Differences between public and private sector pensions: an analysis based on career profile simulations

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Following the alignment of the rules for private and public sector pension schemes, which began with the reform of the French pension system in 2003, there remain a number of differences. These include structural variations between the two schemes, the definition of the reference salary (salary over the best 25 years in the private sector or salary excluding bonuses over the final six months in the public sector).

We simulate the application of the two types of rules to several standard civil service careers. The impact on the replacement rate is not homogeneous: for the generation born in 1955 preparing to retire in 2017, applying private sector rules would be more beneficial for a standard category B civil servant, but less beneficial for a teacher, and slightly less beneficial for an "A+" category manager. This is the result of the interplay of the factors that determine pension amounts with each type of rule: the proportion of bonuses in the total remuneration for civil service schemes (the higher this proportion, the lower the pension amount as a proportion of the final pay), the level and slope of the wage trajectory for private schemes (the more the slope is ascending and the greater the proportion of pay over the social security ceiling, the lower the pension as a proportion of the final pay).

A change from one sector to another during a career can have a significant and varied impact on the replacement rate. It often leads to a lower replacement rate than would be achieved by remaining employed in either the public or the private sector throughout a career (for identical net salaries at all ages), but there are some configurations where a change of sector leads to a higher replacement rate: for example, the case of a category A+ civil service manager whose career finishes with around ten years in the private sector.

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Reminder:

The opinions and analyses in this article are those of the author(s) and do not necessarily reflect their institution's or Insee's views.

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As in many OECD countries[1], the French pension system is characterised both by the range of mandatory schemes and a diversity of rules for acquiring pension benefits and calculating pensions. In addition to the basic general scheme (Cnav), the French system has some basic occupational pension schemes (agricultural employees, craftsmen and merchants), special employee schemes (civil servants and some private sector employees[2]), and self-employed schemes (self-employed professions, self-employed agricultural workers, etc.).

Such a diversity of rules generates much debate about the equity between schemes – as evidenced by simply reading through the parliamentary debate proceedings around the last reform of the pension system, and observing the frequent references to the situation of special schemes and civil servants. This led the legislator to explicitly mention this issue among the general objectives and principles of the pension system, stating that "*individuals covered by social security shall be treated equitably with regard to the pension period and amount, regardless of their scheme"* (Paragraph II of Article L111-2-1 of the French Social Security Code). Furthermore, monitoring disparities between schemes was underlined as one of the specific missions of the new Committee for Pensions Monitoring, since the Act which establishes this committee states that it will be required to "*examine the situation of the pension system, with regard in particular, […] to comparative pension benefits under the various pension schemes*" (Article 4 of Act no. 2014-40 of 20 January 2014). This issue is also regularly assessed by the Pensions Advisory Council (COR, 2009; 2014; 2015b; 2016a and b) and the *Cour des Comptes* (French National Audit Office) (2003; 2016).

While questions around equity are raised for all special schemes, given their importance in the French pension system, the debate often focuses on comparison between the general scheme, which covers most private sector employees, and civil service schemes[3]. This article also focuses on these schemes.

Beyond the obvious differences in rules and structure between schemes, which are primarily a product of history, the question of the equity or potential inequity of treatment between civil servants and private sector employees[4] is particularly complex – not least because it raises the question of the equity standards to consider, which are not set out in law. In any case, there would be little sense in limiting the question to the similarity or uniformity of rules, because identical rules applied to different groups of people do not always ensure equity, while diversity of rules does not necessarily result in pension inequality. Employment structures, career profiles and pay vary considerably depending on a person's career – in whole or in part – as a civil servant or private sector employee.

These differences in employment structure between the private and public sectors significantly complicate straightforward descriptive statistical comparison between sectors. While mean pension amounts are higher for former civil servants – a mean of €2,520 per month at the end of 2014 for former Central Government civilian public servants, €1,840 per month for former local authority and public hospital workers, and €1,770 per month for former private sector employees, at the end of a full career affiliated to a single plan (Drees, 2016, p.44) – the differences are explained first and foremost by the fact that, on average, the public sector workforce has higher qualifications. We therefore cannot use these differences in their current state to assess whether or not the rules for public sector pension schemes are more "generous". Equally, comparisons between replacement rates (that is, the ratio of total pension amount at retirement to the final salary at individual level) can be deceptive, although the impact of structural effects on this indicator is probably lower than for the pension amount. Although the most recently available data show that replacement rates between the private and public sectors are fairly close to one another - the median replacement rate following a full career is slightly lower for individuals who finish their career in

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1. For example, Germany, Belgium, Spain and even Japan have a specific plan for civil servants, with some specific rules – however in Spain and Japan, this plan has recently been closed to new members. In other countries (e.g. Canada, the USA, the Netherlands, the United Kingdom or Sweden), private pension funds exist alongside the public system which is the same for everyone. These vary between employers, and therefore differ between public sector and private sector employers (COR General Secretariat, 2014a).

2. Schemes organised for certain professions (miners, sea fishermen, solicitor clerks and employees, electric and gas company employees, etc.) or operated in some companies (SNCF, RATP, Banque de France, Opéra de Paris, Paris Chamber of Commerce, etc.).

3. At the end of 2014, the general scheme represented 12.9 million pensioners, around 82% of all pensioners on French schemes (employees and self-employed workers from the public and private sectors). The various civil service schemes represented 2.8 million people, around 18% of the total (some of these pensioners were also under the general scheme) (Drees, 2016, p. 9). Other special employee schemes accounted for just over 600,000 pensioners, i.e. around 4% of the total.

4. This article uses the term "private sector" schemes to refer to those under the general scheme and the Agirc and Arrco supplementary schemes. This is something of a simplification, because some public sector employees are also covered by the general scheme, while some private sector employees are not.

the public sector than for those who finish their career in the private sector (73.9% and 75.2% respectively) for people born in 1946 (Senghor, 2015, p.5) - this similarity does not demonstrate equal treatment under identical characteristics. Given that the pension system performs vertical redistribution, which means that the replacement rate generally decreases with the end of career salary level, we might have expected a bigger difference in the median replacement rate between former civil servants and private sector employees, given that, on average, they have higher qualifications, and therefore salaries.

Without going into a normative discussion of the definition of equity, this article seeks to explain the differences in pensions between civil servants and private sector employees by illustrating the effect of the rules on pension amounts *for a given wage trajectory*, based on several standard careers, and by detailing the various mechanisms involved. First we outline the main differences between the schemes, and then in the second part, we present the results of our simulations which involve applying current private pension schemes rules to various standard civil service careers. This standard case approach is useful in that it neutralises career characteristics and can therefore be used to isolate and detail the effects of the rules for calculating pensions for the standard careers selected.

The differences between private and public schemes

The issue of coverage

First, it should be noted that contrasting the "public sector" and the "private sector" is not as simple as it seems when it comes to the analysis of pensions.

Pension schemes do not have exactly the same coverage as jobs: some public sector employees are affiliated to the general scheme (contractual public sector employees, and some civil servants) and conversely, some civil servants are seconded to the private sector (DGAFP, 2014a, p. 231 and 389).

Furthermore, the two "blocks" are not homogeneous in terms of employer practices and remuneration policies (Daussin-Benichou et al., 2014). This heterogeneity is particularly prominent in the private sector, especially between corporations, small and medium-sized enterprises and very small enterprises. But it is also present in the civil service, e.g. between the State, local authorities and public hospitals.

