Chapter 6 was aimed at identifying and discussing the first best outcome of an educational system wherein effort delivered by individual teachers and peer effects — the local social spillover in the classroom — matter. The main results show that social efficiency implies both absence of teacher surplus ($V = \overline{V}$) and allocative efficiency. Under certain conditions, this means to attain a perfect 'mixing' or total desegregation of pupil types in each school ($R_i^* = \Omega\,;\, i = 1,2$).

This chapter aims at discussing a quasi-market's propensity to achieve this first best (or ideal) outcome. To avoid confusion, we will use the following notation for the first-best values of decision variables $\hat{e}^*$, $\hat{R}_i^*$ and $\hat{E}^*$ while equilibrium values produced by the quasi-market — the decentralised outcome — will be referred to as e_i^* and R_i^*. The quasi-market we are talking about is the one described in chapters 2 and 3. We assume that per-pupil expenditure is uniform ($E_i = E$) and fixed by the government. Our intention is actually to abstract from the numerous singularities characterising existing quasi-markets' efficiency (see Part 1, chapter 3). We particularly suppose that regulatory requirements in terms of admission standards (recruitment) are either non-existent or inefficient, so that allocation of pupils can be considered as totally decentralised.

Inefficiency can arise for three reasons. **First**, the decentralised allocation of pupils (R_i^*) can be different from the 'desegregation' optimum. In other words, non-monetary inputs can be mis-allocated. We will constantly suppose hereafter that allocative efficiency requires perfect desegregation ($\hat{R}_i^* = \Omega$, $i = 1,2$) **Second**, teachers can limit their effort so that some surplus appears ($V_i > \overline{V}$) or equivalently ($e_i^* < \hat{e}^*$). And, **third**, the level of per-pupil expenditure chosen by the government — not necessarily behaving like the social planner as described in the previous chapter — can be suboptimal in the sense that it does not permit an effort level compatible with the social optimum ($E \neq \hat{E}^*$).

We will neglect this third source of inefficiency hereafter[1] and focus on the two others. We are aware that the level of per-pupil expenditure retained by a government can be suboptimal ($E \neq \hat{E}^*$). We think however that the two other sources of inefficiency logically deserve much more attention at this stage. The reason for this is twofold. First, it is of limited interest to question the optimality of E if the incentive problem exists and/or some mis-allocation of pupils persists. To raise E in order to reach the first best ceiling if the teachers are 'lazy' amounts to increasing the surplus abandoned to those teachers. Second, regulatory difficulties raised by incentive problems and ability grouping issues are more puzzling basically because they involve numerous (*a priori* non co-ordinated) decision-makers.

Section 1 briefly presents the financing mechanism and the general formulation of the school choice decision rule. It explains in which sense the latter is a reputation-based decision process. Section 2 presents the general formulation of school optimisation program. Section 3 examines the duopoly competition when clients (parents and/or pupils) define educational reputation as continuous variable. This basically means that they immediately revise their preference when schools in competition diverge in terms of outcomes. Section 4 and section 5 aim at incorporating market imperfections into the basic model. Section 4 examines the case of educational reputation being a binary variable more than a continuous one. We assume that parents and pupils do not distinguish sharply between various levels of educational achievement (March, 1988). We assume that they only react when outcomes respect a certain target (success) or do not meet it (failure). Section 5 develops another variant of the school choice decision rule. We assume that some product differentiation exists and that parents and pupils face costs which influence their choice when the product they get diverges from the one they most prefer. The simplest illustration of this is the situation where parents face transportation costs when the home-to-school distance is superior to a few hundred metres.

1. PEER EFFECTS, FINANCING MECHANISM AND PARENTAL CHOICE

1.1. Peer effects

Allocation of heterogeneous individuals between strictly delimited entities thus becomes a critical issue as regards to efficiency. It relates to 'productive'

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1 We will pay more attention to this problem in chapter 8.

efficiency problems: the production of human capital is directly affected by the way heterogeneous individuals are allocated.

We assume hereafter that desegregation is preferable to segregation because (simultaneously): [I] the presence of an additional high-ability pupil in school 1 generates a peer-effect (teaching climate) improvement that does not offset the negative consequences of the presence of an additional low-ability pupil in school 2. In other words, the peer effect function is concave in the proportion of high-ability pupils; [II] low-ability pupils are more sensitive to peer-effects than their more able comrades; [III] peer effects have a decreasing marginal productivity.

We expect condition [III] to be verified simply because peer effects, like any other input, probably have a decreasing marginal productivity beyond a certain threshold. Empirical work tends to suggest that the two other conditions are verified at the primary and secondary level at least. Henderson, Mieskowski & Sauvageau (1978) were the first to clearly conclude that condition [I] is verified. A more recent study, focusing on primary education, (Leroy-Audouin, 1995) concludes that condition [II] is also verified. Low-ability children are more sensitive to peer effects than their more able counterparts. This result seems to be confirmed by a more recent study carried out by Gamoran & Nystrand (1994) on US secondary education data.

1.2. Financing and parental choice

Schools in a quasi-market get public money on a per-pupil basis. The sum they receive per-pupil (E) — the voucher — is supposedly uniform. Note that the voucher (E) can be seen as a product of a teacher-pupils ratio and a salary per teacher[2].

Parents of type $ß^j$ choosing at the beginning or period t maximise utility $U(ß^j)$:

$$(7.1) \quad \text{Max}_{i}\ U_t(ß^j) = w(ß^j) - T + \tilde{E}(K(ß^j)_{i,t-1}); \quad i = 1,2;\ j = h,l$$

It is the sum of [I] actualised disposable income (wage $w(ß^j)$ minus lump sum tax T financing the educational system) and [II] expected human capital attainment of their child j=h,l in school i $\tilde{E}(K(ß^j)_{i,t-1})$. In that sense, parents

2 $E=\theta.\alpha$; with θ the average salary and α the average teacher-pupil ratio.

are altruistic. As the tax level financing education is beyond their control and access to education is free of charge, the only decision variable is the school ($i = 1,2$) they select for their child.

In addition, we assume that parents cannot predict a school's production when registering their children. Their expectation about educational outcome in school i at the end of period t is based to their observation of school i's end-of-period t–1 outcome. Hence, there is a **reputation** effect.

2. THE SCHOOLS' PROBLEM

We suppose that schools operate like co-operative societies in a non-profit legal environment (James, 1993). Their objective is to maximise the representative teacher's inter-temporal utility function (V)[3] while respecting a participation constraint ($V \geq \overline{V}$).

$$(7.2) \quad \text{Max}_{R_{i,t-1}, R_{i,t}, e_{i,t-1}, e_{i,t}} V = V_{i,t-1}(e_{i,t-1}, L(R_{i,t-1})) + \rho . V_{i,t}(e_{i,t}, L(R_{i,t}))$$

with

- $i=1,2$
- $R_{2,t-1} = 2\Omega - R_{1,t-1}; R_{2,t} = 2\Omega - R_{1,t}$
- $0 \leq \Omega \leq 1; 0 \leq R_{i,t-1} \leq 2\Omega; 0 \leq R_{i,t} \leq 2\Omega$
- $V_{i,t-1} = E + L(R_{i,t-1}) - \Pi(e_{i,t-1}) \geq \overline{V}$
- $V_{i,t} = E + L(R_{i,t}) - \Pi(e_{i,t}) \geq \overline{V}$
- $0 \leq \rho \leq 1$, depending on a school's preference for the present;

To be realistic, we suppose schools maximise the representative teacher's utility over **two periods**. If the school size is fixed at 1[4], the two categories of control variables are [I] the effort level (e_i) in periods t–1 and t and [II] the degree of segregation of types β^h and β^l (i.e. R_i) in periods t–1 and t.

3 There is no distinction between the principal (head of school) or the governing council's objective and that of the teachers. Profits are prohibited and — more fundamentally — difficult to imagine if teachers are not paid at school level, but directly by the Ministry of education like in Belgium.

4 The fixed size assumption reflects two ideas. First, schools face a capatity constraint: they cannot enroll more than a certain number of pupils. Second, schools need to enroll a minimal number of pupils. This question can be treated more systematically by the introduction of a fixed cost constraint defining a minimal enrolment size under which a school cannot organise a compulsory number of school years, programs,... or alternatively by the introduction of short-run payroll constraint.

Note that the second category of control variables (R_i) is conditional on parental preferences. If all parents want to attend the same school then the latter potentially controls the characteristics of its inputs, i.e. can decide upon the value of R_i. By contrast, if nobody wants to attend that school this degree of freedom disappears. This is also the case if parents are indifferent. In that particular case, one can predict that they will chose on a random basis so that both schools get applicants exactly in number 1, and perfect mixing ($R_i = \Omega$; i = 1,2) of types imposes itself on the schools.

To keep things simple, we will normalise the inter-temporal coefficient ρ at 1.

2.1. Period 2 effort

As period t is perceived by each school as being the last one, rational choice commands to fix $e^*_{i,t} = 0$ in period t–1; i = 1,2.

2.2. General rules of recruitment

The recruitment strategies in periods t–1 **and** t are conditional to 'reputation'. Suppose there is some hierarchy or reputation differential: for example school 1 has a better reputation than school 2 in the sense that school 1's pupils are successful when applying for university admission while school 2's pupils are not. Given the parental choice logic described above, school 1 gets all applicants, while school 2 gets nobody at first. What is school 1's rational attitude? As peer effects ($L(R_i)$) have a direct influence on its utility V (see expression 7.2), we can predict that it will 'skim off the cream' (Glennester, 1991 ; Le Grand & Bartlett, 1993). It will recruit in priority pupils with higher human capital endowment: type β^h pupils. Most reputed schools (here school 1) will select the highest number of type β^h pupils compatible with their enrolment constraint i.e. to acquire a size 1, in our model). School 1's rational decision is to retain $R^*_i = R^*_{i,t-1} = R^*_{i,t} = 2\Omega$. Simultaneously school 2 finds itself in a no-choice deadlock. It survives only because some pupils are rejected by school 1.

2.3. Duopoly competition

School 1 will get a higher utility level in period t, if it manages to finish period t–1 with a better reputation than school 2. Clearly, the level of peer effect it will enjoy from will be higher ($L_{1,t}(2\Omega) > L_{2,t}(0)$) if it can afford to 'skim off the cream'. The same is true for school 2. But can we expect this would-be peer effect differential to trigger off (socially desirable) competition — synonymous with effort and thus higher per-pupil value-added human capital — while maintaining some level of ability mixing? In other words, can we expect free parental choice and competition between schools to eliminate teachers' surplus ($V = \overline{V}$) and simultaneously achieve allocative efficiency ($\hat{R}_i^* = \Omega$)? The next three sections will attempt to answer this question.

3. DUOPOLY COMPETITION — BASIC MODEL

Suppose that any 'net' human capital attainment differential[5] is valorised either by higher education institutions or by potential employers and consequently by parents and pupils when choosing their secondary school. In that sense the variable of reputation, governing school-choice, is a **continuous** one. Decision-rule corresponds to the following utility maximising program.

$$(7.3) \quad \underset{i}{\mathrm{Max}}\; U_t(ß^j) = w(ß^j) - T + \tilde{E}(K(ß^j)_{i,t-1});$$
$$i = 1,2;\ j = h,l$$
with

$$\tilde{E}(K(ß^j)_{i,t-1}) = K_{i,t-1}$$

Expectations of human capital achievement in school i at the end of period t ($\tilde{E}(K(ß^j)_{i,t-1})$) are simply equal to period t–1 achievement of pupils coming out of that school. In that context, competition between school 1 and 2 can be analysed as a Bertrand-type of duopoly competition. The strategy space corresponds to the effort level ($e_{i,t-1}$). Beyond (or under) a certain relative effort, one observes a complete shift of demand (which is the reason to refer to Bertrand). Several cases must be analysed.

3.1. No reputation differential

If there is no reputation differential, both school get the same peer effect endowment for period t–1. For a given level of effort delivered ($e_{1,t-1} \geq 0$) by school 1, what is school 2's best reply? To produce an effort marginally superior ($e_{2,t-1} = e_{1,t-1} + \varepsilon$) provided some threshold is not overstepped. This threshold (Φ) can be equal to e^+ which is the maximal effort that a school i is

5 Suppose indeed that parents are properly informed about the real value added to the children attending the school i.e. effort plus peer effects.

ready to produce in period t–1 provided it gets the maximal level of peer effect $L(2\Omega)$ in period t. This effort is computed by reference to the situation where the school produces no effort and get the lowest peer effect endowment during period t. This threshold is the same for school 1 and school 2, no matter the initial peer effect endowment if V is additive.

(7.4) e^+ is s.t. $\Pi(e^+) - \Pi(e_{i,t-1} = 0) = L(2\Omega) - L(0)$
$i = 1,2$

It can also be equal to the effort saturating the period t–1 participation constraint e^{IR}[6]. We shall hereafter use the following synthetic notation: $\Phi = \text{Min}\{e^{IR}, e^+\}$[7].

Strictly speaking, three situations must be examined. First, suppose $e_{1,t-1}$ is (strictly) **inferior** to Φ. School 2 has four options. The first one is to produce no effort ($e_{2,t-1} = 0$) and to recruit pupils rejected by school 1 (i.e. get L(0) during period t). The second consists of producing a positive but lower effort than school 1 ($0 \leq e_{2,t-1} < e_{1,t-1}$). In that case, school 2 suffers some disutility because it produces some effort but gets no benefit in terms of peer effect as all potential clients apply in school 1 at the beginning of period t (i.e. peer effect is still L(0)). The third option is to produce the same effort than school 1 ($e_{2,t-1} = e_{1,t-1}$). As $e_{1,t-1}$ is (strictly) inferior to Φ, this strategy is dominated by the fourth strategy consisting of producing marginally more effort ($e_{2,t-1} = e_{1,t-1} + \varepsilon$). This strategy thus dominates the three others.

Second, suppose $e_{1,t-1}$ is **superior** to Φ. By definition of Φ the optimal answer of school 2 is to produce no effort.

Third, imagine $e_{1,t-1}$ is **equal** to Φ.

<u>Subcase 1</u> : $\Phi = e^+ \leq e^{IR}$;

The strategy that consists of producing marginally more effort is dominated by the no effort strategy (by definition of e^+). Alternatively, school 2 can pro-

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6 $V = E + L(\Omega) - \Pi(e^{IR}) = \overline{V}$. Subscript IR stands for Incentive Rational which is the usual way to refer to the participation constraint in the new theory of regulation (Baron, 1989).

7 Very little can be said *a priori* about the relative values of e^{IR} and e^+. The former is defined by $\Pi^{-1}(E+L(\Omega)-\overline{V})$ while the latter corresponds to $\Pi^{-1}(L(2\Omega)-L(0))$. By analogy with the theory of regulation, we could say that e^{IR} represents the participation constraint, while e^+ echoes the incentive compatibility constraint.

duce some effort but less than school 1. This option is also dominated by the no effort option. The remaining option consists of equalising effort levels ($e_{2,t-1} = e_{1,t-1} = e^+$). In that case, school 2 gets the same peer effect as school 1 ($L(\Omega)$). This strategy is dominated by the no-effort option. By definition, combination (e^+, $L(2\Omega)$) is equal to the pair (0, $L(0)$) in terms of payoff, hence couple (e^+, $L(\Omega)$) generates less utility than pair (0, $L(0)$).

Subcase 2 : $\Phi = e^{IR} \leq e^+$:

The strategy that consists of producing marginally more effort is dominated by the no effort strategy (by definition of e^{IR}). Alternatively, school 2 can produce some effort but less than school 1. This option is obviously dominated by the no effort option too. The remaining option is the equal effort one ($e_{2,t-1} = e_{1,t-1} = e^{IR}$). As long as the disutility of effort is superior to the benefit in terms of peer effect $\Pi(e^{IR}) > L(\Omega) - L(0)$, the no effort strategy dominates the equalisation strategy. If $\Pi(e^{IR}) = L(\Omega) - L(0)$, school 2 is indifferent between producing the same effort as school 1 or producing no effort. But if this disutility is inferior to the peer effect premium $\Pi(e^{IR}) < L(\Omega) - L(0)$, the best strategy is to equalise.

Intersection between reaction functions (i.e. a Nash equilibrium) occurs only when e^{IR} is inferior to e^+ **and** $\Pi(e^{IR}) < L(\Omega) - L(0)$. This equilibrium is socially optimal in the sense that no segregation exists and no surplus is abandoned to the teacher ($e^*_{i,t-1} = e^{IR} = \hat{e}^*$; $i = 1,2$). It is unique. In all other cases no (unique) Nash equilibrium exists.

The two conditions guaranteeing the existence of a — unique and socially optimal — Nash equilibrium express the same idea. In non-technical terms, they both mean that the magnitude of the peer effect payoffs must be high enough to sustain the effort level — and the corresponding disutility — saturating the participation constraint. If this is not the case, our model leads to the conclusion that no Nash equilibrium exists. This result highlights the uncertain nature of quasi-market outcomes when the peer effect payoff function is **of limited magnitude** and simultaneously *all* clients correctly and immediately react to effort differentials. Typically, if too many parents exercise their exit option simultaneously, the system becomes extremely unstable. Immediate and massive shifts of the demand side of the market explain the suppliers' difficulty to define their optimal strategy. Excessive uncertainty paralyses the quasi-market. In other words, competition among 'rational' decision-makers appears non-practicable if clients are too alert[8].

3.2. Reputation differential

It is important to test the sensitivity of our results to random disturbance generating reputation differentials. Suppose indeed school 2 suffers a major organisational crisis during period t–2 : the head of school or some outstanding teachers have gone on pension for example. This crisis could mean that effort becomes temporarily impossible, extremely costly or of limited impact on pupils. Hence, at the end of period t–2, school 2's outcome is inferior to school 1's outcome.

Period t–1 is now synonymous with reputation differential. School 1 has a better reputation than school 2. Given the parental choice mechanism and the optimal recruitment strategy presented in section 1 (equation 7.1), school 1 gets L(2Ω) while school 2 gets L(0). This means that school 2 faces a more stringent participation constraint than school 1: $e_2^{IR} < e_1^{IR}$. Given the parental program and the production function, the effort school 2 has to deliver to reverse that reputation differential ($e_{2,t-1}$), given school 1's own effort ($e_{1,t-1}$), is defined by:

(7.5) $e_{2,t-1} \geq e_{1,t-1} + \Delta L$
with
(7.6) $\Delta L = L(2\Omega) - L(0)$

Each type $ß^h$ child, traditionally attending school 1, will opt for school 2 at the beginning of period t, provided he expects — on the basis of what he observes at the end of period t–1 — a greater improvement of his human capital. As expressions (7.5) and (7.6) suggest, he must be 'compensated' for the peer effect differential ΔL.

For a given effort level ($e_{2,t-1} \geq 0$), what is school 1's best reply? As long as school 2 does not produce the effort 'compensating' the peer effect differential ($e_{2,t-1} < \Delta L$) school 1's best strategy is to produce no effort. The pair of strategies consisting of producing no effort will be a Nash equilibrium ($e^*_{i,t-1} = 0$; i = 1,2) if school 2 hits its constraint $\Phi^2 = \text{Min}\{e_2^{IR}, e^+\}$ before being able to compensate the peer effect differential ($\Phi^2 < \Delta L$).

8 See Willms & Echols (1992) for an informal presentation of this idea.

If school 2 is incited to compensate ($e_{2,t-1} \geq \Delta L$ because $\Phi^2 \geq \Delta L$), school 1's optimal answer is to produce the minimal effort (ε) preventing a change of 'regime' ($e_{1,t-1} = e_{2,t-1} - \Delta L + \varepsilon$). This answer is optimal as long as the effort delivered is inferior to its maximal value ($e_{1,t-1} = e_{2,t-1} - \Delta L + \varepsilon < \Phi^1 = \text{Min}\{e_1^{IR}, e^+\}$). School 2's reaction function is almost symmetric. Its optimal strategy is to fix its effort marginally above the sum of the peer effect differential and school 1's effort ($e_{2,t-1} = \Delta L + e_{1,t-1} + \phi$) until it reaches the threshold $\Phi^2 = \text{Min}\{e_2^{IR}, e^+\}$. This clearly means that there is no intersection between the reaction functions.

(7.7) $e_{1,t-1} = e_{2,t-1} - \Delta L + \varepsilon$ if $e_{1,t-1} < \Phi^1$
$e_{1,t-1} = 0$ if $e_{1,t-1} \geq \Phi^1$
$\varepsilon > 0$

(7.8) $e_{2,t-1} = e_{1,t-1} + \Delta L + \phi$ if $e_{2,t-1} < \Phi^2$
$e_{2,t-1} = 0$ if $e_{2,t-1} \geq \Phi^2$
$\phi > 0$

Hence, and quite surprisingly, **no equilibrium** can be identified. Contrary to the no-reputation case, this rule now suffers no exception. Reason for this is that incentive rational efforts for period t–1 are different ($e_1^{IR} > e_2^{IR}$). If school 2 opts for e_2^{IR}, school 1's best reply is to produce marginally more effort. By contrast with the no-reputation differential case, pair (e_1^{IR}, e_2^{IR}) can not be a Nash equilibrium.

3.3. Conclusion

In case 'reputation' is a continuous variable, the existence of an equilibrium is conditional to the magnitude of payoff functions.

[I] If costs and benefits corresponding to different levels of peer effects are sufficiently large, a quasi-market will generate Nash equilibria.

• If no reputation differential exists, the equilibrium will be socially optimal. Both schools will produce the same effort level. This effort will saturate participation constraints which means that no surplus will be abandoned to teachers. Finally, no segregation will occur and allocative efficiency will thus be verified.

• In case some reputation differential exists — which can happen very rapidly as clients shift instantaneously from one school to another —, the equilibrium will be synonymous with no effort. School 2 renounces the high-ability pupils because the effort it would have to deliver to overcome its 'bad' reputation is too high. Consequently school 1 can keep its 'good' reputation without any effort. This situation is socially suboptimal because no effort is produced and because segregation persists in the long run.

[III] If costs and benefits corresponding to different levels of peer effects are not sufficiently large, a quasi-market will generate no Nash equilibria. This result is still valid when some reputation differential is introduced[9]. It highlights the uncertain nature of quasi-markets outcomes when *all* clients correctly and immediately react to effort differentials. Typically, if too many parents exercise their exit option simultaneously, the system becomes extremely unstable. Immediate and massive shifts of the demand side of the market explain the suppliers' difficulty to define their optimal strategy. Excessive uncertainty paralyses the quasi-market. In other words, competition among 'rational' decision-makers appears non-practicable if clients are too alert. We will see in section 4 and 5 that some attenuation of the demand pressure is necessary to get Nash equilibria in those circumstances.

4. DUOPOLY COMPETITION — REPUTATION IS A BINARY VARIABLE

In this section, we modify the school choice decision rule. For informational motives but also — most likely — for reasons related to the way society works, we expect parents to care essentially about 'graduation'. In other words, they want a school from which they expect their child to graduate with a certain human capital level.

(7.9) $$\operatorname{Max}_i U(\beta) = W(\beta) - T + \tilde{E}(K(\beta)_{i,t-1});\ i=1,2$$

with

$$\tilde{E}(K(\beta)_{i,t-1}) = 0 \quad \text{if } K_{i,t-1} < \overline{K}$$
$$\tilde{E}(K(\beta)_{i,t-1}) = \overline{K} \quad \text{if } K_{i,t-1} \geq \overline{K}$$

9 The only way to generate equilibria is by introducing some sequence in the game — i.e. a school has the possibility to react to the other's choice . In the no reputation differential case two equilibria are possible. In both cases, some unilateral effort is predictable. This effort is always underoptimal. More significantly, its main effect is to create a reputation differential — synonymous of 'cream-skimming' at the beginning of the following period. If there is a reputation differential and the game is sequential, the equilibrium is characterised by some effort produced by the reputed school only. Its main consequence is preservation of the reputation differential, synonymous with segregation, thus allocative inefficiency.

Parents do not care about the value added to their children either because they are not able to measure it or — most likely — because it is of little 'private' value to them[10]. In the real world, what matters is a diploma certifying that its holder possesses a certain knowledge ($\overline{K}$) and is consequently able to undertake higher education or exert a particular job. This assumption is supported by the identification of 'sheepskin' effects (Heckman, Layne-Farrar & Todd, 1995) i.e. discrete increases in the return to education that arise after completing a degree. The key point for parents is thus to find a school where they expect — they indeed operate on the basis of relative reputations — their children to reach that threshold. In other words, if pupils coming out of secondary school i get their degree, or are accepted at college (i.e. reach $K_{i,t-1} \geq \overline{K}$) they will consider school i as 'good' for their children. If it is not the case, the school will be classified as 'bad'. Both schools will be considered as 'good' or 'bad' if they have the same outcome at the end of period t–1.

The parental choice mechanism can be summarised as follows: [I] type $ß^h$ and type $ß^l$ obey the *same* decision rule, and [II] this decision rule consists of i) applying in school 1 if it has a better reputation than school 2 ($K_{1,t-1} \geq \overline{K}$ while $K_{2,t-1} < \overline{K}$), ii) applying indifferently in school 1 and school 2 if both schools have the same reputation ($K_{1,t-1} = K_{2,t-1}$), iii) applying in school 2 if it has a better reputation than school 1 ($K_{2,t-1} \geq \overline{K}$ while $K_{1,t-1} < \overline{K}$).

Reputation directly echoes academic 'reputation' of graduate pupils and has now the status of a binary variable: a school is 'good' if $K_{i,t-1} \geq \overline{K}$; it is 'bad' if $K_{i,t-1} < \overline{K}$. Clients are not equally desirable in terms of pedagogical comfort and thus utility. Schools must decide whether it is profitable to produce a certain amount of effort in order either to preserve some reputation advantage (to preserve cream-skimming privileges) or to acquire a better reputation than in the past (to acquire cream-skimming privileges).

4.1. No reputation differential

Suppose that period t–1 is synonymous with no or equal reputation. Think of the origin of the system for example. Suppose the allocation of children takes place on a random basis so that the peer effect is identical in both schools. Competing schools can decide to produce no effort ($e_{t-1} = 0$) or the effort level necessary to ensure graduation: $e(\overline{K})$[11]. If parents and the 'real'

10 We are grateful to F. Martou for this suggestion.

11 Analytically $e(\overline{K}) = \Omega.[\overline{K} - F^h(\Omega)] + (1-\Omega).[\overline{K} - F^l(\Omega)]$

world only care about graduation ($\overline{K}$), any effort inferior or superior to that threshold $e(\overline{K})$ is 'invisible' and thus of no interest from a strategic player's standpoint. In technical terms, the games we analyse in this section and in the next one are simplified by elimination of dominated strategies: efforts other than 0 and $e(\overline{K})$ are excluded for the domain of strategies.

What are the possible outcomes of this game? If we except the zero effort level, four levels of effort are of central importance in this discussion. The first one is obviously the amount of effort that is necessary to be perceived as a 'good' school $e(\overline{K})$. The second one is simply the 'incentive rational' effort (e_i^{IR}): the maximal effort compatible with school i's participation constraint[12]. Note that in the no reputation differential case, both schools face the same constraint so that subscript i can be skipped.

The other critical efforts correspond more to the 'incentive compatible' constraint idea. A school will not produce an effort generating costs superior to benefits (here a higher peer effect level). When a school supposes that **its opponent adopts the no effort strategy**, the maximal effort it is ready to deliver is noted e^M. Analytically, e^M is such that the school is indifferent between [I] delivering this effort and getting peer effect $L(2\Omega)$ in period t and [II] delivering no effort and getting intermediate peer effect $L(\Omega)$. Said differently, if $e(\overline{K})$ is superior to e^M a school will always find more advantageous to produce no effort and accept a 'mixed' population of pupils ($R_i = \Omega$).

(7.10) e^M is s.t. $V(e^M, 2\Omega) = V(0, \Omega)$
with
- $V(e^M, 2\Omega) = [E + L(\Omega) - \Pi(e^M)] + [E + L(2\Omega)]$
- $V(0, \Omega) = [E + L(\Omega) - \Pi(0)] + [E + L(\Omega)]$

Hence e^M is s.t.

(7.11) $\Pi(e^M) = L(2\Omega) - L(\Omega)$ as by assumption $\Pi(0) = 0$
with $e^M > 0$ as $L(2\Omega) > L(\Omega)$

When the conjecture is that **the competitor produces effort** $e(\overline{K})$, the maximal effort it is ready to deliver is noted e^N. Analytically it is such that the school is indifferent between [I] producing this effort while benefiting from intermediate peer effect $L(\Omega)$ during period t and [II] producing no effort and benefiting from low peer effect $L(0)$.

12 $V = E + L(\Omega) - \Pi(e^{IR}) = \overline{V}$

(7.12) e^N is s.t. $V(e^N, \Omega) = V(0, \Omega)$
with
- $V(e^N, \Omega) = [E + L(\Omega) - \Pi(e^N)] + [E + L(\Omega)]$
- $V(0, 0) = [E + L(\Omega) - \Pi(0)] + [E + L(0)]$

Hence e^N is s.t.

(7.13) $\Pi(e^N) = L(\Omega) - L(0)$ as by assumption $\Pi(0) = 0$
with $e^N > 0$ as $L(\Omega) > L(0)$

The problem is to compare $e(\overline{K})$ to e^{IR}, e^M and e^N. To facilitate the discussion we can first use synthetic notations to represent the constraints schools are coping with: $\Psi^M \equiv Min\{e^{IR}, e^M\}$ and $\Psi^N \equiv Min\{e^{IR}, e^N\}$. Second, if L is concave then $e^N > e^M$. Concavity of L means that $L(\Omega) - L(0)$ is higher than $L(2\Omega) - L(\Omega)$. Hence, e^N is superior to e^M as we have assumed that Π is monotone increasing in e. Third, we should keep in mind that Ψ^M can not be superior to Ψ^N when $e^M < e^N$.

Combining these observations leads to the conclusion that only three cases are possible. Table 7.1 presents these three cases and summarises the possible results. In case 1, the effort necessary to be perceived as a 'good' school is inferior or equal to both sets of constraints: $e(\overline{K}) \leq \Psi^M \leq \Psi^N$. This means that the dominant strategy for both players is to produce effort $e(\overline{K})$[13]. In case 3, the same effort is superior or equal to the two constraints: $\Psi^M \leq \Psi^N \leq e(\overline{K})$. The dominant strategy for both players is to deliver no effort. Cases 1 and 3 thus correspond to dominant strategy equilibria i.e. unique Nash equilibrium (Varian, 1992).

By contrast, case 2, $\Psi^M \leq e(\overline{K}) \leq \Psi^N$, presents no dominant strategy. School i's best strategy depends on the other school's strategy. If the game is simultaneous, two Nash equilibria are possible. If school i adopts the no-effort strategy, the other school's best reply is to adopt the no-effort strategy too. Similarly, if school i opts for $e(\overline{K})$, the other school's best reply is to produce the same effort $e(\overline{K})$.

13 A strategy is dominant if it confers a maximal payoff no matter the other player's strategy.

Table 7.1 — Oligopoly competition outcomes (no reputation differential)

Case 1	Case 2	Case 3
$e(\overline{K}) \leq \Psi^M \leq \Psi^N$	$\Psi^M \leq e(\overline{K}) \leq \Psi^N$	$\Psi^M \leq \Psi^N \leq e(\overline{K})$
$e^*_{i,t-1} = e(\overline{K}); i = 1,2$	$e^*_{i,t-1} = e(\overline{K}); i = 1,2$ or $e^*_{i,t-1} = 0; i = 1,2$	$e^*_{i,t-1} = 0; i = 1,2$

The absence of reputation differential on a quasi-market with reputation-sensitive clients leads to symmetric equilibria. Peer effects are then allocated equally between the two schools. The quasi-market is thus allocative efficient. By contrast, depending on the level of $e(\overline{K})$ this equilibrium will be synonymous with effort (case 1) or absence of effort (case 3). The higher $\overline{K}$ the more likely the no-effort situation and thus the more severe the accountability problem.

The interval $|e^N - e^M|$ and the corresponding likelihood of the non-unique equilibrium situation (case 2) varies with L's level of concavity. A first type of equilibrium is synonymous with no bilateral effort. Each school produces the effort level necessary to be perceived as 'good' by parents. But the second type of equilibrium is synonymous with no effort in both schools. Both cases are satisfactory with regard to the allocative efficiency criteria but the equilibrium synonymous with bilateral effort is obviously preferable in terms of accountability.

Note that if L is linear, the interval $|e^N - e^M|$ vanishes simply because by definition, $e^M = e^N$. If no peer effect exists we have $e^M = e^N = 0$. The only possible equilibrium is absence of effort as case 3 is the only possibility. In this model, absence of peer effect means that there is no incentive to invest i.e. produce some effort that is likely to maintain or generate a 'cream-skimming' privilege.

A preliminary conclusion could be that a quasi-market wherein clients define reputation as a binary variable instead of a continuous variable, with no reputation differential, **can** generate effort and **always** avoids segregation. The allocative efficiency condition is thus always fulfilled. The point however is that [I] there is no warranty that effort will emerge and [II] that this effort will correspond to the first best solution ($e^*_{i,t-1} = e^{IR}$).

