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VARIA

Social Benefits, Related Entitlements and Local Social Support: A New Assessment

Denis Anne* and Yannick L'Horty**

Abstract – We draw up an inventory of entitlements related to social benefits and social support available locally to beneficiaries of the *Revenu de Solidarité Active* (RSA, the current scheme of minimum income) in 20 French cities, including Paris, Lyon and Marseille. We then compare the social scales inventoried in 2020 to those collected in 2001 and 2007, i.e. prior to the switch from the previous minimum income scheme (RMI) to the RSA. We show an overall shift towards more degressive conditions for granting support. In all the cities covered and for all family configurations, threshold effects have become limited, at the cost of a sometimes high degree of complexity. The only exception is Paris, where social support is generally more generous and where threshold effects remain. Taken as a whole, local social support scales have been brought into line with the RSA scale, whereas prior to 2008 they were more in line with the RMI scale, which confirms the guiding role played by national scales on local scales. In particular, we examine the effects of these transformations on the standard of living of recipient households and on incentives to work.

JEL Classification: H55, H75, I38
Keywords: local social support, related entitlements, redistribution, fight against poverty, RSA

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The French low income support system is not limited to national and statutory benefits, such as the RSA and housing benefits. It is organised around several interdependent levels, with a layer of primary support that falls under the national and legal basis and a vast array of secondary social support referred to as "related entitlements". This expression is misleading. Of course, these forms of support are related because they are small in amount and their purpose is to supplement the national and legal basis of social transfer income (statutory minimum income, family benefits, etc.); however, they are not always rights, as the French term *droits* would suggest, as they are often granted on the basis of a social assessment carried out by the providers.

Some of these related benefits are national support measures, such as the Christmas bonus payment (*prime de Noël*), exemptions from the public-service broadcasting contribution (*contribution à l'audiovisuel public*), the social telephone discount (*réduction sociale téléphonique*), the energy voucher (*chèque énergie*) and the complementary health cover (*Couverture maladie universelle complémentaire*, which was replaced by the *Complémentaire santé solidaire* on 1 November 2019). They also include local social support, granted by the departments, municipalities and groups of municipalities, the regions and local family benefit funds in various social action areas, such as school meals, leisure centres, holiday support, payment of outstanding debts, transport and mobility support and social rates for public facilities (swimming pools, museums, etc.). These social benefits are means-tested and/or status-tested when aimed to specific groups of population (jobseekers, large families, RSA recipients, people with disabilities, etc.).

While they are individually small in amount, the benefits from related entitlements can cumulatively provide a significant income supplement for low-income households. As they are highly degressive on the basis of household resources, they are quickly lost on return to work and can play an important role in monetary incentives to work. Taking them into account can therefore significantly alter the diagnoses of the many studies on the impact of social transfers, which ignore this aspect of redistribution. This is the case of studies on the effects of national and statutory tax and transfers on poverty (Bargain *et al*., 2017), on redistribution (Bourguignon, 1998; Chanchole & Lalanne, 2012), on the standard of living of families (CSERC, 1997; Simonnet & Danzin, 2014) or on the monetary gains of returning to work (Laroque & Salanié, 1999; Legendre *et al*. 2003; Hagneré & Trannoy, 2001; Bargain & Terraz, 2003; Gurgand & Margolis, 2008; Bargain & Vicard, 2014; Lehmann, 2016; Sicsic, 2018).

However, little is known about these benefits, probably largely due to the difficulty of observing them. They cover an extremely wide variety of schemes in terms of allocation, involve multiple actors at different geographical intervention levels, and there is no exhaustive inventory of all the local social support scales. These were the starting points of two previous studies carried out in France on related entitlements (Anne & L'Horty, 2002; 2009). These studies were based on two data collection campaigns, in 2001 and 2007, and on a simulation tool called Equinoxe (see Box 1). In particular, they have shown that the highly degressive nature of the scales and their powerful threshold effects can significantly alter the findings on the redistributive nature of national transfers that do not take into account related entitlements.

In this new study, we rely on a third data collection campaign on related entitlements and local social support, carried out in 2020, using the same procedure, the same assumptions and the same data processing as in the 2001 and 2007 collection campaigns. This new campaign to collect data on local social scales covers a sample of 20 cities, including Paris, Lyon and Marseille, corresponding to all of the localities studied previously. We can thus observe, for the first time, the long-term evolution of the scales over two decades, before and after the reform of the minimum income scheme in 2008 (which replaced the *Revenu minimum d'insertion*, RMI, by the *Revenu de solidarité active*, RSA, the current scheme)

The first section recalls the main findings of previous studies on related entitlements. The second section presents the procedures and assumptions adopted for data collection and processing. The third section presents the main findings of the study.

1. The Previous Studies

While there is extensive theoretical and empirical literature on the local effects of national social transfers, this is not the case for the national effects of local social support. In fact, decentralised financial support granted by local authorities to poor households, and more specifically the conditions governing allocation and the scales of local and/or optional support, are not a topic of interest in the economic

literature on redistribution. Empirical work on the progressive nature of taxation and the degressive nature of social support, the calculation of the marginal tax rates implicit in a given redistribution scheme and the evaluation of the incentive effects of support scales do not take local support into account.

In France, the first study on social and/or optional support, carried out in response to a commission from the Ministry of the Economy and Finance, was published in the early 2000s (Anne & L'Horty, 2002). In 10 cities and for 6 types of family configurations, it gathered data on all the social benefits for which the conditions governing allocation are explicit, excluding support without a precise scale and support restricted to certain categories (young people, elderly people, unemployed people or disabled workers). The study showed firstly that, for a household with no income that would receive all the benefits to which it is entitled, the accumulation of related entitlements can represent, on average, almost a fifth of its resources and increase the support received by more than a quarter compared to the resources from national transfers alone. Although the scales for the allocation of this support vary considerably by type of benefit and locality, the focus on children is a common feature of local benefits, which are much higher, and more regular, everywhere for households with children.

This first study showed that these benefits are stable in the case of earned income up to the RMI ceiling, whereas national and statutory benefits decrease very sharply. Above the RMI, they decrease sharply, sometimes with huge threshold effects, while national benefits become less decreasing. Local benefits also considerably increase the minimum working time required for employment to generate a monetary gain (known as the "reservation period"): on the basis of a job paid at the minimum wage (SMIC), it is necessary, on average, to work 13 hours more each week to compensate for the loss of these local benefits, this being particularly noticeable for households with children. The study thus establishes a high level of responsibility on the part of local and extra-statutory benefits in the existence of poverty traps, i.e. low income areas from which it is expensive to escape. This has more to do with the conditions under which local support is granted than with the generosity of such support: local support subject to status, means-tested flat-rate support or, more generally, the highly degressive nature of local transfers above the RMI ceiling heavily penalises a return to work.

The second study on related entitlements (Anne & L'Horty, 2009) was carried out in the context of the reform of the RSA, at the request of the *Haut commissariat aux Solidarités actives contre la pauvreté* (a National Commission dedicated to poverty). It is based on a new inventory of the scales of the local and/or non-statutory social support offered in 2007 in 13 French cities, including Paris, Lyon and Marseille. It shows that, in most localities and for most family configurations, a part-time job paid at the minimum wage leads to a loss of income relative to a situation without a job, while a full-time job does not always guarantee a net gain. The positive effects of some reforms have been neutralised by the effects of other measures, such as the widespread application of transport subsidies distributed by the regions, the development of social telephone and electricity tariffs or the exemption from the public-service broadcasting contribution. Despite their low amount, related entitlements continue to have a significant effect on reservation durations for almost all family configurations. Although the incentive scheme enables RMI recipients to compensate for these effects, it is only temporary and is not available for all family configurations or in all localities.

The study also offers a simulation of the replacement of the RMI and the *Allocation de parent isolé* (API, a benefit to single parents) with the RSA. The simulation shows that the RSA makes the return to work provide a monetary gain in almost all cities and family configurations, which is not possible with the RMI, even taking into account the incentive. The simulation covers several theoretical RSA scales and was used by the government to determine the final RSA scale. The marginal rate of 30% initially planned allows for the elimination of all local poverty trap situations. The same result is also obtained with a marginal rate of 40%, which corresponds to a lower cost for public finances. Above 40%, however, the RSA is no longer as effective in stimulating gains from a return to work. The study thus provides a strong justification for the marginal rate of 38% ultimately chosen by the government, which effectively achieves the objective assigned to the RSA of not penalising its recipients monetarily when they find a job, at a minimal cost to public finances. This effect is described as "spectacular" in the study: the simulation of the implementation of the RSA scale with a marginal tax rate of 38% does indeed eliminate poverty traps in all localities and family configurations.

This result is nevertheless obtained under the assumption that the amounts of related

Box 1 – **EQUINOXE**

Equinoxe (an acronym of the French phrase *Évaluateur QUantitatif INtégré de droits cOnneXEs*, which translates as Quantitative evaluation tool integrating related entitlements) is a system for observing social support to low-income households and for simulating social transfer reforms. It is the only simulation tool available in France that integrates the local aspect of social transfers by taking into account the support paid by town halls, departments, family benefit funds and local charities. Equinoxe calculates the amount of social support based on household resources for a sample of cities (including Paris, Lyon and Marseille). The version of the model used for this study is the third; the first was developed based on a sample of 10 localities and for scales relating to the year 2001 (Anne & L'Horty, 2002) and the second was based on a new sample of 13 localities for scales collected between the end of 2006 and the beginning of 2007 (Anne & L'Horty, 2009).

The point of view adopted is that of the household receiving the support. The simulator comprehensively integrates national and/or statutory benefits, as well as all local and/or optional benefits, provided that these benefits are monetary (or can be translated into a monetary equivalent), paid on a regular basis and calculated on the basis of a scale.

In each locality and for each family configuration, Equinoxe calculates the amount of support based on income, taking into account the conditions for cumulating related entitlements, including if their basis includes the amount of national benefits (which Equinoxe checks). It provides the amount of social support, net income and marginal tax rates according to household income, by support category, by household type or by locality. It also evaluates the weekly time of work in a minimum wage job to earn at least as much as if one did not work (referred to as "reservation time").

Equinoxe can simulate the effect of national and statutory benefit reforms on related entitlements, which makes it possible to evaluate the effects of a reform of social transfers on income by taking into account the interdependencies between benefits.

entitlements remain unchanged following the RSA reform. A more forward-looking analysis, which looks at possible adjustments to local support in the new context of the RSA, shows that certain adjustments to local support may limit the positive effects of the RSA and recreate poverty traps (for example, if a local authority, noting the greater generosity of national support for the working poor, chooses to tighten its support for the poorest recipients). The study then recommends that local support subject to status be transformed into means-tested support, with scales that are not very degressive, in order to make local social policies consistent with the objectives of the national RSA reform.

This regulatory part of the study was drawn up as part of a parliamentary mission on behalf of the High Commission against Poverty (*Haut commissariat aux Solidarités actives contre la pauvreté*), aimed at formulating proposals to "put an end to the threshold effects linked to the entitlements related to the statutory minimums granted by local authorities, their groupings and public establishments and social security funds". Following the publication of the parliamentary mission's report (Desmarescaux, 2009), a guide to local related entitlements was produced in July 2009 by the High Commission against Poverty and a joint declaration on the criteria for the allocation of optional social support was signed by eight institutions,[1] recommending that any threshold effect in local social support scales should be avoided so as not to discourage recipients from returning to work or taking up an activity. This study will make it possible to verify, more than a decade later, the extent to which these recommendations have had effects.

2. Coverage of the Study and Assumptions

For the study presented here, a third data collection campaign concerning related entitlements and local social support was carried out between October and December 2020. As with the two previous studies, we again collected data on social support from the websites of the various providers at municipal, inter-municipal, departmental and regional levels (including municipal social centres – CCAS, *Centres communaux d'action sociale*, inter-municipal authorities – EPCI, *Établissements publics de coopération intercommunale*, local family benefits centres – CAF, *Caisse d'allocations familiales*), supplementing these data as necessary with direct requests to the support providers.

The sample covers 20 cities (see Appendix 1, Table A1-1), including all those used in the two previous studies (Anne & L'Horty, 2002; 2009). The sample contains a total of 4.6 million inhabitants and includes cities of various sizes: in addition to Paris,[2] Lyon and Marseille, the

1. Assemblée des départements de France, Association des maires de France, Association des régions de France, Caisses nationales d'allocations familiales *(CNAF), the National Health Insurance Funds* (Caisse Nationale d'Assurance Maladie des Travailleurs Salariés – *CNAMTS, and* Caisse centrale de la mutualité sociale agricole – *CCMSA*)*, the Employment agency* (Pôle emploi) *and the National Union for Municipal Social Action Centres* (Union Nationale des Centres Communaux d'Action Sociale – *UNCCAS*).

2. For Paris, we consider two arrondissements (the 14th and the 19th) where and the local support offered differs.

three largest cities in France, it includes three other cities with more than 100,000 inhabitants, six cities with 50,000 to 100,000 inhabitants, three cities with 10,000 to 50,000 inhabitants and two municipalities with fewer than 10,000 inhabitants. In addition, these cities belong to 12 different departments and 6 different regions, making it possible to observe a wide variety of departmental and regional support.

2.1. Social Support Covered

The focus is on monetary support available to poor households, in particular RSA recipients. For all of the support, whether national or local, the scales for which data is collected are those in force in 2020.[3]

We first take national and statutory benefits into account: the RSA, the in-work benefit (*prime d'activité*), housing benefits (*allocations logement*), family benefits (*allocations familiales*), early childhood benefits (*prestation d'accueil du jeune enfant* – PAJE, which includes birth and basic allowance), the back-to-school allowance (*allocation de rentrée scolaire*) and the complementary health insurance. We then look at national related entitlements, such as the Christmas bonus payment, the television licence exemption, the social telephone discount, the social electricity tariff, the energy voucher and the housing tax rebate (*dégrèvement de taxe d'habitation*). Finally, we take into account local and/or optional social benefits, in particular social support from the departmental councils (mobility, holidays, etc.), social action from the Family Allowance, support from towns and municipal social action centres (including school meals, leisure centres, holiday support and municipal facilities) and regional support (public transport).

We do not include emergency support, support from charities, temporary support for returning to work (*prime de retour à l'emploi*), discretionary support granted by local commissions without scales, social loans, support restricted to particular populations (the elderly, young people and people with disabilities or illness) and support specific to certain equipment and needs (e.g. the energy transition tax credit).

The study does not take into consideration childcare support, although it is likely to have an important effect on women's return to work. This support varies greatly depending on the type of childcare (existence of a crèche, nature of the crèche and rate of coverage). Families are therefore assumed not to use any form of childcare for children under the age of three, which means that no distinction is made between couples in which one partner works or couples in which both partners work. The implicit assumption is that they have free childcare, such as that provided by a close relative, for example. This assumption minimises the cost of access to employment for mothers.

2.2. The Case Study

The methodology used is a case study approach. We cover all categories of households in all localities and, for each cell thus constituted, we create a fictitious household for which the reference person is aged between 25 and 60 and the other attributes are the most frequent characteristics of each distribution (modal point) or are determined by assumption. We assume that couples are married or in a civil partnership and that children are in school from the age of three. We also assume that single parents have sole custody of their child and receive the family support allowance. Their dwelling is assumed to be in the private sector.

We consider seven household types (Table 1), with each case study corresponding to a given household configuration in a particular locality (for example, a couple with three children in Marseille), giving a total of 140 case studies.

2.3. Assumptions on Take-Up and Use

For each case study, we make reasonable assumptions about the use of support, which are the same as in our previous studies. These assumptions are set out in Table 2. Generally speaking, we do not measure the amounts of support actually received by recipient households, but rather estimate general entitlements based on the level of resources of a typical household. Firstly, many types of support are not taken into account in the analysis, when they are category specific or allocated without a means test. Secondly, there is no guarantee that the support identified is received systematically by each potential recipient (for example, for the basic RSA, the non-take-up rate would be between 28% and 35% according to Chareyron, 2018). It is likely that situations of non-take-up are more frequent for local support than for national support, due to support being provided by multiple bodies, the lack of information for applicants and the complexity of the conditions for granting support.

3. The study does not include any exceptional support or revaluation associated with the COVID-19 health crisis.

Table 1 – **Household types**

Household configuration and abbreviation	Assumptions about children's schooling: Child 1	Child 2	Child 3	Dwelling type
Single person (SP)				T1
Single parent family, one child under three (S. parent ch-3)	< 3 years old, not in school			T2
Single parent family, one child over three (S. parent ch3+)	6–10 years old, in primary school			T2
Couple without children (C. 0 child)				T2
Couple with one child (C. 1 child)	< 3 years old, not in school			T3
Couple with two children (C. 2 child.)	6–10 years old, in primary school	< 3 years old, not in school		T3
Couple with three children (C. 3 child.)	6–10 years old, in primary school	3–5 years old, in kindergarten	< 3 years old, not in school	T4

Sources: Equinoxe 2020, TEPP-CNRS.

Table 2 – **Use assumptions**

Nature of the support	Use	Use/consumption assumption
School meals	Yes, for children in school	144 days per year per child in school
Children leisure centres without accomodation (CLSH)	Yes	20 days per year per child over 6 years old
Holidays	Yes	1 week (7 days) per year*
Sports activity	Yes	1 per week (swimming pool) per household
Cultural activity	Yes	1 per month (museum or theatre) per household
Transport	Yes	"Pass" type subscription if available. Otherwise, assumption of 150 annual SNCF return trips for municipalities close to an urban centre (less than 30 km) and 52 return trips if the municipality is farther away (i.e. 1 per week)
Social housing support (*Fonds de solidarité pour le logement*)**	Yes	Housing maintenance support. Every 10 years. Annualised amount
Housing equipment	Yes	Every 5 years. Annualised amount

*The rent is based on the average rent used in Equinoxe second version (Cf. Box 1) plus the increase in the average rental price since then, i.e. 1.9% per year since 2007. For a single person, the rent amount used is €268 for a week's holiday.
**The amount is either the maximum amount in Euro or 4 months' unpaid rent.
Sources: Equinoxe 2020, TEPP-CNRS.

The sources of income, whether from work or assistance, taken into account are detailed in Table 3. We assume that jobseekers are not compensated under unemployment insurance and therefore we do not take its scale into account (for information on the threshold effects of unemployment insurance, see Cahuc & Prost, 2015). However, jobseekers can receive certain support (e.g. for transport or for access to municipal facilities) simply by being registered with the employment agency (Pôle emploi), which can lead to threshold effects. We therefore assume that jobseekers are registered with Pôle emploi. An additional assumption was needed to determine the point at which individuals ceased to be registered with Pôle emploi.[4] We have assumed that this occurs once each adult in the household receives a monthly earned income corresponding to the full-time SMIC, i.e. €1,219 net per adult in 2020.

For the income tax, we use the scale in force for 2019 income and we apply the family quotients corresponding to the case studies, the 10% fixed deduction for professional expenses, the discount, the ceiling on the tax advantage linked to the family quotient and the income tax collection threshold. Due to the assumptions used in the study, no deductions (other than the fixed deduction for professional expenses) or specific tax credits are taken into account.

In order to calculate the rent, which is necessary for the calculation of housing allowances and several related support measures, we have used the same sources as in the 2001 and 2007 studies. In 2001, we used INSEE data on average rents according to the size of the municipality. In 2007, we used the more precise data from the National Real Estate Federation's (*Fédération nationale de l'immobilier* – FNAIM) national rental market observatory. These data provided

4. We checked with Pôle emploi that this assumption was consistent with the modal reservation wage reported by those registered.

Table 3 – **Sources of income taken into account in the calculations**

Income or transfer	Inclusion	Comments
Earned income	Yes	In increments of €20 per month
Unemployment benefits	No	Hypothesis
RSA	Yes	
In-work benefit	Yes	
Family benefits	Yes	Couple with 2 children/Couple with 3 children
PAJE basic allowance (child under 3 years old)	Yes	Single person with 1 child under 3 years old/Couple with 1 child/ Couple with 2 children/Couple with 3 children
PAJE birth bonus payment	Yes	Single person with 1 child under 3 years old/Couple with 1 child/ Couple with 2 children/Couple with 3 children
Family support allowance	Yes	Single person with 1 child under 3 years old/ Single person with 1 child aged 3 or over
Family supplement	No	Couple with three children (children must be over 3 years old to receive assistance)
Personal housing benefit (*Aide personnalisée au logement* – APL)	Yes	Based on an estimate of local rental costs
Income tax	Yes	
National related entitlements		
Back-to-school allowance	Yes	Single person with one child aged 3 or over/Couple with 2 children/ Couple with 3 children
Christmas bonus payment	Yes	
Exemption from the public-service broadcasting contribution	Yes	
Social telephone discount	Yes	
Energy voucher	Yes	
Complementary health insurance	Yes	Estimated by comparison with the cost of a basic mutual insurance policy from the MAAF group
Housing tax rebate	Yes	Difference between the amount of housing tax with and without rebate

Sources: Equinoxe 2020, TEPP-CNRS.

the average rents for the different types of dwellings (T1, T2, etc., which refers to the number of rooms) for the various regional urban centres. In order to estimate the 2020 rent based on our 2001 and 2007 estimates, we use the INSEE's rent index (*Indice de référence des loyers* – IRL), which provides the basis for rent increases in the private rental sector. A discount of 20% is applied to these rents on the assumption that low-income households occupy dwellings with below average rents. For small towns not explicitly listed by the FNAIM, an additional discount is applied to the average rent of the reference municipality (10% for medium-sized cities and 20% for small municipalities). We estimate utilities costs to be 25% of the rent. These costs are used for the allocation of various social support measures, as part of the calculation of an "available income" ("*reste à vivre*"), i.e. the income remaining after taking into account compulsory expenses. Some support measures define this available income in a restrictive way by excluding all the compulsory expenses linked to the dwelling (insurance, water, electricity, gas, heating, telephone, etc.) from the utilities costs. We also estimate these expenses to total 25% of the rent. As the dwelling is assumed to belong to the private rental sector, the rent reduction (*Réduction de loyer de solidarité* – RLS) does not apply and is therefore not included in the calculation of the housing benefits (*Aide personnalisée au logement* – APL). In line with the assumption of the dwelling being in the private rental sector, we do not take the rent reductions associated with social housing into consideration. Finally, the social tax on income (CRDS) is not included in the calculations either.

As in our previous studies, we include the reduction in the amount of the housing tax enabled by the rebate (including the ongoing extension thereof) in the total of national related entitlements. The amounts of housing tax are established based on the rates for 2019, which is the last year for which data is available on the tax authorities' website (www.impots.gouv.fr). Some cities (Lyon, Le Mans, Martigues, Paris and Fontenay-sous-Bois) have retained tax abatement rates (or flat rates) that were previously more favourable than the current common law rates and the general tax abatement rate applied by the city is not available; in such cases, the tax abatement rates applied are the current maximum rates (15%), except

for Paris, where the flat-rate tax abatements actually applied have been included. An overall taxation rate is therefore estimated (the sum of the rates applied by the various local authorities) and applied to the estimated gross rental value (GRV) of the household's dwelling. As this GRV for the municipality is based on old land register databases, it is assumed to correspond to 6 months of current rents. The amount of the abatements is in turn calculated based on the average rental value (ARV) of the city (average of the municipal GRVs). In order to estimate this ARV, we use the GRV of a T3 dwelling in the municipality as the central value.[5]

3. Results

The data collected in this manner can be analysed based on various aspects, such as differences between localities, differences according to family configuration, differences according to the nature and amount of the support, differences according to the level of earned household income and changes over time.

To begin with, we examine the amounts of national and statutory social transfers, national related entitlements and local social support on average (unweighted) across the 20 cities, for different household configurations and different levels of earned income. This is a way of producing an initial overview of related entitlements.

3.1. The Importance of Related Support for Poor Households

Figure I shows the amounts of the three categories of benefits for households with no earned income (I-A), then for "average" households earning the equivalent of half a minimum wage (I-B) and one full minimum wage (I-C), assuming those households use the full range of national and statutory benefits to which they are entitled in all cases.

It can be seen that the amounts of the various support measures depend on family configuration and that they logically decrease when the earned income increases, but they remain positive. For example, a single person with no earned income received a total of €8,702 national and statutory social transfers in 2020, €1,432 national related entitlements (Christmas bonus payment, television licence exemption, social telephone discount, energy voucher, social health cover and housing tax rebate), or 12.9% of their income, together with (on average, for the 20 cities in our sample) €949 in local social support, or 8.6% of their income. At the other end of the family configuration scale, a couple with no earned income and three children had €20,873 in national and statutory transfers, to which national related entitlements added €3,274, or 11.8% of their resources, while local support added €3,546, or 12.8% of their resources.

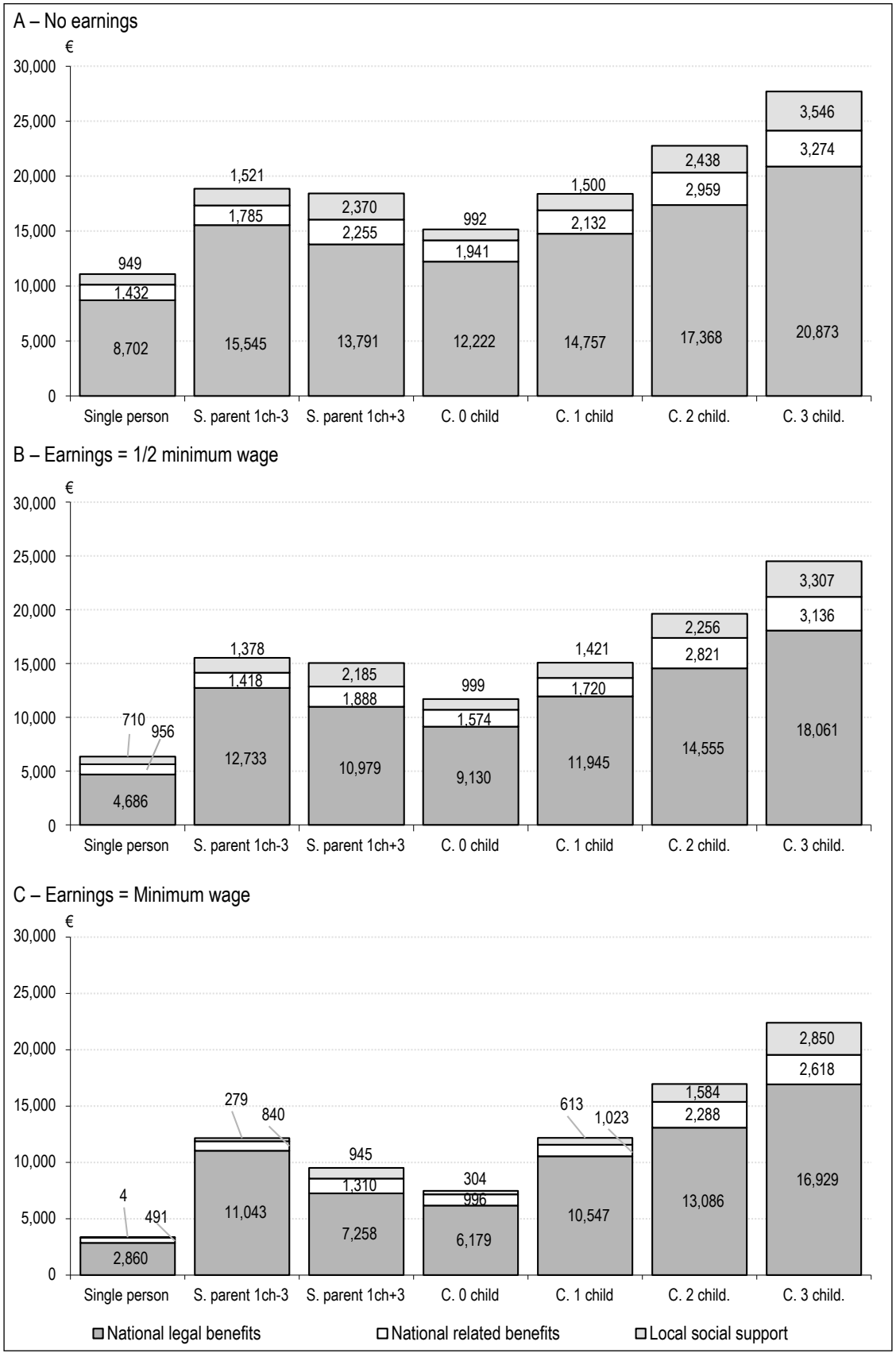
Related entitlements therefore potentially represent a significant proportion of the resources of poor households. Depending on family configuration, local social support represents between 6.5% and 12.8% of the total resources of households with no earned income. The sum total of related, national and local entitlements represents between 17.5% and 25% of total income. Local support represents at least half of the national related entitlements and can be as high as 110%. All related entitlements add between 21.3% and 33.3% to the national statutory benefits of poor households, depending on the family configuration. When households have earned income, the weighting of benefits linked to related entitlements relative to national and statutory transfers increases slightly at half a minimum wage and decreases slightly at one full minimum wage. Up to half a minimum wage, the overall degressive nature of related entitlements is therefore no more marked than that of national and statutory transfers.

It can be noted that the larger the household, the greater the weighting of benefits associated with related entitlements in household income. In other words, local social support is more sensitive to family size and the presence of children than national and statutory benefits. This result, already present in our first study (Anne & L'Horty, 2002), shows that the equivalence scale of related transfers (national or local) is very different from that of national and statutory transfers. Couples without children seem to be disadvantaged, while households with children are given preference by the local support scales, compared to the national scales.

There is little spatial variation in statutory national support and the same is true of national related entitlements, although there are elements of variation through the calculation of housing tax rebate. However, local social support does vary greatly from one locality to another. For example, for a single unemployed person, the amount of local social support, averaging €949, ranges from a minimum of €390 in Béziers to a maximum of €2,392 in the 19th arrondissement

5. The credibility of this assumption has been checked in four municipalities; it also confirms the previous assumption of a rental value based on 6 months' rent, see Appendix 1, Table A1-2.

Figure I – **Amount of support by household type, according to earned income (average across the 20 localities, 2020 data)**



Sources: Equinoxe 2020, TEPP-CNRS.

of Paris, which is a ratio of 1 to 6. For a couple with three children, the average amount of local social support is €3,515, with the minimum being €1,410 in Pecquencourt, in the Nord department, and the maximum being €8,535, again in the 19th arrondissement of Paris; the ratio remains 1 to 6.

3.2. Diversity of the Support

We will now disaggregate the support to get a fuller picture of its diversity. The first impression that emerges from the observation of all the scales for which data was collected, for each type of support, in each city and for each family configuration, is indeed one of the great diversity of the support. As we have already noted in our previous studies, the conditions governing the allocation of local social support are heterogeneous both between cities and between benefits. Within a single locality, there are usually as many different scales as there are different benefits. For a single benefit, there are often as many different scales as there are localities. This diversity is reflected in both the amount and the form of the support.

It can be highlighted first of all for some example benefits. In Figure II, we show the scale giving the amount of local social support in accordance with gross earned income for a selection of 12 localities[6] for three types of social support: transport support for a single person (II-A), which corresponds either to regional support or to support granted by an EPCI; reductions associated with the social rate for school canteens for a single person with one child over the age of three in primary school (II-B); support rate for attendance at the municipal theatre for a single person (II-C). For each of these support measures, the scales differ from one city to another, not only in respect of the amount of the support, but also in relation to the type of scale (staircase scale, degressive linear scale, whichever) and the income bracket that defines eligibility for support. This profile is the same for all local social support and all family configurations.

The diversity of the support can also be highlighted by looking at the scales of all local social support for a given locality and family configuration. In Figure III, we illustrate this diversity for a couple with two children in 3 localities: Béziers (III-A), Montreuil (III-B) and the 14th arrondissement of Paris (III-C). For each of these cities, the scales differ from one benefit to another, not only in respect of the amount of the support, but also in relation to the type of scale (staircase scale, degressive linear scale, whichever) and the income bracket that defines eligibility for support. The same applies to all other localities and for all family configurations.

3.3. Common Features of Local Social Support

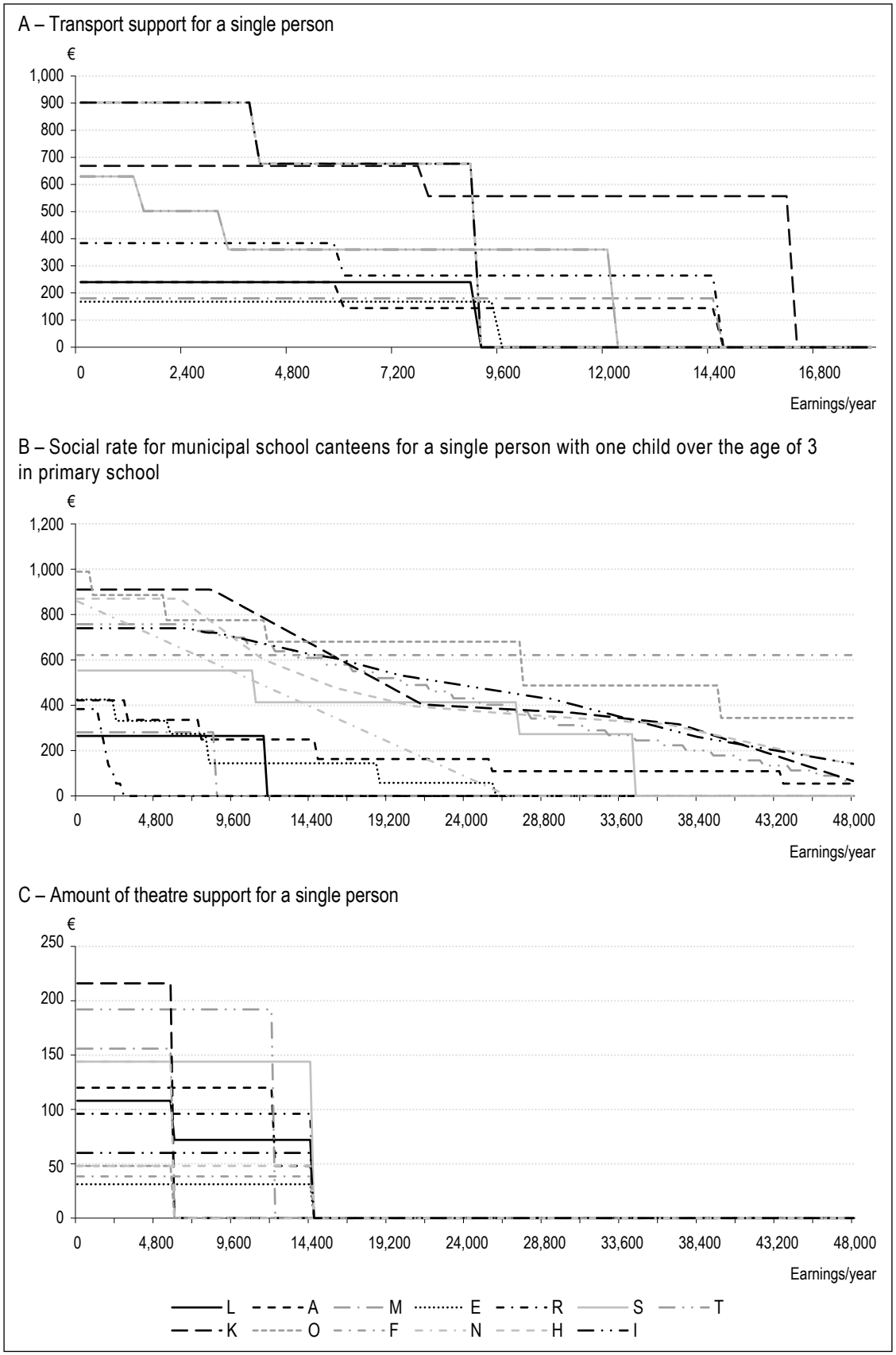
In the absence of any regularity, the very subject of related entitlements would be of little interest from a research perspective. In addition to the finding of great diversity, both parametric and non-parametric, in all aspects of support, one of the key findings of our 2002 and 2009 studies was the identification of a common feature of the related entitlement scales: the typical local social support was a fixed amount up to a given resource threshold, beyond which it was zero. Where the scale includes multiple thresholds, the support was a fixed amount between those thresholds. The scales of related entitlements therefore looked like a staircase – usually with only one step. This is not incompatible with the great diversity regarding the scales mentioned earlier, as the height and size of the step vary greatly depending on the social support measure and the locality. The diversity of the scales is only parametric in nature.

The advantage of this type of scale, the staircase type, is that it is easy to implement. In the most basic case, the support is a one-off amount and is granted to recipients on condition that they do not exceed a given resource threshold. Two variables, the amount of support and the resource threshold, are sufficient to fully define the scale. The disadvantage from the recipient's point of view is that the accumulation of different types of support can lead to penalties that are sometimes heavy in the event of an increase in household resources (Diagram 1). When means-testing is more diversified and degressive support coexists with flat-rate support, the profile is very different (Diagram 2).

To illustrate, we compare the total amount of related entitlements in 2007 and 2020 for each family configuration (Figure IV). In 2007 (IV-A), on average over the 13 localities in the sample, the profile corresponds to the type shown in diagram 1, with horizontal lines which drop vertically above a certain income threshold, corresponding more or less to that of the RMI or the basic RSA. This drop is synonymous with a threshold effect, which corresponds to

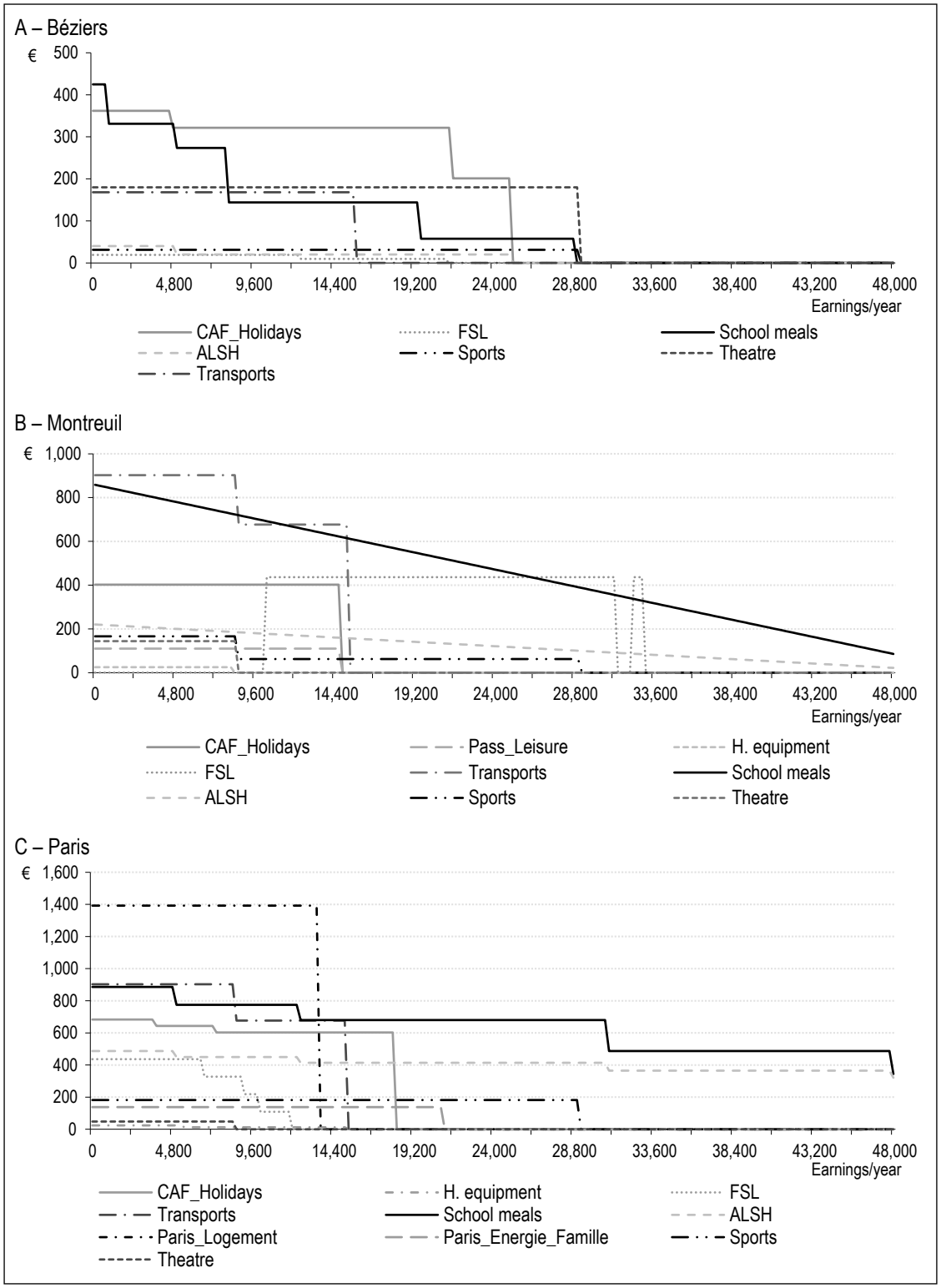
6. For legibility reasons, only the scales of the municipalities already surveyed in 2007 are shown. The 20 localities are presented in the Online Appendix. Link at the end of the article.

Figure II – **Amount of local support by locality for some typical support measures (2020 data)**



Notes: The profiles of the 20 localities are presented in the Online Appendix. Link at the end of the article.
Sources: Equinoxe 2020, TEPP-CNRS.

