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Economic Efficiency of Reducing Class Size

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Reducing class size is a well-documented policy tool to improve student learning, particularly in primary education. This Focus applies the methodological framework of the Marginal Value of Public Funds (MVPF) to this policy in order to assess its social cost-benefit ratio. The analysis focuses on class splitting in priority education areas, while also considering the potential effects of a general reduction in class size in both primary and secondary education.

The MVPF index measures the social return of a public policy by comparing the gains it generates to its net cost for public finances. In the case of class size, it relies on a transmission chain linking a reduction in the number of students per class to improved academic skills, and then to increased future income. The parameters used are drawn from rigorous evaluations based on experimental or quasi-experimental variations, as well as on French administrative data on educational and salary trajectories.

The results highlight a strong return on investment for the policy in primary education, where the MVPF index suggests that class splitting is self-financing in the long run. In middle school, the estimated effect on learning is more uncertain, but the index remains well above 1, indicating a net social gain for every euro invested. These results support the relevance of continuing efforts in primary education, while also calling for targeted experiments to better document the effects in secondary education.

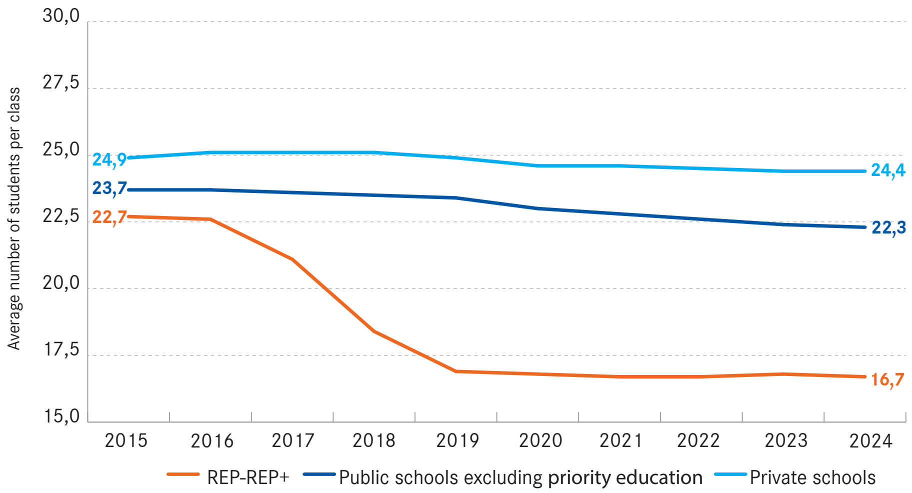
Context

In France, the implementation of the class size reduction policy in priority education areas builds upon a body of scientific literature demonstrating the beneficial effects of small class sizes, particularly in the early years of schooling (Bouguen et al., 2017). This observation has reinforced the idea that targeted reductions in student numbers could be an effective policy tool to reduce educational inequalities.

Initiated in 2017 with the splitting of 2,500 first-grade (CP) classes in the most underprivileged school districts (known as REP and REP+ for "reinforced priority education networks"), the policy was subsequently expanded to all first-grade and second-grade (CE1) classes in REP and REP+ schools, and from 2020 onwards, to preschool classes (grande section) within those same networks. This reform has led to a substantial decrease in the average number of students per class in priority education elementary schools (Figure 1): between the 2015 and 2024 school years, the average class size, across all grades, fell from 22.7 to 16.7 students – a reduction of 6 students per class.

Outside priority education, the steady decline in births since 2010 has also led to a gradual reduction in the number of students per class. In the absence of a proportional adjustment in the number of teachers, this demographic trend has resulted in a structural reduction in class size. Between 2015 and 2024, the average number of students per class in public elementary schools outside of priority education fell from 23.7 to 22.3.

Figure 1. Evolution of Average Class Size in Elementary Education



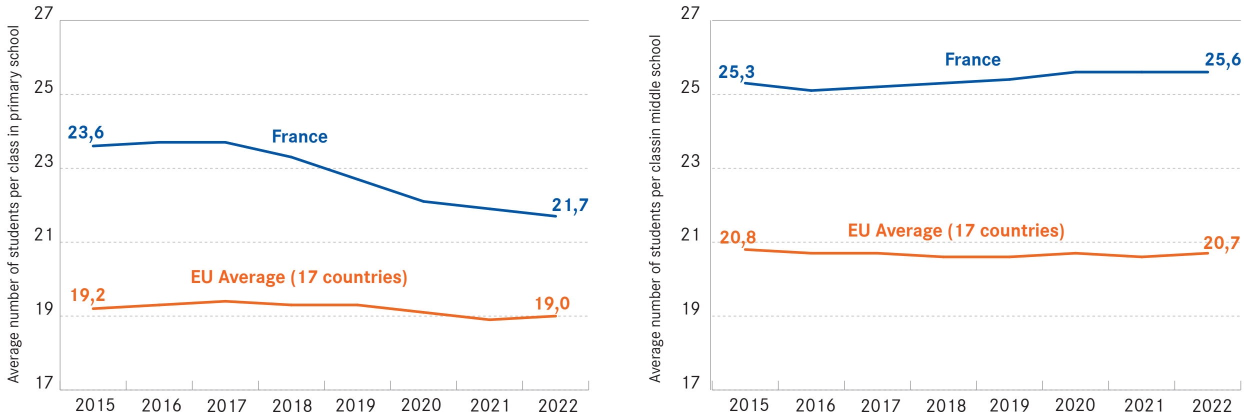
Scope: Public and private contract schools, excluding ULIS.
Source: Evain (2024, 2025).

Despite this trend, France continues to stand out for its relatively large class sizes compared to international standards (Figure 2). In 2024, the average number of students per class in French primary education was 21.7, compared to an average of 19.0 in the 17 other EU countries for which data are available. The gap is even wider at the secondary level: French middle schools average 25.6 students per class, compared to 20.7 in other EU countries.[1]

Beyond class size, the student-teacher ratio – measured as the average number of students per teacher – provides another indicator of student learning conditions. In this regard, France is also above the European average: in middle schools, there are on average 15 students per teacher, four more than the EU average of 11. The countries with the most favorable student-teacher ratios are Norway and Greece, with around 8 students per teacher in middle school. Germany's ratio is similar to that of France.

[1] However, the interpretation of international comparisons of class size in secondary education should be interpreted with caution. Unlike in primary school, where the pedagogical structure is more uniform, teaching in middle school often includes instructional time in smaller groups, which makes it more difficult to measure the effective class size.