Generally speaking, the introduction of a threshold $\overline{K}$ increases the probability of an equilibrium. The instability of the demand that paralyses the schools is now limited. Decentralised schools can thus identify strategies that are mutually optimal. Strictly speaking the absence of effort in this model is the consequence of a high level of $\overline{K}$. If $\overline{K}$ is too high, a policy consisting of gradually reducing its level[14] would ensure bilateral effort such that each school produces some amount of effort. In other words, $\overline{K}$ could be chosen such that $e^{*}_{i,t-1} = e(\overline{K}) = \Psi^{M}$.

Yet, some limitation persists. Ψ^{M} can be equal to e^{IR} or e^{M}. If $e^{*}_{i,t-1} = e(\overline{K}) = e^{IR} \leq e^{M}$ the situation is optimal from a social point of view. By contrast, if $e^{*}_{i,t-1} = e(\overline{K}) = e^{M} \leq e^{IR}$ effort will exist, but its level could be socially suboptimal: teachers do not saturate their participation constraint. In non-technical terms, the fact that e^{M} (and e^{N}) are inferior to e^{IR} is the logical consequence of the peer effect variable's **bounded** character (relatively speaking). Like in the model wherein effort is a continuous variable, the limited magnitude of peer effect payoff functions can compromise the quasi-market's capacity to fuel a high level of effort.

4.2. Reputation differentials

Imagine school 1 has a better reputation than school 2 at the end of period t–2. Given the parental choice mechanism and the optimal recruitment strategy presented in equation 7.9, school 1 gets L(2Ω) while school 2 gets L(0) during period t–1. This means that school 2 faces a more stringent participation constraint than school 1: $e_2^{IR} < e_1^{IR}$. Despite its recovery — i.e. the reputation crisis is supposedly over — school 2 must produce a greater effort than its competitor to attain $\overline{K}$. In other words $e_2(\overline{K}) > e_1(\overline{K})$.[15] Note finally that, with an additive specification of V, maximum effort levels schools are willing to deliver with reference to the potential benefits in terms of peer effect (e^{M} and e^{N}) remain unchanged.

The comparison of $\Psi_i^{M} \equiv \text{Min}\{e_i^{IR}, e^{M}\}$ and $\Psi_i^{N} \equiv \text{Min}\{e_i^{IR}, e^{N}\}$; $i = 1,2$ with $e_1(\overline{K})$ and $e_2(\overline{K})$ now generates 16 different cases. Each of them corresponds to a set of relative positions of the different effort levels at stake. Fortunately, it rapidly turns out that only 6 of them are possible. Remember that $e_1(\overline{K}) < e_2(\overline{K})$ and that $\Psi_i^{M} \leq \Psi_i^{N}$ as $e^{M} < e^{N}$ when L is concave.

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14 If $\overline{K}$ is the success-failure threshold at the university entrance exam, its reduction means for example reduced severity or easier questions imposed by an external regulator.

15 $e_2(\overline{K}) - e_1(\overline{K}) = 2\overline{K} + [F^{l}(2\Omega) - F^{l}(0)] + 2\Omega\,[F^{h}(2\Omega) - F^{l}(2\Omega)] > 0$

In case 1 (see Table 7.2), both schools can signal themselves as being 'good' without saturating their participation constraint or producing an effort level generating more costs than benefits (no matter the strategy adopted by the other player). Technically, this occurs when $e_1(\overline{K}) \leq \Psi_1^M \leq \Psi_1^N$ and $e_2(\overline{K}) \leq \Psi_2^M \leq \Psi_2^N$. If those two conditions are fulfilled, $e_1(\overline{K})$ and $e_2(\overline{K})$ are dominant strategies and define a unique Nash equilibrium.

Case 6 corresponds to the opposite situation. Both school 1 and school 2 prefer the no effort strategy because the effort necessary to signal themselves as 'good' surpasses the benefits they could get in that situation or exceeds the incentive rational threshold: $\Psi_1^M \leq \Psi_1^N \leq e_1(\overline{K})$ and $\Psi_2^M \leq \Psi_2^N \leq e_2(\overline{K})$. Consequently, the dominant strategy for both players is to deliver no effort. Cases 1 and 6 thus correspond to dominant strategy equilibria i.e. unique Nash equilibria (Varian, 1992).

In case 2, the no effort strategy is dominated from school 1's standpoint as $e_1(\overline{K}) \leq \Psi_1^M \leq \Psi_1^N$. School 2 can thus ignore the case in which school 1 produces no effort. Hence, effort $e_2(\overline{K})$ will be its best strategy if $e_2(\overline{K}) \leq \Psi_2^N$ — which is the case as $\Psi_2^M \leq e_2(\overline{K}) \leq \Psi_2^N$. Strategies $e_1(\overline{K})$ and $e_2(\overline{K})$ thus define a unique Nash equilibrium.

In case 5, the effort strategy is dominated from school 2's point of view: $\Psi_2^M \leq \Psi_2^N \leq e_2(\overline{K})$. School 1 can thus take for granted that its rival adopts the no-effort strategy. Given this conjecture, the effort strategy $e_1(\overline{K})$ will be dominated if $\Psi_1^M \leq e_1(\overline{K})$. This is the case as $\Psi_1^M \leq e_1(\overline{K}) \leq \Psi_1^N$. The no effort pair of strategies is consequently the only possible Nash equilibrium.

In case 3, school 1 and school 2 are in a situation where no strategy is dominant and no strategy is dominated as $\Psi_1^M \leq e_1(\overline{K}) \leq \Psi_1^N$ and $\Psi_2^M \leq e_2(\overline{K}) \leq \Psi_2^N$. School i's best strategy depends on the other school's strategy. If the game is simultaneous, two Nash equilibria are possible. If school i adopts the no-effort strategy, the other school's best reply is to adopt the no effort strategy too. Similarly, if school i opts for $e_i(\overline{K})$, the other school's best reply is to produce the same effort; i = 1,2.

Finally, in case 4 school 1's dominant strategy is to produce effort $e_1(\overline{K})$ as $e_1(\overline{K}) \leq \Psi_1^M \leq \Psi_1^N$ while school 2's dominant strategy is to produce no effort as $\Psi_2^M \leq \Psi_2^N \leq e_2(\overline{K})$. The resulting dominant strategy equilibrium is thus asymmetric.

Table 7.2 — Duopoly competition outcomes (reputation differential)

Case 1	Case 2	Case 3
$e_1(\bar{K}) \leq \Psi_1^M \leq \Psi_1^N$	$e_1(\bar{K}) \leq \Psi_1^M \leq \Psi_1^N$	$\Psi_1^M \leq e_1(\bar{K}) \leq \Psi_1^N$
$e_2(\bar{K}) \leq \Psi_2^M \leq \Psi_2^N$	$\Psi_2^M \leq e_2(\bar{K}) \leq \Psi_2^N$	$\Psi_2^M \leq e_2(\bar{K}) \leq \Psi_2^N$
$e^*_{1,t-1} = e_1(\bar{K})$ $e^*_{2,t-1} = e_2(\bar{K})$	$e^*_{1,t-1} = e_1(\bar{K})$ $e^*_{2,t-1} = e_2(\bar{K})$	$e^*_{i,t-1} = 0$; or $e^*_{i,t-1} = e_i(\bar{K})$; $i = 1,2$
Case 4	**Case 5**	**Case 6**
$e_1(\bar{K}) \leq \Psi_1^M \leq \Psi_1^N$	$\Psi_1^M \leq e_1(\bar{K}) \leq \Psi_1^N$	$\Psi_1^M \leq \Psi_1^N \leq e_1(\bar{K})$
$\Psi_2^M \leq \Psi_2^N \leq e_2(\bar{K})$	$\Psi_2^M \leq \Psi_2^N \leq e_2(\bar{K})$	$\Psi_2^M \leq \Psi_2^N \leq e_2(\bar{K})$
$e^*_{1,t-1} = e_1(\bar{K})$ $e^*_{2,t-1} = 0$	$e^*_{1,t-1} = 0$ $e^*_{2,t-1} = 0$	$e^*_{1,t-1} = 0$ $e^*_{2,t-1} = 0$

The introduction of reputation differentials multiplies the possible outcomes of the quasi-market. Four types — instead of three — of outcomes are now possible. First, the result can be a symmetric equilibrium synonymous with bilateral effort (cases 1 and 2). Both schools produce the effort necessary to be perceived as 'good'. Typically, school 2 produces more effort than school 1 to acquire that reputation. At the beginning of the next period, parents and children can be expected to choose on a random basis so that the initial hierarchy disappears and the game at the beginning of period t is the same as the one studied in section 3.1. Hence, cream-skimming and segregation disappear. Reputation differential and cream-skimming are bound to be temporary.

Second, at the other end of the spectrum, the outcome can be a symmetric equilibrium (cases 5 and 6) where both schools decide to produce no effort. In that situation, both schools estimate that investing some effort to be perceived as 'good' is too demanding and decide to give up. The resulting allocation of pupils is more heterogeneous, which is positive in terms of allocative efficiency. However, in terms of surplus abandoned to the teacher ($V > \bar{V}$), this situation is appalling.

A third type of outcome corresponds to the non-unique equilibrium (case 3). Just like in the no reputation differential case (section 3.1), there is an indetermination interval $|e^N - e^M|$. If for both players the effort necessary to be perceived as 'good' intersects this interval (case 3), no unique equilibrium exists.

The fourth of outcome innovates. It is an asymmetric equilibrium consisting of unilateral effort (case 4). In that situation, school 1 produces the level of effort necessary to maintain its better reputation and preserve its cream-skimming privilege. But school 2 prefers to produce no effort and continue to work with the low-ability children. The reputation differential persists. If heterogeneity is required to achieve allocative efficiency, this situation is problematic. It is even worse in terms of accountability, because school 1's effort can be suboptimal ($e^{*}_{1,t} < \hat{e}^{*}$) and school 2's effort is nil.

Qualitatively speaking we can say that quasi-market wherein clients define reputation as a binary variable, which is subject to random reputation differentials, **can** still be synonymous with bilateral effort and no segregation.

The first novelty lies in the fact that the no segregation situation is no longer automatic. It can happen that the school which suffers a temporary loss of reputation (for accidental reasons for example) finds optimal to stay in that situation: it prefers to produce no effort and to recruit the low-ability pupils that are rejected by the most reputed schools. Allocative inefficiency and lack of effort can thus coexist. The second new element is that, in case some reputation differential exists, the absence of surplus is simply impossible. We know that bilateral effort occurs exclusively when (see cases 1 and 2, Table 7.2) $e_1(\overline{K}) \leq \Psi_1^M \leq \Psi_1^N$ and $e_2(\overline{K}) \leq \Psi_2^M \leq \Psi_2^N$ or $e_1(\overline{K}) \leq \Psi_1^M \leq \Psi_1^N$ and $\Psi_2^M \leq e_2(\overline{K}) \leq \Psi_2^N$. Each of those cases embraces five situations. It can be easily shown that the participation constraint is never satisfied for both schools simultaneously. Reason for this directly derives from the fact that school 1 produces less effort than school 2 ($e_1(\overline{K}) < e_2(\overline{K})$) and simultaneously, its 'incentive rational' effort is higher ($e_1^{IR} > e_2^{IR}$). If school 2 saturates its participation constraint ($e_2(\overline{K}) = e_2^{IR}$), inevitably school 1 does not ($e_1(\overline{K}) < e_1^{IR}$).

4.3. Conclusions

On a quasi-market with reputation-sensitive clients and 'reputation' operating as a binary variable, the absence of reputation differential leads to a symmetric equilibrium. Depending on the 'reputation' threshold level this equilibrium will be synonymous with effort or absence of effort. The higher this threshold the more likely the no-effort situation. If desegregation is socially desirable, both equilibria are of equal value. The bilateral effort equilibrium logically dominates the no-effort equilibrium because the latter entitles to a limitation of the surplus abandoned to teachers. There is no guarantee however that this level of effort will be socially optimal. The peer effect variable is **bounded** in magnitude. The quasi-market's capacity to induce the level of effort saturating the participation constraint can consequently be compromised.

The introduction of a reputation differential generates the additional possibility of an asymmetric equilibrium. The 'good' school produces the level of effort necessary to maintain its better reputation and preserve its cream-skimming privilege. The 'bad' school prefers to produce no effort and continue to work with low-ability children. The reputation differential persists. If heterogeneity is required to achieve allocative efficiency, this situation is problematic. Inefficiency also stems from the fact that some surplus is abandoned to the teacher. The 'good' school's effort can be suboptimal and the bad school's effort nil.

5. DUOPOLY COMPETITION – PRODUCT DIFFERENTIATION

In this last section, we introduce a new variant of the demand function. We suppose that 'reputation' is a continuous variable like in section 3, but we now also assume that parents and pupils have heterogeneous preferences. They still want to reach the maximum level of human capital but simultaneously develop preferences for a particular characteristic of this human capital or for the way it is produced. Some want to specialise in sciences while others absolutely want a lot of maths or ancient Greek and Latin for example. Some parents valorise liberal education while others absolutely want a traditional, rigorous and severe education style...

To formalise this idea, we use Hotteling's model of the linear city (Hotteling, 1929). We assume that school 1 and school 2 are located at the extremities of a segment[16] of length 1. The length of the segment represents the level of product differentiation between the two schools (e.g. the differences in terms of curricula on offer, educational style...). School 1 is at $x = 0$ while school 2 is at $x = 1$.

Clients (type $ß^h$ and type $ß^l$) with heterogeneous tastes are distributed uniformly along this segment. Each, position on the segment represents a certain preference or taste. Clients incur a unit cost τ (a loss of utility) per unit of length[17] as soon as they do not get the possibility to send their child to the school offering exactly the education they want (in terms of curricula, educa-

16 This segment represents the district.
17 This cost may include the value of time spent by parents on home to school travel.

tional style...). The higher this unit cost τ , the higher their sensitivity to a certain level of product mismatch or — equivalently — the higher the level of product differentiation. A client located in x will support cost $x.\tau$ if he decides to go to school 1. This cost will be $(1-x).\tau$ if he goes to school 2. Note that product differentiation as modelled here can simply be interpreted as the level of geographical 'proximity' offered by the school. Parameter τ can then be interpreted as the transportation cost per unit of distance.

5.1. No reputation differential

If schools have the same reputation at the beginning of period t–1 — thus the same level of peer effect — human capital outcomes at the end of that period will exactly reflect investments in terms of effort ($e_{1,t-1}$, $e_{2,t-1}$). An individual living in x will be indifferent between going to school 1 or school 2 provided:

(7.14) $$e_{1,t-1} - x_t.\ \tau = e_{2,t-1} - (1-x_t).\tau$$

From this indifference condition, we immediately derive the period t demand functions for school 1 (x_t) and school 2 ($1-x_t$):

(7.15) $$x_t = \frac{e_{1,t-1} - e_{2,t-1} + \tau}{2\tau} \text{ and } 1-x_t = \frac{e_{2,t-1} - e_{1,t-1} + \tau}{2\tau}$$
with $x_t \in [0,1]$

Using the idea that type $ß^h$ pupils are uniformly distributed on the segment of length 1, and assuming that the maximal proportion of type $ß^l$ is 2Ω, we can immediately derive from those demand functions the level of peer effects that school 1 and school 2 will benefit from during period t if they invest respectively $e_{1,t-1}$ and $e_{2,t-1}$.

(7.16) $$L(R_{1,t}) = L(x_t.2\Omega) = L(\frac{e_{1,t-1} - e_{2,t-1} + \tau}{2\tau}.2\Omega)$$

(7.17) $$L(R_{2,t}) = L((1-x_t).2\Omega) = L(\frac{e_{2,t-1} - e_{1,t-1} + \tau}{2\tau}.2\Omega)$$

with
- $R_{1,t}$ the proportion of type $ß^h$ pupils in school 1;
- $R_{2,t} = 2\Omega - R_{1,t}$ the proportion of type $ß^h$ pupils in school 2;
- $x_{t-1} \in [0,1]$;
- and $\Omega < 1/2$ ensuring the maximal proportion of type $ß^h$ in a school is 2Ω;

Note that this model implicitly contains a 'cream-skimming' mechanism. We still suppose that school 1 and school 2 have a size 1. This means that if school 1 (for example) manages to capture the whole market at the beginning of period t ($x_t = 1$), it will retain all type β^h pupils ($R_{1,t} = 2\Omega$ given our assumption), recruit the number of type β^l pupils ($1-2\Omega$) necessary to reach its size and reject all other type β^l pupils.

We can now formulate the optimisation problem school 1 is confronted with[18]. Imagine school 2 produces effort ($e_{2,t-1} \geq 0$), school 1's optimal answer is defined by:

(7.18) $$\text{Max}_{e_{1,t-1}} V = E + L(\Omega) - \Pi(e_{1,t-1}) + E + L(R_{1,t}(e_{1,t-1};e_{2,t-1}))$$

$$\text{s.t. } E + L(\Omega) - \Pi(e_{1,t-1}) \geq \overline{V}$$
$$\text{with } R_{1,t}(e_{1,t-1};e_{2,t-1}) = \frac{e_{1,t-1} - e_{2,t-1} + \tau}{2\tau}.2\Omega$$

First order condition and second order derivatives are

(7.19) $$-\Pi'_{e_{1,t-1}}(e_{1,t-1}) + L'_{R_{1,t}}(R_{1,t}).\frac{\Omega}{\tau} = 0$$

(7.20) $$-\Pi''_{e_{1,t-1}e_{1,t-1}}(e_{1,t-1}) + L''_{R_{1,t}R_{1,t}}(R_{1,t}).[\frac{\Omega}{\tau}]^2 < 0$$
if $L''_{R_{1,t}R_{1,t}}(R_{1,t}) < 0$ as, by assumption, $\Pi''_{e_{1,t-1}e_{1,t-1}}(e_{1,t-1}) > 0$

If the peer effect function is concave ($L''_{R_{1,t}R_{1,t}}(R_{1,t}) < 0$) we can say that first order condition (7.19) defines a maximum. This expression also implicitly defines school 1's reaction function to school 2's choice of effort. School 2's reaction function is exactly symmetric.

The existence of a Nash equilibrium is conditional to the presence of an intersection between the two reaction functions. To determine whether this intersection exists, we need to describe those reaction functions. We know these functions are **perfectly symmetric** because demand functions are symmetric in ($e_{1,t-1}$, $e_{2,t-1}$) — see expression (7.15). The total differential of the first order condition (expression 7.21) helps us characterise **the slope** (expression 7.22) of the functions:

18 School 2's problem is exactly symmetric.

(7.21) $L''_{R_{1,t}R_{1,t}}(R_{1,t}).[\frac{\Omega}{\tau}]^2 . de_{1,t-1} - \Pi''_{e_{1,t-1}e_{1,t-1}}(e_{1,t-1}). de_{1,t-1} + L''_{R_{1,t}R_{1,t}}(R_{1,t}).[\frac{\Omega}{\tau}]^2 .[-1]. de_{2,t-1} = 0$

(7.22) $$\frac{de_{1,t-1}}{de_{2,t-1}} = \frac{L''_{R_1R_1}(R_{1,t}).[\frac{\Omega}{\tau}]^2}{L''_{R_{1,t}R_{1,t}}(R_{1,t}).[\frac{\Omega}{\tau}]^2 - \Pi''_{e_{1,t-1}}(e_{1,t-1})}$$

$\in [0,1[$ as $\Pi''_{e_{1,t-1}e_{1,t-1}}(e_{1,t-1}) > 0$

with

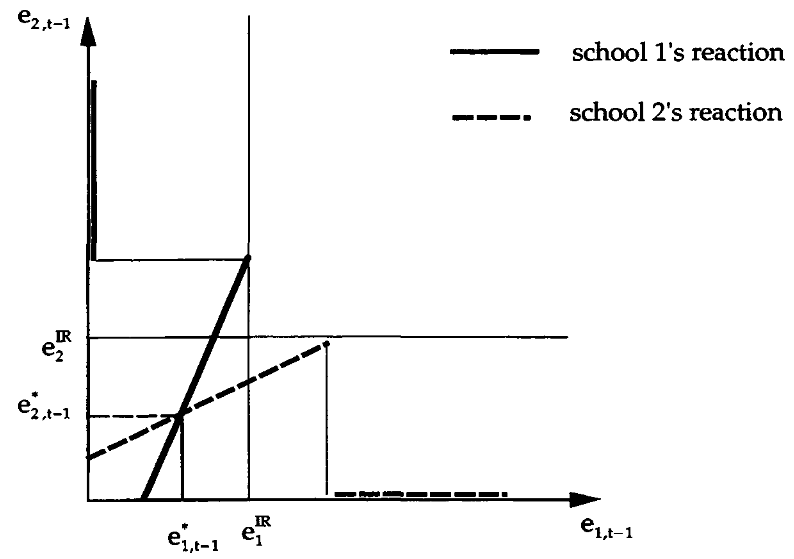
$$R_{1,t} = \frac{e_{1,t-1} - e_{2,t-2} + \tau}{2\tau}.2\Omega$$

Expression (7.22) shows that slopes are positive and inferior to 1 when the effort disutility function is convex ($\Pi''_{e_{1,t-1}e_{1,t-1}}(e_{1,t-1}) > 0$). Consequently, the sufficient condition to get an intersection in the first quadrant is that **the constant at the origin** is strictly positive (see graph 7.1). Analytically, this will be the case if the marginal benefit of effort is superior to its cost in ($e_{1,t-1} = 0$, $e_{2,t-1} = 0$):

(7.23) $$L'_{R_{1,t}}(\Omega).\frac{\Omega}{\tau} > \Pi'_{e_{1,t-1}}(0)$$

Condition (7.23) is necessarily verified if the marginal disutility of effort is nil in zero $\Pi'_{e_{1,t-1}}(0) = 0$ and if cost (τ) is not infinite. By definition $L'_{R_{1,t-1}}(\Omega) > 0$

Graph. 7.1 — Schools' reaction function when transportation costs are positive. No reputation differential



Finally, using the symmetry of the problem, we can say that effort levels at equilibrium will be equal ($e^*_{1,t-1} = e^*_{2,t-1}$) and such that:

$$(7.24) \quad L'_{R_{i,t}}(\Omega).\frac{\Omega}{\tau} = \Pi'_{e_{i,t-1}}(e^*_{i,t-1})$$

$$\text{provided } e^*_{1,t-1} \leq e^{IR}_{1,t-1} = e^{IR}_{2,t-1};\ i = 1,2$$

In terms of **allocative efficiency**, the situation is optimal. Symmetry between schools is perfect. Conditional to the verification of the participation constraint, the effort generated by the quasi-market will essentially be determined [I] by the importance of the unit cost τ (determining the constant value at the origin of the reaction functions) and [II] the convexity of the effort disutility (influencing the slope of the reaction functions). The more important product differentiation — i.e. the higher schools' market power — the lower the effort delivered by schools at equilibrium. If cost τ is infinite, effort will be nil. By contrast, if cost τ is nil, the left-hand term of expression (7.24) tends to infinity. This result echoes the discontinuity of payoff functions that we discussed in section 3 and the corresponding absence of equilibrium.

Simultaneously, the more convex the effort disutility function, the 'flatter' the reaction functions (see expression 7.22), and the lower the level of effort at equilibrium.

In terms of **social welfare**, the point is that nothing guarantees that the particular value taken by τ will generate the optimal level of effort ($e^*_{1,t-1} = e^{IR}_{1,t-1} = e^{IR}_{2,t-1}$). Mathematically, there is a (positive) value of τ ensuring that the no-surplus condition is verified (perfect accountability). Practically speaking however, τ is probably hard to control. We would *a priori* say that it has the status of an exogenous variable.

5.2. Reputation differential

Suppose that, for any particular reason, school 2 produces less effort than school 1 during **period t–2**. Imagine that the effort differential is $\mu \equiv e^*_{1,t-2} - e^*_{2,t-2} > 0$. Allocation of peer effect during **period t–1** will reflect this spread.

$$(7.25)\quad L(R_{1,t-1}) = L(x_{t-1}.2\Omega) = L(\frac{\mu+\tau}{\tau}.\Omega)$$

$$(7.26)\quad L(R_{2,t-1}) = L((1-x_{t-1}).2\Omega) = L(\frac{-\mu+\tau}{\tau}.\Omega)$$

Reaction functions describing effort decisions in period t–1 — conditioning the allocation of peer effect in **period t** — are thus different for school 1 and school 2. In non-technical terms, school 2 must produce more effort than school 1 to preserve its reputation as it benefits from a lower peer effect endowment. Analytically, reaction functions are implicitly defined by the two following first order conditions:

$$(7.27)\quad -\Pi'_{e_{1,t-1}}(e_{1,t-1}) + L'_{R_{1,t}}(\frac{e_{1,t-1} - e_{2,t-1} + \tau + \Delta L(\mu)}{\tau}.\Omega).\frac{\Omega}{\tau} = 0$$

$$(7.28)\quad -\Pi'_{e_{2,t-1}}(e_{2,t-1}) + L'_{R_{2,t}}(\frac{e_{2,t-1} - e_{1,t-1} + \tau - \Delta L(\mu)}{\tau}.\Omega).\frac{\Omega}{\tau} = 0$$

$$\text{with } \Delta L(\mu) \equiv L(\frac{\mu+\tau}{\tau}.\Omega) - L(\frac{-\mu+\tau}{\tau}.\Omega)$$

The main consequence of the reputation differential is the disappearance of symmetry (see Graph 7.2). It is also obvious that school 2 hits its participation constraint before school 1. It can be shown very easily that the **constant value at the origin** is higher for school 2 than for school 1 when the peer effect function is concave. The **slopes** of the reaction functions are much more difficult to characterise:

$$(7.29)\quad \frac{de_{1,t-1}}{de_{2,t-1}} = \frac{L''_{R_{1,t}R_{1,t}}(\frac{e_{1,t-1}-e_{2,t-1}+\Delta L(\mu)}{\tau}.\Omega).[\frac{\Omega}{\tau}]^2}{L''_{R_{1,t}R_{1,t}}(\frac{e_{1,t-1}-e_{2,t-1}+\Delta L(\mu)}{\tau}.\Omega).[\frac{\Omega}{\tau}]^2 - \Pi''_{e_{1,t-1}}(e_{1,t-1})}$$

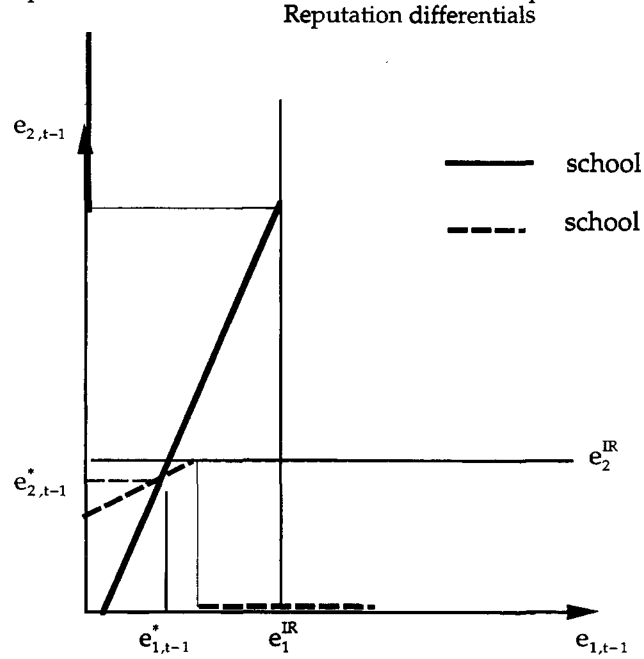
$\in [0,1[$ as $\Pi''_{e_{1,t-1}}(e_{1,t-1}) > 0$

$$(7.30)\quad \frac{de_{2,t-1}}{de_{1,t-1}} = \frac{L''_{R_{2,t}R_{2,t}}(\frac{e_{2,t-1}-e_{1,t-1}-\Delta L(\mu)}{\tau}.\Omega).[\frac{\Omega}{\tau}]^2}{L''_{R_{2,t}R_{2,t}}(\frac{e_{2,t-1}-e_{1,t-1}-\Delta L(\mu)}{\tau}.\Omega).[\frac{\Omega}{\tau}]^2 - \Pi''_{e_{1,t-1}}(e_{1,t-1})}$$

$\in [0,1[$ as $\Pi''_{e_{1,t-1}}(e_{1,t-1}) > 0$ and $L'' < 0$

Expressions (7.29) and (7.30) do not entitle us to predict the impact of reputation difference on equilibrium **in terms of effort**. An assumption about the sign of the third-order derivative of the effort disutility function is necessary to say something relevant. If it is constant for example ($L'''(.) = 0$), we can say that the slopes of the reaction functions will be identical with or without reputation differential. Hence, up to its participation threshold, school 2 is likely to produce more effort than in the case of no reputation differential. By contrast, school 1 is likely to produce less effort. This result directly reflects its advantage in terms of peer effect endowment. Note however that the greater the asymmetry between school 1 and school 2, the more likely the absence of intersection between the reaction functions in the 'Incentive Rational' region ($e_{1,t-1} \leq e^{IR}_{1,t-1}$; $e_{2,t-1} \leq e^{IR}_{2,t-1}$). Hence, the more likely the absence of a Nash equilibrium.

Graph 7.2 — Schools' reaction function when transportation costs are positive. Reputation differentials



Concerning **allocative inefficiency** the situation is even more difficult to characterise. During **period t–1**, school 1 benefits from a peer effect level defined by expression (7.31).

$$(7.31)\quad L(\frac{\mu+\tau}{\tau}.\Omega) > L(\Omega) \text{ as } \mu \equiv e^*_{1,t-2} - e^*_{2,t-2} > 0$$

It is superior to the social optimal level $L(\Omega)$ as μ is positive. In **period t**, this expression becomes:

$$(7.32)\quad L(\frac{e^*_{1,t-1} - e^*_{2,t-1} + \Delta L(\mu) + \tau}{\tau}.\Omega)$$

The evolution of peer effect level between period t–1 and t is entirely determined by the value of $e^*_{1,t-1} - e^*_{2,t-1} + \Delta L(\mu)$. If it is equal to $e^*_{1,t-2} - e^*_{2,t-2}$ the asymmetry of reputation will persist: school 1 will keep its advantage over school 2. The equilibrium will be synonymous with long-lasting allocative inefficiency. If it is equal to zero, the peer effect differential disappears completely at the beginning of period t+1: allocative inefficiency is temporary. But all sorts of alternative situations are *a priori* possible. To go further in this analysis, one would need to specify $e^*_{1,t-2} - e^*_{2,t-2}$ as a function of

$\mu \equiv e^*_{1,t-1} - e^*_{2,t-1}$. In mathematical terms, this would amount to specifying the difference equation defining the time path of the system after the initial shock μ.

5.3. Conclusion

On a quasi-market with reputation-sensitive clients and 'reputation' operating as a continuous variable, the introduction of product differentiation reduces uncertainty among schools in competition. By contrast with the situation with no product differentiation and clients shifting from one school to another instantaneously — free of charge —, Nash equilibria are now more likely. The more extensive product differentiation, the more frequent are Nash equilibria, synonymous with bilateral effort. Note however that effort levels corresponding to the social optimum are less likely when product differentiation is important. This result simply echoes the well-documented idea that product differentiation is synonymous with market power and that excessive market power is bad for efficiency.

The introduction of reputation differentials potentially alters these results in an unpredictable way. In addition, it increases the likelihood of a no Nash equilibrium situation.

In conclusion, we can say that optimality requires the benefits of school choice — the additional teacher effort that families can benefit from by choosing a school instead of another — to come at a certain cost. This seems to be a necessary, though not sufficient, condition for school competition to be a good regulatory principle. We know, by definition, that quasi-markets are based on a free-of-charge idea. Our results consequently suggest that quasi-markets — more than markets — need product differentiation to work properly. Product differentiation is the only way to ensure that what parents benefit from, when they use their right to choose, comes at a certain cost. As we define it here, product differentiation means [I] that schools offer different kinds of products (curricula, education styles or location...), [II] that preferences are heterogeneous and [III] not ability-biased. Remember that we assume in our model that both low and high-ability pupils are evenly distributed on the segment. Condition [I] is easily verified. Verification of condition [III] is likely although some observers (Levin , 1991) have sevious doubts about this. To us, condition [II] is the most problematic one. In many cases, 'objective' differences in terms of curricula and educational styles offered by suppliers are completely occulted by strong hierarchies which are deep-rooted in the public's mind. To reverse these hierarchies in order to let genuine product differentiation emerge is a puzzling challenge for most regulators around the world. The current crisis of vocational track of secondary education in some European countries might be an illustration of this problem. Vocational curricula diverge from those on offer in the academic track but almost nobody seems to want them spontaneously.