Figure III – **Amount of local support for a couple with two children (2020 data)**



Notes: *Paris Logement* is a means-tested support scheme provided by the Paris city authorities. Specific support is offered to single-parent families and families with at least two children (as in the example chosen here).
Sources: Equinoxe 2020, TEPP-CNRS.

a locally infinite value of the marginal tax and transfer rate. This increase in the marginal rate directly affects all household resources, since at this level the marginal rates implicit in each transfer add up.

This profile of local social transfers according to earned income is very different from that of national and statutory transfers. While the latter start to decrease sharply with gross income, local transfers are stable. This initial

Diagram 1 – **Cumulation of flat-rate social support measures**

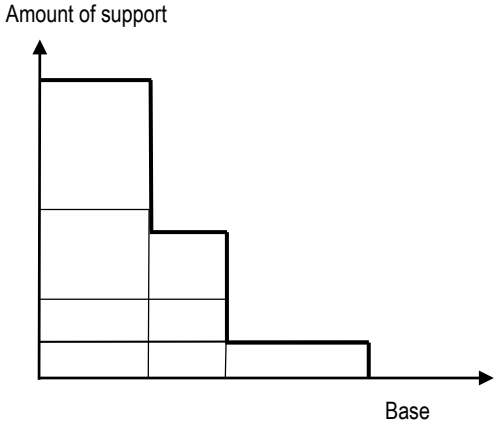


Diagram 2 – **Cumulation of partly degressive social support measures**

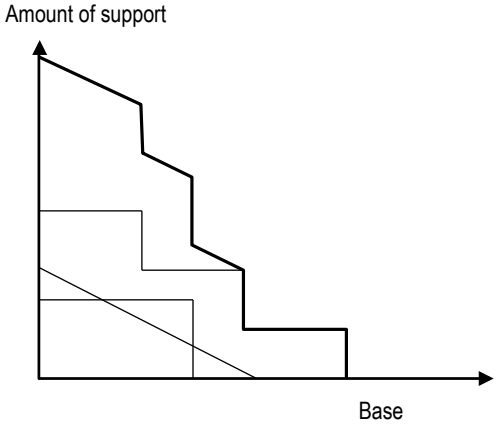
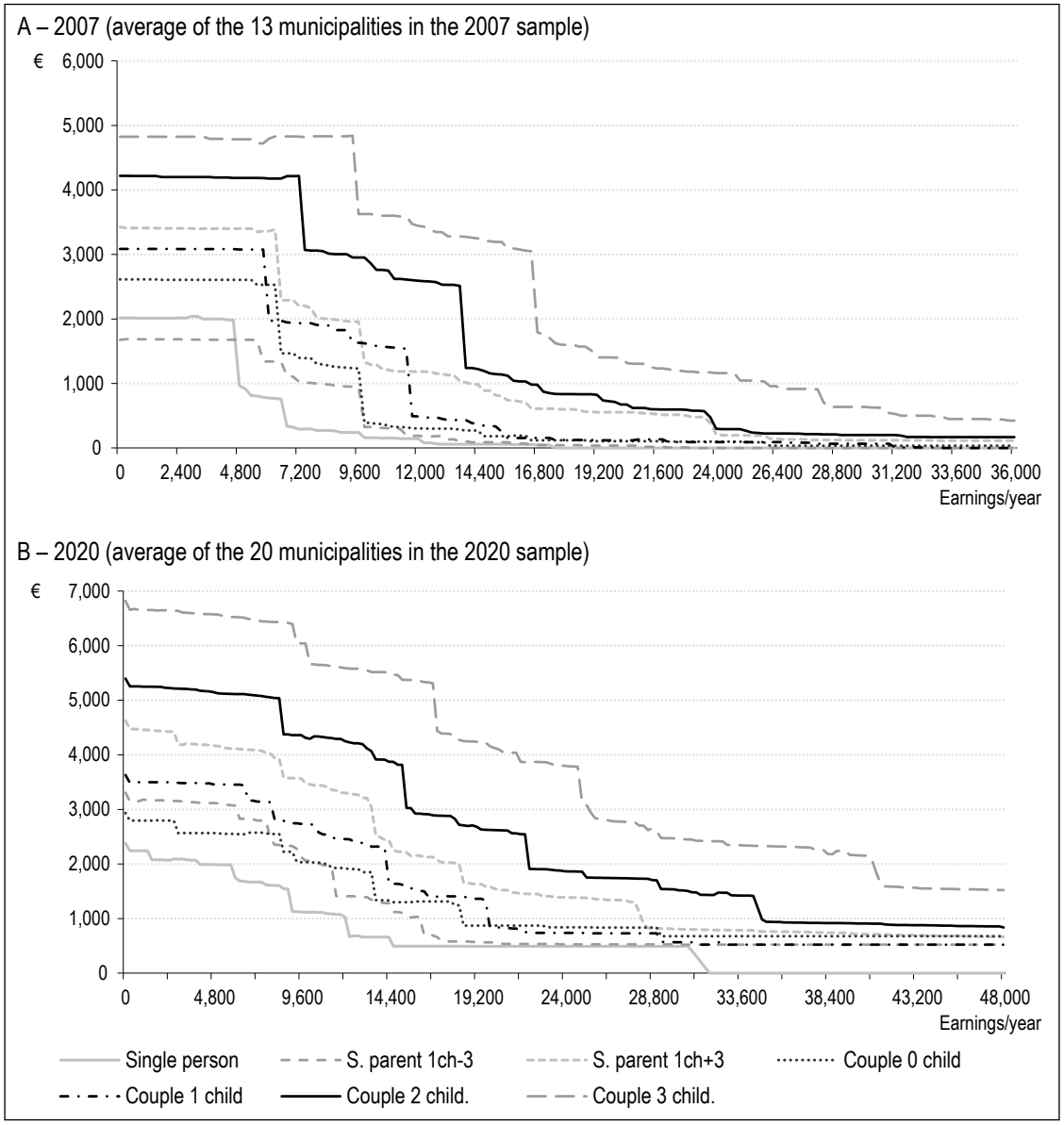


Figure IV – **Yearly amount of related entitlements by family configuration**



Sources: Equinoxe 2020, TEPP-CNRS.

stability is observed in all cities and for almost all benefits. Then, while national transfers decrease less sharply, local transfers in most cities undergo a rapid decrease with sometimes brutal threshold effects.

In 2020 (figure IV-B), we see a profile similar to that of Diagram 2: the amount of related entitlements (on average for the 20 cities in the sample) decreases less sharply with earned income; this change in the profile of support between 2007 and 2020 is not explained by the difference in sample size between the two studies. The decrease in support is much more regular with income, following a profile that rather evokes the linear decrease in the amount of RSA in accordance with earned income. This characteristic profile is obtained when the scales of certain basic support are degressive in relation to the gross resources of households. Box 2 provides an illustration in the case of social scales for school meals.

The amounts of support in the municipalities appear to be broadly of the same order of magnitude in 2020 as in 2007 if we take into account the revaluation of the RSA, which is 28.1% between 2007 (when the monthly RMI was €441) and 2020 (when the RSA is up to €564.79). The major change seems to be in the nature of the scales and not in the generosity of the support.

The average profiles observed for all the cities in the samples can be observed, by and large, at the level of each individual locality. This is what we will now illustrate, for two family configurations in a selection of localities.[7] Whether it is a single person with one child (Figure V) or a couple with three children (Figure VI), it is visually apparent that the clear step corresponding to the pre-RSA situation has been largely eroded by 2020.

3.4. Local Social Support Now Contributes to Eliminating Poverty Traps: A Simulation

One of the objectives of the RSA was to ensure that "work pays" from the first hour worked. The change has the consequence of helping to eliminate poverty traps, which correspond to employment situations or earned income brackets in which an increased number of hours worked does not increase the net resources of households. Such situations are no longer observed and the amount of net resources always increases in accordance with the gross resources

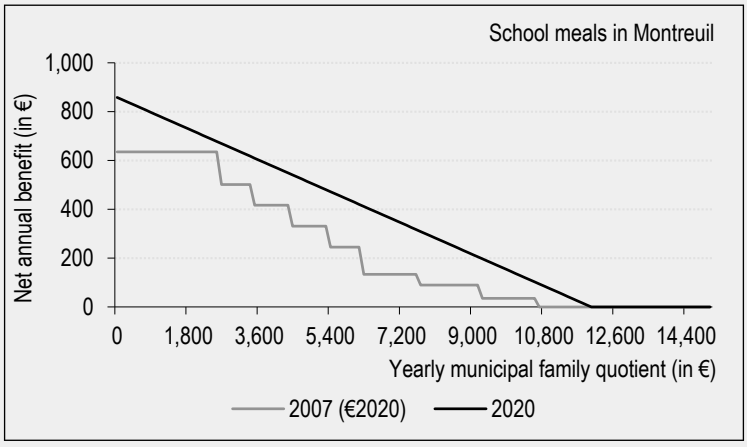
7. The profiles for the whole 20 localities are presented in the Online Appendix. See link at the end of the article.

Box 2 – **Illustration of the Changes in Local Scales: The Example of School Meals**

With the exception of some municipalities offering universally low rates to all households (or even free of charge, as in Drancy), school meals in primary schools is a service for which most municipalities offer rates that are defined in relation to parents' income. A minimum and maximum rate are defined based on resources and the rate paid increases in accordance with a number of variable bands between these two extremes. The scales of these municipal rates for extra-curricular services have frequently undergone non-parametric changes between 2000 and 2020. In several municipalities, this support has been reformed to adopt degressive profiles, decreasing steadily with each additional euro of resources, thus eliminating the threshold effects caused by the bracketed scales (cf. Diagram 1).

The graph below provides an illustration for the city of Montreuil by comparing the savings made in relation to the full rate in 2007 and in 2020, following a change in the school meals scale.

From a staircase-shape scale to a degressive scale



Reading Note: In 2007, a household with a family quotient of less than €2,568 benefited from a reduced rate corresponding to a saving of €635 in 2020 compared to the full rate.
Sources: Equinoxe.

➔

Box 2 – (*contd.*)

These reforms are quite costly: they replace a scale that is legible but has threshold effects with a much more regular scale that is more complicated to calculate, using the equation of an affine function. In a number of cases, the switch from one scale to the other was carried out by retaining the different income brackets and adding a specific degressive aspect to each bracket. The equation therefore varies within each of income bracket, making the calculation of the rate to be paid sometimes complex and therefore opaque for users. Two illustrations of such scales are provided in the table below:

School meals rates in Fontenay-sous-Bois and Lyon

Fontenay-sous-Bois		Lyon	
Income bracket	Daily rate (€)	Family quotient bracket	Daily rate (€)
1	0.56	QFM 1	0.80
2	0.56 to 2.42	QFM 2	0.80 to 4.42
3	2.42 to 3.30	QFM 3	4.42 to 4.68
4	3.30 to 3.85	QFM 4	4.68 to 5.05
5	3.85 to 4.07	QFM 5	5.05 to 6.83
6	4.07 to 4.40	QFM 6	6.83 to 7.30
7	4.40 to 5.49	QFM 7	7.30
8	5.49 to 6.60		

Notes: QFM for municipal family quotient.
Sources: Municipal documents.

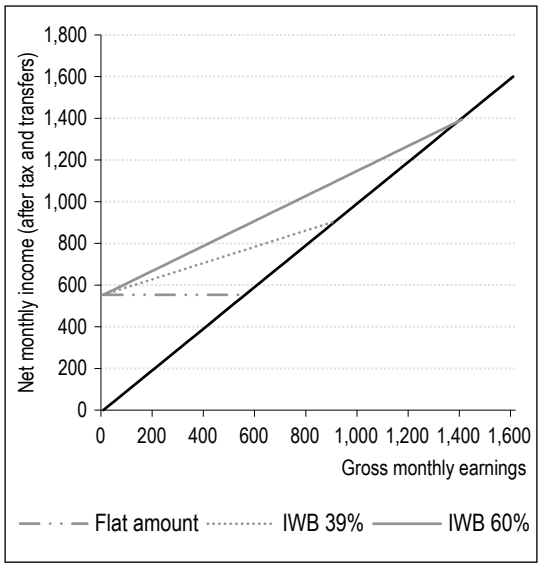
The collection of information provided several examples in which households were unable to know the precise rate that would be applied to them without first registering on a dedicated portal.

of households (see Appendix 2). This was one of the objectives of the RSA reform and we can see that there has been a real alignment of local scales with the profile of the national scale. As a result, this convergence has contributed to strengthening monetary incentives for work. The adjustments of local social support have been broadly in line with the national reforms of the RSA in 2008 and the in-work benefit in 2016.

The use of the concept of a marginal tax rate is another way of showing monetary incentives and poverty traps. This is the ratio of the change in the amount of support received by the recipient as a result of an increase in their earned income. In the case of the RMI, this rate was 100% after the incentive period (a €100 increase in wage would eventually reduce the amount of the RMI by €100). The simulations in our 2009 study highlighted that the rate chosen for the RSA by the government (38% marginal rate, rising to 39% in 2019) was below the value that would give rise to the emergence of local poverty trap situations.

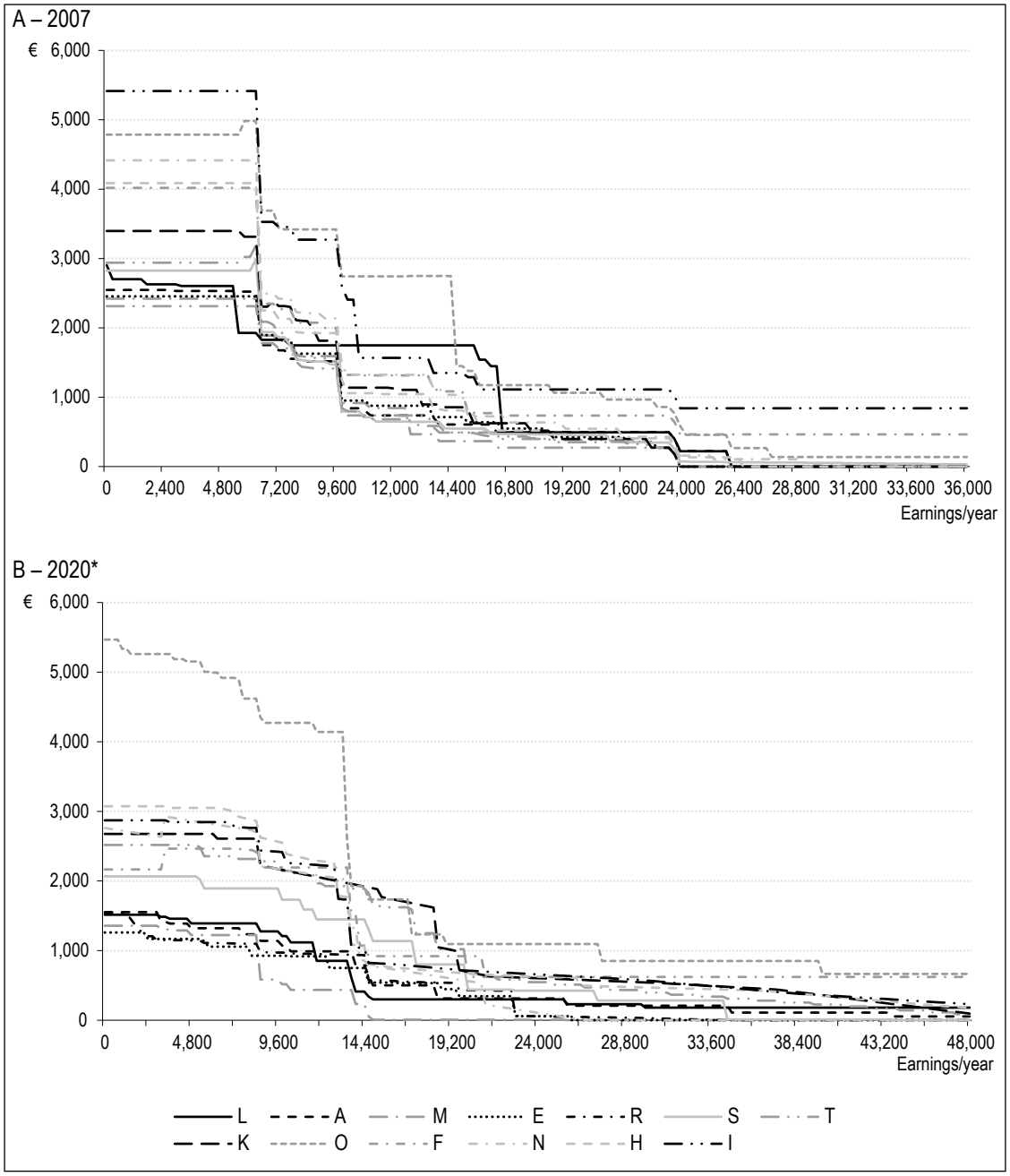
It is interesting to update these simulations using the 2020 scales for related entitlements. In view of the evolution of local scales, what marginal rate for the in-work benefit would lead to the re-creation of local poverty traps today? Firstly, it should be noted that in the case of a low income support mechanism at a constant marginal rate, as soon as the marginal tax rate is increased, the amount of support paid to poor households is automatically reduced. The mechanism is illustrated in Diagram 3 for the in-work benefit, by comparing two marginal

Diagram 3 – **Theoretical link between marginal rate, gradient of the in-work benefit and exit point**



Reading Note: This diagram shows the amount of a household's net resources in accordance with its gross resources under different support configurations. In the case of a purely differential benefit, such as the RMI, the net resources form a horizontal line (the marginal tax rate is 100%). With an in-work benefit, net resources increase with earned income, especially since, on average over the twenty localities, the income of a couple with two children from transfers is greater than €20,000 per year when local and/or non-statutory transfers are taken into account. In order to receive an equivalent income while employed, a couple needs to accrue €15,550 in earned income, which corresponds to a weekly working time of 44.5 hours at the minimum wage over the year.
Sources: Equinoxe 2020, TEPP-CNRS.

Figure V – **Yearly amount of local social support for a single person with a child over the age of 3**



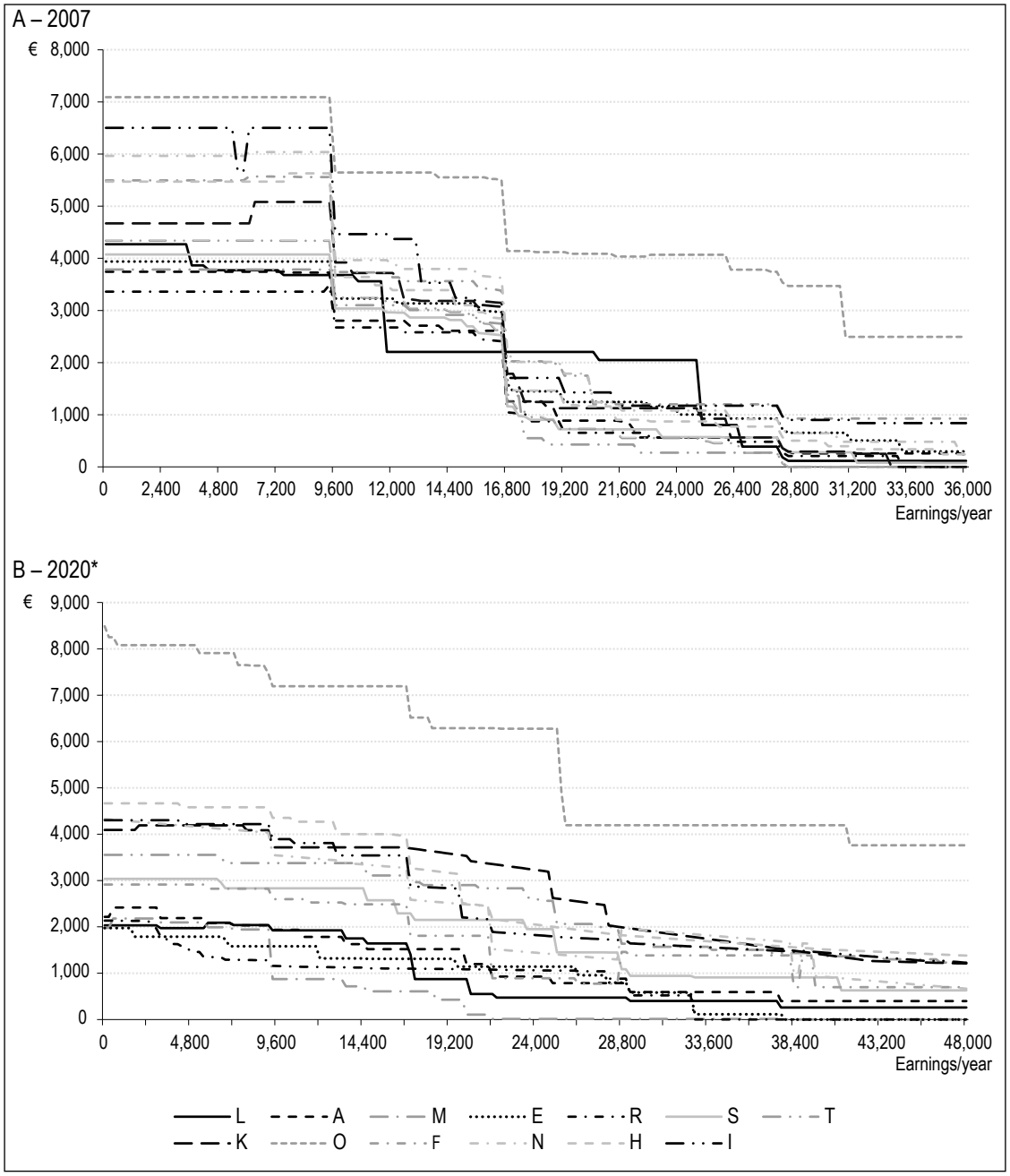
* The profiles for the 20 localities are presented in the Online Appendix.
Sources: Equinoxe 2020, TEPP-CNRS.

tax rates, 39% and 60% (excluding individual bonuses). The increase in the marginal tax rate reduces the amount of support paid to households and narrows the eligibility window for the in-work benefit. This contradicts the very purpose of these support measures, which is to provide financial support to vulnerable groups. Based on John Rawls' (1971) *maximin* principle, the fairness of a situation must be assessed from the point of view of the benefit it provides to the least well off in society. From this point of view, the RSA and the in-work benefit are fairer than the RMI. In contrast, an increase in the marginal tax rate for the in-work benefit contradicts this principle.[8]

The purpose of our simulation is thus to show how the reforms of related entitlements have accompanied the "Rawlsian" nature of the RSA reform. We change the marginal tax rate of the in-work benefit (excluding the flat-rate bonus), initially set at 39%, to cover a wide range of

8. It should be noted that the increase from 38% to 39% decided upon in 2009 was concomitant with an increase in the individual bonus which complements the in-work benefit.

Figure VI – **Yearly amount of local social support for a couple with three children**



* The profiles for the 20 localities are presented in the Online Appendix.
Sources: Equinoxe 2020, TEPP-CNRS.

values, up to a rate of 100% which is equivalent to cancelling the in-work benefit.

The simulation on discretionary income shows that, compared to the situation without any professional activity, poverty traps are absent as long as the marginal tax rate does not exceed 55%; beyond that, depending on the city and the family configuration, areas of loss of disposable income appear. Table 4 shows, for the different family configurations, the maximum number of hours of work paid at the minimum wage they would need to work to earn more than they would receive without any work.

3.5. The Exception of Paris

Another interesting result, which appears in figures V-B and VI-B, is the exceptional nature of Paris (i.e. "O"). For each family configuration, Parisian households are potentially entitled to a much higher level of local social support, around twice as high as the average in other localities. The social support measures available to Parisians are not only offered by the Paris city authorities, but some are provided by the Regional authorities, in particular the public transport support. The gap already existed in 2007 but has widened since.

Table 4 – **Reservation durations, in weekly working hours paid at the minimum wage, for different gradients of the in-work benefit marginal tax rate**

	Marginal tax rate of the in-work benefit (%)									
	39	45	50	55	60	65	70	80	90	100
Single person	1	1	1	1	24	24	24	24	24	24
Single parent with a child <3	2	2	2	2	38	38	38	38	38	38
Single parent with a child 3+	2	2	2	2	33	33	33	33	33	33
Couple without children	1	1	1	1	37	38	38	38	38	38
Couple with 1 child	2	2	2	2	2	2	3	4	7	23
Couple with 2 children	1	1	1	2	2	2	2	3	22	26
Couple with 3 children	2	3	3	3	3	4	5	7	24	29

Notes: The non-zero value of 39% is mainly due to the exemption from the public-service broadcasting contribution for people with a tax reference income of zero.
Reading Note: With a marginal rate of 60%, in one of the municipalities in the sample, a single person would have to work 24 hours a week while being paid the minimum wage to receive as much as they would without earned income.
Sources: Equinoxe 2020, TEPP-CNRS.

The difference does not come from one support measure in particular. The difference is explained by the number of local social support measures available in Paris and by the amount of each support measure, in particular the Paris housing support and the transport support in the Île-de-France region. Another peculiarity specific to Paris concerns the housing tax. Even though an ongoing reform aims to extend the housing tax rebate to the entire population, Paris was already making full use of the autonomy afforded it by the State to grant particularly generous abatements, especially for dependants. By comparing the amounts paid in Paris with those that would correspond to the average tax rates and minimum legal abatements, we show (under the assumptions presented above) that a person living alone, without children, in a T1 type dwelling and with low resources "saved" €670 (excl. taxes), an amount that rose to €850 for a single person with one child and €1,150 for a couple with two children.

In the averages presented above (Figures I and IV), we have counted Paris twice – i.e. once for each of the two arrondissements considered (the 14th and the 19th). As the amounts of social support are simple unweighted arithmetic averages, they are therefore pulled upwards by Paris. This compositional effect masks a reality that can be seen when comparing the results for 2007 and 2020. With the exception of Paris, local social support in 2020 is at a lower level overall than in 2007. If Paris is excluded from the sample, the amount of local support has therefore decreased, in euro at current prices, in absolute terms. With a constant budget, this reduction in the level of social support for households without resources makes it possible to widen the window of eligibility for support.

Going back to the prospective part of our study published in 2009, this evolution corresponds to a mixture of the so-called staggering scenario and the scenario involving a switch from conditions based on status to means testing, with the same budget.[9] In both cases, with a constant budget, the aim is to give less generous support to more recipients.

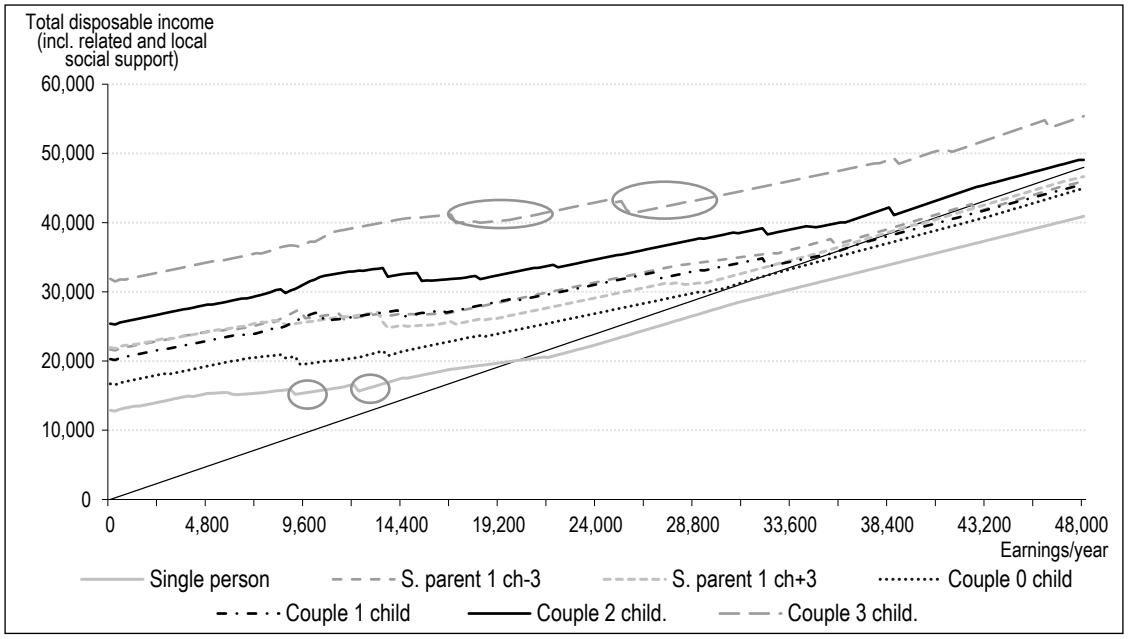
Households living in Paris are a specific case. On the one hand, social support is more generous overall. On the other hand, the configuration of the different local support scales seems to favour the existence of earned income areas, i.e. work situations, in which an additional effort seems to be penalised financially. The representations provided by Equinoxe allow the identification of multiple income areas where an additional hour of work results in a loss of income. Figure VII, which focuses on the Parisian scales, effectively shows multiple areas of earned income for which an increase in gross resources results in a decrease in net resources. In Paris, the recommendations of the Desmarescaux report thus seem to have been rendered ineffective.

A more detailed examination by family configuration indicates that this local trap phenomenon is fully explained by the local support scales. By superimposing the amounts of disposable income with and without local social support for different family configurations, it appears that poverty traps are due to the local social support scales (Figure VIII). These anomalies in the scales can be identified locally, to a greater or lesser extent, for almost all configurations of Parisian households.

The negative effect of the Parisian local scales can be quantified more precisely. It is common to speak of "inactivity traps" (or unemployment traps, poverty traps) when returning to work does not improve total income or is financially

9. Scenario 3 and scenario 4 of the 2009 study, respectively.

Figure VII – **Local poverty traps in Paris (2020 data)**



Notes: Four examples of poverty traps are shown on the graph; they are reported in Table 5.
Sources: Equinoxe 2020, TEPP-CNRS.

costly. The introduction of the RSA in 2009 (and then of the in-work benefit in 2016) was explicitly aimed at combating the traps created by the RMI, the amount of which fell after a transition period by an amount equivalent to the wage supplement associated with a return to work (Anne & L'Horty, 2002). It can be seen that, even for Parisian households, there are no longer any situations where returning to work results in a loss of disposable income compared to a situation without any work (Figure VIII). The RSA and the in-work benefit play their part in this respect. In contrast, there are wage levels for which an increase in work reduces disposable income, due to the disappearance of sufficiently generous support to compensate for the wage supplement.

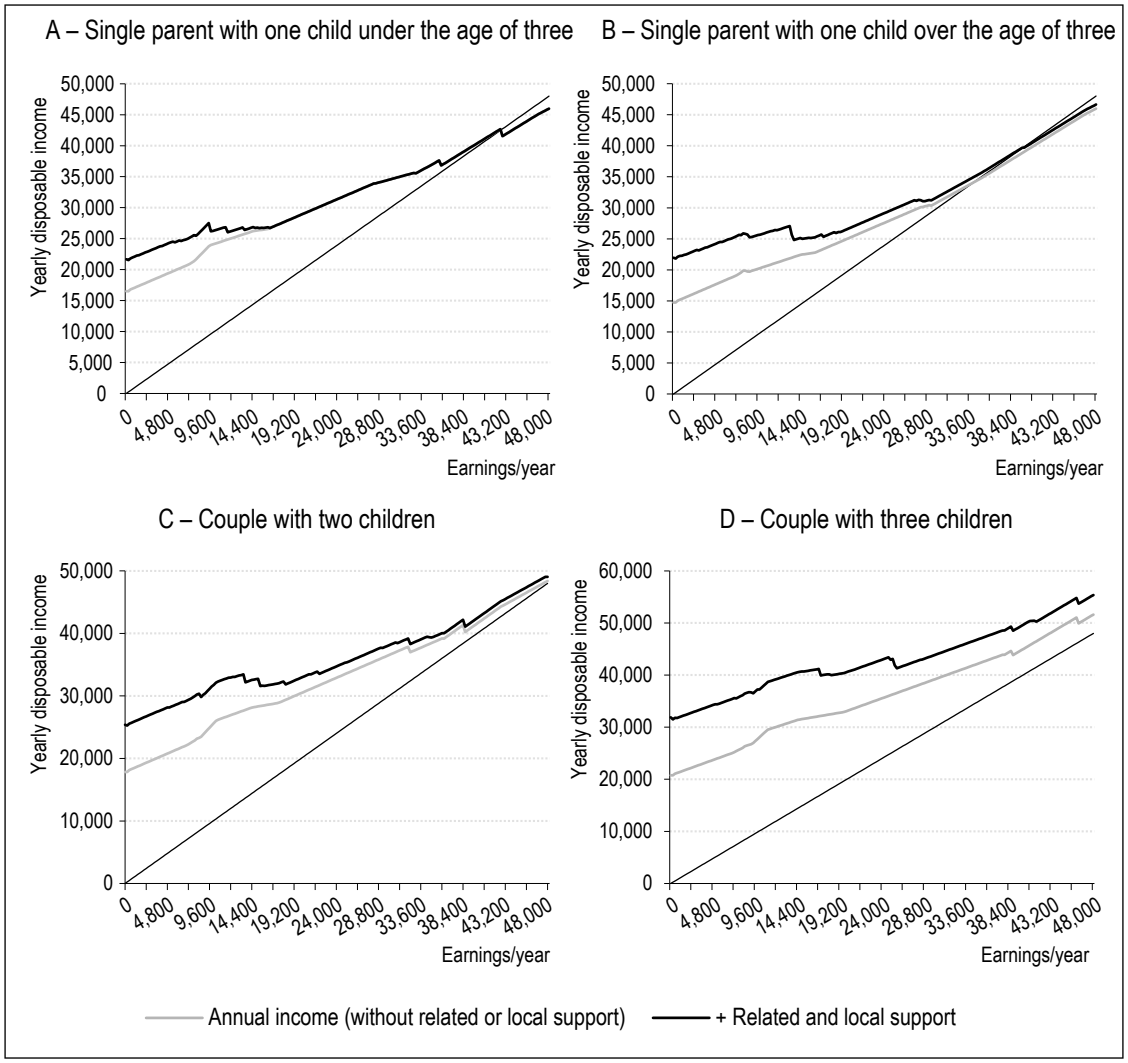
Table 5 shows, for the different family configurations in Paris, the level of earnings where such "local traps" appear, and their level at the end of the trap, i.e. when disposable income becomes at least equivalent to that before the trap and the translation, in terms of the number of hours of work paid at the minimum wage, of the additional work required to escape this trap.[10] Such local trap situations are also found in other municipalities in our sample, but they are never as large.

If we look at the scales of the various support measures, it is not surprising to see that these traps are the consequence of the disappearance of support measures that use a single scale or are not very degressive (Cf. Diagram 1). The end of transport support thus explains the trap observed for a single person.[11] The numerous housing-related support measures offered in Paris (in addition to the support from the *Fonds de solidarité pour le logement* provided in all French departments,) explain the other traps. The cost of housing, which is particularly high in Paris, justifies this local focus. Depending on their resources and family situation, Parisians can benefit from several support measures:[12] housing support (*Paris Logement* with schemes aimed to families and to single parents, support for electricity or heating expenditure (*Paris énergie famille*), and for child-related expenses (*Paris forfait famille*).

Moreover, as we have already indicated, Paris makes extensive use of its autonomy to reduce the amount of the housing tax for households with low resources and family responsibilities. Nevertheless, the effect of this local support is quite small in our calculations. Indeed, the amount of housing tax is proportionally low in Paris, including for households with earned income; the gain for households with low resources is therefore quite limited. Furthermore, and this is not specific to Paris, the extension

10. As a further reminder, these calculations relate to potential entitlements available to households, under the take-up and usage assumptions presented earlier in Section 2. The actual use of these support measures is not studied here.
11. The Île-de-France Region offers two social scales for transport (free or 75% reduction), combining conditions relating to status (RSA, ASS, CSS) and means testing. In order to avoid giving undue importance to this support, we assumed that only one member of the household was receiving it.
12. Due to the assumptions and case studies used in this study, various Parisian support measures to specific populations are not included (support for the disabled, support for home improvement, etc.).

Figure VIII – **Details of the local Parisian poverty traps (2020 data)**



Reading Note: In Paris, under the assumptions specified in Tables 1 and 2, a couple with 3 children and no earned income would be entitled to annual resources of €20,770 thanks to State support. In addition, a theoretical amount of €11,105 in related entitlements and local support, provides this typical household with total resources of €31,875.
Source and coverage: Equinoxe 2020, TEPP-CNRS. Support available according to family configuration and resources for a household residing in Paris (for at least 3 years for housing support measures).

Table 5 – **Local poverty traps in Paris**

	Yearly earnings in €		Equivalent in number of weekly hours at min. wage
	Start of the trap*	End of the trap**	
Single person 1st trap	8,880	10,800	4.6
Single person 2nd trap	12,000	13,440	3.4
Single parent with 1 child under 3	9,360	17,760	20.1
Single parent with 1 child over 3	13,200	20,640	17.8
Couple without children	8,400	12,720	10.3
Couple with 1 child	10,320	13,680	8.0
Couple with 2 children	13,440	21,120	18.4
Couple with 3 children 1st trap	16,800	21,120	10.3
Couple with 3 children 2nd trap	24,720	30,240	13.2

* Yearly earning for which an increase in working time results in a decrease in disposable income.
** Yearly earnings needed to regain a disposable income equivalent to that at the start of the poverty trap.
Notes: The 1st and 2nd traps are those shown on Figure VII.
Reading Note: In Paris, under the assumptions used, a single person household with a child under 3 years of age working for a yearly wage of €9,360 would see its disposable income fall if it were to increase its professional activity. It would regain an equivalent disposable income on condition that it obtained a wage of €17,760, which represents an increase in its working time of 20 hours a week paid at the minimum wage.
Sources: Equinoxe 2020, TEPP-CNRS.

of the housing tax rebate ongoing since 2018 constitutes a "national related entitlement" that benefits all households, regardless of their earned income; threshold effects are therefore absent and this support does not create traps.

The range of local social support available to Parisians (whether municipal or regional) is therefore consistent with the characteristics of the capital city, particularly in terms of housing and transport costs. In contrast, the absence of changes in the types of scales leads to the creation of local poverty traps that other municipalities have managed to eliminate through non-parametric changes. In our small sample of 20 localities, Paris is the only city with this configuration but, strictly speaking, we cannot rule out that there are other localities in France following the same pattern as Paris. Given the diversity and generosity of Parisian support measures, we nevertheless believe that this is a Paris-specific issue, while reiterating that it is not only the responsibility of the local authorities of the particular municipality-department that forms Paris, but also of regional support measures. In contrast, our research shows very few differences within the two arrondissements studied. For example, school meal rates have been unified in all Parisian arrondissements since 2010, the rates for the municipal swimming pools are identical in the two arrondissements studied and only the discounted theatre rates show local differences.

* *
*

The study of local social support scales reveals a transformation of the general profile of support between the first inventories drawn up in 2001 and 2007 and this new assessment in 2020. This transformation of the general form of local social support scales is clearly in line with the erosion of the threshold effects associated with previous scales. In this sense, the peaks in marginal tax and transfer rates generated by the local social support scales, themselves often staircase-shaped, have been progressively capped. The scales of local social support schemes have evolved towards becoming more degressive, as with the switch from the RMI to the RSA. It is as if the local scales had imitated the national minimum income scale. The staircase-shaped scales were in line with the RMI, which was purely differential in the long term, beyond the incentive mechanism. From now on, more degressive scales will be implemented, similar to that of the RSA.

National minimum income schemes thus seem to play a guiding role in local social support scales. In the same way as the RMI had at the time, the RSA has influenced the way in which optional local social support is allocated. Means testing is commonly based on the RSA thresholds, where the RSA is not a status condition for obtaining support. Support is subject to adjustment by local decision-makers following national reforms of the RSA or the in-work benefits. The study shows that the guiding role of national reforms also affects the form of local social support scales.

Since the implementation of the RSA, local support has become less generous overall for the poorest households and the means test to determine eligibility has been extended. The amount of local support has indeed decreased in absolute terms, in euro at current prices. With a constant budget, the reduction in the level of support for households without resources makes it possible to widen the window of eligibility. This overall transformation is in line with the recommendations of the report of the parliamentary mission on related entitlements (Desmarescaux, 2009) and is consistent with the decisions taken at that time by all support providers. Without being able to establish causality, we note the consistency of the overall movement with the commitments of the institutions involved in the design of local social support schemes.

This study, based on a sample of 20 localities in mainland France, cannot claim to be a representative sample even though it includes a total of 4.6 million inhabitants. Our approach is to look for characteristics common to all these localities, which were selected for their diversity in terms of size and location. At this stage, we note that Paris is an exception: on the one hand, social support is generally more generous there; on the other hand, local support scales favour the existence of earned income areas, i.e. work situations, in which additional effort is financially penalised.