Last but not least, neither are the two sets of "civil service schemes" and "private employee schemes" fully homogeneous in terms of pension rules. For civil servants, the rules regarding the minimum age at which pensions become payable, for example, are different for military personnel, civil servants in professions classified as arduous or dangerous[5] and "sedentary" civil servants, the latter having the same minimum age as "private sector" employees. At the same time, the rules are not fully uniform for individuals under private sector schemes. Pension rules are only identical for the part of careers subsequent to 1999. Before this date, at which the Arrco supplementary plan was introduced, pension benefits acquired vary for identical salary levels, depending on the specific rules for each supplementary pension fund. Even after 1999, contribution rates to Arrco are not fully homogeneous, because some sectors still have a contribution rate above the contractual rate. The similarity of rules can also only be considered when the supplementary social security offered by some companies (additional pension schemes, "in-house" retirement indemnities and early pensions) is not taken into account.

We also need to remember that individuals can change plans during their career. A substantial proportion of former civil servants actually have multiple pensions, since part of their career has been spent in the private sector, and they therefore also have private sector employee schemes (Aubert et al., 2012).

Differences in rules

Apart from this issue of coverage, the main difference between "private" and "public" schemes is their respective structures. Private schemes are built in stages and include a basic annuities plan (the general scheme), supplementary points

5. Categories referred to as "active" (firemen, municipal police officers, nurses, healthcare assistants, etc.), "super-active" (national police officers, prison officers, etc.) or "insalubrious" (sewage workers). These are professions which generally have no private sector equivalent. As of 31 December 2012, these categories accounted for 160,000 State employees (around 12% of total numbers), 500,000 public hospital employees (around 60% of all civil servants – an estimation that takes into account the fact that on 1 December 2010, half of nurses chose to be recategorised as category A, and are therefore no longer under the "active" category) and 55,000 local authority employees (around 5% to 10 % of total numbers) (DGAFP, 2014, pages 124-127).

schemes (Arrco and Agirc), and any additional professional schemes, with procedures which can vary a great deal (these schemes are not mandatory and therefore only apply to companies and branches that have decided to implement them). Another difference is associated with the level of annual pay: the proportion of remuneration below the social security ceiling (€38,616 annually in 2016) is covered by the basic plan, the supplementary Arrco plan and any additional company plan, while the proportion of remuneration over this ceiling is only covered by the supplementary schemes (Arrco or Agirc, depending on whether the individual has management status or not), and any other additional schemes.

However, the public sector schemes (the State civil service scheme, CNRACL for local authority and public hospital employees, FSPOEIE for government-employed manual workers), offer annuities and are integrated schemes, i.e. a single scheme fulfils the role of all three stages in the private sector scheme at the same time[6]. The pension rate used under these schemes is therefore higher: for a full career, it is 75% of the reference salary under the civil service plan, as opposed to 50% under the general scheme. Moreover, an additional scheme (the RAFP), operating a points and fully funded system, was created in 2005, but the new plan cannot be considered an exact replica of supplementary private sector employee plans for civil servants, because it applies to a remuneration basis that is totally dissociated from that of the integrated schemes.

In order to fully understand the differences between schemes, we first need to restate the formulae for calculating pensions. These can be expressed, under annuity schemes, as follows:

Pension = pension rate x *prorata coefficient* x *reference salary.*

For points schemes, the formula is as follows:

Pension = early retirement reduction factor x *number of points* x *point value.*

The pension rate for basic schemes and the early retirement reduction factor for supplementary schemes, express the modulation of the pension amount depending on the retirement age and the length of contribution under the basic schemes, via a reduced pension for retiring early or extra pension for retiring late in line with a reference rate. It is therefore determined by the age at which the pension becomes payable (the minimum age at which individuals can retire), the required length of contribution for the full rate (the minimum length required in order to avoid a reduced pension for retiring early) and the age at which the reduction is cancelled out. The prorata coefficient for annuity plans expresses the prorata calculation of the pension amount as a function of the length of contribution under the scheme. It is therefore determined by the reference period for a full career, which defines the length required for a prorata calculation of 100%, and by the methods for calculating the period for which contributions have been made under the scheme. This is higher than the length of employment periods, as it also includes periods of involuntary inactivity (unemployment, sickness, etc.) which are treated as paid up, and additional entitlements (credited for the individual's children). Finally, the reference salary under annuity schemes depends in whole or in part on the gross wages received over the individual's career. It therefore does not depend on the contribution rates that have been applied to these wages, whereas the number of points acquired under points schemes does depend on the contributions paid.

Recent pension reforms since 2003 have aligned some of these parameters between public and private schemes (COR, 2015b, p. 5-6). Since the 2003 reform, the rules have been the same for the length of contribution required for the full rate (they were also the same before the 1993 reform), for the reference period of the prorata coefficient denominator (since 2008, this period has been identical to the period required for the full rate, but they differed between 1993 and 2008) and for the common law legal minimum retirement age (which has always been the same for both public and private schemes – the only differences being exceptions granted to some categories). Procedures for yearly pension increases have also been identical between the integrated civil service schemes and the general scheme since 2004.

For other parameters, the differences between schemes are gradually being reduced, but the process of convergence has been spread over a longer period, and has therefore not yet been achieved. The age at which the reduction is cancelled out (2003 reform) and employee contribution rates (2010 reform) will not be fully aligned until 2020.

6. This article does not cover the additional stage provided by personal pension savings schemes (PERP, PREFON, COREM, etc.), for which individuals are solely responsible.

However, some differences remain: the definition of the reference salary for calculating pensions (salary below the social security ceiling for the best 25 years under the general scheme, and final six months excluding bonuses for civil servants) and employer contribution rates (see below); the measurement of the length of contribution (calendar period for civil servants, period based on an annual salary income threshold for private sector employees); the opportunities for early retirement and additional entitlements credited for specific categories (military personnel and "active" category civil servants); additional quarters for children (2 years per child for mothers employed in the private sector, as opposed to one year – under certain conditions – or 6 months for civil servants, depending on whether the child was born before or after 2004); pension increases for large families (a 10% increase in pension for parents of at least three children, regardless of the number of children under private schemes, but increasing beyond the third child under civil service schemes); minimum pension amounts (the minimum guaranteed level is higher in the public sector than in the general scheme); the returns on supplementary or additional schemes[7]; or the eligibility conditions and calculation methods for reversionary pensions (SG-COR, 2014b; COR, 2015b; *Cour des Comptes*, 2016).

The reference salary calculation can give the impression of being more beneficial for public sector schemes because for ascending wage trajectory profiles, the mean of the final 6 months is always higher than that of the best 25 years. However, this "advantage" is balanced out by the fact that the reference salary for civil service pensions is calculated only on part of their earnings. These earnings break down into a "main" part (the basic index-related salary, which depends on the civil servant's index, and therefore primarily on his or her grade and length of service) and an "accessory" part (bonuses[8], indemnities associated with residence, mobility or overtime, family salary supplement, etc.). However, only the main earnings are taken into account for calculating the pension amount under the integrated civil service plan. Their replacement rate, i.e. the ratio of the first pension to the final total salary, is therefore primarily determined by the proportion of bonuses, and therefore decreases as this proportion rises.