6. GENERAL CONCLUSION

Generally speaking, our analysis indicates that a quasi-market is not automatically synonymous with no teacher surplus (perfect accountability) and allocative efficiency. Some regulatory intervention might be necessary. This is the case when segregation is long-lasting because this situation is synonymous with allocative inefficiency and lack of effort especially in less reputed schools. It is also the case when there is no segregation. The problem then is that the quasi-market, as me model it here, presents no mechanisms ensuring that the level of effort at equilibrium coincides with social optimum. The possibility to overcome these imperfections through a proactive regulatory approach is explored in the next part of this work.

Part 3

Quasi-market regulation

Our positive analysis of quasi-markets has highlighted their propensity to generate no equilibria or to produce equilibria characterised by both inadequate effort and allocative inefficiency due to segregation of pupils along the ability line.

Chapter 8 will explore the kind of regulatory framework that a social planner (financing the educational quasi-market) can (should) adopt to enhance efficiency i.e. maximise human capital coming out of schools 1 and 2. The social planner must now incorporate in his analysis the strategic behaviour that schools tend to adopt. Correspondence between social priorities and each school's interest cannot be taken for granted. In other words, inefficiency cannot be eliminated simply by 'informing' the decentralised decision makers (schools) on recruitment choice or effort levels that are socially desirable. We will explore how this planner can (or must) modulate his financing formula to ensure some compliance from schools. We have abundantly discussed several configurations of the quasi-market. Each of them has its specificity in terms of inefficiency. Yet, the purpose of this part of our work is to define a *general* regulation strategy providing answers to the various deficiencies of quasi-markets. Our aim is to identify a regulatory strategy that is likely to bring a unique answer to the whole set of deficiencies that can emerge on a quasi-market wherein reputation is a state or a variable, with or without reputation differentials, with or without transportation cost.

We will suppose here — like in chapter 7 — that allocative efficiency means no segregation[1]. This means first that segregation must be prevented to ensure an efficient allocation of peer effects between school 1 and school 2. Second, teachers must be incited to saturate their participation constraints. Previous developments have revealed that if the incentive mechanism is exclusively based on potential fluctuations of the peer effect endowment, effort delivered can be either:

[I] insufficient: this is the case when reputation amounts to a state more than a continuous variable or when product differentiation is important — see part 2, chapter 7, sections 4 and 5. We have seen that the lack of effort is not exclusively caused by asymmetry between schools in terms of peer effect endowment. If the peer effect variable is of limited magnitude, the quasi-market's capacity

1 Conditions under which this is true have been exposed extensively in chapter 6.

to induce the level of effort saturating the participation constraint is compromised even when schools are perfectly symmetric.

[II] or unpredictable in the sense that no Nash equilibrium exists: this is the case when 'reputation' amounts to a continuous variable and no product differentiation exist — Part 2, chapter 7, section 3. We have seen that if too many parents exercise their exit option simultaneously, the system can be extremely unstable. Immediate and massive shifts of the demand side of the market explain the suppliers' difficulty to define their optimal strategy. Excessive uncertainty paralyses the quasi-market. In other words, competition among 'rational' decision-makers becomes non-practicable when clients are too alert. In that particular case, the regulator has no option but to dissuade schools from choosing the socio-economic composition of their intake. Afterwards however, the only way to generate effort is by introducing a money-based incentive mechanism .

Finally, the regulator must be able to determine the socially optimal per-pupil expenditure. The per-pupil expenditure must be sufficiently high to entitle a school to produce the effort that is socially optimal[2]. But it must not be too high because in that case, teachers would benefit from an undue utility surplus. The regulator's ability to cope with asymmetry of information concerning the teacher's utility function will heavily condition the solution to this problem.

Chapter 9 analyses the consequences of an additional constraint: the **exit threat** from parents and pupils with higher human capital endowment (type $ß^h$). Imagine indeed that those parents have access to a private — or locally financed — educational alternative at no or very limited cost. Parents are expected to use this alternative if the regulator successfully convinces publicly financed schools to become totally desegregated. This adds a new dimension to the regulatory problem: the regulator is indeed confronted with the parental strategic behaviour and must take this behaviour into account when designing his regulation scheme. Results obtained with our quasi-market model are confronted to those put forward by recent developments of the Tiebout Local Public Good model. We particularly refer to papers incorporating the local social spillover assumption (Schwab & Oates, 1991; Glazer, Mumy & Niskanen, 1991 ; Brueckner & Lee, 1989 ; de Bartolome, 1990).

2 We have demonstrated in chapter 6 that socially optimal effort must be such that (discounted) marginal disutility of effort is equal to its marginal contribution to human capital accumulation.

Chapter 10 concludes the analysis of the regulatory problem. We move away from the formal apparatus developed so far and discuss the consequences on previous results of the existence of various phenomena that have been documented empirically. The first one is the **self-selection** propensity among low-ability pupils and families: more than the others, those pupils apparently avoid the most selective schools (Willis & Rosen, 1979). The second phenomenon we would like to treat is the implication of people's sensitivity to **signalling** difficulties (Spence, 1974).

CHAPTER 8. HOW SHOULD STRATEGIC SCHOOLS BE REGULATED?

To this point, the only engine of competition in a quasi-market is the possibility for teachers to recruit more able pupils and to improve their utility level by these means. Actual segregation can be socially undesirable (cause allocative inefficiency). In addition, potential segregation can paralyse effort decisions made by non-cooperative players. We have seen in chapter 7 that non-cooperative players anticipating immediate and massive shifts of the demand because their effort decisions diverge marginally cannot identify an optimal strategy. For those two reasons, the regulator can be tempted to prohibit or firmly discourage segregation. However, when allocation of pupils is controlled and segregation becomes impossible, the engine of competition totally disappears. Hence, some other incentive mechanisms must be recreated and — of course — based on a different kind of remuneration: 'good' schools must receive money instead of getting the possibility to retain the 'cream of the crop'.

1. HOW TO GET LESS SEGREGATION

If a quasi-market leads to segregation synonymous with allocative inefficiency, the first policy that comes to mind consists of 'school zoning'. Each child would be assigned to a particular school depending on his residence. The regulator could divide the territory into districts showing some socio-economic heterogeneity. We will not examine this option here. This choice can simply reflect a political constraint. In several countries, the constitution imposes free school choice. But this option has its problems. One should refer to some theoretical and empirical work (Bénabou, 1993; Kazal-Thresher, 1994) illustrating the general tendency of people to reproduce socio-economic segregation through residential mobility.

If school zoning is discarded, the other policy that comes to mind consists of using the financing formula to incite schools to revise their recruitment strategies. Heads of schools maximise the utility of their teachers. As per-pupil expenditure is a central determinant of that utility level, the regulator can steer recruitment practices simply by making E conditional on the socio-economic composition of the school (the human capital endowment of the recruited pupils)[3]. This variable is probably publicly known or, at least, observable at a limited cost. Conditional allocation could (for example) correspond to the suppression of financial subsidy to schools insufficiently 'mixed' (i.e. their proportion of type β^h pupils (R_i) does not correspond to the district's proportion Ω). In that extreme situation, the participation constraint ($V \geq \overline{V}$) would obviously not be satisfied[4], and school heads would modify their recruitment policy. This is trivial.

2. OUTPUT-BASED COMPENSATION

Once schools are totally dissuaded from 'skimming off the cream', the regulator has solved the problem of allocative inefficiency, and has also eliminated the situation where non-cooperative players are trapped in a no-equilibrium deadlock (see chapter 7, section 3). A Nash equilibrium exists, but it is synonymous with no effort. The regulator must consequently move to the next step of his regulatory programme i.e. find the output-based financing formula inciting schools to deliver the socially optimal level of effort.

Suppose the gross output and initial human capital endowment are measurable at a limited cost[5]. By contrast, suppose that the regulator cannot estimate the level of the other variables at stake: [I] the actual contribution of peer effects ($L(\Omega)$) to gross output and [II] both the teacher utility function ($V = E + L(\Omega) - \Pi(e_i)$) and its reservation level ($\overline{V}$). The following developments will easily demonstrate that the regulator's ignorance of the teacher utility function generates some 'residual' inefficiency. An output-based financing formula can incite teachers to deliver the socially optimal level of effort. Yet, this mechanism is not sufficient to simultaneously ensure saturation of the participation constraint.

Suppose the new regulatory scheme is introduced at the beginning of (for example) period t–1. To incite schools to deliver some effort, the regulator can use the following 'output-based' — and 'segregation-deterrent' — formula[6] :

3 For a development of a similar reasoning in the health care sector see Matsaganis & Glennerster (1994); Van de Ven & Van Vliet (1992).

4 We have assumed in Part 2, chapter 5 that some positive per-pupil expenditure is necessary to satisfy a teacher's participation constraint. Maximal peer effect and minimal effort is not sufficient to retain a teacher.

5 Imagine that the regulator has access to standardised test results (SAT scores in the US, Baccalaureate in France)

6 A more 'integrated' version of this formula aiming at maximizing desegregation and simultaneously optimising output (effort) does not seem appropriate given the regulatory problem we have to deal with. We have seen that on a quasi-market where reputation is a continuous variable, when transportation costs are nil or low, the major problem is the absence of equilibrium, not the particular values it takes. The first priority is thus to eliminate what

(8.1) $E_{i,t-1} = E$

$E_{i,t} = \Gamma + v.K(e_{i,t-1})$

with

- $E_{i,t-1} = E_{i,t} = 0$ if $R_{i,t-1}$, $R_{i,t} > \Omega$, ensuring that none of the players will depart from Ω
- $K(e_{i,t-1}) = R_{i,t-1}.F^h(\Omega) + (1-R_{i,t-1})F^l(\Omega) + e_{t-1}$; school i's

gross output at the end of period t–1;

- E; the lump-sum allocated per-pupil during the first period of the new regulatory scheme (period t–1);
- $v > 0$, the output-based incentive coefficient, Γ the fixed component of the financing formula determining the per-pupil expenditure for period t;
- $i = 1,2$

School i's program — once this financing formula is implemented — can be stated as follows:

(8.2) $\text{Max}_{e_{i,t-1}} V = E + L(\Omega) - \Pi(e_{i,t-1}) + \Gamma + v.K(e_{i,t-1}) + L(\Omega)$

s.t. $V_{i,t-1} = E + L(\Omega) - \Pi(e_{i,t-1}) \geq \overline{V}$

First order condition is that:

(8.3) $\Pi'_{e_{i,t-1}}(e_{i,t-1}) = v$

Expression (8.3) defines an (unconstrained) maximum (as $\Pi''_{e_{i,t-1}e_{i,t-1}} < 0$ by assumption). By setting v equal to $1/(1+\lambda)$, the regulator is sure that the (unconstrained) effort delivered will be socially optimal: $e^*_{i,t-1} = \hat{e}^*$ such that $(1+\lambda)\Pi'_{e_{i,t-1}}(\hat{e}^*) = 1$. In other words, the 'private' return of effort as incorporated in the financing formula (v) must be equal to the 'social' return of effort.

Inefficiency potentially persists however. To be sure that this unconstrained solution is feasible, E (for period t–1) and Γ (for subsequent periods) must be compatible with the participation constraint. For example E can diverge from its first best level. The same is true for the fixed term[7] Γ. If the regulator does not perfectly know the teacher's utility function and its reservation utility level, he cannot appropriately decide upon per-pupil expenditure, and financial needs defined by schools themselves are bound to be exaggerated.

3. YARDSTICK COMPETITION

If information concerning the teacher's utility function is asymmetric, 'simple' output-based mechanisms show deficiencies. But these limitations can be circumvented by a yardstick competition mechanism (Shleifer, 1985). First, schools must decide upon their effort level **and** their per-pupil cost (expenditure)[8]. Second, school 1's revenue in period t must be based on its relative performance in terms of output and per-pupil cost at the end of period t–1. The higher its effort, the higher its per-pupil income. The lower its cost, the higher its income. But simultaneously, the higher school 2's effort, the lower school 1's per-pupil income and the lower school 2's cost, the lower school 1's income.

Suppose that school 1 is confronted at the beginning of period t–1 to the following formula conditioning its period t income (and similarly for school 2):

(8.4) $$E_{1,t} = E_{1,t-1} + v.[K_{1,t-1}(e_{1,t-1}) - K_{2,t-1}(e_{2,t-1})] - k[E_{1,t-1} - E_{2,t-1}]$$

with :

- $E_{1,t-1} = E_{1,t} = 0$ if $R_{1,t-1}$, $R_{1,t} > \Omega$; ensuring that none of the players will depart from Ω;
- $v > 0$, $k > 0$ the yardstick premium (penalty) coefficients

The first equation of expression (8.4) simply indicates that school i is told that its per-pupil amount during period t will equal the per-pupil expenditure it has chosen for period t–1 ($E_{1,t-1}$) **plus** two premiums/penalties. The first one — $v.[K_{1,t-1}(e_{1,t-1}) - K_{2,t-1}(e_{2,t-1})]$ — is simply proportional to the difference in terms of output between the two schools in competition. The second one — $k.[E_{1,t-1} - E_{2,t-1}]$ — is proportional to the cost differentials.

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causes the no-equilibrium deadlock: the possibility of peer effect reallocation. This does not seem to be possible without imposing very large penalties i.e. pushing the players beyond their participation constraint in case segregation occurs.

7 $\hat{E}^* = \overline{V} + \Pi(\hat{e}^*) - L(\Omega)$; $\hat{\Gamma}^* = \overline{V} + \Pi(\hat{e}^*) - L(\Omega) - \frac{1}{1+\lambda}.K_{i,t-1}(\hat{e}^*)$

8 To this point, we have always supposed that E was *a priori* fixed by the regulator. Note also that cost or expenditure is equal to income E as schools are supposed to operate on a non-profit basis.

Suppose also school 1 and school 2 play simultaneously. For a given level of effort delivered by school 2 ($e_{2,t-1} \geq 0$) and a certain per-pupil expenditure chosen by school 2 ($E_{2,t-1}$), what is school 1's best reply[9]? Using (8.4), the problem (8.2) can be reformulated as follows:

$$(8.5) \quad \text{Max}_{E_{1,t-1}, e_{1,t-1}} V = 2.L(\Omega) - \Pi(e_{1,t-1}) + v.[K(e_{1,t-1}) - K(e_{2,t-1})] + (2-k).E_{1,t-1} + k.E_{2,t-1}$$

s.t.

$$V_{i,t-1} = E_{i,t-1} + L(\Omega) - \Pi(e_{i,t-1}) \geq \overline{V}$$

Using the Kuhn-Tucker approach, we can rewrite problem (8.5) as follows:

$$(8.6) \quad \text{Max}_{E_{1,t-1}, e_{1,t-1}} G = 2.L(\Omega) - \Pi(e_{1,t-1}) + v.[K(e_{1,t-1}) - K(e_{2,t-1})] + (2-k).E_{1,t-1} + k.E_{2,t-1} + y.[E_{1,t-1} + L(\Omega) - \Pi(e_{1,t-1}) - \overline{V} - s]$$

Where (y) is the Lagrangian multiplier and (s) a dummy variable transforming the inequality constraint into an equality. The Kuhn-Tucker conditions give the first-order necessary conditions for a maximum. We can also consider those conditions as sufficient, as both objective function V and the constraint are concave in the non-negative orthant (Chiang, 1984)[10].

$$(8.7) \quad \frac{\partial G}{\partial e_{1,t-1}} \leq 0 \,;\, e_{1,t-1} \geq 0 \,;\, e_{1,t-1}.\frac{\partial G}{\partial e_{1,t-1}} = 0$$

$$(8.8) \quad \frac{\partial G}{\partial E_{1,t-1}} \leq 0 \,;\, E_{1,t-1} \geq 0 \,;\, E_{1,t-1}.\frac{\partial G}{\partial E_{1,t-1}} = 0$$

$$(8.9) \quad \frac{\partial G}{\partial s} \leq 0 \,;\, s \geq 0 \,;\, s.\frac{\partial G}{\partial s} = 0$$

$$(8.10) \quad \frac{\partial G}{\partial y} = 0$$

Those conditions can be restated using the specification of G in expression (8.6). Combining expression (8.9) and (8.10) we get:

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9 To prevent collusion, the regulator can replace school 2 by a school of another district, randomly selected at the end of period t-1.

10 $d^2V = -\Pi''_{e_{1,t-1}e_{1,t-1}} d^2 e_{1,t-1} < 0$ as $\Pi''_{e_{1,t-1}e_{1,t-1}} > 0$ by assumption

(8.11) $v - (1+y)\ \Pi'_{e_{1,t-1}}(e_{1,t-1}) \leq 0$
$e_{1,t-1} \geq 0$
$e_{1,t-1}.[v - (1+y)\ \Pi'_{e_{1,t-1}}(e_{1,t-1})] = 0$

(8.12) $(2-k) + y \leq 0;\ E_{1,t-1} \geq 0$
$E_{1,t-1}.[(2-k) + y] = 0$

(8.13) $y \geq 0;\ E_{1,t-1} + L(\Omega) - \Pi(e_{1,t-1}) - \overline{V} \geq 0;$
$[E_{1,t-1} + L(\Omega) - \Pi(e_{1,t-1}) - \overline{V}].y = 0$

By assumption we know that $E_{1,t-1} > 0$ is necessary to verify the second condition in expression (8.13)[11]. If $E_{1,t-1} > 0$, we then need $(2-k) + y = 0$, or equivalently $y = k-2$, in order to verify the slackness condition in expression (8.12). If $k > 2$, as $y = k-2$, we logically have $y > 2$. Now if $y > 0$, the verification of the slackness condition (8.13) imposes $(E_{1,t-1} + L(\Omega) - \Pi(e_{1,t-1}) - \overline{V} = 0)$, i.e. saturation of the participation constraint participation constraint. Consequently, we can say that $k > 2$ ensures that school 1 will retain the value of $E_{1,t-1}$ saturating its participation constraint.

If the regulator wants a positive effort level ($e_{1,t-1.} > 0$), the slackness condition of expression (8.11) suggests that $v - (1+y)\Pi'_{e_{1,t-1}}(e_{1,t-1}) = 0$, or equivalently $v = (k-1)\,\Pi'_{e_{1,t-1}}(e_{1,t-1})$. In conclusion, to achieve the first best solution, the regulator must set v and k such that :

(8.13) $v = \frac{k-1}{1+\lambda};\ k \geq 2$
with $\lambda > 0$

Using this rule, the regulator is sure that the effort delivered will be optimal ($e^*_{1,t-1} = \hat{e}^*$ such that $(1+\lambda)\Pi'_{e_i}(\hat{e}^*) = 1$) and that the participation constraint will be binding. School 2's optimal reply is exactly symmetric. Hence, we can say that a yardstick competition mechanism generates the first best outcome at equilibrium.

Note that the value of k determines the propensity of schools to retain a low per-pupil expenditure. We have seen that the sufficient condition to get that result is to fix k superior to 2. Strictly speaking, v must be proportionately adapted to the value of k (expression 8.13). In non-technical terms, this means that

11 Remember again that we assume that the participation constraint cannot be satisfied if the per-pupil endowment E_i is nil.

schools must not be incited to reduce their effort in order to relax their participation constraint and to be able to reduce their cost further; cost reduction must not come at the expense of effort incentive.

CHAPTER 9. BYPASS AND DECENTRALISATION THREAT

So far, we have considered that the only source of regulatory difficulty was the school. In chapter 8 we have identified the kind of regulatory strategy that is likely to tackle this problem. Nonetheless, one could reasonably argue that the regulator's problem is a bit more complex than simply imposing his social priorities on schools and teachers: he probably has also to impose them on (strategic) parents[12]. A 'public choice' perspective would indeed indicate that parents are political clients, that they can dismiss politicians (regulators) or boycott their fiscal duties when displeased with an educational policy. By imposing financial sanctions, the regulator can persuade teachers and heads of schools to renounce 'cream-skimming' privileges. But how would parents — especially those with high human capital endowment — react to this sort of desegregation policy? Note that even if the cost of attending a desegregated school is extremely limited, bypass — if feasible — is likely to occur. Private parties are sensitive to peer effects when these are beneficial to their children. Yet, they most likely ignore the social benefits or costs of their individual decision: they ignore the effect of their school choice on the quality of peer effects in the rest of the educational system. What comes next is organised in two sections. The first one is introductory. It aims at examining the problem of educational desegregation in the US. Sections 2, 3 and 4 are more analytical. Using our quasi-market model we study both feasibility and social desirability of a policy that ensures 'voluntary' desegregation.

1. SCHOOL DESEGREGATION AND BYPASS THREAT IN THE US

The United States more than any other country in the world, have tried (and are still trying) to control the spontaneous allocation of pupils among public schools. Some institutional initiatives date back to the late 50's and are aimed at desegregating elementary (primary), middle and high (secondary) schools. It is clear that these policies are not primarily aimed at socio-economic desegregation. Their first target is the dramatic black vs. white segregation. But the two are obviously related. They are of great interest to us because they tend to illus-

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12 Note that in Belgium the constitution imposes to the State to finance private educational initiatives. This means that parents can collude, establish a new school and get public money, provided they respect some basic conditions : enrolment size must be significant, teachers hired must have the appropriate diplomas, and the school must accept the annual visit of a government officer.

trate the kind of difficulty a regulator must cope with when confronted with parental resistance.

1.1. Institutional strategies to achieve desegregation of elementary and secondary schools

During the 50's courts passed the first judgements obliging local authorities to abolish racial discrimination within the educational system[13]. Afterwards 'white-only' schools were officially open to black pupils. In practice this decision turned out to be inefficient. The courts went then a step further by imposing a more 'dirigiste' policy. Previously simply aiming at no-discrimination, the policy became more 'affirmative'. To achieve racial balance at district level, local authorities had to bus children from one place to another.

It turns out now that this extremely ambitious policy was also a semi-failure. White middle-class families were strongly opposed to racial mixing. They circumvented it simply by moving from racially mixed districts to more homogeneous and generally more expensive ones. This phenomenon, called 'white flight' is now extremely well documented (Farley, Richard & Wurdock, 1980 ; Rivkin, 1994; Taeuber, 1990 ; Five, 1994).

Quite interestingly, since the early 70's, US courts have began to allow educational authorities to modify their desegregation strategy. Busing progressively gave place to a new institutional arrangement: 'magnet' schools. The idea of magnet schools is to achieve desegregation[14] on a **voluntary** basis by offering outstanding and unique curricula to gifted students. By attracting students with common educational interests, and diverse abilities and socio-economic backgrounds, a magnet school would enrol a racially heterogeneous student body and offer a unique educational experience.

Instead of busing black children to predominantly white schools, the 'magnet' school philosophy is to incite 'bright' (mostly white or Asian) children to attend urban schools where black pupils were over-represented. The incentive, in this case, takes the form of unique programs benefiting from a higher per-pupil funding level[15]; by attending those schools, pupils benefit from programmes and teacher-pupil ratios that are unavailable in the rest of the public school system.

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13 The most famous law case is the 1954 'Brown versus Board of Education' decision.

14 The initial regulations required a magnet school plan to reduce district racial isolation by at least five per cent.

15 See Chaborar (1989) for a discussion of «magnet» schools' extra cost.

Busing and magnet schools coexisted during the 80's although the magnet school idea progressively gained the favour of both local authorities and voters who now recognise that the concept presents a combination of attributes that have the potential for addressing the issues of desegregation, choice and education quality (Rossell, 1990). Attainment comparisons suggest that magnet schools lead to a lower interracial exposure than busing. However, the former is longer-lasting than the latter. Some observers are doubtful however about the comparative advantage of magnet schools in the long-run (Five, 1994 ; West, 1994). They convincingly argue that some magnet schools work like real enclaves inside large urban schools with little or no contacts between pupils attending magnet and non magnet programs. The debate has also a methodological component: the appropriate measurement of interracial exposure is quite difficult to determine (Farley, Richard & Wurdock, 1980).

More fundamentally, Rivkin (1994) notices that desegregation strategies — even magnet schools — are generally implemented at district level. Even when successful at that level, these policies maintain a certain segregation level between districts simply because of the great inter-district residential segregation. The phenomenon is quite clear in the great metropolitan areas where green suburbs are organised in districts separated from those corresponding to the urban centres. Several analysts plead in favour of large-scale (i.e. metropolitan area-wide) desegregation policies (Taeuber, 1990). Simultaneously, other observers try to promote this shift in order to reduce the inter-district per-pupil expenditure differentials. Yet, this approach has strong opponents among those who want as many policies as possible to remain local and decentralised. Accordingly, most government functions must be left to localities to prevent bureaucracy, monopoly and inefficiency or equivalently to keep government accessible to citizens or social services on a human scale.

1.2. 'Merit' grants inside the higher education system in the US

While magnet schools implicitly offer 'bribes' to middle class and upper class families, higher education suppliers (colleges) do the same much more explicitly. The practice of awarding college scholarships — 'merit' grants to be distinguished from more classical 'social' grants — to high-ability students is indeed relatively frequent in the US.

Higher education institutions in the US operate essentially on the free choice model. If some of them receive substantial public support, particularly from the States, the point is that most of them have a discretionary power in terms of registration fees. The same institutions can decide on how to spend their financial resources. It particularly means that they can devote a substantial part of their budget to financing 'merit' grants.

Cook & Franck (1993) stress the striking hierarchy among US higher education institutions. Compared to 30 years ago, the concentration of elite students in a limited number of universities (Ivy League) has risen. Simultaneously the amount of resources devoted to 'merit' grants in less reputed colleges has increased considerably. McPherson & Schapiro (1994) observe a (significant) positive correlation between an institution's bad reputation (i.e. its propensity to concentrate low-ability students) and its 'merit' grants budget. They verify econometrically that those 'merit' stipends are granted to students with a substantially higher ability than their average intake. Finally, they notice that the 'merit' grant system does not introduce a big bias in favour of high income students. This result suggests that academic ability and parental income are not completely correlated, and that autonomous institutions situated at the bottom-end of the higher education spectrum attempt to entice 'bright' students to accept a suboptimal level of educational inputs.

The expansion of those merit grants seems thus to illustrate the idea of 'bribery' deliberately and spontaneously adopted by autonomous decision-makers. It can be supposed that those real world evidences obey a certain rationality and that they have a positive influence on those higher education institutions' teaching and research activities.

2. QUASI-MARKETS AND BRIBERY

2.1. Alternatives to public schools: private or decentralised financing of schools

We will deliberately adopt the extreme standpoint traditionally developed by the local public good theory (Tiebout, 1956). We will assume indeed that high-ability clients (type β^h) always have access to educational alternatives at no cost: they can bypass or circumvent the inclusive public system, boycott educational tax, and develop their own educational community. If there is residential segregation (all type β^h parents live in the same district, town, area...) one can expect the system to be financed through a uniform local tax and segregation ensured by a zoning regulation (access to the local school is conditional to residence and local contribution). If there is no residential segregation, the system could be financed through direct (uniform) contribution (fees...) and segregation ensured by 'high' admission standards.

The sufficient condition for secession and segregation is the existence of some 'private' benefit when concentrating pupils with higher human capital endowment ($L'_{R_i} > 0$). Individuals are most likely sensitive to higher peer effect, but they ignore the effect of their decision on the quality of peer effects in the other community and do not incorporate social benefits or costs ($L''_{R_iR_i} < 0$).

We will assume that the educational cost function is universal i.e. teacher participation constraint is universal ($V > \overline{V}$). We examine here at which level educational expenditure will be fixed in such a financially decentralised system. We still suppose private schools are non-profit organisations: we assume that the (private) school board maximises the school community surplus (W_i).

(9.1) $\text{Max}_{e_i, E_i} \; W_i = F(\beta^j, R_i) + e_i - (1+\lambda).E_i$

such that

- $j = h,l$
- $R_1 = 2\Omega$; $R_2 = 1-2\Omega$; the proportion of type β^h pupils in community 1 and community 2;
- $E_i \geq \overline{V} + L(R_i) - \Pi(e_i)$ the participation constraint;
- $i = 1,2; j = h,l;$

Using the strategy we have already used in part 1, we rapidly come to the conclusion that effort chosen by community will be such that:

(9.2) $(1+\lambda)\,\Pi'_{e_i}(e_i) = 1$

Effort will be chosen so that its (actualised) marginal disutility is equal to its marginal return in terms of human capital. As expression (9.2) does not incorporate the peer effect endowment or any other variable that would be specific to the community, both educational communities choose the same level of effort.

(9.3) $e_1^* = e_2^* = \hat{e}^*$

Because of segregation, educational communities face different teacher participation constraints (expression 9.4). As a result, the community with more type β^h pupils is likely to adopt a lower per-pupil expenditure than its counterpart ($E_1^* < E_2^*$).

(9.4) $E_1^* = \overline{V} + \Pi(\hat{e}^*) - L(2\Omega)$
$E_2^* = \overline{V} + \Pi(\hat{e}^*) - L(0)$
as
$L(2\Omega) > L(0)$
hence
$E_1^* < E_2^*$

As we have seen in part 1, chapter 6, a social planner would have imposed desegregation ($R_i = \Omega$) and identical per-pupil expenditure among schools: $E_1^* = E_2^* = \hat{E}^* = \overline{V} + \Pi(\hat{e}^*) - L(\Omega)$.

2.2. High-ability families' bribery condition

The decentralised outcome can be used to define a participation constraint (equivalent to a bypass threat) specific to type β^h families. In order to stay in (or re-integrate) the public system, a type β^h family must get a utility level higher or equal to U_b defined by the right-hand side term of expression (9.5).

(9.5) $U(\beta^h, T(\beta^h), L(\Omega)) \geq U^b(\beta^h, E_1^*, L(2\Omega)) \equiv w(\beta^h) - E_1^* + F^h(2\Omega) + \hat{e}^*$
with
- $w(\beta^h)$; a representative type β^h family's (actualised) gross income
- $E_1^* = \overline{V} + \Pi(\hat{e}^*) - L(2\Omega)$: the per-pupil expenditure (local tax or fee) in the decentralised system:

Constraint (9.5) shows that a regulatory policy aimed at desegregation must provide incentives directly to clients, particularly type β^h ones. The (actualised) tax they actually pay ($T(\beta^h)$) when attending the public (desegregated) education system must be such that they get the same utility (U^b) as in a private or decentralised and segregated system.

The regulator wants to ensure voluntary participation of a type β^h family in a desegregated school ($R_i = \Omega$) where per-pupil expenditure is imposed by the regulator and is higher than the expenditure they would have chosen for themselves in their community ($\hat{E}^* > E_1^*$). By assumption, such a family has access to private, socially segregated schools where peer effects are maximum ($L(2\Omega)$). To ensure participation in a school with a (lower) proportion of type β^h pupils

($\Omega < 2\Omega$), the level of the bribe ($B^{IR}(\Omega)$) — taking the form of a credit tax for example[16] — must be such that:

$$(9.6) \quad w(ß^h) - T(ß^h) + F^h(\Omega) + \hat{e}^* \geq w(ß^h) - E_1^* + F^h(2\Omega) + \hat{e}^*$$
with
$$T(ß^h) = \hat{E}^* - B^{IR}(\Omega)$$

Hence by substitution, expression (9.6) becomes :

$$(9.7) \quad B^{IR}(\Omega) \geq (\hat{E}^* - E_1^*) + F^h(2\Omega) - F^h(\Omega)$$
with
- $\hat{E}^* = \overline{V} + \Pi(\hat{e}^*) - L(\Omega)$
- $E_1^* = \overline{V} + \Pi(\hat{e}^*) - L(2\Omega)$ and thus
- $\hat{E}^* - E_1^* = L(2\Omega) - L(\Omega)$

The bribe $B^{IR}(\Omega)$ must be superior or equal to the sum of the per-pupil expenditure differential and the value of the difference in peer effects.

2.3. Low-ability families' willingness to pay for the presence of high-ability pupils

We take for granted that the loss of utility supported by type $ß^h$ families when attending inclusive schools must be compensated financially. The issue at stake is to determine whether this policy still increases efficiency (i.e. is socially desirable). In other words, is there an alternative allocation of resources (money and peer effects) improving the utility of type $ß^l$ families and simultaneously preserving the utility of type $ß^h$ families: a Pareto improving policy? Financial compensation for type $ß^h$ families — i.e. parents forming educational community 1 — necessarily means increased fiscal contribution by type $ß^l$ individuals. And this raises an immediate question: do type $ß^l$ families — i.e. parents forming the other educational community — have any good reason to pay that additional tax?

The condition ensuring voluntary fiscal contribution from a type $ß^l$ family is defined by equation (9.8). Note the apparition of the bribe $B^{IR}(\Omega)$ in addition to the 'normal' tax burden ($\hat{E}^*$). The bribe is indeed financed by type $ß^l$ families.