In conclusion, we can mention the negative aspects of this convergence of the scales. The change has come at the cost of increasing engineering and greater complexity of the conditions for support distribution. In addition, more degressive scales may be less directly legible to recipients and the amount of support received varies more frequently with earned income. Furthermore, additional information needs to be collected to determine the amounts of support, which undoubtedly increases the costs of managing the support. □

Link to Online Appendix:
https://www.insee.fr/en/statistiques/fichier/6328081/ES530-31_Anne-LHorty_Annexe-en-ligne_Online-appendix.pdf

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APPENDIX 1

Table A1-1 – **The 20 localities in the study**

City	Code	Number inhabitants*	Département	Region	Poverty rate (%)**	Collection year(s) in previous studies
Arles	A	53,000	Bouches-du-Rhône	Provence-Alpes-Côte d'Azur	20.8	2007
Arras	B	41,000	Pas-de-Calais	Hauts-de-France	14.1	2001
Amiens	C	133,000	Somme	Hauts-de-France	16.1	2001
Belley	D	9,000	Ain	Hauts-de-France	10.8	2001
Béziers	E	76,000	Hérault	Occitanie	23.5	2007
Drancy	F	70,000	Seine-Saint-Denis	Île-de-France	17.2	2007
Evry	G	55,000	Essonne	Île-de-France	15.3	2007
Fontenay-sous-Bois	H	54,000	Val-de-Marne	Île-de-France	17.4	2007
Ivry-sur-Seine	I	62,000	Val-de-Marne	Île-de-France	17.4	2007
Le Mans	J	143,000	Sarthe	Pays de la Loire	13.6	2001
Lyon	K	516,000	Rhône	Auvergne-Rhône-Alpes	13.6	2001&2007
Marseille	L	863,000	Bouches-du-Rhône	Provence-Alpes-Côte d'Azur	21.9	2001&2007
Martigues	M	49,000	Bouches-du-Rhône	Provence-Alpes-Côte d'Azur	14.5	2007
Montreuil	N	107,000	Seine-Saint-Denis	Île-de-France	22.2	2001
Paris (14th, 19th)	O&P	2,150,000	Paris	Île-de-France	17.4	2001&2007
Pecquencourt	Q	6,000	Nord	Hauts-de-France	19.4	2001
Sète	R	44,000	Hérault	Occitanie	19.5	2007
Tourcoing	S	97,000	Nord	Hauts-de-France	23.6	2007
Villeneuve-d'Ascq	T	62,000	Nord	Hauts-de-France	14.9	2007

*In the 2015 census.
**In 2018, at the level of the INSEE employment area. The national rate is 14.8%.

Table A1-2 – **Calculation of gross rental value**

Municipality	ARV in 2019 (euros)	Value in euros of 6 months' estimated rent for a T3 dwelling
Paris	6,555	6,546
Marseille	3,163	3,802
Arras	2,773	2,535
Lyon	3,521 (EPCI=3,764)	3,802

APPENDIX 2

SOCIAL TRANSFERS SCALES

Figure A2-I – **National and legal social transfers by earnings level**

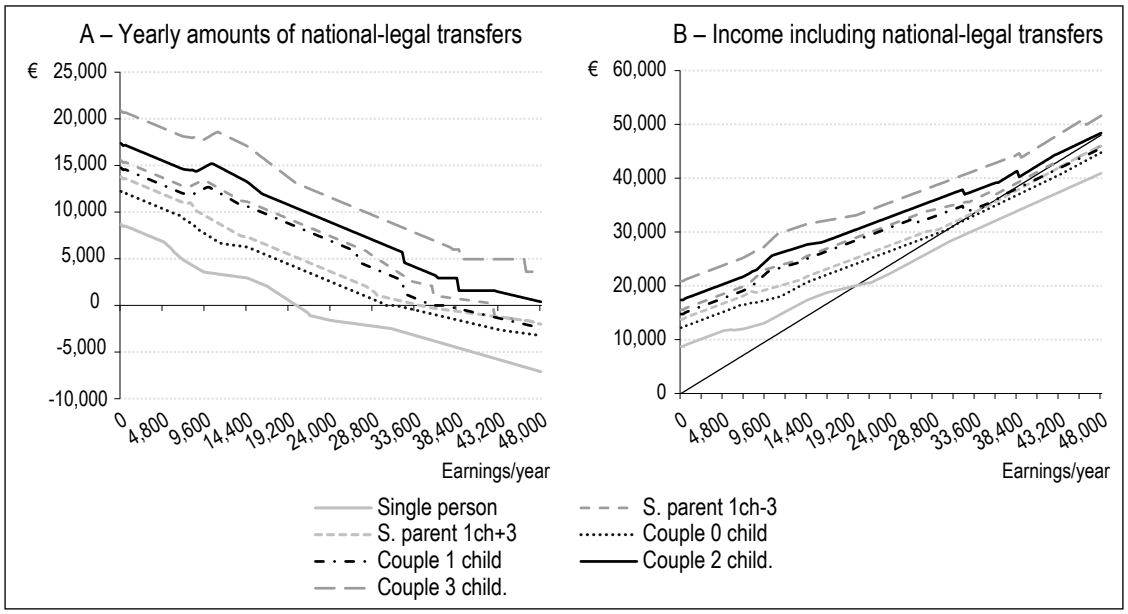
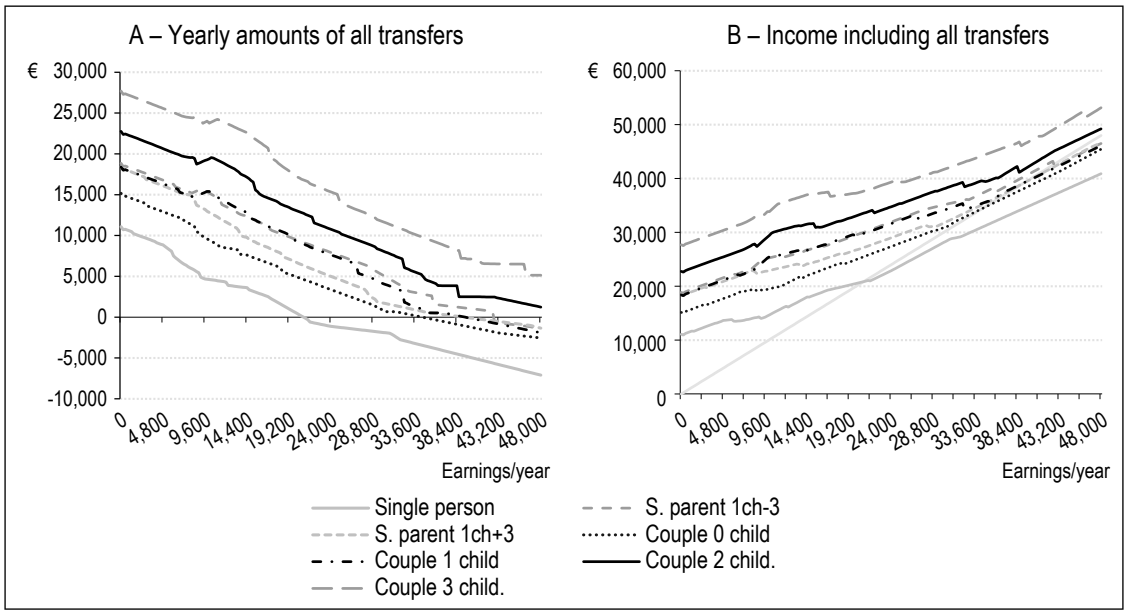


Figure A2-II – **All social transfers by earnings level**



Impacts of the 2018 Household Capital Tax Reforms on Inequalities in France: A Microsimulation Evaluation

Félix Paquier* and Michaël Sicsic**

Abstract – This study assesses the impact on standard of living inequality and public finances of the transition from the tax on wealth (ISF) to a tax on real estate assets (IFI), the introduction of a flat-rate tax on capital income (PFU), and the increase of the social tax (CSG) on capital income in 2018. We achieve this through the use of the Ines microsimulation model and the ERFS data, which we supplement by imputing the wealth held by each household on the basis of the Household Wealth survey (*enquête Patrimoine*) and tax data on the ISF and IFI. In the short term, the positive impact of these reforms on standards of living is highly concentrated at the top end of the distribution, although the gains are limited by the increase in the CSG. The cost to public finances is 3.4 billion euros per year. Although they lead to additional public revenues, the short-term behavioural effects of the flat tax on the dividends received by households further accentuate the rise in the standard of living of the wealthiest households.

JEL Classification: D31, D63, H20, H23, H31
Keywords: public policy evaluation, microsimulation, inequality, tax on wealth, flat-rate tax on capital income

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The evaluation of capital tax reforms is a key public policy issue for two reasons. Firstly, capital tax can be seen as an exacerbated example of the trade-off between efficiency and equity: on the one hand, capital is very unevenly distributed,[1] more so than labour income (Garbinti & Goupille-Lebret, 2019), which makes its taxation an important tool in the fight against inequality. On the other hand, capital income is more sensitive to tax incentives than labour income (Kleven & Schulz, 2014), which could lower the tax rate that maximises public revenues (Lefebvre *et al.*, 2020). Secondly, there are few findings regarding capital taxation, since very few studies have been carried out in this subject, which is nevertheless very important for economic policy. In 2018, three tax reforms were targeted directly at households holding wealth in France: *(i)* the transition from the tax on wealth (ISF) to the tax on real estate assets (IFI), *(ii)* the transition from the progressive taxation of capital income (included in the income tax base) to a flat tax on capital income, and *(iii)* the increase in the rate of the general social tax (CSG) paid on capital income. The latter two reforms constitute the introduction of a single flat tax (the PFU) of 30% for some of the capital income; this corresponds to the sum of the flat-rate of 12.8% for income tax, and 17.2% for the CSG.

The aim of this study is to evaluate the impacts of these three reforms on standard of living inequality and on the State budget using the Ines microsimulation model. For this purpose, we primarily draw upon the ERFS (*enquête Revenus fiscaux et sociaux*, a survey on household tax and social revenue), the INSEE's main database for producing standard of living inequality indicators, and to which the Ines microsimulation model is linked. In order to assess the impact of these reforms, we calculate the counterfactual amounts of taxes (ISF, income tax and CSG), i.e. those that would have been paid by households in 2018 had the reforms not taken place. The impact of the reforms is evaluated by comparing these amounts to the amounts of IFI, income tax and CSG calculated by applying the 2018 reforms. Nevertheless, this evaluation faces at least three difficulties.

First of all, there is no database that provides all the components used to calculate both standards of living[2] and the wealth tax[3] for the same sample of households. The analyses presented in this article are therefore based on the imputation, in the ERFS, of the amounts of different types of wealth held by households (Paquier *et al.*, 2019). This imputation was carried out by combining several methodological approaches and several sources of data (the INSEE's Household wealth survey and the ISF and IFI data provided by the Directorate-General of Public Finances, DGFiP) in order to assign the most precise possible wealth amounts to the households in the ERFS.

The second difficulty is the fact that the impact of the PFU differs depending on the year on which the analysis is performed. Firstly, the tax paid on capital income in 2018 is partly made up of taxes paid on income from 2017, to which the legislation that came into force in 2018 did not yet apply. In addition, certain types of capital income (interest on homebuyer savings plans, for example) were not subject to the PFU when it first came into existence, but are in the longer term.

Finally, several elements suggest that the introduction of the PFU and the modification of the ISF could have had an impact on the stock of wealth held by households in 2018 or on capital income as a result of behavioural reponses to taxation. In this article, we will primarily assess the impacts of the reforms with behaviour remaining unchanged. However, we also simulate the PFU and the IFI, taking account of the short-term behavioural effects, by making use of a range of empirical work for the PFU and variations in the stock of wealth observed between 2017 and 2018 for the ISF.

It should be specified that the behavioural effects studied here are purely short term: none of the potential long-term impacts – such as on the accumulation of capital or tax exile – which are often used to justify reforms, are evaluated here. This is not to assume that such impacts do not exist, of course. However, since these reactions are not certain and may take time to manifest themselves, it is also very useful to highlight the short-term effects, which can be observed much more quickly (Bach *et al.,* 2020). That is what this article is aiming to achieve.

Our study follows on from publications evaluating the budgetary and redistributive effects of the 2018 social and fiscal reform package by Biotteau *et al.* (2019), Fabre *et al.* (2019) and Madec *et al.* (2019), together with the reports by

1. At the start of 2018, the wealthiest 10% of households held almost half of the total wealth in France (Cazenave-Lacrouts et al.*, 2019).*
2. A household's standard of living corresponds to its disposable income (declared income net of social security contributions, plus benefits and less direct deductions) in relation to a number of consumption units.
3. For this reason, the standard of living that INSEE usually uses to study inequality and monetary distribution on the basis of individual data from the ERFS does not take account of the ISF.

France Stratégie (2019, 2020)[4] and the Senate (2019). When compared with all of these works, the main original feature of our article is that it presents a joint analysis – separately from the other social and fiscal reforms that took place in 2018 – of the 2018 reforms that directly targeted wealth-holding households. In addition, we use an original methodology to impute wealth to the households included in the ERFS while ensuring the best possible preservation of the correlation between standard of living and wealth. This is a fundamental step when it comes to correctly measuring the impact of the reforms affecting taxation of the stock of household wealth (transition from the ISF to the IFI) on standard of living inequality. Finally, we also try to take account of certain short-term behavioural reactions of households and to highlight how this changes the outcomes in terms of inequality and the State budget.

This article starts by describing the three reforms studied, the data used and the simulations using the Ines model. The second section is devoted to the methodology for assessing the impact of the reforms. The third section details the impact of the reforms, first under the assumption that behaviours will remain unchanged, before analysing how the results vary when potential behavioural effects are taken into account. Finally, a discussion regarding the long-term impact is presented by way of a conclusion.

1. The Reforms Evaluated and Simulations Using the Ines Model

1.1. The Reforms Assessed

A large number of reforms of the taxation of capital have taken place in France since the 1980s (France Stratégie, 2019). We will provide a brief review of those for which the impact was assessed in the article.

1.1.1. Transition from ISF to IFI

Taxes on wealth (the *impôt sur les grandes fortunes*, created in 1981, then the ISF created in 1986) have been modified more than ten times, with the most recent reform being the transition from the ISF to the IFI in 2018, which is what we are assessing here. The 2018 reform amended the definition of the taxable base: *(i)* moveable assets are no longer included, but the indirect real estate component has been retained,[5] *(ii)* moveable liabilities are no longer deductible, and *(iii)* the discounts for investment in small and medium-sized enterprises (SMEs) have been abolished.

1.1.2. Introduction of the Income Tax Component of the PFU

Between 2013 and 2017, the majority of income from moveable assets (dividends, fixed-income investments), capital gains from the sale of securities and some life insurance income in a given year *N* were subject to a progressive income tax (IR) in year *N*+1 (with a 40% deduction for dividends).[6] Life insurance income not subject to the progressive income tax was subject to a withholding tax in the year of receipt. Finally, interest on homebuyer savings plans (PEL, *plans épargne logement*) and homebuyer savings accounts (CEL, *comptes épargne logement*) were exempt from income tax.[7]

The Finance Act for 2018 reformed the taxation of capital income by removing it from the progressive income tax base and introducing instead a single flat-rate tax of 12.8% (hereafter income tax component of the PFU), and of 17.2% for social tax (see below) to arrive at the effective tax rate of 30%. From 2018 onwards, the income tax component of the PFU was applied to capital gains on the sale of securities and income from moveable assets (particularly dividends and interest from fixed-income investments, such as bonds) – for income from life insurance policies, this only applies if they relate to payments made after 27 September 2017,[8] and for interest on PELs and CELs, only if they were opened after 1 January 2018.[9] The PFU corresponding to the income received in a given year *N* is paid in connection with the income tax return, so in year *N*+1. However, a non-final withholding flat-rate tax (usually at the same rate) is paid in the year in which the income is received and constitutes a tax credit the following year.[10]

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4. A summary of the various institutional evaluations can be found in the France Stratégie report (2019). Of these studies, those by the Institute of Public Policies (IPP) have been updated and are presented in Fabre et al. *(2019). The latter studies make use of DGFiP data and provide results that are less concentrated at the upper end of the distribution than those published the previous year by the IPP and are therefore closer to the results obtained using our methodology. See also Dherbécourt & Lopez-Forero (2019) on the effective taxation of wealth and capital income between 2011 and 2018.*

5. These include, for example, shares in real estate companies (SCIs).

6. With a non-final withholding tax for income from moveable assets (also referred to as the prélèvement forfaitaire obligatoire*, PFO) in the year of receipt, which was reimbursed in the form of a tax credit the following year.*

7. With the exception of PELs more than 12 years old.

8. However, income from life insurance policies more than 8 years old (and within the limit of 150,000 euros of life insurance reserves) is subject to a levy of 7.5% rather than 12.8%.

9. Except for PELs more than 12 years old, the interest on which is subject to the PFU from 2018 onwards. Income from life insurance policies that relates to payments made before 27 September 2017, together with interest on PELs and CELs opened prior to 1 January 2018, continues to be taxed in accordance with the regime in place before 2018.

10. Some households may apply for exemption from the non-final withholding tax in the year in which they received the income if the reference tax income does not exceed a certain threshold. In addition, a household receiving income subject to the PFU can opt for the application of the progressive income tax to that income.

1.1.3. Increase in the Rate of the Social Tax (CSG) on Wealth

In 2018, the CSG was increased for all income. That increase took place in parallel with a reduction in the payroll taxes paid by employees and self-employed workers and formed part of a much broader shift from the financing of social welfare from social security contributions to the CSG. An analysis of the overall impact of the shift from social security contributions to the CSG on standard of living inequality in 2018 can be found, for example, in Biotteau *et al.* (2019). As we explained in the introduction, the aim of this article is simply to analyse the impact of this reform on the taxation of capital income. For this income, the rate of the CSG has increased from 8.2% to 9.9%, bringing the total rate of social taxes[11] on capital income[12] to 17.2%. For income that is also subject to the income tax component of the PFU (see above), this tax of 17.2% constitutes the second component of the PFU, resulting in a total PFU rate of 30%. However, the basis for the CSG on capital income is broader than that of the income tax component of the PFU: property income, annuities or interest from life insurance policies in the absence of buy-back, for example, are subject to the increase in CSG, but they are not covered by the income tax component of the PFU.

1.2. The Simulation of Income Tax, the CSG and Taxes On Wealth in the Ines Model

The analyses presented in this article are based on the Ines microsimulation model.[13] This model simulates the majority of the taxes and benefits in cash. It is primarily underpinned by the ERFS (see Box), which, among other information, brings together socio-demographic information from the Labour Force Survey (*enquête Emploi*) and income declared to the tax authorities for the purposes of calculating income tax. When compared with comprehensive tax sources, the ERFS makes it possible to better simulate

11. In addition to the CSG, there is also the Contribution pour le Remboursement de la Dette Sociale *(CRDS, a tax for the social debt repayment, with a rate of 0.5%), the social security contribution (4.5%), the additional "solidarity-autonomy" contribution (0.3%) and the solidarity levy (2%).*
12. In PLFSS 2018, the increase in public revenue linked to the increase in the CSG is calculated at 22.5 billion euros, 2 billion of which relates to the CSG on income from capital. This figure relates to a much broader coverage – all households in the whole of France – than that included in the ERFS, which is limited to ordinary households in metropolitan France.
13. See https://www.insee.fr/fr/information/2021951 for a brief description and Fredon & Sicsic (2020) for a more detailed presentation of the INES model and its applications.

Box – **Data**

*The ERFS (*Enquête Revenus Fiscaux et Sociaux*)*

For each year *N*, the ERFS is composed from the matching of the respondents to the Labour Force Survey (*enquête Emploi*) for Q4 and the fiscal sources for the year, i.e. the income declarations for year *N* (completed in March *N*+1), housing tax as at 1 January of year *N* and the files from the *Caisse nationale des allocations familiales* (CNAF, the fund for family allowances), the *Caisse nationale de l'assurance vieillesse* (CNAV, the fund for old age pensions) and the *Caisse centrale de la mutualité sociale agricole* (CCMSA, a fund specific to the agricultural sector) which provide the social benefits paid.

In the ERFS, some financial income that is tax-exempt or only partially taxable and therefore not well-known from tax sources is calculated by applying rates of return to stocks of assets imputed to the households covered by the ERFS on the basis of the Wealth survey *(enquête Patrimoine*) (Baclet & Raynaud, 2008).

We use here the 2016 edition of the survey. The sample from the ERFS 2016, drawn from the housing tax files, is composed of 118,626 individuals across 53,374 respondent households, so-called "ordinary" households (i.e. excluding people living in collective housing or in mobile homes, and homeless people) in metropolitan France.

Fiscal Data from the ISF and the IFI

The data from the 2016 and 2017 ISF files and the data from the 2018 POTE file (*fichier Permanent des Occurrences de Traitement des Émissions*, a management file) as well as IFI files, recently made available by the DGFiP, are also used in this article.

The ISF file used contains the amounts of net wealth taxable under the ISF for all households liable for ISF. For households with net assets of less than 2.57 million euros, only total net wealth needed to be declared on annual tax return no. 2042, which is therefore included in the file. For households with net assets of more than 2.57 million euros, a specific ISF declaration was required and, in addition to the value of the primary residence and fixed assets, we also have details of moveable assets and liabilities.

Those liable for the IFI are required to complete form no. 2042-IFI, to which they attach appendices in which they list and assess assets subject to taxation under the IFI. The 2018 IFI data are included in the data contained within the 2017 POTE file, which collates all of the information from the 2017 income tax returns. This means that details of net wealth taxable under the IFI is available for all households, together with the amounts of reductions for donations and SMEs, the IFI cap and the amount paid for this tax.

benefits and contributions using information from the *enquête Emploi*. It also allows to evaluate the impact of tax and benefit reforms on standards of living, which are measured by INSEE on the basis of the ERFS.

The evaluation presented in this article is based in particular on the simulation of the ISF and then the IFI, as well as the simulations of income tax and the CSG. The simulation of these schemes by the INES model has several specific features that will be adressed here. In the below, we will first look at the simulation of taxes on capital income and on income tax, followed by that of the ISF and the IFI.

1.2.1. Simulation of CSG on Capital Income and Income Tax

Income tax is one of the schemes that the Ines model is best at simulating. For 2018, if we compare the total tax paid by ordinary households in metropolitan France, as simulated by Ines, with that obtained from the DGFiP data (corrected to create coverage equivalent to that of the ERFS), it turns out that Ines very slightly underestimates taxes (the difference is -1% for 2018). This difference remains the same, regardless of whether or not the various flat-rate levies on capital income are included in the totals being compared.[14]

The simulation by Ines of the social taxes on capital income (the majority of which is made up of the CSG) also results in totals paid by households that are close, albeit slightly overestimated, to the data published by the *Commission des comptes de la Sécurité sociale* (social security accounts committee) corrected to create coverage equivalent to that of the ERFS.[15]

1.2.2. Simulation of the ISF and IFI

The simulation of the ISF and IFI in Ines comes up against a particular difficulty: there is no information available in the ERFS with regard to the amounts of wealth held by households. Until very recently, the Ines model therefore did not simulate the ISF and the IFI, the taxable bases for which are made up of household wealth. To allow an assessment to be made of the transition from the ISF to the IFI in 2018, an imputation of the amount of wealth held by each household covered by the ERFS has been introduced into the latest version of the Ines model. This operation is described in the Online Appendix (link at the end of the article) and in greater detail in Paquier *et al.* (2019). It is based on data from INSEE's Wealth Survey for the year 2014 and then on comprehensive data on wealth taxable under the ISF and IFI and the elements of which it is comprised. The imputation method used ensures good correlation between wealth on the one hand and standard of living and the socio-demographic variables of the ERFS on the other hand. In addition, it ensures that the findings are consistent with DGFiP data. This is a crucial preliminary step for the assessment of the impact of the reforms described in this article.

On the basis of the imputed wealth, an amount of wealth taxable under the ISF is deducted by applying the various deductions,[16] and a tax on wealth is simulated by applying the legislation and taking account in particular of the discount, reductions and cap. This imputation allows Ines to create a precise simulation of the ISF or IFI paid by households (Paquier *et al.*, 2019). Therefore, the total ISF paid by ordinary households in metropolitan France in 2017 is 3.9 billion euros, which is close to the values available from external sources. According to our estimates, almost 70% of the total amount of ISF would be paid by the 5% with the highest declared income, compared with around 75% according to the tax data.[17] As regards IFI in 2018, the total amount arrived at by the Ines simulations is 1.1 billion euros, so a slight underestimation (of around 2%) when compared with the DGFiP data with the same coverage.

2. Method Used to Evaluate the Impact of the Reforms

2.1. Measuring the Impacts Using the Ines Model

In order to assess the impact of the three reforms directly targeting the holders of wealth that are being studied in this article, a counterfactual 2018 legislation has been defined, i.e. the legislation that would have been in force had the reforms not been implemented (André *et al.*,

14. When including the flat-rate levies, the total simulated by Ines for 2018 is 70.8 billion euros, compared with 71.2 billion according to the DGFiP data. If we exclude these levies, the total simulated by Ines is 67.3 billion euros, compared with 68.2 billion according to the DGFiP data.

15. The totals resulting from the Ines simulations amount to 20.9 billion euros for 2018, compared with 19.7 billion euros in the data provided by the Commission des comptes de la Sécurité sociale, *i.e. an overestimation of 6%.*

16. The deductions taken into account include the following in particular: 30% for the primary residence, 100% for professional assets, 75% for employee savings in the form of company shares in certain situations, 100% for the Plan d'épargne retraite populaire *(PERP, a retirement savings plan), 100% for supplementary and voluntary supplementary pension plans and for the ownership of woods and forests and shares in a forestry group and agricultural leases.*

17. According to the France Stratégie (2019) report, based on reference tax incomes (RFR). The differences between France Stratégie's estimate and ours may be due to differences in scope, the unit considered (we reason in terms of households, whereas the France Stratégie report uses tax households), or the income variable (the income declared is not strictly identical to the reference tax incomes).

2015). The usual revaluations of transfers, the increase in the thresholds defining the income tax brackets that are indexed to inflation and also the tax and benefit reforms that took place in 2018, with the exception of the reforms studied in this article, are all included in the counterfactual scenario. Likewise, the cyclical variations in income between 2017 and 2018 are also present in the counterfactual scenario. The INES model is used to simulate the taxes that would have been paid by each household within the sample, the benefits they would have received and therefore their disposable income[18] under this counterfactual legislation. By performing a comparison between the disposable income obtained using the counterfactual legislation and that obtained with the legislation incorporating the three reforms we are studying here, we are able to see their impact via the resulting differences.[19]

For the introduction of the income tax component of the PFU, given the various stages of the progressive implementation, there are several possible options available for the simulation of the 2018 legislation. The first option consists of simulating the legislation actually applied in 2018, i.e. a situation in which capital income received in year *N*-1 (in this case 2017) continues to be subject to the 2017 legislation (only the non-final withholding taxes change at the time of receipt of the income). The second option consists of adding the impact that is due to the fact that the income from year *N*-1 is subject to the PFU (which, in reality, could only be observed from 2019 onwards). Finally, a third option consists of also subjecting income from life insurance buy-backs and PEL and CEL to the PFU and therefore of simulating the legislation that, in reality, will only be applied in the long term. We have used the second option for this article as it seems to be the most relevant for measuring the short to medium-term impact of the PFU.[20] Some elements will also be presented using the first and third options.

In order to simulate the PFU, account must also be taken of the fact that tax households that lose out on the introduction of the PFU (i.e. those for which the rate of tax on capital income is lower than the PFU) are able to opt to have their capital income included in the progressive income tax base. Nevertheless, it appears that the extreme hypothesis that all households for which the tax rate is lower than the PFU will opt for the comprehensive income tax system is not especially credible. Indeed, the default option in the tax return is the PFU, and numerous studies popularised by the book by Thaler & Sunstein (2008) have demonstrated that *nudges* or default options have a much greater influence over behaviour than tax incentives.[21] We therefore simulate a scenario that appears more plausible to us, in which half of households that have an interest in taking the comprehensive income tax system option actually do so.[22]

The findings presented in Section 3.1 assess the impact of the reforms in the event that behaviour remains unchanged, i.e. under the assumption that the reforms do not change the situation of households prior to redistribution. This scenario allows the "pure" impact of the measure to be assessed thanks to the differences in tax bases and rates. In this section, we calculate the 2018 dividends by applying the average change over the previous three years to the 2017 dividends. The procedure is more complex for household wealth: for each household, the assets present in the wealth taxable under the ISF in 2017 are aged by +6.0% in the case of property assets (a rate derived from changes in property prices)[23] and by +5.9% for moveable assets (a rate corresponding to the change in the value of CAC 40 index listed shares between the beginning of 2017 and the beginning of 2018).[24] The reductions for donations and investments in SMEs imputed for the 2017 ISF and the liabilities are maintained at their 2017 levels.[25] The assumption is therefore made that behaviours, particularly in relation to donations, remain unchanged when compared with the situation observed in 2017 (Table 1).

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18. The definition of disposable income used here differs slightly from the usual definition: the taxation of capital gains is included among the elements that reduce disposable income in order to take account of the impact of the reforms being studied here on households in receipt of capital gains. Capital gains tax is not normally taken into account in disposable income, since the capital gains themselves are not taken into account.

19. It should be noted here that, for reasons linked to the architecture of the INES model, the interactions between the increase in the CSG and tax (the increase in the deductible CSG reduces taxable income and therefore income tax) is not taken into account here.

20. The first option only provides an incomplete analysis of the impacts of the reform by failing to take account of an impact that came fully into play with effect from the year following its entry into force, i.e. in 2019.

21. See, for example, the case of automatic enrolment in funded pension schemes, which was studied by Madrian & Shea (2001).

22. We carry out a random draw from among the tax households with an interest in opting for the tax rate by applying a draw probability that increases in line with the amount the household is set to lose with the introduction of the PFU.

23. This rate corresponds to the average change in property prices between Q1 2017 and Q1 2018 by department (sources: INSEE), weighted in accordance with the total ISF paid by each department (based on DGFiP data for each municipality).

24. The changes are calculated in relation to the start of the year, since wealth taxable under the ISF is evaluated on 1 January each year, but declared on 15 June. The value of the wealth therefore most likely reflects the value of the property at the start of the year.

25. Conversely, indirect property assets, which need to be separated in order to calculate the IFI for 2018, are taken directly from the data concerning the IFI paid by households in 2018 (indirect real estate assets from 2017 cannot be included in the ISF data as they are not separated out from the rest of the moveable assets). Similarly, moveable liabilities are taken directly from data regarding the IFI paid by households in 2018, as these are not separated out from the other liabilities in the ISF data.

2.2. Taking Behavioural Responses Into Account

However, the PFU reform appears to have had a short-term impact on the behaviours surrounding the payment of dividends, and the IFI on declarations of wealth and donations. The introduction of the PFU resulted in a significant reduction in the marginal effective tax rates on capital income.[26] At the same time, an increase of almost 70% in the dividends paid to households between 2017 and 2019 (of which +60%, i.e. +9 billion euros in 2018) is observed in the 2018-2019 fiscal record data. The amounts of the dividends paid are very sensitive to their taxation, as can be seen from the economic literature on this subject (Chetty & Saez, 2005; Yagan, 2015; Bach *et al.,* 2019a; Lefebvre *et al.,* 2020). It is therefore likely that the increase in dividends between 2017 and 2019 can be explained, in part, by the introduction of the PFU.

In the case of the IFI reform, the short-term effects on reporting behaviour can go one of two ways. Cases in which the decrease in the property wealth declared could point to optimisation behaviours in response to the withdrawal of the ISF (for example the replacement of property assets with moveable assets within the wealth portfolio). In cases where the property wealth increases, this could reflect the anticipation of increased controls or a re-evaluation that had not been carried out in previous years.[27] Empirically speaking, the DGFiP data on the ISF in 2017 and the IFI in 2018 show, in all cases, that the IFI reform appears to have brought about changes in the declared value of property, both upwards and downwards.[28]

In Section 3.2, we therefore measure how our results may have been affected had we taken account of these behavioural effects when determining the impact of the reforms. We therefore consider the same counterfactual situation as in Section 3.1, but with a different post-reform situation. We simulate the 2018 IFI using the wealth actually observed in 2018, drawing directly upon the property assets declared and the IFI reductions present in the DGFiP data on the IFI paid by households in 2018. In the case of the PFU, we rely on empirical studies in order to determine the increase in dividends that can be explained by a behavioural response to the introduction of the PFU. In the case of the wealthiest households with the highest dividend amounts,[29] we apply an increase of 30% to the amount of dividends received, as Bach *et al*. (2019b) who calibrate this increase on the basis of the estimates made by Bach *et al.* (2019a).[30] This increase corresponds to an elasticity of dividends at their marginal retention rate[31] between 1.8 and 2.3 depending on the tax bracket. For the other households, we use an elasticity of 0.7, as estimated by Lefebvre *et al.* (2020) for the period from 2008 to 2017 and with a large population of French households. This estimate is also close to the findings made by Chetty & Saez (2005), Yagan (2015) and Boissel & Matray (2019). This calculation results in account being taken of an increase in dividends linked to the 2018 reform between +2% (for households in the income tax bracket with a marginal tax rate of 30%) and +10% (for households in the 41% tax bracket). In addition, we do not take account of the impact of income shifting of work income to dividends in 2018, partly because, in 2018, work income was not subject to income tax due to the application of withholding tax, which significantly reduced the incentives to income shifting, and, on the other hand, because no studies have been carried out in France that highlight any such behaviour during previous capital tax reforms (Boissel & Matray, 2019; Bach *et al.,* 2019a; Lefebvre *et al.,* 2020). The behavioural impact taken into account brings about an increase in dividends of a little under 2 billion euros. This increase is small compared with the observed increase of around 9 billion euros; it is therefore considered to be a low estimate of the impact of the PFU on the payment of dividends. At the same time, it is of interest to consider a high estimate making the opposite assumption, i.e. that the total increase of 60% for dividends that was observed between 2017 and 2018 resulted from behavioural changes linked to the introduction of the PFU. The differences between the counterfactual situation that we consider in our analyses and the various scenarios studied for the post-reform situation are summarised in Table 1.

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26. For those with the highest incomes (subject to the exceptional payment for high earners), it fell by almost 10 points (from 40% to 30%), taking account of the 40% allowance on dividends and the deductible CSG.

27. For example, the fact that all households must, with effect from 2018, declare details of the assets that they hold, something that households with wealth not exceeding 2.57 million euros did not need to do previously, could have prompted households to reassess their wealth more accurately.

28. Between 2016 and 2017, declared property wealth remained stable for more than 40% of households (Paquier et al.*, 2019). This was only seen in half as many cases between 2017 and 2018.*

29. i.e. households in the 41% or 45% income tax bracket and receiving dividends of more than 1,000 euros in 2018.

30. This increase is calculated as follows. Bach et al. *(2019a) arrive at a fall in dividends received by households in 2013 of 40% as a result of those dividends being made subject to a tax rate in 2013 according to the difference in differences method. Based on an analysis of company data, they observed a fall of 20.7% in the dividends paid in 2013 as a result of the introduction of tax rates, and an increase of 15.3% in 2018 due to the introduction of the PFU. The 30% increase was obtained by means of a cross-referenced product. Since the group involved in the analysis at the household level is made up of households with dividends in excess of 1,000 euros, we also apply this increase to that same population.*

31. The marginal retention rate directly complements the marginal rate.

Table 1 – **Data taken into account for the various tax bases**

	Counterfactual	Estimate	
		without behavioural effects	with behavioural effects
Moveable assets	ISF aged 2017	-	-
Indirect real estate assets	-	IFI 2018	IFI 2018
Direct property assets	ISF aged 2017	ISF aged 2017	IFI 2018
Liabilities	ISF 2017	IFI 2018	IFI 2018
Reductions for donations	ISF 2017	ISF 2017	IFI 2018
Reductions for SMEs	ISF 2017	IFI 2018	IFI 2018
Dividends	ERFS aged 2017	ERFS aged 2017	Amounts obtained using elasticities from the literature (low assumption) or the observed increase in dividends (high assumption)

Notes: "2017 ISF" refers to the data from the 2017 ISF (sources: DGFiP); "2018 ISF" refers to the POTE 2017 data, which include the 2018 IFI data.

Finally, it should be specified that we do not take account here of any possible behavioural effects with regard to income subject to the PFU, other than dividends (for example, interest on fixed-income investments or capital gains)[32] or income not subject to the income tax component of the PFU, but instead subject to the increase in the CSG (such as property income).

3. Results

This section starts by presenting the findings on the basis of unchanged behaviours, then evaluates how those findings change when the short-term behavioural effects that may have arisen in 2018 are taken into account.

3.1. The Impacts With Unchanged Behaviour

3.1.1. The Transition From the ISF to the IFI Increases the Standard of Living of the Wealthiest Households, Pensioners and the Self-Employed

If behaviour remains unchanged, the impact of replacing the ISF with the IFI in 2018 on household disposable income amounts to +3.44 billion euros, i.e. a 3.44 billion euro loss of tax revenue for the State (Table 2). This would correspond to a 0.3% increase in the standard of living of all households in 2018. The reform results in 340,000 households benefiting, while 10,000 households lose out (due to the loss of the reduction for investing in SMEs and the non-deductibility of moveable liabilities with effect from 2018). The average impact on households that are affected by this measure is +9,770 euros for disposable income and +6,720 euros in 2018 for standard of living.

The gain of 3.44 billion euros is unevenly distributed according to position in relation to the standard of living vigintiles:[33] the average annual increase in standard of living amounts to 830 euros (+1.2%, Figure I) for the wealthiest 5% of people and 150 euros[34] between the 18th and 19th vigintiles (+0.4%), while it amounts to 90 euros (+0.3%) between the 8th and 9th deciles

32. The changes observed between 2017 and 2018 do not suggest the existence of any significant short-term behavioural impacts on interest on fixed income investments.

33. The standard of living prior to the reforms being studied is used as a reference for the presentation of the findings throughout the article. The deciles and vigintiles are defined for the standard of living distribution prior to the reforms being studied.

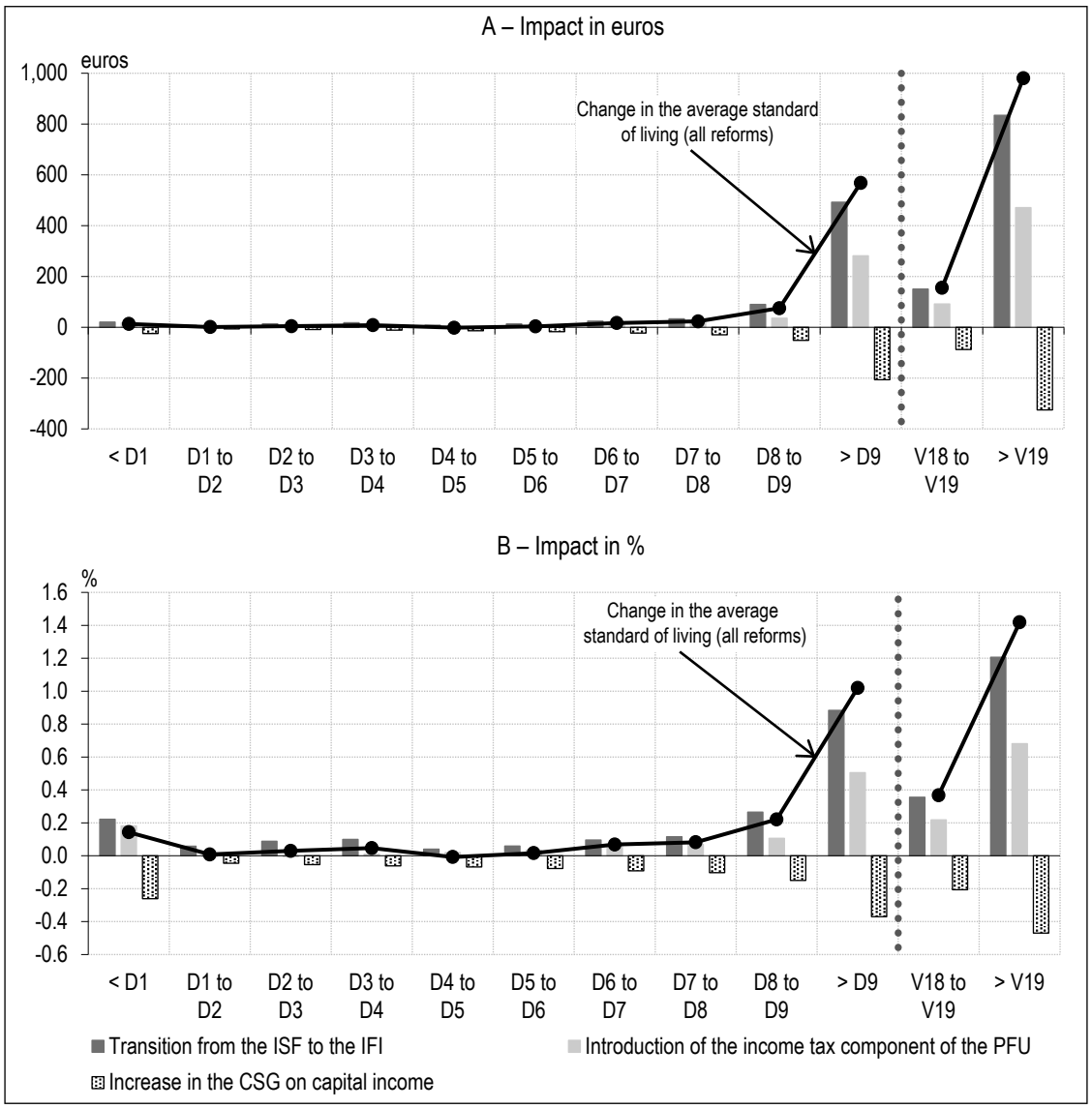
34. These are the average annual impacts calculated for all categories, regardless of whether they are affected by the reform or not.

Table 2 – **Aggregated impacts of the reforms evaluated with behaviour remaining unchanged**

	Impact on total disposable income (in millions of euros)	Number of households that benefit (in thousands)	Number of households that lose out (in thousands)	Average impact on annual disposable income per household concerned (in euros)	Average impact on annual standards of living per household concerned (in euros)
Transition from the ISF to the IFI	+3,440	340	10	+9,770	+6,720
Introduction of the income tax component of the PFU	+1,760	4,910	1,750	+260	+180
Increase in the CSG on capital income	-1,830	0	16,110	-110	-80
Aggregated impact of the three reforms	+3,360	2,460	13,820	+210	+140

Sources and Coverage: INSEE, ERFS 2016 (updated 2018), *enquête Patrimoine* (Household Wealth survey) 2014-15; DGFiP ISF 2017, POTE 2017; Ines model 2018. Metropolitan France, ordinary households whose income is positive or nil and where the household reference person is not a student.