In 2012, "accessory" earnings accounted on average for one fifth to one quarter of civil servants' total pay (DGAFP, 2014a, p. 160 and 186). Between the generation born in 1940 and the one born in 1955, this accessory part, observed at the end of the career, changed relatively little for teachers (whether they are category A or B) and category C staff in the active category (prison officers, etc.), but has significantly and regularly increased for other civil service categories, by +5 to +10 percentage points between the 1940 and 1955 generations (DGAFP, 2014b). It should be noted that an increase in the index-related salary can take place at the very end of the career, which leads to a higher pension amount, sometimes referred to as a "*coup de chapeau*". A Drees statistical study seems to show that this phenomenon is not, however, widespread. For example, between the 5 years before the final year, and the final year of a career, the index of civil servants only increased an average of 4.3% for the generation born in 1942. This increase exceeds 10% only for less than one civil servant in ten (Chantel & Collin, 2014).

The difficulty of estimating contribution levels

Contribution rates differ between private sector employees and civil servants, but also between civilian public servants, military personnel, local authority, and public hospital workers. Analysing them presents a significant issue for comparing schemes.

A simple comparison of mandatory contribution rates (employee contribution + employer contribution) reveals very significant differences: in 2015, in comparison with a non-manager private sector employee, the rate was 14 points higher for a local authority or public hospital worker, and 57 points higher for a civilian public servant (Figure I).

However, this kind of comparison is virtually irrelevant, since the bases from which

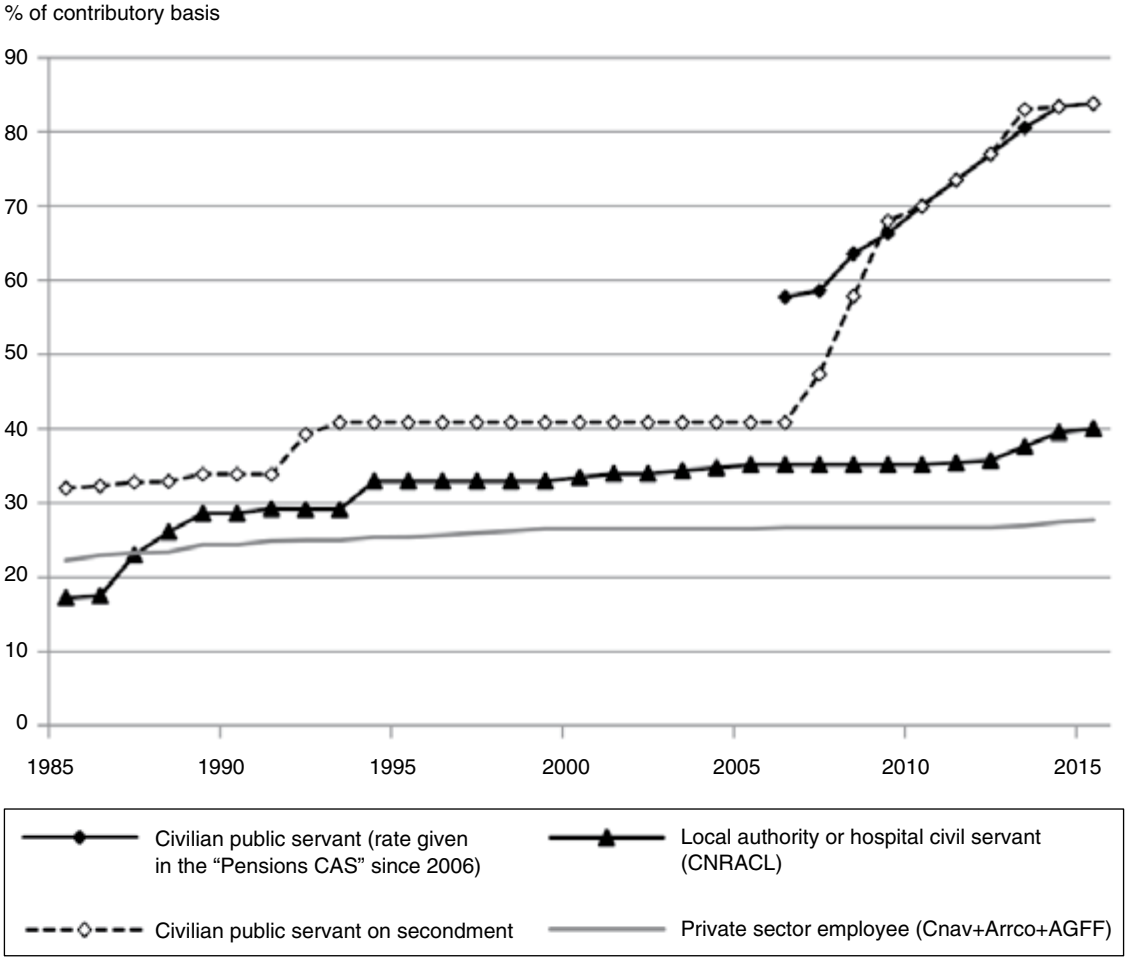
7. The "instantaneous return" is the amount that an individual would obtain in return for an effective Euro contribution if the individual took his or her pension benefit immediately after purchasing it. Under a points plan, it is defined as the ratio between the point value and the point purchase value, multiplied by any call rate. In 2015, the instantaneous yield for Agirc and Arrco was 6.56 % for retirement at the full rate or, taking into account specific contributions that do not generate pension benefits (AGFF contributions, and for managers, CET), 5.21% for non-managers and 5.03% for manager wages below the social security ceiling. For RAFP, this rate is 3.90% for retirement at 62 and 4.76% for retirement at 67.

8. Bonuses in the civil service refer to a permanent component of total earnings; they are not the same thing as the "bonuses" paid occasionally by some employers in the private sector.

contributions are calculated are different, and only represent part of the total earnings. If we consider contributions using a more comparable basis, i.e. the overall earnings including employer contributions, the differences in contribution rates appear to be significantly reduced (in 2013, 15.5% for private sector employees, as opposed to 23.5% for public hospital and local authority civil servants, 35.9% for civilian public servants and 42.2% for military personnel). However, even with a harmonised base, the comparison of contribution rates needs to be interpreted with caution, due to differences in the structure of plan funding – public schemes are funded almost exclusively by social security contributions, while the general scheme receives other sources of funding (SG-COR, 2014b; COR, 2015b and 2016a, p.102-104).

More fundamentally, contributions only give a partial view of employee contribution levels (see Online supplement C2). Some people may accept a lower salary in a sector in return for pension rules that they consider more generous. The lower salary accepted may then be seen as a kind of contribution to pension funding, which needs to be taken into account. So pension comparisons, if we want to be able to consider the contribution levels for various systems, need to take into account salary differentials between sectors, all other things being equal. This makes the analysis extremely complex, because some components cannot be observed, in particular the actual productivity of employees. Analysis ends up being extremely theoretical, since it has to rely strongly on conventional assumptions. It is never really conclusive.

Figure I
Pension contribution rates (employee + employer contribution) since 1985



"Pensions" CAS = "Pensions" special purposes account.
Note: Pension contributions are based on the index-related salary for civil servants, and earnings below the social security ceiling (i.e. segment 1) for private sector employees (non-managers). See Online supplement C1.
Reading note: In 2015, employee and employer pension contributions for local authority or hospital civil servants represented 40% of their gross index-related salary.
Source: legislation.

For this reason, the second part of this article will focus solely on pension amounts, and more specifically on these amounts as a ratio of the final salary – i.e. replacement rates. Since we cannot determine what career and pay each civil servant whose wage trajectory is observed would have had in the private sector, the effect of the pension rules is illustrated by reasoning on the basis of a *given wage trajectory*, i.e. assuming that the wages paid at each age are identical in both sectors.