16 Subscript IR simply refers to the idea of Incentive Rational in regulation theory (Baron, 1989).

(9.8) $w(ß^l) - T(ß^l) + F^l(\Omega) + \hat{e}^* \geq w(ß^l) - E_2^* + F^l(0) + \hat{e}^*$

with
$T(ß^l) = \hat{E}^* + (\Omega/1-\Omega).B^{IR}(\Omega)$

Using the definition of $B^{IR}(\Omega)$ — equality case of expression 9.7 — and the definition of $\hat{E}^*$ and E_2^* we rewrite (9.8) and get:

$$(9.9) \quad \frac{L(\Omega) - L(0) + F^l(\Omega) - F^l(0)}{L(2\Omega) - L(\Omega) + F^h(2\Omega) - F^h(\Omega)} \geq \Omega/1-\Omega$$

Equation (9.9) simply restates the concavity condition for L and $F^j(R_i)$ (see Part 2, chapter 6). Hence, the answer to our question is simple: if L is concave ($L''_{R_iR_i} < 0$), if $F''_{ßL} < 0$ (i.e. peer effects are more profitable to type $ß^l$ pupils) and if $F''_{LL} < 0$ (i.e. marginal productivity of peer effects is decreasing), the benefit derived from desegregation by a type $ß^l$ family is higher than the loss suffered by a type $ß^h$ family. By definition, the tax supplement supported by the type $ß^l$ family is equal to the monetary value of that loss. We thus expect a type $ß^l$ family to retain some 'net' benefit. The bribery approach to desegregation is thus Pareto improving.

Given the objective function of our social planner (W) 'bribery' is neutral in the sense that it does not affect his optimum (expression 9.10). We have supposed indeed that the regulator simply cares about the monetary value of the stock of human capital coming out of schools (communities) 1 and 2 ($K_1 + K_2$)[17] for an aggregate investment (T). The distribution of the corresponding fiscal burden among type $ß^l$ families $T(ß^l)$ and type $ß^h$ families $T(ß^h)$ does not influence W.

(9.10) $W = (K_1 + K_2) - (1+\lambda).T$
with
- $T = 2.\hat{E}^* = \Omega.T(ß^h) + (1-\Omega)T(ß^l)$
- $T(ß^h) = \hat{E}^* - B^{IR}(\Omega)$.
- $T(ß^l) = \hat{E}^* + (\Omega/1-\Omega).B^{IR}(\Omega)$

If feasible, bribery is thus socially optimal. In a system of explicit vouchers, it could mean that type $ß^h$ families receive larger vouchers conditional to their participation in a desegregated public school. In a Tiebaut local public good

17 $K_1 = R_1.[F^h(R_1) + e_1] + (1-R_1).[F^l(R_1) + e_1]$; the actualised monetary value of human capital produced in community 1; $K_2 = R_2.[F^h(R_2) + e_2] + (1-R_2).[F^l(R_2) + e_2]$; the actualised monetary value of human capital produced in community 2.

scheme, it means that type $ß^l$ families pay higher local tax. This result echoes some recent developments of Local Public Good literature (Brueckner & Lee, 1989 ; Schwab & Oates, 1991) as well as Rothschild & White's recent paper (1995) concerning optimal pricing of higher education. Under some conditions, these authors conclude that social optimality requires that each participant pays a fee or a tax inversely proportional to his human capital endowment. In the context of higher education this means that students should be charged for what they get as net profit (output minus input). This pricing rule internalises the mutual effect of students with different human capital endowment. Schwab & Oates (1991) indicate that optimality in the Tiebout model with local social spillover depends heavily on the possibility (or political feasibility) of intra-club transfers. Brueckner & Lee (1989) for example assume that local regulators can charge different prices to individuals, depending on the influence they exert on the production process, and conclude that the local public model is socially optimal. This idea is also developed by Epple & Romano (1993). In contrast, de Bartolome (1990) supposes that local regulators (must) treat all their clients equally and consequently concludes that the existence of local social spillover leads to inefficient outcomes.

2.4. Bribery and wealth effects

The 'bribery' strategy's feasibility is conditional to the **no-wealth effect** assumption (Milgrom & Roberts, 1992). It turns out that our version of the parents' utility function (expression 9.5) implicitly incorporates this strong assumption .

We suppose indeed that human capital is commensurable with money as both expressions enter the parental utility function. We assume that there is a finite amount of money that is likely to persuade type $ß^h$ parents to accept type $ß^l$ pupils' presence. This is precisely the first of the three conditions defining the no-wealth effect condition.

The second condition simply states that the financial compensation ensuring desegregation is independent of the parental income's level. Our additive specification of utility is a perfect illustration of this assumption.

The third condition defining the absence of wealth effect is that those who support a policy's financial burden must be able to afford it. In other words, type $ß^l$ families must have enough money to finance the 'bribery' policy the regulator wants to implement. If parental income and human capital endowment are systematically correlated, this can be a problem.

2.4. Commensurability

But amid those three assumptions, the *first one* — *commensurability* — is probably the most crucial. Can money 'buy' disutility attached to the presence of 'different' pupils ? So far we have assumed that the 'difference' among pupils was synonymous with ability differentials generating higher or lower peer effects which in turn could improve or decrease human capital achievement. In that particular case, the assumption seems plausible.

Yet, people do not only differ in terms of ability but also in their beliefs, cultural sensitivity, ethnicity or political convictions...People can indeed be of equal 'intelligence' but dramatically diverge when it comes to moral and religious values. Difference is indeed a multidimensional variable. This simple observation raises several questions that are all particularly puzzling. First, do some children (or their parents) particularly suffer (i.e. endure some disutility) when confronted with some of those 'differences'? Secondly, what is the origin of this disutility? Is there an ineluctable deterioration of the human capital production process when 'different' people have to share the same school? Is this simply the consequence of a xenophobic feeling? Thirdly, can money buy this sort of disutility?

CHAPTER 10. QUASI-MARKET REGULATION WITH SELF-SELECTION, GRADE REPETITION AND SIGNALLING

In this chapter, our intention is to enrich the analysis of quasi-market functioning and regulation by the discussion of important empirical phenomena. We deliberately move away from the model in its formal version as used so far. The first phenomenon we attempt to evaluate is the self-selection propensity among low-ability children and families. More than others, those pupils apparently avoid the most selective schools (Willis & Rosen, 1979). This suggests that our 'cream-skimming' assumption could be irrelevant and consequently that the regulatory problem could be more to incite those individuals to apply for 'selective' schools than to persuade the latter to modify their recruitment policy or their clients to accept the company of low-ability pupils. The second phenomenon we would like to treat is the importance of people's sensitivity to signalling difficulties. We will explore their consequences in terms of desegregation policy (Spence, 1974).

1. SELF-SELECTION AND REPEATERS

When confronted with data suggesting the existence of segregation in an educational system characterised by some level of choice, several observers argue that it essentially illustrates the 'non-take-up' problem. Along this line of reasoning, the major problem in a quasi-market is that some individuals do not exert the choice possibilities they have (Clune & Witte, 1990). Willms & Echols (1992) make a sharp distinction between 'alert' and 'inert' clients. When confronted with school choice, the latter apparently stay in their district or designated 'catchment' area while the former move away. So far, our theoretical analysis has focused on supply-side-driven selection: low-ability type pupils, like their more able peers, want to attend the 'best' schools but are not accepted by reputed schools. Which of those two approaches is most relevant? The following discussion aims at disentangling and re-articulating demand and supply-driven explanations of segregation and stratification.

1.1. *Ex ante* self-selection or selection.

Imagine that parents have the choice between a 'reputed' school (school 1) whose graduates reach the human capital threshold ($\overline{K}$) for example, and another school (school 2) where this threshold is not attained[18]. Suppose now they develop some subjective probability of success in school 1 relative to school 2. So far we have supposed that this probability was equal to 1 i.e. all parents and children consider their chance to reach that threshold as maximal. This can mean that parents do not anticipate the supply-side logic and have very little knowledge of their relative position on the human capital endowment scale. In this context, there is no room for self-selection. All parents opt for school 1.

Suppose now some evaluation has occurred at a previous stage of the educational process: at the end of elementary education for example. The point here is to assume that the result of this evaluation — the marks and appreciation children were given — can reduce their subjective probability of success (or that of their parents).

Marks depend on the sort of evaluation teachers use. Pedagogues explain that evaluation practices can be either 'formative' or 'normative' (Crahay, 1992). In the first case, marks correspond to each child's progress during the school year. The evaluation reflects the 'value added' to each child. In our model, this kind of evaluation leads to perfect equality among children attending the same class: each child acquires the same amount of human capital corresponding to a certain peer effect level and a certain effort produced by teachers.

But this kind of evaluation is extremely infrequent. Very few teachers want their evaluation to reflect each child's real progress. In most cases, marks simply indicate either the relative position of a child compared to his classmates or his/her position compared to a threshold defined externally. In both cases, low-ability children are bound to get inferior marks than their more able classmates. In our model if the teacher uses the average human capital of his class to define the success threshold, a child with low-ability endowment (type $ß^l$ pupils) is bound to fail.

The type of evaluation is crucial when combined with the idea of subjective probability of success in reputed schools. Suppose this probability is maximal when entering elementary education. If elementary education uses 'normative' evaluation, type $ß^h$ and type $ß^l$ parents' perception of secondary school choice parameters will vary.

18 Think of a secondary school of which graduates pass the higher education entrance examination vs. another secondary school of which graduates have no academic future. For more details about this idea see also chapter 7, section 4.

Low-ability families ($ß^1$) will opt for school 1 (reputed school) as long as their subjective cost-benefit analysis indicates that school 1 offers greater prospects of achievement than school 2. If the subjective probability of success in school 1 is very low, some self-selection is possible. Low-ability families then spontaneously avoid those schools. Quite interestingly however, this self-selection phenomenon is strongly correlated with supply-driven practices. It turns out that self-selection is simply the consequence of a certain type of evaluation. If, for any particular reason, teachers adopt a 'value added' approach to evaluation, the subjective probability of success in reputed schools remains unaltered and the only way segregation can occur is through selection or cream-skimming[19].

1.2. Selection and self-selection *ex post*

So far we have supposed that a school could easily refuse or reject an applicant when observing his low human capital endowment. In reality this might be impossible for at least two reasons. The first one is simply the lack of information concerning an applicant's endowment, especially when he comes out of elementary education where evaluation is not standardised or systematic. The second one — probably the most significant — is that a net refusal of admission might be perceived as totally illegitimate by parents and applicants. For those two reasons, we think it is more relevant to assume that most applicants are enrolled in the school they have initially chosen, despite their low human capital endowment. This does not mean that there is no selection. It simply suggests that it does not happen at admission stage, but later, at the end of the first or second year for example, when examination occurs. The more normative this evaluation, the more likely low-ability pupils' failure. Consequently, those pupils revise downwards their subjective probability of success which in some cases — already discussed — leads to a voluntary change of school. This form of self-selection occurs *ex post* instead of *ex ante*. Yet, the mechanism at stake is the same. Subjective probability of success is determined by the type of evaluation — a supply-side instrument. Once again, the distinction between selection and self-selection is puzzling and ambiguous.

1.3. Self-selection and grade repetition

Nevertheless, failure does not necessarily lead to immediate exit. Parents of unsuccessful pupils may want them to stay in the school, despite the fact they

19 For an illustration of this self-selection vs. selection logical and conceptual closeness in the residential context, see Galster (1989).

must then repeat the grade[20]. Grade repetition could be interpreted as the result of a trade-off integrating costs and benefits. Without loss of generality, we could say that education entails some 'normal' private cost. To repeat a year is synonymous with extra private costs. But parents might simultaneously think their child keeps some chance of acquiring extra human capital provided by the type 1 school. If failure is of limited amplitude, subjective probability of success in school 1 might still be very high. Repeating entails some extra cost, but, by and large, this option looks still preferable to the other[21]. Briefly said, a pupil and his parents decide to repeat a grade as long as the cost of repeating the year is inferior to the expected net human capital gain attached to the possibility of staying in the initial school.

1.4. How to regulate a quasi-market with (self)selection and grade repetition

From a social point of view, grade repetition tends to inflate the population registered in the different schools of the educational system. As schools are financed on a per-pupil basis in a quasi-market, grade repetition also increases the size of the educational budget[22]. To force a pupil to repeat his grade in order (for example) to get him out of the school is thus a source of inefficiency. That particular source of inefficiency can be eliminated very simply: the regulator just needs to announce that he will no longer finance grade-repeaters. Nevertheless, allocative inefficiency will persist if the actual purpose of grade-repetition is to enforce segregation along the ability line. In the long run, if grade-repetition is prohibited, reputed schools will become more stringent at admission stage and reject more systematically applicants thought to be low achievers. Several observers (Witte, 1992) have indeed noticed that schools can develop very efficient strategies to detect pupils with low human capital endowment and persuade them not to attend the school. The major problem is then similar to the one analysed so far. Once the extra cost entailed by grade-repetition has been eliminated, the regulator has still to cope with the segregation problem. His fundamental problem remains unchanged. He must still define strategies to achieve socio-economic desegregation and simultaneously maintain strong incentives to stimulate effort. Those problems have been studied formally in chapter 8 and chapter 9.

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20 Grade repetition is relatively frequent in some countries. Belgium is one of them. Some other countries systematically forbid it for both financial and pedagogical reasons.

21 See Vandenberghe (1993b) for a presentation of this phenomenon in the Belgian case. See Gomes-Neto & Hanushek (1994) for a discussion of the Brazilian situation.

22 Our own estimation (Delvaux & Vandenberghe, 1992 ; Vandenberghe, 1993b) for secondary education in the French-speaking Community of Belgium led to the conclusion that grade repetition inflated the size of school population by 9 percent.

2. HOW TO REGULATE A QUASI-MARKET WITH SIGNALLING

Theoretical literature analysing the hiring process at the entrance of the labour market tells us that one of the major problems employers have to deal with is asymmetry of information concerning an applicant's actual human capital (Spence, 1974). To establish wage scales they tend to use proxies. Education (highest grade completed for example) is one of those. In our model employers can use the type of school (1 or 2) as a good proxy of human capital attainment: they can offer higher wages to pupils coming out of reputed type 1 schools for example.

The crucial point here is that desegregation means more heterogeneous intake in both schools. Consequently, employers can no longer discriminate among applicants on the basis of educational history. They might then decide to offer a **uniform** wage reflecting the average human capital of applicants coming out of desegregated and undifferentiated schools.

Being aware of that 'peril' — anticipating the loss of the signalling value of their school — high-ability parents and students might then be very reluctant to accept desegregation, even with financial compensation for the resulting loss of human capital (see our discussion on bribery in chapter 9). As a matter of fact, the fear of desegregation can be solely driven by the fear of a signal-jam.

The point here is that the regulator who cares about allocative inefficiency, and consequently tries to prevent segregation, simultaneously needs to make sure his desegregation policy does not depreciate the signalling value of education. As suggested by Bowles & Gintis (1993), the best way to fulfil that condition might be to strengthen central certification or at least to make sure that certification correctly reflects the actual level of gross human capital attainment. The necessity for this accurate evaluation is particularly strong at higher education level: it is indeed the last stage before entrance on the job market.

From a positive standpoint, this result echoes existing institutional arrangements. As stated by James (1993), almost no educational system around the world can be termed totally decentralised or centralised. Several dimensions have to be taken into account simultaneously. Some countries allocate pupils on a decentralised basis — because they have adopted quasi-markets for example — but still organise evaluation or certification centrally. Along this line of reasoning, very selective higher education might operate as a guarantee for high-ability students and parents who otherwise might be frightened by total desegregation at elementary and secondary levels. Perfect desegregation at that early stage of the educational process does not indeed jeopardise their possibility to signal themselves as 'superior' or 'more able' when applying for their first job.

3. CONCLUSION

A social planner must incorporate in his analysis the strategic behaviour that schools and parents tend to adopt. Correspondence between social priorities and each school's interest cannot be taken for granted. Concerning schools, the strategy that is likely to remedy all potential inefficiencies of a quasi-market consists of simultaneously preventing segregation and providing effort incentives. Schools must be strongly dissuaded from concentrating high-ability pupils. Simultaneously, an output-based mechanism must be introduced to incite schools to deliver some effort. To obtain an effort equal to the social optimum, the regulator must simply equate the 'private' marginal return of effort with the 'social' marginal return of effort. However, social optimality requires more than this. If the regulator does not perfectly know the teacher's utility function and his/her reservation utility level, he cannot appropriately fix the level of total per-pupil expenditure (output-based component and fixed term component) that will exactly saturate the participation constraint. This difficulty can be circumvented by the introduction of some yardstick competition — also called peer comparison (Wunsch, 1996). *Ex Ante*, schools must choose their per-pupil expenditure. *Ex post* however, school i's revenue must be based on its relative performance in terms of output and per-pupil cost. The higher its effort, the higher its per-pupil income. The lower its cost, the higher its income. But simultaneously, the higher the other school's effort, the lower school i's per-pupil income and the lower the other school's cost, the lower school i's income. We have demonstrated that this mechanism can lead to a Nash equilibrium , and thereby to social optimality.

Chapter 9 has led to the conclusion that the exit threat from parents and pupils with higher human capital endowment requires an additional regulatory instrument: bribery. High-ability families should pay less tax than low-ability ones, in order to accept to attend totally desegregated schools. This solution is optimal from a social standpoint. If the human capital production function is concave, the benefit derived from desegregation by a low-ability family is higher than the loss suffered by a high-ability family. By definition, the tax supplement supported by the low-ability family is equal to the monetary value of that loss. We thus expect a low-ability family to retain some 'net' benefit.

Our discussion in chapter 10 indicates that self-selection and selection mechanisms are probably interrelated. *Ex ante* self-selection can be interpreted as the result of a cost-benefit calculus based on a subjective probability of success. We have explained that the latter could be determined by the type of evaluation — a supply-side instrument. If marks reflect gross human capital achievement instead of value added to the child, low-ability children mechanically get lower marks than their more able peers and thus reduce their expectations. Accordingly, the distinction between selection and self-selection is puzzling and ambiguous.

We have also developed the idea that a regulator who cares about allocative inefficiency, and consequently tries to prevent segregation, simultaneously needs to make sure his desegregation policy does not depreciate education's signalling value. Desegregation means more heterogeneous intake in both schools. Consequently, employers can no longer discriminate among applicants on the basis of educational history. They might then decide to offer a uniform wage reflecting the average human capital of applicants coming out of desegregated and undifferentiated schools.

The best way to prevent negative reactions from high-ability families fearing signal jam caused by desegregation policies might be to strengthen central certification or at least to make sure that certification correctly reflects the actual level of gross human capital attainment. The necessity for this accurate evaluation is particularly strong at higher education level: it is indeed the last stage before entrance on the job market.

Part 4

Belgian quasi-markets' efficiency: empirical evaluation

The theoretical part of our work dealt with the positive and normative analysis of quasi-markets of educational services. It has shown that quasi-markets potentially provide sub-optimal outcomes when there is segregation. This is due to the fact that peer effects are important in the educational process. The empirical work presented in this part of our thesis aims at examining the quasi-market's propensity to generate segregation among schools along the ability line in the French-Speaking Community of Belgium.

Remember that Belgian schools operate on a quasi-market principle in the sense that the system is competitive and publicly funded on a per-pupil basis. Since 1959, an article of the Constitution emphasises that parents be allowed to choose the school their children attend. All public schools — central, provincial and municipal government schools — and 'approved' private schools receive full public funding for their operating costs. Since 1959, government funds have been allocated to schools on a per-pupil basis, and all schools, public or 'private' receiving public money, are prohibited from charging tuition.

Requirements are that schools conform to program requirements. Regulation, however is confined to the list of subjects taught and language used. Except in schools under government control (at most 25% of the total) regulatory requirements concerning curricula, teaching methods evaluation and admission standards are very limited. Schools are relatively free to define the contents of their programs. Most importantly given what follows, evaluation — including the possibility to impose grade repetition — as well as certification are totally in their hands. By contrast, in the Netherlands, the UK or New-Zealand, evaluation criteria are partly or totally fixed by central commissions. Finally it is worth stressing that no procedure or incentive exists to ensure that admissions are non-selective and non-discriminatory.

Segregation is central to our analysis. It should be clear that the word segregation hereafter simply refers to the idea that a low status group is over-represented in some geographical areas or institutions, and under-represented in others. We will refer here to pupils with a low ability or a low human capital endowment as the 'low status group'. We will also focus on segregation between schools. The average situation of a district will be used as a benchmark to determine the degree of segregation among schools. Strictly speaking, what follows is an attempt to determine whether quasi-markets as they exist in the

French-Speaking Community of Belgium **are associated with** segregation along the 'ability' line.

It should be clear that this exercise is not an attempt to directly estimate the impact of quasi-markets (school choice more generally) on educational achievement. What follows does not attempt to measure peer effects, to test their existence or estimate their concavity either.

The main reason for this is that data that would entitle us to examine these questions are not available. First, the educational quasi-market is quite old in Belgium. It was introduced in the late 50's. It is thus hard to evaluate its relative performance: the extent to which it has improved educational outcome compared to the older and more classical institutional setting wherein choice and competition were much less central. A typical before/after comparison is impossible because data describing the educational situation in the 50's are simply not available. In addition, even if those data were available it would be extremely hard to disentangle socio-cultural (exogenous) factors from institutional-driven ones. Second, the Ministry of Education has never developed cohort analysis that would entitle us to develop a Hoxby-like evaluation (Hoxby 1994a, 1994b, 1995a). If those data were available, we could for example examine the relation between school competition in a certain geographical area (measured by a Herfindahl index on enrolment shares for example) and educational achievement (test scores, highest grade completed or wage levels when entering the labour market) of pupils who come from this area.

For all these reasons, we will focus hereafter on 'ability' segregation between schools (inter-school segregation hereafter). The exercise is rather limited in scope. Yet, we invite the reader to keep in mind that segregation can be synonymous with suboptimality for the different reasons that we have identified in our theoretical analysis.

If peer effects exist, optimality — be it defined by reference to a social objective in terms of maximal surplus or equal achievement for all at minimal cost — seem to require maximal desegregation. We also invite the reader to bear in mind that what follows indirectly echoes the problem of the level of effort that will be chosen by the teachers and thus the production of human capital produced. If there is no effort incentive problem — in the sense that we have reasons to believe that teachers automatically produce the maximal effort compatible with their participation constraint — chapter 6 has demonstrated that segregation can be synonymous with inefficiency. Peer effect is an input in its own right. An egalitarian distribution of this input can induce a **higher** average level of effort than a less egalitarian one.

If there is *a priori* an accountability problem (i.e. an effort incentive problem), the allocation of peer effect probably determines its seriousness. We have seen in chapter 7 that a highly segregated quasi-market could be synonymous with 'poor' accountability (effort) incentives, especially in schools with a 'bad' reputation. Evidence of strong segregation hereafter should be interpreted as potential evidence — but not empirically proven evidence — of poor accountability (effort) incentive on a quasi-market.

Geographically speaking, inter-school segregation will be explored at district level. The average size of a district ranges from 20 to 40 square kilometres. The data we look at exclusively refer to secondary education in the French-Speaking Community of Belgium. In 1991-92, a total of 334.509 pupils were enrolled in one of the 650 schools scattered throughout the territory of the French-Speaking Community of Belgium. Both elementary and higher education are excluded from this analysis.

The data used in this study — which are roughly centred on the year 1991 — come from several sources. The first one is the Ministry of Education (Services des Statistiques, 1993). The data this Ministry releases consist of a distribution of pupils by year of birth and by district, by school inside the district, and by grade and academic track inside the school. It allows us to compute grade-repetition indexes showing the extent to which pupils registered in a particular school, at a certain grade, in a certain academic track, have been forced to repeat some of their (previous) grades because of unsatisfactory results.

The second set of data we use here comes from a survey — the 'Radioscopy' — carried out in 1991-92 (Communauté française de Belgique, 1992). Some of the questions are very informative with regard to the issue of quasi-market functioning. Hereafter, we principally use the information concerning end-of-term evaluation (success, failure) and the socio-economic profile of pupils attending the school. Unfortunately some schools (about 15 percent) didn't return their questionnaire. In addition, the information provided by some schools is of limited reliability.

Our third source of information is the 1991 census, recently published by the National Bureau of Statistics (INS, 1995). These data are ventilated by district. They give the employment/unemployment rate in each district, as well as the education level of the active population. Finally, in order to complete our description of the general socio-economic environment of each district, we have collected fiscal information (INS, 1992). The best data set we have been able to gather relates to the distribution of taxable income. This information is collected for each active person throughout Belgium. It is also ventilated per district.

Finally, it should be clear that the 'Radioscopy' database — contrary to the three other databases — contains no geographical reference. Hence, the reader should not be surprised hereafter that some cross-database treatments have not been performed. The reason for this is simply that the structure of the information doe not allow us to compute the appropriate variables or create the relevant subsets. To avoid confusion, we will use particular notations when manipulating variables extracted from the Radioscopy database.

Heteroscedasticity arises frequently in the analysis of cross-section data and has some potentially serious implications for inference based on the results of least squares (Greene, 1993). Hence all econometric results hereafter[1] incorporate a correction ensuring that the estimates of variance of the residuals are unbiased[2]. We have also controlled for the presence of strong multicollinearity i.e. highly interrelated explanatory variables that compromise the identification of individual effects. For each regression presented hereafter, we have followed the thumb rule proposed by Greene (1993): we have considered that we should not be concerned by multicollinearity if the overall determination coefficient (R-square) is superior to each explanatory variable's individual determination coefficient. This condition has been verified in all regressions presented hereafter.

Chapter 11 will explore the inter-school segregation phenomenon at district level. We will try to estimate the latter's importance. Chapter 12 will take a more analytical look at this phenomenon. We will indeed try to determine the origin(s) of inter-school segregation. Can 'ability' segregation be attributed to the quasi-market? If so, to which extent is it a supply-side driven phenomenon? Some observers (Levin, 1991; Willms & Echols, 1992) argue indeed that segregation occurs simply because less educated parents do not exert their school choice option and send their child to the neighbourhood school[3].

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1 Software programs used to compute results presented hereafter are TSP (1995) and Systat (Wilkinson , Hill & Vang, 1992)

2 We use the TSP 4.3 OLSQ (ROBUST) instruction to carry out our regressions (see TSP (1995) for further details).

3 See chapter 10, section 1, for a first discussion of this argument.

CHAPTER 11. IS THERE SEGREGATION IN THE BELGIAN EDUCATIONAL QUASI-MARKET?

We have briefly mentioned above that the statistical apparatus in the French-Speaking Community of Belgium is underdeveloped in some aspects. This is especially true with standardised test scores which are the usual way proxies for 'ability' (human capital endowment) are computed. To circumvent this limitation we have been forced to use the grade-repetition record variable. Pupils hereafter are almost exclusively characterised by the number of grades they have repeated. Repeaters are by definition pupils who have failed at least one end-of-term examination.

1. ARE GRADE REPEATERS LOW-ABILITY PUPILS?

Evaluation is decentralised in the French-Speaking Community of Belgium. Each teacher defines his evaluation criteria and distributes marks by reference to his (subjective) idea of success or failure. In that context, can we reasonably use the grade-repetition variable as a proxy for ability? Can we claim that schools with an above-average proportion of repeaters are 'second best' schools in the sense that they concentrate low-ability children?

1.1. Decentralised evaluation: a poor proxy for ability?

Some Belgian pedagogues (Crahay, 1992) argue that a very decentralised evaluation is very subjective. Each teacher tends to adapt his demands to his classroom. In other words, two pupils with the same 'ability' could get quite different marks — with the consequence that the first one fails and is forced to repeat his grade while the other one succeeds — depending on the composition of their classroom. A pupil with an intermediate ability would fail in a classroom essentially composed of high-ability pupils. By contrast, the same pupil would be successful in a classroom where most of his classmates are of lower ability. Along this line of reasoning, grade-repetition sanctions must be considered as extremely subjective and as very poor proxies for academic ability when evaluation is decentralised.

Yet, this theory seems to be possibly contradicted by several empirical studies. Donny & Lejeune (1994) for example have analysed Belgian grade-repetition data. They estimate a probit model where the dependent variable is the probability of grade repetition. The independent variables come from a panel study of 4.500 Belgian households containing information about family composition, income, profession of parents...). The authors conclude that the grade-repetition variable is positively (and significantly) correlated with a low socio-economic profile: principally the highest grade completed by parents. More recent results released by Dal & Dupierreux (1996) indicate that 'older' candidates — those who have repeated at least one grade — systematically show lower success rates at the entrance of university than their 'younger' counterparts. If evaluation in each of the 650 secondary schools was totally subjective, large scale evaluation procedures in the large universities would partially invalidate its results: pupils with no grade repetition record would not systematically be more successful than their colleagues. Briefly said, the Dal & Dupierreux study corroborates the idea that pupils and students with a grade-repeating history have — on average — a lower human capital endowment, at least in terms of academic capabilities as currently valorised by the main universities of the French-Speaking Community of Belgium.

1.2. Further evidence

a) Grade repetition, foreigners, 'poor' socio-economic background and violence

We have also attempted to test the grade-repetition/human capital endowment relation with our own database. The school cross-section study we used (the Radioscopy) contains information about the proportion of pupils with a grade-repetition record in each of the 430 schools that answered the questionnaire. It also contains information about nationality, social origin of pupils, presence of a professional track inside the school, and propensity of children to commit crime. Ordinary Least Square (OLS) results are presented in Table 11.1. The dependent variable in those regressions is the proportion of pupils with a no-grade-repetition (NGR hereafter) history attending 3rd grade ($\overline{P}^{k}_{i,j} = \overline{P}^{0}_{3,j}$; k being the grade-repetition index, i the grade index and j the school index[4]).

Variables that have a negative and statistically significant impact on this proportion are essentially threefold. First, the proportion of foreigners who originate from a country which is not member-state of the European Union ($\overline{PNCE}$): typically immigrants from Morocco, Tunisia, Turkey or Africa. If we look at regression 4 in Table 11.1, increasing the proportion of foreigners for 50

4 The upper bar indicates that the variable is extracted from the Radioscopy database which contains no geographical identification of schools.

to 55 percents leads to a 1.76 points drop of the dependent variable. The second significant variable is the proportion of pupils with a 'poor' socio-economic background ($\overline{DEF}$) as reported by the school head[5]. A rise of this proportion from 50 to 55 percent results in a 1.47 point reduction of the dependent variable. Note that the proportion of pupils who originate from an 'upper-class' socio-economic background ($\overline{FAV}$) has apparently a positive, but statistically insignificant, influence on the proportion of pupils with a NGR record. Finally, a school's propensity to concentrate pupils with a NGR record is negatively correlated with the frequency of police interventions inside the school ($\overline{POL}$).

5 Thus partly subjective as these persons did not used standardised criteria to answer this question.

Table 11.1. — Proportion of pupils with a NGR record at grade 3 ($\overline{P}^{k=0}_{3,j}$) and socio-economic profile of the school's intake.
OLS regression coefficients (t-statistics) [p-values]

Dependent Variable $\overline{P}^{0}_{3,j}$ proportion of pupils with a NGR record at grade 3	Regression 1	Regresion 2	Regression 3	Regression 4
Constant	0.615** (15.315)	0.601** (12.836)	0.693** (16.568)	0.630** (18.034)
$\overline{PNCE}$: proportion of pupils who originate from a country outside the European Community	-0.244** (-2.818)	-0.274** (-3.075)	-0.376** (-5.222)	-0.352** (-5.212)
$\overline{NOFR}$: proportion of pupils who do not speak French at home	0.063 (0.999)	0.082 (1.298)		
$\overline{FAV}$: proportion of pupils with an 'upper-class' socio-economic background	0.138 (1.659)	0.095 (1.092)	0.087 (0.974)	0.106 (1.284)
$\overline{DEF}$: proportion of pupils with a 'poor' socio-economic background	-0.324** (-4.571)	-0.303** (-4.085)	-0.308** (-3.274)	-0.294** (-3.707)
$\overline{D2P}$: school organises professional track at grade 3 & 4	-0.058 (-1.002)	-0.040 (-0.6748)		
$\overline{D3P}$: school organises professional track at grade 5 & 6	-0.032 (-0.657)	-0.013 (-0.260)		
$\overline{PP}$: total proportion of pupils attending professional track			-0.094 (-1.229)	
$\overline{BI}$: school located in an industrial suburb		0.018 (0.460)	0.032 (0.670)	
$\overline{POL}$: number of police interventions on an annual basis		-0.019** (-3.794)	-0.016** (-3.624)	-0.018* (-3.949)
$\overline{EL}$: total enrolment size		0.000 (1.462)		
$\overline{ELDIM}$: enrolment size is declining			-0.009 (-0.286)	
N	244	230	207	232
F-Ratio [pvalue]	30.297** [0.000]	21.943** [0.000]	23.198** [0.000]	46.994** [0.000]
R^2adj	0.420	0.451	0.430	0.443
White Het. Test	39.965* [0,029]	71.943** [0,028]	35.447 [0.352]	13.480 [0.489]
Jarque-Bera normality test	6.436* [0.040]	2.644 [0.267]	4.492 [0.106]	2.679 [0.262]

** Denotes a significance at 5 percent
* Denotes a significance at 10 percent

b) Grade repetition and district socio-economic data

To explore the relation between grade repetition and 'ability' we also used the socio-economic information that was available in our census data base (INS, 1995). In Table 11.2 we simply regress the proportion of pupils with a k grade repetition at grade k ($P^{k}_{d,i}$) on several variables describing the socio-economic profile of the active population of the district. The first variable computed is the unemployment rate ($UNEMPL_d$). The second one is the relative average income level ($SREV_d$) in the district[6] The other variables describe the qualification of the workers in activity: those with no Belgian degree and no foreign degree either ($FORND_d$)[7], those whose highest degree corresponds to primary school ($PRIM_d$) and, finally, those who possess a university degree ($UNIV_d$).