Figure I – **Impact on the average annual standards of living by position in the distribution with behaviour remaining unchanged**



Notes: The x-axis represents the position of individuals in relation to the standard of living deciles (D1 to D9) or vigintiles (V18 and V19) had the 2018 reform not taken place.
Sources and Coverage: INSEE, ERFS 2016 (updated 2018), *enquête Patrimoine* (Wealth survey) 2014-15; DGFiP ISF 2017, POTE 2017; Ines model 2018. Metropolitan France, ordinary households whose income is positive or nil and where the household reference person is not a student.

and 30 euros or less below the 8th decile (+0.2% or less). The wealthiest 10% of people therefore obtain 68% of the total benefit in terms of standard of living, while the figure for the wealthiest 15% of people is 76%. Of the 340,000 households that benefit from the reform, around three quarters are above the highest decile and around 60% are above the highest percentile. However, although the increase is concentrated at the top end of the distribution, certain households that are not the wealthiest also benefit. Indeed, the correlation between standard of living and wealth is strong, but not perfect: at the beginning of 2018, 42% of households positioned within the wealthiest 10% in terms of gross wealth also belonged to the wealthiest 10% in terms of standard of living (INSEE, 2021) and 43% of the 1% of households with the highest initial income are also among the 1% of households with the highest gross wealth (Cazenave-Lacrouts *et al.*, 2019). The increase in the share of inheritances since the 1970s (which represented 55% of total wealth in 2010 according to Frémeaux, 2019) results, for example, in young people, in some cases with lower incomes, having significant wealth, and therefore brings about a reduction in the correlation between labour income and wealth (Garbinti *et al.*, 2021). Therefore, as can be seen from the results obtained by means of matching between the income tax data and the ISF/IFI tax data performed by France Stratégie (Dherbécourt & Lopez-Forero, 2019), 40% of the total for the

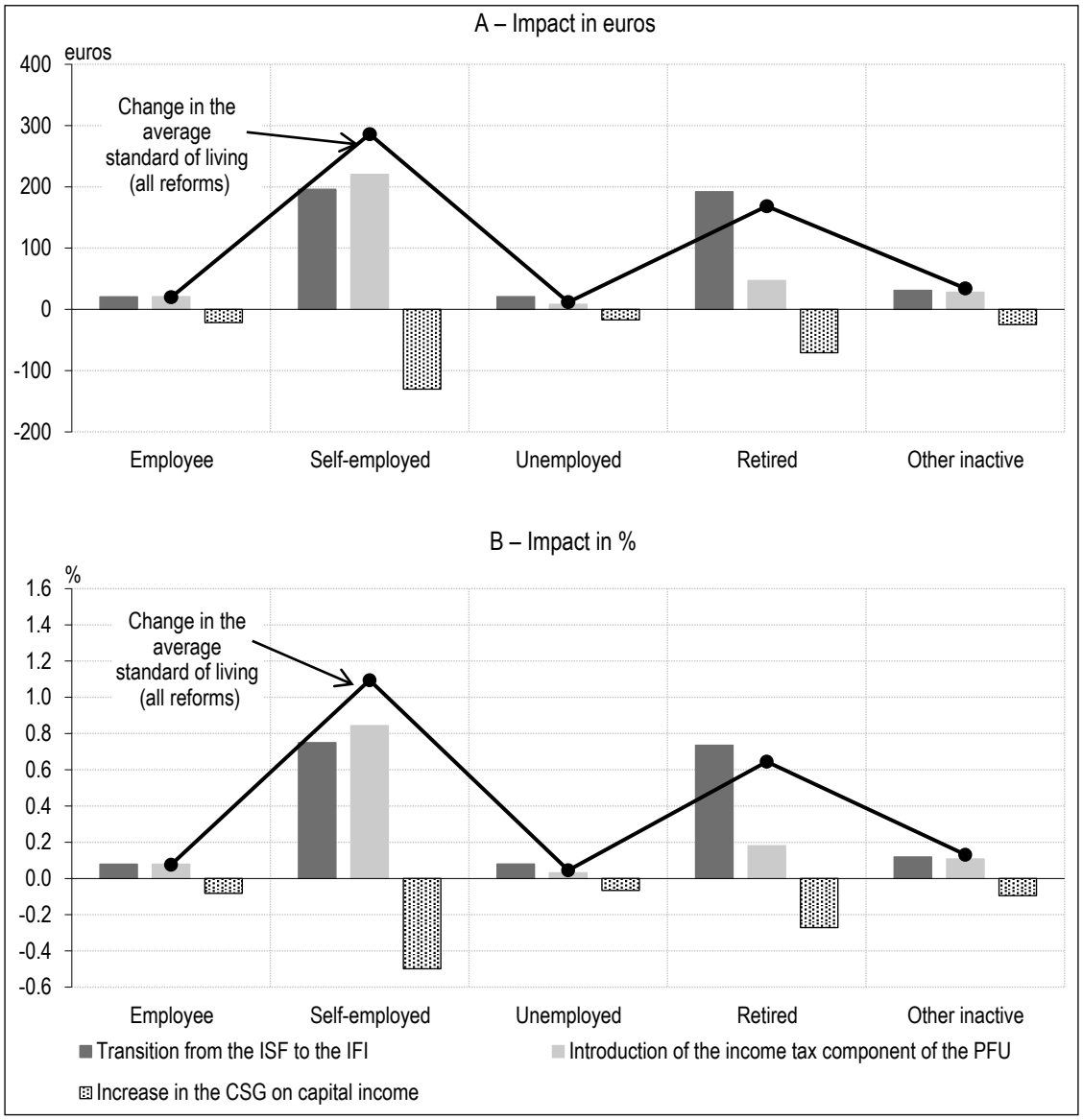
ISF is paid by households positioned below the 98th centile of the reference tax income (RFR).

The impact of the reform on the average annual standard of living varies according to the employment status of the individuals in question (Figure II). It turns out that the greatest impacts are felt in terms of standard of living when the individuals are self-employed or pensioners (+0.7%, i.e. approximately +200 euros on average). Among the pensioners, it is those who were previously self-employed who benefit the most from this measure. This can be explained by the fact that they tend to hold greater wealth (with professional capital being added to non-professional capital in some cases, see Lamarche & Romani, 2015). The findings also indicate a greater increase for older people; the average age of ISF taxpayers is indeed high (69 years according to France Stratégie, 2019); a finding that is consistent with the fact that pensioners have accumulated more wealth during their lives.

3.1.2. The Introduction of the PFU Also Favours Wealthier Households, But Not Specifically Pensioners

We will now assess the impacts of the introduction of the PFU of 12.8% for income tax, still under the assumption that behaviour remains unchanged. The assumption is made that all of the life insurance income from 2018 relates to payments made before 27 September 2017, and that all PELs and CELs were opened prior to 2018; none of the income resulting from these

Figure II – **Impact on average annual standards of living by activity status with behaviour remaining unchanged**



Sources and Coverage: INSEE, ERFS 2016 (updated 2018), *enquête Patrimoine* (Wealth survey) 2014-15; DGFiP ISF 2017, POTE 2017; INES model 2018. Metropolitan France, ordinary households whose income is positive or nil and where the household reference person is not a student.

investments is therefore affected by the introduction of the PFU.

The impact of the introduction of the income tax component of the PFU gives rise to an increase in household disposable income amounting to 1.76 billion euros, which represents the budgetary cost of the reform (cf. Table 2). The average annual increases in standard of living are highly concentrated among the wealthiest 5% of households (+470 euros on average, i.e. +0.7%, cf. Figure I), but are also not negligible between the 18th and 19th vigintiles (+90 euros or +0.2%). They are much smaller below the 9th decile. The wealthiest 15% of people therefore obtain 80% of the total benefit in terms of standard of living. 4.9 million households benefit from the reform, but there are also 1.8 million households that lose out. Those households that lose out, the average loss of which is relatively small (80 euros of disposable income per year, compared with an average increase of 390 euros for those that benefit) are the households for which the rate of the progressive income tax on capital income is lower than the PFU, but that have not opted to continue paying tax in accordance with that rate. Our simulation is indeed based on the assumption that 50% of tax households that would benefit in opting for the progressive tax rate actually opt for that rate (see above).

The average annual increase in standard of living is much greater for the self-employed[35] (+220 euros or +0.8%, see Figure II) than for the rest of the population. The very significant increase for the self-employed appears to be driven by managers of companies subject to corporate income tax, for whom the amounts received in the form of dividends is, on average, higher than for the rest of the population.

It should be noted that the transitional impact of the 2018 reform is slightly different, as the income received in 2017 remained subject to the 2017 legislation:[36] for the wealthiest 10% of people, the average annual increase in standard of living was smaller (around 50 euros). This can be explained by the fact that people positioned above the 9th decile have higher marginal tax rates than the 2017 PFO rates (21% or 24% depending on income).

3.1.3. The Losses Linked to the Increase in the CSG Are Concentrated on the Wealthiest People, but to a Lesser Extent than the Increases Brought About by the Other Two Reforms

The increase in the rate of the CSG on capital income effectively reduced the disposable income of households by 1.83 billion euros in 2018 (see Table 2). The 16 million households affected by the reform all lost out. The average loss incurred by these households was 110 euros from their annual disposable income. This loss is much more marked for the wealthiest households: it amounts to 210 euros for the average annual standard of living of the wealthiest 10% of people (or -0.4%, cf. Figure I) and 320 euros for the wealthiest 5% (-0.5%). However, the annual average loss in standard of living is significantly higher for the self-employed (-130 euros, or -0.5%, Figure II) and, to a lesser extent, for pensioners (-70 euros, or -0.3%, compared with -20 euros, or -0.1%, for employees).

The concentration of the impacts of the CSG at the top end of the standard of living distribution is less marked than for the introduction of the income tax component of the PFU (cf. Figure I): for example, the wealthiest 5% and 15% account for 42% and 60% of the total loss in standard of living, respectively, compared with 62% and 80% respectively for the increase linked to the introduction of the income tax component of the PFU. This lower concentration can be explained by the fact that the CSG is a flat-rate tax. The introduction of the income tax component of the PFU results in the PFU rate being applied to capital income rather than the marginal rate defined by the progressive income tax scale; the impact of this is therefore more marked among the wealthiest people, for whom the marginal rate is higher. In addition, the income base subject to the increase in the CSG is larger than the income base subject to the income tax component of the PFU. Property income, for example, which makes up a significant share of the capital income received by households, is subject to the increase in the CSG; however, it is not affected by the introduction of the income tax component of the PFU. However, such income is slightly less concentrated in the wealthiest households than income from moveable assets. Overall, the cumulative impact of the introduction of the PFU as income tax and the increase in the CSG is positive for the standard of living of the wealthiest people (+150 euros for the average annual standard of living of the wealthiest 5%), but negative for that of the poorest 90%. These averages make it possible to

35. The self-employed are identified by means of the ACTEU5 ERFS variable, which allows for the inclusion of the main managers of private limited liability companies (SARLs) or single owner limited liability companies (EURLs, who declare their income in the wage category).

36. For 2018 only, the impact of the introduction of the PFU is purely linked to the change in the non-final withholding tax rate applied to the investment income for 2018.

highlight the differences in impacts depending on the position of the households in the distribution of standards of living. It should nevertheless be borne in mind that they mask significant disparities between households with similar standards of living, but which hold different types of wealth: for example, among the wealthiest households, those that only receive income from property lose out, whereas those that only receive income from moveable assets benefit.

3.1.4. The Reforms Increase Inequality in Standards of Living

The cumulative impact of the three reforms grows significantly with standards of living: the variation in the average annual standard of living is less than or equal to +20 euros below the 8th decile (cf. Figure I), while it is 80 euros between the 8th and 9th deciles (+0.2%), +570 euros (+1.0%) above the 9th decile and +980 euros (+1.4%) for the wealthiest 5%. In total, the wealthiest 10% of people obtain 80% of the total benefit in terms of standard of living. The reforms also have an upward impact on the main standard indicators measuring overall inequality in standards of living (Table 3): +0.2 points for the Gini index, +1.9 points for the quintile share ratio (ratio between the average standard of living of the wealthiest 20% of households and that of the poorest 20%), +0.8 points for the ratio between the average standard of living of the wealthiest 10% of households and the poorest 50%, +0.9 for the interdecile ratio.

It should be noted that all the previous findings were presented based on the standard of living of individuals. The impact of these reforms broken down by capital income percentiles is therefore logically even more marked at the top end of the distribution: the impact would be +2,240 euros for the average annual standard of living of the 5% of people with the highest capital income.

3.2. Taking Account of Short-Term Behavioural Effects

In this section, we assess how the findings presented above change when the short-term behavioural responses to taxation that may have arisen in 2018 are taken into account.

As regards the transition from the ISF to the IFI, taking account of short-term behavioural responses has little impact on the findings: the benefits for the wealthiest people are slightly lower (20 euros lower for the average annual standard of living of the wealthiest 5%, Figure III) and the increase to total disposable income (and therefore also the cost to public finances) is slightly lower than for the scenario where behaviour remains unchanged (+3.32 billion euros, compared with +3.44 with behaviour remaining unchanged). The optimisation effect between financial and property wealth would therefore be more than offset by the increase in declared wealth (see above).

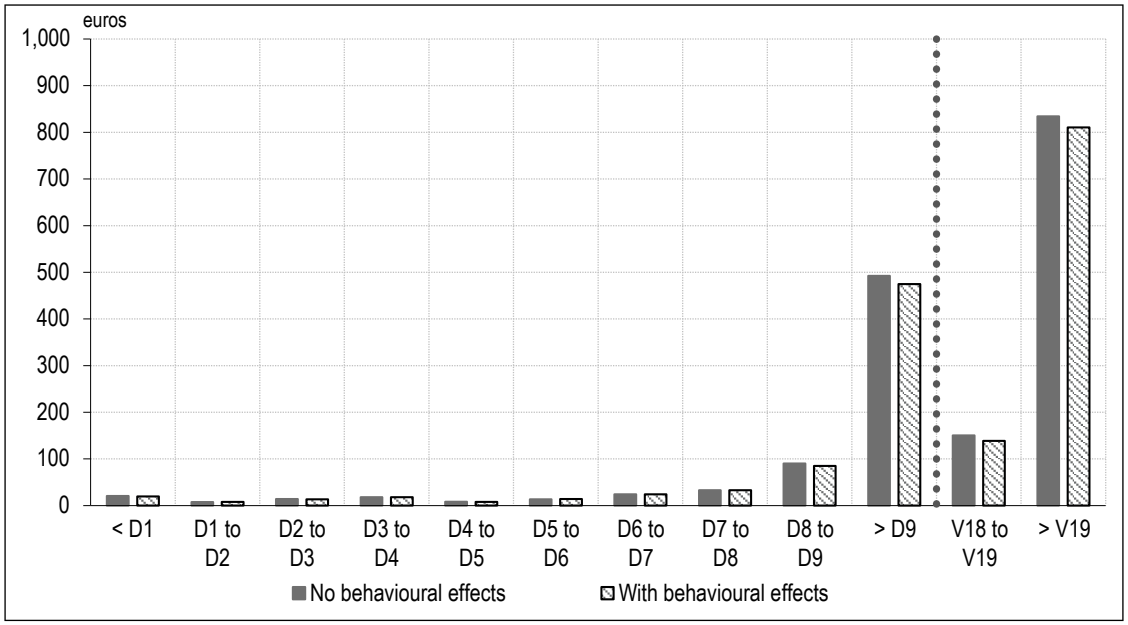
For the introduction of the income tax component of the PFU and the increase in the CSG, taking account of the impact of the reform in terms of the increase in the dividends received by households brings about a more significant change in the assessment of the impact of the reform. The impact on standards of living is therefore highly concentrated at the top end of the distribution: among the wealthiest 10% of people (and the wealthiest 5%, respectively), the total benefit in terms of their average annual standard of living is 80 euros (or 150 euros, respectively) with behaviour remaining unchanged, compared with 310 euros (or 610 euros, respectively) assuming a low impact of the PFU on the dividends and 1,010 (or 1,830 euros, respectively) assuming a high impact (Figure IV). The benefits in terms of standard of living, calculated taking account of the impacts of the PFU on dividends

Table 3 – **Evaluation of the impact of the reforms on inequality indicators for standard of living with behaviour remaining unchanged**

Inequality indicators for standard of living	Variation between the counterfactual situation and the situation with the reforms (in percentage points)
Gini index	+0.2
Income Quintile Share Ratio	+1.9
Interdecile ratio (D9/D1)	+0.9
Standard of living of the wealthiest 10% relative to the standard of living of the poorest 50%	+0.8
Proportion of standard of living held by the wealthiest 5%	+0.2
Poverty rate	+0.0
Poverty gap	+0.0

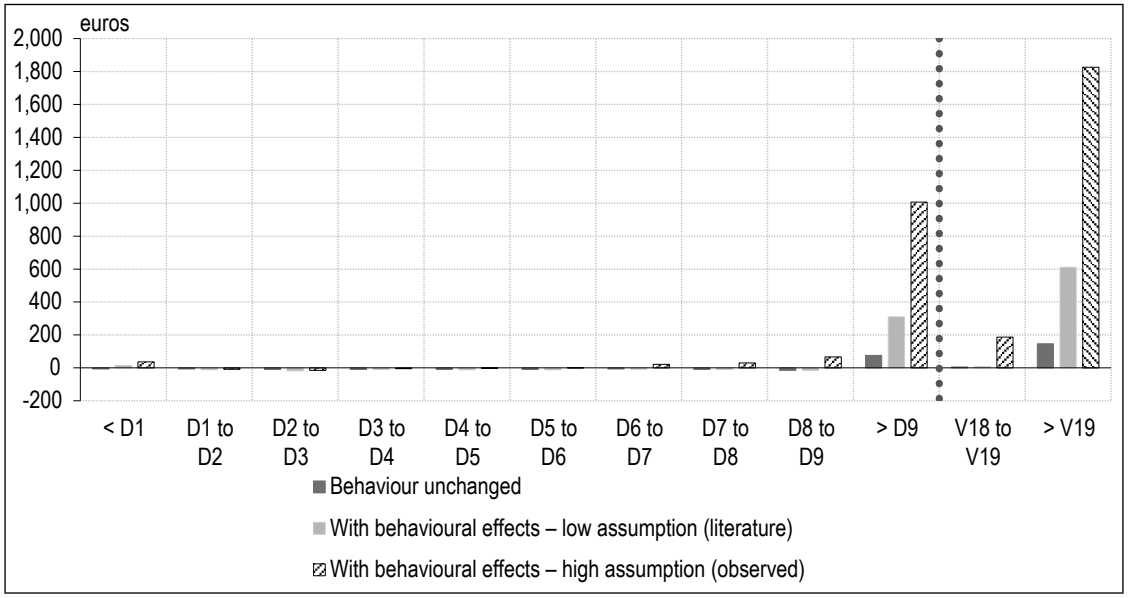
Sources and Coverage: INSEE, ERFS 2016 (updated 2018), *enquête Patrimoine* (Household Wealth survey) 2014-15; DGFiP ISF 2017, POTE 2017; Ines model 2018. Metropolitan France, ordinary households whose income is positive or nil and where the household reference person is not a student.

Figure III – **Impact of the transition away from the ISF with and without behavioural effects**



Notes: The x-axis represents the position of individuals in relation to the standard of living deciles (D1 to D9) or vigintiles (V18 and V19) had the 2018 reform not taken place.
Sources and Coverage: INSEE, ERFS 2016 (updated 2018), *enquête Patrimoine* (Wealth survey) 2014-15; DGFiP ISF 2017, POTE 2017; INES model 2018. Metropolitan France, ordinary households whose income is positive or nil and where the household reference person is not a student.

Figure IV – **Impact of the introduction of the income tax component of the PFU and the increase in the CSG on capital income, with and without behavioural changes**



Notes: The x-axis represents the position of individuals in relation to the standard of living deciles (D1 to D9) or vigintiles (V18 and V19) had the 2018 reform not taken place.
Sources and Coverage: INSEE, ERFS 2016 (updated 2018), *enquête Patrimoine* (Wealth survey) 2014-15; DGFiP ISF 2017, POTE 2017; INES model 2018. Metropolitan France, ordinary households whose income is positive or nil and where the household reference person is not a student.

(high or low estimate) include the increase in household income associated with behavioural effects, together with the changes in income linked to the changes in tax scale (whereas, in the absence of behavioural effects, the impact of the PFU is limited to changes in tax scale).

From the point of view of public finances, the increase in dividends gives rise to a surplus of levies (CSG and income tax) when compared with the scenario in which behaviour remains unchanged: the cost of introducing the income tax component of the PFU falls from 1.76 billion euros with behaviour remaining unchanged to 1.55 billion euros assuming only minor behavioural changes and 0.83 billion euros assuming significant changes (Table 4). The

Table 4 – **Impact of the reforms on public finances with and without behavioural effects (in millions of euros)**

	Without behavioural effects	With behavioural effects	
		(low assumption)	(high assumption)
Transition from the ISF to the IFI	-3,440	-3,320	-3,320
Introduction of the income tax component of the PFU	-1,760	-1,550	-830
Increase in the CSG on capital income	+1,830	+2,110	+3,080
of which: increase in the CSG on income falling under the PFU	+710	+810	+1,190
Aggregated impact of the three reforms	-3,360	-2,770	-1,070

Sources and Coverage: INSEE, ERFS 2016 (updated 2018), *enquête Patrimoine* (Household Wealth survey) 2014-15; DGFiP ISF 2017, POTE 2017; Ines model 2018. Metropolitan France, ordinary households whose income is positive or nil and where the household reference person is not a student.

budgetary savings linked to the increase in the CSG on capital income increases from 1.83 billion euros with behaviour remaining unchanged to 2.11 billion euros assuming only minor behavioural changes and 3.08 billion euros assuming significant changes. If we add together the cost associated with introducing the income tax component of the PFU and the budgetary savings linked to the increase in the CSG, taking only the share of the latter that stems from an increase in the CSG payable on income subject to the income tax component of the PFU,[37] we are able to calculate the impact of the introduction of the 30% PFU (tax and CSG): the reform would cost 1.05 billion euros with behaviour remaining unchanged and 740 million euros assuming only minor behavioural changes; the assumption of significant behavioural changes would turn this around, with the PFU supplementing the budget to the tune of 360 million euros.

Overall, although the cumulative impact of the three reforms assessed in this article results in a loss of 3.36 billion euros for the State in the event that behaviours remain unchanged, the cost is only 2.77 billion euros assuming only minor behavioural changes and 1.07 billion euros assuming significant changes.

These findings, which include short-term behavioural effects, therefore tend to show that the introduction of the PFU had much less of a negative impact, or indeed even a positive impact, on state budget, while bringing about significant increases in standards of living for the wealthiest households and minor losses for other households. However, it is likely that other impacts will be felt over the medium or long term; we will come back to this in the conclusion. Generally speaking, the findings presented here must therefore be interpreted as a contribution to the way in which the assessment of the reform may be impacted by behavioural effects, rather than as a complete and definitive assessment.

* *
*

As a conclusion, we will discuss how the short-term findings could change, taking account of the long-term impacts of these reforms. We discuss, in particular, the impacts of the PFU using recent studies contained within the literature. The transition from the ISF to the IFI could also have long-term impacts on the accumulation of capital, but there is no available evaluation to measure the extent of those impacts.

In the long term, the income tax component of the PFU will apply to new types of income, in particular income from PELs and CELs opened after 2018 and life insurance income relating to payments made after 27 September 2017. Over the long term, this could bring about additional revenues for public finances, as well as an increase in inequality (since PELs/CELs are most likely to be held by those in the top half of the distribution).[38]

Beyond this impact, which is linked to the gradual introduction of the income tax component of the PFU, the behavioural responses to the PFU could also differ over the long term.

First of all, the dividends could continue to increase to make up for the five years (2013-2017) of lower payments. Indeed, Bach *et al.* (2019a) demonstrated that there was no impact on company investment because of the 2013 reform of dividends taxation (inverse of the PFU reform) and they suggest that dividends were likely to have been set aside between 2013 and 2017 while awaiting a more favourable tax regime. With this in mind, the increase in dividends associated with the introduction of the PFU could therefore continue and become larger than that taken into

37. For this purpose, we use the following order of magnitude, calculated within the ERFS: around 40% of the income affected by the increase in the CSG is subject to the PFU in the long term (i.e. following the full implementation of the PFU for income from life insurance and from PELs and CELs).
38. The reform would bring about small losses for this population.

account in the previous section.[39] Conversely, there could be a downward impact on capital gains. Indeed, in the counterfactual situation in which the reform did not take place, meaning that the increase in dividends also did not take place, the retained profits could have increased the capital and therefore the value of the companies, which would ultimately lead to an increase in capital gains when the company is resold. In this case, the amount of tax due in the counterfactual scenario could be higher, meaning that the public finances benefit less from the reform. It should also be noted that, although the 2013 and 2018 reforms had significant impacts on standards of living, they would not have done so with a very broad definition of income, as per "Haig-Simons", or with the inclusion of retained company profits. On the other hand, the impact of the income shifting of work income to dividends could be felt by the self-employed in the long term (Pirttilä & Selin, 2011), even if they are not seen in the short run. Taking these impacts into account would likely lead to an increase in the cost of the reform in the medium term as a result of the fall in work incomes (and consequently in income tax and social security contributions) for some of the self-employed.□

39. According to preliminary administrative data, dividends seem to have continued to increase in 2019 by between 2 and 3 billion euros (France Stratégie, 2020, p. 112).

Link to the Online Appendix:
https://insee.fr/en/statistiques/fichier/5426465/ES_Paquier-Sicsic_Annexe-en-ligne_Online-appendix.pdf

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Telecoms Deflators: A Story of Volume and Revenue Weights

Mo Abdirahman*, Diane Coyle, Richard Heys*** and Will Stewart******

Abstract – Fast-changing technology products present inherent measurement challenges in relation to ensuring that deflators adequately adjust for quality change to allow a like-for-like comparison of volumes of output. Telecommunications services present significant challenges in this area not just because of rapid changes in prices and volumes, but also because the different services provided (text, voice, data) are displaying increasing substitutability. This paper builds on previous work by the authors to provide improved alternatives for telecoms services deflators, calculated for the UK, focussing on treatment of access charges and also whether using revenue weights or volume weights for fixed components of contract bundles delivers more reasonable results. Our new options deliver declines in the deflator series of between 64% and 85% between 2010 and 2017. These are far faster declines than the deflator calculated by the existing method but considerably reduce the range of price declines calculated in earlier work. Overall, we recommend using our volume-weighted deflator options, as these seem to better reflect how consumers evaluate the utility of different telecoms services components.

JEL Classification: E01, L16, L96
Keywords: technological progress, telecommunications, deflators

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The measurement of telecommunications (often shortened to telecoms) services prices for the purpose of deflating output in the sector is a matter of considerable debate among economists and national statistics experts. This discussion has focused on how to quality-adjust the price of the service in view of the incredible growth in data usage and transport. For example, the 2001 Ottawa Group meeting of prices experts considered telecoms services prices, and highlighted quality change and changing patterns of usage as key challenges (summarised in Diewert, 2001). This issue of quality-adjusting a rapidly-innovating product is of wider application to a number of digital services whose usage has increased dramatically in recent years.

While data services now represent the primary output of the telecommunications services sector, the existing output deflator used in the UK and elsewhere gives higher weight to traditional voice and text (SMS) services. Because the price of these traditional services has demonstrated less change, using a deflator weighted towards these items implies slow growth in the real-terms output and productivity of the sector, which seems at odds with the considerable usage growth and experience of service improvements, and motivated the consideration of alternatives.

Abdirahman *et al.* (2020), therefore, developed two alternatives to the current deflator for telecommunications services, used in the output measure of GDP within the UK's National Accounts (see Box for an overview of the 2020 article). The first option was an improved Services Producer Price Index (SPPI) for telecommunications services, adding broadband and mobile data, annually updating weights, and capturing both producer and consumer prices within the index.[1] This is an enhanced version of the current method. The second option was to depart from the standard approach and instead adopt a data usage approach through utilising a unit value index that considered all the component services as being essentially equivalent to bit transport services. Voice and text services were converted into bytes, like data services, and this data usage deflator was defined simply as the average price per byte.

These alternatives both attempted to adjust for quality change due to rapid technological advances. However, although using the same data sources,[2] they deliver radically different pictures of a quality-adjusted deflator, showing respectively a 51% and 96%[3] decline over the years 2010 to 2017, compared to a broadly flat index on the current definition. In this paper we analyse why the two options differ so much and propose three new alternatives.

Telecommunications services include a mix of traditional services such as voice calls and newer data-based services, which often substitute directly for traditional services; sometimes the services are also bundled with handsets although our focus is on the service, not the hardware. Almost all services, traditional (like voice or fax) or more modern, use the same physical networks and provide transport and routing to the desired destination in much the same way; the content is digitised and sent as data 'packets' with an address 'header' attached in front. The header data content is typically much less than 1% of the data in a packet; the cost of routing may be greater than this but is similar for all the types of service.

However, for historic or market reasons traditional services are often charged at a much higher rate per unit of data. For example, the price per byte for a traditional voice call is significantly higher than the price of transporting a similar quantity of 'data' (and this gap is much greater if the call is international). As newer technologies for voice calls, such as Skype or WhatsApp, count as data services they are thus significantly cheaper, especially for longer distance calls. Naturally, users are migrating away from more expensive traditional services to relatively cheaper newer ones. These may also offer new service 'bundles', for example by integrating 'text and voice' or 'voice and video' in a single 'call'. This is in line with consumers' shift toward purchasing bundles of different services with different caps and usage limits. For example, Ofcom estimates that 79% of all fixed line telecommunications services contracts were bundles of multiple services, up from 39% in 2009.[4]

Consumers also pay an access charge for fixed line services. The access charge is treated in the current index as a separate service in its own right, and our first step is to allocate it to the component communication services. This is appropriate because consumers do not appear

1. Background to the change of the SPPI from a Business to Business to a Business to All index can be found here: https://www.ons.gov.uk/economy/inflationandpriceindices/articles/improvementstotheimportandexportpriceindicesipiandepiandservicesproducerpriceindicesppi/november2016#regulatory-change (Retrieved: 5th November 2021)

2. Acquired from Ofcom, the UK's telecommunications regulator.

3. This range differs from the original range in Abdirahman et al. *(2020). This is due to the fact the the Improved SPPI index was changed to a chained Laspeyres type index. Methodological details for the Improved SPPI (called Option A in this paper) can be found in Appendix 2.*

4. Ofcom Review of the market for stand-alone landline telephone services, Figure 1: https://www.ofcom.org.uk/__data/assets/pdf_file/0014/107321/standalone-landline-evidence.pdf (Retrieved: 5th November 2021)

Box – **Synthesis of the 2020 article (Abdirahman *et al.*, 2020)**

In the article, we considered the role that deflators could play in explaining why real Gross Value Added (GVA) for the telecoms services industry in the UK declined even as data traffic had grown exponentially. Between 2010 and 2017, data usage in the UK increased by 2,300%, whilst the measured real GVA for the industry declined by 8%. We found that the construction of the telecoms services deflators played a significant role in understating telecoms services GVA.

At the time, the telecoms services output deflator was constructed from a combination of the Consumer Price Index (CPI) for Telecommunication Services and Equipment (with a weight of around two thirds) and the Services Producer Price Index (SPPI) for Telecommunications Services (with a weight of around one third). The paper discussed various problems with this approach, including that the CPI captured many unrelated items, such as telecoms equipment, and did not adequately take into account quality changes in the telecoms services products. The SPPI, on the other hand, was only capturing business prices and, more importantly, did not include any fixed or mobile data services in the index. As a result of these, and other problems with the methods, the measured telecoms services deflator suggested that prices increased by 3% between 2010 and 2017, even though there were substantial technological advances during that time, such as the move from 3G to 4G on the mobile side and considerable improvement in fixed broadband speeds.

We found that even modest improvements to the method had a large impact on the telecoms services deflator. So we proposed a modest change to the deflator which we called Improved SPPI (Option A). The main changes were thereby:

- Removing the CPI from the deflator
- Including business-to-consumer transactions in the scope of the SPPI to ensure continued coverage of both business-to-business and business-to-consumer sales
- Introducing fixed and mobile data service items into the SPPI
- Annually updating weights

As a consequence of these relatively modest changes, the Option A deflator suggested that telecoms services prices might have fallen by around 37% between 2010 and 2017, instead of the 3% increase suggested by the official deflator at the time.

Despite this substantial decline in the Option A deflator, we argued that this could still be upwardly biased. This was due to traditional telecoms services such as voice calls and text messages being heavily weighted in the Option A deflator, despite their diminished importance to consumers and operators. In addition, there was a particular issue with the treatment of fixed access charges which were included as a separate, highly weighted service, despite it bearing little relevance to consumers when choosing telecoms contracts in the UK.

We therefore also considered a more radical method change to the deflator which was more reflective of the quality and technological improvement to the service. From an engineering and production perspective, telecoms services are primarily a bit-transport service, and data the output. Consumers, we argued, would notice little difference between using traditional services (e.g. sending a text message) or sending a message through a service like WhatsApp. Traditional services such as calls and text messages could equally be represented in data bits and the output of the telecoms services industry measured as bits of data transported.

Based on the above, we proposed an alternative, data usage-based deflator (Option B). This was an aggregate unit value index (UVI) for the price per unit of data transmitted across all telecoms services. The Option B UVI deflator suggested that telecoms services prices declined by 96% between 2010 and 2017, considerably faster than the decline that was suggested by the Option A deflator.

The paper acknowledged the wide range of estimates between the two deflator improvement options for the UK and the need for further research to better explain and narrow the range. This is the starting point of the present article.

to select their telecoms service on the basis of the access charges or ever purchase the access charge as a standalone product. We then consider the treatment of the prices of each component service in mobile bundles. The current practice in the UK is to use out-of-bundle revenue weights to apply to the bundled price. We consider total usage volume weights instead.

Our results show that the key explanation for different paces of decline in the range of deflator options is the extent to which the index uses volume rather than revenue shares to weight the component services. The alternative deflators we construct progressively trend towards the data usage unit value index, the greater the use of volume weights.

The telecommunications services sector is thus a stark illustration of an old conceptual problem in the construction of deflators: how to adequately control for quality change when there is a new or higher quality product, with rapid volume growth and declining price, which substitutes for an existing good or service. The challenge arises across the spectrum of digital services and has implications for the interpretation of the calculated deflators and thus real growth rates for such sectors. This issue may be important in the case of a number of digital goods, where bundling is becoming increasingly common. In the case of telecommunications services, the price trends differ greatly between OECD countries, although the technological advances are

similar everywhere, suggesting statistical offices may be implementing a variety of approaches to the challenges we discuss. For instance, price indices increased from 100 in 2002 to almost 130 in 2015 in Canada, while they decreased in various European countries during the same period (see Ahmad *et al.*, 2017, p. 11).

Our practical recommendation is that statistical offices should for now allocate fixed line access charges using volume weights, as revenue weights reflect accounting allocations rather than consumer choices, but should not apply volume weights to bundled charges for mobile services. However, the key point is to be aware of the sensitivity of the price index to the assumptions made about weights.

The rest of this paper has the following structure. The next section provides the context to the paper and the challenges of constructing deflators for telecommunication services. Section 2 discusses the methodology and Section 3 presents the impacts of the method changes to the telecoms services deflator. Finally, Section 4 provides a discussion of the results and highlights its limitation.

1. Context

Deflators are used in National Accounts to convert nominal measures of output into consistent volume measures. This conceptually involves splitting price change into two elements: a consistent measure of changes in prices of the same 'like-for-like' products over time, and an adjustment to control for quality change. In short, price changes can either reflect a true change in the price of a unit of product, or reflect that purchasers are receiving more (or less) volume of the product through the quality of any individual unit. This may be a change in the size of the product at a certain price (for example there have been recent complaints about 'shrinkflation' whereby the price of chocolate bars remain constant whilst their size in grams falls),[5] or a change in the character of the product.

When it comes to technology goods and digital services the latter is a key factor. For these products the rate of technological change can be rapid, and in some instances the sample product in the basket of goods in the deflator can be withdrawn before statisticians construct the new basket, making it difficult to find consistent prices for some goods. Controlling for quality change is therefore considered essential to estimating accurately a 'like-for-like' price change.

The challenge stems from the construction of deflators as being (as close as possible to) the target measure of a constant utility index, an essentially abstract concept, using observed expenditure data. In addition, statistical offices need to consider the practicalities of data collection and timely statistical production. Their actual practices will reflect these practicalities as well as standard international definitions. In the case of the UK's existing deflator for telecoms services, this has previously been a chain-linked fixed basket index weighting together producer and consumer price indices. In line with best practice recommendations, it will in future need to be constructed as a single business-to-all price index which will be delivered through an improved SPPI index. In this paper, we consider how best to align the actual telecoms services price index with a constant utility index.

The utility delivered by an improved or new good will depend on the characteristics of consumer demand, as well as on observable expenditure, and in particular on how close a substitute the new good is for the old one (or the price elasticity of demand). One way to conceptualize this is to think of a quality improvement as a scalar change in quantity, for example, one byte of data providing as much communication as two bytes previously thanks to better compression. Then, if q_i and z_i are respectively the quantity and quality of good i, we can write consumer utility over n goods as:

$$u = v(z_1q_1, z_2q_2, \ldots, z_nq_n)$$

The z_i can be thought of as hedonic functions of characteristics of each good. This formulation makes it apparent that a quality improvement has two effects: directly reducing demand because less of the good is needed to deliver the same utility; but also acting as a price reduction for the same (constant utility) quantity, and hence tending to increase demand indirectly. For if prices are p_i and the consumer has total expenditure of x then the demand functions g_i are:

$$q_i = (1/z_i)\, g_i(x, p_1/z_1, p_2/z_2, \ldots, p_n/z_n)$$

A constant utility price index requires the use of 'effective' prices, which in this set up are the prices divided by their associated quality scalar. If one byte now does what two used to, the price per byte should be halved. Then the minimum cost of obtaining utility u is given by:

$$c(u, p_1/z_1, p_2/z_2, \ldots, p_n/z_n)$$

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5. ONS, 'Shrinkflation: How many of our products are getting smaller?': https://www.ons.gov.uk/economy/inflationandpriceindices/articles/theimpactofshrinkflationoncpihuk/howmanyofourproductsaregettingsmaller (Retrieved: 5th November 2021)

The constant utility (or 'cost of living') change would be given by the cost of attaining a fixed utility level in each of two periods. We would like to construct a price index using the p_i/z_i. Deaton (1998) suggests the thought experiment of homothetic preferences (so an increase in income does not change the relative demand for different goods) and an identical increase in the quality of all goods: "The quality change is precisely equivalent to consumers becoming more efficient as 'utility machines'" (p. 40). They have higher utility but there is nothing in the empirical evidence to reveal the fact. In general, it will be impossible to recover some welfare consequences of quality changes from the data. Quality-adjustment of a price index is in effect partly adjustment for preferences unless we believe it is possible to identify separately changes in quality and changes in preferences.

Either conventional hedonic regressions, or Nordhaus's (1994; 2007) direct approach of calculating the cost of technologies such as lighting and computing power, do provide information about quality change. Hedonic adjustment estimates the value of specific characteristics of a product whose quality is improving and uses this to estimate a price closer to the level delivering unchanged consumer utility. For example, some information technology goods prices in the consumer price index (CPI) basket in the UK and other countries are hedonically adjusted and so in theory capture the rapid change in the price of a consistent unit of utility provided by the goods. However, national statistical offices only apply hedonic adjustment to a small number of goods, and these vary considerably between countries. The method requires the selection of measurable quality characteristics assumed to contribute to consumer utility. This depends on the availability of measurements for various characteristics. Crawford & Neary (2019) also note that hedonic methods only incorporate intensive quality change – that is, improvements in existing characteristics; they omit extensive changes such as the introduction of new characteristics (or loss of old ones) and therefore feature what is in effect an omitted variables bias, unless the equations are regularly updated. Hedonic methods have been applied to mobile phone handsets in the United States, while Aizcorbe *et al*. (2019) also propose a method for adjusting the prices of handsets bundled with telecommunications services. The US Bureau of Labor Statistics has improved on some hedonic adjustment of wireless communications services by considering features such as the size of data bundles consumers purchase.[6] However, hedonic adjustment of telecommunication services to reflect significant technological improvements in compression, data speeds, reduced latency, and call reliability appears not to be generally applied. What's more, it does not contain all the necessary information about the utility consumers derive from the quality change.

Hedonic methods also have significant practical limitations that make them less suited for application in telecommunications services. Many hedonic regressions for broadband often use download and upload speeds as the main quality characteristics. However, these regressions rely on high level tariffs, rather than individual contract level data. This means that hedonic regressions tend to use advertised, rather than actual, speeds since actual speeds can only be observed at the individual contract level. Advertised speeds can oftentimes remain unchanged whilst consumers experience improvements to their actual speeds and so hedonic regressions can mis-estimate quality change from improvements. Further, whilst speeds are one of the main quality characteristics in telecommunications services, other factors are also important such as coverage and latency. These factors are also not observable at the tariff level and vary for individual consumers. More broadly, hedonic regressions rely on the use of traditional price indices and accompanying basket of goods. However, it is difficult to construct a representative basket of tariffs, especially mobile tariffs. This is due to the large range of available and constantly changing tariffs which consumers subscribe to. While one could consider treating parts of telecommunications services, such as bundle options, as a separate good for hedonic adjustment, these same practical challenges would arise. As a result, statistical guidelines[7] often recommend the use of a 'basket of consumers' approach, where a set of consumer profiles are identified (e.g. high, medium, low usage) and their profiles are then matched to the cheapest available tariff for a given usage profile.