Disparities in pension amounts for a number of standard careers

Our analysis will involve performing simulations alternating between public sector and private sector rules on a number of standard wage trajectories, based on those developed and frequently used by the Pensions Advisory Council (COR) for its analyses.

The COR has established eight standard careers, four of which are affiliated to the general scheme only, and four of which are affiliated to the civil service scheme only. The simulations will be performed on three of these standard civil service careers. Applying rules from civil service schemes to the careers of private sector employees would present the difficulty of needing first to impute, purely by convention, a breakdown of their wages in terms of basic salary and bonuses. However, it is easy to simulate the application of private sector schemes on wage trajectories for standard cases of civil servants, since we only need to know their total earnings. In practice, these simulations were performed using the CALIPER tool developed by Drees for calculating pension amounts (see Online supplement C3). It is also possible to simulate the application of these rules to just part of a career of a given length, in order to demonstrate the impact of being under both the public and private sector employee schemes over the course of a career.

The standard case approach cannot, and does not intend to, give an overview of the effects of systematically applying the Cnav, Arrco and Agirc rules to all civil servants. It aims to use the example of a few careers under one or more pension schemes (public and/or private) in order to set out in detail the mechanisms involved, and demonstrate the sensitivity of results to some modelling assumptions. A broader perspective would require performing simulations on a representative sample of this population, in order to take into account the weight of each standard career. This article therefore offers a supplementary contribution, and must be read in association with other existing analyses based on representative data, which we will refer to at the end of the article.

The standard career profiles considered

In practice, standard cases correspond to individuals who have worked a full career without interruption, in various civil service categories: a category B sedentary civil servant, whose total end of career earnings include a bonus of around 20% (standard case 5)[9]; a teacher with end of career earnings with a low bonus of around 10% (standard case 6); finally an A+ category manager with end of career earnings with a high bonus of around 33% (standard case 7). The results presented here therefore cover only sedentary categories of civil servants, for whom the rules in terms of age at which pensions become payable and length of contribution required are identical for private employees from the generation born in 1948.

The approach used to build the standard cases was somewhere between a purely theoretical approach which involves selecting individual standard situations by convention, and a purely statistical approach which involves extracting from a sample of observed data a number of real careers that are "representative" of all the others (SG-COR, 2013; COR, 2015a, pages 142-148). More specifically, it is based on statistical analyses of real individual situations to deduce a certain number of realistic career characteristics, in order to produce some stylised standard cases that are simpler than real situations, but are not defined in a completely *ad hoc* way.

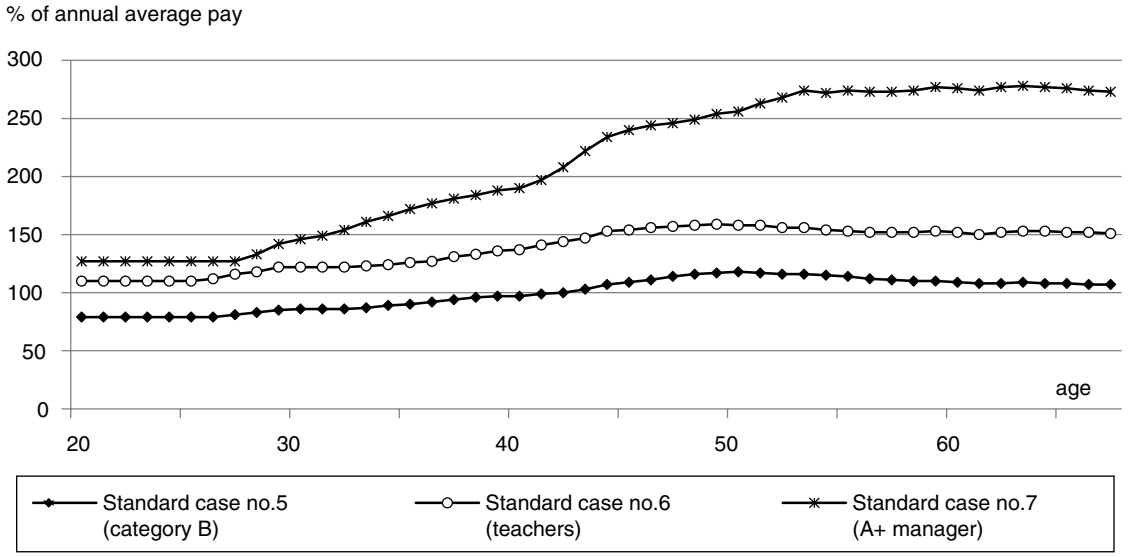
In practice, standard careers are developed on the basis of a statistical analysis conducted by the DGAFP using the Insee civil servant panel (Flachère & Schreiber, 2013). This analysis involved defining, for each standard case, corresponding categories of individuals ("empirical counterparts"), then, for these categories, estimating a wage and bonus proportion profile at each age using the mean values observed for a generation that has completed or virtually completed its career (in this case, the 1950 generation, observed until 2006). The empirical counterpart

9. The term "bonus" is used incorrectly here to refer to all earnings over and above the salary index (including indemnities, overtime, etc.)

for the category B sedentary civil servant standard case generally covers administrative secretaries, inspectors, clerks and higher technicians (excluding, however, category B primary school teachers and police officers). For teachers, it covers accredited or certified teachers and for A+ category staff, magistrates, police commissioners, central administration and local executive managers, engineers, civil administrators, etc.

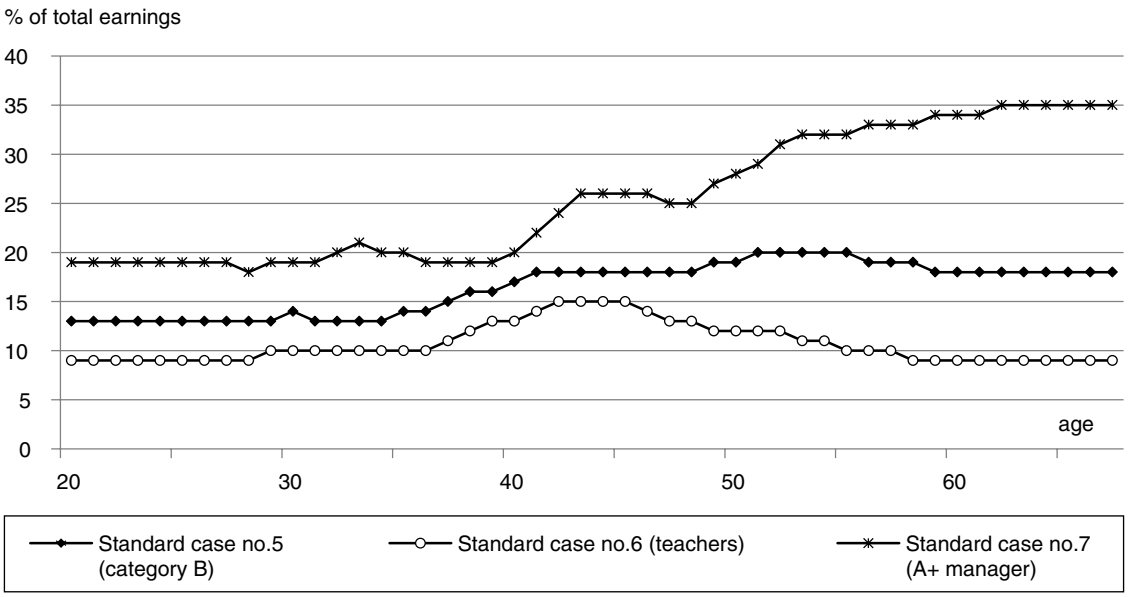
For other generations than the one born in 1950, the *relative* index-related salaries (expressed as a proportion of the annual average pay per capita) and the proportion of bonuses at each age are assumed to be constant and equal to the value observed for the 1950 generation (Figures II et III). This is a conventional assumption that does not take into account actual past changes in the civil service remuneration policy, and in

Figure II
Total earnings as a proportion of annual average pay per capita for the civil servants standard cases



Reading note: salary at 60 for the teacher standard case (no.6) is equal to 152% of the average pay per capita.
Source: COR (2015a) pp. 146-148.