Looking at regression 1 to 4 in Table 11.2. we observe that two variables are systematically negatively correlated with a high proportion of pupils with a NGR record. The higher the proportion of unemployed workers ($UNEMPL_d$), the lower the proportion of pupils with a NGR record. The higher the proportion of active workers with no degree ($FORND_d$) the lower the proportion of pupils with a NGR record. Other socio-economic variables, including the income variable ($SREV_d$), have coefficients that are statistically insignificant.

6 $SREV_d$ is actually a ratio. The latter's numerator is the average taxable income in district d while the denominator is the lowest average taxable income observed in 1990: 610.250 BEF in the district (arrondissement) of Bastogne.

7 Mostly immigrants of the first generation.

Table 11.2. — Proportion of pupils with a k grade repetition record at grade k ($P^k_{d,i}$) and socio-economic profile of the district.
OLS regression coefficients (t-statistics) [p-values]

Dependent Variable $P^k_{d,i}$ proportion of pupils with a k grade repetition record at grade i in district d	Regression 1 k=0 i=1	Regression 2 k=0 i=3	Regression 3 k≥2 i=5	Regression 4 k=0 i=5
C	0.894** (4.560)	0.838** (7.661)	-0.323 (-1.267)	0.931** (4.884)
$UNEMPL_d$	-0.893** (-3.356)	-1.018** (-6.001)	1.192** (3.450)	-1.237** (-4.798)
$SREV_d$	0,0031 (0.0184)	0.0556 (0.496)	0.282 (3.033)	1.752 (-0.899)
$FORND_d$	-1.008* (-2.253)	-1.298** (-8.081)	1.468** (3.033)	-1.752** (-4.129)
$PRIM_d$	0.497 (1.003)	0.165 (0.390)	-0.225 (-0.283)	0.429 (0.668)
$UNIV_d$	-0.773 (-1.166)	-1.083* -2.676	0.442 (0.567)	-0.306 (-0.381)
N	21	21	21	21
F-Ratio [pvalue]	6.195** [0.003]	15.281** [0.000]	23.198** [0.005]	7.385** [0.001]
R^2adj	0.565	0.781	0.514	0.614
White Het. Test (not computed by TSP if degrees of freedom are insufficient)				
Jarque-Bera normality test	0.916 [0.632]	0.142 [0.931]	1.171 [0.557]	1.486 [0.475]

** Denotes a significance at 5 percent
* Denotes a significance at 10 percent

1.3. Conclusion

Results exposed in the previous section are very partial, mainly because we have no individual data. Ideally, we should cross grade repetition variables with the profession of parents, their income, the highest grade completed... Nonetheless, results of Table 11.1 and Table 11.2 tend to reinforce the conclusion drawn by Donni & Lejeune (1994). From Table 11.1. we can reasonably conclude that the presence of a large proportion of pupils with a grade-repetition record in a school is correlated with variables suggesting that this school concentrates low-ability children or teenagers. Although teachers are not *a priori* very co-ordinated when evaluating pupils, they seem to be relatively 'coherent': they apparently impose grade-repetition sanctions to pupils with a low human capital endowment, pupils who are native of a non-European Community country and pupils who are apparently more violence-prone. Similarly, from Table 11.2. we are tempted to conclude that the grade repeating phenomenon is more frequent in districts where unemployment and immigration are more developed.

2. REPEATERS IN THE FRENCH-SPEAKING COMMUNITY — DESCRIPTIVE STATISTICS

If we look at the data issued by the Ministry of Education (Table 11.3), we immediately notice that the average proportion of pupils attending secondary education with some grade-repetition history is quite large. In 1991-92, more that 55 percent of the overall number of pupils in the French-Speaking Community of Belgium had repeated at least one grade[8]. This situation varies from district to district quite dramatically. The grade-repetition phenomenon is obviously more frequent in some districts than in others. Big urban districts like Charleroi and Brussels count less pupils with a NGR record (P_d^0, see equation 11.1) than very rural ones, as for example Bastogne. They represent less than 40 percent of the district population in Charleroi. By contrast, they correspond to 60 percent of the population in the rural district of Bastogne.

$$P_d^0 = \frac{1}{EL_d} \sum_i^6 \sum_j^{N_d} EL_{d,i,j}^{k=0} \qquad (11.1)$$

with:

- j, the school index;
- i, the grade index;
- N_d, the number of schools in district d;
- k; the grade-repetition record index;
- $EL_{d,i,j}^{k=0}$, the number of pupils with a NGR record in school j, at grade i, in district d;
- EL_d, the total number of pupils in district d;

8 For a more detailed presentation of grade repetitions data see Delvaux (1994a, 1994b).

Table 11.3 — Secondary education 1991-92; proportion of pupils with a grade-repetition record by district — grade 1 to 6

District (d)	Total	P_d^0	P_d^1	P_d^2	$P_d^{>2}$
FSCB (all districts)	**100**	**44,69**	**27,49**	**17,27**	**10,56**
Charleroi	100	39,20	27,48	19,96	13,36
Brussels	100	39,96	27,08	18,97	13,99
Philippeville	100	41,70	32,28	18,29	7,73
Tournai	100	42,33	26,84	18,91	11,91
Mouscron	100	42,82	30,17	17,07	9,94
Liège	100	43,44	27,06	17,98	11,51
Namur	100	43,64	28,38	17,25	10,73
Mons	100	44,97	27,46	17,37	10,20
Arlon	100	45,86	24,93	17,84	11,37
Soignies	100	47,16	28,09	16,33	8,42
Ath	100	47,28	29,03	15,98	7,71
Thuin	100	47,55	27,60	16,46	8,39
Dinant	100	48,79	31,00	14,89	5,32
Nivelles	100	50,88	26,66	14,93	7,53
Virton	100	51,66	29,94	13,34	5,06
Huy	100	52,00	26,48	15,05	6,47
Neuchâteau	100	52,16	26,06	14,79	6,99
Verviers	100	52,65	26,98	13,64	6,72
Marche-en-Fam.	100	54,08	28,96	12,34	4,62
Waremme	100	55,90	25,30	13,17	5,63
Bastogne	100	60,46	27,64	8,57	3,33

This result is informative. It supports the general impression that geographical segregation is significant in Belgium. Districts tend to vary dramatically in terms of average income, unemployment rate but also in terms of educational realities. Table 11.3 displays the evidence of a clear and crude educational discrepancy among districts. Yet, given our research orientation, we will neglect that result and focus on intra-district disparities. Remember that our foremost objective is to evaluate the propensity of 'local' quasi-markets to generate segregation.

A quick glance at Table 11.4 immediately illustrates the enormous **inter**-school segregation, prevailing inside a particular district (here Brussels). Despite a very similar supply (the same set of grades is offered to the public), equally accessible schools do not recruit the same public. Some secondary schools in the district of Brussels have almost no pupil with a NGR history ($p^0_{d,i,j}$), while in some other schools the latter represents almost 90 percent of the intake.

Table 11.4 — Secondary education 1991-92; proportion of pupils with some failure record ($P^k_{Brussels,1,j}$) in each school of the district of Brussels (d=Brussels); first grade (i=1)

School (j)	Number of pupils	Proportion of pupils with a NGR(1) record	Proportion of pupils with a grade-repetition record		
	$EL_{Brussels,1,j}$	$P^0_{Brussels,1,j}$	$P^1_{Brussels,1,j}$	$P^2_{Brussels,1,j}$	$P^{>2}_{Brussels,1,j}$
j= 1	42	0,00	0,40	0,38	0,21
2	47	0,06	0,49	0,43	0,02
3	47	0,09	0,47	0,32	0,13
4	90	0,09	0,13	0,21	0,57
5	56	0,11	0,34	0,43	0,13
6	65	0,11	0,51	0,34	0,05
7	47	0,13	0,32	0,47	0,09
8	34	0,15	0,35	0,41	0,09
9	20	0,15	0,35	0,40	0,10
10	106	0,15	0,48	0,34	0,03
11	56	0,16	0,45	0,30	0,09
12	68	0,16	0,47	0,29	0,07
13	45	0,18	0,36	0,33	0,13
14	97	0,19	0,38	0,33	0,10
15	92	0,20	0,33	0,33	0,15
16	79	0,20	0,41	0,34	0,05
	...	...	...	...	...
128	72	0,88	0,11	0,00	0,01
129	147	0,88	0,11	0,01	0,00
130	189	0,88	0,12	0,01	0,00
131	213	0,89	0,09	0,01	0,00
132	183	0,90	0,07	0,04	0,00
133	278	0,90	0,09	0,01	0,00
134	295	0,92	0,05	0,02	0,01
135	156	0,93	0,06	0,01	0,00
136	186	0,93	0,06	0,01	0,00

(1) No-Grade-Repetition

3. DISSIMILARITY

To synthesise the segregation phenomenon within districts we use the Dissimilarity index (Willms & Raudenbush, 1989). This index gives the proportion of the sub-group (here pupils who have repeated a certain number of grades) that would have to change schools in order to achieve an even distribution across schools operating in the district.

3.1. Mathematical definition

Mathematically, the dissimilarity index is defined as follows:

(11.2) $$D^k_{d,i} = \frac{1}{2.EL_{d,i}.P^k_{d,i}(1-P^k_{d,i})}\cdot\sum_{j=1}^{N_{d,i}} EL_{d,i,j}\cdot\left|p^k_{d,i,j} - P^k_{d,i}\right|$$

where

- $EL_{d,i,j}$ is the number of pupils in school j at grade i in district d;
- $EL_{d,i}$ is the total number of pupils at grade i in district d;
- $p^k_{d,i,j}$ is the proportion of pupils in school j at grade i, in district d, who have repeated k times;
- $P^k_{d,i}$ is the proportion of pupils at grade i, in the whole district d, who have repeated k times;
- d= 1...21, the district index;
- i = 1...6, the grade index;
- j = 1...$N_{d,i}$, the school index with $N_{d,i}$ the number of schools organising grade i in district d;
- k = 0, 1, 2, ≥2, the grade-repeating-record index;

3.2. Implicit assumptions

We see from the numerator of this index that segregation depends on the **discrepancy** between **the proportion of sub-groups in each school** and **the overall proportion of those sub-groups in the district** ($p^k_{d,i,j} - P^k_{d,i}$). Note also that the denominator standardises the index so that it ranges from 0 to 1.

Like every index, the dissimilarity index used here conveys a certain number of implicit assumptions. To compute a dissimilarity index, we need a standard, a benchmark. Using expression 11.2, we clearly assume that there is dissimilarity as soon as — in district d, for grade i — a school shows a proportion of pupils with a certain grade-repetition record that does not correspond the district's proportion ($P^k_{d,i}$). But are we sure that the district's average is the right standard to compute our dissimilarity index?

Schools are indeed more or less specialised. They do not all offer exactly the same services. Specialisation in this case essentially means tracks and differentiated curricula. Like in several other countries, the secondary educational system in the French-Speaking Community of Belgium incorporates different specific academic tracks (see Table 11.1 above). Some schools are more specialised in the 'general' track while others organise more systematically 'technical' and 'vocational' tracks. We have demonstrated elsewhere (Vandenberghe 1993a; 1993b) that there is a clear correlation between the specific track a pupil attends and the number of grades repeated. Inside each track, curricula are extremely differentiated. This is especially true beyond grade 3. Although no rule prescribes it explicitly, tracks and curricula inside tracks, are synonymous with hierarchy in the French-Speaking Community of Belgium. The 'general' track clearly concentrates high-ability pupils with no or a limited grade-repetition record while the others are very often a reservoir for low-ability pupils. Inside the 'general' track, curricula incorporating a lot of mathematics clearly 'dominate' those offering social sciences in abundance.

Hence, one would expect a district wherein schools are very specialised in terms of track or curricula to show more dissimilarity as defined by expression 11.2. Accordingly, one could argue that the reference in expression 11.2. should not be the district's average for all schools indistinctly, but the district's average **for the schools offering the same specialised service** (ex. a definite track or a particular curriculum inside a track). Nonetheless, this raises a serious difficulty. To which extent should we take for granted — and consequently discard as a source of dissimilarity — that pupils with a particular ability systematically attend a certain track or a particular curriculum? We believe that this approach, if pushed to extremes, can lead to the conclusion that no dissimilarity exists. This would typically be true of a system where ability segregation is systematically correlated with some degree of track or curricular specialisation.

We will stick to our assumption that the first reference with regard to dissimilarity is the district's average for all schools irrespective of their level of specialisation. We acknowledge however that further developments of this work are needed. Ideally, **several** dissimilarity measures using different references should be computed and compared. But this is beyond the scope of this work. An interesting research program would be to examine the extent to which gradual standardisation for specialisation[9] 'reduces' the magnitude of dissimilarity. Beyond, it would also be extremely interesting to identify the causal links between the two variables. Some US studies (Oakes, Gamoran & Page, 1992) suggest that the curriculum differentiation process for example is a by-product of ability segregation and not the reverse.

3.3. Empirical evidence

Table 11.5 presents dissimilarity indices that have been computed for grade 5. We insist that the dissimilarity measure is not influenced by the district's average proportion: a district with a high average proportion of pupils with some

9 We are grateful to M. Marchand for suggesting this.

grade-repetition record has no particular reason to have a high dissimilarity index. It is the dispersion around this average that determines the importance of dissimilarity. Table 11.5. confirms indeed that the average proportion of pupils with a grade-repetition record in a district is relatively independent of the inter school dissimilarity phenomenon. Philippeville and Liège districts for example, have approximately the same proportion of pupils with a grade-repetition history. Yet, they diverge dramatically in terms of inter-school dissimilarity.

The district of Liège is the worse in terms of dissimilarity. Some 54 percent of pupils attending 5th grade with a NGR history ($P^0_{d,5}$) would have to be 'bused' from one school to another in order to obtain an even allocation. At the other end of the spectrum, a rural district like Philippeville appears much less segregated. Only 24 percent of pupils showing a NGR record should be removed to achieve some district-wide balance[10].

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[10] The complete presentation of dissimilarity statistics can be found in Appendix IV.1.

Table 11.5 — Secondary education 1991-92, fifth grade, proportion of pupils with a grade-repetition record by district ($P^k_{d,5}$) and inter-school dissimilarity indices ($D^k_{d,5}$). School year 1991-92. French-Speaking Community of Belgium.

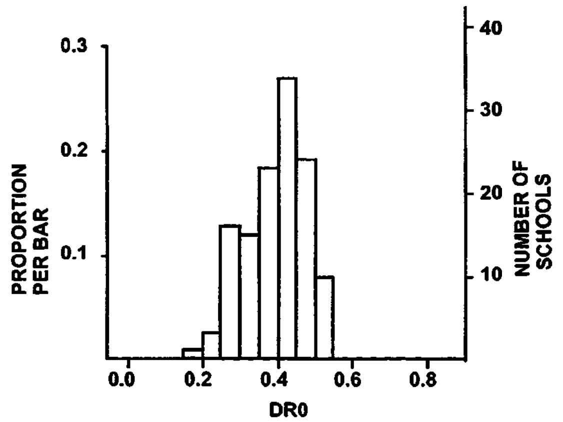
District (d)	Number of pupils in the district (EL_d)	Proportion of pupils with a k grade-repetition record				Inter-school Dissimilarity			
		k=0	k=1	k=2	k≥2	k=0	k=1	k=2	k≥2
		$P^0_{d,5}$	$P^1_{d,5}$	$P^2_{d,5}$	$P^{\geq 2}_{d,5}$	$D^0_{d,5}$	$D^1_{d,5}$	$D^2_{d,5}$	$D^{\geq 2}_{d,5}$
Philippeville	645	0,31	0,33	0,24	0,36	**0,24**	0,13	0,21	0,29
Marche-Fam.	485	0,50	0,26	0,17	0,24	**0,32**	0,16	0,22	0,34
Bastogne	501	0,53	0,30	0,12	0,16	**0,33**	0,19	0,31	0,32
Virton	540	0,42	0,29	0,21	0,29	**0,34**	0,13	0,3	0,25
Waremme	756	0,48	0,25	0,17	0,27	**0,37**	0,13	0,27	0,4
Arlon	902	0,38	0,23	0,22	0,39	**0,37**	0,18	0,26	0,24
Dinant	1157	0,42	0,32	0,18	0,26	**0,37**	0,17	0,33	0,45
Thuin	1272	0,41	0,26	0,19	0,33	**0,40**	0,15	0,3	0,5
Nivelles	3451	0,40	0,27	0,19	0,33	**0,42**	0,12	0,26	0,48
Ath	849	0,40	0,31	0,18	0,30	**0,42**	0,22	0,32	0,49
Mouscron	1142	0,31	0,31	0,21	0,37	**0,42**	0,15	0,21	0,43
Neuchâteau	866	0,42	0,27	0,20	0,31	**0,42**	0,17	0,33	0,4
Huy	1022	0,46	0,25	0,19	0,29	**0,43**	0,14	0,37	0,56
Soignies	2253	0,36	0,29	0,21	0,35	**0,44**	0,13	0,28	0,43
Mons	3438	0,34	0,29	0,22	0,37	**0,45**	0,14	0,26	0,34
Charleroi	4737	0,30	0,27	0,24	0,44	**0,46**	0,14	0,24	0,35
Verviers	2324	0,44	0,27	0,17	0,29	**0,48**	0,2	0,31	0,43
Tournai	2528	0,34	0,27	0,22	0,40	**0,49**	0,16	0,28	0,4
Namur	4462	0,33	0,28	0,21	0,39	**0,50**	0,14	0,29	0,42
Brussels	9786	0,33	0,25	0,21	0,42	**0,52**	0,15	0,3	0,49
Liège	7430	0,34	0,26	0,22	0,40	**0,54**	0,13	0,31	0,43

CHAPTER 12. WHAT ARE THE CAUSES OF SEGREGATION?

Quasi-market is synonymous with school choice — a well identified and distinct institutional feature. We have seen in our theoretical analysis that it could generate segregation. Yet, from an empirical standpoint, the observation of inter-school dissimilarity in a local quasi-market — as shown in chapter 11 — is not sufficient to conclude that the quasi-market *causes* segregation.

The reader should bear in mind that inter-school dissimilarity is not uniform. Table 11.4. and Graph 12.1 clearly illustrate that some variance exists between districts. Some districts display more inter-school dissimilarity than others. The same observation can be made when moving along the grade line. What follows aims at explaining this inter-district and cross-grade variance of dissimilarity indexes.

Graph 12.1. Inter-school dissimilarity (DR0 ≡ $D_{d,i}^{k=0}$) in terms of pupils with a no-grade-repetion history, histogram. Secondary education. Grade 1 to 6. School year 1991-92.



Our first hypothesis is that dissimilarity could be exacerbated by the importance of school choice in the district. People with a no-grade-repetition (NGR) record (our proxy for high-ability pupils) would be isolated from the rest of the population more systematically when options — for them and the others — are more numerous[11]. The strategy we adopt here to test this assumption is simple.

11 It should be clear that districts with more schools must not, by definition, show more dissimilarity. In mathematical terms the magnitude of the dissimilarity index is not conditioned by the number of schools, unless this number is one. If there is only one school in the district, inter-school dissimilarity is nil ...

We try to find out whether the structure of the local quasi-market (measured by a Herfindahl index or other measures of concentration) exacerbates dissimilarity.

We simultaneously test a second assumption. We attempt to see whether the importance of inter-school dissimilarity points to the intensity of pre-existing human capital disparities among inhabitants (and children) of the district. The underlying reasoning is to say that people with a NGR record tend to group themselves more when the socio-economic or ability gap between them and the rest of the population grows[12].

1. PRE-EXISTING HUMAN CAPITAL DISPARITIES OR LOCAL QUASI-MARKET STRUCTURE?

1.1. Definition of variables

Our dependent variable is the level of disparity (or segregation) of the proportion of pupils with no grade-repetition record[13] ($D^{k=0}_{d,i}$), inside each district, between schools organising the same grade (i= 1 to 6). Its statistical measure is based on the dissimilarity index (Willms & Raudenbush, 1989) that has been presented in chapter 11 (see expression 11.2).

In order to explain inter-school dissimilarity, two categories of predictor (independent) variables have been computed. The first category of variables intends to capture the intensity human capital (socio-economic) or ability disparities inside the district. The second set of variables refers to the structure of the local quasi-market.

a) Ability or socio-economic disparities

In order to describe ability disparities (or the 'ability gap') among children of the district, we need to characterise pupils with a NGR record (supposedly high-ability pupils) and the others (low-ability pupils). Our information is limited. We have no way of characterising the first category. Hence, we essentially use the information available concerning pupils with some grade-repetition record to build our measure of the ability gap. Among these pupils some have repeated 1 grade, while others have a 2 or more grades...We make the as-

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12 The distance between $ß^h$ and $ß^l$ in our theoretical analysis.

13 We assume that those pupils roughly correspond to $ß^h$-type pupils in our theoretical analysis.

sumption that the higher the number of grades repeated the less 'able' the pupil. Technically speaking, the ability gap will be measured by the following index:

$$\text{(12.1)} \quad AGAP^{\psi}_{d,i} = \sum_{k=1}^{3} \mu^{k}_{d,i} \cdot (k)^{\psi}$$

with
- $k = 1, 2, \geq 3$, the grade-repetition record index;
- $d = 1 \ldots 21$, the district index;
- $i = 1 \ldots 6$, the grade index;
- $\mu^{k}_{d,i}$ the proportion of pupils who repeated k grades among the total number of pupils with a grade-repetition record($k \geq 1$);
- $\psi \geq 1$ the extra-weight we put on 'big' grade repeaters;

In order to describe the socio-economic disparities among inhabitants (and children) of a district, we also exploit fiscal and census data (INS, 1992, 1995). With the distribution of the taxable income inside each district we have created two income inequality variables: a Gini index ($GINI_d$) and a coefficient of variance ($CVAR_d$) variable — see expressions (12.2) and (12.3)[14].

$$\text{(12.2)} \quad GINI_d = 2.\left[\sum_{l=1}^{m} (x_{d,l+1} - x_{d,l}).\frac{f(x_{d,l+1}) + f(x_{d,l})}{2}\right]$$

where
- $x_{d,l}$ is the cumulated frequency of persons living in district d with a taxable income inferior or equal to the limit defined by the upper bound of interval l;
- $f(x_{d,l})$ is the corresponding cumulated frequency of taxable income located in district d, inferior or equal to the limit defined by the upper bound of interval l;
- m is the number of income intervals;

14 See Appendix IV.2. for a complete presentation of Taxable Income disparities among the districts ("arrondissements") of the French-Speaking Community of Belgium.

(12.3) $$CVAR_d = \frac{\sqrt{Var(w_{d,l})}}{\overline{\overline{w}}_d}$$

where

- $w_{d,l}$ is the (average) taxable income of people corresponding to interval l, living in district d;
- $Var(w_{d,l}) = \frac{\sum_{l=1}^{m}(w_{dl} - \overline{\overline{w}}_d)^2}{m}$
- $\overline{\overline{w}}_d = \frac{\sum_{l=1}^{m} w_{d,l}}{m}$

In order to complete the characterisation of the socio-economic disparities inside each district, we have used the 1991 census data (INS, 1995). We have built inter-municipality[15] dissimilarity indexes for both the proportion of unemployed people (DU_d) and the proportion of people in activity with a university degree ($DUNIV_d$)[16].

b) Structure of the local quasi-market

In order to measure the concentration on the local quasi-market we have computed two variables. The first one simply amounts to a Herfindahl index measuring the structure of the quasi-market by its concentration[17] (see Hoxby, 1994a, 1994b, 1995). Expression (12.4) indicates that this index is based on each school's share of the district's market: for a certain grade i, the size of a school's intake relative to the district's total intake. The lower the Herfindahl index, the lower the concentration in the local quasi-market i.e. the larger the number of schools of relatively similar size organising the same grade of secondary education.

15 Each district counts a certain number of municipalities. The latter is the smallest administrative unit of Belgium.

16 The reader interested by the underlying statistics can refer to Appendix IV. 3

17 See Hoxby (1994a, 1994b, 1995) for a similar use of Herfindahl concentration indexes to evaluate the impact of school choice.

(12.4) $$H_{d,i} = \sum_{j=1}^{N_{d,i}} \left[\frac{EL_{d,i,j}}{EL_{d,i}} \right]^2$$

with

- $EL_{d,i,j}$: the number of pupils registered in school j, at grade i in district d;
- $EL_{d,i}$: the number of pupils registered at grade i in district d;

The second measure of market concentration is simply the inverse of the number of schools organising a particular grade[18] :

(12.5) $$CONC_{d,i} = \frac{1}{N_{d,i}}$$

with $N_{d,i}$: the number of schools organising grade i in district d;

c) Grade dummies, intra-school dissimilarity and distances

Additional variables have been introduced in order to control for a certain number of side-phenomena. The different grades (i = 1...6) have been put into the equation as dummy variables.

We also control for the presence of **intra**-school segregation. Indeed, segregation is also potentially present inside each school. Remember that like in several other countries, the secondary educational system in the French-Speaking Community of Belgium incorporates different specific academic tracks (Table 12.1). These tracks significantly reduce the level of interaction between pupils inside schools. Pupils attending different academic tracks generally attend different classes and have almost no contact with each other.

18 See Appendix IV.4. for a complete presentation of concentration data.

Table 12.1 — Academic tracks inside secondary schools: categories that have been retained to ventilate pupils inside schools.

Grade (i)	General track	Technical track		Professional track
	Transition	Transition	Qualification	Qualification
1	1A/1G	-	1T	1P/1B
2	2A/2G	-	2T	2P
3	3Tr/3G	3TTr	3TQ/3T	3P
4	4Tr/4G	4TTr	4TQ/4T	4P
5	5Tr/5G	5TTr	5TQ/5T	5P
6	6Tr/6G	6TTr	6TQ/6T	6P

The computation of an average intra-school dissimilarity index by district, for each grade, ($WDINTRA^{k=0}_{d,i,j}$) intends to control for what can be legitimately interpreted as artificial desegregation. The issue at stake is simply to control for the possible relation between inter-school and intra-school dissimilarity while controlling for the concentration of the local market. To what extent does intra-school segregation complement or counterbalance inter-school dissimilarity?

The index $D^{k=0}_{d,i,j}$ in equation (12.6) gives the proportion of the sub-group (here pupils who have repeated a certain number of grades k that would have to change academic track inside a particular school to achieve an even distribution school-wide. Equation (12.7) defines the index we use in our regression ($WDINTRA^{k=0}_{d,i,j}$) as the district-wide (arithmetic) average of intra-school dissimilarity indexes ($D^{k=0}_{d,i,j}$).

$$(12.6)\quad D^{k=0}_{d,i,j} = \frac{1}{2.EL_{d,i,j}.P^{k=0}_{d,i,j}(1-P^{k=0}_{d,i,j})}.\sum_{j=1}^{N_{d,i}} EL_{d,i,j,t}.\left|p^{k=0}_{d,i,j,t} - P^{k=0}_{d,i,j}\right|$$

with:

- $EL_{d,i,j,t}$ the number of pupils in academic track t, in school j, at grade i, in district d;
- $EL_{d,i,j}$ the number of pupils , in school j at grade i, in district d;
- $p^{k=0}_{d,i,j,t}$ the proportion of pupils with a NGR record in academic track t, in school j at grade i, in district d;
- $P^{k=0}_{d,i,j}$ the proportion of pupils with a NGR record at grade i, in school j, district d, ;
- d= 1...D, the district index;
- i = 1...6, the grade index;
- j = 1...$N_{d,i}$, the school index with $N_{d,i}$ the number of schools organising grade i in district d;

- t = 1...4, the academic track index;
- k= 0, 1, 2, ≥2, the grade-repetition record index;

(12.7) $$WDINTRA_{d,i}^{k=0} = \sum_{j=1}^{N_{d,i}} \alpha_{d,i,j} \cdot D_{d,i,j}^{k=0}$$

with $\alpha_{d,i,j}$ school j's enrolment share at grade i in district d;

Finally, we try to control for the distance separating schools that organise the same grade. Using the total surface of the district's territory, we simply divide it by the number of schools and then take the square root. We get the average number of kilometres per school. The proxy ($DIST_d$) should be considered with great care. It does not correspond to the exact distance between schools and does not necessarily reflect the importance of transportation costs: a district can count very few schools as regards to the importance of its territory but they can be all located in a limited number of cities concentrating the vast majority of inhabitants.

1.2. OLS results

a) Socio-economic discrepancy and inter-school dissimilarity are almost unrelated

Ordinary least square regression results are of great interest (see Table 12.2). All variables, except one, describing the pre-existing socio-economic discrepancy inside the district have non-significant coefficients in all equations estimated. The coefficient of the income inequality proxy ($GINI_d$) is positive but insignificant[19] in most equations. The inter-municipality unemployment rate dissimilarity (DU_d) has a negative but always insignificant coefficient. The same conclusion can bet set forth concerning our proxy of the ability gap ($AGAP_{d,i}^{v=2}$)[20]. Its coefficient in equation 4 is insignificant. The only socio-economic variable which turns out to be significant is the inter-municipality dissimilarity index concerning the proportion of active persons with a university degree ($DUNIV_d$). The higher this dissimilarity, the higher the dissimilarity among schools.

Thus, inter-school segregation — all other things equal — does not seem more important in districts where socio-economic disparities and ability differences

19 Similar results are derived when using the coefficient of variance variable (CVAR).
20 Formally defined by expression 12.1.

are apparently more accentuated. The only exception which is worth mentioning is the one corresponding to districts wherein municipalities display very different proportions of university graduates. Districts wherein high-skilled workers are unevenly distributed show more school segregation along the ability line.

b) Less concentration (more school choice) means more inter-school dissimilarity

By contrast, variables describing the structure of the local quasi-market show more systematically significant coefficients. A substantial part of inter-school variance in terms of NGR history is explained by concentration indexes. Equations 1 to 3 are computed with the Herfindahl index ($H_{d,i}$). The coefficient of the Herfindahl variable is negative and significant (t-ratio is high in absolute value). The higher the concentration on the local quasi-market, the lower the dissimilarity between schools. In equation 1, an increment from H = 0.1 (10 schools of equivalent size) to H = 0.11 (9.09 schools of equivalent size) leads to a 0.742 point drop of inter-school dissimilarity.

c) But more concentration, synonymous with less inter-school dissimilarity, also means more intra-school dissimilarity

However, equation 3 reveals that part of this effect can be attributed to a higher intra-school (between tracks) dissimilarity effect. In equation 1, the effect of higher concentration on inter-school dissimilarity is partly incorporated into the coefficient of the intra-school dissimilarity variable ($WDINTRA_{d,i}^{k=0}$). Once intra-school dissimilarity is taken into account, the Herfindahl index's coefficient is reduced by approximately 40 percent (from – 0.742 to – 0.384).

Equation 3 reveals that the higher the **intra-school** dissimilarity the lower the **inter-school** dissimilarity inside the district. In other words, a 0.50 to 0.55 rise of the average intra-school dissimilarity (i.e. dissimilarity among academic tracks) leads to a 2.09 points drop of inter-school dissimilarity.

More concentration — synonymous with less inter-school dissimilarity — thus means more intra-school dissimilarity. This is obvious if one takes a closer look at the relation between concentration of the local quasi-market ($H_{d,i}$) and intra-school dissimilarity ($WDINTRA_{d,i}^{k=0}$) — see Graph 12.2. This observation reinforces the position of those who claim that school desegregation is not 'the end of the road' (West, 1994). Greater attention should be paid to segregation occurring *within* the school, between academic tracks and also — what we have not been able to measure here — between classrooms inside each track[21].

Those results are confirmed by equation 5, where the Herfindahl index is replaced by the inverse of the number of schools organising a particular grade ($CONC_{d,i}$). In equation 5, the coefficient of this simple concentration index is negative and statistically significant. An increment from $CONC_{d,i} = 0.1$ (10 schools) to $CONC_{d,i} = 0.11$ (9.09 schools) leads to a 0.501 points drop of inter-school dissimilarity. In the same equation, a rise of the average intra-school dissimilarity (i.e. dissimilarity among academic tracks) from 0.5 to 0.55 leads to a 2.305 percent drop of inter-school dissimilarity.

d) Average distances between schools do not augment inter-school dissimilarity

It is important to observe also that our proxy for inter-school distances ($DIST_d$) does not appear significant in equation 5 of Table 12.2 : greater distances between schools does apparently not mean less segregation along the ability line. The reader should however bear in mind that the variable ($DIST_d$) is a poor proxy of actual distances separating schools in competition.

e) Inter-school dissimilarity rises along the grade line

Finally, grade dummies (i = 1...6) have a significant influence on inter-school dissimilarity. Coefficients of grade dummies superior to 1 (our regressions are indeed centred on grade 1) are all positive and statistically significant. Maximal inter-school dissimilarity seems to occur at grade 3 and grade 4: compared with grade 1, the dissimilarity index is inflated by 10 points or more. The shift from grade 5 to 6 seems to be synonymous with less inter-school dissimilarity. This could be the consequence of «before-graduation» drop-outs.[22]

In other words, taking dissimilarity at entrance grade 1 as a benchmark, higher grades are synonymous with greater dissimilarity, no matter the value of the concentration index[23] ($H_{d,i}$ or $CONC_{d,i}$). Dissimilarity seems to be systematically 10 percent higher at grade 3 (and beyond) than at grade 1.