Figure 2. Class Size in Primary and Middle School: France-EU Comparison



Scope: France and 17 EU countries with available data on class size since 2015 (Germany, Austria, Denmark, Spain, Estonia, Finland, Greece, Hungary, Italy, Latvia, Lithuania, Poland, Portugal, Czech Republic, Slovakia, Slovenia, Sweden).

Source: OECD (2024a).

These observations raise questions about the advisability of continuing or expanding a class size reduction policy in France. Such a reflection requires answers to two key questions:

- Are smaller classes an effective means to improve academic performance and long-term student success?
- What would be the collective returns likely to justify their cost to public finances?

This *Focus* aims to provide some answers by evaluating the impact of class splitting in REP/REP+ on academic results and future earnings of students. This policy represents a particularly visible and targeted form of class size reduction, making it a prime case for rigorous evaluation. Moreover, the magnitude of the reduction involved – shifting from standard classes to groups of 12 students – is consistent with existing scientific literature, which generally relies on significant variations in class size to identify causal impacts on student success.

The objective is twofold: first, to provide a robust estimate of the effectiveness of this targeted policy; second, to use this concrete case as a basis for informing the potential effects of a broader class size reduction policy.

Reminder of the Principle and Calculation Method of the Marginal Value of Public Funds (MVPF)

A specific methodological Focus[2] sets out in detail the calculation of the Marginal Value of Public Funds (MVPF), also known by this name in the international literature. This index provides a standardized measure of the social return of a public policy by relating the benefits it generates to its net cost for public finances (Hendren and Sprung-Keyser, 2020; 2022).

The MVPF is defined as the ratio between the total social benefit to the recipients and the net cost of the policy to the state, that is, the gross cost minus the tax revenues or budgetary savings it generates in the short or long term (for example, through an increase in taxable income or a decrease in future social expenditures). The formula is as follows:

$$\text{MVPF} = \frac{\Delta B}{\Delta C - \Delta E}$$

where:

[2] Fajeau M., Fougère C., Grenet J., Landais C., and Laveissière E. (2025): "The Marginal Value of Public Funds Applied to the Sourdun Excellence Boarding School," Focus No. 111, CAE, May.

- ΔB refers to the total social benefits received by the policy's beneficiaries, whether direct (monetary transfers, higher income, improved working conditions, etc.) or indirect (increased overall productivity, reduced crime, civic engagement, etc.);
- ΔC represents the deployment cost of the policy for the state, that is, all expenses required for its implementation;
- ΔE represents the additional tax revenues generated by the policy, for instance through an increase in the income of the beneficiaries.

This method makes it possible to measure the "return on investment" – the "bang for the buck" – of a public intervention by comparing the social benefits generated to the actual cost borne by public finances. An index greater than 1 means that the policy generates a net benefit for society for every public euro invested.

The MVPF index is a particularly useful decision-making tool for guiding the allocation of public resources, as it allows for the comparison of the relative efficiency of very different policies, regardless of their nature or scope. Designed to assess long-term efficiency, it accounts for the fact that returns on public investment – especially in the field of education – may take several years to materialize. Unlike the traditional cost-benefit analysis approach, where future savings are included in the total benefits, the MVPF incorporates them into the calculation of the net cost. This methodological difference enables the MVPF to identify so-called Pareto-improving situations, where a policy produces a net gain for society without disadvantaging any individual. However, it is important to emphasize that this index is not meant to replace democratic debate around public policy decisions: it should be viewed as a tool to clarify trade-offs and to promote a better distribution of resources in line with collective priorities.

Application of the MVPF to the Class Splitting Policy

Social Benefit of Class Splitting (ΔB)

Educational policies – whether they involve revising the curriculum, improving teaching quality, or adjusting school organization – share a common goal: strengthening student skills. These policies contribute to the development of human capital (Becker, 1964), which determines individuals' future productivity and, consequently, their income level in the labor market. Although the benefits of education go far beyond just wage returns – influencing such diverse aspects as health, civic engagement, or crime – earnings nonetheless remain a central indicator of social benefit[3], given the well-established causal link between academic success and income level (Card, 1999). The academic literature also shows that the effects of educational policies on future income tend to be positively correlated with their effects on other dimensions of well-being. This makes income a useful summary measure to assess the overall social impact of an education policy. In this context, the expected wage gain can be interpreted as an initial measure of the willingness to pay for or support such a policy.

To quantify the social benefit of class splitting, five parameters are required:

Effect of the policy on academic skills (θ)

The impact of an educational policy on student achievement is most often assessed using standardized test scores. In the case of class size, the main methodological challenge is to identify a causal effect, independently of selection biases that may affect class composition. This is why the estimates used here are based on experimental or quasi-experimental variations in class size, drawn from economic research.

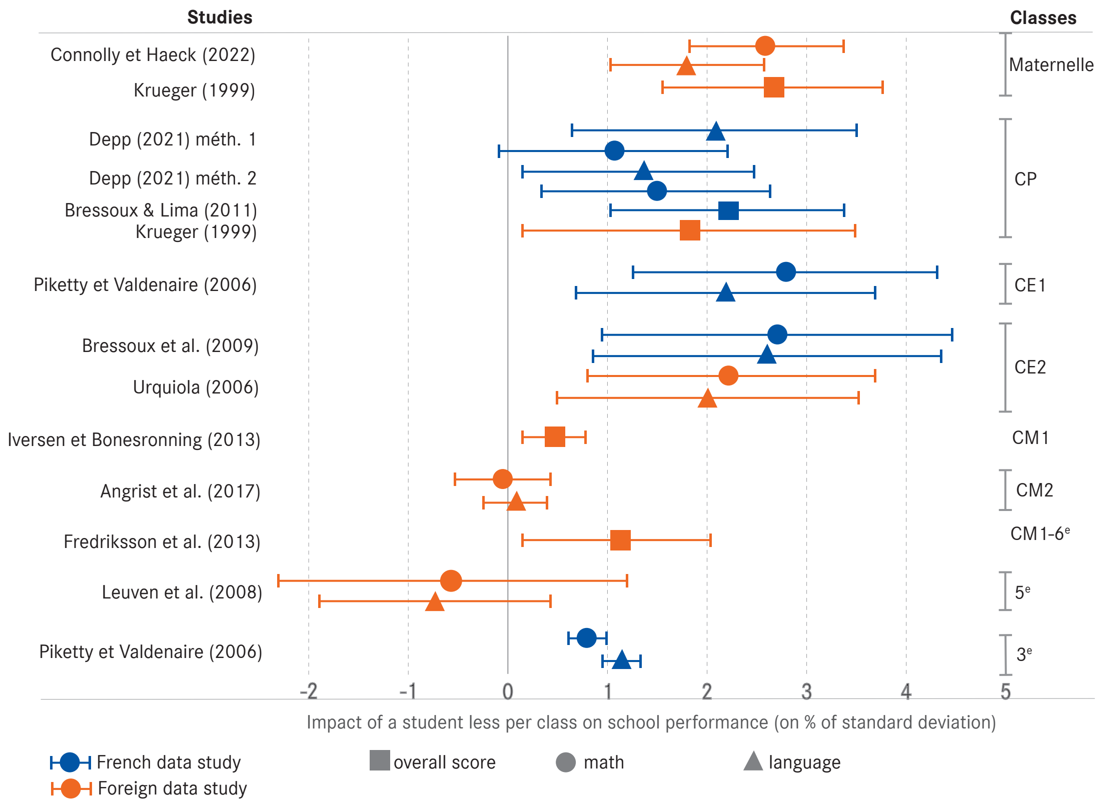
The impact of class size on student academic performance has been extensively studied in the scientific literature. In order to neutralize selection biases that distort comparisons between small and large classes, the most methodologically rigorous studies rely on the STAR randomized experiment conducted in Tennessee in 1986 (Krueger, 1999; Krueger and Whitmore, 2001; Chetty et al., 2011), in which students were randomly assigned to classes of different sizes, or on analyses using class size thresholds as a source of exogenous variation.[4]