Figure III
Proportion of bonuses in the total earnings for the civil servants standard cases



Reading note: at 60, bonuses (including indemnities and accessory earnings, etc.) represent 9% of total earnings for the teacher standard case.
Source: COR (2015a) pp. 146-148.

particular, effective changes in the index point value. Neither does it cover increases in bonus rates observed over the past 10 to 15 years (DGAFP, 2014b).

The effect of the rules of the different schemes

Table 1 presents the replacement rates at retirement, i.e. the ratio of the first pension payment to the final total salary (including bonuses, etc.) received by individuals covered by social security (both pension payments and salary are calculated net of social security contributions) for standard civil services cases of the 1955 generation, about to take their pension at the full rate in 2017. To give a general idea, final net salaries are around €2,600, €3,600 and €6,800 per month respectively for a category B civil servant, teacher and A+ manager standard cases. The replacement rates are calculated both according to the civil service plan rules (basic civil service plan and RAFP) and the private employee plan rules (Cnav and Arrco for the three standard cases considered, and also Agirc for the standard teacher and A+ manager cases).

For application of the private sector rules, a number of modelling assumptions were adopted according to the contribution rate applied in the Agirc and Arrco supplementary schemes and to whether the private sector rules to civil servants are applied to gross or net identical salaries at each age (Online supplement C1).

As mentioned above, the rules for calculating pensions under the civil service schemes are often seen as more generous, due to the 75% pension rate for a full career, as opposed to 50% for the general scheme, and calculation of the reference salary based on the final 6 months rather than the 25 best years across the career. But this apparent advantage is actually nuanced by the fact that the reference salary is only calculated on the basis of the salary *excluding bonuses* (the additional RAFP plan takes into account bonuses, but this has a very low impact on the replacement rate, because it is only partial and has only applied since 2005). For a given set of total earnings, the pension amount therefore systematically decreases as the bonus proportion of total earnings increases. For the generation that is preparing to retire (born in 1955), the replacement rate is therefore lower for A+ managers (54% replacement rate for an end of career bonus of 33%), than for category B staff (69% replacement for a bonus of 20%), which in turn is lower than for teachers (77% replacement rate for an end of career bonus of 10% of total earnings)[10].

The partial exclusion of bonuses in the calculation of civil service pensions may mean that private sector rules are less beneficial than public sector rules if the bonus proportion is low, and vice versa. The replacement rate for the teacher standard case (case no.6) is therefore higher

10. In the civil service, the bonus rate generally tends to increase with the salary level, and therefore with the qualifications of civil servants. This only applies, however, to employees other than teachers, who are highly qualified but have a low proportion of bonuses, and represent a high proportion of civil servants. Moreover, the correlation between salary level and bonus proportion does not seem to apply to teachers or active category civil servants (Flachère & Pouliquen, 2012).

Table 1
Net replacement rates at retirement as a percentage of final salary for civil servants standard cases according to various public and private sector pension calculation rules (generation born in 1955)

Standard case	**Civil service rules**	Cnav-Agirc-Arrco rules					
		for gross salary equivalence:			for net salary equivalence:		
		Arrco and Agirc contribution rate max.	Arrco and Agirc contribution rate min.	**Arrco and Agirc contribution rate mean**	Arrco and Agirc contribution rate max.	Arrco and Agirc contribution rate min.	**Arrco and Agirc contribution rate mean**
Category B (case no.5)	69	84	73	76	83	72	75
Teacher (case no.6)	77	76	65	69	75	65	69
A+ manager (case no.7)	54	56	49	52	55	49	51

Note: assuming full rate pension (taken at 62 for the three standard cases). Regulations as of June 2016.
Reading note: the net replacement rate at retirement for a category B civil servant (case no.5) born in 1955 is 69%. If we applied private sector pension rules to this standard case, assuming a net salary in the private sector equivalent to total net earnings (including bonuses), the net replacement rate at retirement would be 75%, assuming mean contribution rates to supplementary pension schemes (Arrco only for case no.5).
Source: CALIPER tool (Drees) and authors calculations.

than it would be if the Cnav, Arrco and Agirc rules were applied (between 65% and 76% depending on the conventions used), while the category B sedentary civil servant standard case (case no.5), whose bonus rate is double that of teachers, has a lower replacement rate than it would have under private sector plan rules (69% versus between 72% and 84%).

However, this relation does vary. Despite the higher bonus rate for category B civil servants and the resulting low public sector replacement rate, a category A+ manager (case no.7) born in 1955 would still be slightly better off under the civil service plan rules by comparison with private sector rules, unless these were applied assuming Agirc and Arrco contributions at the maximum rate (which would give a replacement rate of 55% of the final net salary, including bonuses, i.e. one percentage point more than under the civil service pension rules). This result is only surprising on the surface, because while this standard case presents career characteristics associated with a low civil service replacement rate, it also presents characteristics that lead to a lower replacement rate with private sector rules, i.e. a strongly ascending wage trajectory profile and a high proportion of earnings over the social security ceiling. Calculating the Cnav reference salary as a mean value over part of the career is actually unfavourable, in terms of replacement rate, to individuals for whom the difference is highest between the final salary and the mean reference salary, in particular those individuals with a strongly ascending wage trajectory. Moreover, the fact that the pension amount takes into account all career years under the Arrco and Agirc supplementary schemes, while it is based on just the 25 best years in the general scheme, results in a replacement rate that generally decreases as earnings increase over the social security ceiling, and therefore as the proportion of these supplementary schemes in the total pension increases (Duc & Lermerchin, 2011, p.25-27).

Replacement rates calculated using private sector plan rules also vary significantly depending on the assumptions used for Arrco and Agirc contribution rates (at the minimum, mean[11] or maximum rate). These variations are of the order of 4 to 8 replacement rate points, depending on the standard case considered. Until the mid-1990s, the differences between the minimum and maximum contribution rates were significant: 4 points for Arrco segment 1 (i.e. for the proportion of earnings below the social security ceiling), 8 points for Agirc segment B and 12 points for Arrco segment 2 (Figure IV). These differences dropped significantly between 1995 and 1999 as measures came in for raising minimum mandatory contribution rates, but they did not fully disappear after 1999, because some sectors covered by a collective labour agreement continue to set a contribution rate over the minimum mandatory rate. The longer the career before 1999, the greater the systematic effect of assumptions concerning the Arrco and Agirc contribution rates on the simulated replacement rates for the standard cases. For standard cases born in 1955, this portion represents a little over half the career.

It can be seen from the results above that public sector rules are not necessarily more generous than private sector plan rules (including when we take into account modifications to the Agirc-Arrco rules which will only come into effect as of 2019[12] – see Online supplement C4). This is particularly true when civil servant earnings include a high proportion of bonuses - although this alone is not an adequate condition either (as in the case of an A+ category civil servant). Either way, the preceding analyses for standard cases seek more to highlight the mechanisms at work than draw overall conclusions about whether public sector schemes are more generous than private sector schemes, a task which would be extremely complex given the diversity of civil service career profiles and the changes to these careers and the rules that are applied to them down the generations (see Online supplement C5).