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21 For a complete presentation of the intra-school (i.e. between academic tracks inside each school) dissimilarity index, see Appendix IV.5.

22 See Appendix I.V.6. for an illustration of this phenomenon.

23 We have indeed computed those OLS equations with interaction terms (H.i) or (CONC.i). None of the coefficients are significant.

In the light of this, one could say that 'cream-skimming' probably occurs. Remember that evaluation is left at each school's discretion in the French-Speaking Community of Belgium. Hence, the observation of an increasing dissimilarity along the grade scale hints at 'cream-skimming'. Each end-of-term examination could be used by the most selective schools to 'improve' their relative position. Yet, this assumption needs to be tested more systematically. This is precisely what we do in section 2.

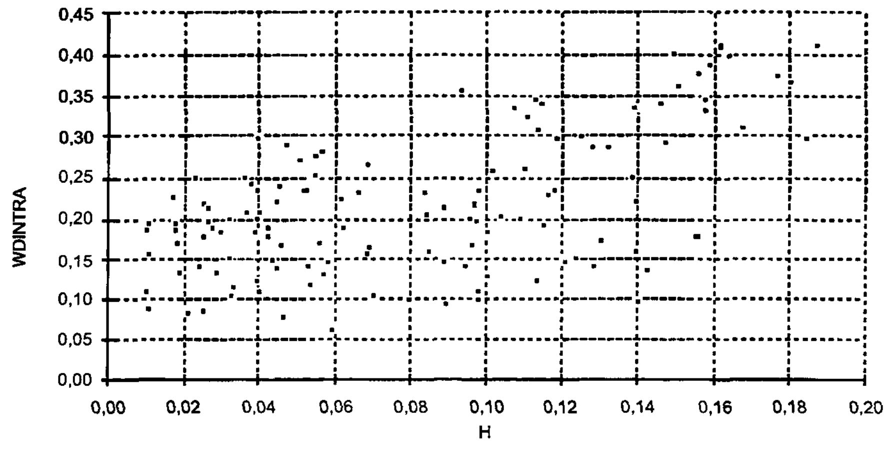
Table 12.2 — Explanation of inter-school dissimilarity in terms of pupils with NGR record ($D^{k=0}_{d,i}$). French-Speaking Community of Belgium. Secondary education. All grades. School year 1991-92. OLS regression coefficients (t-statistics) [p-values]

Dependant variable: $D^{k=0}_{d,i}$: Dissimilarity index of pupils with a NGR record.	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5
Constant	0.132 (1.184)	0.074 (0.779)	0.203* (2.153)	0.412* (7.538)	0.195* (2.076)
$AGAP^{\psi=2}_{d,i}$				0.0171 (0.888)	
$GINI_d$: Gini index measuring district-wide income inequality	0.409* (2.286)	0.412** (2.739)	0.248 (1.752)		0.260 (1.842)
DU_d: Inter-municipality unemployment rate dissimilarity index	0.103 (0.702)	0.096 (0.771)	-0.021 (-0.181)		-0.033 (-0,291)
$DUNIV_d$: Inter-municipality dissimilarity index for the proportion of workers with a university degree	0.411** (3.259)	0.401** (3.576)	0.429** (4.045)		0.433** (4.287)
$DIST_{d,i}$: average distance (in kilometre) between schools organising grade i in district d				0.0045 (-1.370)	
$H_{d,i}$: Herfindahl concentration index	-0.742** (-5.454)	-0.769** (-6.686)	-0.384** (-2.745)	-0.519** (-3.748)	
$CONC_{d,i}$: Simple concentration index (1/number of schools organising the grade)					0.501** (-3.250)
$WDINTRA^{k=0}_{d,i,j}$: Intraschool dissimi. index: pupils with a NGR record (k=0)			-0.418** (-4.161)	-0.332** (-3.257)	-0.407** (-4.299)
i=2: school organises grade 2		0.043** (2.818)	0.063** (3.965)	0.052* (3.209)	0.064** (4.116)
i=3 : school organises grade 3		0.091** (6.232)	0.151** (8.109)	0.116** (3.882)	0.150** (8.284)
i=4 : school organises grade 4		0.079** (5.692)	0.136** (7.144)	0.099** (3.085)	0.134** (7.210)
i=5 : school organises grade 5		0.084** (5.906)	0.134** (8.164)	0.095** (2.657)	0.130** (8.018)
i=6 : school organises grade 6		0.062** (3.481)	0.110** (5.881)	0.075* (2.226)	0.109** (5.876)
N	126	126	126	126	126
F-Ratio [pvalue]	30.187** [0.000]	24.195** [0.000]	27.332** [0.000]	25.977** [0.000]	28.343** [0.000]
R^2adj	0.48	0.62	0.70	0.64	0.69
White Het. Test	29.634** [0.009]	49.983 [0.112]	53.179 [0.352]	39.38 [0.452]	51.85 [0.402]
Jarque-Bera normality test	1.515 [0.469]	5.360 [0.069]	3.312 [0.191]	10.99** [0.004]	3.353 [0.187]

** Denotes a significance at 5 percent

* Denotes a significance at 10 percent

Graph 12.2. Average intra-school dissimilarity (WDINTREA) and concentration index (H). School year 1991. Secondary education. Grade 1 to 6. School year 1991-92.



2. SELECTION (CREAM-SKIMMING) OR SELF-SELECTION?

The observation of segregation between schools, especially when concentration on the local quasi-market is limited (i.e. school choice is important), leads us to believe that the quasi-market institutional feature exacerbates segregation along the 'ability' line: more school choice is synonymous with more dissimilarity between schools in competition. This leads to our second point i.e. the identification of the segregation's *modus operandi*.

This section aims at developing several tests to determine whether segregation is a supply-side or a demand-side phenomenon. We try indeed to determine whether segregation can be attributed — to some extent — to a genuine 'selection' process synonymous with 'cream-skimming'. The rival hypothesis is indeed that segregation is simply the consequence of voluntary or benevolent sorting (Willis & Rosen, 1979).

Be it benevolent or imposed, segregation can be problematic. Our theoretical analysis has indeed highlighted that excessive segregation can be synonymous with inefficiency: i.e. allocative inefficiency — peer effects are not adequately distributed — or lack of effort, at least in the less reputed schools concentrating low-ability children. It is also obvious that it is inequitable in the sense that educational achievement diverges dramatically from school to school. The point here is that origin of segregation heavily determines the kind of regulatory strategy that the regulator must implement to prevent or limit its importance. If segregation is partly orchestrated by schools and teachers, the regulator should incite them to be less selective. By contrast, if segregation is the result of a self-selection process, the regulatory strategy must also focus on the demand side of the market by inciting individuals to mix more systematically.

Our main methodological problem hereafter stems from the fact that we have no direct way to test our assumptions. We are a bit like the man in Plato's cave: we are condemned to understand reality through imperfect and fuzzy images. We have no cohort data that would enable us to characterise allocation of pupils among schools. We have no information concerning attendance preferences expressed by the 'clients' or admission decisions taken by the 'suppliers'.

Our reasoning hereafter is based on the idea that the evolution of the proportion of pupils with a NGR record along the grade line, potentially conveys some information about the *modus operandi* of segregation.

2.1. Preliminary observations

Consider a distribution of pupils with no grade-repetition record, in a particular district d, at grade 1. Suppose quite realistically that school 1 concentrates a lot of those pupils (90 percent) while school 2 counts very few of them (30 percent). To keep things simple suppose also both schools have the same size (100 pupils). Imagine now that the failure rate between grade 1 and grade 2 is identical in both schools (0.5 for example) — see Table 12.3, case 1.

Table 12.3. — Numerical example. Evolution of school composition between grade 1 and grade 2. Case 1: failure rate of 50 percent. Case 2: failure rate of 50 percent and redistribution of pupils with grade-repetition record between school 2 and school 1.

Case 1

Grade 1	k = 0	k > 0	Total		Grade 2	k = 0	k > 0	Total
School 1	90	10	100	=>	School 1	45	55	100
School 2	30	70	100		School 2	15	85	100
District	120	80	200		District	60	140	200

Case 2

Grade 1	k = 0	k > 0	Total		Grade 2	k = 0	k > 0	Total
School 1	90	10	100	=>	School 1	45	55 − 40	60
School 2	30	70	100		School 2	15	85 + 40	140
District	120	80	200		District	60	140	200

How will the proportion of pupils with a NGR record evolve between grade 1 and grade 2? It will inevitably decrease. However, school 1 will undergo a greater (absolute) reduction (from 0.9 to 0.45) of its proportion of pupils with no grade-repetition than school 2 (from 0.3 to 0.15).

Suppose now that some reallocation of pupils takes place between grade 1 and grade 2. Suppose in particular that 40 pupils with some grade-repetition record quit school 1 and register in school 2 — see Table 12.3, case 2. Despite its high failure rate between grade 1 and grade 2, school 1 maintains a high proportion of pupils with a NGR record (from 0.9 to 0.75). Simultaneously school 2 suffers a greater reduction of its proportion of pupils with a NGR history (from 0.3 to 0.10)

We can conclude from this brief discussion that the evolution of the proportion of pupils with no-grade repetition record between the first grade and subsequent grades is *a priori* affected by two processes: [I] evaluation inside each school and [II] redistribution of pupils with some grade-repetition record — what we shall interpret as potential evidence of 'cream-skimming'.

What follows aims at disentangling these two rival assumptions and determining whether the 'cream-skimming' one deserves some credit. Note that we will not be able to treat the two assumptions jointly from an econometric point of view: data sources cannot be consolidated adequately and this will reveal problematic.

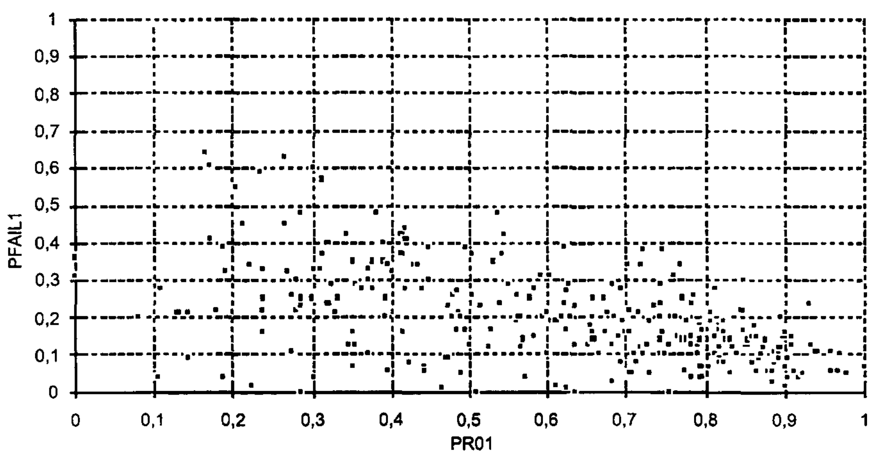
2.2. Proportion of pupils with a no-grade repetition (NGR) record and failure rate

The 'Radioscopy' contains information about end-of-term results (success or failure) and proportion of pupils with a grade-repetition record for a large set of secondary schools. We have used these data to determine whether schools show similar evaluation results.

Graph 12.3.1 & 12.3.2 and Table 12.4 clearly reveal that failure rates ($\overline{PF}_{i,j}$) are **higher** in schools with smaller proportions of pupils with a NGR record ($\overline{P}_{i,j}^{k=0}$). This is true for the different grades, although failure rates are globally more important at grade 1 than at grade 5.

In Table 12.4., regression 3 confirms that at grade 3 a rise of the proportion of pupils with a NGR record ($\overline{P}_{3,j}^{k=0}$) from 0.5 to 0.55 reduces the failure rate by more than 1.2 point[24]. In all equations, coefficients are negative and statistically significant.

Graph 12.3.1 — Proportion of pupils who fail their end-of-year exams and proportion of pupils with a NGR record. School year 1991-92. Secondary education. French-Speaking Community of Belgium. Case 1: PFAIL1 ≡ $\overline{PF}_{1,j}^{k=0}$ failure rate at grade 1 against PR01 ≡ $\bar{P}_{1,j}^{k=0}$ proportion of pupils with a NGR record at grade 1



24 Note that this result strengthens our hypothesis: grade-repetition history rightly mirrors pupils' academic ability. Pupils who have repeated several grades tend to fail more often than others. This result also supports the idea that grade-repetition is a poor remedial strategy.

Graph 12.3.2 — Proportion of pupils who fail their end-of-year exams and proportion of pupils with a NGR record. School year 1991-92. Secondary education. French-Speaking Community of Belgium. Case 2: PFAIL3 ≡ $\overline{PF}_{3,j}$ failure rate at grade 3 against PR03 ≡ $\overline{P}_{3,j}^{k=0}$ proportion of pupils with a NGR record at grade 1

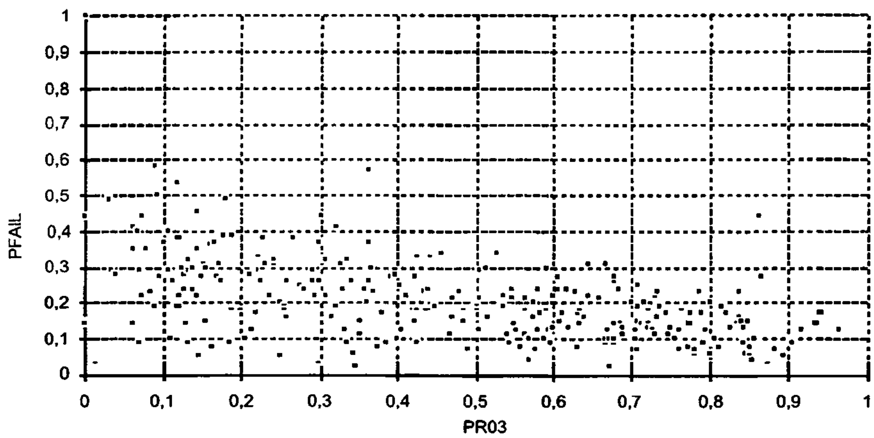


Table 12.4 — Failure rate and proportion of pupils with a NGR record. Grade 3. School year 1991-92. Secondary education. OLS regression coefficients (t-statistics) [p-values]

	Regression 1	Regression 2	Regression 3	Regression 4
Dependent Variable:	$\overline{PF}_{1,j}$ failure rate grade 1	$\overline{PF}_{1\&2,j}$ failure rate grades 1&2	$\overline{PF}_{3,j}$ failure rate grade 3	$\overline{PF}_{4\&5,j}$ failure rate grades 4&5
Constant	0.370** (15.568)	0.307** (15.033)	0.310** (19.012)	0.263** (23.595)
$\overline{P}_{1,j}^{k=0}$: proportion of pupils with a NGR record at grade 1	- 0.292** (-8.861)	- 0.226** (-7.911)		
$\overline{P}_{3,j}^{k=0}$: proportion of pupils with a NGR record at grade 3			- 0.233** (-8.674)	
$\overline{P}_{5,j}^{k=0}$: proportion of pupils with a NGR record at grade 5				- 0.186** (- 8.880)
N	295	297	303	286
F-Ratio (pvalue)	113.625** [0.000]	100.364** [0.000]	105.038** [0.000]	85.516** [0.000]
R^2adj	0.277	0.251	0.256	0.443
White Het. Test (not computed by TSP if degrees of freedom are insufficient)	51.446** [0.000]	53.852** [0.000]	25.202** [0.000]	10.340** [0.006]
Jarque-Bera normality test	13.103** [0.001]	34.540** [0.000]	844.454** [0.000]	100.651** [0.000]

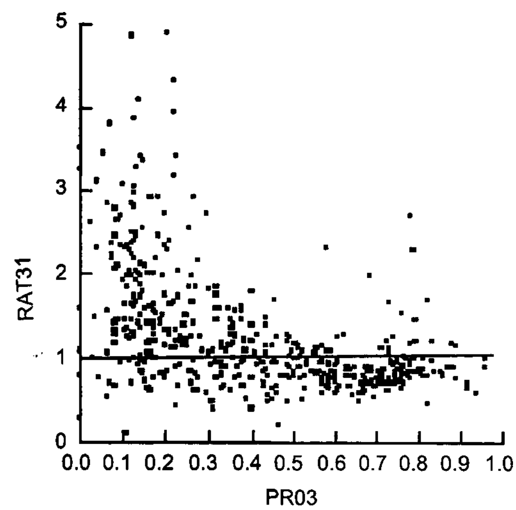
** Denotes a significance at 5 percent

* Denotes a significance at 10 percent

2.3. Proportion of pupils with a no-grade-repetition (NGR) record and grade progression

The other factor at stake is the possibility of inter-school transfers: progression along the grade line could be synonymous with some reallocation of pupils and this can also affect the evolution of the proportion of pupils with a NGR record. A first sign of this phenomenon can be found in Graph 12.4. The abscissa shows the proportion of pupils at grade 3 (PR03 ≡ $P^{k=0}_{3,j}$) while the ordinate displays the evolution of the enrolment size — a ratio — between grade 1 and grade 3 (RAT31 ≡ $RAT^{3,1}_{d,j}$.).We immediately notice that most schools with more than 30 percent of pupils with NGR record at grade 3 have smaller intakes at grade 3 compared to grade 1 (RAT31<1). By contrast, a large number of schools with less than 30 percent of pupils with NGR record increase their intake dramatically (RAT31>1).

Graph 12.4 —Proportion of pupils at grade 3 (PR03 ≡ $P^{k=0}_{3,j}$) and evolution of the enrolment size between grade 1 and grade 3 (RAT31 ≡ $RAT^{3,1}_{d,j}$.). School year 1991-92. Secondary education.



This visual result is confirmed by econometric methods. Table 12.5. contains a certain number of regressions suggesting that inter-school reallocation exists and has some impact on this evolution. Note that all variables are logarithms. Consequently, coefficients in Table 12.5 must be considered as elasticities.

a) Stable hierarchy along the grade line

Regression 1 indicates that schools which were in a 'bad' position at grade 1 — in the sense that their intake was principally composed of pupils with some grade-repetition history: i.e. $P^{k=0}_{d,1,j}$ is low — tend to be in a similar position at grade 3: i.e. $P^{k=0}_{d,3,j}$ is low. The opposite is true for schools which rank best at grade 1. The immediate conclusion is that the grade 1 ranking (hierarchy) is maintained at higher grades. This is reflected by the fact that the variable's coefficient is close to 1 (actually 1.137) and (largely) significant.

Some general reduction of the proportion of pupils with a no-repetition record has taken place as the constant at the origin is negative (– 0.274) and statistically significant. This is the logical consequence of end-of-term evaluation: some pupils with no grade-repetition record fail at the end of grade 1.

Regression 2 incorporates a dummy variable corresponding to the three large urban districts wherein school concentration is low. Its coefficient is statistically insignificant. This suggests that all districts (be they rural or urban) present the same characteristics. In both rural and urban districts, some general reduction of the proportion of pupils with no grade-repetition is visible. Schools also tend to preserve their relative position along the grade line.

This is corroborated by the fact that the distance variable's coefficient is not significant. Redistribution of pupils among schools — which we capture here with the RAT variable — is not affected by the average distance separating schools. We expect the latter to be more important in rural districts.

b) Enrolment expansion in schools occupying a 'bad' position in the initial hierarchy

But beyond this rather deterministic relation, regressions 1 and 2 also reveal that enrolment expansion (reduction) between grade 3 and grade 1 is correlated with a lower (higher) proportion of pupils with no grade-repetition record at grade 3 ($P^{k=0}_{d,3,j}$). Indeed, in regression 1, the coefficient of the grade 3-grade 1 intake ratio $RAT^{3,1}_{d,j}$ is negative and statistically significant (– 0.258): a 1 point reduction of this ratio — from 0.9 to 0.81 for example — entails a 25 points increase of the dependent variable. Accordingly, a reduction of the enrolment size means a greater proportion of pupils with a NGR record at grade 3. Inversely, enrolment expansion goes along with smaller proportions of pupils with a no-grade repetition record at grade 3. This result hints at 'cream-skimming' practices.

Regressions 3 and 4 in Table 12.5 replicate the previous analysis but for grades 3 and 5. Results are similar except that the evolution of the enrolment size $RAT_{d,j}^{5,3}$ no longer exerts a significant impact on the dependent variable. The reason for this could simply be that 'cream-skimming' principally occurs between grade 1 and grade 3.

Redistribution of pupils between schools on a quasi-market is quite normal. Yet, we claim that the redistribution occurring on the quasi-market of the French-Speaking Community of Belgium could be the consequence of 'cream-skimming'. Our argument is simply that the observed redistribution is biased. If the likelihood of school change between grade 1 and grade 3 was the same for all pupils — pupils with or without grade-repetition history — enrolment size expansion ($RAT > 1$) or reduction ($RAT < 1$) would not be significantly correlated with the evolution of proportion of pupils with a NGR history between grade 1 and grade 3.

Table 12.5 — Explanation of the proportion of pupils with no grade-repetition record at grade 3 ($P^{k=0}_{d,3,j}$) or 5 ($P^{k=0}_{d,5,j}$). School year 1991-92. Secondary education.
OLS regression coefficients (t-statistics) [p-values]

I. Dependent variable: $P^{k=0}_{d,3,j}$: prop. of pupils with a NGR record at grade 3	Regression 1	Regression 2	II. Dependent variable: $P^{k=0}_{d,5,j}$prop. of pupils with a NGR record at grade 5	Regression 3	Regression 4
Constant	-0.274** (-4.450)	-0.375** (-4.341)	Constant	-0.252** (-6.113)	-0.233** (-3.066)
$P^{k=0}_{d,1,j}$:proportion of pupils with a no-grade-repet. record at grade 1	1.137** (21.013)	1.138** (21.024)	$P^{k=0}_{d,3,j}$:proportion of pupils with a no-grade-repet. record at grade 3	0.992** (34.633)	0.992** (34.689)
$RAT^{3,1}_{d,j}$: grade 3-grade 1 intake ratio	-0.258** (-3.524)	-0.261** (-3.584)	$RAT^{5,3}_{d,j}$: grade 5-grade 3 intake ratio	0.0052 (0.090)	0.0051 (0.088)
$DIST_{d,i=3}$: average distance between schools in district d, grade 3	-0.009 (0.281)	0.058 (1.333)	$DIST_{d,i=5}$: average distance between schools in district d, grade 5	0.0386 (1.719)	0.029 (0.765)
URB d=Brussels, Liège or Charleroi		0.087 (1.720)	URB d=Brussels , Liège or Charleroi		0.0161 (-0.288)
N	477	477	N	562	562
F-Ratio	472.17** [0.000]	355.5** [0.000]	F-Ratio	747.57** [0.000]	599.79 [0.000]
R^2adj	0.74	0.74	R^2adj	0.79	0.79
White Het. Test	72.470** [0.000]	83.28** [0.000]	White Het. Test	99.021** [0.000]	105.225 [0.000]
Jarque-Bera normality test	541.76** [0.000]	523.3** [0.000]	Jarque-Bera normality test	747.57** [0.000]	259.09** [0.000]

**Denotes a significance at 5 percent
* Denotes a significance at 10 percent

2.4. Cream-skimming evidence? further comments and observations

a) Underestimation of the RAT 's coefficient

The problem with the result of section 2.3 is that the evolution of the enrolment size between grade 3 and grade 1($RAT^{3,1}_{d,j}$) is probably highly correlated with the failure rate variable at the end of grades 1&2 ($\overline{PF}_{1\&2,j}$). The latter is absent of regressions 1 and 2 in Table 12.5 but is correlated with the NGR variable as demonstrated by regression results and graphs of section 2.2. Hence, results of section 2.3. presented in Table 12.5 and suggesting that some cream-skimming exists are potentially affected by a **bias for omitted variable.**

The normal way to separate each factor's impact on the dependent variable would be to regress the latter on the two explanatory variables simultaneously. Unfortunately, our data sources are such that the two variables cannot be adequately matched.

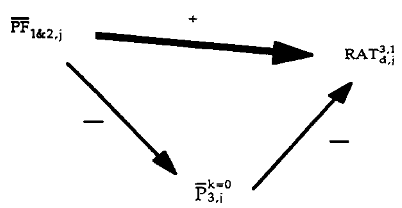
Yet, we can *a priori* try to determine the sign of the bias using the omitted variable formula proposed by Greene (1993). Letting (a) be the estimate of the $RAT^{3,1}_{d,j}$ coefficient, α the true value of this coefficient and γ the true value of the failure rate coefficient (at the end of grade 1 and 2) $PF_{1\&2,j}$, we obtain:

$$(12.8) \quad E(a) = \alpha + \frac{Cov[RAT^{3,1}_{d,j}, PF_{1\&2,j}]}{Var[PF_{1\&2,j}]}\gamma$$

The sign of $Var[PF_{1\&2,j}]$ is **positive** by definition. The sign of γ is **negative**: the higher the failure rate, the lower the proportion of pupils with a NGR record at grade 3. This is the main result exposed in section 2.3. (see Table 12.4 and Graphs 12.3.1 and 12.3.2). Hence, if the sign of the covariance term is positive, the sign of the bias is negative. This leads to an underestimation of the true value of (a) and — by extension — of the cream-skimming factor's weight in the explanation of ability segregation.

The covariance term will be positive if schools reducing their enrolment size between grade 1 and grade 3 simultaneously have a lower failure rate. Do we have any indication that this is the case? Apparently yes (see Graph 12.5 for a visual presentation).

Graph 12.5 — Sign of Covariance between failure rates and evolution of enrolment size between grade 1 and grade 3. Deductive approach



We have seen in regression 3 of Table 12.4 that the proportion of pupils with a NGR record at grade 3 ($\overline{P}^{k=0}_{3,i}$) is **negatively correlated** with the failure rate at grade 1 and 2 ($\overline{PF}_{1\&2,j}$). Looking at Graph 12.5. we also find that the proportion of pupils with a NGR record at grade 3 ($P^{k=0}_{d,3,j}$) is **negatively correlated** with the evolution of the enrolment size ($RAT^{3,1}_{d,j}$). Combining those two observations, we can say that the higher the failure rate, the lower the proportion of pupils with a NGR repetition record, and the lower this proportion, the higher is the ratio between enrolment sizes at grade 3 & grade 1. In other words $\overline{PF}_{1\&2,j}$ and $RAT^{3,1}_{d,j}$ are **positively correlated.** The sign of their covariance should be positive and the underestimation bias in Table 12.5 for the coefficient of $RAT^{3,1}_{d,j}$ rather significant.

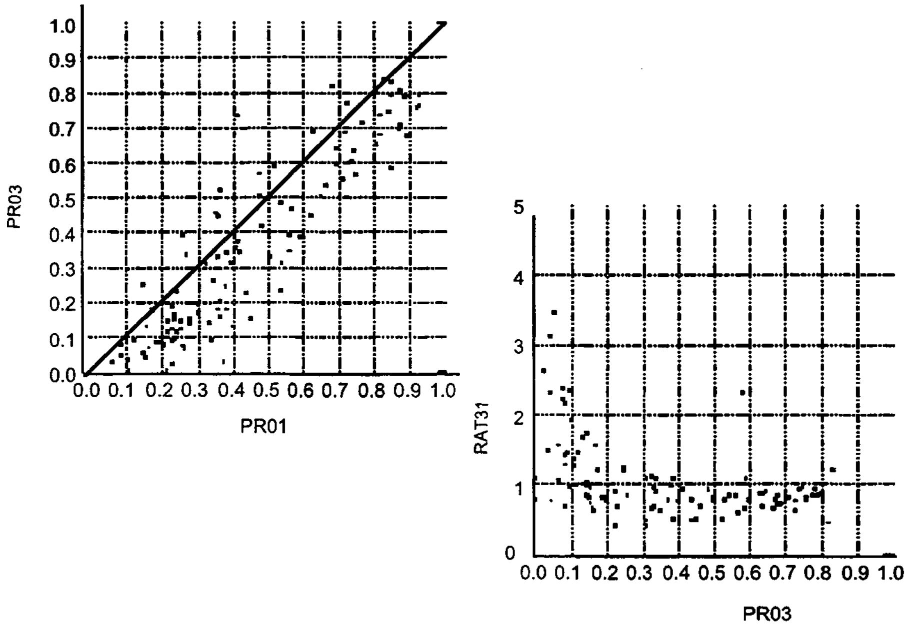
b) Urban district of Brussels

The argument of **inter-school transfers** must ideally be established at the district level. That is where those transfers are most likely to occur. Graph 12.6 — presenting the situation in the district of Brussels — confirms the OLS results of Table 12.5. Roughly speaking, the first part of Graph 12.6. indicates that schools which were in a 'bad' position at grade 1 — in the sense that their intake was principally composed of pupils with some grade-repetition history — tend to be in a similar position at grade 3. Some general reduction of the proportion of pupils with no grade-repetition is visible. This is the logical consequence of end-of-term evaluation: some pupils with no grade-repetition record fail at the end of grade 1 or grade 2.

It is important to note that top-of-the-scale schools do not undergo a dramatic reduction of their proportion of pupils with NGR record. According to our previous reasoning (section 2.1), explanation for this could be that those 'top' schools have lower failure rates.

However, the second part of Graph 12.6 suggests that the same observation can also be the consequence of 'cream-skimming'. When looking at the left part of Graph 12.6, we immediately notice that most schools with more than 30 percent of pupils with NGR record at grade 3 have smaller intakes at grade 3 compared to grade 1. By contrast, a large number of schools with less than 30 percent of pupils with NGR record increase their intake dramatically.

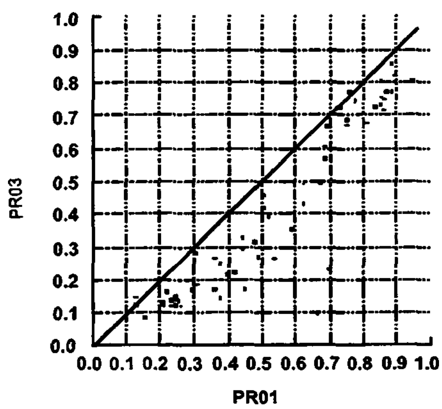
Graph 12.6 — Evolution of the proportion of pupils with no grade-repetition record between grade 1 (PR01 $\equiv P^{k=0}_{d=\text{Brussels},1,j}$) and grade 3 (PR03 $\equiv P^{k=0}_{d=\text{Brussels},3,j}$). Evolution of the enrolment size between grade 1 and grade 3 (RAT31 $\equiv RAT^{3,1}_{d=\text{Brussels},j}$ ·). School year 1991-92. Secondary education. District of Brussels

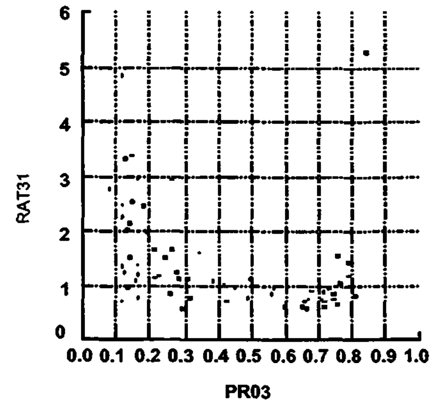


c) Urban district of Liège and rural districts of the Luxembourg province

The analysis developed for the district of Brussels can be reproduced for the district of Liège (see Graph 12.7). Tendencies are similar: the proportion of pupils at grade 1 with no-repetition record is the best predictor of the situation at grade 3. Schools in a 'good' position in the initial hierarchy tend to preserve this position later on. Signs of redistribution of pupils with grade-repetition records are visible graphically. Like in the district of Brussels, enrolment expansion (reduction) is synonymous with a lower (higher) proportion of pupils with no grade-repetition record. Once again, this result hints at cream-skimming.