[3] Fajeau M., Grenet J., and Laveissière E. (2025): "The Effect of Academic Skills on Future Wages," Focus No. 112, CAE, May.

[4] Angrist and Lavy, 1999; Angrist et al., 2019; Bressoux et al., 2009; Bressoux and Lima, 2011; Browning and Heinesen, 2007; Chetty et al., 2011; Connolly and Haeck, 2022; DEPP, 2021; Fredriksson et al., 2013; Iversen and Bonesrønning, 2013; Leuven et al., 2008; Piketty and Valdenaire, 2006; Urquiola, 2006.

The vast majority of these studies find statistically significant effects of class size on learning in primary education (Figure 3). To facilitate comparisons across contexts – since class splitting does not always correspond to the same change in size – it is common to express estimated effects in standard deviation units of the distribution of standardized test scores (see Box 1), for one fewer student per class. On average, a reduction of one student per class is associated with an improvement in academic results of between 1.5% and 2.5% of a standard deviation over a school year, with effects tending to be greater for students from disadvantaged backgrounds. The evaluation conducted by the Ministry of National Education on the splitting of first-grade classes (CP) in REP+ (DEPP, 2021) falls within this range, with an average gain of 1.62% of a standard deviation per student removed.[5] This value is used here as the central estimate of the parameter θ for calculating the MVPF associated with class splitting in primary school.

Figure 3. Meta-Analysis of the Impact of Class Size on Academic Performance



Reading note: According to Krueger (1999), reducing class size by one student in first grade (CP) is associated with a 1.8% improvement in performance, measured in standard deviation units.

Notes: The effects are expressed as a percentage of a standard deviation of the observed score (math, language, or overall score), per student fewer in a class over one school year. A positive coefficient indicates a beneficial effect of smaller class size on student outcomes. Symbols represent the estimated effect (square: overall score; circle: mathematics; diamond: language), and horizontal bars indicate 95% confidence intervals. Studies based on French data appear in dark blue.

Sources: Full references for the studies are provided in the bibliography.

[5] Two distinct methods were used by the DEPP (2021) to evaluate the impact of class splitting in first grade (CP) in REP+ on student achievement one year after the policy was implemented. The first method compares the change in scores in French and mathematics from the beginning to the end of CP for students enrolled in REP+ schools with that of a control group of students enrolled in similar REP schools not affected by the reform. The second method compares the progress made at the beginning of CE1 by REP+ students who benefited from class splitting in CP to the previous cohort (not exposed), using a difference-in-differences approach relative to the non-exposed group. The results show significant effects of class splitting on student achievement: according to method 1, an improvement of 14% of a standard deviation in French and 12% in mathematics (Table 4.7, columns 2 and 4); according to method 2, an estimated effect of 9% of a standard deviation in both French (Table 4.12, column 2) and mathematics (Table 4.13, column 2). The study shows that the policy led to an average reduction of 6.8 students per CP class in REP+ schools compared to the control group (Table 4.3). When expressed per student removed from the class, these results imply effects of 2.1% of a standard deviation in French and 1.8% in mathematics using method 1, and 1.3% of a standard deviation in both subjects using method 2. The average of these four estimates yields a combined effect of 1.62% of a standard deviation per student removed from the class.

Box 1. Interpreting Effect Sizes in Education Research

In education research, the effects of educational interventions are generally expressed in standard deviation units. This measure allows for the comparison of results obtained in different contexts by converting them to a standardized scale. The standard deviation measures the spread of results around the mean: stating that an intervention has an effect of 0.2 standard deviations (or 20% of a standard deviation) means that, on average, the affected students scored 0.2 standard deviations higher than those in the control group.

The table below provides a practical interpretation of effect sizes expressed in standard deviation units by translating them into percentile gains. This helps illustrate how much an educational intervention can move a student up in the performance distribution:

Effects	Interpretation[a]
0,10 standard deviation	From 50th to 54th centile
0,20 standard deviation	From 50th to 58th centile
0,30 standard deviation	From 50th to 62th centile
0,40 standard deviation	From 50th to 66th centile
0,50 standard deviation	From 50th to 69th centile

In the empirical literature, an effect below 0.05 standard deviations is generally considered small, an effect between 0.05 and 0.20 as moderate, and an effect of 0.20 or higher as large.[b] These thresholds account for the fact that, in the education sector, effects observed through rigorous evaluations (experiments or quasi-experiments) are often more modest than those observed in other areas of public policy.

[a] This interpretation assumes a normal distribution.

[b] Kraft M. (2020): "Interpreting Effect Sizes of Education Interventions," *Educational Researcher*, 49(4), pp. 241–253.

Beyond short-term effects on academic performance, several studies have highlighted significant long-term benefits. They show that smaller class sizes in primary school are associated with a higher likelihood of accessing higher education (Krueger and Whitmore, 2001; Chetty et al., 2011), as well as higher adult earnings (Fredriksson et al., 2013).