A higher increase in pension with age in the civil service

In Table 1, replacement rates are calculated on the assumption of full rate pensions. Nevertheless, the pension amount and the replacement rate vary depending on the retirement age, in a way that varies depending on the scheme.

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11. The mean rate is calculated by the Agirc-Arrco technical departments for all individual covered by these plans. Unfortunately, the mean Arrco rate is not calculated separately for managers and non-managers, so the same value has been used for both in the simulations.

12. The simulations are based on the 1955 generation and do not take into account changes under the October 2015 Agirc-Arrco agreement which will only come into effect from the 1957 generation, and include in particular, the implementation of temporary early retirement reduction factors (for 3 years) in the event of retirement at the full rate under the basic schemes. For this reason, the results were replicated for the 1960 generation in the Online supplement C4. This did not affect conclusions.

Under the Cnav and the civil service plan, working beyond the age at which pensions become payable and the period required for the full rate impacts the pension amount via the application of an extra pension for retiring late proportional to the period worked beyond the minimum retirement age, and to a lesser extent, by improvement to the reference salary (assuming end of career earnings are higher). Under the Agirc and Arrco supplementary schemes, there is no permanent extra pension for retiring late (paid until the death of the pensioner), but individuals continue to acquire pension points, which are paid as an additional pension. Finally, under the RAFP, a permanent extra pension is applied in the event of retirement after the age at which pensions become payable. Working beyond the age at which benefits become payable therefore increases the pension amount, both through a higher extra pension and more points.

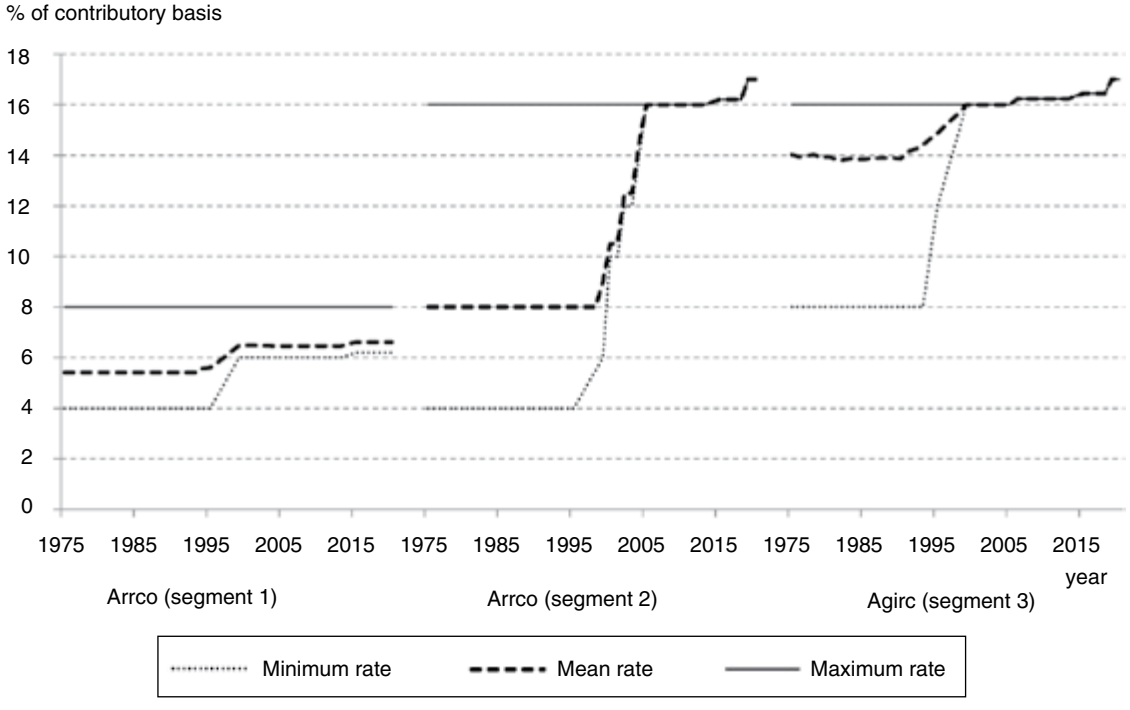
The increase in pension associated with working beyond the minimum age can therefore vary depending on the wage trajectory profile (Aubert, 2017). The scales can give an initial idea of the orders of magnitude involved. In the basic and integrated schemes, the increase in pension amount represents + 5% for an additional year of work (according to the extra pension for retiring late scale), plus any increase in the reference salary (the average increase is of + 1 percentage point for private sector employees). Under supplementary schemes, working for an extra year leads to additional points of around + 2.5% (e.g. ≈ 1/41 for a 41 year career), after which a term depending on the difference between the end of career salary and the mean salary across the career is added or deducted.

In practice, for the three standard cases, assuming an individual born in 1955, the increase in pension associated with working beyond the minimum age at which benefits become payable is higher with the civil service than the private sector rules. For example, for retirement at 67 rather than 62, depending on the standard case considered, the increase goes from + 26% to + 28% in the first case, versus + 17% to + 21% in the second case (case no. 5 and no. 6, respectively, in Figure V).

The impact of coverage under both public and private schemes over a career

In the same way that we applied public and private sector pension rules to the overall wage trajectories of the three standard COR civil service

Figure IV
Arrco and Agirc minimum, mean and maximum contribution rates



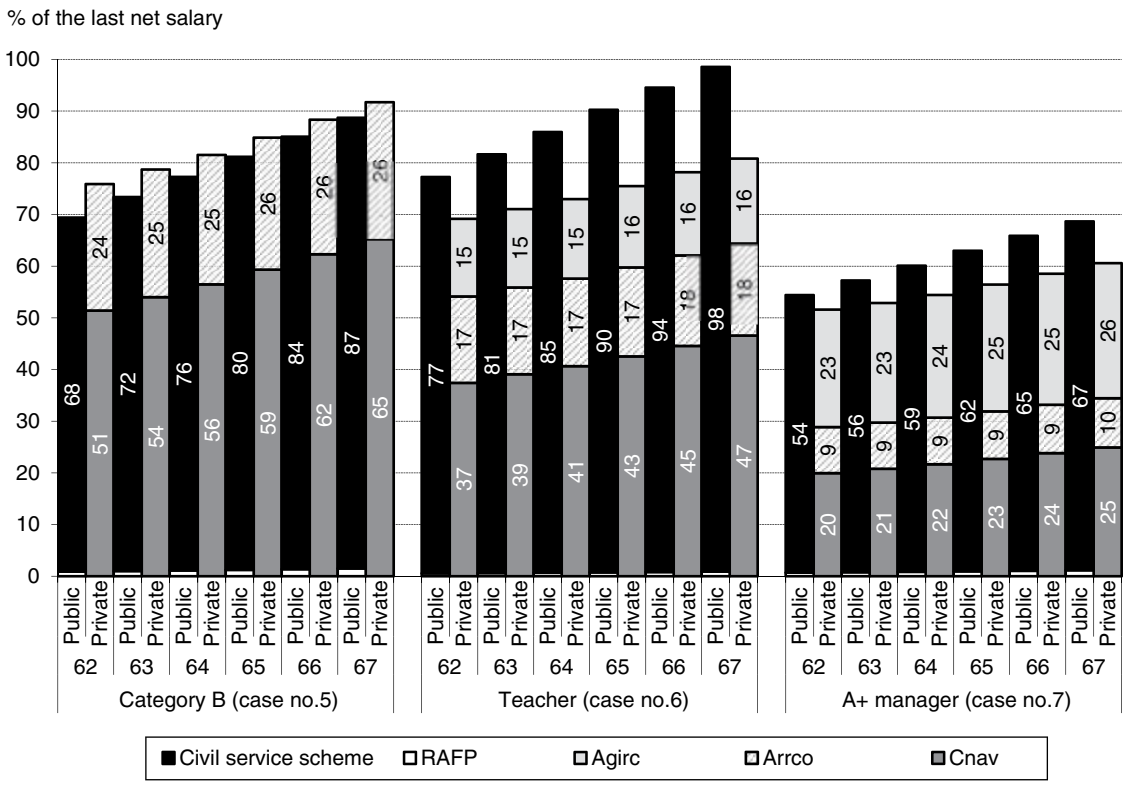
Note: regulations as of June 2016.
Source: Agirc-Arrco.