Graph 12.7 — Evolution of the proportion of pupils with no grade-repetition record between grade 1 (PR01 $\equiv P^{k=0}_{d=\text{Liège},1,j}$) and grade 3 (PR03 $\equiv P^{k=0}_{d=\text{Liège},3,j}$). Evolution of the intake between grade 1 and grade 3 (RAT31 $\equiv RAT^{3,1}_{d=\text{Liège},j}$). School year 1991-92. Secondary education. District of Liège

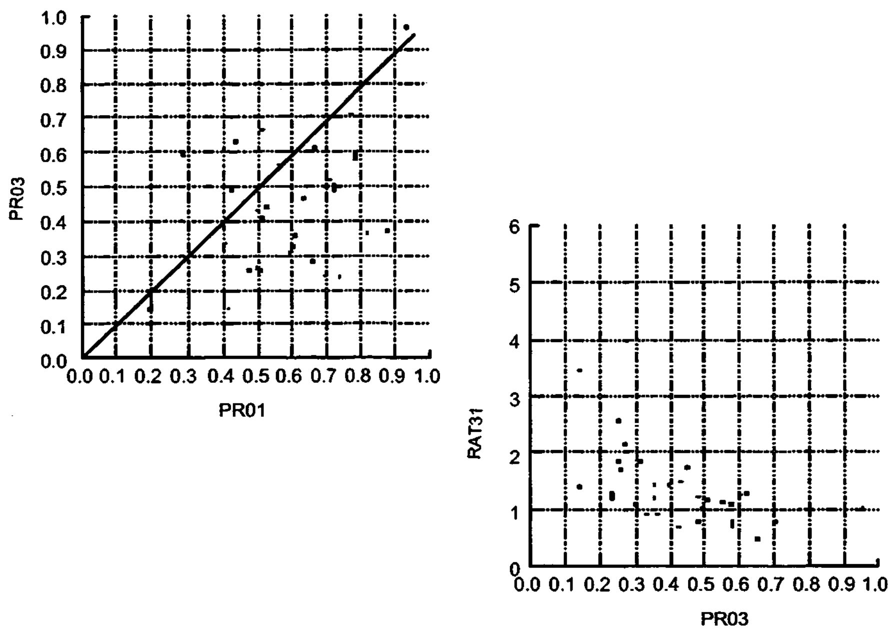




The situation in the rural districts forming the province of Luxembourg is a bit different. This observation is interesting because school choice is much more limited than in the two previous districts, Brussels and Liège. Graph 12.8. suggests that the hierarchy along the grade line is much less stable than in those districts, at least at the beginning of secondary education[25]. The proportion of pupils with no grade-repetition record is no longer a good predictor of the corresponding proportion at grade 3. However, some redistribution of pupils between schools takes place (see second part of Graph 12.8) and this phenomenon significantly determines a school's position in the hierarchy at grade 3. Compared with the situation of the urban districts of Brussels or Liège, this could mean that the 'cream-skimming' process does not systematically originate in schools that are at the top of the hierarchy at grade 1.

25 Indeed, we have observed that the hierarchy observed at grade 3 roughly persists at grade 5. In addition, no major redistribution of pupils seems to occur.

Graph 12.8 — Evolution of the proportion of pupils with no grade-repetition record between grade 1 (PR01 $\equiv P^{k=0}_{Lux.,1,j}$) and grade 3 (PR03 $\equiv P^{k=0}_{Lux.,3,j}$). Evolution of intake between grade 1 and grade 3 (RAT31 $\equiv RAT^{3,1}_{d=Lux.,j}$). School year 1991-92. Secondary education. Province of Luxembourg



3. CONCLUSION

Section 1 of this chapter contains empirical evidence that school choice favours 'ability' segregation: the less concentrated the local quasi-market, the more dramatic inter-school segregation. As regards to peer effects, school choice in the quasi-market seems to generate allocative inefficiency.

The more developed is school choice, the more frequent is ability segregation. Yet, when peer effects exist, optimality — be it defined by reference to a social objective in terms of maximal surplus or equal achievement for all at minimal cost — seems to require maximal desegregation. If there is no effort incentive problem — in the sense that we have reasons to believe that teachers automatically produce the maximal effort compatible with their participation constraint — segregation can be synonymous with inefficiency. Peer effect is an input in its own right. An egalitarian distribution of this input can induce a **higher** average level of effort than a less egalitarian one. If there is *a priori* an accountability problem (i.e. an effort incentive problem), the allocation of peer effect probably determines its seriousness. We have seen in chapter 7 that a highly segregated quasi-market could be synonymous with 'poor' accountability (effort) incentives, especially in schools with a 'bad' reputation. Evidence of strong segregation identified here should be interpreted as potential evidence — but not empirically proven evidence — of a poor accountability (effort) incentive.

Section 2's exact purpose was to evaluate the extent to which this particular form of segregation — and the corresponding misallocation of peer effects — can be attributed to the quasi-market's supply side. In other words, can we reasonably claim that segregation is orchestrated by the most reputed schools that skim-off the cream?

Segregation measured by dissimilarity indexes — the proportion of pupils with a no-grade-repetition history that should be reallocated among schools to get an even distribution — rises along the grade line: it is more important at grades 3, 4 and 5 than at grade 1. This is a first evidence that polarisation between schools is positively correlated with the (cumulative) evaluation process totally controlled by the suppliers. Our cross-grade analysis in section 2 has entitled us to confirm this first sign of cream-skimming. We have indeed accumulated indications that schools that score best at grade 1 — in the sense that their intake is principally composed of pupils with no grade-repetition record — manage to keep this position at grade 3 or grade 5 partly[26] because some redistribution of pupils systematically occurs. Top-of-the ladder schools undergo a 10 to 25 percent reduction of their intake between grade 1 and grade 3 while, at the other end of the spectrum, some schools dramatically increase their enrolment size.

Simultaneously, we must concede that the grade-repetition record at grade 1 is still the best predictor of the corresponding proportion at grades 3, 4, 5 or 6. The interpretation of this evidence is not univocal. One could argue for example that this is a clear indication that the main part of inter-school segregation amounts to a self-selection process. Parents and pupils with a grade-repetition record at the end of elementary school spontaneously gather in some schools while the others decide to attend different schools. This initial voluntary sorting would then persist along the grades with only a marginal alteration due to selection orchestrated by teachers and school heads (*ex post* cream-skimming). But this in only one possibility. Yet, one could also argue that the dramatic segregation observed at grade 1 reveals very selective admission policies (*ex ante* cream-skimming).

26 Partly because the other explanation lies in end-of-term failure rate differentials: schools that rank best at grade 1 have lower failure rates.

Conclusion and further reflections

Echoing Bowles & Gintis (1975), the different sections of this thesis have developed the idea that the social organisation of schooling can in no way be totally depicted as the result of an aggregation of individual preferences co-ordinated by a price mechanism, be it subsidised or not. The human capital model must be completed by other approaches focusing on the functioning of the educational system. It can no longer be taken for granted that educational systems will mechanically implement the choice made by their private or public clients. The exploration of the black box's contents and logic is a stream of research in its own right. Our analysis has highlighted the complexity of this problem. To elaborate an educational policy requires more than public financing of educational efforts. Some conceptual and analytical (both theoretical and empirical) effort is needed to understand the black box's functioning and identify the key variables at stake.

1. COMMENTS ABOUT OUR RESULTS

1.1. Summary

a) Conceptual framework

Our survey of production function analyses — a first attempt to overcome human capital theory — has led to the conclusion that no clear and indisputable relation exists between both expenditure per student and specific resources they can buy (teacher 's degree, seniority or experience, smaller student-teacher ratios...) on the one hand, and student achievement on the other. The only well established result — recently confirmed by a survey (Haveman & Wolfe, 1995)— is that socio-economic origin is decisive. Schools differ dramatically in 'quality' but this appears to result from differences between teachers' skills that defy detailed description and empirical causal analysis (Hanushek, 1986).

We have argued that the reason for this deadlock could be that traditional production function research in Economics of Education relies upon a too simple — actually too mechanical — conception of the production process. Regression techniques are more and more sophisticated but their conceptual background is still very similar to the technological conception of production conveyed by micro-economics textbooks. The implicit idea is generally that transforming inputs to outputs is merely a matter of choice between efficient production techniques. It is common to present production possibility frontiers as a purely technical relationship, void of any economic content. From our point of view, some conceptual development around the idea of human capital production is necessary to overcome the analytical — and also political — limitations illustrated for example by the endless 'school quality' debate in the US (Betts, 1995 ; Card & Krueger, 1996).

We have attempted to achieve this objective by focusing on three ideas: intra-school organisation, school choice and social interaction synonymous with social and local spillover.

Several case studies (Monk, 1992), but also nation-wide empirical research (Hanushek, 1986, 1992) tend to confirm the critical role played by intra-organisational attributes. Internal organisation of schools is a very puzzling issue wherein numerous variables play a role (administration, curricular arrangements, scheduling, tracks....). However, a parameter of central importance is **teacher effort**. Our standpoint is that effort-prone teachers is a necessary — though not sufficient — condition to get well organised schools. Effort can be understood both in a restricted or large sense. It might simply refer to the necessity to stimulate individual effort and increase accountability. In a larger sense, the notion of effort could also echo the whole idea of co-ordination across grades and subject matters. In that case, effort can correspond to the difficulty to overcome the fear of team-work and evaluation by colleagues. This difficulty seems particularly prevalent in the teaching profession.

Our second idea is the key role played by the **regulatory principle** regarding effort inducement. We have attempted to evaluate the potential of a particular one: school choice within publicly financed education systems i.e. quasi-markets. Reasons for this choice are twofold. First, economists are quite familiar with competition-based regulatory approaches and have a long tradition of evaluating their performance. Secondly, school choice and market-oriented schools are becoming more and more popular in western countries.

The third idea we put forward is that effort is only one face of the coin. The capacity to mobilise **non-monetary input** is probably as important as effort inducement, and both dimensions are inextricably related. Non-monetary inputs basically amount to social interactions called 'peer' effects in the school context — some people also use the term 'contextual' effects. By social interaction, we refer to the idea that the knowledge a child assimilates during a school year depends directly on the characteristics or actions of his comrades. In other words, education is one of those numerous human activities characterised by social spillovers. The incorporation of social interaction as a determinant of the human capital production process is central to our thesis.

b) Theoretical analysis: first best results

From a theoretical point of view, our work has contributed to identify and discuss the first best outcome of an educational system wherein effort delivered by individual teachers and peer effect — the local social spillover in the classroom — matter. The main results show that maximisation of society-wide human capital return implies both absence of teacher surplus (maximal effort) and allocative efficiency. We can say that perfect desegregation is advisable if simultaneously:

[I] The intensity of the peer effect spillover rises with the proportion of high-ability pupils at a decreasing rate i.e. the peer effect variable is concave.

[II] Low-ability pupils are more sensitive to peer effects than their more able peers.

[III] Peer effects have a decreasing marginal productivity beyond a certain threshold.

Those conditions are not directly influenced by the kind of social utility function used in the model. If the social planner's objective is to achieve equality of gross achievement at a minimal cost, perfect desegregation will necessarily be his first best policy if conditions [I], [II] and [III] are verified.

We assume condition [III] to be verified simply because peer effects — like more common inputs — possibly show decreasing marginal productivity. Empirical work suggest that the two other conditions are verified at the primary and secondary level at least. Henderson, Mieskowski & Sauvageau (1978) were the first to clearly conclude that condition [I] is verified. A more recent study, conducted by French researchers (Leroy-Audouin, 1995) focusing on primary education in France, concludes that condition [II] is also verified : low-ability children are more sensitive to peer effects than their more able comrades. A more recent study, carried out by Gamoran & Nystrand (1994) on US secondary education data, corroborates this conclusion.

c) Theoretical analysis: second best results

The other fundamental result is that school choice is not necessarily the optimal determinant for the allocation of educational inputs: its capacity to achieve the first best outcome described before is limited in the sense that it is conditional upon an impressive number of rather contingent circumstances.

c.1) School reputation is a continuous variable

First of all, when school 'reputation' is a continuous variable, the existence of a Nash equilibrium is not automatic. Typically, if too many parents exercise their exit option simultaneously, the system becomes extremely unstable. Immediate and massive shifts of the demand side of the market explain the suppliers' difficulty to define their optimal strategy. Imagine there is no reputation differential. Each player has *a priori* an incentive to outbid his rival: a marginal effort increment generates a complete shift of the demand and gives him a 'cream-skimming' privilege synonymous with high peer effect endowment during the following school year. Outbidding is rational up to the point where costs in terms of effort are inferior to the maximal potential benefits in terms of peer effect (i.e. the difference between maximum and minimum peer effect level). Yet, this threshold cannot be an equilibrium. If both players simultaneously produce this threshold effort, the benefits no longer cover the costs. The payoff function is indeed discontinuous. By comparison, each school prefers to produce no effort. But if one of the two schools decides to produce no effort, the optimal answer of the second school is no longer to produce this threshold effort but just marginally more than its opponent. The circular outbidding process is potentially endless. This result is still valid when some reputation differential is introduced.

The only factor that is likely to stabilise this game is the participation constraint. When there is no reputation differential, the higher the potential payoff in terms of peer effect, the more likely the players will hit their participation constraint during the outbidding process. By definition of the participation constraint, none of the players is incited to outbid in order to acquire a better reputation. If the peer effect payoff attached to the equal reputation situation is higher than the one corresponding to the 'bad' reputation, equal effort saturating the participation constraint will be a Nash equilibrium. In addition it will be socially optimal by definition of the participation constraint. If this is not the case, our model leads to the conclusion that no Nash equilibrium exists.

In case some reputation differential exists, the magnitude of the payoff function also increases the likelihood of a Nash equilibrium. Yet, this equilibrium is synonymous with no effort. School 2 renounces to the high-ability pupils because the effort it would have to deliver to overcome its 'bad' reputation is too high. Consequently school 1 can keep its 'good' reputation without any effort. This situation is socially underoptimal because no effort is produced and because segregation persists in the long run.

c.2) School reputation is a binary variable

We have seen that in a quasi-market with reputation-sensitive clients and reputation operating as a binary variable, the absence of reputation differential leads to a symmetric equilibrium. The notion of binary variable simply reflects the idea that, in the real world, what matters is the possession of a diploma, certifying that its holder possesses a certain knowledge and is consequently able to undertake higher education or exert a particular job. The key point for parents is thus to find a school where they can expect — they indeed operate on the basis of relative reputations — their children to reach that threshold. In other words, if pupils coming out of secondary school i get their degree, or successfully apply for college, parents will consider school i as 'good' for their children. If it is not the case, the school will be classified as 'bad'. Both schools will be considered as 'good' or 'bad' if they have the same outcome at the end of the school year.

Depending on the reputation threshold level, this equilibrium will be synonymous with effort or absence of effort. The higher this threshold, the more likely the no-effort situation. If desegregation is socially desirable, both equilibria are of equal value. The bilateral effort equilibrium logically dominates the no-effort equilibrium because the former does limit the surplus left with teachers. There is no guarantee however that this level of effort will be socially optimal.

The introduction of a reputation differential generates the additional possibility of an asymmetric equilibrium. The 'good' school produces the level of effort necessary to maintain its better reputation and preserve its cream-skimming privilege. The 'bad' school prefers to produce no effort and continues to work with low-ability children. The reputation differential persists. If heterogeneity is required to achieve allocative efficiency, this situation is problematic. Inefficiency also stems from the fact that some surplus is abandoned to the teacher. The 'good' school's effort can be underoptimal and the bad school's effort nil.

c.3) Product differentiation

It turns out that some level of product differentiation improves the functioning of educational quasi-markets. Diversity of products (and tastes) prevents unbridled competition for clients synonymous with no Nash equilibria — in our duopoly model.

It should be clear that product differentiation is synonymous with cost: parents can get a more efficient school (i.e. wherein teachers produce more effort), but must generally renounce to other characteristics of education their like. Families support utility loss when attending a school that is not offering their preferred educational style, curricula... The general idea is thus that the benefits of school choice apparently need to come at a certain cost to the individual to ensure school choice is an efficient regulatory mechanism. But we know that quasi-markets are based on a free-of-charge idea. Fees and charges being absent or banned of the quasi-market, product differentiation is the only way to ensure that the benefits of school choice comes at a certain cost.

Product differentiation means [I] that schools offer different kind of products (curricula, education styles or location...), [II] that those products are no uniformly valorised by the clients i.e. preferences are heterogeneous and [III] not ability-biased (both low and high-ability pupils are evenly distributed on the segment symbolising preferences). Condition [I] is easily verified. Verification of condition [III] is likely although some observers (Levin , 1991) have serious doubts about this. We believe that condition [II] is the most problematic one. In many cases, 'objective' differences in terms of curricula and educational styles are completely occulted by strong hierarchies, generally deep-rooted in the public's mind. To neutralise these hierarchies in order to let genuine product differentiation emerge is a puzzling challenge for most regulators around the world. Its analysis is beyond the scope of this work.

d) Theoretical analysis: regulation

What kind of regulatory framework a social planner (financing the educational quasi-market) can (should) adopt to enhance efficiency i.e. maximise human capital coming out of schools? Correspondence between social priorities and each school's interest cannot be taken for granted. In other words, inefficiency cannot be eliminated simply by 'informing' the decentralised decision makers (schools) on recruitment choice (perfect desegregation according to the results presented above) or effort levels that are socially desirable.

d.1. Cream-skimming deterrence scheme

If school zoning is discarded, the policy that comes to mind consists of using the financing formula to incite schools to revise their recruitment strategies. The regulator can steer recruitment practices simply by making the per-pupil amount allocated to schools conditional on the socio-economic composition of the school (the human capital endowment of the recruited pupils). This variable is probably publicly known or, at least, observable at a limited cost. Conditional allocation could (for example) correspond to the suppression of financial subsidy to schools insufficiently 'mixed'. In that extreme situation, school heads would obviously modify their recruitment policy.

d.2. Output-based formula

Once schools are totally dissuaded from 'skimming off the cream', the regulator has solved only one part of his problem. Indeed, the new equilibrium is probably synonymous with poor accountability. On a quasi-market, the level of peer effect a school benefits from is possibly the main source for teachers' payoff[1]. If the allocation of peer effects is totally prescribed by the regulator, schools might lack the minimal incentive to deliver effort. Several studies have suggested that a lack of effort or accountability could considerably alter the performance of educational systems (Chubb & Moe, 1990 ; Bowlse & Gintis, 1993). In the United Kingdom for example, the conservative party, presented quasi-markets as a crucial necessity to fulfil requirements imposed by citizens' interests i.e. efficiency and accountability. Hence, if the accountability problem is serious, the regulator must presumably complement his cream-skimming deterrence mechanism by some output-based financing formula.

d.3. Refined output-based formula: yardstick competition

Residual inefficiency potentially persists however. If the regulator does not perfectly know the cost function's parameters, the latter cannot appropriately decide upon the level of per-pupil expenditure. These limitations can be circumvented by a yardstick competition mechanism (Shleifer, 1985). The latter means that schools decide upon their effort level and their per-pupil cost

1 A teacher is sensitive to the aggregated characteristics of his pupils. In other words, the level of peer effects enters into his utility function. He wants to maximise the level of this local social spillover in his school or classroom simply because this is synonymous with greater comfort.

(expenditure)[2]. Most importantly, — in a district with two schools for example — school 1's revenue is based on its relative performance in terms of output and per-pupil cost. The higher its effort, the higher its per-pupil income. The lower its cost, the higher its income too. But the same is true for school 2. Hence, the higher school 2's effort, the lower school 1's per-pupil income and the lower school 2's cost, the lower school 1's income.

We have demonstrated analytically that a combination of cream-skimming deterrence and yardstick competition embedded in the financing scheme, can generate the first best outcome.

d.4. Bribes for high-ability families?

One could reasonably argue that the regulator's problem is a bit more complex than simply imposing his social priorities on schools and teachers: he probably has also to impose them on (strategic) parents[3]. A 'public choice' perspective would indeed indicate that parents are political clients, that they can dismiss politicians (regulators) or boycott their fiscal duties when displeased with an educational policy. Note that even if the cost of attending a desegregated school is extremely limited, bypass — if feasible — is likely to occur. Private parties are sensitive to peer effects when these are beneficial to their children. Yet, they most likely ignore the social benefits or costs of their individual decision: they ignore the effect of their school choice on the quality of peer effects in the rest of the educational system.

To persuade these high-ability families to — voluntarily — attend desegregated schools, their contribution to cost should be inferior to that of low-ability families. If the social planner is not sensitive to distribution issues — at least for the parents' generation — it is easy to show that this policy is Pareto-improving in the sense that low-ability families are better off in the long run even when their contribution to cost is raised. The human capital surplus their children obtain by attending the same schools as their more able peers more than offsets the extra financial cost they bear.

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2 To this point, we have always supposed that the per pupil expenditure was *a priori* fixed by the regulator.

3 Note that in Belgium, parents can 'collude', establish a new school and get public money, provided they respect some basic conditions : enrolment size must be significant, teachers hired must have the appropriate diplomas, and the school must accept the annual visit of a government officer. The constitution imposes to the State to finance private educational initiatives.

Some major limitations exist however. Bribery is optimal only if there is perfect commensurability between money and disutility entailed by desegregation. But can money really 'buy' disutility attached to the presence of 'different' pupils? So far, we have assumed that the 'difference' among pupils was synonymous with ability differentials. Yet, people do not only differ in terms of ability but also in their beliefs, cultural sensitivity, ethnicity or political conviction. People can indeed be of equal ability but dramatically diverge when it comes to moral and religious values. This simple observation raises questions that are all particularly enigmatic and go far beyond economic reasoning.

d.5. Fear of signal jam

Eventually, as segregation might be driven by a signalling problem, its eradication could be conditional to persistence — or even reinforcement — of an accurate evaluation before entrance into the labour market. Last stage evaluation must accurately reflect **gross** human capital endowment. A very selective admission policy at post-secondary stage would have the same function: it would facilitate the implementation of desegregation policies at primary and secondary levels by attenuating the fear of signal jam.

e) Empirical evaluation of quasi-markets in the French-Speaking Community of Belgium

Our empirical work centred on the quasi-market of the French-Speaking Community of Belgium contains strong evidence that school choice — measured by low Herfindahl concentration indexes or other proxies of school choice — exacerbates 'ability' segregation: the less concentrated the local quasi-market, the more dramatic inter-school segregation.

When controlling for the importance of ability (and socio-economic) discrepancy among children (and inhabitants) of a district and the distance between schools, we get the same results. **Extensive school choice** in the local quasi-market exacerbates segregation all other things being constant. This result casts doubts about the capacity of quasi-markets — as they operate and are regulated in the French-Speaking Community of Belgium — to properly internalise the externalities i.e. achieve an egalitarian allocation of peer effects across schools and prevent situations where effort is insufficient. We have seen in chapter 7 that a highly segregated quasi-market could be synonymous with 'poor' accountability (effort) incentives, especially in schools with a 'bad' reputation concentrating low-ability children.

The same line of research highlights the fact that inter-school segregation is significant and rises along the grade line: it is more important at grades 3, 4, 5 than at grade 1. We interpret this result as an evidence that ability segregation among schools is positively correlated with the (cumulative) evaluation process. The latter is totally controlled by the suppliers in the French-Speaking Community of Belgium. Our cross-grade analysis enables us to confirm this first indication of possible 'cream-skimming'. We have indeed accumulated signs that schools scoring best at grade 1 — in the sense that their intake is principally composed of pupils with no grade-repetition record — manage to keep this position at grade 3 or grade 5, partly because some redistribution of pupils systematically occurs. Top-of-the ladder schools undergo a 10 to 25 percent reduction of their intake between grade 1 and grade 3 while, at the bottom-end of the spectrum, some schools dramatically increase their enrolment size.

Simultaneously, we must concede that the proportion of pupils with a grade-repetition record at grade 1 is still the best predictor of the equivalent proportions at grades 3, 4, 5 or 6. Interpretation of this evidence is not univocal. One could argue for example that this is a clear indication that the main part of inter-school segregation amounts to a self-selection process. Parents and pupils with a grade-repetition record at the end of elementary school spontaneously gather in some secondary schools while the others decide to attend different ones. This initial voluntary sorting would then persist along the grades with only a marginal alteration due to selection orchestrated by teachers and heads of school (*ex post* cream-skimming). But this is only one possibility. One could also argue that the dramatic segregation observed at grade 1 reflects very selective admission policies (*ex ante* cream-skimming). Remember also that our theoretical analysis has highlighted the conceptual closeness of selection and self-selection: the latter might simply reflect the low-ability families' anticipation of selective admission or evaluation practices.

1.2. Analytical and policy implications

We believe our work presents analytical features that are of some interest concerning educational problems, but also more general issues.

a) Heterogeneous individuals

First, our work has placed heterogeneity of individuals at the heart of economic reasoning. Co-ordination challenges in our model arise partly because pupils show different abilities, i.e. fundamentally diverge in terms of human capital endowment. This research orientation follows a long run tendency in economics which is to move away from a 'representative individual' and an undifferentiated homogeneous capital framework.

b) Beyond efficiency-equity trade-off

Second, our work tends to support the idea that the traditional opposition between efficiency and equity (the traditional trade-off idea) is partly irrelevant. In our model, increased inequality of educational achievement is potentially synonymous with less human capital in the whole society.

c) Endogenous social variables

Third, our focus on local social spillover (i.e. peer effects) constitutes a modest attempt to incorporate sociological dimensions into the economic paradigm. Our focus on peer effect relates to the idea of social capital (Coleman, 1988). Indeed, contrary to traditional work in mainstream economics, our model internalises sociological variables. Their level directly affects choices made by individuals (families, schools, teachers). This conveys the idea that outcome is more than the simple result of an individual's effort. The immediate social environment directly influences both the level of effort that the individual will retain and the outcome of that effort. Some form of social conditioning appears in our model.

Note also that social contextualisation is not absolute. We have indeed indicated that the social variable is endogenous. The combination of heterogeneity among individuals and entity-bound social spillover shows that individuals — at least some of them — can actually choose the kind of social determinism they will be exposed to simply by selecting the social characteristics of the entity (firm, area, school...) where they live, work or learn.

d) New public policy challenges

Fourth, our model conveys the message that the role of public authority in western societies is bound to evolve. Its traditional role of money collector and welfare provider based on both a progressive tax system and various forms of conditional — targeted — or unconditional transfers shows some limitations. Inefficiencies (e.g. non-internalised externalities) or inequalities occur despite the public nature of many financing mechanisms. Modern western societies have to cope with co-ordination challenges requiring more than public financing. Adequate answers call for new forms of intervention which are probably more complex to implement. In our model, for example, the regulator's fundamental problem is to generate effort or influence the allocation of heterogeneous individuals in order to fully exploit social interactions. His role is to define incentive financing formula, prevent cream-skimming, encourage mixing or avoid signalling jam.

2. FURTHER REFLECTIONS

2.1. The growing importance of human capital

Traditional arguments in favour of human capital accumulation are still prevalent and probably relevant. Many social challenges imply human capital enhancement: productivity gain slowdown, rise of inequality, violence, health, multi-culturalism and political participation in democratic societies.

More than ever, education is perceived as a vital issue by the vast majority of the population regarding economic success and development. The relative wage premium for College or University degree holders has increased significantly during the 80's both in the US and in Europe. Employers are more and more demanding too. They believe that a better educated working force is a decisive condition for economic success in a more integrated economy where technological evolution is constantly accelerating. Both sides ask for genuine quality (Maroy, 1992) i.e. 'real' knowledge supplied by efficient schools and accountable teachers.

The growing focus on human capital could also partly reflect the growing importance of technology. More rudimentary techniques had possibly the — rather unsuspected — consequence of hiding human capital differences among individuals or at least limiting their use with regard to employment decisions and remuneration policies. The current skill-biased technological change (Piketty, 1994) introduces a major change with this respect. Technological progress tends to highlight existing human capital differences and accentuate them. Workers who are recruited to use new technologies are among the most able but, in turn, get more opportunity to increase their competence and lifelong income. Simultaneously, low skilled individuals are more and more likely to get caught in low paid jobs, unemployment and poverty status.

2.2. The necessity to develop an economic analysis of human capital production outside traditional education systems

Education inside traditional — full-time — systems cannot meet the great human capital challenge with all respects. If we take for granted that demand for human capital will continue to grow steadily, we then have to question both the capability and the opportunity for existing — full-time — formal educational systems to remain the principal institutionalised answer to human capital needs.

Our priority in this thesis has been to explore the puzzling and exciting issue of efficiency inside formal and full-time educational systems. We still believe this issue is of central importance. Yet, we would like to conclude by inviting analysts and policy-makers to focus on complementary inputs that heavily determine the effectiveness of formal education. Our analysis of educational quasi-markets has highlighted some economic concepts and mechanisms that might be of some help to understand other sectors of our society wherein human capital production potentially occurs.

a) Families

Education occurs in first instance inside families. Over the last decades, significant shifts have been observed at this elementary social level. Some of them might have strong impacts on the domestic production of human capital. There is the well-documented phenomenon of expanding single parenthood. Besides, some empirical studies (Murphy & Welch, 1993) identify a rising correlation between both educational attainments and income levels of husbands and wives. Kremer (1994) indicates that the rise in divorce rates has contributed to reinforcing that correlation. His analysis suggests that the marital matching process tends to be a 'learning by doing' one. Along this line of reasoning, families no longer play a major role of social insurance and redistribution of human capital endowments.

b) Neighbourhoods

Cream-skimming and socio-economic segregation mechanisms identified in the educational context are probably complements to identical processes in the residential market (Bénabou, 1993 ; Fernandez & Rogerson, 1993). These concepts might help understand the systematic division of cities into 'good' and 'bad' areas. According to Case & Katz (1991) the company kept by low income people in neighbourhoods has a significant impact on their patterns of human capital accumulation.

If the public authority has little or no control over family patterns[4], their role concerning residential trends is potentially more significant. Residential segregation can be encouraged by the importance of decentralisation. The more local the provision and financing of some public goods (education, sports facilities, theatres...), the more likely the propensity of residential segregation (Bénabou, 1993) and the corresponding misallocation of social spillovers.

2.3. A special focus on firms

Gradually, companies will probably increase their role regarding human capital accumulation. Reasons for this are threefold. Public finances run into great trouble. The mid-70's coincided with the first major public finances' crisis since the end of World War II. The economic growth slow-down and the relative failure of Keynesian economic policies implemented during the late 70's, combined with the rise of real interest rates, led to an explosion of public deficits. These deficits gave birth to dramatic public debts: between 1970 and 1994, most advanced and industrialised western nations (G7 countries) doubled their public debt–GDP ratio.

a) The cost disease

The progressive erosion of the state quasi-monopoly over education — if we except domestic production of human capital or what is directly related to neighbourhood — might be reinforced by the 'cost disease' phenomenon (Baumol, 1993). Personal services like education, health care or insurance services show low productivity gains especially in relative terms. Each of these sectors happens to be an economic activity whose technology does not lend itself to rapid productivity growth. The result is that each of them has a record of productivity growth slower than that of the economy as a whole. This potentially means rising (relative) costs of education in real terms. Part of the answer to this latent problem might be found in a re-aggregation of learning and production activities: the latter directly financing the former. Note that a polar case

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4 Note that this standpoint would probably be contested in the US by opponents of the AFDC program: the Aid to Families with Dependent Children aims at providing welfare support to single mothers. They argue that this program has contributed to the explosion of teenager pregnancies, marital disruption, correlated with subsequent social problems (unemployment, school dropout...).

of production-learning 'aggregation' is 'learning by doing', another one is Research & Development.

Transfers from production activities to education will still be required. However, one can hope that these internal transfers will happen more spontaneously — they might be invisible in the sense that no separate budget for training activities will appear in the balance sheet although some production of human capital occurs — and avoid distortion costs entailed by taxes and transfers orchestrated by the State.

b) Firms as prime knowledge producers

Finally, it seems more and more obvious that some form of knowledge is monopolised by firms and intrinsically related to the production process. If this is true, the research agenda for human capital analysts will have to expand. Just like formal, full-time educational systems, firms must be scrutinised and cautiously analysed. A black box approach will rapidly prove unsatisfactory.

b.1) The well-known poaching problem

It is known that firms (as well as workers) have an incentive to invest in firm-specific training but that there is a spillover problem with general training that can lead to under-investment (Becker, 1964). Germany's apparent success with regard to this problem deserves a lot of attention. Harhoff & Kane (1993) discuss the structure of incentives supporting the German system of apprenticeship training. Many German firms face large net costs of apprenticeship training. Yet they continue to provide such training in spite of considerable worker turnover upon completion of training. The simplest human capital model suggests that employers would be willing to finance only firm-specific training. Part of the explanation might lie in the characteristics of the German labour market: rigid wage scales, implemented — and respected — sector by sector.

b.2) The labour market polarisation problem

Besides, recent labour market changes (Piketty, 1994 ; Murphy & Welch, 1993) are worrying with regard to 'on the job training' possibilities. Smaller wage dispersion inside companies but greater divergence between companies (Gibbons & Katz, 1992) attests to a general tendency towards greater segregation among workers with different human capital endowment. Indeed, using the conceptual apparatus we have developed in the school context, it is easy to understand why high-ability individuals prefer to work in segregate professional environments: the 'quality' of peers can be one reason for this. Like schools or families, employees and employers are potentially incited to accumulate social capital.

If firms substantially differ in terms of peer effect endowment (or social capital), we can expect human capital accumulation inside those firms to diverge. As a result, human capital accumulation paths can persistently differ among social and/or ethnic groups. This result seems to coincide with recent (controversial) empirical findings in the United States (Herrnstein & Murray, 1994). When 'rich' individuals tend to isolate themselves from the rest of the population — at family level, in the neighbourhoods, schools and firms — do they accumulate proportionally more human capital than the poor tend to loose? Are there socio-economic processes that can become less efficient because of great heterogeneity of human capital attainments? We could certainly expect democratic deliberation to become more difficult beyond a certain level of heterogeneity among citizens.