Studies on the effects of class size in secondary education are fewer than those for primary education, and their results tend to show more modest effects. In France, the analysis conducted by Piketty and Valdenaire (2006) shows that reducing class size by one student in ninth grade (troisième) improves performance on the national diploma (brevet) by 0.80% of a standard deviation in mathematics and by 1.14% in French – for a combined average effect of 0.97% of a standard deviation. This value is used as the parameter θ in the calculation of the MVPF index for class splitting in middle school.

However, the parameter θ should not be interpreted as a constant marginal effect – that is, as if reducing class size from 22 to 21 had the same impact as the reduction from 12 to 11. Such an interpretation would imply a linear relationship between class size and academic performance, which is contradicted by the literature. In fact, recent studies – notably Connolly and Haeck (2022) – show that the marginal effect of one fewer student increases as class size decreases. In this context, the parameter θ should be understood as a linear interpolation of the overall effect observed in a full class-splitting scenario, typically from a class of 22 to one of 11 students. Rather than modeling a simple marginal reduction (from 22 to 21 students, for example), we adopt here an approach based on the evaluation of class splitting, as it aligns with the estimates available in the literature and avoids making structural assumptions about the shape (likely non-linear) of the effect function.

Concretely, in a class-splitting scenario starting from an average class size of 22 students, each student benefits from a reduction of $\Delta n = 11$ students, resulting in a total gain in academic performance equal to $\theta_{11} = \Delta n \times \theta$. This framework allows for the inclusion of the cumulative effect of a structural pedagogical change without overinterpreting empirical results as constant per-student effects.

Finally, it is important to emphasize that regardless of the chosen approach – marginal reduction or full class splitting – the MVPF index remains unchanged, as long as the assumption holds that class size is a zero-sum game (see discussion in the Appendix). This assumption means that, for a given number of students distributed across a fixed number of classes, the average aggregate score of students does not vary depending on class configuration: gains obtained by some students (in smaller classes) are offset by losses of others (in more crowded classes).

The Effect of Academic Skills on Wages (δ)

The parameter δ measures the impact of an improvement in academic skills on future wage earnings. It allows the effects of an education policy (such as class splitting) on academic achievement to be converted into individual economic gains by translating a variation in standardized test scores into a percentage increase in adult wage income.

We estimate this parameter using data from the secondary school student panel – 1995 cohort – matched with the Entry into Working Life survey (EVA) 2005–2012, the only dataset currently available in France that links early educational data (collected by the DEPP) with detailed information on parental socio-economic characteristics, school progress, and employment status upon entering adulthood. Based on these data, we estimate that an increase of one standard deviation in national assessment performance in sixth grade (6e) is associated with a 9.5% increase in adult wage income, i.e., $\delta = 0.095$.[6]

The Average Marginal Tax Rate (τ)

The parameter τ represents the marginal tax rate applied to labor income, including all mandatory contributions: social security contributions (both employer and employee, excluding pension contributions), the CSG and CRDS levies, and the income tax.[7] It is expressed as a proportion of the super-gross wage, that is, the total labor cost for the employer (gross salary plus employer social contributions).

We deliberately exclude pension contributions from the calculation of τ, since these constitute deferred income that is ultimately paid back to the beneficiaries at retirement and therefore do not represent a net resource for public finances.[8]

The parameter τ is calculated as follows:

- According to the most recent OECD data, the average marginal tax rate in France amounts to 58.17% of the super-gross salary for a single person without children (OECD, 2024b, Table 3.6).
- The OECD also indicates that the average rate of employer contributions applied to gross salary is 36.3%.[9] The relationship between the super-gross and gross salary is thus: super-gross salary = (1 + 36.3%) × gross salary.
- The total pension contribution rate (base scheme + complementary scheme) for both employers and employees is 25.74% based on gross salary. To express this rate in terms of the super-gross salary, the calculation is: 25.74% / (1 + 36.3%) = 18.9%.

Finally, by subtracting the pension contribution share (18.9%) from the total marginal tax rate (58.17%), we obtain an average marginal tax rate excluding pension contributions of 39.27% of the super-gross salary.

Present Value of Future Earnings (w_e)

The social benefits of class splitting are measured here through the increase in wages earned by beneficiaries in adulthood. As these incomes are received throughout the working life, it is necessary to discount them to the age at which the policy begins to have an effect — referred to as the age of exposure (denoted e).

We denote we as the present value of future earnings in the counterfactual scenario, that is, the income beneficiaries would have received in the absence of class splitting. This amount is discounted to the age e, corresponding to the

[6] For the methodological details of the estimate, see Fajeau M., Grenet J., and Laveissière E. (2025): Focus No. 112, op. cit.

[7] We use the marginal income tax rate because it measures the portion of additional earnings captured by the State through mandatory levies. Unlike the average tax rate, which relates total levies to total income, the marginal rate reflects the taxation applied to a change in income, which is relevant in the context of a public policy designed to raise individual income.

[8] Strictly speaking, this statement is valid only under the assumption of actuarial neutrality of pension systems, i.e., when the pension entitlements acquired are equivalent, in present value, to the contributions paid (Legros, 1996). We adopt this assumption here to simplify the calculation of the MVPF index.

[9] This rate is calculated by applying the average rate of employer contributions expressed as a proportion of the super-gross wage (26.6% – see OECD, 2024b, Table 1.2) to the average super-gross wage (€83,034 according to Table 1.2) before dividing the result by the average gross wage (€60,922 according to Table 1.3).

theoretical age of exposure to the policy: 6 years old for primary school, and 11 years old for middle school. Working life is assumed to begin at age 23 and end at age 64.

The formula used is as follows:

$$w_e = \sum_{a=23}^{64} \frac{\mathrm{p(a)} \cdot \mathrm{w(a)}}{(1+r)^{a-e}}$$

Where:

- e is the age of exposure to the policy (6 or 11);
- p(a) is the probability of being employed at each age a, estimated using data from the Employment Survey, which accounts for career breaks;
- w(a) is the annual super-gross salary at age a, estimated from Annual Social Data Declarations (DADS);
- r is the discount rate, set at 3%, in line with conventions used by Chetty et al. (2011) and Hendren and Sprung-Keyser (2020).

Under these assumptions, the present value of future income is estimated at:

w_6 = €441,356 (discounted to age 6, for primary school), and

w_{11} = €482,282 (discounted to age 11, for middle school).