We therefore do not propose hedonic adjustment. This paper instead focuses on alternative ways of improving deflators in an area where there is general scepticism whether quality adjustment has been or can be adequately applied. As we are looking at telecommunications services, rather than purchased durable goods, we in effect make

6. Bureau of Labor Statistics – Producer Price Indexes: https://www.bls.gov/ppi/broadbandhedonicmodel.htm (Retrieved: 5th November 2021)
7. See for example: https://ec.europa.eu/eurostat/documents/272892/7048317/HICP+recommendation+on+telecoms+-+June+2015 (Retrieved: 5th November 2021)

the simplifying assumption that consumers will gain utility from quality improvements in aspects such as speed and latency as they actually use the services. The value and/or actual volume of usage therefore seem appropriate metrics for taking quality change into account and calculating an actual transaction price as consumers do not always use all the data in their monthly bundle or all the apps provided.

As described in Abdirahman *et al.* (2020), the existing UK price indices for telecommunications services have failed to keep pace with the rapid rate of change in this part of the economy. Following Bean (2016), improved deflators for improving the UK's National Accounts have been a focus of research, although the issue arises in other countries also. The two alternative methods in the earlier paper resulted in strikingly different profiles for telecoms services prices. In this paper we propose refinements of our earlier methodology, taking thorough account of the way the services are priced, with access charges for some services and bundling, and using value or volume of data usage as alternative weights. These alternatives can be viewed as reducing the bounds derived from the two countervailing effects of quality change, one reducing demand due to the greater utility per unit of data used, the other increasing demand and usage due to the decline in the price.

2. Methodology

The Data Usage Approach (called Option B in this paper) and Improved SPPI (called Option A in this paper) methods are outlined in Abdirahman *et al.* (2020). A summary of the Option B methodology can be found in Appendix 1 and a summary of the Option A method can be found in Appendix 2.

The Option A method involved updating the SPPI while broadly retaining the current methodology. This paper introduces further improvements to the Option A model. These refinements primarily focus on the treatment of fixed line access charges and bundled mobile charges.

Telecoms service providers typically set a separate access charge, and offer either a usage fee (price per call or SMS or per GB of data) or – more often – a bundled fee with a mixture of services. In the UK, many consumers now purchase a bundle of text messages, voice calls and a data allowance, with the following characteristic components:

- Access Charges: These are currently treated as a separate service in the SPPI. In the below refinement options, we re-assign this revenue to the Voice and Data service components using either revenue or volume weights.

- Bundled Mobile Revenues: As mobile operators increasingly bundle more and more services into a single monthly payment, the current approach of using out-of-bundle revenue weights for each mobile service to proxy the weights within the bundle seems inappropriate. This paper investigates using total volume weights, instead of out-of-bundle revenue weights, to apply to the bundled revenue.

Fixed line access charges have to date been treated as a distinct telecoms service in the SPPI. This treatment is debatable. In the UK market, the regulator Ofcom sets the level of access charges and requires providers to report data against this concept. However, consumers are increasingly unable to easily observe the access charge, as it is included in the total bundle price without separate identification. The authors' investigation of prices presented on-line, for example, has found that many operators no longer present information in this form. It appears prudent to assume, therefore, that users do not base their purchasing decision on the cost of these access charges. If one imagines they are making their decision on the basis of the information available to them, the primary considerations for consumers appear to be their call, text and data allowances,[8] alongside the speed of the service. On this basis, the access charge revenue should be apportioned to the services that consumers are using, just as, if one goes to a restaurant, one does not pay one charge for the food and a separate charge to contribute to the capital costs of the building and kitchen equipment. A further rationale for this approach is the 'matching principle' in accounting for allocation of fixed costs, whereby these are matched to the profile of future revenue streams they enable (Diewert, 2005; Bierman, 2009).

Our improved method therefore proposes ceasing to price the fixed line access charge as a separate service, and instead apportioning the relevant revenues to the services whose prices are likely to influence consumer choice: voice calls and broadband internet. This can be done using either revenue or volume weights, and we consider both. The access charge share of total fixed line revenues in the UK has increased from around 40% to 44% between 2010 and 2017, likely

8. On access charges, the authors have additionally identified that some operators have already stopped listing these as a separate charge. In addition, their value is fixed by the regulator.

reflecting competitive pressure on pricing in terms of the services which are salient to consumers.

Bundled mobile tariffs are the second area we have identified for further investigation. This pricing strategy is frequently found in markets where incumbents have market power. The literature on bundling by multi-product producers concludes that when consumer valuations of bundle components are high relative to marginal costs (as in telecoms and digital markets), bundling will tend to be more profitable than pricing and selling the goods separately (Stigler, 1963; Adams & Yellen, 1976; Lewbel, 1985; Eppen *et al.*, 1991). The bundled pricing strategy enables the firm to introduce a version of price discrimination that would otherwise be impractical in the face of multiple products and heterogeneous demand, as there is less variation in demand for bundles than in demand for the individual components. There are also strategic reasons to bundle to reduce competition (Carbajo *et al.*, 1990), and particularly so when the marginal cost of some of the goods is zero (Carlton *et al.*, 2010; Choi, 2012).

In calculating a deflator, bundled mobile revenues need to be split into calls, texts and data and appropriate weights derived for each element in the absence of separate prices for each component. Our earlier Option A method used out-of-bundle revenue weights (see Appendix 2).[9] However, this implied that the usage patterns within the bundle were similar to those outside the bundle. This is a strong assumption as it implies consumers would not have a strong reason for selecting bundled service packages, and yet it appears this is what a majority do. We, therefore, consider as an alternative using total volume weights to split the bundle.

This paper therefore updates the estimates introduced in Abdirahman *et al.* (2020) with the latest available data and uses a chained Laspeyres type method to calculate the indices. In addition, it proposes three refinements to the Improved SPPI/Option A option described there:

- Option A.1: This presents a new version of the Improved SPPI where Access Charges are broken down using revenue weights.

- Option A.2: This presents a second alternative to the Improved SPPI where Access Charges are broken down using volume weights.

- Option A.3: This builds on option A.2, where Bundled Mobile Charges are also broken down using volume weights.

3. Results

3.1. Option A.1: Breaking Down Fixed Line Access Charges Using Revenue Weights

Under this option we break down the fixed line access charges using revenue weights. We first subtract the access charge revenues from total revenue. From the remaining revenue we then calculate weights for voice and broadband. Using these revenue weights, we break down the access charge revenue into voice and broadband revenue, and add these to the revenue of the respective service.

The Option A.1 deflator shows a more significant decline than the Option A, of around 64% between 2010 and 2017, compared to 51% for the Improved SPPI (Figure I). This is due to the fact that in the Option A deflator the increasing and highly weighted access charges have a significant effect in counteracting the decline in data costs. Option A.1 instead assigns a higher weight to the broadband data component, whose price is declining at a rapid pace.

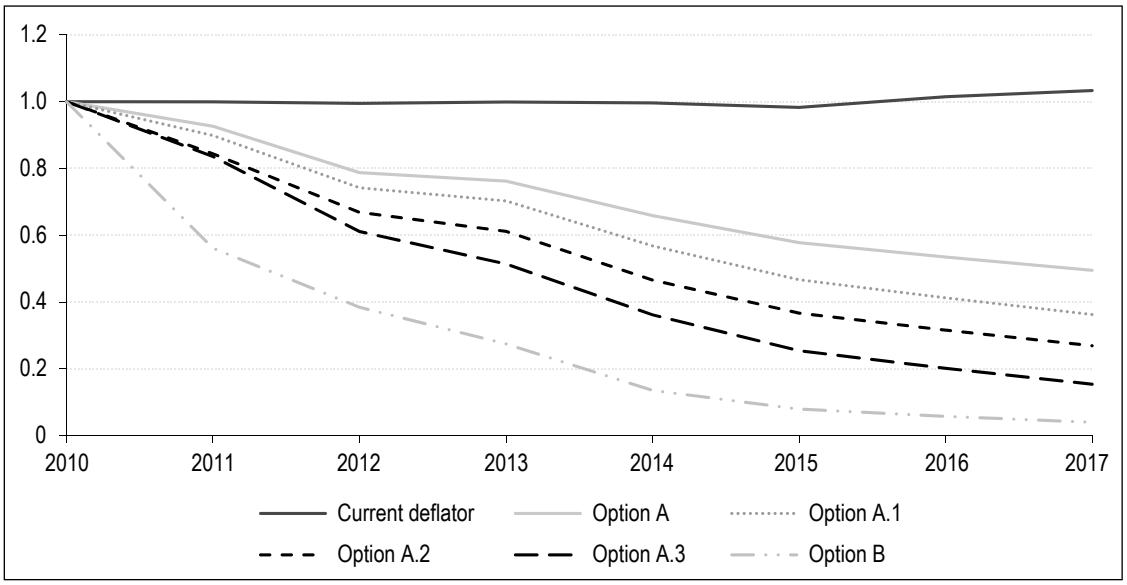
3.2. Option A.2: Breaking Down Fixed Line Access Charges Using Volume Weights

The revenue weights for Option A.1 are derived from the relative revenue share of voice and data services. However, due to differential pricing of these services, it is unlikely that the revenue weights would represent consumer usage; the price per byte differs considerably between the component services, being lowest for data (and data services), higher for voice and highest for SMS.

A volume-weighted approach to breaking down the access charges might therefore be preferable. Option A.2 is similar to A.1 but uses volume weights so the breakdown of fixed line access charges reflects the services consumers are using. First, we convert voice usage into bytes of data, using our standard conversion rate of 480 kBytes per minute. We then calculate volume weights (based on actual usage) for voice and broadband. We use these weights to break down the fixed line access charge revenues and apportion them to voice and broadband respectively. This results in nearly all of the access charge revenues being allocated to the broadband revenue as this dominates the usage

9. 'Out-of-bundle' refer to the pattern of purchases for those telecommunication services purchased outside of a bundled contract.

Figure I – **Range of potential telecoms deflators**



Sources: Authors' calculations – see Appendices 1&2.

of telecommunication services. In 2010, data services already accounted for around 97% of usage, and by 2017 it was almost 100%.

The Option A.2 index declines by 73% between 2010 and 2017 (Figure I). This is not substantially different from Option A.1 as fixed line access charges are only one component of the overall SPPI index. In addition, even in Option A.1 the (revenue) weight of the data services was around 77% by 2017 so the Option A.2 changes therefore only have a limited additional impact.

3.3. Option A.3: Breaking Down Both Fixed Line Access Charges and Bundled Mobile Tariffs Using Volume Weights

This option builds on Option A.2 by retaining the breakdown of fixed line access charges using volume weights. Option A.3 also breaks down the bundled mobile tariffs using volume, rather than (out-of-bundle) revenue, weights. This again enables the bundle breakdown to reflect consumers' actual usage of the services.

We start by converting all telecoms services into a common quantity measure: bytes of data. As with Option A.2, we convert voice services using our conversion rate of 480 kBytes per minute. For text messages we use a conversion rate of 140 bytes per text. We then calculate volume weights for the different services and use these to allocate the bundled mobile revenue to the different services.

As can be seen (Figure I), the Option A.3 index declines by 85% between 2010 and 2017, showing that it also decreases faster than the original Option A deflator (and closer to the naïve unit value, Option B deflator). The reason for this is that the largest share of the bundled revenue gets allocated to mobile data services, whose price has been declining at a rapid pace. While data services accounted for 56% of mobile volume in 2010, this increased to 96% in 2017.

The original deflator options proposed in Abdirahman *et al.* (2020), along with the refinements proposed in this paper are all presented together (Figure I). The price changes from 2010 to 2017 range from plus 3% for the current deflator (top line) to minus 96% (bottom line, the Data Usage Approach/Option B unit value index from Abdirahman *et al.* (2020)).

As can be seen, all the proposed options are significantly lower than the deflator currently used in the UK National Accounts, but the differences between them are large. The three options A.1-A.3 segment the gap between our original Option A and Option B deflators. This is because, as the different options allocate the access charge and gradually extend the role of volume weights in constructing the deflator, they progress from the Option A, which uses exclusively revenue weights, toward the Option B, which uses exclusively volume weights. The variation between the deflator options is therefore a story of revenue and volume weights. Data services are showing significant decreases in prices but tend to have relatively low weight in terms of revenue. As we extend the use of volume weighting, the resulting deflators decline much faster. The choice of the 'correct' deflator for telecommunication services therefore

depends on whether revenue or volume weights are more appropriate.

While revenue-weighted indices are always argued to represent consumer value considerations appropriately, it is not clear how much force these arguments have in this context. For one thing, the apportionment of revenue (particularly bundled revenue) is often simply an accounting exercise, potentially to meet regulatory requirements, rather than reflecting economic transactions. Where bundling is not a big issue – for example in fixed line telephone contracts where voice service allowances are not usually (in the UK) included in the bundled price – data services account for a much greater revenue share. An index which makes greater use of volume weights thereby avoids potential distortions resulting from conflating accounting assignments with true price signals.

Option A.2 thus uses volume weights to break down access charges. Although this approach is preferable for the reason just given, it does require obtaining a like-for-like volume measure for both data and voice services. We rely on a fixed conversion rate of voice into kBytes/min of data, a rate which represents the average data usage for a voice message. This has been fairly constant over many years. Although complex processors can compress voice signals into lower data rates this takes processor time and invariably involves some loss of quality. Thus, given the fairly low rates required for voice, and the tight latency (processing delay) specifications compared to video for example, extra compression is not seen as being worth the saving. But this assumption has little effect on the deflator calculated, because the volume-weighted approach assigns nearly all access revenue to data services. Even if we assumed a substantially higher data consumption for voice calls, it would still have little effect on the Option A.2 deflator.

A similar argument can be made for bundled mobile charges as well as fixed access charges. The original Option A deflator, and the new Options A.1 and A.2, break down bundled mobile charges using out-of-bundle revenue weights. However, if usage patterns between bundled and out-of-bundle services differ – as one might expect – then this would appear an erroneous assumption to apply. In A.3, therefore we consider an alternative of the same model as applied to fixed line charges in A.2, where we look to break down bundled revenue using total volume weights to represent usage, rather than revenue weights. This is the Option A.3 deflator.

However, Option A.3 has some limitations. Although the data share of revenues is gradually increasing, voice calls and texts still accounted for 57% in 2017 (Table 1). This still-substantial share is reflected in the Option A.1 and A.2 deflators, where the component index for the services in mobile bundles declines much more slowly than the corresponding index for Option A.3 (Figure II).

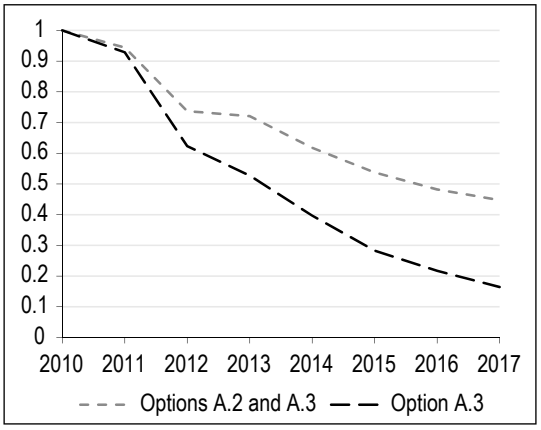
But when it comes to the Option A.3 deflator, the revenue shares of voice and text services reduces significantly as the usage of data services has been increasing exponentially (Table 2). Thus, using this volume approach to break down the bundle into component elements would suggest that in-bundle revenues for text services in the UK in 2017 were only around £60,000 for the entire industry. This looks highly implausible given the fact that out-of-bundle revenues for text services in 2017 were around £642m. A similar pattern, though less extreme, is observed for voice services where the estimated in-bundle revenue for 2017 is £423m but the out-of-bundle revenue is significantly higher at £1.6bn. These imputed figures reflect the fact

Table 1 – **Out-of-bundle mobile revenues and weights by service type**

	Revenues (£millions)			Weights (%)		
	Calls	Texts	Data	Calls	Texts	Data
2010	4,181	2,578	1,731	49	30	20
2011	4,863	2,573	2,247	50	27	23
2012	3,670	2,420	2,506	43	28	29
2013	3,213	1,807	2,651	42	24	35
2014	2,878	1,298	2,734	42	19	40
2015	2,352	773	1,758	48	16	36
2016	1,996	713	1,772	45	16	40
2017	1,644	642	1,731	41	16	43

Sources: Ofcom, Author's calculations.

Figure II – **Services in mobile bundle, component comparison**



Sources: Authors' calculations.

Table 2 – **Imputed bundled mobile revenues and weights by service type for Option A.3**

	Revenues (£millions)			Weights (%)		
	Calls	Texts	Data	Calls	Texts	Data
2010	2,768	0.83	3,646	43	0.01	57
2011	2,289	0.78	3,637	39	0.01	61
2012	1,533	0.58	5,778	21	0.01	79
2013	1,221	0.34	6,605	16	0.00	84
2014	904	0.21	7,428	11	0.00	89
2015	748	0.15	9,589	7	0.00	93
2016	588	0.10	10,295	5	0.00	95
2017	423	0.06	11,127	4	0.00	96

Sources: Ofcom, Author's calculations.

that the estimated in-bundle volume weight for data services under Option A.3 increases from 57% in 2010 to 96% in 2017. While the data component is probably the biggest consideration for consumers in selecting their bundle, it is not clear that its deflator weight should be so high. On the other hand, using out-of-bundle revenue weights would significantly underestimate the share of data services in the bundled tariff. For example, the figures in Table 1 suggest that the data share in the bundle on the basis of revenue weights should be around 43%. Yet this also seems improbable, in light of the fact that we observe falling calls and text volumes and an exponential increase in data usage.

* *
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The above considerations are familiar in the extensive literature on bias in price indices (for example Reinsdorf, 1993; Diewert, 1998; Hausman, 2003; Diewert *et al.*, 2018). In general, Laspeyres indices using base period weights are biased upward relative to an ideal constant utility index while Paasche indices using current period weights are biased downward (Diewert, 1998). The challenge in trying to calculate a 'true' constant utility price index is the inability to observe 'missing' reservation prices, or constant utility prices, which consumers would have paid for the new (or higher quality) product had it been available previously. Estimating these prices is an econometric and data challenge. As discussed earlier, the results of using revenue and volume weights can be considered as bounds on the 'true' constant utility index.

As statisticians have to produce deflators meanwhile, we have argued there is strong reason to move on from the current UK deflator for telecommunications services, and from the Option A index we calculated previously, to allocate access charges using volume weights (in our A.2 deflator), as revenue weights for bundled access charges reflect accounting convenience rather than exchange values. At present we would caution against using our Option A.3, at least without further exploration of the large difference between actual (revenue-weighted, albeit out-of-bundle revenue) and imputed (volume-weighted) revenues for the different components, as the revenues we use are out of bundle and may not be a good proxy for bundles. Using our preferred option, which may still be characterised by some upward bias, the price of telecommunication services in the UK declined by 73% from 2010-2017, rather than remaining broadly flat as suggested by the current deflator. □

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APPENDIX 1

METHODOLOGY GUIDE TO THE DATA USAGE APPROACH (OPTION B)

Data Sources

The data used in this paper comes from Ofcom's Communication Market Reports. We thereby use the reports for the years 2016, 2017 and 2018 for this paper. Whilst the data in the reports is available for all of 2010-2017, some years are missing for fixed line and mobile broadband. We extrapolate the missing values by fitting exponential growth functions. Table A1-1 below shows the data used in constructing the Option B deflator.

Table A1-1 – **Data used in constructing Option B deflator**

	Total operator reported revenues (£bn)	Fixed calls (bn mins)	Mobile calls (bn mins)	SMS & MMS (bn texts)	Fixed data usage (PB)	Mobile data usage (PB)
2010	40.5	123.0	131.1	129	2,352.0	79.0
2011	39.5	111.1	131.3	150	4,222.8	98.9
2012	38.8	103.1	132.1	151	6,016.8	239.3
2013	37.7	93.2	133.7	129	8,208.0	347.3
2014	36.7	82.2	137.3	110	16,495.2	541.7
2015	37.1	73.9	143.0	101	28,750.8	880.3
2016	37.6	64.8	151.2	91	40,233.6	1,270.1
2017	38.1	53.6	148.6	77	59,280.0	1,877.1

Sources: Ofcom, Author's calculations.

Constructing the Deflator

The construction of the Option B deflator starts by converting all calls and text messages into data bytes. We thereby use conversion rates of 480 kb/min for a voice call and 140 byte/text message. We then aggregate all the volumes into one measure for the total amount of data usage across all telecommunication products. We divide the total revenue for telecommunications services by the total volume to get a unit value and index these unit values to get a deflator, such that:

$$I_t = \frac{R_t / Q_t}{R_0 / Q_0}$$

where I_t is the deflator index in time period t, R is the total revenue for telecommunications services and Q is the total volume of data used across all telecommunications services types (expressed in bytes of data).

APPENDIX 2

METHODOLOGY GUIDE TO THE IMPROVED SPPIS (OPTION A)

Data Sources

The data used of the Option A deflators come from Ofcom's Telecommunications Market Data Tables and the Communications Market Reports for the years 2016, 2017 and 2018. This data is complete for the years 2010-2017, with the exceptions of the fixed line and broadband data which is only available until 2011. We estimate the 2010 figures by fitting exponential growth function. Table A2-1 below shows the data used in constructing the Option A deflators.

Table A2-1 – **Data used in constructing Option deflators A.1 to A.3**

Fixed line retail data

	Revenues					Volumes				
	UK geographic calls	International calls	Calls to mobiles	Other calls	Access charges	UK geographic calls	International calls	Calls to mobiles	Other calls	Number of lines
2010	935	293	849	824	3,259	65,134	4,850	5,642	14,736	23,752
2011	787	237	675	742	3,375	56,083	4,570	4,471	13,066	23,872
2012	723	198	566	659	3,706	51,985	4,111	3,902	11,506	24,462
2013	673	155	488	620	3,964	46,191	3,455	3,351	10,681	24,970
2014	577	132	430	620	4,148	40,766	3,015	2,940	9,028	25,549
2015	498	123	369	604	4,462	35,586	2,749	2,735	8,855	26,075
2016	428	111	270	596	4,776	30,471	2,169	2,811	7,826	26,482
2017	362	89	228	543	4,969	24,705	1,550	2,587	6,126	26,661

Fixed line business data

	Revenues					Volumes				
	UK geographic calls	International calls	Calls to mobiles	Other calls	Access charges	UK geographic calls	International calls	Calls to mobiles	Other calls	Number of lines
2010	393	181	628	252	1,743	23,229	2,346	6,205	7,948	9,658
2011	302	143	554	195	1,768	18,483	1,899	5,875	7,449	9,381
2012	265	132	466	193	1,640	17,045	1,756	5,490	7,280	8,754
2013	233	116	408	173	1,778	14,666	1,470	5,023	7,130	8,377
2014	208	103	333	208	1,654	14,394	1,401	4,720	5,915	7,988
2015	188	91	293	185	1,556	12,818	1,294	4,356	5,453	7,647
2016	198	77	259	211	1,580	11,456	1,131	4,069	4,888	7,083
2017	189	68	213	212	1,496	9,988	964	3,665	3,997	6,437

Mobile Data

	Revenues							
	Calls					Texts	Data	Bundled
	UK fixed calls	On-net mobile calls	Off-net mobile calls	International calls	Other calls			
2010	638	607	1,228	353	1,355	2,578	1,731	6,415
2011	650	542	1,093	486	2,092	2,573	2,247	5,926
2012	639	420	924	594	1,093	2,420	2,506	7,311
2013	574	316	694	637	992	1,807	2,651	7,826
2014	486	375	518	598	901	1,298	2,734	8,332
2015	395	315	434	523	685	773	1,758	10,337
2016	313	280	364	453	586	713	1,772	10,883
2017	253	243	296	415	437	642	1,731	11,550

	Volumes						
	Calls					Texts	Data
	UK fixed calls	On-net mobile calls	Off-net mobile calls	International calls	Other calls		
2010	31.999	44.528	38.074	2.051	8.296	129.012	79
2011	31.71	43.45	41.57	5.5	7.41	151	98.88
2012	31.47	41.62	43.6	7.86	7.74	171.88	239.328
2013	32.36	40.57	47.04	7.92	5.84	129.44	347.34
2014	32.07	39.29	51.59	6.98	7.43	109.61	541.728
2015	33.22	39.59	56.18	6.49	7.51	101.01	880.296
2016	33.78	42.98	60.65	5.94	7.82	90.95	1270.08
2017	32.59	43.85	59.53	4.72	7.95	77.23	1877.112

Notes: The following units are used for the above data: Revenues (in £m), Calls (bn of minutes), Texts (bn of texts), Data (Petabytes), Number of lines (in thousands). The Mobile Revenue data for calls, texts and data is the out-of-bundle revenue.
Sources: Ofcom, Authors' calculations.

Construction of Deflators

As with the Option B deflator, the Option A methods use unit values. However, these will be based on low level aggregates which are aggregated up using either revenue or volume weights. The general formula for constructing all indices is given below:

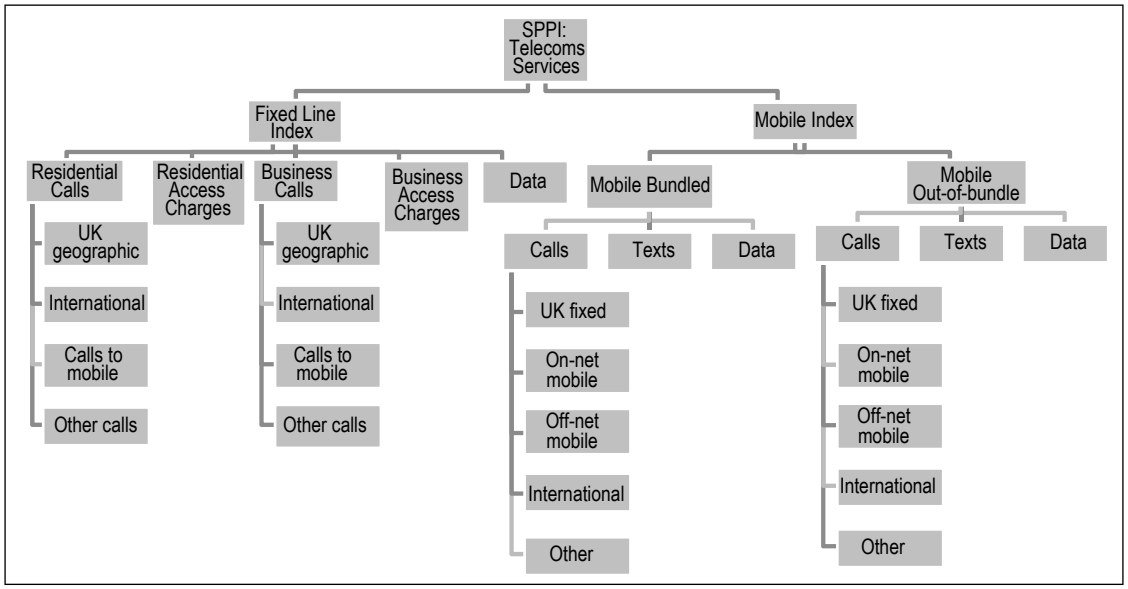
$$I_t = \sum_i \frac{W_{i,t-1}\left(\frac{R_t^i}{Q_t^i}\right)}{\left(\frac{R_{t-1}^i}{Q_{t-1}^i}\right)} / \sum_i W_{i,t-1}$$

where I_t is the final deflator index in time period, R and Q are the total revenue and volumes respectively for items i and W_i is the weight of the item in the final index. The index is then annually chain linked, such that:

$$I_{CL,t} = \left(\sum_i \frac{W_{i,t-1}\left(\frac{R_t^i}{Q_t^i}\right)}{\left(\frac{R_{t-1}^i}{Q_{t-1}^i}\right)} / \sum_i W_{i,t-1} \right) \times I_{CL,t-1}$$

The aggregation structure for the Option A deflator is presented in Figure A2-I below.

Figure A2-I – **Aggregation structure for improved SPPI**



This aggregation structure is similar to the one currently used in the UK's SPPI Telecommunications Services, with the main addition of fixed line and mobile broadband items.

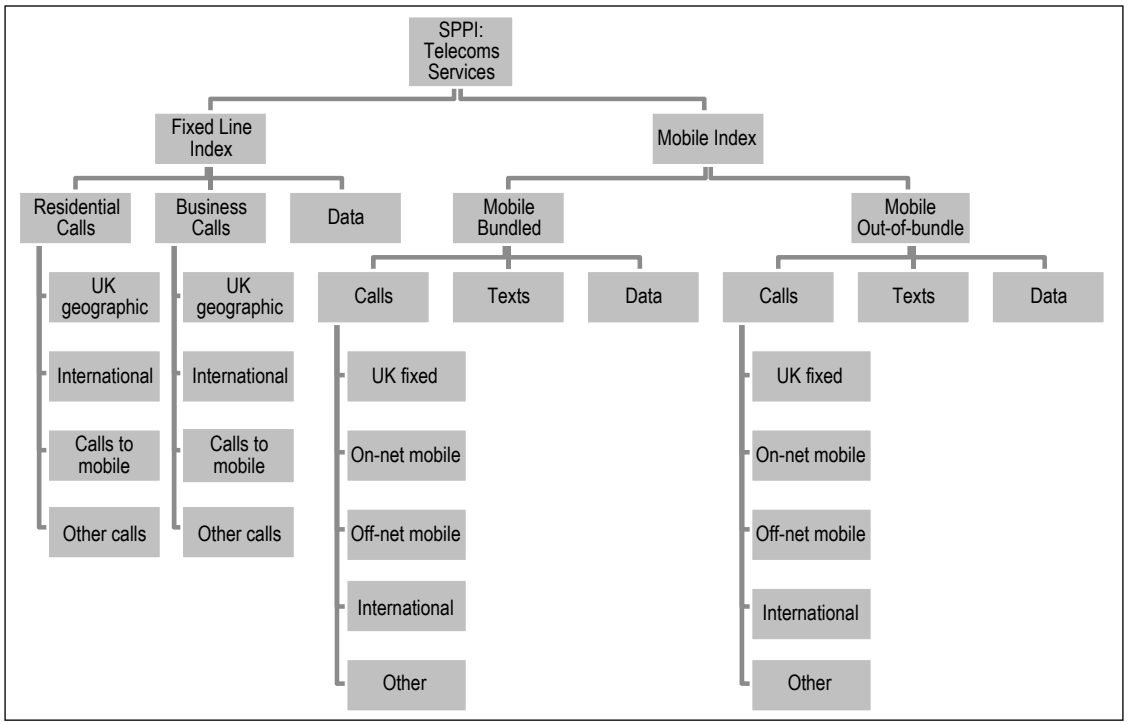
Unit values are calculated for each item and then aggregated up using revenue weights. This is straightforward for most items but some challenges present themselves for a few items. On the fixed line side, it is difficult to determine an appropriate volume by which to construct unit values for access charges. Under Option A, we use the number of subscribers as the corresponding volume. On the mobile side, we have to deal with a mismatch between revenues and corresponding volumes. Whilst the volume data contains total usage, the corresponding revenue data is not available at such a granularity as bundled revenues are not broken down by service type. To overcome this problem, we impute a breakdown for mobile revenues and volumes assuming that the bundled revenue breakdown by service type (shares of calls, texts and data) is the same as in the out of bundle revenue.

We also have to breakdown the total volume figures into bundled and out-of-bundle volumes. To do this, we assume again that bundled/out-of-bundle split in the volume (shares of calls, texts and data) is the same as the split in the revenue.

Option A.1

The aggregation structure for the Option A.1 deflator is shown in Figure A2-II below.

Figure A2-II – **Aggregation structure for Option A.1 deflator**



The aggregation structure is similar to the Option A with the main exception that it excludes fixed line access charges. These are redistributed towards the individual fixed line services using revenue weights. Table A2-2 below presents the revenue weights used to breakdown the access charges in any given year. As can be seen, the weight of the data item increases rapidly from around 43% in 2010 to around 77% in 2017.

Table A2-2 – **Revenue weights for breakdown of access charges**

	Residential				Business				Data
	UK geographic calls	International calls	Calls to mobiles	Other calls	UK geographic calls	International calls	Calls to mobiles	Other calls	
2010	0.123059	0.038563	0.11174	0.10845	0.051724	0.023822	0.082653	0.033167	0.426823
2011	0.108021	0.03253	0.092649	0.101845	0.041452	0.019628	0.07604	0.026765	0.501071
2012	0.101859	0.027895	0.07974	0.092843	0.037334	0.018597	0.065652	0.027191	0.54889
2013	0.097849	0.022536	0.070952	0.090143	0.033876	0.016866	0.05932	0.025153	0.583305
2014	0.080303	0.018371	0.059844	0.086287	0.028948	0.014335	0.046345	0.028948	0.63662
2015	0.066358	0.01639	0.049169	0.080482	0.025051	0.012126	0.039042	0.024651	0.686732
2016	0.053821	0.013958	0.033952	0.074947	0.024898	0.009683	0.032569	0.026533	0.729638
2017	0.043891	0.010791	0.027644	0.065837	0.022916	0.008245	0.025826	0.025704	0.769147

Option A.2

The aggregation structure for the Option A.2 deflator is the same as for Option A.1. The only difference between the Option A.1 and A.2 deflators is the choice of weights. Whilst the Option A.1 deflator uses revenue weights, the Option A.2 deflator uses volume weights. Table A2-3 below shows the volume weights used in breaking down the access charges for Option A.2. Using volume weights assigns almost all access charge revenues to the data service. Data services accounted for around 97% of the volume weights in 2010 but by 2017 it accounted nearly 100% of the volume weights.

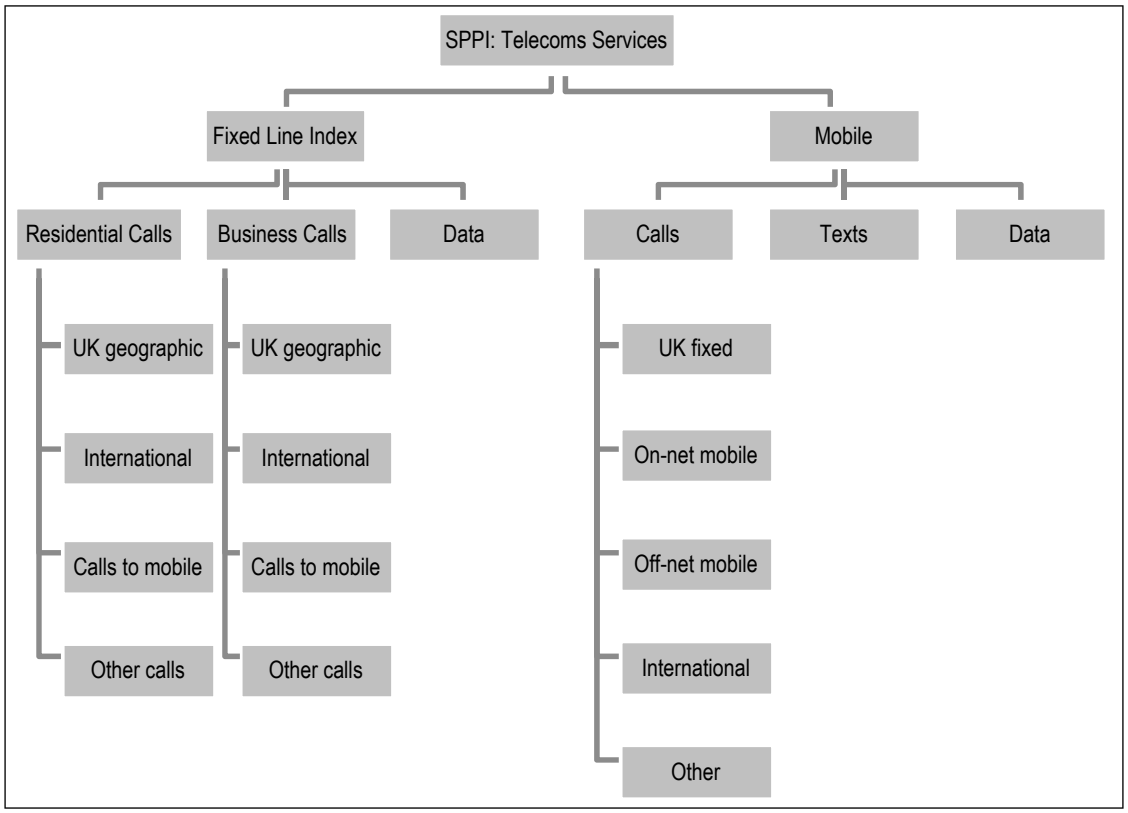
Table A2-3 – **Volume weights to break down access charges**

	Residential				Business				Data
	UK geographic calls	International calls	Calls to mobiles	Other calls	UK geographic calls	International calls	Calls to mobiles	Other calls	
2010	0.012949	0.000964	0.001122	0.00293	0.004618	0.000466	0.001234	0.00158	0.974138
2011	0.006295	0.000513	0.000502	0.001467	0.002075	0.000213	0.000659	0.000836	0.987441
2012	0.004113	0.000325	0.000309	0.00091	0.001349	0.000139	0.000434	0.000576	0.991844
2013	0.002687	0.000201	0.000195	0.000621	0.000853	8.55E-05	0.000292	0.000415	0.994651
2014	0.001183	8.75E-05	8.53E-05	0.000262	0.000418	4.07E-05	0.000137	0.000172	0.997614
2015	0.000593	4.58E-05	4.56E-05	0.000148	0.000214	2.16E-05	7.26E-05	9.09E-05	0.998769
2016	0.000363	2.59E-05	3.35E-05	9.33E-05	0.000137	1.35E-05	4.85E-05	5.83E-05	0.999227
2017	0.0002	1.25E-05	2.09E-05	4.96E-05	8.08E-05	7.8E-06	2.97E-05	3.24E-05	0.999566

Option A.3

The aggregation structure for the Option A.3 deflator is shown in Figure A2-III:

Figure A2-III – **Aggregation structure for Option A.3 deflator**



Similar to the Option A.2 deflator, the Option A.3 deflator uses volume weights to break down fixed line access charges. However, unlike the other deflators, the Option A.3 deflator also breaks down the bundled mobile revenues down using volume weights. Table A2-4 below shows the volume weights used to break down the bundled mobile revenues. As can be seen, the weight of the data item increases rapidly from around 57% in 2010 to over 96% in 2017. Traditional text messages on the other hand have only negligible weights throughout our assessment period.

Table A2-4 – **Volume weights to break down bundled mobile revenues**

	Calls					Texts	Data
	UK fixed calls	On-net mobile calls	Off-net mobile calls	International calls	Other calls		
2010	0.110506	0.153773	0.131485	0.007083	0.028649	0.00013	0.568374
2011	0.094464	0.129437	0.123837	0.016384	0.022074	0.000131	0.613672
2012	0.049878	0.065965	0.069103	0.012458	0.012267	7.95E-05	0.790249
2013	0.037742	0.047318	0.054864	0.009237	0.006811	4.4E-05	0.843983
2014	0.025332	0.031035	0.040751	0.005513	0.005869	2.53E-05	0.891475
2015	0.016803	0.020026	0.028417	0.003283	0.003799	1.49E-05	0.927657
2016	0.012076	0.015365	0.021682	0.002124	0.002796	9.48E-06	0.945947
2017	0.008028	0.010802	0.014665	0.001163	0.001958	5.55E-06	0.963377

Baccalaureate Tracks and Employment at the End of Education: Contribution of the Educational Pathway and Analysis of Gender Gaps

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Abstract – The aim of this article is to identify the consequences of the stream followed in high school on the professional opportunities of baccalaureate holders at the beginning of their career. By combining the 1995 panel of secondary level pupils with the survey on entry into adult life, we are able to identify the effects that grouping pupils by track at secondary level has on the early stages of their professional careers. This rich database allows us to account for this grouping of different students in different streams. A mediation analysis makes it possible to estimate the extent of the divergence in trajectories according to the stream, whether or not the baccalaureate holders continued their studies. The results highlight the importance of taking into account the characteristics of students prior to orientation when comparing the early career opportunities of baccalaureate holders. Mediation analysis also allows us to identify a complex dynamic between academic skills and levels of qualification, which tends to partially conceal inequalities between women and men at the beginning of their careers, whereas the track of the baccalaureate obtained tends to explain them.

JEL Classification: I26, J16
Keywords: baccalaureate, tracks, early career, gender inequality

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Education systems can be distinguished by an organisation that differentiates education by streaming pupils to a greater or lesser extent: in some systems, pupils are grouped into tracks at an earlier or later stage; in others, more unified, they are grouped only for certain courses and on an ad hoc basis (Lafontaine, 2017). While various research projects have identified the consequences of education tracks on education and schooling (Felouzis *et al.*, 2011; Hanushek & Wößmann, 2006; Holm *et al.*, 2013), analyses of the consequences on employment opportunities in the longer term are rare (Brunello & Checchi, 2007).