cases, it is also possible to apply them to just parts of these careers, in order to model, on a conventional basis, situations where employees have contributed to one and then another plan over the course of their career. These simulations are performed below, assuming a contribution rate at the mean Arrco and Agirc contribution rates and equivalent net salaries between the public and private sectors. The latter assumption supposes that an individual changing from one sector to another would maintain the same salary. This assumption, which is only justified here by the purpose of demonstrating the "pure" effect of the pension rules, is not always observed in reality. In practice, changing employment sector does not necessarily provide an immediate increase in salary (after one year), and can even lead to a slight decrease in salary in the short term, but there is often a medium-term salary increase (after 5 years) (Daussin-Benichou et al., 2014).

We simulate a number of profiles of individuals contributing to several successive schemes, with various lengths of employment in the private sector (5, 10, 15, … up to 35 years) and chronological sequence of contribution (public sector followed by private sector, or private sector followed by public sector).

In most situations where individuals have contributed to both public and private schemes, with identical periods worked and salary levels in each sector, replacement rates are higher when individuals finish their career in the private sector rather than in the public sector (Figure VI). The methods for calculating the reference salary for each sector have a strong impact on this result. As only the final salary (excluding bonuses) is taken into account for the civil service plan, while the 25 best years are taken into account under the general scheme (and the whole career for supplementary schemes), starting one's career in the public sector makes it possible to exclude salaries from the beginning of the career, which are the lowest, in calculating the pension amount,

Figure V
Net replacement rate at retirement depending on retirement age (generation born in 1955)



Note: regulations as of June 2016. Assuming net salaries would be identical under application of public or private rules. Assuming mean Agirc, Arrco and RAFP contribution rates across the period and constant projected yields (yearly pension increase of purchase and point values with inflation).
Reading note: retirement at 67 gives standard case no.5 a pension rate of 89% (87% for the civil service plan only). Retirement at the same age under application of private sector pension rules gives a pension rate of 92% (65% thanks to the Cnav pension and 26% from the Arrco pension).
Source: CALIPER tool (Drees) and author calculations.

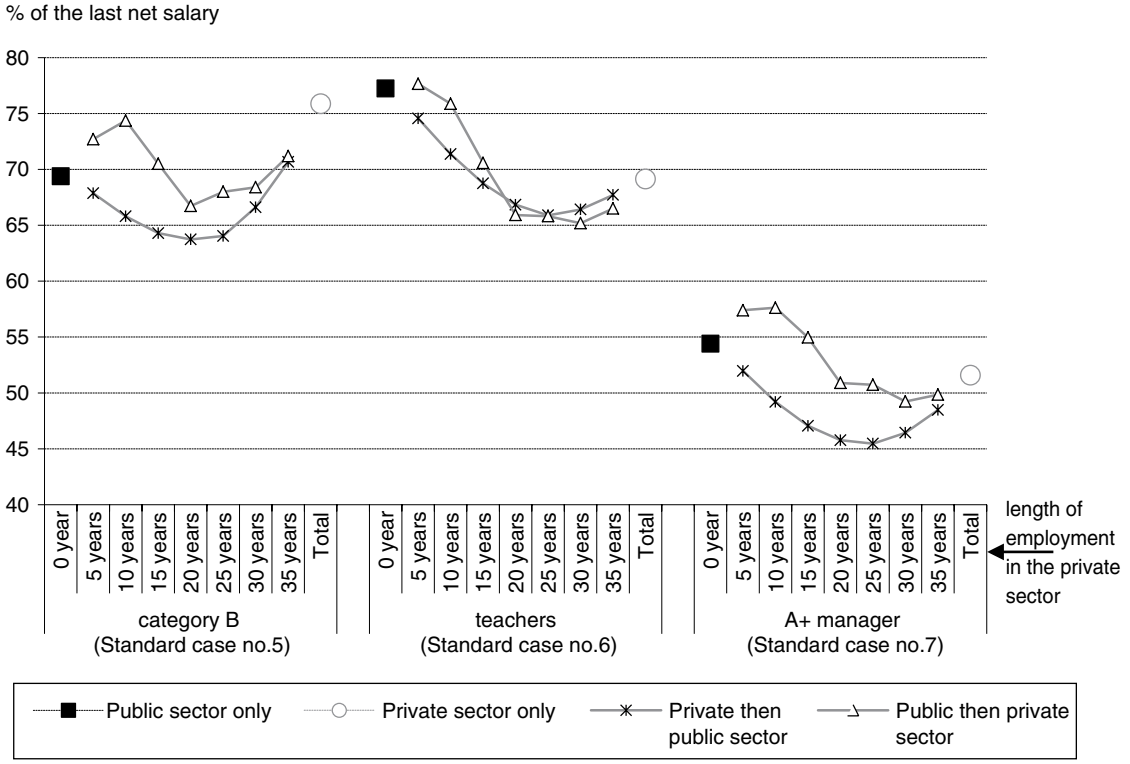
while starting one's career in the private sector means the low initial salaries are taken into account when calculating the reference salary[13], and therefore the pension amount[14].

However, this is not always the case. In the example of the standard case of a teacher born in 1955 having contributed to both public and private schemes, with a fairly long period in the private sector (20 years or more), the replacement rate seems a little higher for a career ending in the public sector, than for the other way round. The addition of a low bonus rate and earnings over the social security ceiling make this standard case the case with the greatest loss in pension under the rules of the Cnav, Arrco and Agirc rather than the civil service rules. A longer period in the private sector therefore has a more negative effect in the second part of the career than in the first part, because it is during this period that the highest salaries are paid, i.e. those that contribute the most to the total pension amount.

Finally, of the three standard cases studied, the highest and lowest replacement rates often correspond (given salary assumptions) to situations of multi-coverage, where the individuals have contributed to both public and private schemes. For example, for the category A+ manager standard case (case no.7), the highest replacement rate is obtained for a career that starts in the

13. If the period of employment in the private sector is under 25 years, all annual salaries are taken into account.
14. In addition to the selection of the years used for calculating the reference salary, the replacement rate also depends on the way in which pension benefits acquired under the initial plan increase yearly. If the change in employment sector occurs after 2004, these yearly pension increases are identical under the Cnav and civil service schemes. For a civil servant who leaves the public sector before retirement, the final salary increases yearly according to the same index used for pensions paid (in application of the final paragraph of Article L. 25 of the French Civil and Military Pension Code), i.e. since 2004, according to price changes apart from tobacco, as per the pensions and salaries under Cnav. However, for those leaving the public sector before 2004, the yearly pension increases applied up to this date correspond to changes in the civil service index point value, plus the effects of any possible yearly increases for categories. The simulations presented here do not, however, take into account such yearly increases for categories.