Social Benefit per Student from Class Splitting (ΔB)

By combining the various parameters, the social benefit ΔB is calculated as follows:

$$\Delta B = \Delta n \times \theta \times \delta \times we \times (1 - \tau)$$

This equation reflects the transmission chain between class size reduction and economic gains for the beneficiary students. Each student experiences an increase in academic skills equal to $\Delta n \times \theta$, i.e. the cumulative effect of reducing Δn students from their class, multiplied by the marginal impact θ of one fewer student on learning outcomes. This improvement in academic achievement translates into an expected increase in future income, through parameter δ, which captures the effect of skills on wages. The present value of lifetime earnings (we) incorporates the time distribution of these gains. Finally, the factor (1 – τ) expresses the net gain received by the individual after deducting mandatory levies (excluding pension contributions).

Applying this formula with the previously presented parameters, the estimated benefit per student for one year spent in a split class is: €4,538 in primary school, and €3,509 in middle school.

Cost per Student of Implementing the Class Splitting Policy (ΔC)

The cost per student of implementing the class splitting policy can be estimated by allocating the cost of an additional teacher – required for each split class – across the number of students originally present in the class before implementation. This approach measures the unit fiscal effort required to halve class sizes.

The cost per student is estimated using the following formula:

$$\text{Cost} = \frac{w^{ens}\,(1+\tau^{ens})(1+c)}{n}$$

Where:

- w^{ens} is the gross annual salary of a teacher. According to DEPP (2024a), in 2022 this amounted to €36,672 in primary education and €42,072 in secondary education (Table 2, p. 333).
- τ^{ens} is the employer contribution rate, expressed as a proportion of the gross salary, including social contributions excluding pensions, and contributions financing future teacher pensions. The official pension contribution rate for civil servants is currently set at 78.28%, but this includes a significant balancing subsidydesigned to compensate for demographic imbalances– the gap between the regime's demographic ratio and that of the

overall population – which explains why it is far higher than the private-sector rate (15.3%). For a more realistic approach to the cost of teacher pensions, we instead use a rate of 34.65%, which applies to local and hospital public sector employees (CNRACL), and more closely reflects the actuarial cost of their pensions.[10] Taking into account all applicable employer contributions, and adding the selected pension contribution rate (34.65%),[11] the resulting employer contribution rates are: 45.94% in primary education, and 43.35% in secondary education. This leads to a total annual cost of: €53,520 per primary school teacher, and €60,311 per secondary school teacher.[12]

- c is an additional factor representing fixed non-salary costs associated with splitting (logistics, facilities), expressed as a proportion of total teacher cost. Due to a lack of budgetary data allowing precise estimation of these costs in the REP and REP+ class-splitting policy, we estimate this using information from DEPP on the structure of national education expenditure (DEPP, 2024b, chart p. 3). By comparing the share of investment spending (8.5% in 2022) to the share of teacher pay, social contributions, and pensions (48.8%), we derive an estimated value of 17.4% (i.e. 8.5% / 48.8%) for this parameter.
- n is the number of students per class before class splitting, set at 22 for primary school and 26 for middle school.

From these parameters, the estimated cost per student for class splitting is:

$$\text{Primary} = \frac{36\,672 \times (1+45{,}94\,\%) \times (1+17{,}4\,\%)}{22} = €2{,}856$$

$$\text{Middle school} = \frac{42\,072 \times (1+43{,}35\,\%) \times (1+17{,}4\,\%)}{26} = €2{,}723$$

Fiscal Externality per Student Associated with Class Splitting (ΔE)

The parameter ΔE represents the fiscal externality – that is, the additional public revenuesgenerated by the increase in future labor income of students who benefited from class splitting. In other words, it is the portion of individual economic gains recovered by the state via mandatory levies, due to the positive effect of the policy on academic skills.

This externality is calculated using the same components as those used for the social benefit ΔB, but applying the average marginal tax rate τ (excluding pension contributions):

$$\Delta E = \Delta n \times \delta \times \theta \times (\tau \times w_e)$$

Using this formula with the parameters described above, the fiscal externality per student is estimated at: €2,934 in primary school, and €2,269 in middle school

Results and Limitations of the Exercise in the Case of Class Splitting

By combining the expressions for social benefit (ΔB), direct cost of the policy (ΔC), and fiscal externality (ΔE) per student, the following formula is obtained for the MVPF index applied to class splitting in primary and middle school:

$$\text{MVPF} = \frac{\Delta n \cdot \delta \cdot \theta \cdot w_e(1-\tau)}{\left(\frac{w^{ens}(1+\tau^{ens})(1+c)}{n}\right) - \Delta n \cdot \delta \cdot \theta(\tau \cdot w_e)}$$

[10] In a note published in 2022, the High Commission for Planning proposed using a combined employer and employee pension contribution rate of 28% to approximate a "normal" rate – the rate the State would pay if it were not subsidizing its contributions to balance the pension system. However, this assumption raises two issues: (1) it does not account for the specific benefits offered by the public-sector pension scheme, which justify a higher contribution rate than in the private sector; and (2) the contribution bases of the two systems differ, notably due to the exclusion of bonuses and allowances in the public sector, which mechanically leads to higher rates to ensure equivalent coverage. To account for these specifics, we adopt a more cautious alternative assumption, based on the pension contribution rate applied to local and hospital civil servants (CNRACL).

[11] These contributions include: mandatory employer contributions on the gross base salary, namely health, maternity, disability, and death insurance (9.70%), family allowances (5.25%), the autonomy solidarity contribution contribution (0.30%), FNAL (0.50%), the mobility payment (using an average rate of 1%); the employer contribution to the public-sector supplementary pension scheme (5% of bonuses and allowances, capped at 20% of gross base salary); and pension contributions calculated by applying the CNRACL rate (34.65%) to the gross base salary.

[12] For the full calculation of teacher costs, see the table in Appendix 2.

Applying this formula with the selected parameters yields the following results:

- $MVPF_{primary}$ = infinite: in the case of primary education, the fiscal externality generated by the policy exceeds its implementation cost. Class splitting is therefore self-financing in the long term.
- $MVPF_{middle}$ = 7.7: in middle school, each net euro invested in class splitting generates a social benefit of €7.70 for beneficiaries. The policy thus remains highly profitable, even though it is not self-financing in the long term.