In France, this grouping of pupils in distinct education tracks takes place at the entry in high school, with all tracks leading to the baccalaureate. Several works describe the effect of the track chosen by the students leaving secondary education, and especially vocational education (Arrighi & Sulzer, 2012; Dauty & Lemistre, 2010). More recently, the impact of intermediate-level qualifications on integration into the labour market, for given final qualifications, has also been analysed (Béduwé *et al*., 2009; Dauty & Lemistre, 2010; Lemistre & Merlin, 2018; Ménard, 2020). While these works show the importance in the long-term of the baccalaureate track chosen, they do not allow an assessment of the extent of the divergences in paths depending on the secondary education track. To analyse the link between the track chosen in secondary education and integration into the labour market, it is necessary to look at the professional future of all baccalaureate holders, not only those leaving education at this level. Indeed, the track chosen during secondary education also influences the professional career as it is an important determinant of access to higher education and of the greater or lesser probability of obtaining a degree.

This article analyses the consequences of the choice of education track (i.e. stream and specialty)[1] made at high school, taking into account not only the type of baccalaureate (general, technological or vocational) but also the specialty. Contrary to the majority of French studies into these issues, but in keeping with the emerging international literature on the consequences of the educational choices made in secondary education, we seek to identify the effects of these choices for all baccalaureate holders, irrespective of whether or not they continued their studies in higher education.

Each baccalaureate track has pupils with common characteristics in terms of academic performance, social or migratory background (Ichou & Vallet, 2013; Duru-Bellat & Kieffer, 2008). In order to assess the impact of the track chosen on the professional future of baccalaureate holders, we must control for social and academic characteristics of the pupils before the choice of an education track.

We also analyse the link between the baccalaureate tracks and labour-market integration in order to shed light on inequalities associated with gender. Research shows that, in almost all developed countries, women today have, on average, higher educational levels than men (DiPrete & Buchmann, 2013) but still have less favourable careers and wages. In higher education, the gendered choice of track leads to occupational segregation on the labour market (Smyth & Steinmetz, 2008). But this gendered choice could begin to take effect earlier. In other words, does the track chosen in high school contribute to the gender inequalities observed at the start of working life?

After a literature review in section 1, we present in section 2 the data used as a basis for this work and our estimation approach. In section 3, we analyse the link between the tracks in secondary education and integration into the labour market taking into consideration the socio-demographic and academic differences between pupils prior to the choice of track in secondary education. Then in section 4 we analyse the differences in the outcomes of educational trajectories by gender.

1. Literature Review

1.1. The Influence of the Baccalaureate Track on Employment Opportunities

The link between the track chosen during secondary education and integration into the labour market depends on several mechanisms (Birkelund *et al.*, 2021). Firstly, the different secondary-level tracks are very hierarchical and group together pupils who differ widely in terms of academic performance and social characteristics (Ichou & Vallet, 2013; Duru-Bellat & Kieffer, 2008). These characteristics influence their trajectories once they reach higher education (Lemistre & Ménard, 2019) and, therefore, have a potential impact on their integration into the labour market. While the most prestigious tracks are associated with better employment

1. In France, in the period analysed here, there were 3 streams of secondary education, leading to 3 types of baccalaureate (general, technical and vocational), and several series (3 in the general stream, 8 in the technical stream and more in the vocational stream) based on the specialty (e.g. within the general stream: S for 'scientific', L for 'literature' and ES for 'economic-social').

opportunities, this is not necessarily an effect of the track itself but may reflect the fact that the pupils in these tracks have, even before being guided towards a particular pathway, common characteristics that favour their labour-market integration. This could create a spurious association between the track chosen and employment opportunities; this is one of the recurrent methodological challenges in the literature seeking to identify the specific effect of education tracks (Gamoran, 2010).

Secondly, the choices made during secondary education are likely to have considerable consequences on professional careers due to the path dependence mechanism (Kerckhoff, 1993). The educational system is cumulative in nature and some tracks are better in preparing students for academic achievement in higher education and access to the most prestigious qualifications. We can therefore expect higher education and the qualification obtained through this to play a considerable mediating role in the association between the baccalaureate track and labour market integration.

Lastly, the track chosen in secondary education has a specific effect on labour-market integration. Several theories can explain the causal link between the education track and employment opportunities. The human capital approach (Becker, 1964) focuses on the skills developed in each education pathway, which would generate greater or lesser productivity gains and, in doing so, determine the value of the qualifications on the labour market. The distinction between general skills and specific skills can lead to other hypotheses. Skills gained from vocational training, specific to a task or meeting the needs of a company via work-study contracts or internships, and which are specific and immediately available on the labour market, are said to be of greater value than general skills (Wasmer, 2006; Rözer & Bol, 2019). However, employees may initially prioritise cross-disciplinary skills. For example, according to the job competition model (Thurow, 1975), employers primarily value the abilities to adapt and to learn, skills that may be better developed in the general tracks than in the vocational ones. The assignment theory (Sattinger, 1993) highlights the multiplicity of tasks in each job and the heterogeneity of the skills of each individual, which makes the process for assigning individuals to different jobs complex and only partially dependent on academic qualifications.

Conversely, the filter theory (Arrow, 1973) and the signalling theory (Spence, 1974) hypothesise that education does not have an influence on productivity as such, but that qualifications reveal employers individual skills that are not easily observed during a job interview. This function of the educational system implies that the labour market assigns lesser value to qualifications obtained via the vocational route at high school because the tracks within that route generally involve young people with poorer academic results (Ichou &Vallet, 2013). From the perspective of social reproduction, based on the work of Bourdieu, the general route is also seen as bringing together pupils with the highest cultural capital (Bourdieu & Passeron, 1964; 1970). This could therefore promote a socialisation that would develop familiarity with the culture and the conventions of the ruling class, a familiarity that would be valuable in accessing managerial positions.

Finally, the wealth of literature on the issue of downgrading (e.g. Baudelot & Glaude, 1989; di Paola & Moullet, 2018; Doazan & Eckert, 2014; Lemistre, 2003) shows that the value assigned to a qualification on the labour market also depends on the balance between the demand for a skill level or type on the labour market and the corresponding number of people holding that qualification. It also highlights the importance of the economic context and of cyclical effects when interpreting the returns to various qualifications (di Paola *et al*., 2018).

In the case of France, few empirical studies have assessed the consequences of grouping pupils into tracks in secondary education on their educational and professional paths. Without empirically isolating the effect of each of the mechanisms presented above, our contribution to the literature is twofold. Firstly, we examine the consequences of educational choices in secondary education on employment opportunities: here, we consider the academic performance and socio-demographic characteristics of the pupils, prior to making those educational choices. Secondly, we assess the mediating role of higher education, which is a consequence of the cumulative nature of academic pathways.

1.2. Professional Inequalities Between Men and Women

The opening up of education over the last decades has had a much greater impact for women, whose average level of qualification has now exceeded that of men (Baudelot & Establet, 1992; Bouchet-Valat, 2015). The standardised assessments throughout schooling also show that girls have better performance in France and that

this advantage has become more pronounced over the last few years, while the advantage for boys in maths has reduced (Chabanon & Steinmetz, 2018). However, this progression in girls' academic results has not translated into wage equality. In particular, research had shown that, from the early 1990s to the early 2000s, the gap in average monthly wage between men and women in France had been stagnating at around 25% (Meurs & Ponthieux, 2006). According to the authors, 75% of these wage gaps could be explained by differences in qualification and characteristics of the job held. Structural differences in the types of jobs held can be explained by gender segregation on the labour market. The distribution of men and women across the different sectors is unequal, with the highest concentration of women in the lowest-paying sectors, for example the public sector or personal services, which contributes to the wage gaps (Couppié *et al.*, 2012; Meng & Meurs, 2001). This occupational segregation largely reflects academic segregation, even though a specific occupational segregation mechanism at the early career stage is modulating the segregation seen in the final stages of education (Couppié & Épiphane, 2006). The arrival of a child also contributes to wage inequalities as this leads to changes to mothers' working time (Pailhé & Solaz, 2006; Meurs & Pora, 2019). However, the links between professional segregation and gender pay gaps are not identical across all professions (Couppié *et al*., 2012; 2014). These results show that professional gender inequalities are linked, in part, to the study choice made in the education system. Despite the convergence in skill levels in maths and science, the educational choices made while in school continue to be gender-based, both in general education as in technological and vocational education, where production-based tracks primarily attract boys and service-sector tracks primarily attract girls (Caille *et al.*, 2002; Vouillot, 2010). It is therefore particularly important to assess the impact of these educational choices made in high school on employment opportunities at the end of education and their contribution to gender inequalities (see Section 4).

2. Data and Approach

The first aim of this article is to identify the consequences of the educational choices made in secondary education on the employment opportunities of baccalaureate holders, by isolating the contribution of their characteristics before those choices and the mediating role of higher education, i.e. the educational path dependence mechanism. We also examine the contribution of secondary school track to gender inequalities at the beginning of working life, taking into account academic performance before streaming.

We use the data from the *Panel d'élèves du second degré, recrutement 1995*[2] (hereafter Panel 1995 – a panel of the French ministry of education statistical services, DEPP, following the pupils entering secondary education in 1995), combined with data on integration into the labour market from the INSEE survey *Entrée dans la vie adulte* (EVA, a survey on entry into adult life).

We are focusing on baccalaureate holders, whether they have or not continued their studies in higher education, and on the first job they reported in the EVA survey, which does not always correspond to the first job held by the individual after their studies (*infra*). This allows us to cover the largest possible situations in terms of education path. We model the link between the track of the baccalaureate obtained and two variables characterising professional integration at the beginning of working life: holding a job in the executive or intermediate categories and the net monthly salary received. The independent and dependent variables used in the analysis are available for 5,090 out of the 7,101 baccalaureate holders who reported a job in the EVA survey. The characteristics of individuals with or without missing data are relatively similar in terms of social background or academic results on starting middle school and we have checked that imputing missing data changed the results only marginally.

We first present our data in more detail, our modelling approach and then some descriptive statistics on our sample of baccalaureate holders.

2.1. The Data

The Panel 1995 from the DEPP monitored about 17,000 pupils starting secondary school in 1995 throughout their secondary education and, for those going further, into their higher education, until the end of their studies or the achievement of a degree equivalent to 5 years of higher education (Bac+5). Between 2005 and 2012, those who had completed their studies were interviewed every year about their labour-market integration; those leaving higher education were transferred to the EVA sample in the year following that in which they reported having stopped their studies.

2. Panel d'élèves du second degré, recrutement *1995 - 1995-2006. Ministère de l'Éducation, DEPP (producteur), ADISP (diffuseur).*

This therefore provides extremely rich data to study the links between academic career and integration into the labour market. This is currently the only French database enabling us to take into account the academic performance before the choice of educational track and the social background in such a detailed way; this is particularly interesting to account for the effects of differences prior to educational choices. However, with a few exceptions (Le Rhun & Monso, 2015; Olympio & di Paola, 2018), research into labour market integration in France uses rather Céreq's "Generation" surveys. This can be explained by the complexity and methodological limits of the EVA survey.

Indeed, the young people followed in the EVA survey, who have all started secondary education during the same year, have not all finished their studies the same year. Those leaving education are then not interviewed at the same point of their labour-market integration: for example, a pupil leaving without a qualification in 2000 is, at the time of the survey, i.e. between 2005 and 2012, out of the education system for between 5 and 12 years. Conversely, a student who obtained a Master's in 2008 would be transferred to the EVA survey the year after, and interviewed for the first time in 2010; the information on their labour-market integration then corresponds to their very first years in the world of work. As a result, the first job reported in the EVA survey is closer to the end of education for those with higher education qualifications than for those leaving at the end of secondary education.

In order to limit the heterogeneity of the time spent on the labour market, and in possibly in employment, after the end of education, we focus on baccalaureate holders. On average in our sample, 2.4 years (with a standard error of 1 year) pass between leaving the education system and the first job reported in the EVA survey (see Appendix 1, Table A1-1).

2.2. The Modelling Approach and Variables

In order to analyse the link between the track of the baccalaureate obtained and labour market integration, we start by the estimation of the total association between baccalaureate track and labour-market integration, then we introduce in sequence variables aimed to capture the effect of students characteristics prior to the choice of track (social background and academic performance in lower secondary education), then the academic performance at the end of upper secondary education and the highest degree achieved in higher education, in the framework of a mediation analysis. This type of analysis (sometimes referred to as a pathway model) makes it possible to estimate both the direct effect of a variable X (in this case, the stream followed in high school) on an outcome Y (in this case, successively the two variables characterising the first job reported in the EVA survey) and its indirect effect via a mediating variable.

We must point out that this approach is not in line with the literature on returns to qualifications, which distinguishes between the effect of the baccalaureate as a final or as an intermediate qualification. This approach is of particular interest in identifying the long-term effects of the baccalaureate track where final qualifications are equivalent (Ménard, 2020). However, it does not allow us to distinguish within the effects of the tracks those related to the students' characteristics prior to making educational choices and those related to path dependence in higher education, which are the focus of this article.

The baccalaureate track is approached by nine categories combining the baccalaureate stream (general, technological and vocational) and the series or specialty within each of them. For vocational baccalaureate, we group the specialties into three tracks, in order to ensure a sufficient number of observations in each one: an "industrial" track, a "trade and administration" track (for example, secretarial, management, accounting, etc.) and a "health, social and services" track. In the same way, for technological baccalaureates, we regroup the "industrial and technical" tracks (STI and STL, respectively), the "trade and administration" tracks (STT) and the "health, social and services" tracks (SMS and hotel industry). For general baccalaureates, we retain the three series: scientific (S), economic and social (ES) and the literary (L).

For each of our dependent variables, we estimate models of linear regression, including for the probability of access to a job in a managerial or intermediate category; in this case, with robust standard errors in heteroscedasticity. The linear regression was preferred over logistic modelling in order to avoid logistic coefficient and odds ratio comparison issues between nested models (Mood, 2010). We start by estimating the total association between the baccalaureate obtained and our two dependent variables that characterise the first job reported in the EVA survey (model 1 in Section 3). We then add in sequence the variables that may contribute indirectly to the effect of the baccalaureate track on employment opportunities: firstly the

students characteristics before the choice of track, distinguishing socio-demographic characteristics (model 2) and performance on leaving middle school (model 3) to assess the effect of the pupil's characteristics before making their educational choices.

The socio-demographic variables controlled for are: the student's gender, the parents' level of education (defined as the highest qualification obtained between the two parents), the socio-professional category of the household reference person, the parents' country of origin (France or abroad) and the urban unit of the secondary school on starting secondary education (less than 20,000 inhabitants, between 20,000 and 200,000 inhabitants, city over 200,000 inhabitants excluding Paris, and the Paris region). The academic performance prior the choice of track is approached through the average of the grades obtained in French and maths in the continuous assessment for the French certificate of general education (*Diplôme national du brevet*, obtained at the end of lower secondary education).

We then add the baccalaureate honours, which depends on the average of all the grades obtained (model 4) to estimate the effect of the performance at the end of secondary education. Finally, to assess the importance of the path dependence mechanism, we introduce the highest degree achieved in higher education (model 5). The highest qualification in higher education is defined with the following modalities: no higher education degree, 2 years of higher education, Bachelor's degree, baccalaureate+4/5 years at university, qualification from a *Grande école*.[3]

In this last sequence, since the first job reported in the EVA survey is more or less close to the end of education depending on the final highest qualification (*supra*), we must ensure that the effects of these qualifications are definitely due to the latter and not to the differences in the number of years spent on the labour market, age or economic situation at the time of entry. We then estimate a model 5bis in which we control for the age and year at the time of first reporting a job in the EVA survey, and the time elapsed (in years) since leaving the education system.

The comparison of the coefficients of the baccalaureate tracks from models 1 to model 5 allow us to identify the contribution of each additional variable to the association between the baccalaureate track and the dependant variable. For example, if the estimated coefficient of a baccalaureate track is reduced by adding a variable, this means that this variable contributes to the effect of the track (role of mediation). Conversely, if the coefficient is increased by adding a variable, this means that this variable is helping to "conceal" that gap (role of moderation or even suppression). A reduction in the coefficient between model 1 and model 2 (with the introduction of socio-demographic characteristics) or model 3 (introduction of the academic performance at the end of middle school) would indicate that the differences initially observed between the tracks result in fact from the differences between students in the different tracks. A reduction in the coefficient in model 4 would indicate that differences in academic performance at the end of high school contribute to the differences observed between tracks. A reduction in the coefficient in model 5 indicates, conversely, that the effect of the baccalaureate corresponds to a mechanism of path dependence. The results of this last model also allow us to estimate the effect of the track itself on the baccalaureate, for given final qualification. This last model is therefore the closest point of comparison with the literature on return on qualifications.

The approach to assess the contribution of the secondary education tracks to gender inequalities at the start of working life (Section 4) follows the same logic, but the first model estimate the total association between gender (controlling for social background, parents' country of origin and urban unit of the secondary school on starting secondary education) and the two variables of outcome, and we introduce separately the education stream and the baccalaureate specialty or series. We then sequentially add the explanatory variables to observe the effect of their inclusion on the gender variable coefficient: the academic performance at the end of middle school is added to model 2, then the stream (general, technological or vocational) chosen in secondary education in model 3, the specific track of the baccalaureate obtained in model 4, the performance at the end of secondary education in model 5 and finally the qualification achieved in higher education (model 6).

2.3. First Descriptive Elements on the Characteristics of Baccalaureate Holders and First Jobs by Track

The socio-demographic profiles and academic performance of the baccalaureate holders differ considerably by baccalaureate stream and track (Table 1). The proportion of pupils who have at least one parent with a higher education qualification varies between 5% among holders

3. Doctorate is not in the scope of the EVA survey, which stops before doctorate holders enter the labour market.

Table 1 – **Characteristics of baccalaureate holders**

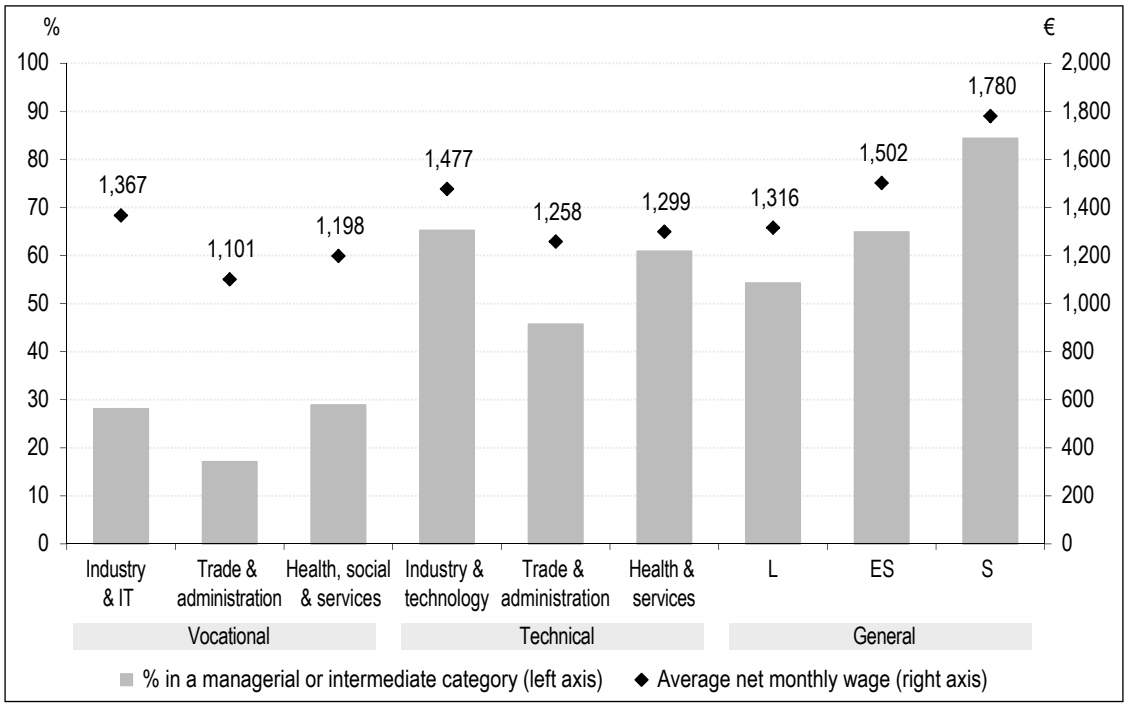
	One parent with higher education qualification		One parent in a managerial position		Both parents born abroad		Starting secondary education in a small town		Girls		Average grade (/20) at the end of middle school	Number of obs.
	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*		
Voc. Industry & IT	12.7	42	4.5	15	4.5	15	48.6	161	8.8	29	9.6	331
Voc. Trade & administration	5.3	11	2.4	5	12.4	26	43.1	90	80.4	168	9.1	209
Voc. Health, social & services	9.6	18	5.3	10	10.1	19	41.0	77	55.9	105	9.5	188
Tech. Industry & technology	24.5	122	12.4	62	5.4	27	40.0	199	12.2	61	11.1	498
Tech. Trade & administration	18.5	135	10.8	79	10.8	79	41.7	304	68.2	497	10.9	729
Tech. Health & services	18.3	39	8.9	19	5.6	12	38.0	81	89.2	190	10.8	213
General L	38.8	198	24.1	123	4.3	22	36.1	184	86.3	440	12.4	510
General ES	36.0	331	23.2	213	6.1	56	36.9	339	71.5	657	12.6	919
General S	52.2	780	34.6	516	3.8	57	34.4	513	47.6	710	14.0	1,493
Total	32.9	1,676	20.5	1,042	6.1	313	38.3	1,948	56.1	2,857	12.1	5,090

Notes: *N* corresponds to the number of people in the study sample.
Reading Note: 12.7% of holders of vocational "manufacturing & IT" baccalaureates (*N*=331) have at least one parent with a higher education qualification.
Sources and coverage: Panel 1995-EVA. Baccalaureate holders having reported a job in the EVA survey.

of vocational "trade and administration" baccalaureate and 52% among holders of general S baccalaureate. Girls are underrepresented in the industrial tracks (barely 9% of vocational baccalaureate holders and 12% of technological baccalaureate holders) and overrepresented in the "trade and administration" tracks (68% in the technological stream and 80% in the vocational stream), in the "health and services" track of the technological stream (89%) and in the L track of the general stream (86%). Finally, the average of the marks in French and maths at the end of middle school is between 9 and 10 among holders of vocational baccalaureates, while it is 14 for holders of S baccalaureate.

The category of the job at the start of the professional career varies considerably between baccalaureate streams: 74% of general baccalaureate holders are in a managerial or intermediate

Figure I – **Access to a managerial or intermediate job and average net wage at start of career by baccalaureate track**



Reading Note: Among holders of vocational "Industry & IT" baccalaureates at the start of their career, 28.1% reported a job in a managerial or intermediate category and an average monthly wage of 1,367 euros.
Sources and coverage: Panel 1995-EVA. Baccalaureate holders having reported a job in the EVA survey.

category compared with just 50% of technological baccalaureate holders and 24% of vocational baccalaureate holders, and these proportions vary also by track within each baccalaureate stream (Figure I). The same goes for the average monthly wage at career start. However, the hierarchy between the vocational, technological and general streams is less clear-cut than for access to managerial or intermediate professions; here, it is the track specialty that makes the difference.

3. The Effect of the Baccalaureate on Employment at Career Start

In relation to access to a managerial or intermediate profession at career start, the differences between the tracks within each baccalaureate stream are particularly marked (Table 2). For example, holders of vocational "trade and administration" and "health, social and services" baccalaureates are 10 and 8 percentage points (p.p.), respectively, less likely to access these professions than holders of vocational baccalaureates from the industrial tracks used as reference, while holders of technological "trade and administration" baccalaureates are 9 p.p. more likely to achieve these jobs. However, this advantage is 37 p.p. for holders of technological baccalaureates from industrial tracks and 29 p.p. for holders of baccalaureates from health and social tracks. Among those who take the general stream, those who achieve a qualification in the S series have the greatest chance of achieving this status: +55 p.p., while the effect of the L series is "only" +32 p.p. and +39 p.p. for the ES series.

The effects of socio-demographic and especially academic characteristics contribute to a significant proportion of the differences observed between the tracks (models 2 and 3). For example, for the S series of the general baccalaureate, the introduction of socio-demographic and performance variables at the end of middle school (age 14) reduces the size of the relationship by almost a quarter (model 1 *vs.* model 3).

Table 2 – **Probability of having a managerial or intermediate position at the start of working life (linear regressions)**

	Total association	+Socio-demographic variables	+Performance at end of middle school	+ Bac. honours	+ Higher education degree	
	(1)	(2)	(3)	(4)	(5) No controls	(5bis)* + Controls
Baccalaureate (*ref.*: Vocational Industry & IT)						
Voc. Trade & administration	-0.10 ***	-0.08 **	-0.07 *	-0.07 *	-0.09 **	-0.10 ***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Voc. Health, social & services	-0.08 **	-0.07 *	-0.06	-0.07 *	-0.06 *	-0.07 *
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Tech. Industry and technology	0.37 ***	0.34 ***	0.31 ***	0.34 ***	0.14 ***	0.13 ***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Tech. Trade & administration	0.09 ***	0.08 ***	0.07 **	0.10 ***	-0.05 *	-0.06 **
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Tech. Health & services	0.29 ***	0.29 ***	0.28 ***	0.31 ***	0.12 ***	0.10 ***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
General L	0.32 ***	0.29 ***	0.25 ***	0.29 ***	0.01	-0.01
	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
General ES	0.39 ***	0.35 ***	0.31 ***	0.36 ***	0.06 *	0.04
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
General S	0.55 ***	0.49 ***	0.42 ***	0.47 ***	0.15 ***	0.12 ***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Constant	0.28 ***	0.38 ***	0.21 ***	0.25 ***	0.26 ***	0.64 *
	(0.02)	(0.03)	(0.04)	(0.04)	(0.04)	(0.36)
Number of observations	5,090	5,090	5,090	5,090	5,090	5,090
R^2	0.181	0.201	0.205	0.215	0.316	0.328

* An analysis of variance inflation factors (VIF) shows that the collinearity between the year in which the job is reported and age is high. This concerns only these two control variables, and increases their standard errors. However, it does not affect the variance inflation factors of our variable of interest, i.e. the baccalaureate streams.

Note: Robust standard errors shown in brackets. Significance thresholds: 10% (*), 5% (**), 1% (***).

Reading Note: With no other control variable (model 1), holders of vocational "trade & administration" baccalaureates are 10 p.p. less likely to exercise a managerial, intellectual or intermediate profession at the start of their working life than holders of vocational "manufacturing & IT" baccalaureates, who represent the reference category.

Sources and coverage: Panel 1995-EVA. Baccalaureate holders having reported a job in the EVA survey.

A significant number of the best employment opportunities offered to S series baccalaureate holders are therefore the result of advantageous characteristics that they have even before starting high school. Conversely, the introduction of the grade honours obtained at the baccalaureate increases the estimated advantage of general baccalaureate holders by several percentage points (model 4). This can be explained by the fact that, where performance at the end of middle school is the same, pupils who take the general stream are less likely to obtain the honours at baccalaureate than those taking the vocational or technological streams. In cases of identical performance at the end of middle school and the same honours at baccalaureate, the opportunities from the general stream are therefore even better than those estimated with model 3 (suppressor role of baccalaureate honours).

Above all, it is the qualification gained in higher education that explains the greatest probability of baccalaureate holders accessing managerial or intermediate professions, as shown by the reduction in the coefficients when this variable is introduced (model 5 and 5bis, i.e. without and with controls for age, year of the job reported in the EVA survey, and labour market potential experience – cf. Section 2). In particular, the advantage for those who take the S, ES and L series of the general stream is almost entirely explained when the highest qualification obtained in higher education is taken into account (model 5 or 5bis).

Supplementary analyses (available from the authors on request) show that the field of study in higher education seems to make only a marginal difference, and primarily for holders of technological baccalaureates, while the inclusion of the characteristics of the job held does not change the estimated effects of the baccalaureate tracks. Once all the explanatory variables have been introduced, a S series baccalaureate (or a technological baccalaureate with an industrial track) provides an advantage of 10 p.p. relative to a vocational baccalaureate in an inductral track when it comes to accessing a managerial or intermediate profession. There is therefore an effect specific to the education tracks chosen at high school that persists when taking into consideration the differences in academic performance and qualification obtained in higher education.

Table A2-1 in the Appendix 2 shows the complete results of the estimation of access to a managerial or intermediate profession at career start. In relation to social background, only the parents' level of education and having started secondary school in the Paris region have a systematic impact (model 5). The results regarding the effects of academic performance show that a better average grade on leaving middle school increases the probability of having a managerial or intermediate profession at career start (model 3). However, this is entirely driven by better baccalaureate results and greater success in higher education and the average grade at the end of middle school has no longer any effect once the entire academic path has been taken into account (model 5 or 5bis).

The results on monthly wages at career start (Table 3) confirm the very considerable advantage of the industrial tracks of the vocational and technological baccalaureates. For example, holders of vocational baccalaureates from the industrial tracks have an average net monthly wage significantly higher than that of other vocational baccalaureate holders, higher than that of technological baccalaureate holders from the "trade and administration" and "health and services" tracks and of holders of general L series baccalaureates (model 1).

The S track is again in a favourable position: +27% compared to holders of vocational baccalaureates from the industrial tracks, still used as reference. This advantage can be explained by the students characteristics prior to the choice of track and the qualifications obtained in higher education. Contrary to what we saw in terms of access to a managerial or intermediate profession, the wages of baccalaureates holders of some vocational and technological tracks are, for given higher education qualifications, substantially similar to that of general baccalaureates holders. However, this relates to wages at career start, a variable that is likely to change significantly depending on the type of job held.

Among the other variables, the socio-professional category of the reference person has a statistically significant effect on average wage, contrary to what was seen for the probability of a job in a managerial or intermediate category (Table A2-2 in Appendix 2, model 2). However, this effect almost disappears once the rest of the academic path is taken into account, in contrast to what we see for the parents' level of education and high school attendance in the Paris region: here, some of the effects remain once all the variables have been introduced (model 5 and 5bis). Academic performance at the end of middle school has a statistically significant effect on wages at career start (model 3) but this effect disappears too once the qualification in higher education is

Table 3 – **Net monthly wage (in logarithm) at start of working life (linear regressions)**

	Total association	+Socio-demographic variables	+Performance at end of middle school	+ Bac. honours	+ Higher education degree	
	(1)	(2)	(3)	(4)	(5) No controls	(5bis)* + Controls
Baccalaureate (*ref.*: Vocational Industry & IT)						
Voc. Trade & administration	-0.23 ***	-0.15 ***	-0.14 ***	-0.14 ***	-0.16 ***	-0.17 ***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Voc. Health, social & services	-0.13 ***	-0.08 **	-0.07 **	-0.08 **	-0.08 ***	-0.09 ***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Tech. Industry and technology	0.08 ***	0.06 **	0.03	0.05 **	-0.05 **	-0.06 **
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Tech. Trade & administration	-0.11 ***	-0.06 **	-0.08 ***	-0.04	-0.12 ***	-0.13 ***
	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)
Tech. Health & services	-0.06* *	0.02	0.01	0.04	-0.06 *	-0.07 **
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
General L	-0.07 ***	-0.02	-0.07 **	-0.02	-0.17 ***	-0.18 ***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
General ES	0.06 ***	0.10 ***	0.04 *	0.10 ***	-0.06 **	-0.07 ***
	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
General S	0.24 ***	0.22 ***	0.14 ***	0.20 ***	0.01	-0.01
	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
Constant	7.19 ***	7.30 ***	7.10 ***	7.14 ***	7.15 ***	7.44 ***
	(0.02)	(0.03)	(0.04)	(0.04)	(0.04)	(0.32)
Number of observations	4,781	4,781	4,781	4,781	4,781	4,781
R^2	0.137	0.181	0.190	0.212	0.276	0.283

Notes: Standard error shown in brackets. Significance thresholds: 10% (*), 5% (**), 1% (***).
Reading Note: With no other control variable (model 1) and taking into consideration the logarithmic form of the model, holders of general scientific baccalaureates have a wage exp(0.24)=27% higher than holders of vocational "industry & IT" baccalaureates, who represent the reference category.
Sources and coverage: Panel 1995-EVA. Baccalaureate holders having reported a job in the EVA survey.

accounted for: this implies that, with the same baccalaureate track, a better performance at the end of middle school leads to a higher qualification in higher education and impacts wage level only through this mechanism. The baccalaureate grade honours also influences the wage level, but only where the higher education qualification is the same (model 5).

4. Gender Inequalities at Career Start and the Mediating Role of the Baccalaureate Track

Girls are overrepresented in the "trade and administration" and L series tracks (cf. Table 1), which are less favourable in terms of integration into the labour market. However, they are also more often holders of a general baccalaureate (63%) than boys (50%). The proportion of higher education graduates is higher among girls than boys (78% compared with 71%) while they are receiving half as many qualifications from the *Grandes écoles* (8% compared with 16%). Not only do girls and boys tend to take different tracks at high school, but even where they obtain their baccalaureate in the same track, they do not always go on to gain the same higher education qualifications. These complex differences in trajectories at high school and in higher education are shown in Figure A1-I in Appendix 1.

The results relating to integration into the labour market show that women have net monthly wages that are 13% lower than those of men, while the differences in terms of access to managerial or intermediate categories are not statistically significant (Table 4, model 1).

Whether in relation to the probability of a managerial or intermediate position or wages, the mediation analyses show that the disadvantage suffered by women becomes considerably larger when the academic performance at end of middle school variable is taken into account. This shows that girls' better academic performances, on average, partially compensate for the disadvantages they face (suppressor role, cf. Section 2).

Where performance at the end of middle school is the same, women are 6 p.p. less likely to have a job in a managerial or intermediate category than men, and their average wage is 16% less

Table 4 – **Inequalities between men and women at start of working life and mediating role of the baccalaureate (linear regressions)**

	Total association	+Performance at end of middle school	+Baccalaureate stream	+Baccalaureate track	+Baccalaureate honours	+Higher education degree
	(1)	(2)	(3)	(4)	(5)	(6)
Managerial/intermediate professions						
Women (*ref.*: men)	-0.02	-0.06 ***	-0.08 ***	-0.03 *	-0.02	-0.04 ***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
N	5,090	5,090	5,090	5,090	5,090	5,090
R^2	0.077	0.141	0.181	0.205	0.215	0.328
Net monthly wage (log.)						
Women (*ref.*: men)	-0.14 ***	-0.17 ***	-0.17 ***	-0.12 ***	-0.12 ***	-0.11 ***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
N	4,781	4,781	4,781	4,781	4,781	4,781
R^2	0.103	0.158	0.166	0.190	0.212	0.283

Notes: All models control for social background, urban unit division on starting secondary education and parents' country of origin. Standard errors shown in brackets. Significance thresholds: 10% (*), 5% (**), 1% (***).
Reading Note: Women are 2 p.p. less likely to have a managerial position or exercise an intellectual profession or intermediate profession at the start of their working life than men (model 1, upper part of the table). The net monthly wage for women represents only exp(-0.14)=87% of that of men (model 1, lower part of the table).
Sources and coverage: Panel 1995-EVA. Baccalaureate holders having reported a job in the EVA survey.

than that of men. This gap is even more marked when we consider only managerial positions (Table A2-3 in Appendix 2): with identical performance at the end of middle school, women are 11 p.p. less likely to have a managerial position at the start of their career. Given that 23% of baccalaureate holders in our sample start their careers in this category, this difference is particularly significant.

The stream of baccalaureate obtained (vocational, technological and general) plays a similarly suppressor role (model 3): girls are more likely to hold a general baccalaureate than boys, which masks some of the gender inequalities on entering working life. These results therefore highlight how crucial it is to take into account the characteristics prior the choice of track and the course of secondary education so as not to underestimate the gender inequalities that are "concealed" by girls' better academic performance.

Conversely, the track at high school explains some of the gaps observed, which reduce when this variable is included (model 4). This mediating role is particularly significant when it comes to access to managerial and intermediate category, where the gap is reduced by almost two-thirds when we introduce this variable (from -8 p.p. to -3 p.p. between models 3 and 4). In terms of wage differences, the inclusion of the baccalaureate track also reduces the gender gap by almost 30%. This implies that women more often gain qualifications in tracks that are less favourable for integration into the labour market. In particular, they are overrepresented in the "trade and administration" tracks, within both the vocational baccalaureate (80% of baccalaureate holders in this track) and the technological baccalaureate (68%). Conversely, they are particularly underrepresented in industrial tracks, within both the vocational baccalaureate (9%) and the technological baccalaureate (12%). Within the general stream, girls are overrepresented in the least favourable track (86% of holders of L baccalaureate).

In contrast, the differences in qualification level in higher education contribute to gender inequalities (model 6) but only in terms of access to managerial or intermediate category, where the inclusion of this variable again increases the gender gap, suggesting that fewer women access these categories despite their better academic trajectory in higher education than men. Additional analyses (available from the authors on request) show that the differences in working time are the biggest contributor to the wage gaps seen.

* *
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This article has explored the impact of the track taken in high school on baccalaureate holders' early careers. In contrast to the majority of French studies on this subject, we have assessed the extent of the differences in paths by baccalaureate track for all baccalaureate holders, whether they continued their studies or not, taking into consideration their social and academic characteristics before making educational choices.

The results firstly highlight the advantages of holders of general baccalaureates over holders of vocational, and to a lesser extent, technological baccalaureates. In all the models, the links, of varying strengths, between the various baccalaureates and higher education appear to be a determining factor in explaining the differences in returns between the baccalaureate tracks, which confirms the importance of the path dependence mechanism in the education system (Kerckhoff, 1993). However, some of the advantages of holders of general baccalaureates, and in particular those who take the S track, remain once the advantages of their social background, good academic performance and highest qualification obtained in higher education are taken into account. This enduring effect of the general baccalaureate, which is far from negligible, could confirm the hypothesis based on the signalling theory (Spence, 1974), according to which the vocational pathway is afforded a lesser value on the labour market as would be the sign of having struggled at school. This track hierarchy on the labour market also seems to have been internalised by pupils and their parents across all social groups, who expect a general baccalaureate to provide for better labour-market integration, even without a higher education qualification (Barone *et al.*, 2021). The enduring effect of the baccalaureate track, even among higher education graduates, can also be interpreted in the light of research showing the role of academic paths on employment opportunities where people ultimately gain an equivalent final qualification (Béduwé *et al.*, 2009; Dauty & Lemistre, 2010; Ménard, 2020).

Our results also highlight the heterogeneity of employment opportunities at career start between baccalaureate tracks, which, in some cases, shakes up the hierarchy between the vocational, technological and general streams. For example, a technological "trade and administration" baccalaureate is associated with a lower average wage at career start than a vocational industrial baccalaureate. These results echo those of Arrighi & Sulzer (2012) who had already used Céreq data to highlight the very low labour-market value of secondary education specialty from the administrative tertiary sector, which can be explained by the fact that this sector now recruits graduates of short higher education courses (Arrighi & Sulzer, 2012).

In terms of professional inequalities between men and women, the results firstly indicate that these inequalities already exist when people begin their careers, and therefore before childbirth and conjugal unions, echoing former studies or the recent conclusions of a study conducted in Switzerland (Combet & Oesch, 2019). The mediation analysis also allowed us to identify a complex dynamic between academic skills and qualification levels that tend to partially conceal gender inequalities, while the track of the baccalaureate obtained tends to explain them. Girls' academic performance on leaving middle school are better, and they are more likely to obtain a baccalaureate in the general stream, which contributes to concealing the gender inequalities at the start of their working life. However, the overrepresentation of girls in the secondary education tracks that are less favourable on the labour market, such as the vocational "trade and administration" tracks and the L track in the general baccalaureate, help to explain the gender inequalities at the start of working life. Academic segregation in secondary education therefore contributes to employment inequalities between men and women.

Despite this, some of these gender inequalities cannot be explained by differences in academic trajectories, which suggests that these inequalities are also formed via other mechanisms. In particular, it has been shown that, over the first ten years of a person's professional career, the weight of educational segregation on wage inequality reduces but gender wage gaps increase due to professional segregation, which cannot be explained solely by differences in pathways (Couppié *et al.*, 2012). As the level of educational segregation (between tracks) seems to fall over time (Couppié & Épiphane, 2018), it therefore seems important to develop research into the mechanisms specific to the labour market that are contributing to gender wage gaps. Despite everything, educational segregation remains a fundamental factor in understanding the emergence of gender inequalities at the time at which people enter the labour market and it is still necessary to continue researching the mechanisms behind gendered educational choices and their consequences on professional trajectories.

In general, our results highlight the importance of taking into consideration the characteristics of the students grouped into each track so as to compare their employment opportunities. For example, for a prestigious track such as the S track, the estimated advantage in accessing a job in managerial or intermediate category is reduced by almost a quarter when the characteristics prior to the choice of track are taken into account, while the advantage in terms of salary falls by 40%. The positive effect of the S track on employment opportunities therefore partly reflects the selection of better pupils in

this track. Globally, the inclusion of students' characteristics prior to the choice of track tends to reduce early career differences between baccalaureate holders.

These results highlight the importance of educational decisions made during secondary education for professional careers in the French context. They also question the relevance of certain tracks of vocational education, for which the opportunities on the labour market seem to be very limited, in particular the "trade and administration" tracks, which contribute to professional inequalities between men and women. The high school reforms over the last few years have, however, may change the employment opportunities offered by the various qualifications. In particular, the reform of the general stream from 2019, which replaced the grouping into tracks with a choice of specialty, could change the hierarchies and the scope of differences in employment opportunities within the general stream. It will therefore be interesting to replicate the analyses carried out in this article with more recent data, once these are available.