Figure VI
Net replacement rate at retirement for civil servant standard cases according to career period in private and public sectors (generation born in 1955)



Note: regulations as of June 2016. Assuming net salaries would be identical under application of public or private rules. Assuming mean Agirc and Arrco contribution rates across the period.
Reading note: if standard case no.5 had spent the first 20 years in the private sector rather than a complete career in the civil service (for identical net salaries), the replacement rate would be 64% rather than 69%.
Source: author calculations.

public sector and ends with 10 years in the private sector, while the lowest rate is achieved when the career starts with 25 years in the private sector, before going into the public sector. This final result underscores the fact that the impact of contributing to both public and private schemes on the pension amount may vary Depending on the career characteristics, it can make individuals either better or worse off.

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To summarise, the simulations performed on the examples of the three COR standard cases for sedentary categories of civil servants produce the following results.

First, the impact of applying private sector plan pension rules rather than civil service pension rules varies. For the generation preparing to retire (born in 1955), applying private sector rules would be more beneficial for a category B civil servant, but less beneficial for a teacher, and slightly less beneficial for an A+ category manager. However, these results vary depending on the private sector rules applied, and in particular, the Arrco and Agirc contribution rate used. These results correspond to the situation following the convergence of some public and private sector pension rules, which began under the 2003 pension reform. Second, this analysis is likely to change significantly in the future, even if legislation remains the same, in accordance with developments in the determinants under each set of rules, i.e. the bonus proportion of total end of career earnings in the civil service, and the mean rate of salary growth in the private sector. Monitoring these factors, among other things, is therefore essential for assessing the equity between schemes, which is constantly changing over time. Third, the pension amount also depends on the retirement age. For the three standard cases studied, the increase in pension due to working beyond the minimum retirement age seems higher under public sector rules, due to the extra pension for retiring late in the basic and integrated schemes (which would be more beneficial than accumulating points in private supplementary schemes). Finally, the impact on pension amount of individuals contributing to both public and private schemes over their career, assuming identical net salary at each age, varies. It can be either positive or negative by comparison with an individual under a single plan (using public or private rules). Of the three examples studied, for a given career period in each sector, moving from the public to the private sector usually leads to a higher replacement rate than moving from the private to the public sector, although this is not systematically true.

As we have stated on a number of occasions, the COR standard cases are not "representative" of the entire civil service, or even of all civil servants in their category. It is therefore impossible to extrapolate the results associated with them, and they need to be interpreted as three examples that illustrate the mechanisms in play, and test the sensitivity of the assumptions and conventions used. The analysis presented here therefore serves to supplement simulations on representative samples of individuals covered by social security, such as those performed by Beffy and Blanchet (2009) using the Insee DESTINIE microsimulation model or, more recently, Duc (2014) using the Drees contributor inter-scheme sample (EIC) data from 2009. These analyses of representative samples confirm the main lessons of these standard cases, in particular the fact that the impact of applying private sector pension plan rules, rather than public sector plan rules varies, and that the effects differ a great deal depending on civil servant characteristics. For example, according to Duc (2014), assuming constant net salaries, a little over half of civil servants born in 1958, would have a higher pension under private sector rules, while for other civil servants, the pension is highest under public sector rules (according to legislation in force when this study was conducted, and before the Agirc-Arrco agreement of 30 October 2015).

These kinds of representative sample analyses can also be used to put the results of these standard cases into perspective with regard to the diversity of actual civil service careers. In particular, the results of Duc (2014) suggest that the conclusions for the A+ manager standard case, for which the simulations suggest that public sector pension rules are slightly more beneficial, would only apply to a minority of civil servant managers in reality. Overall, around six out of ten civil servant managers born in 1958 would have a higher pension under private sector rules, for net equivalent salaries at all ages. More generally, the proportion of civil servants who would have a higher pension under Cnav, Agirc and Arrco rules is higher among women, sedentary categories, managers and individuals who started their career in the private sector and finished it in the public sector. It would, however, be below 50% for men, active categories, and individuals

who started their career in the public sector but finish in the private sector (Table 2). These effects also take into account some differences in rules between private and public schemes which have no impact on the standard cases, due to the simplified nature of the careers they represent, and specifically the fact that they are assumed to have no children and that their length of employment (apart from the retirement year) always corresponds to full calendar years. In particular, for women, additional entitlements due to children provide longer periods of contributions under the Cnav rules (two years, rather than one year or six months, depending on whether the child is born before or after 2004, under civil service schemes[15]). However, for parents of four children or more, public sector plans apply higher pension increases than private schemes. Furthermore, for years that have only been partially worked, private sector schemes sometimes mean that four quarters can be counted (since the number of quarters used is defined based on the total annual salary). This is not the case with civil service schemes (quarters are counted depending on the calendar period worked).

Whether they are performed on standard careers or a representative sample, the simulations involving application of pension rules from one sector on another cannot be used to draw conclusions on the relative "generosity" of these sectors. Analysing the calculation of pension amounts, *assuming constant salaries and identical retirement age,* leaves open the question of earnings that would have been received in the public sector if other pension rules were in place, since higher pensions can, in some cases, serve as compensation for lower salaries, and the question of the retirement behaviour of individuals. The analysis also provides no information on differences in the rates of return on contributions. It compares pension levels without examining past contribution rates for the two groups of employees.

Whatever the case, considerations to align or standardize the rules applicable to the various French pension schemes must go beyond a simple comparison of the rules or their impact, all else being equal, just as the impression of equity or inequity held by some individuals covered by social security would not be justified by the results of such comparison. These reflections also raise the issue of comprehensibility and transparency that the legislator intends to give to the pension system, and more general reflections on its overall structure (see COR, 2015b, pages 11-12). □

15. Furthermore, additional entitlements due to children apply to calculation of both the reduced pension for retiring early/extra pension for retiring late and the prorata coefficient under Cnav, while it only applies to the reduced pension for retiring early/extra pension for retiring late for children born after 2004 under civil service schemes.

Table 2
Results of a simulation in which private sector pension rules are applied to a representative sample of civil servants born in 1958 (as per Duc, 2014)

	Mean variation (in %) of the pension amount under application of Cnav-Agirc-Arrco rules (for mean contribution rates) rather than civil service rules	Proportion of individuals covered by social security (%) for whom the most beneficial pension rules are…	
		… the civil service plan rules	… the Cnav, Agirc and Arrco plan rules (for mean contribution rates)
Total	+ 2.4	47	53
Men	+ 0.9	53	47
Women	+ 3.9	43	56
Sedentary category	+ 3.8	44	56
Active category	- 1.7	56	44
Non-managers	+ 1.0	50	50
Managers	+ 4.9	41	59
Public and private plans, primarily private	+ 0.7	54	44
Public and private plans, primarily public	+ 2.9	45	55
Public sector plans only	+ 3.0	48	52

Note: regulations as of April 2014. Assuming identical net salaries at all ages and retirement without a reduced pension for retiring early under the civil service plans. In the data used, careers were observed up to 51 years old (until 2009 for civil servants born in 1958). Changes after this age were simulated using the Drees TRAJECTOIRE model. The percentages do not add up to 100%. The difference corresponds to cases where the two types of rules give the same pension amounts.
Coverage: civilian public servants born in 1958, excluding military personnel and staff retired before 54.
Source: Duc (2014).

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