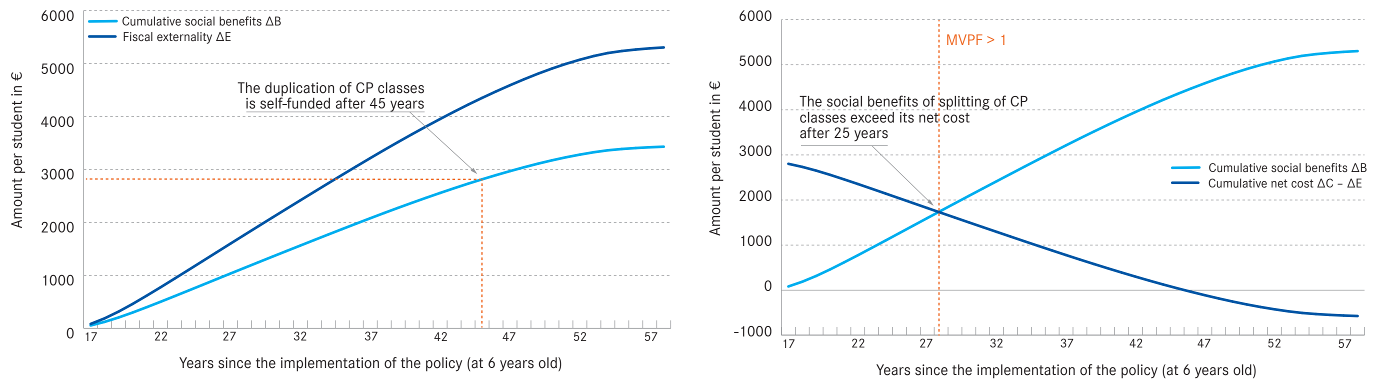
These results reflect stronger pedagogical effects of class splitting in primary education, where the relationship between class size and skill acquisition is more firmly established than in secondary education. Individual gain and fiscal externality are therefore mechanically higher.

Since the social benefits of educational policies are realized in the long term, while their costs are borne immediately at the time of implementation, it is important to take into account the time dynamics of the various components of the MVPF index. This makes it possible to identify the momentwhen a policy becomes profitable or self-financing.

Figure 3 illustrates these dynamics in the case of class splitting in primary school. Panel (a) shows, based on the number of years since the implementation of the policy, the evolution of the three components of the index: cumulative social benefits (ΔB), gross cost to the State (ΔC), and induced fiscal externality (ΔE). It shows that the fiscal externality exceeds the gross cost after 45 years, which means that the policy becomes self-financing at that point. Panel (b) compares cumulative social benefits (ΔB) to the net cost for public finances (ΔC – ΔE). It shows that class splitting becomes socially profitable (in the sense that MVPF > 1, i.e. ΔB > ΔC – ΔE) after 28 years.

Figure 3. Dynamics of the MVPF components for class splitting in primary school

(a) Social benefits (ΔB), deployment cost (ΔC) and fiscal externality (ΔE) (b) Social benefits (ΔB) and net cost (ΔC – ΔE)



Notes : Panel (a) shows the evolution of the three components of the MVPF index for class splitting in primary school, based on the number of years since the policy was implemented: cumulative social benefits (ΔB), gross cost to the State (ΔC), and generated fiscal externality (ΔE), in order to identify when the policy becomes self-financing (ΔE > ΔC). Panel (b) compares the evolution of cumulative social benefits (ΔB) with that of the net cost to public finances (ΔC – ΔE), to identify the point when the policy becomes socially profitable (MVPF > 1).

The preceding analysis focuses on two key parameters of the transmission chain: the effect of one fewer student per class on academic skills (θ), and the effect of these skills on future wages (δ). The index remains greater than 1 — meaning the policy is profitable from a societal point of view — as long as the following conditions are met (assuming all other parameters held constant):

Level of education	θ: effect of one fewer student on academic skills (in SD)	δ: impact of academic skills on future wages
Primary	0.62%	3.64%
Middle school	0.46%	4.48%

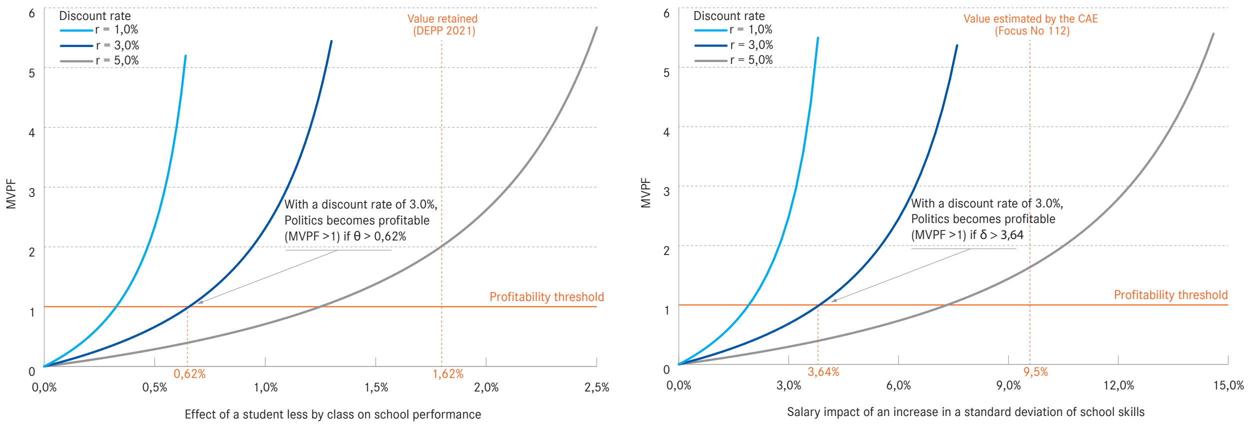
These thresholds remain below the values generally estimated in the literature, which most often identifies the effect of one fewer student on academic skills as greater than 1% of a standard deviation (θ), and the effect of academic skills on future wages as greater than 9.5% (δ). This finding is particularly robust for primary education, where experimental and quasi-experimental studies are numerous. In contrast, the results are more uncertain for middle school, due to a smaller evidence baseand more heterogeneous findings. Some research (Angrist et al., 2019; Leuven et al., 2008) has indeed found non-significant effects, which calls for caution in interpreting the MVPF of class splitting in middle school.

More generally, Figure 4 analyzes the sensitivity of the MVPF index for class splitting in primary education to the discount rate (r) and to the parameters selected for the impact of one fewer student per class on academic skills (θ) and the wage return on academic skills (δ). The presented graphs show that, even with a high discount rate (r = 5%), the policy remains profitable at parameter values θ and δ below those generally retained in the literature.