To conclude, three limits to the present study that must be highlighted. Using socio-demographic characteristics and school performance prior to educational choice, we were able to account for a substantial part of the differences between students grouped in streams. However, we cannot exclude the possibility that other individual characteristics may play a role in the track effects identified – such as motivation, or whether the choice of track was more or less constrained, or non-cognitive skills – and bias the links between secondary education tracks and employment opportunities assessed here. A more rigorous control of the selection effects would require to develop a quasi-experimental analysis, which seems difficult to implement with the data available. Furthermore, the categorisation of the tracks and specialisms used in this research, while more detailed than in the majority of studies into this issue, is based on clustering tracks that are similar, yet still different. A more granular categorisation, without track grouping, and inclusion of the specialty and options chosen in secondary education would, in all likelihood, shed light on the notable differences in labour-market integration within each category. However, an analysis of this kind would require exhaustive data at national level, which are not currently available. Finally, our results relate only to employment opportunities in the short-term. It is possible that the differences reduce, remain or increase over time; these changes could be analysed using data on the course of the professional career in the medium term, such as the Céreq's 'Generation after 10 years' surveys. □

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APPENDIX 1

DESCRIPTIVE STATISTICS

Table A1-1 – **Variables used in the analysis**

Dependent variables: first job reported in the EVA survey		
Job in a managerial or intermediate category (%)		60.1
Net monthly wage (€)	Mean	1,484.7
	Standard error	550.3
	% missing	6.0
Independent variables		
Baccalaureate obtained (%)	Vocational – Industry & IT	6.5
	Vocational – Trade & administration	4.1
	Vocational – Health, social & services	3.7
	Technological – Industry & technology	9.8
	Technological – Trade & administration	14.3
	Technological – Health & services	4.2
	General L	10.0
	General ES	18.1
	General S	29.3
Gender (%)	Male	43.9
	Female	56.1
Parents' level of education (%)	Unqualified & lower secondary education	15.6
	Upper secondary education	32.0
	Baccalaureate	19.5
	Higher education qualification	32.9
Parents' socio-professional category (household reference person) (%)	Managerial and intellectual professions	20.5
	Intermediate professions	22.5
	White-collar workers	15.0
	Craftspeople, traders	8.8
	Farmers	3.3
	Blue-collar workers	29.3
	Unemployed	0.6
Urban unit of the school on starting secondary education (%)	Village or small town	38.3
	Medium-sized town	26.8
	Large town or city, excluding Paris	21.6
	Paris region	13.3
Parents' country of origin (%)	At least one parent born in France	93.9
	Parents born abroad	6.1
Average grades/20 (in French and Maths) in the continuous French certificate of education	Mean	12.1
	Standard error	2.5
Baccalaureate honours (%)	Pass	64.5
	Fair	26.6
	Good or very good	8.9
Highest qualification achieved in higher education (%)	Unqualified	24.9
	2 years of higher education (DEUG/BTS/DUT)	22.1
	Bachelor's	27.5
	4/5 years at university	13.9
	Grande école qualification	11.6

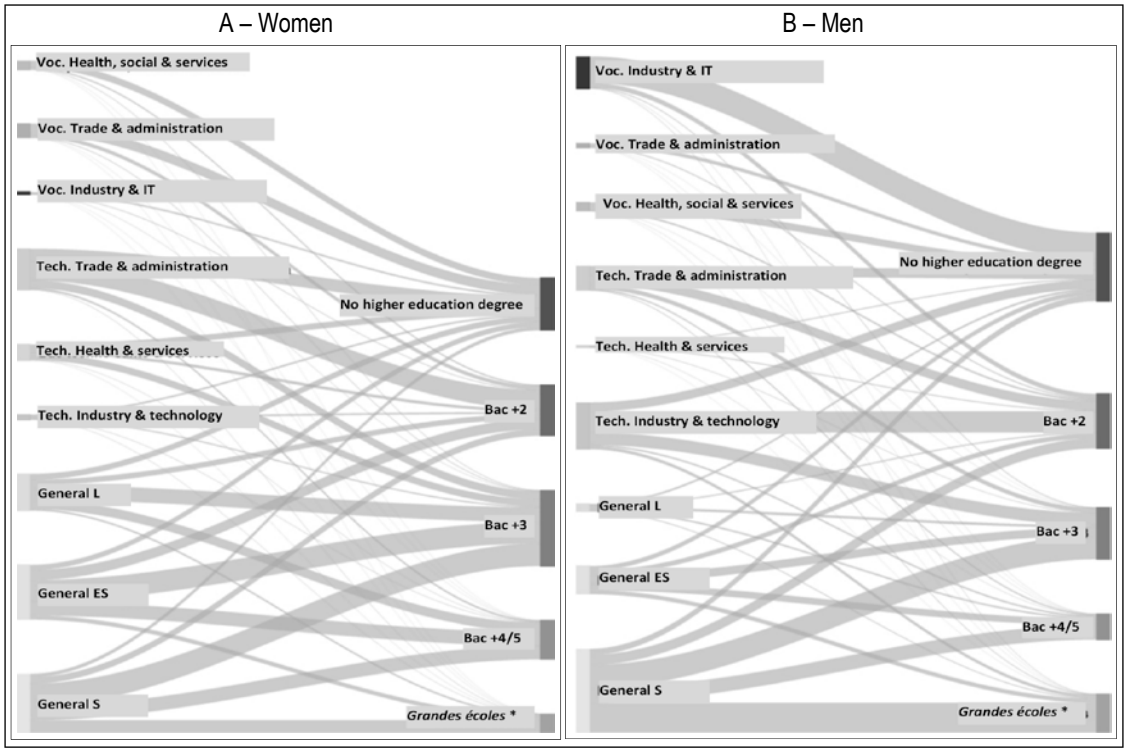
➔

Table A1-1 – (*contd.*)

Independent variables		
Field of studies for highest qualification achieved in higher education (%)	Unqualified	24.9
	Arts, literature and language	2.9
	Human and social sciences	3.6
	Law and political science	2.3
	Trade, administration and economics	8.9
	Basic and life sciences	3.7
	Engineering and production	12.5
	Sport	0.7
	Health and social issues	7.1
	Services	10.1
	Non-specific field of study	23.3
Age at first job reported in EVA	Mean	25.0
	Standard error	1.5
Number of years since leaving the education system	Mean	2.4
	Standard error	1.0
Year first job reported in EVA (%)	2005	1.1
	2006	5.2
	2007	10.2
	2008	15.4
	2009	33.7
	2010	18.7
	2011	9.1
	2012	6.7
Type of employer in first job reported (%)	Private company, association, craftsman	74.9
	Public company	4.2
	Civil service	12.7
	Local and regional authority, public hospital	8.2
Type of contract in first job reported (%)	Fixed-term contract, contractor	25.0
	Permanent or civil-service contract	68.0
	Temporary contract	4.7
	Subsidized employment	1.6
	Intern	0.4
	Own business or family carer	0.3
Working time in first job reported (%)	Full-time	89.3
	80% or more	4.1
	50% to 80%	5.3
	Less than 50%	1.2
Observations		5,090

Sources: Panel 1995-EVA. Baccalaureate holders having reported a job in the EVA survey.

Figure A1-I – **Number of people in the baccalaureate tracks and highest degree achieved in higher education**



* Prestigious higher education institutions.
Source: Panel 1995-EVA. .

APPENDIX 2

COMPLETE RESULTS OF LINEAR REGRESSIONS

Table A2-1 – **Probability of having a job in a managerial or intermediate position at start of working life**

		Total association	+Socio-demographic variables	+Performance at end of middle school	+ Bac. honours	+ Higher education degree	
		(1)	(2)	(3)	(4)	(5) No controls	(5bis) + Controls
Baccalaureate obtained	Vocational – Industry & IT (*ref.*)						
	Voc. Trade & administration	-0.10*** (0.04)	-0.08** (0.04)	-0.07* (0.04)	-0.07* (0.04)	-0.09** (0.04)	-0.10*** (0.04)
	Voc. Health, social & services	-0.08** (0.04)	-0.07* (0.04)	-0.06 (0.04)	-0.07* (0.04)	-0.06* (0.04)	-0.07* (0.04)
	Tech. Industry & technology	0.37*** (0.03)	0.34*** (0.03)	0.31*** (0.03)	0.34*** (0.03)	0.14*** (0.03)	0.13*** (0.03)
	Tech. Trade & administration	0.09*** (0.03)	0.08*** (0.03)	0.07** (0.03)	0.10*** (0.03)	-0.05* (0.03)	-0.06** (0.03)
	Tech. Health & services	0.29*** (0.04)	0.29*** (0.04)	0.28*** (0.04)	0.31*** (0.04)	0.12*** (0.04)	0.10*** (0.04)
	General L	0.32*** (0.03)	0.29*** (0.04)	0.25*** (0.04)	0.29*** (0.04)	0.01 (0.04)	-0.01 (0.04)
	General ES	0.39*** (0.03)	0.35*** (0.03)	0.31*** (0.03)	0.36*** (0.03)	0.06* (0.03)	0.04 (0.03)
	General S	0.55*** (0.03)	0.49*** (0.03)	0.42*** (0.03)	0.47*** (0.03)	0.15*** (0.03)	0.12*** (0.03)
Gender	Male (*ref.*)						
	Female		-0.01 (0.01)	-0.03* (0.01)	-0.02 (0.01)	-0.03** (0.01)	-0.04*** (0.01)
Parents' level of education	Higher education degree (*ref.*)						
	Baccalaureate		-0.07*** (0.02)	-0.07*** (0.02)	-0.06*** (0.02)	-0.04** (0.02)	-0.04** (0.02)
	Upper secondary		-0.11*** (0.02)	-0.11*** (0.02)	-0.10*** (0.02)	-0.07*** (0.02)	-0.06*** (0.02)
	None or lower secondary		-0.15*** (0.02)	-0.15*** (0.02)	-0.14*** (0.02)	-0.09*** (0.02)	-0.09*** (0.02)
Household reference person's socio-professional category	Managerial and intellectual professions (*ref.*)						
	Intermediate professions		0.01 (0.02)	0.01 (0.02)	0.02 (0.02)	0.02 (0.02)	0.03 (0.02)
	White-collar workers		-0.00 (0.02)	-0.00 (0.02)	0.01 (0.02)	0.03 (0.02)	0.04* (0.02)
	Craftspeople and traders		0.03 (0.03)	0.03 (0.03)	0.03 (0.03)	0.03 (0.02)	0.04* (0.02)
	Farmers		0.06* (0.04)	0.06 (0.04)	0.07** (0.04)	0.05 (0.03)	0.06** (0.03)
	Blue-collar workers		-0.02 (0.02)	-0.02 (0.02)	-0.01 (0.02)	0.01 (0.02)	0.02 (0.02)
	Unemployed		-0.01 (0.08)	-0.00 (0.08)	-0.00 (0.08)	0.03 (0.07)	0.04 (0.07)
Urban unit on starting secondary education	< 20 000 inhabitants		-0.00 (0.02)	-0.01 (0.02)	-0.01 (0.02)	0.00 (0.01)	0.00 (0.01)
	20 000 to 200 000 inhabitants (*ref.*)						
	200 000+ inhabitants (excluding Paris)		-0.01 (0.02)	-0.00 (0.02)	-0.00 (0.02)	0.00 (0.02)	0.00 (0.02)
	Paris		0.09*** (0.02)	0.10*** (0.02)	0.10*** (0.02)	0.07*** (0.02)	0.06*** (0.02)
Parents' country of birth	At least one parent born in France (*ref.*)						
	Both parents born abroad		0.06** (0.03)	0.07** (0.03)	0.07** (0.03)	0.04 (0.03)	0.04 (0.03)
Grade in French and maths (/20) in the continuous French certificate of education				0.02*** (0.00)	0.01* (0.00)	-0.00 (0.00)	0.00 (0.00)
Baccalaureate honours	Pass (*ref.*)						
	Fair				0.09*** (0.01)	0.02 (0.01)	0.02 (0.01)
	Good or very good				0.16*** (0.02)	0.07*** (0.02)	0.06*** (0.02)
Highest qualification achieved in higher education	No qualification (*ref.*)						
	Bac+2 (DEUG/BTS/DUT)					0.23*** (0.02)	0.19*** (0.02)
	Bachelors'					0.47*** (0.02)	0.39*** (0.02)
	Bac+4/5 in university					0.50*** (0.02)	0.41*** (0.03)
	Grandes écoles					0.53*** (0.02)	0.44*** (0.03)
Age at which employment is reported							-0.02 (0.02)
Number of years since leaving the education system							-0.03*** (0.01)
Year in which employment is reported	2005 (*ref.*)						
	2006						0.07 (0.05)
	2007						0.22*** (0.06)
	2008						0.27*** (0.07)
	2009						0.35*** (0.08)
	2010						0.35*** (0.09)
	2011						0.39*** (0.11)
	2012						0.46*** (0.13)
Constant		0.28*** (0.02)	0.38*** (0.03)	0.21*** (0.04)	0.25*** (0.04)	0.26*** (0.04)	0.64* (0.36)
Observations		5,090	5,090	5,090	5,090	5,090	5,090
R^2		0.181	0.201	0.205	0.215	0.316	0.328

Notes: Standard errors shown in brackets.
Sources: Panel 1995-EVA. Baccalaureate holders having reported a job in the EVA survey.

Table A2-2 – **Net monthly wage (in logarithnm) at start of working life**

		Total association	+Socio-demographic variables	+Performance at end of middle school	+ Bac. honours	+ Higher education degree	
		(1)	(2)	(3)	(4)	(5) No controls	(5bis) + Controls
Baccalaureate obtained	Vocational – Industry & IT (*ref.*)						
	Voc. Trade & administration	-0.23*** (0.03)	-0.15*** (0.03)	-0.14*** (0.03)	-0.14*** (0.03)	-0.16*** (0.03)	-0.17*** (0.03)
	Voc. Health, social & services	-0.13*** (0.03)	-0.08** (0.03)	-0.07** (0.03)	-0.08** (0.03)	-0.08*** (0.03)	-0.09*** (0.03)
	Tech. Industry & technology	0.08*** (0.03)	0.06** (0.03)	0.03 (0.03)	0.05** (0.03)	-0.05** (0.03)	-0.06** (0.03)
	Tech. Trade & administration	-0.11*** (0.02)	-0.06** (0.03)	-0.08*** (0.03)	-0.04 (0.02)	-0.12*** (0.02)	-0.13*** (0.02)
	Tech. Health & services	-0.06* (0.03)	0.02 (0.03)	0.01 (0.03)	0.04 (0.03)	-0.06* (0.03)	-0.07** (0.03)
	General L	-0.07*** (0.03)	-0.02 (0.03)	-0.07** (0.03)	-0.02 (0.03)	-0.17*** (0.03)	-0.18*** (0.03)
	General ES	0.06*** (0.02)	0.10*** (0.02)	0.04* (0.03)	0.10*** (0.03)	-0.06** (0.03)	-0.07*** (0.03)
	General S	0.24*** (0.02)	0.22*** (0.02)	0.14*** (0.03)	0.20*** (0.03)	0.01 (0.03)	-0.01 (0.03)
Gender	Male (*ref.*)						
	Female		-0.11*** (0.01)	-0.12*** (0.01)	-0.12*** (0.01)	-0.11*** (0.01)	-0.11*** (0.01)
Parents' level of education	Higher education degree (*ref.*)						
	Baccalaureate		-0.05*** (0.02)	-0.05*** (0.02)	-0.05*** (0.02)	-0.03* (0.01)	-0.03** (0.01)
	Upper secondary		-0.07*** (0.02)	-0.07*** (0.02)	-0.06*** (0.02)	-0.03* (0.01)	-0.03* (0.01)
	None or lower secondary		-0.10*** (0.02)	-0.09*** (0.02)	-0.08*** (0.02)	-0.05*** (0.02)	-0.05*** (0.02)
Household reference person's socio-professional category	Managerial and intellectual professions (*ref.*)						
	Intermediate professions		-0.05*** (0.02)	-0.05*** (0.02)	-0.03** (0.02)	-0.02 (0.02)	-0.02 (0.02)
	White-collar workers		-0.04* (0.02)	-0.04* (0.02)	-0.03 (0.02)	-0.00 (0.02)	0.00 (0.02)
	Craftspeople and traders		-0.03 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.01 (0.02)	-0.01 (0.02)
	Farmers		-0.00 (0.03)	-0.01 (0.03)	0.00 (0.03)	-0.01 (0.03)	-0.01 (0.03)
	Blue-collar workers		-0.04** (0.02)	-0.04** (0.02)	-0.03 (0.02)	-0.02 (0.02)	-0.01 (0.02)
	Unemployed		-0.14** (0.07)	-0.14** (0.07)	-0.14** (0.07)	-0.12* (0.06)	-0.11* (0.06)
Urban unit on starting secondary education	< 20 000 inhabitants		-0.02 (0.01)	-0.02* (0.01)	-0.02* (0.01)	-0.01 (0.01)	-0.01 (0.01)
	20 000 to 200 000 inhabitants (*ref.*)						
	200 000+ inhabitants (excluding Paris		0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
	Paris		0.10*** (0.02)	0.11*** (0.02)	0.11*** (0.02)	0.08*** (0.02)	0.08*** (0.02)
Parents' country of birth	At least one parent born in France (*ref.*)						
	Both parents born abroad		0.00 (0.02)	0.01 (0.02)	0.02 (0.02)	-0.00 (0.02)	-0.01 (0.02)
Grade in French and maths (/20) in the continuous French certificate of education				0.02*** (0.00)	0.01* (0.00)	-0.00 (0.00)	0.00 (0.00)
Baccalaureate honours	Pass (*ref.*)						
	Fair				0.10*** (0.01)	0.05*** (0.01)	0.05*** (0.01)
	Good or very good				0.19*** (0.02)	0.11*** (0.02)	0.10*** (0.02)
Highest qualification achieved in higher education	No qualification (*ref.*)						
	Bac+2 (DEUG/BTS/DUT)					0.13*** (0.02)	0.10*** (0.02)
	Bachelors'					0.22*** (0.02)	0.17*** (0.02)
	Bac+4/5 in university					0.31*** (0.02)	0.25*** (0.02)
	Grandes écoles					0.41*** (0.02)	0.36*** (0.02)
Age at which employment is reported							0.02 (0.01)
Number of years since leaving the education system							-0.01* (0.01)
Year in which employment is reported	2005 (*ref.*)						
	2006						0.10* (0.05)
	2007						0.17*** (0.06)
	2008						0.22*** (0.06)
	2009						0.28*** (0.08)
	2010						0.28*** (0.09)
	2011						0.29*** (0.10)
	2012						0.34*** (0.11)
Constant		7.19*** (0.02)	7.30*** (0.03)	7.10*** (0.04)	7.14*** (0.04)	7.15*** (0.04)	7.44*** (0.32)
Observations		4,781	4,781	4,781	4,781	4,781	4,781
R^2		0.137	0.181	0.190	0.212	0.276	0.283

Notes: Standard errors shown in brackets.
Sources: Panel 1995-EVA. Baccalaureate holders having reported a job in the EVA survey.

Table A2-3 – **Gender inequalities in access to a managerial position at start of working life and the mediating role of the baccalaureate**

	Total association	+Performance at end of middle school	+Baccalaureate stream	+Baccalaureate track	+Baccalaureate honours	+Higher education degree
		(2)	(3)	(4)	(5)	(6)
Women (*ref.*: Men)	-0.07***	-0.11***	-0.12***	-0.10***	-0.09***	-0.06***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Observations	5,090	5,090	5,090	5,090	5,090	5,090
R^2	0.117	0.197	0.213	0.231	0.262	0.436

Notes: All models control for social background, urban unit division on starting secondary education and parents' country of origin. Standard errors shown in brackets.
Sources: Panel 1995-EVA. Baccalaureate holders having reported a job in the EVA survey.

Forms of Work Organisation and Daily Mobility of Workers in Île-de-France

Laurent Proulhac*

Abstract – This article examines the effects of recent spatial and temporal changes in forms of work organisation on the daily mobility of working people in the Île-de-France region. On the basis of the 2010 Transport Global Survey (Île-de-France Mobilités-OMNIL-DRIEA), spatial ("sedentary", "mobile") and temporal ("standard", "shifted") categories are defined to describe forms of work organisation. The results show that these are associated with different daily mobility practices of workers in Île-de-France and their use of modes of transport. Mobile work organisation results in them travelling more and for greater distances, spending more time on transport and using automobiles more often. Shifted work organisation favours more intensive use of automobiles, but reduces personal daily mobility. Over the period 2001-2010, the results suggest that the decline in automobile use concerns all Île-de-France workers, regardless of the form of work organisation.

JEL Classification: R23
Keywords: daily mobility, workers, work organisation, Île-de-France

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The way in which the production of goods and services is organised has evolved in recent decades, influenced by fundamental trends such as globalisation and the tertiarisation of the economy, the specialisation and relocation of production sites, the outsourcing and subcontracting of business activities, the development of high-speed transport systems and the dissemination of information and communication technologies. These trends are contributing to changes in employment conditions (e.g. the increase in part-time, unpaid and precarious work) and to the emergence of new ways of organising work (more weekend work, the four-day week, etc.). The transformation in how working time is organised is reflected in the diversification of the working hours and schedules of employees. The working day is becoming more irregular and fragmented, with flexible, shifted and extended hours (Bué *et al.*, 2002; Chenu, 2002; Lesnard, 2006; Algava & Vinck, 2015). As well as these temporal developments, there have also been changes in the locations where work is carried out. The workplace is thus increasingly far from home, reflecting urban sprawl and the functional specialisation of spaces (Massot & Roy, 2004). It is also becoming more variable and multiple, in terms of meetings, visits to customers or patients, business meals, conferences, teleworking, etc. (Cragué, 2003; 2005; Boboc *et al.*, 2006). Beyond the sphere of work alone, these temporal and spatial changes are influencing how the daily lives of employees are organised. In particular, they make it harder to separate work and personal life (Chenu & Herpin, 2002; Tremblay, 2003; Belton & de Coninck, 2007).

In this context, daily mobility, meaning all local journeys[1] by individuals on an average working weekday in order to perform routine activities in different timeframes and locations, is playing an increasingly important role in structuring the organisation of the daily lives of workers (Massot & Orfeuil, 2005; Gallez & Kaufmann, 2009). It has resulted in the adjustment of their work and personal activities in spatial and temporal terms. The daily mobility of workers has been evolving for several decades, influenced by new forms of work organisation, the dispersion of business spaces and lifestyle changes. The survey data show a decrease in the proportion of journeys between home and work, although these continue to dominate. The decrease in working hours, the gradual disappearance of the custom of going home in the lunch break, the growth of variable workplaces and the development of personal activities explain the decrease in travel to a fixed workplace (Aguiléra *et al.*, 2010; Hubert *et al.*, 2013). These trends are leading to an increase in the complexity and individualisation of workers' daily mobility. They are thus travelling further and further away from their place of residence. The democratisation of the automobile and the development of transport networks have contributed since several decades to the increase in the distance between home and work locations and to the expansion of the catchment areas in which workers live (Orfeuil, 2000). In Île-de-France, the distance between home and work increased from 6.8 km on average in the 1970s to 10.6 km in the 2010s, while the daily distance travelled by workers increased from 18.8 km to 24.4 km.[2] Also, the average speed of travel of workers is increasing as a result of changes in the use of modes of transport. Île-de-France workers are using the car more than in the 1970s, making an average of 1.88 journeys per day compared with 1.64 in the 1970s, despite a recent decrease. They are also using public transport more – at least in absolute terms – with 0.90 journey on average compared with 0.85 in the 1970s (Courel, 2008; Grimal, 2012; Courel & Bouleau, 2013; Calvier & Jacquesson, 2015).

In the literature on the daily mobility of workers, few studies have looked at the effects of forms of work organisation. Daily mobility is most often studied using data on commuting drawn from the census surveys. Although these data are useful because of their comparability over time (Commenges & Fen-Chong, 2017), commuting figures only take account of regular practices and do not include the effects of the spatial and temporal dispersion of work on worker daily mobility. Based on the National Transport Survey 1993-94, Gallez *et al.* (1997) conclude, however, that types of employment (full-time or part-time permanent contracts, fixed-term contracts, apprenticeships and temporary contracts) have a significant influence on workers' daily mobility. Based on the 1983, 1991 and 2001 Global Transport Survey, Aguiléra *et al.* (2010) show that more and more Île-de-France workers are working exclusively in fixed locations and that their work-related daily mobility is less than that of those working in variable locations. Lejoux & Pochet (2019) construct categories of workers with atypical daily mobility based on the 2015 Rhône-Alpes

1. On the basis of surveys on the scale of large conurbations or urban areas, it is limited to travels within 80 km of home. This limitation excludes some long-distance journeys, even if they take place daily.
2. Author's calculations, based on Global Transport Survey 1976 (DREIF) and 2010 (IDFM-DRIEA).

Regional Transport Survey, including workers without fixed workplaces, workers arriving at work before 7.00 am and those ending work after 8.00 pm. The authors explain the contrasting effect of these situations on their daily mobility in terms of journeys, distances, durations and automobile use.

In line with this research, this paper focuses on the daily mobility of Île-de-France workers in different forms of work organisation. It assumes that the spatial and temporal constraints of work affect their daily mobility practices in different ways.

The rest of the paper is organised into four sections. The first section presents the data, sample and methodological choices. The second section sets out the forms of work organisation, the characteristics of the workers associated with them and their evolution. The third section examines the effects of forms of work organisation on the number of journeys, their distance and their duration, and the fourth section addresses the use of modes of transport. The conclusion sets out the limits and other avenues of research.

1. Data and Methods

1.1. The Global Transport Survey and the Measurement of Journeys

The quantitative analysis draws on the 2001 and 2010 Global Transport Survey (*Enquête globale transports*), carried out by the Regional directorate of equipment of Île-de-France (*Direction régionale de l'equipement d'Île-de-France,* DREIF) in 2001 and by *Île-de-France Mobilités* (IDFM) and the Regional and interdepartmental directorate of equipment and development (*Direction régionale et interdépartementale de l'équipement et de l'aménagement,* DRIEA) in 2010.

These surveys allow for monitoring the evolution of the local journey practices of people in Île-de-France in order to define daily mobility and transport policy. In 2010, the population sample consists of 14,885 households in the region, i.e. 32,241 individuals aged 5 years and over completing 124,262 journeys. An adjustment corrects the sample so that it can be representative of households. The household questionnaire collects information such as the town of residence, the type of property, income and car ownership. The individual questionnaire provides information on the gender, age, main occupation, socioprofessional category, the town of work and driving license possession of the individuals in the household. Lastly, the journey questionnaire specifies the starting point, destination, mode of transport, reason, duration and distance of each journey of individuals on one working weekday.

Based on these data, the analysis is developed using four indicators: (*i*) the number of journeys per worker, (*ii*) the distance budget,[3] (*iii*) the transport time budget and (*iv*) the division between modes of transport (Massot & Orfeuil, 2005). Each indicator is built around the concept of a "journey" defined as a movement between a starting point and a destination point, characterized by one or more modes of transport, and by a single motive (Commenges, 2015).

On the basis of the information in the journey questionnaire, we can identify the workplaces to which workers are travelling. Work related journeys are divided into a fixed and usual reported workplace where workers go at least three times a week, and variable and secondary workplaces[4] (CERTU, 2013). In the analysis, the definition of the workplace is based on the actual journeys of the respondent on the day of observation and not on the location reported *a priori*, which is often at the address of the employer's establishment (Crague, 2003; Commenges & Fen-Chong, 2017).

For workers whose work includes professional tours or visits to patients, for example, only one workplace is retained, the furthest from the starting point. In addition, information related to travel that is inherent to the activity (bus driver, deliveryman, etc.) are not reported, since transport, and the succession of stops, is part of the working activity itself.

Finally, for the study of changes between 2001 and 2010, the modalities of the motives of work related journeys reported in the 2001 survey needed to be recoded: in this survey, workers with several places of work had to report one as fixed in the individual questionnaire, whereas in 2010 they declared only one variable place of work. As a result, in 2001 the journey questionnaire contained two motives (travel to a variable workplace and travel to a fixed location), whereas in 2010 it only contained one (travel to a variable location). The correction for the 2001 survey then consisted in recoding the journeys to the fixed workplace of workers

3. The calculation of distance is based on a grid of 100x100 metres in 2010 and 300x300 metres in 2001. A distance as the crow flies (range) is measured for each journey based on the starting point and destination squares (Courel, 2008).

4. The 2010 survey distinguishes three reasons for a journey related to work in a variable location: work in another location, business outside the usual workplace (professional appointments, meetings, etc.) and professional tours.

reporting multiple workplaces as journeys to a variable workplace.

1.2. Categorization of Forms of Work Organisation

The analysis is restricted to only those workers who worked on the day to which the survey refers, and having made at least one work-related trip. We exclude workers who usually work at home (5%) as well as those who teleworked at home on the day surveyed. In addition to home-based teleworkers, workers travelling outside Île-de-France (2% of workers) are also left out because the distances and durations of these journeys are not reported. In 2010, 82% of workers with work outside the home work one day a week, a figure which stood at 86% in 2001. They represent 12,105 respondents in 2010, i.e. 3.9 million Île-de-France workers among the 5.1 million surveyed, and 8,789 surveyed in 2001.

Actual daily mobility practices enable the identification of the spatial and temporal organisation of the workers' work on one business day. As proposed by Crague (2003), the spatial dimension of work is built on the basis of the reasons for work journeys. Two forms of spatial organisation of work are distinguished. First, a "sedentary" work organisation when the work is carried out exclusively at a fixed location, as long as the reason for all the work journeys is "fixed and usual workplace". Second, a "mobile" organisation of work when the work is carried out in at least one variable workplace, as long as at least one reason for the work journeys is "variable workplace". In terms of the temporal dimension of work, two forms of work organisation are distinguished based on work journey times. First, a "standard" temporal organisation as long as work journey arrival times at the workplace (marking the start of work) are between 7.00 am and 8.00 pm, and work journey departure times (indicating the end of work) are also included in this time bracket.[5] This temporal organisation is the most usual norm for working. It is consistent with an ordinary working day, lasting approximately eight hours and organised around the middle of the day (Lesnard, 2006; Bué *et al.*, 2009; Sautory & Zilloniz, 2015). Second, work carried out between 8.00 pm and 7.00 am (even partially) is classed as a "shifted" temporal organisation. It corresponds to at least one work journey for which the time of arrival at work or departure from work is between 8.00 pm and 7.00 am. This organisation involves shifted working hours and includes night work (11.00 pm-5.00 am according to the Labour Code) and morning and evening work.

Combining these spatial and temporal dimensions, a categorisation of four forms of work organisation is retained: (*i*) "sedentary and standard", or *sedent_s* hereinafter, the most traditional form of work; (*ii*) "sedentary and shifted", *sedent_d*; (*iii*) "mobile and standard", *mobile_s*; and (*iv*) "mobile and shifted",[6] *mobile_d*. Note that this categorization is based on the observation of a weekday that does not capture the individual variation in work organisation from one day to the next (Commenges, 2015).

2. Evolution of the Forms of Work Organisation of Île-de-France Workers

2.1. Traditional Work Organisation Still Dominant but Decreasing

The sedentary form of work organisation is prevalent: it applies to 73% of Île-de-France workers (Table 1). In contrast, 27% have worked in at least one variable location (18% worked there without going to a fixed location). Between 2001 and 2010, the spatial organisation of work has changed: the sedentary form decreases (-4% of workers) while the mobile form increases (+36% of workers). This growth also appears in the average number of variable workplaces per worker: 0.40 in 2010 *vs.* 0.32 in 2001. These variable workplaces account for 33% of their total daily workplaces, compared with 27% in 2001. The literature suggests that the multiplicity of workplaces observed since the 1980s and 1990s by Crague (2003; 2005) and Boboc *et al.* (2006) is related to changes in the organisational and productive approach of companies which requires more contacts, changes in employment conditions – including the rise in the number of involuntary part-time workers with several jobs and self-employed workers – and the spread of remote working tools (Aguiléra *et al.*, 2007; Bouleau & Leroi, 2016).

The majority of workers in Île-de-France (82%) work in a standard form of temporal organisation. In the period 2001-2010, the concentration of work in the 7.00 am-8.00 pm bracket increases (Table 2). While working times are closely connected to socioprofessional categories (Chenu, 2002), the reduction in shifted work organisation over the period mainly concerns

5. However, the start of the journey to get to work might not be included in the bracket, and the same applies to the end of the journey from work. For example, the temporal organisation of a worker leaving home at 6.45 am and arriving at work at 7.30 am, and then leaving work at 7.30 pm to return home at 8.15 pm, is considered standard.

6. The spatial and temporal dimensions are not necessarily simultaneous. For example, work at a variable location may be done during the day and work between 8.00 pm and 7.00 am at a fixed location.

Table 1 – **Evolution of the spatial organisation of work (2001–2010)**

	2001	2010
Forms of spatial organisation of work (%)		
Sedentary	79	73
Mobile	21	27
Number of different workplaces (mean and CI)[1]		
Total number of workplaces	1.19 [1.17; 1.20]	1.22 [1.21; 1.23]
Number of variable workplaces	0.32 [0.31; 0.34]	0.40 [0.39; 0.42]
Journeys between home and fixed workplace		
Average (median) distance in km	10.3 (7.2)	10.9 (7.7)
Average (median) time in minutes	37 (30)	43 (35)
Journeys between home and variable workplace [2]		
Average (median) distance in km	10.9 (7.6)	12.2 (8.1)
Average (median) time in minutes	41 (30)	48 (40)

[1]The number of workplaces is defined with the grid: each square in which a working activity is carried out is considered a workplace. The lower and upper limits of the 95% confidence interval [CI] are specified.
[2]The distance is calculated using the coordinates of the home and variable workplace squares.
Sources and coverage: Enquête Globale Transport 2001 (DREIF) and 2010 (IDFM-DRIEA). Employed workers.

Table 2 – **Change in the temporal organisation of work (2001–2010)**

	2001	2010
Forms of temporal organisation of work (%)		
Standard	78	82
Shifted	22	18
Distribution of workers by working hours and times (%)		
At work before 7.00 am	9	8
At work after 8.00 pm	13	9
Working time more than 10 hours	19	14
Working time fewer than 4 hours	6	8
Average (and median) work schedule		
Time of arrival at work	9.00 am (8.40 am)	9.00 am (8.45 am)
Time of departure from work	5.20 pm (5.45 pm)	5.30 pm (5.35 pm)
Average (and median) working time		
Working time (hours)	8.15 am (8.35 am)	8.00 am (8.20 am)
Working time at fixed workplace (hours)	7.00 am (8.15 am)	6.30 am (7.55 am)
Working time at variable locations (hours)	1.15 am (0.00 am)	1.30 am (0.00 am)

Notes: The reduction of the day to between 4.00 am and 4.00 pm results in a slight underestimation of the working time of workers.
Sources and coverage: Enquête Globale Transport 2001 (DREIF) and 2010 (IDFM-DRIEA). Employed workers.

tradespeople, retailers and company heads (27% in 2010 *vs.* 33% in 2001), managers (14% *vs.* 19%) and employees (20% *vs.* 23%). In contrast, the proportion of manual workers in a shifted organisation is stable (34%).

The working day of Île-de-France workers starts at 9.10 am on average. For half of them, it starts before 8.45 am, for 8% before 7.00 am and for 1% after 8.00 pm. Between 2001 and 2010, the average time of arrival at work increased by 10 minutes. In 2001, more workers started work earlier: 50% of workers before 8.40 am, and 9% before 7.00 am. But the delay in the start of work does not mean any spreading of the time of arrival at work. For example, the times of arrival at work of managers in Île-de-France are increasingly synchronised between 9.00 am and 9.30 am despite greater flexibility in their choice of times (Munch, 2017). Also, the average time of departure from work is delayed by 10 minutes, until 5.30 pm, so the length of the working day is stable. However, the later end of work does not mean a higher frequency of evening or night work – only 9% of Île-de-France workers end work after 8.00 pm in 2010, compared with 13% in 2001 – but again reflects a higher concentration at the end of the working day: 25% of workers end work between 5.30 pm and 6.29 pm in 2010, compared with 23% in 2001.

The average length of the working day for Île-de France workers is 8 hours, with 14% of them having a long working day (over 10 hours) and 8% a short day (under 4 hours). Over the period, the decrease in long working days and the growth in short working days resulted in a 15-minute decrease in average working time. Île-de-France workers spend less time (-30 minutes) in a fixed workplace – 81% of active time in 2010 compared with 85% in 2001 – and more time (+15 minutes)

at variable locations. This decrease in working time is consistent with that observed in work based on the Time Use surveys, analysed as a consequence of the laws of 2002 on the reduction of working hours and the development of part-time work (Chenu & Herpin, 2002; Brousse, 2015).

The *sedent_s* (sedentary and standard) work organisation represents the day of six in ten Île-de-France workers, while the *mobile_d* (mobile and shifted) organisation represents the day of only one in twenty workers (Table 3). The change from 2001 to 2010 is characterized by the increase in *mobile_s* (mobile and standard) work, which represents more than one in five working days in 2010, the decrease in *sedent_d* (sedentary and shifted) work and the decrease in the *sedent_s* form.

At the same time, the spatial restructuring related to urban sprawl and the functional specialisation of spaces has increased the distance between workers and workplaces. In 2010, workers living and working in Île-de-France travel 10.9 km on average to reach their fixed workplace, compared with 10.3 km in 2001, and 12.2 km to reach variable locations, compared with 10.9 km in 2001. Variable workplaces are further from the place of residence than the fixed location. The difference in distance probably reflects the fact that workers take the distance to their fixed workplace into account in their choice of residential location – in addition to urban facilities, the neighbourhood and the price/surface area ratio of the property – which a multitude of variable workplaces does not allow for (Baccaïni, 1996; Massot & Roy, 2004). It also perhaps expresses more limits on the choice of location of some workers working at variable locations due to their socioeconomic characteristics. Increased spatial distance from workplaces is accompanied by temporal distance. Île-de-France workers take an average of 43 minutes to travel from their home to a fixed workplace in 2010, compared with 37 minutes in 2001, and 48 minutes to reach their variable workplaces, compared with 41 minutes in 2001.

2.2. Different Forms of Work Organisation by Socioprofessional Categories

The form of work organisation strongly correlates to the socioprofessional category (Table 4). Specifically, professional status is essential: the self-employed are always much more likely to work in an atypical form of work organisation. On the one hand, work outside their fixed location is common among company heads and tradespeople, and to a lesser extent, due to being based in a store or shop, among retailers (Crague, 2003). On the other hand, their work is often carried out during extended hours, in the morning and evening (Lesnard, 2006).

There is also a hierarchy between the socioprofessional categories. Less skilled workers, such as manual workers and personal service providers, are more likely to work in an atypical form of work organisation. These results are consistent with those of the literature (Chenu, 2002; Crague, 2003; 2005; Lesnard, 2006; Boulin & Lesnard, 2018). For example, Chenu (2002) observes that work in shifted schedules primarily concerns manual workers in industry, handling, warehouse work and transportation and, among personal service providers, childminders, cleaners and caterers.

Nevertheless, other socioprofessional categories regularly work in atypical forms of organisation too. Thus, the work of supervisors is often sedentary and shifted, and mobile and standard, in line with their supervisory role on site. Similarly, the *sedent_d* organisation is common among sales staff and public sector employees due to demand from customers, patients and citizens (Chenu, 2002; Daniel, 2014; Sautory & Zilloniz, 2015). Moreover, as already noted by Crague (2003) and Boboc *et al.* (2006), management and intermediate professions correspond somewhat, particularly in the public sector, to a mobile work organisation, but not as much as company heads and professional occupations. Two explanations can be put forward. On the one hand, managers sometimes seek to reduce their local work journeys – viewed increasingly negatively – by

Table 3 – **Breakdown of forms of work organisation**

	2001		2010		Change in population (%)
	Population in thousands	%	Population in thousands	%	
Sedentary and standard	2,336	63	2,310	60	-1
Sedentary and shifted	612	16	508	13	-17
Mobile and standard	572	15	854	22	+49
Mobile and shifted	213	6	211	5	-1
Total	3,734	100	3,883	100	+4

Sources and coverage: Enquête Globale Transport 2001 (DREIF) and 2010 (IDFM-DRIEA). Employed workers.