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Appendix

Appendix IV. 1: Inter-school dissimilarity. Secondary education 1991-92, all grades, proportion of pupils with a grade-repeating-record by district and inter- school dissimilarity indices. School year 1991-92. French-Speaking Community of Belgium.

District (d)	Grade (i)	Number of pupils ($EL_{d,i}$)	$P^0_{d,5}$	$P^1_{d,5}$	$P^2_{d,5}$	$P^{\geq 2}_{d,5}$	$D^0_{d,5}$	$D^1_{d,5}$	$D^2_{d,5}$	$D^{\geq 2}_{d,5}$
All districts	All grades	334509	0,45	0,27	0,17	0,28				
Brussels	1	12824	0,54	0,30	0,13	0,17	0,45	0,26	0,44	0,57
Nivelles	1	4506	0,66	0,24	0,09	0,10	0,37	0,27	0,38	0,55
Ath	1	854	0,64	0,28	0,07	0,08	0,43	0,36	0,38	0,69
Charleroi	1	5619	0,56	0,29	0,13	0,15	0,4	0,25	0,36	0,52
Mons	1	3502	0,65	0,25	0,09	0,10	0,37	0,29	0,36	0,58
Mouscron	1	1336	0,63	0,28	0,08	0,09	0,26	0,19	0,35	0,6
Soignies	1	2555	0,64	0,26	0,08	0,09	0,35	0,27	0,34	0,51
Thuin	1	1770	0,64	0,27	0,08	0,09	0,35	0,23	0,43	0,47
Tournai	1	2231	0,63	0,24	0,11	0,13	0,42	0,29	0,41	0,62
Huy	1	1277	0,67	0,23	0,09	0,10	0,44	0,31	0,48	0,44
Liège	1	7521	0,62	0,26	0,10	0,12	0,41	0,27	0,45	0,52
Verviers	1	2695	0,70	0,23	0,06	0,07	0,39	0,31	0,47	0,55
Waremme	1	874	0,71	0,22	0,07	0,07	0,24	0,19	0,4	0,35
Arlon	1	941	0,63	0,24	0,10	0,14	0,27	0,18	0,23	0,39
Bastogne	1	536	0,75	0,21	0,03	0,04	0,26	0,26	0,25	0,91
Marche-fam.	1	616	0,67	0,25	0,07	0,07	0,2	0,13	0,31	0,71
Neuchateau	1	964	0,73	0,20	0,06	0,07	0,33	0,26	0,35	0,5
Virton	1	678	0,68	0,24	0,06	0,07	0,3	0,26	0,32	0,67
Dinant	1	1461	0,64	0,28	0,07	0,08	0,26	0,22	0,36	0,65
Namur	1	4037	0,65	0,26	0,08	0,09	0,36	0,25	0,4	0,72
Philippeville	1	793	0,58	0,31	0,10	0,11	0,26	0,21	0,26	0,54
Brussels	2	12591	0,44	0,30	0,19	0,26	0,49	0,21	0,41	0,5
Nivelles	2	4495	0,57	0,28	0,13	0,15	0,37	0,2	0,41	0,5
Ath	2	889	0,55	0,30	0,13	0,15	0,47	0,31	0,4	0,55
Charleroi	2	5871	0,46	0,30	0,19	0,24	0,41	0,19	0,37	0,4
Mons	2	3611	0,53	0,29	0,14	0,18	0,42	0,26	0,36	0,35
Mouscron	2	1359	0,49	0,31	0,16	0,20	0,41	0,24	0,34	0,49
Soignies	2	2604	0,55	0,29	0,14	0,16	0,43	0,25	0,39	0,57
Thuin	2	1741	0,52	0,30	0,14	0,18	0,41	0,25	0,32	0,38
Tournai	2	2296	0,58	0,28	0,12	0,14	0,42	0,3	0,38	0,58
Huy	2	1284	0,58	0,27	0,12	0,15	0,45	0,25	0,47	0,63
Liège	2	7783	0,52	0,29	0,16	0,20	0,45	0,23	0,39	0,54
Verviers	2	2771	0,60	0,27	0,11	0,13	0,46	0,31	0,45	0,54
Waremme	2	988	0,60	0,25	0,12	0,14	0,3	0,21	0,24	0,5
Arlon	2	955	0,56	0,26	0,15	0,18	0,29	0,12	0,35	0,33
Bastogne	2	555	0,65	0,29	0,05	0,07	0,26	0,19	0,35	0,36
Marche-fam.	2	596	0,59	0,27	0,12	0,14	0,37	0,25	0,36	0,49
Neuchateau	2	966	0,59	0,28	0,11	0,13	0,29	0,13	0,5	0,54
Virton	2	640	0,58	0,33	0,09	0,10	0,34	0,28	0,29	0,57

Appendix IV.1 (2nd)

District (d)	Grade (i)	Number of pupils ($EL_{d,i}$)	$P^0_{d,5}$	$P^1_{d,5}$	$P^2_{d,5}$	$P^{\geq 2}_{d,5}$	$D^0_{d,5}$	$D^1_{d,5}$	$D^2_{d,5}$	$D^{\geq 2}_{d,5}$
Dinant	2	1494	0,56	0,31	0,12	0,14	0,35	0,25	0,32	0,63
Namur	2	4331	0,54	0,31	0,12	0,15	0,4	0,26	0,37	0,55
Philippeville	2	778	0,53	0,31	0,14	0,16	0,29	0,17	0,28	0,47
Brussels	3	12575	0,38	0,26	0,21	0,36	0,54	0,17	0,35	0,52
Nivelles	3	4939	0,44	0,28	0,17	0,28	0,41	0,16	0,33	0,49
Ath	3	1036	0,44	0,28	0,18	0,28	0,42	0,22	0,29	0,49
Charleroi	3	6301	0,37	0,26	0,21	0,37	0,45	0,15	0,28	0,4
Mons	3	4016	0,43	0,27	0,18	0,29	0,44	0,18	0,33	0,41
Mouscron	3	1490	0,39	0,29	0,19	0,32	0,5	0,19	0,28	0,44
Soignies	3	2780	0,47	0,28	0,16	0,26	0,5	0,2	0,37	0,5
Thuin	3	1932	0,43	0,28	0,19	0,30	0,45	0,11	0,32	0,51
Tournai	3	2645	0,42	0,27	0,20	0,31	0,48	0,21	0,37	0,39
Huy	3	1328	0,48	0,28	0,16	0,24	0,5	0,22	0,36	0,52
Liège	3	8397	0,41	0,28	0,19	0,31	0,5	0,16	0,35	0,47
Verviers	3	2848	0,47	0,30	0,15	0,22	0,46	0,24	0,35	0,44
Waremme	3	966	0,52	0,27	0,14	0,21	0,4	0,19	0,31	0,44
Arlon	3	1098	0,43	0,27	0,19	0,31	0,36	0,1	0,27	0,4
Bastogne	3	594	0,59	0,29	0,09	0,12	0,35	0,26	0,29	0,29
Marche-fam.	3	566	0,52	0,31	0,12	0,17	0,34	0,17	0,35	0,49
Neuchateau	3	1083	0,51	0,26	0,16	0,23	0,43	0,21	0,36	0,39
Virton	3	643	0,52	0,29	0,13	0,19	0,33	0,2	0,27	0,39
Dinant	3	1555	0,47	0,30	0,16	0,23	0,39	0,19	0,32	0,4
Namur	3	4847	0,43	0,29	0,18	0,28	0,5	0,19	0,37	0,47
Philippeville	3	866	0,41	0,34	0,17	0,25	0,29	0,17	0,21	0,24
Brussels	4	10828	0,35	0,26	0,22	0,39	0,53	0,14	0,32	0,51
Nivelles	4	3801	0,44	0,28	0,18	0,27	0,4	0,14	0,33	0,49
Ath	4	895	0,42	0,29	0,19	0,29	0,39	0,19	0,26	0,35
Charleroi	4	5702	0,33	0,26	0,23	0,41	0,46	0,12	0,25	0,4
Mons	4	3696	0,40	0,27	0,20	0,33	0,46	0,15	0,3	0,39
Mouscron	4	1228	0,34	0,31	0,20	0,34	0,48	0,17	0,35	0,34
Soignies	4	2528	0,40	0,28	0,20	0,33	0,5	0,15	0,33	0,48
Thuin	4	1550	0,39	0,27	0,21	0,34	0,47	0,14	0,31	0,46
Tournai	4	2608	0,35	0,28	0,24	0,37	0,47	0,15	0,31	0,4
Huy	4	1204	0,46	0,28	0,17	0,26	0,43	0,13	0,36	0,61
Liège	4	7890	0,38	0,28	0,21	0,35	0,52	0,16	0,35	0,43
Verviers	4	2664	0,48	0,26	0,17	0,25	0,46	0,22	0,33	0,48
Waremme	4	931	0,51	0,27	0,15	0,22	0,39	0,17	0,32	0,37
Arlon	4	945	0,38	0,25	0,21	0,38	0,35	0,04	0,24	0,32
Bastogne	4	516	0,54	0,30	0,10	0,16	0,29	0,17	0,31	0,36
Marche-fam.	4	519	0,46	0,32	0,15	0,22	0,33	0,19	0,24	0,39
Neuchateau	4	969	0,44	0,30	0,18	0,27	0,38	0,17	0,34	0,36
Virton	4	612	0,46	0,31	0,17	0,23	0,37	0,21	0,27	0,37
Dinant	4	1352	0,41	0,32	0,19	0,26	0,35	0,17	0,29	0,4
Namur	4	4572	0,38	0,28	0,22	0,34	0,47	0,16	0,31	0,42
Philippeville	4	775	0,35	0,32	0,22	0,33	0,28	0,11	0,25	0,27

Appendix IV.1 (3rd)

District (d)	Grade (i)	Number of pupils ($EL_{d,i}$)	$P^0_{d,5}$	$P^1_{d,5}$	$P^2_{d,5}$	$P^{\geq 2}_{d,5}$	$D^0_{d,5}$	$D^1_{d,5}$	$D^2_{d,5}$	$D^{\geq 2}_{d,5}$
Brussels	5	9786	0,33	0,25	0,21	0,42	0,52	0,15	0,3	0,49
Nivelles	5	3451	0,40	0,27	0,19	0,33	0,42	0,12	0,26	0,48
Ath	5	849	0,40	0,31	0,18	0,30	0,42	0,22	0,32	0,49
Charleroi	5	4737	0,30	0,27	0,24	0,44	0,46	0,14	0,24	0,35
Mons	5	3438	0,34	0,29	0,22	0,37	0,45	0,14	0,26	0,34
Mouscron	5	1142	0,31	0,31	0,21	0,37	0,42	0,15	0,21	0,43
Soignies	5	2253	0,36	0,29	0,21	0,35	0,44	0,13	0,28	0,43
Thuin	5	1272	0,41	0,26	0,19	0,33	0,4	0,15	0,3	0,5
Tournai	5	2528	0,34	0,27	0,22	0,40	0,49	0,16	0,28	0,4
Huy	5	1022	0,46	0,25	0,19	0,29	0,43	0,14	0,37	0,56
Liège	5	7430	0,34	0,26	0,22	0,40	0,54	0,13	0,31	0,43
Verviers	5	2324	0,44	0,27	0,17	0,29	0,48	0,2	0,31	0,43
Waremme	5	756	0,48	0,25	0,17	0,27	0,37	0,13	0,27	0,4
Arlon	5	902	0,38	0,23	0,22	0,39	0,37	0,18	0,26	0,24
Bastogne	5	501	0,53	0,30	0,12	0,16	0,33	0,19	0,31	0,32
Marche-fam.	5	485	0,50	0,26	0,17	0,24	0,32	0,16	0,22	0,34
Neuchateau	5	866	0,42	0,27	0,20	0,31	0,42	0,17	0,33	0,4
Virton	5	540	0,42	0,29	0,21	0,29	0,34	0,13	0,3	0,25
Dinant	5	1157	0,42	0,32	0,18	0,26	0,37	0,17	0,33	0,45
Namur	5	4462	0,33	0,28	0,21	0,39	0,5	0,14	0,29	0,42
Philippeville	5	645	0,31	0,33	0,24	0,36	0,24	0,13	0,21	0,29
Brussels	6	8103	0,35	0,25	0,19	0,40	0,47	0,16	0,29	0,5
Nivelles	6	2546	0,47	0,26	0,17	0,28	0,45	0,16	0,33	0,48
Ath	6	667	0,42	0,28	0,21	0,31	0,4	0,22	0,32	0,44
Charleroi	6	3951	0,34	0,27	0,21	0,39	0,38	0,15	0,23	0,38
Mons	6	2884	0,38	0,28	0,19	0,33	0,48	0,16	0,31	0,39
Mouscron	6	830	0,40	0,27	0,20	0,33	0,45	0,15	0,35	0,46
Soignies	6	1846	0,39	0,29	0,20	0,32	0,48	0,14	0,36	0,41
Thuin	6	1001	0,45	0,25	0,18	0,30	0,45	0,18	0,31	0,52
Tournai	6	2033	0,36	0,30	0,21	0,35	0,42	0,13	0,3	0,35
Huy	6	839	0,45	0,28	0,18	0,27	0,39	0,09	0,37	0,48
Liège	6	5986	0,38	0,25	0,20	0,37	0,54	0,15	0,31	0,46
Verviers	6	2050	0,47	0,28	0,16	0,25	0,45	0,18	0,39	0,47
Waremme	6	612	0,54	0,25	0,14	0,21	0,32	0,08	0,35	0,41
Arlon	6	752	0,40	0,24	0,21	0,36	0,26	0,08	0,18	0,27
Bastogne	6	412	0,58	0,25	0,12	0,17	0,29	0,19	0,32	0,31
Marche-fam.	6	411	0,49	0,32	0,12	0,19	0,26	0,16	0,25	0,4
Neuchateau	6	715	0,45	0,26	0,19	0,29	0,4	0,15	0,3	0,42
Virton	6	494	0,44	0,32	0,17	0,24	0,41	0,25	0,22	0,32
Dinant	6	1009	0,40	0,34	0,18	0,26	0,32	0,12	0,28	0,41
Namur	6	3608	0,35	0,29	0,20	0,37	0,5	0,13	0,29	0,43
Philippeville	6	518	0,30	0,34	0,25	0,37	0,17	0,12	0,14	0,3

Appendix IV. 2: Average Taxable Income — by fiscal declaration — by district and corresponding Income Inequality Indexes (French-Speaking Community of Belgium. School year 1990).

District (d)	Average taxable income (1990) thousands of BEF	Inequality indexes	
		Coefficient of Variance ($CVAR_d$)	Gini Index ($GINI_d$)
Brussels	740,96	0,927	0,58
Nivelles	855,32	0,936	0,54
Ath	667,86	0,767	0,63
Charleroi	660,08	0,754	0,64
Mons	682,15	0,717	0,65
Mouscron	639,85	0,746	0,66
Soignies	695,80	0,757	0,63
Thuin	676,98	0,753	0,65
Tournai	666,09	0,762	0,64
Huy	734,33	0,970	0,62
Liège	708,83	0,794	0,63
Verviers	685,41	0,803	0,63
Waremme	719,59	0,758	0,63
Arlon	732,20	0,762	0,62
Bastogne	610,25	0,762	0,64
Marche-fam.	635,54	0,854	0,62
Neuchâteau	626,70	0,805	0,63
Virton	658,50	0,735	0,64
Dinant	641,13	1,071	0,64
Namur	713,28	0,774	0,62
Philippeville	639,68	0,783	0,64

Appendix IV. 3. Unemployment rate and highest degree completed in the different districts of the French-Speaking Community of Belgium and corresponding inter-municipality dissimilarity index. Year 1991.

District (d)	Total population in the district	Active population	Unemployment rate	Population at work: Total	Proportion of primary or middle school degree holders	Proportion of university degree holders
Brussels	954 045	359 858	0,15	305 077	0,18	0,12
Nivelles	321 144	134 494	0,09	121 863	0,24	0,13
Ath	76 785	30 664	0,14	26 465	0,27	0,05
Charleroi	426 372	159 949	0,21	126 337	0,28	0,05
Mons	252 285	92 644	0,21	72 936	0,24	0,06
Mouscron	71 362	29 960	0,15	25 604	0,27	0,04
Soignies	168 150	67 870	0,17	56 030	0,26	0,05
Thuin	143 266	56 509	0,19	45 674	0,27	0,05
Tournai	140 571	57 930	0,15	49 402	0,28	0,05
Huy	94 111	38 238	0,15	32 427	0,28	0,07
Liège	588 705	230 127	0,19	185 482	0,27	0,07
Verviers	253 500	108 326	0,11	95 922	0,35	0,05
Waremme	63 330	26 313	0,12	23 103	0,30	0,06
Arlon	48 945	20 346	0,09	18 503	0,27	0,08
Bastogne	37 836	15 406	0,10	13 930	0,34	0,06
Marche-fam.	46 522	18 419	0,11	16 352	0,32	0,06
Neuchâteau	53 696	21 340	0,09	19 409	0,32	0,06
Virton	45 814	17 792	0,10	15 997	0,27	0,07
Dinant	93 567	37 084	0,14	31 886	0,29	0,05
Namur	270 670	110 395	0,15	94 119	0,28	0,08
Philippeville	59 080	23 537	0,19	19 170	0,28	0,04

Appendix IV. 3. (2nd)

District (d)	Intra-municipality dissimilarity index : Unemployment rates (DU_d)	Proportions of primary or middle school degree holders	Proportions of university degree holders ($DUNIV_d$)
Brussels	0,14	0,13	0,27
Nivelles	0,07	0,11	0,19
Ath	0,13	0,10	0,10
Charleroi	0,08	0,06	0,13
Mons	0,10	0,11	0,22
Mouscron	0,02	0,05	0,06
Soignies	0,16	0,05	0,15
Thuin	0,12	0,06	0,17
Tournai	0,05	0,04	0,16
Huy	0,09	0,09	0,16
Liège	0,11	0,09	0,26
Verviers	0,20	0,11	0,21
Waremme	0,07	0,06	0,09
Arlon	0,08	0,06	0,19
Bastogne	0,03	0,05	0,08
Marche-fam.	0,04	0,07	0,09
Neuchâteau	0,08	0,05	0,06
Virton	0,05	0,07	0,09
Dinant	0,07	0,04	0,08
Namur	0,09	0,04	0,17
Philippeville	0,08	0,03	0,04

Appendix IV. 4: Number of schools organising grade (i) in the different districts of the French-Speaking Community of Belgium and concentration indexes. Secondary education. School year 1991-92.

District (d)	Grade (i)	Number of schools organising the grade i in district d ($N_{d,i}$)	Simple concentration index ($CONC_{d,i}= 1/N_{d,i}$)	Herfindahl concentration index ($H_{d,i}$)
Brussels	1	118	0.008	0,0102
Nivelles	1	39	0.026	0,0334
Ath	1	14	0.071	0,0987
Charleroi	1	50	0.020	0,0252
Mons	1	31	0.032	0,0409
Mouscron	1	12	0.083	0,0983
Soignies	1	24	0.042	0,0598
Thuin	1	18	0.056	0,0796
Tournai	1	25	0.040	0,054
Huy	1	12	0.083	0,1005
Liège	1	71	0.014	0,0213
Verviers	1	29	0.034	0,0469
Waremme	1	9	0.111	0,1291
Arlon	1	8	0.125	0,1427
Bastogne	1	8	0.125	0,1402
Marche-fam.	1	9	0.111	0,1398
Neuchâteau	1	15	0.067	0,0851
Virton	1	8	0.125	0,1557
Dinant	1	22	0.045	0,0585
Namur	1	43	0.023	0,0326
Philippeville	1	12	0.083	0,1004
Brussels	2	122	0.008	0,0103
Nivelles	2	39	0.026	0,0322
Ath	2	14	0.071	0,0891
Charleroi	2	50	0.020	0,0241
Mons	2	31	0.032	0,0394
Mouscron	2	13	0.077	0,0896
Soignies	2	24	0.042	0,0574
Thuin	2	18	0.056	0,0707
Tournai	2	25	0.040	0,0534
Huy	2	12	0.083	0,0947
Liège	2	73	0.014	0,019
Verviers	2	31	0.032	0,0402
Waremme	2	9	0.111	0,1215
Arlon	2	8	0.125	0,1397
Bastogne	2	8	0.125	0,1305
Marche-fam.	2	9	0.111	0,1282
Neuchâteau	2	15	0.067	0,0843
Virton	2	8	0.125	0,1387
Dinant	2	23	0.043	0,056
Namur	2	44	0.023	0,0292
Philippeville	2	12	0.083	0,1094

Appendix IV. 4. (2nd)

Brussels	3	123	0.008	0,0099
Nivelles	3	38	0.026	0,0402
Ath	3	14	0.071	0,0846
Charleroi	3	52	0.019	0,0229
Mons	3	32	0.031	0,038
Mouscron	3	13	0.077	0,0966
Soignies	3	28	0.036	0,0443
Thuin	3	18	0.056	0,0684
Tournai	3	27	0.037	0,0474
Huy	3	12	0.083	0,0976
Liège	3	74	0.014	0,0167
Verviers	3	30	0.033	0,0405
Waremme	3	9	0.111	0,1171
Arlon	3	8	0.125	0,1509
Bastogne	3	7	0.143	0,1615
Marche-fam.	3	9	0.111	0,1464
Neuchâteau	3	16	0.062	0,0937
Virton	3	8	0.125	0,1395
Dinant	3	22	0.045	0,0551
Namur	3	50	0.020	0,025
Philippeville	3	12	0.083	0,1139
Brussels	4	122	0.008	0,0101
Nivelles	4	37	0.027	0,0324
Ath	4	14	0.071	0,0889
Charleroi	4	52	0.019	0,0256
Mons	4	32	0.031	0,0402
Mouscron	4	13	0.077	0,1038
Soignies	4	28	0.036	0,0456
Thuin	4	18	0.056	0,0665
Tournai	4	27	0.037	0,0513
Huy	4	12	0.083	0,096
Liège	4	75	0.013	0,0176
Verviers	4	30	0.033	0,0398
Waremme	4	9	0.111	0,1152
Arlon	4	8	0.125	0,1578
Bastogne	4	7	0.143	0,1644
Marche-fam.	4	9	0.111	0,1499
Neuchâteau	4	16	0.062	0,1075
Virton	4	8	0.125	0,1476
Dinant	4	22	0.045	0,0566
Namur	4	51	0.020	0,0265
Philippeville	4	12	0.083	0,1105
Brussels	5	122	0.008	0,0102
Nivelles	5	36	0.028	0,0362
Ath	5	12	0.083	0,1156
Charleroi	5	52	0.019	0,0267
Mons	5	30	0.033	0,0452
Mouscron	5	13	0.077	0,124
Soignies	5	28	0.036	0,046
Thuin	5	18	0.056	0,0688
Tournai	5	25	0.040	0,0546

Appendix IV. 4. (3rd)

Huy	5	12	0.083	0,0983
Liège	5	73	0.014	0,0182
Verviers	5	29	0.034	0,0426
Waremme	5	9	0.111	0,1252
Arlon	5	8	0.125	0,158
Bastogne	5	7	0.143	0,1804
Marche-fam.	5	9	0.111	0,156
Neuchâteau	5	16	0.062	0,1107
Virton	5	7	0.143	0,1846
Dinant	5	21	0.048	0,062
Namur	5	48	0.021	0,0301
Philippeville	5	11	0.091	0,1129
Brussels	6	122	0.008	0,0105
Nivelles	6	33	0.030	0,0368
Ath	6	10	0.100	0,1188
Charleroi	6	52	0.019	0,0262
Mons	6	28	0.036	0,0457
Mouscron	6	12	0.083	0,1137
Soignies	6	27	0.037	0,0464
Thuin	6	18	0.056	0,0693
Tournai	6	25	0.040	0,052
Huy	6	12	0.083	0,0974
Liège	6	72	0.014	0,0178
Verviers	6	29	0.034	0,0423
Waremme	6	8	0.125	0,132
Arlon	6	8	0.125	0,159
Bastogne	6	6	0.167	0,1876
Marche-fam.	6	8	0.125	0,1768
Neuchâteau	6	16	0.062	0,1019
Virton	6	7	0.143	0,168
Dinant	6	20	0.050	0,0628
Namur	6	49	0.020	0,0278
Philippeville	6	10	0.100	0,1191

Appendix IV. 5: Average intra-school (between academic tracks) dissimilarity indexes. Secondary education. French-Speaking Community of Belgium. School year 1991-92.

District (d)	Grade (i)	$WDINTRA_{d,i}^{k=0}$	$WDINTRA_{d,i}^{k=1}$	$WDINTRA_{d,i}^{k=2}$	$WDINTRA_{d,i}^{k\geq2}$
Brussels	1	0,09	0,06	0,08	0,09
Brussels	2	0,11	0,05	0,08	0,08
Brussels	3	0,20	0,07	0,11	0,15
Brussels	4	0,19	0,10	0,12	0,16
Brussels	5	0,19	0,09	0,11	0,16
Brussels	6	0,16	0,09	0,09	0,12
Nivelles	1	0,11	0,09	0,09	0,10
Nivelles	2	0,15	0,08	0,13	0,14
Nivelles	3	0,30	0,09	0,19	0,25
Nivelles	4	0,20	0,08	0,13	0,19
Nivelles	5	0,25	0,08	0,14	0,18
Nivelles	6	0,21	0,11	0,14	0,17
Ath	1	0,11	0,09	0,12	0,12
Ath	2	0,15	0,10	0,11	0,10
Ath	3	0,21	0,08	0,14	0,20
Ath	4	0,21	0,14	0,15	0,18
Ath	5	0,19	0,16	0,14	0,18
Ath	6	0,23	0,15	0,11	0,19
Charleroi	1	0,08	0,06	0,09	0,09
Charleroi	2	0,14	0,08	0,10	0,11
Charleroi	3	0,25	0,10	0,16	0,23
Charleroi	4	0,22	0,09	0,14	0,19
Charleroi	5	0,20	0,09	0,12	0,17
Charleroi	6	0,20	0,08	0,13	0,17
Mons	1	0,11	0,04	0,03	0,01
Mons	2	0,18	0,04	0,06	0,04
Mons	3	0,24	0,05	0,05	0,05
Mons	4	0,23	0,03	0,05	0,05
Mons	5	0,22	0,02	0,04	0,05
Mons	6	0,24	0,04	0,04	0,04
Mouscron	1	0,10	0,02	0,06	0,02
Mouscron	2	0,09	0,02	0,04	0,03
Mouscron	3	0,17	0,03	0,03	0,03
Mouscron	4	0,20	0,03	0,05	0,04
Mouscron	5	0,15	0,02	0,04	0,02
Mouscron	6	0,12	0,03	0,04	0,02
Soignies	1	0,06	0,01	0,03	0,01
Soignies	2	0,13	0,02	0,04	0,03
Soignies	3	0,15	0,02	0,04	0,03
Soignies	4	0,14	0,02	0,02	0,03
Soignies	5	0,17	0,02	0,03	0,03
Soignies	6	0,17	0,02	0,04	0,03
Thuin	1	0,10	0,04	0,06	0,01
Thuin	2	0,10	0,03	0,04	0,02
Thuin	3	0,27	0,06	0,07	0,04

Appendix IV. 5 (2nd)

Thuin	4	0,23	0,04	0,05	0,05
Thuin	5	0,16	0,03	0,06	0,04
Thuin	6	0,16	0,05	0,04	0,03
Tournai	1	0,12	0,03	0,03	0,02
Tournai	2	0,14	0,02	0,03	0,01
Tournai	3	0,29	0,04	0,03	0,03
Tournai	4	0,27	0,03	0,03	0,03
Tournai	5	0,25	0,02	0,03	0,02
Tournai	6	0,23	0,03	0,03	0,02
Huy	1	0,13	0,00	0,00	0,00
Huy	2	0,14	0,00	0,00	0,00
Huy	3	0,20	0,00	0,00	0,00
Huy	4	0,20	0,00	0,00	0,00
Huy	5	0,23	0,00	0,00	0,00
Huy	6	0,21	0,00	0,00	0,00
Liège	1	0,08	0,06	0,07	0,08
Liège	2	0,13	0,06	0,11	0,12
Liège	3	0,22	0,10	0,13	0,19
Liège	4	0,19	0,09	0,13	0,15
Liège	5	0,17	0,09	0,10	0,14
Liège	6	0,19	0,09	0,10	0,14
Verviers	1	0,08	0,03	0,04	0,01
Verviers	2	0,12	0,03	0,03	0,02
Verviers	3	0,21	0,05	0,05	0,03
Verviers	4	0,20	0,04	0,04	0,04
Verviers	5	0,18	0,04	0,04	0,03
Verviers	6	0,19	0,03	0,04	0,02
Waremme	1	0,14	0,05	0,04	0,03
Waremme	2	0,15	0,04	0,05	0,02
Waremme	3	0,23	0,06	0,06	0,03
Waremme	4	0,34	0,08	0,07	0,04
Waremme	5	0,30	0,06	0,07	0,07
Waremme	6	0,29	0,07	0,07	0,05
Arlon	1	0,13	0,05	0,03	0,01
Arlon	2	0,22	0,04	0,07	0,05
Arlon	3	0,36	0,08	0,07	0,06
Arlon	4	0,35	0,05	0,05	0,06
Arlon	5	0,33	0,07	0,06	0,05
Arlon	6	0,39	0,09	0,05	0,05
Bastogne	1	0,10	0,06	0,03	0,00
Bastogne	2	0,17	0,06	0,07	0,02
Bastogne	3	0,41	0,18	0,09	0,04
Bastogne	4	0,40	0,15	0,10	0,03
Bastogne	5	0,36	0,13	0,11	0,04
Bastogne	6	0,41	0,17	0,08	0,05

Appendix IV. 5 (3rd)

Marche-fam.	1	0,16	0,07	0,06	0,02
Marche-fam.	2	0,28	0,10	0,09	0,05
Marche-fam.	3	0,34	0,09	0,10	0,04
Marche-fam.	4	0,40	0,11	0,09	0,06
Marche-fam.	5	0,37	0,11	0,11	0,08
Marche-fam.	6	0,37	0,09	0,09	0,05
Neuchateau	1	0,16	0,07	0,04	0,02
Neuchateau	2	0,23	0,08	0,10	0,04
Neuchateau	3	0,35	0,12	0,08	0,05
Neuchateau	4	0,33	0,09	0,05	0,04
Neuchateau	5	0,32	0,08	0,07	0,05
Neuchateau	6	0,26	0,08	0,06	0,04
Virton	1	0,18	0,08	0,05	0,01
Virton	2	0,25	0,10	0,06	0,01
Virton	3	0,33	0,09	0,10	0,05
Virton	4	0,29	0,05	0,07	0,07
Virton	5	0,30	0,04	0,07	0,06
Virton	6	0,31	0,07	0,07	0,05
Dinant	1	0,15	0,06	0,06	0,02
Dinant	2	0,17	0,04	0,06	0,02
Dinant	3	0,27	0,06	0,06	0,05
Dinant	4	0,28	0,04	0,06	0,06
Dinant	5	0,22	0,04	0,05	0,04
Dinant	6	0,19	0,04	0,06	0,03
Namur	1	0,10	0,03	0,04	0,01
Namur	2	0,13	0,03	0,05	0,02
Namur	3	0,18	0,04	0,04	0,03
Namur	4	0,21	0,03	0,05	0,04
Namur	5	0,18	0,03	0,05	0,04
Namur	6	0,19	0,03	0,04	0,03
Philippeville	1	0,18	0,07	0,06	0,02
Philippeville	2	0,20	0,05	0,09	0,03
Philippeville	3	0,31	0,06	0,08	0,05
Philippeville	4	0,26	0,04	0,05	0,06
Philippeville	5	0,34	0,04	0,05	0,07
Philippeville	6	0,30	0,04	0,07	0,06

Appendix IV. 6: Demography (6-17 years) and total enrolment (grade 1 to 6 primary education and grade 1 to 6 secondary education). School year 1990-91. French-Speaking Community of Belgium.

	Grade/Age	Enrolment (E)	Demography (D)	Ratio (E/D)
Primary education	G1/6years old	55 116	47 890	1,15
Primary education	G2/7years old	52 527	49 296	1,07
Primary education	G3/8 years old	53 572	50 318	1,06
Primary education	G4/9 years old	53 774	50 407	1,07
Primary education	G5/10 years old	54 392	49 366	1,10
Primary education	G6/11 years old	50 299	49 014	1,03
Secondary education	G1/12 years old	60 780	49 352	1,23
Secondary education	G2/13 years old	63 794	49 792	1,28
Secondary education	G3/14 years old	66 644	50 240	1,33
Secondary education	G4/15 years old	60 106	52 065	1,15
Secondary education	G5/16 years old	54 930	54 970	1,00
Secondary education	G6/17years old	44 684	57 053	0,78
Total		**670 615**	**609 762**	**1,10**

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