Figure 4. Sensitivity of the MVPF index for class size to the parameters r (discount rate), θ (impact of one fewer student per class on academic performance), and δ (wage return to academic skills)

(a) As a function of r and θ

(b) As a function of r and δ



Notes : Panel (a) presents the value of the MVPF index for class splitting in first grade (CP) in primary school as a function of the impact of one fewer student per class on academic performance (parameter θ), for different values of the discount rate (r), while holding constant the wage return to academic skills (parameter δ), fixed at 9.5% in accordance with the estimate used in *Focus* No. 112. Panel (b) performs the same exercise, this time varying the value of parameter δ, while keeping parameter θ fixed at its estimated value in this Focus (1.62%).

It should be emphasized, however, that the MVPF index calculated here does not account for all the positive spillovers of class size reduction, and thus constitutes a conservative estimate of the policy's social profitability. In particular, several positive externalities of smaller class sizes are not included in the calculation: for example, the potential long-term effects on crime reduction, due to higher education levels, or the improvement in teachers' working conditions made possible by smaller classes. These qualitative dimensions are frequently highlighted in international surveys. For instance, according to the results of the 2018 TALIS survey conducted by the OECD, 87% of primary school teachers in France consider class size reduction to be the top priority in case of an increase in the budget allocated to national education, making it the most frequently cited measure among primary teachers (DEPP (2021): Note d'information No. 21.34).

Conclusion

Class splitting provides a particularly relevant case study for applying the methodological framework of the Marginal Value of Public Funds index to an educational policy that is empirically well-documented.

The calculation of MVPF indices associated with this policy in primary and middle school shows that it likely yields a high return on investment. Under the assumptions used, class splitting in primary education generates a fiscal externality that exceeds its implementation cost, making it a self-financing policy. In middle school, although the self-financing threshold is not reached, the MVPF index remains well above one, indicating a social gain of more than €7 per beneficiary for each net euro invested by the State. Class size reduction thus appears to be a policy with high social returns, particularly in primary education.

This evaluation, although incomplete as it is limited to individual wage gains, confirms that targeted reductions in class size can improve educational trajectories while reinforcing the collective returns of public investment. It does not take into account certain positive externalities — notably the improvement in teachers' working conditions in less crowded classrooms — which could further amplify the beneficial effects of the measure.

Although France has begun to reduce class sizes in primary education — due to the combined effect of the class splitting policy in priority education areas and demographic decline — it still lags behind international standards in terms of average class size and student-teacher ratios. The results of this Focus argue in favor of mobilizing the budgetary leeway created by demographic decline to continue reducing class sizes where the effects are best established. In primary education, this would mean prioritizing the levels not yet covered by the class splitting policy in priority education networks (nursery and lower primary levels, CE2, and potentially CM1 and CM2). Outside of priority education, a targeted policy could also focus on schools serving the most socially disadvantaged students. In middle school, the expected effects of reducing class size remain more uncertain, which justifies the implementation of a targeted experiment in a sample of schools. A rigorous evaluation, conducted from the first year of implementation, would help clarify the scope and intensity to be considered for such a policy.

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Appendix

Appendix 1. Can the MVPF for class splitting be extrapolated to a marginal reduction in class size?

It is legitimate to ask whether the effectiveness of a marginal reduction in class size – such as a change from 22 to 21 students – can be evaluated using the MVPF estimated for a full class split. Under what conditions do these two approaches yield comparable results?

Interpretation of the effects estimated in the literature

Academic literature generally estimates the impact of class size based on variations involving substantial reductions in the number of students – particularly in the context of class splitting policies – rather than on marginal decreases (such as from 22 to 21 students). Yet the magnitude of class size reduction varies considerably from one study to another: some analyze a drop from 30 to 20 students, others from 24 to 11, etc. In order to make these estimates comparable, it is common practice to standardize the measured effects to a common unit: the effect of one fewer student. This normalization facilitates comparisons but should not be interpreted literally: it does not imply that the marginal effect is constant regardless of the initial class size.

For example, in the STAR experiment conducted in the state of Tennessee in 1986, students were randomly assigned to either small classes (around 15 students) or large classes (around 22 students), representing an average difference of 7 students per class. By comparing the performance of kindergarten students assigned to the two types of classes, Krueger (1999) shows that those in smaller classes performed about 20% of a standard deviation better on standardized tests than those in larger classes. When expressed per one fewer student, this corresponds to an average effect of 3% of a standard deviation (0.20 / 7). However, this effect should not be understood to mean that each successive reduction – from 22 to 21, then from 21 to 20, etc. – consistently yields a 3% improvement. It is more plausible that the marginal effect increases as class size decreases, as confirmed by a recent study by Connolly and Haeck (2022). The 3% effect should therefore be interpreted as a linear interpolation of the gain over the full rangefrom 22 to 15 students, and not as an approximation of a constant marginal effect.

Class splitting vs. marginal reduction in class size

To align with the class size variations that have been estimated in the literature, this Focus evaluates the MVPF associated with class splitting – i.e., a reduction from 22 to 11 students in primary school and from 26 to 13 in middle school – rather than a marginal reduction, such as from 22 to 21 students.

However, from an operational standpoint, class splitting is not the only conceivable option: an education policy might aim for a more gradual decrease in class size. This raises an important question for public decision-making: can the MVPF estimated in a class splitting scenario be validly extrapolated to a more marginal reduction?

It can be shown that these two policies – full class splitting and marginal reduction – are equivalent only under a specific but realistic condition regarding the functional form of the relationship between class size and student performance. If we denote y as student performance and n as the number of students in the class, this relationship must follow the functional form:

$$y = a + b / n \qquad \text{(A.1)}$$

where a and b are constants, with $b > 0$.

This relationship implies that the benefits of reducing class size by one student are greater when the initial class size is small: it is therefore a non-linear function with increasing marginal returns. In other words, reducing a class from 12 to 11 students produces a greater gain than reducing it from 22 to 21.

This specification also has an important property: it ensures that class size constitutes a «zero-sum game». This means that, for a given total number of students distributed across a fixed number of classes, the average overall student performance remains constant regardless of the distribution. In other words, the gains of some students (in smaller classes) are exactly offset by the losses of others (in larger classes).