Table 4 – **Effects of individual characteristics on the probability of exercising a form of work organisation (Reference: Sedentary and standard, *N*=7,365)**

	Proportion (%)	Sedentary and shifted (*N*=1,588)		Mobile and standard (*N*=2,532)		Mobile and shifted (*N*=620)	
		Coeff.	Odds ratio	Coeff.	Odds ratio	Coeff.	Odds ratio
Socioprofessional category							
Private sector executives and engineers	17.6	*Ref.*		*Ref.*		*Ref.*	
Tradespeople	1.5	1.3802***	4.0	2.469	9.2	2.4750***	11.9
Retailers	1.4	0.9752***	2.6	1.0110***	2.7	1.2169***	3.4
Company managers	0.8	0.3653	1.4	1.3674***	3.9	1.7177***	5.6
Liberal occupations	1.4	1.5806***	4.9	1.4115***	4.1	1.5968***	4.9
Public sector executives	10.8	0.2206	1.2	0.4795***	1.6	0.5204***	1.7
Public sector intermediate prof.	10.8	0.2658**	1.3	0.3376***	1.4	-0.0616	0.9
Public sector clerical staff	10.0	1.0892***	3.0	-0.2541**	0.8	0.2589	1.3
Private sector intermediate prof.	10.6	0.1357	1.1	-0.0853	0.9	-0.4765**	0.6
Technicians	4.5	-0.1822	0.8	0.1354	1.1	-0.7922***	0.5
Supervisors, overseers	1.7	1.0406***	2.8	0.5257***	1.7	0.4494	1.6
Clerical staff	8.1	-0.1556	0.9	-0.6210***	0.5	-1.4782***	0.2
Sales staff	2.5	1.6608***	5.3	-1.2969***	0.3	0.0503	1.1
Personal services workers	3.7	1.4927***	4.4	1.2133***	3.4	0.7443	2.1
Skilled manual workers, drivers	10.2	1.2536***	3.5	0.7726***	2.2	0.9489***	2.6
Unskilled and agricultural workers	4.4	1.4947***	4.5	0.3382**	1.4	1.2860***	3.6
Gender							
Male	53.8	*Ref.*		*Ref.*		*Ref.*	
Female	46.2	-0.6565***	0.5	-0.5869***	0.6	-1.0166***	0.4
Working time							
Full-time	91.3	*Ref.*		*Ref.*		*Ref.*	
Part-time	8.7	-0.1302	0.9	0.4255***	1.5	0.3023*	1.4
Property occupancy status							
Owner, homebuyer	51.7	*Ref.*		*Ref.*		*Ref.*	
Tenant	45.5	0.0850	1.1	0.2366***	1.3	-0.0094	1.0
Housed free of charge	2.8	0.0693	1.1	0.4903***	1.6	-0.2978	0.7
Level of education							
Higher	59.5	*Ref.*		*Ref.*		*Ref.*	
Primary	3.0	0.8078***	2.2	0.3978***	1.5	0.4879**	1.5
Secondary	37.5	0.2875***	1.3	-0.0011	1.0	0.1705	1.2
Number of people in the household							
Two or more people	81.0	*Ref.*		*Ref.*		*Ref.*	
Single person	19.0	0.2056***	1.2	-0.1350**	0.9	0.1122	1.1
Age							
30 to 44	45.7	*Ref.*		*Ref.*		*Ref.*	
Under 30	15.2	0.1401*	1.2	-0.0852	0.9	-0.1019	0.9
45 to 59	35.0	-0.0324	1.0	0.0693	1.1	-0.1055	0.9
60+	4.1	0.0943	1.1	0.3449***	1.4	0.4419**	1.6
Place of residence[(a)]							
Urban centre (excluding Paris)	69.1	*Ref.*		*Ref.*		*Ref.*	
Paris	20.1	0.0575	1.1	0.1947***	1.2	0.2743	1.3
Peri-urban	10.8	-0.0910	0.9	0.0323	1.0	-0.0224	1.0
McFadden's pseudo R^2				0.080			
N				12,105			

[(a)]Three categories of residence from the 2010 INSEE urban zoning (Floch & Levy, 2011) are defined: Paris, the urban centre excluding Paris and the peri-urban area. Because the urban area of Paris is larger than the region, peri-urban areas are under-represented.

Notes: The results derive from a multinomial logistic regression. The explanatory variables are age, gender, socioprofessional category, working hours, degree, place of residence, income per unit of consumption of the household, number of employed workers, number of people, number of young children and property occupancy status. The table gives the coefficient and odds ratio for each modality of the most significant variables. The selected variables are sorted in descending order of significance (stepwise procedure). Significance: * 10% threshold; ** 5% threshold; *** 1% threshold.

Sources and coverage: Enquête Globale Transport 2010 (IDFM-DRIEA). Employed workers.

using ICT and delegating to other employees (Aguiléra *et al.*, 2007). On the other hand, part of their work is beyond the local scale and involves long-distance travel that is more valued. This is less relevant to company heads and professional occupations (Aguiléra & Proulhac, 2015).

Since 2001, the growth of the *mobile_s* organisation in Île-de-France relates more to tradespeople, retailers and company heads, manual workers, and managers and intermediate professions in the public sector.[7] The decrease of the *mobile_d* organisation relates to all socioprofessional categories, with the exception of tradespeople, retailers, company heads and manual workers. The same is true of the *sedent_d* organisation. Lastly, the proportion of the *sedent_s* organisation is stable among managers, slightly decreasing among intermediate professions and employees, and decreasing more steeply among manual workers, tradespeople, retailers and company heads. These contrasting developments reinforce the opposition between the categories that mainly operate in a traditional organisation, in particular the intermediate professions and corporate employees, and those operating more often in an atypical organisation (Lesnard, 2006).

3. The Work and Personal Journeys of Workers in Île-de-France Relate to the Form of Work Organisation

3.1. Differences in Daily mobility According to Forms of Work Organisation

On a working day, the daily mobility of Île-de-France workers is, on average, 4.25 journeys covering 28.1 km and taking 123 minutes (Table 5). Work-related journeys account for 36% of journeys, 47% of journey distance and 45% of journey time. Since 2001, their share in total daily mobility has been decreasing, except in terms of distance, but their number has increased (from 1.48 to 1.55 journeys, from 12.7 km to 13.2 km and from 48 to 55 minutes) in line with the increase in journeys to variable locations (from 0.38 to 0.47 journey, from 3.2 km to 4.0 km and from 13 to 18 minutes).

In fact, while work related journeys still primarily relate to fixed workplaces, they nevertheless relate increasingly to variable workplaces, which account for 30% of work related journeys in 2010, compared with 26% in 2001, i.e. 30% of distances travelled for work in 2010 *vs.* 25% in 2001, and 33% of time spent on work journeys *vs.* 27% in 2001. This change is due to the multiplicity of workplaces and, as pointed out by Hubert *et al.* (2013), to the higher proportion of continuous days without returning home in the lunch break. Also, work journeys, particularly those relating to variable workplaces, mainly take place at standard times[8] – more than nine in ten journeys take place between 7.00 am and 8.00 pm. Since 2001, these journeys at standard times have been increased by the decline in the proportion of workers working shifts.

The work journeys of Île-de-France workers vary according to the form of work organisation. The differences reflect the increased daily mobility associated with mobile work organisation. In fact, daily mobility in its *mobile_d* form is more than twice as high as *sedent_d* daily mobility. In the latter category, work activity is more often carried out continuously, without a lunch break outside the workplace.

7. The 2001 classification only enables the comparison of eight positions in socioprofessional categories, but nevertheless allows for a distinction to be made between the private and public sectors.
8. For each work related journey, only the time of arrival is considered to define its time.

Table 5 – **Mobility by motive by form of work organisation in 2010**

	Sedentary and standard	Sedentary and shifted	Mobile and standard	Mobile and shifted	Total
Journeys (number/day)	3.99	3.63	5.15	4.89	4.25
Return home	1.40	1.46	1.56	1.49	1.45
Work	1.30	1.19	2.23	2.44	1.55
Personal	1.29	0.98	1.36	0.96	1.25
Distance (kilometres/day)	25.6	24.1	34.2	40.1	28.1
Return home	10.0	10.6	11.2	13.6	10.5
Work	11.1	10.4	17.9	22.5	13.2
Personal	4.5	3.1	5.1	4.0	4.4
Duration (minutes/day)	112	94	159	163	123
Return home	43	41	51	50	45
Work	45	37	81	95	55
Personal	24	16	27	18	23

Notes: The Student test shows that the means are significantly different, see Appendix 1, Table A1-1.
Sources and coverage: Enquête Globale Transport 2010 (IDFM-DRIEA). Employed workers.

However, the differences in daily mobility between forms of work organisation narrow over the period. This trend can be explained by the increase in daily mobility in sedentary forms of work organisation and by the decrease in daily mobility in mobile forms of work organisation, reflecting the decrease in the proportion of workers having both fixed and variable workplaces (Aguiléra *et al.*, 2010). Lastly, regardless of the form of work organisation, the daily mobility of Île-de-France workers is less and less structured according to work activity.

3.2. Differences in Daily Mobility between Socioprofessional Categories: A Reflect of Different Forms of Work Organisation

Differences in daily mobility by forms of work organisation are also observed within each socioprofessional category. The high level of heterogeneity of daily mobility between these categories thus mainly reflects the unequal distribution of forms of work organisation. The high shares of mobile work among tradespeople, company heads, professional occupations, supervisors, personal service providers, workers and technicians explains their high level of daily mobility (see Figure). The nature of their activity causes them to make many journeys to variable locations.[9] This is especially true for tradespeople (1.34 journeys, 12.6 km, 54 minutes), company heads (1.33 journeys, 12.0 km, 39 minutes) and supervisors (0.72 journey, 9.6 km, 40 minutes). This result is in line with that of Aguiléra *et al*. (2007), which shows that the high level of mobility in the work of some workers is essential for companies to function.

In contrast, the more frequently sedentary work of sales and clerical staff contributes to their low level of daily mobility.[10] The number of their journeys to variable locations is much lower than that of other socioprofessional categories. It accounts for less than 10% of the work-related daily mobility of sales staff. For these categories, the fact that their workplace is fixed and close to home results in limited daily mobility (1.16 journeys, 9.5 km, 46 minutes of transport).

Similarly, differences in daily mobility in shifted schedules between socioprofessional categories cannot be interpreted independently of the mixed distribution of forms of temporal work organisation. For unskilled and skilled manual workers, tradespeople, supervisors, public sector employees, sales staff and personal service providers, work related mobility corresponds most often to shifted working hours. For example, 19% of unskilled workers' work related journeys start and end between 8.00 pm and 7.00 am.

By contrast, shifted daily mobility is marginal among company heads, professional occupations, public sector managers, corporate managers and corporate administrative staff: it accounts for between 1% and 3% of their overall work-related daily mobility.

3.3. The Form of Work Organisation Determines Personal Daily mobility

Personal activities encompass two different types of reasons for travel: the first, according to Tabaka (2009), relates to "leisure and social activities" (visits to friends, walks, entertainment, sports, etc.), and the other to "household logistics" (shopping, care, health, processes, etc.). These activities have a minimal role in structuring the daily mobility of Île-de-France workers, particularly in terms of transport distance and time, since they are often carried out in the immediate spatial and temporal vicinity of the home or the workplace (Robette, 2012). Another explanation is that certain personal activities are delayed until non-work days (Aguiléra *et al.*, 2010). Nevertheless, the growth in journeys related to shopping and leisure activities[11] since 2001 results in a slight increase of the share of the total daily mobility of Île-de-France workers due to personal activities.

The results of a Student test indicate that personal daily mobility is significantly correlated to the form of work organisation (see Table A1-1 in Appendix 1). The *mobile_s* and *sedent_s* forms are associated to a higher level of personal daily mobility, owing to more leisure, social and household logistics activities. Conversely, personal daily mobility is lower in both the forms *nomad_d* and *sedent_d*. This reflects the constraints of morning, evening or night work on workers.

The *mobile_d* and *sedent_d* forms of organisation correspond to lower average personal daily mobility (Table 6). By contrast, the *mobile_s* form is not significantly related to personal daily mobility, indicating that the high work-related daily mobility associated with it does not take place at the expense of personal daily mobility.

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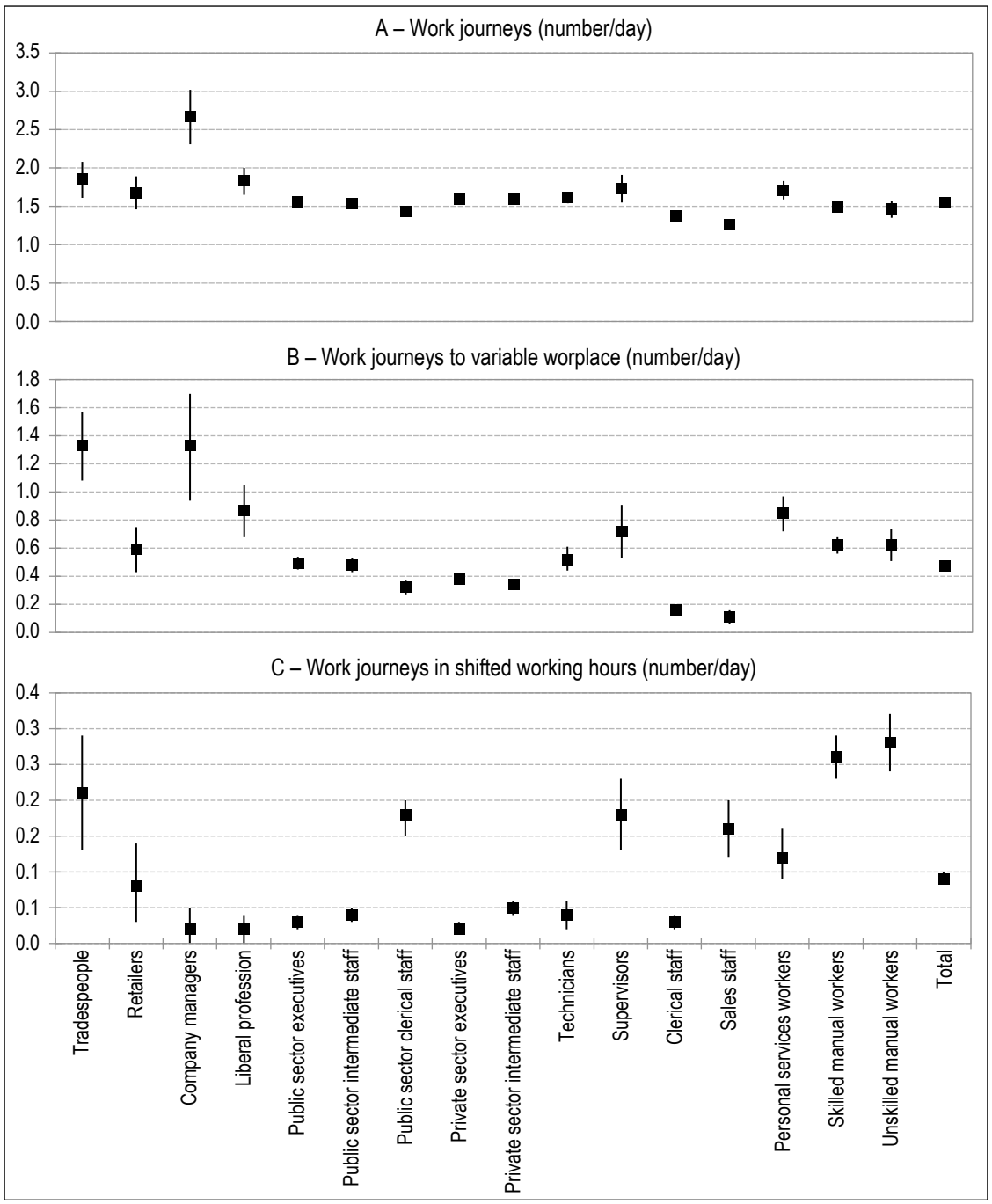
9. Company heads have the highest number of different daily workplaces (1.94 on average), ahead of tradespeople (1.52), professional occupations (1.39) and supervisors (1.39).

10. Administrative and sales staff have the lowest number of different daily workplaces (1.06 and 1.07, respectively).

11. This trend should be viewed with caution due to a methodological change in the 2010 survey, where greater attention is paid to local journeys (which are often related to personal activities).

Figure – **Journeys by socioprofessional category**



Note: The figure shows the means and confidence interval at 95%.
Reading Note: Tradespeople working in variable workplaces make an average of 1.34 business trips per day.
Sources and coverage: Enquête Globale Transport 2010 (IDFM-DRIEA). Employed workers in the sample.

One explanation is that, by providing the opportunity to access urban resources and facilities, work journeys increase workers' personal daily mobility. Detailed analysis of the reasons for journeys shows that this increase in personal daily mobility is due to going to lunch, hence associated with work activity. As regards the influence of individual factors, the results are consistent with those already documented in the literature. In particular, personal daily mobility is positively associated with the presence of young children in connection with care activity (Grimal, 2012). Part-time work also has a significant positive effect through more time available for personal activities (Gallez *et al.*, 1997). Also, as observed by Coutras (1997) and Motte-Baumvol *et al.* (2011), women have a significantly higher level of personal daily mobility – despite engaging in fewer leisure activities – due to more care and shopping activities. Differences are also observed according to the place of residence. The concentration of

businesses, services and equipment in the area of residence of Paris workers and often in that of their workplace – a majority of Parisians work in Paris or in the densely populated surrounding towns – favours higher levels of personal daily mobility (Vallée *et al.*, 2016). Lastly, personal daily mobility is significantly lower for workers in the lowest skilled categories of the socioprofessional hierarchy and for those with reduced cultural and financial resources. This may be partly due, as pointed out by Coulangeon *et al.* (2002), to less time spent in leisure activities.

Table 6 – **Effects of individual characteristics on the probability of making journeys for personal motives**

	Proportion (%)	Coefficient	Odds ratio
Socioprofessional category			
Private sector executives and engineers	17.6	*Ref.*	
Tradespeople	1.5	-0.1335	0.9
Retailers	1.4	0.0663	1.1
Company managers	0.8	-0.0498	1.0
Liberal occupations	1.4	0.0401	1.0
Public sector executives	10.8	0.0229	1.0
Public sector intermediate staff	10.8	-0.0165	1.0
Public sector clerical staff	10.0	-0.1052	0.9
Private sector intermediate staff	10.6	0.0340	1.0
Technicians	4.5	0.1595	1.2
Supervisors, overseers	1.7	-0.0820	0.9
Private sector clerical staff	8.1	0.0727	1.1
Sales staff	2.5	-0.4467***	0.6
Personal service workers	3.7	-0.3914***	0.7
Skilled manual workers, drivers	10.2	-0.2202**	0.8
Unskilled and agricultural workers	4.4	-0.2389**	0.8
Gender			
Male	53.8	*Ref.*	
Female	46.2	0.2301***	1.3
Working time			
Full-time	91.3	*Ref.*	
Part-time	8.7	0.3927***	1.5
Age			
30 to 44	45.7	*Ref.*	
Under 30	15.2	-0.1062*	0.9
45 to 59	35.0	-0.2040***	0.8
60+	4.1	-0.3379***	0.7
Level of education			
Higher	59.5	*Ref.*	
Primary	3.0	-0.4734***	0.6
Secondary	37.5	-0.1073**	0.9
Form of work organisation			
Sedentary and standard (sedent_s)	59.5	*Ref.*	
Sedentary and shifted (sedent_d)	13.1	-0.3297***	0.7
Mobile and standard (mobile_s)	22.0	-0.0160	1.0
Mobile and shifted (mobile_d)	5.4	-0.5007***	0.6
Number of people in the household			
Two or more people	81.0	*Ref.*	
Single person	19.0	0.2528***	1.3
Child under 10			
No children	62.1	*Ref.*	
With child(ren)	37.9	0.6670***	1.9
Place of residence			
Urban centre (excluding Paris)	69.1	*Ref.*	
Paris	20.1	0.3840***	1.5
Peri-urban	10.8	-0.1685***	0.8

➔

Table 6 – (*contd.*)

	Proportion (%)	Coefficient	Odds ratio
Income quintile[a]			
Fifth	20.4	*Ref.*	
First	19.2	-0.1728**	0.8
Second	19.8	0.0111	1.0
Third	20.2	0.0163	1.0
Fourth	20.4	0.0606	1.1
Property occupancy status			
Owner, homebuyer	51.7	*Ref.*	
Tenant	45.5	-0.1208***	0.9
Housed free of charge	2.8	0.0649	1.1
N	12,105		

[a]The thresholds of the monthly income quintiles per consumption unit (CU) are €1,250/CU, €1,800/CU, €2,200/CU and €2,850/CU.
Notes: The results derive from a binomial logistic regression. Significance: * 10% threshold; ** 5% threshold; *** 1% threshold.
Sources and coverage: Enquête Globale Transport 2010 (IDFM-DRIEA). Employed workers.

4. Forms of Work Organisation and the Mode of Transport

4.1. A Reduction in Automobile Use Regardless of the Form of Work Organisation

In Île-de-France, the daily mobility of workers is essentially motorised.[12] The automobile is the main mode of transport in terms of number of journeys (47%) and distance (55%), while public transport is the main mode in terms of duration (46%). Active modes (walking, cycling) occupy a more secondary position, except in terms of number of journeys (28%) (Table 7).

Beyond these averages, there are nevertheless differences in the distribution of the modes of transport between the forms of work organisation, and a Student test indicates that the average numbers of journeys by automobile, public transport and active modes are significantly different (see Table A1-2 in Appendix 1).[13] The traditional form of work organisation is more favourable to modes other than the automobile.[14] In line with the work of Zilloniz (2015) and Lejoux & Pochet (2019), the results indicate that shifted and mobile work organisations are increasing the use of automobiles. Their use is the most intensive in the *mobile_d* form (2.98 journeys, 30.5 km and 104 minutes). This can be explained by the greater ease of movement and parking and

12. The modes of transport are the individual motorised modes, comprising cars and two-wheeled motorised vehicles (for the sake of simplification the term "automobile" is used in the text), public transport, active modes combining walking and cycling, and other modes.
13. Only the averages of journeys by public transport between the "sedentary and standard" and "mobile and standard" work organisations, and in active modes between the "sedentary and shifted" and "mobile and shifted" work organisations do not differ at the 10% threshold.
14. Regarding the link between work activity and mode of transport, it should be borne in mind that two-way causality is credible. Although the choice of mode of transport derives from the activity, the activity doubtless also derives from the choice of mode of transport.

Table 7 – **Mobility by mode of transport according to forms of work organisation**

	Sedentary and standard		Sedentary and shifted		Mobile and standard		Mobile and shifted		Total	
	2001	2010	2001	2010	2001	2010	2001	2010	2001	2010
Journeys (number/day)	3.54	3.99	3.30	3.63	5.00	5.15	5.01	4.89	3.81	4.25
Public transport	0.95	1.10	0.64	0.78	0.95	1.13	0.82	0.95	0.90	1.06
Individual motorized modes	1.83	1.69	2.04	1.97	3.04	2.63	3.38	2.98	2.14	2.00
Active modes	0.75	1.19	0.61	0.87	0.99	1.37	0.78	0.93	0.76	1.18
Other modes	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.01	0.01
Distance (kilometres/day)	24.8	25.6	23.4	24.1	35.2	34.2	37.3	40.1	26.9	28.1
Public transport	11.2	13.3	6.3	7.7	8.6	11.2	6.7	8.7	9.8	11.8
Individual motorized modes	13.0	11.6	16.6	15.8	25.7	22.2	29.8	30.5	16.5	15.5
Active modes	0.6	0.7	0.5	0.5	0.7	0.7	0.5	0.5	0.5	0.7
Other modes	0.0	0.0	0.0	0.1	0.2	0.1	0.3	0.4	0.1	0.1
Duration (minutes/day)	99	112	85	94	145	159	151	163	107	123
Public transport	48	60	30	39	44	58	37	47	44	56
Individual motorized modes	43	39	48	45	84	84	104	104	55	53
Active modes	8	13	7	10	16	16	9	11	8	13
Other modes	0	0	0	0	1	1	1	1	0	1

Notes: The Student test shows that the means are significantly different, see Appendix 1, Table A1-2.
Sources and coverage: Enquête Globale Transport 2001 (DREIF) and 2010 (IDFM-DRIEA). Employed workers.

the lower frequency of public transport supply before 7.00 am and after 8.00 pm. Lastly, the highest daily mobility in the mobile form of work organisation is also accompanied by more journeys by public transport and active modes.

Considering only work-related daily mobility, the results are the same: automobile daily mobility is the most limited in the *sedent_s* form (38% of journeys, 41% of distance) and the most developed in the *mobile_d* form (64% of journeys, 77% of distance). In this form of work organisation, Île-de-France workers make more than three times more journeys and travel nearly four times more in terms of distance by automobile for work than workers in the *sedent_s* form. But they also have high levels of work-related daily mobility, in absolute terms, by public transport and in active modes.

The recent changes in the use of modes of transport in Île-de-France has benefited alternatives to the automobile. Active modes and public transport increase as a proportion of total daily mobility between 2001 and 2010, from 20% to 28% for the former and 24% to 25% for the latter, while the proportion of automobile use decreases from 56% to 47%. The trend is the same in work-related daily mobility alone, with strong growth in active modes, from 18% to 24%, and public transport, from 29% to 32%, and a sharp decrease in automobile use, from 53% to 44%. This decrease concerns both journeys to a fixed workplace (Calvier & Jacquesson, 2015) and to variable workplaces. The main reasons for this include the increased supply of public transport, the decrease in the average speed of automobiles – partly due to higher traffic levels and parking constraints – and the increase in their cost (Grimal, 2012).

While these shifts in the use of various modes of transport can be observed regardless of the form of work organisation, they are uneven in terms of extent. The growth in the proportion of active modes is more associated with Île-de-France workers in the *sedent_s* form, with an increase from 21% to 30%. This reflects in particular the increase in bicycle use, due to the roll-out of self-service bicycles available since 2007 in Paris and later in the surrounding towns. Workers in the *sedent_d* form are also using public transport more. The increase in public transport supply in the morning and evening, particularly of buses, and rising fuel costs – the workers in this form of organisation being among the most financially vulnerable – explain this. Also, automobile use has decreased significantly in favour of public transport in the *mobile_s* form. These trends doubtless reflect the increased difficulties relating to traffic levels and parking in the urban centres where the variable workplaces are concentrated.

4.2. The Mode of Transport Used to Travel to Work Depends on the Form of Work Organisation

In Île-de-France, the place of residence also has a major structuring effect on the use of modes of transport by workers, due to the organisation of the city and the transport system, with differences between socioprofessional categories (Sari, 2011; Proulhac, 2019). We provide an illustration of how wide these differences can be with the example of two socioprofessional categories in three different areas of residence in 2010: Parisian executives[15] and intermediate professions living in urban centres (except Paris) or peri-urban areas – which are the most numerous socioprofessional category in these areas (see Tables A2-1 and A2-2 in Appendix 2). Within each category, the differences remain notable in the use of modes of transport according to forms of work organization, not so much in terms of numbers of journeys, but by the relative share of use of automobile. This mode of transport is much higher among peri-urban workers of intermediate professions than among Parisian executives: whether in terms of number of journeys, distance or time, the hierarchy of the use of automobile or public transport appears completely reversed.

We now seek to examine in a more systematic way the determining factors of the mode of transport used by Île-de-France workers to travel to work. The analysis takes into account the specific effects of the individual characteristics, as already done by Sari (2011), and of the form of work organisation. A multinomial logistic regression models, all other things being equal, the probability of using one mode of transport, with individual motorized modes as the modality of reference. A main mode of transport is assigned to each worker from the first work journey of the day.[16] Individual motorized modes, the reference, account for 47% of the work journeys considered, compared with 43% for public transport and 10% for the active modes. In addition to the form of work organisation, the explanatory variables include the workers' age, gender, socioprofessional category, working hours, education level, place of residence, a control

15. Public and private sector workers are aggregated in order to have sub-populations of adequate size.
16. The mode of transport for the first work journey of the day is most often the one used for subsequent work journeys.

variable for the employment coverage rate,[17] and their household's property occupancy status, household's income, number of people, number of active workers and presence of a young child or children.[18] The results are presented in Table 8.

The odds ratio suggest that the place of residence is the most important variable. Parisian workers are much more likely to use public transport and active transport modes than urban and peri-urban workers (a result also obtained by Sari, 2011). This result is hardly surprising, given the urban structure and the organisation of the transport supply in Paris and the urban centres, which make alternative modes more competitive than automobiles. Another spatial variable, the rate of employment coverage in nearby towns, also has a significant positive effect on the use of alternative modes. The effect is particularly positive on cycling and walking, as workers have shorter journeys between home and work when the density of same socioprofessional jobs around the home is high.

Among the individual variables, the results demonstrate the variation in the choice of mode of transport associated to the socioprofessional category. Compared to executives in the private sector (the reference), the use of public transport is lower for the self-employed, especially company heads and tradespeople, skilled manual workers, intermediate public sector occupations and supervisors, while the use of active modes is lower for supervisors, corporate employees, skilled manual workers and technicians. Conversely, the use of active modes is higher for personal service providers (as is the use of public transport), professional occupations, sales staff and public sector employees. These differences doubtless partly reflect the more decentralized workplace of manual workers, supervisors and technicians, in locations where the availability of alternative modes is lower. As Coulangeon & Petev (2012) point out, they probably also illustrate the social dimension associated with

17. The coverage rate corresponds to the ratio of the number of jobs in a socioprofessional category (8 positions) to the number of workers in this socioprofessional category in the area (Baccaïni, 1996).
18. We do not introduce variables of holding a public transport season ticket or having an automobile since they are very likely of being bidirectional (Orfeuil, 2000).

Table 8 – **Effects of individual characteristics on the probability of using a mode of transport to travel to work (Reference: Individual motorized modes, *N*=6,051)**

		Public transport (*N*=4,935)		Active modes (*N*=1,119)	
	Proportion (%)	Coefficient	Odds ratio	Coefficient	Odds ratio
Place of residence					
Urban centre (excluding Paris)	69.1	*Ref.*		*Ref.*	
Paris	20.1	1.4191***	4.1	1.6448***	5.2
Peri-urban	10.8	-0.9015***	0.4	-0.5600***	0.6
Socioprofessional category					
Private sector executives and engineers	17.6	*Ref.*		*Ref.*	
Tradespeople	1.5	-1.6376***	0.2	-0.3198	0.7
Retailers	1.4	-1.2243***	0.3	-0.3382	0.7
Company managers	0.8	-2.0308***	0.1	-0.2059	0.8
Liberal occupations	1.4	-0.5127***	0.6	0.6722***	2.0
Public sector executives	10.8	-0.0065	1.0	0.4165***	1.5
Public sector intermediate staff	10.8	-0.5313***	0.6	0.3716***	1.4
Public sector clerical staff	10.0	-0.0808	0.9	0.5560***	1.7
Private sector intermediate staff	10.6	-0.0290	1.0	-0.4305***	0.6
Technicians	4.5	-0.3387***	0.7	-0.4615**	0.6
Supervisors, overseers	1.7	-0.4965***	0.6	-1.2946***	0.3
Private sector clerical staff	8.1	0.0358	1.0	-0.4673***	0.6
Sales staff	2.5	0.0735	1.1	0.6008***	1.8
Personal service workers	3.7	0.5805***	1.8	1.1163***	3.1
Skilled manual workers, drivers	10.2	-0.5737***	0.6	-0.4663***	0.6
Unskilled and agricultural workers	4.4	-0.2573**	0.8	-0.1190	1.1
Form of work organisation					
Sedentary and standard (sedent_s)	59.5	*Ref.*		*Ref.*	
Sedentary and shifted (sedent_d)	13.1	-0.7557***	0.5	-0.8431***	0.4
Mobile and standard (mobile_s)	22.0	-0.4647***	0.6	-0.4306***	0.6
Mobile and shifted (mobile_d)	5.4	-0.9230***	0.4	-1.0111***	0.4
Employment coverage rate within 10 km radius		0.6826***	2.0	1.0555***	2.9 →

Table 8 – (*contd.*)

		Public transport (*N*=4,935)		Active modes (*N*=1,119)	
	Proportion (%)	Coefficient	Odds ratio	Coefficient	Odds ratio
Property occupancy status					
Owner, homebuyer	51.7	*Ref.*		*Ref.*	
Tenant	45.5	0.2712***	1.3	0.3607***	1.4
Housed free of charge	2.8	-0.0039	1.0	0.6379***	1.9
Gender					
Male	53.8	*Ref.*		*Ref.*	
Female	46.2	0.2925***	1.3	0.3785***	1.5
Income quintile					
Fifth	20.4	*Ref.*		*Ref.*	
First	19.2	0.5883***	1.8	0.6002***	1.8
Second	19.8	0.1197	1.1	0.1963	1.2
Third	20.2	0.1632**	1.2	0.1013	1.1
Fourth	20.4	0.0619	1.1	0.0017	1.0
Age					
30 to 44	45.7	*Ref.*		*Ref.*	
Under 30	15.2	0.3037***	1.4	0.2892***	1.4
45 to 59	35.0	-0.0963	0.9	0.1285	1.1
60+	4.1	-0.3165***	0.7	0.1777	1.2
Level of education					
Higher	59.5	*Ref.*		*Ref.*	
Primary	3.0	0.5259***	1.7	0.3370	1.4
Secondary	37.5	-0.1544***	0.9	0.0731	1.1
Number of people in the household					
Two or more people	81.0	*Ref.*		*Ref.*	
Single person	19.0	0.2189***	1.2	0.1030	1.1
Child(ren) under 10					
No children	62.1	*Ref.*		*Ref.*	
With child(ren)	37.9	-0.1442***	0.9	0.0874	1.1
Employment coverage rate in the municipality of residence		-0.0617**	0.9	0.0351	1.0
McFadden's pseudo R^2			0.123		
N			12,105		

Notes: The results derive from a multinomial logistic regression. The selected variables are sorted in descending order of significance (stepwise procedure). The unretained variables are the number of workers in the household and working hours. Significance: * 10% threshold; ** 5% threshold; *** 1% threshold.
Sources and coverage: Enquête Globale Transport 2010 (IDFM-DRIEA) and 2012 Census (INSEE). Employed workers.

car use, particularly among the self-employed. Lastly, another significant difference is that of gender, with women traveling more by modes of transport other than individual motorized ones (as already shown by Coutras, 1997).

As regards household characteristics, the transport mode appears associated with the occupancy status of the property: tenants make significantly more use of public transport and active modes than homeowners or people in free of charge accommodation. This reflects tenants' greater proximity to employment as a result of a more central location – homeownership comes at the expense of proximity to employment. As could be expected, the use of alternative modes also differs according to income: workers with the lowest incomes travel significantly more by public transport and active modes, with the cost of automobiles being an obstacle to their use (Jouffe *et al.*, 2015).

Finally, the estimation confirms that the form of work organisation contributes to the choice of mode of transport to travel to work. Any form of work organisation other than *sedent_s* has a significant negative effect on the use of alternative modes, with the highest negative coefficients for those implying a shifted temporal organisation of work. This reflects the competitiveness of the automobile in these forms of work organisation.

* *
*

This paper shows that the form of work organisation is a differentiating factor in the daily mobility practices of Île-de-France workers. It highlights the interest of addressing worker daily mobility not only on the basis of the two-way commute, but in all its complexity and daily variations. For the Île-de-France region, the results indicate that mobile forms of work organisation results in workers making more journeys, travelling longer distances, spending more time on transport and making more use of automobiles. The daily mobility of those working in variable workplaces is all the more intense because their high work-related daily mobility is accompanied by high personal daily mobility. Tradespeople, retailers, company heads, professional occupations, personal service providers and manual workers are particularly concerned by this spatial organisation of work. Over the period under review, the increase in work at variable locations within the 7.00 am to 8.00 pm time bracket is one of the drivers of growth in the daily mobility of workers. The development of mobile workplaces does not seem to affect trends in the use of modes of transport. The decrease in automobile daily mobility and the increase in public and active transport modes in Île-de-France concern workers working only in one fixed location just as much as those working in variable locations. Thus, the spatial reconfiguration of work, while encouraging heavy use of automobiles for workers working at variable locations, does not seem likely to impede the modal shift from the car to alternative modes.

The results also show that shifted temporal work organisations result in lower personal daily mobility and increased automobile use in Île-de-France. This form of work organisation is typical of manual workers, tradespeople, sales staff, retailers, professional occupations, public sector employees and supervisors. The decrease in automobile daily mobility, which is evolving, affects workers in both standard and shifted working hours. It highlights the need to improve public transport supply, particularly at peak times, in order to cope with the growth of daytime work and to support targets for a modal shift from the car to alternative modes of transport.

The analysis proposed here should nevertheless be further refined. Firstly, the definition of forms of work organisation only partially takes into account the diversity of professional situations. A more granular approach is needed to deepen the knowledge of the daily mobility practices associated with certain specific forms of work organisation. In particular, the spatial organisation of work only in variable locations, the dispersion of which raises questions about distance and duration, deserves special attention. Similarly, a detailed analysis of the daily mobility practices of Île-de-France workers working only at night would be interesting. For these workers, who are often less financially well-off, getting to work is all the more difficult because they are less likely to own a car, the absence of a driving licence is more widespread, and public transport provision in their places of residence and work is lower, more often outside well-served centres. Similarly, fragmented forms of work organisation, which are more likely to lead to high work-related daily mobility, might require specific analysis.

Finally, the profound changes in work organisation over the past few years, such as the emergence of new private or shared workplaces (Bouleau & Leroi, 2016) and the accelerated development of teleworking due to the COVID-19 health crisis, are likely to disrupt the daily mobility of workers. Such spatial developments open up new research opportunities and increase the interest of future work. While the first results of the new Global Transport Survey (H2020) for the period 2018-2019 seemed to confirm the trends of the previous decade – decrease in travel to fixed workplace, increase in travel to variable locations, increased use of alternative modes to travel to work – (Omnil, Île-de-France Mobilités, 2019), the post-COVID period could see the use of teleworking, for a long time limited, more frequent in the next few years, at least for certain categories of workers, with major implications for individual worker daily mobility and transport. Lastly, and more generally, the question of the links between work organisation and worker daily mobility should be analysed in urban areas other than Île-de-France which are less specific, particularly in terms of public transport supply. □

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APPENDIX 1

STUDENT TESTS

Table A1-1 – **Differences in means of journeys by motive**

	Number of journeys/day	Distance (km/day)	Duration (minutes/day)
Work related motives			
Sedent_s *vs.* Sedent_d	***	**	***
Sedent_s *vs.* Nomad_s	***	***	***
Sedent_s *vs.* Nomad_d	***	***	***
Sedent_d *vs.* Nomad_s	***	***	***
Sedent_d *vs.* Nomad_d	***	***	***
Nomad_s *vs.* Nomad_d	***	***	***
Personal motives			
Sedent_s *vs.* Sedent_d	***	***	***
Sedent_s *vs.* Nomad_s	**	***	***
Sedent_s *vs.* Nomad_d	***	ns.	***
Sedent_d *vs.* Nomad_s	***	***	***
Sedent_d *vs.* Nomad_d	ns.	**	*
Nomad_s *vs.* Nomad_d	***	**	***

Note: The null hypothesis is rejected at the threshold of *** 1%, ** 5%; *10% ; ns: not significant.
Sources and coverage: Enquête Globale Transport 2010 (IDFM-DRIEA). Employed workers.

Table A1-2 – **Differences in means of journeys by transport mode**

	Number of journeys/day	Distance (km/day)	Duration (minutes/day)
Public transport			
Sedent_s *vs.* Sedent_d	***	***	***
Sedent_s *vs.* Nomad_s	ns.	***	ns.
Sedent_s *vs.* Nomad_d	***	***	***
Sedent_d *vs.* Nomad_s	***	***	***
Sedent_d *vs.* Nomad_d	***	ns.	**
Nomad_s *vs.* Nomad_d	***	***	***
Motorized individual modes			
Sedent_s *vs.* Sedent_d	***	***	***
Sedent_s *vs.* Nomad_s	***	***	***
Sedent_s *vs.* Nomad_d	***	***	***
Sedent_d *vs.* Nomad_s	***	***	***
Sedent_d *vs.* Nomad_d	***	***	***
Nomad_s *vs.* Nomad_d	***	***	***
Active modes			
Sedent_s *vs.* Sedent_d	***	***	***
Sedent_s *vs.* Nomad_s	***	ns.	***
Sedent_s *vs.* Nomad_d	***	**	*
Sedent_d *vs.* Nomad_s	***	***	***
Sedent_d *vs.* Nomad_d	ns.	ns.	ns.
Nomad_s *vs.* Nomad_d	***	***	***

Note: The null hypothesis is rejected at the threshold of *** 1%, ** 5%; *10%; ns: not significant.
Sources and coverage: Enquête Globale Transport 2010 (IDFM-DRIEA). Employed workers.

APPENDIX 2

TWO EXAMPLES OF MOBILITY BY TRANSPORT MODE AND FORM OF WORK ORGANIZATION

Table A2-1 – **Parisian executives**

	Sedentary and standard	Sedentary and shifted	Mobile and standard	Mobile and shifted	Total
Journeys (number/day)	4.12	3.82	5.20	5.41	4.45
Public transport	1.76	1.33	1.98	1.70	1.77
Individual motorized modes	0.49	0.75	1.02	1.69	0.73
Active modes	1.86	1.64	2.17	1.95	1.92
Other modes	0.02	0.09	0.04	0.07	0.03
Distance (kilometres/day)	17.3	13.4	21.1	25.1	18.4
Public transport	12.5	7.8	12.6	10.8	11.9
Individual motorized modes	3.5	4.3	7.0	13.1	5.1
Active modes	1.2	0.9	1.3	1.0	1.2
Other modes	0.1	0.4	0.2	0.2	0.2
Duration (minutes/day)	107	92	135	141	115
Public transport	72	54	78	64	72
Individual motorized modes	15	19	31	52	22
Active modes	20	17	25	24	21
Other modes	0	2	1	1	1

Sources and coverage: Enquête Globale Transport 2010 (IDFM-DRIEA). Employed workers.

Table A2-2 – **Peri-urban intermediate professions**

	Sedentary and standard	Sedentary and shifted	Mobile and standard	Mobile and shifted	Total
Journeys (number/day)	4.06	3.55	5.66	6.02	4.42
Public transport	0.54	0.14	0.31	0.26	0.45
Individual motorized modes	2.87	3.22	4.70	4.76	3.35
Active modes	0.65	0.19	0.65	1.00	0.62
Other modes	0.00	0.00	0.00	0.00	0.00
Distance (kilometres/day)	53.2	43.9	66.5	96.2	56.7
Public transport	23.8	5.3	10.8	5.4	18.9
Individual motorized modes	29.1	38.5	55.5	90.6	37.7
Active modes	0.2	0.1	0.2	0.3	0.2
Other modes	0.0	0.0	0.0	0.0	0.0
Duration (minutes/day)	121	87	183	199	134
Public transport	50	13	28	16	41
Individual motorized modes	65	72	150	175	88
Active modes	6	2	5	8	5
Other modes	0	0	0	0	0

Sources and coverage: Enquête Globale Transport 2010 (IDFM-DRIEA). Employed workers.

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