Under this assumption, it can be shown that the MVPF of a marginal reduction in class size is identical to that of class splitting, for an equal cost. To illustrate this result, consider a stylized framework with 21 classes of 22 students. Two scenarios are compared:

- Policy A (targeted class splitting): one additional teacher is hired to split one of the 21 classes. Only one class is affected, but its 22 students experience a reduction from 22 to 11 students.
- Policy B (generalized marginal reduction): one student is removed from each of the 21 classes, allowing the formation of a 22nd class of 21 students with an additional teacher. All students benefit from a one-student reduction in their class (from 22 to 21).

In both cases, the cost is identical: one additional teacher position. The key point is to show that the total aggregate gain in student performance is the same in both scenarios. The two policies will have the same MVPF, even if their modes of resource allocation (concentrated vs. diffuse) differ.

MVPF index for Policy A (targeted class splitting). In this scenario, the benefit of the policy is concentrated on the 22 students in the split class. These students see their class size halved, from 22 to 11. Assuming that the relationship between individual performance (y) and class size (n) follows the equation given by (A.1), the gain for each student can be calculated as the difference between their score in a class of 11 and their score in a class of 22:

$$\Delta y|_{22\to 11} = \mathrm{y}(11) - \mathrm{y}(22) = a + \frac{b}{0.5 \cdot n_0} - \left(a + \frac{b}{n_0}\right) = \frac{b}{n_0}$$

Since 22 students benefit from this improvement, the total gain for all beneficiaries is equal to b.

MVPF index for Policy B (generalized marginal reduction). In this second scenario, the benefit is distributed across all students in the 21 initial classes. Each class loses one student, going from 22 to 21 students. A new class of 21 students is created, meaning that all 462 students (21 × 22) each benefit from a reduction of one student in their class. According to equation (A.1), the gain for each student going from 22 to 21 students is:

$$\Delta y|_{22\to 21} = a + \frac{b}{n_0 - 1} - \left(a + \frac{b}{n_0}\right) = \frac{b}{n_0 \cdot (n_0 - 1)}$$

Since 462 students benefit from this gain, the total benefit is also equal to b.

We thus obtain the same total gain as in Policy A. This means that, for the same cost, both policies (targeted class splitting vs. generalized marginal reduction) produce the same overall benefit in terms of academic performance. Their MVPF index is therefore identical.

Interpretation of the parameter θ and comparison between marginal and overall effects

The effects of class size reported in the literature typically refer to to substantial reductions in class size, as in the case of class splitting. Let β denote the overall observed effect on the performance of a student assigned to a split class compared to a regular class.

In our theoretical framework, where the average performance of a student is modeled by a function of the form y = a + b/n, this overall effect can be written as:

$$\beta = \left(a + \frac{b}{n_0/2}\right) - \left(a + \frac{b}{n_0}\right) = \frac{b}{n_0}$$

where n_0 is the initial class size (before splitting).

The parameter θ used in the calculation of the MVPF index expresses this effect "per student removed," by dividing the total observed effect by the change in class size (i.e., n_0 / 2 in the case of a split). This implies that:

$$\theta = \frac{\beta}{n_0/2} = \frac{2b}{n_0^2}$$

But if one wishes to estimate the actual marginal impact of one fewer student from the value of θ, under the assumption that the relationship between academic performance and class size follows equation (A.1), the estimate must be adjusted to account for the non-linearity of the relationship. The marginal effect (going from n_0 to $n_0 - 1$) is then expressedas:

$$\Delta y|_{n_0 \to n_0 - 1} = \left(a + \frac{b}{n_0 - 1}\right) - \left(a + \frac{b}{n_0}\right) = \frac{b}{n_0(n_0 - 1)}$$

To recover this marginal effect from the parameter θ, one simply needs to divide θ by $2(n_0 - 1)/n_0$. Indeed:

$$\frac{\theta}{2(n_0 - 1)/n_0} = \frac{2b}{n_0^2} \times \frac{n_0}{2(n_0 - 1)} = \frac{b}{n_0(n_0 - 1)}$$

In our example, starting from an estimated effect θ of 1.62% of a standard deviation (which corresponds to the average estimate by DEPP of the impact of splitting first-grade classes in REP+ on academic performance, expressed per student removed), the "true" marginal effect of reducing a class from 22 to 21 students is obtained by adjusting θ using the corrective factor mentioned above:

$$\Delta y|_{22 \to 21} = \frac{\theta}{2(n_0 - 1)/n_0} = \frac{0{,}0162}{2 \times 21/22} \approx 0{,}0085$$

In other words, reducing a class from 22 to 21 students would, on average, improve student performance by 0.85% of a standard deviation – nearly half the crude estimate. This calculation yields the same overall effect in both scenarios:

- Splitting a class of 22 students results in an aggregate performance gain equal to 22 students × 11 students fewer × 0.0162 ≈ 3.9 standard deviations;
- Reducing class size by one student in 21 classes of 22 students results in an aggregate gain of 462 students × 0.0085 ≈ 3.9 standard deviations.

This reasoning shows that estimates from the literature on class size effects must be interpreted with caution: they do not reflect a constant marginal effect, but rather an average interpolated effect over a substantial range of reduction. Nevertheless, under the assumption that the relationship between class size and performance follows a 1/n law, the MVPF index for a marginal reduction remains equivalent to the one measured in a class splitting scenario.

Annexe 2. Calcul du coût complet d'un enseignant

		1er degré	2nd degré
Gross base salary		€2,678	€2,883
Bonuses		€378	€623
Total gross monthly salary		€3,056	€3,506
Total gross annual salary		€36,672	€42,072
Contributions	**rates**		
MIS	9,70%	€260	€280
Family allowances	5,25%	€141	€151
CSA	0,30%	€8	€9
FNAL	0,50%	€13	€14
Mobility payment	1%	€26.78	€29
ATI	0,32%	€9	€9
RAFP	5%	€19	€29
CNRACL pensions*	34,65%	€928	€999
Total contributions		€1,404	€1 520
Overall contribution rate (% of gross)		45.94%	43,35%
Employer cost (monthly)		€4,460	€5 026
Employer cost (annual)		€53,520	€60 311

* Although the official employer pension contribution rate applied to the gross base salary of public-sector teachers is 78.28%, this rate includes a substantial balancing subsidy intended to offset the demographic gap between the pension scheme's dependency ratio and that of the national population. For a more realistic estimate of the pension cost for teachers, we instead use the alternative rate of 34.65%, which is the rate applied to local and hospital civil servants (CNRACL), whose contribution rate is more closely aligned with the actuarial cost of pensions for the employees concerned.

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