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THEMATIC SECTION: THE TAX QUOTIENT SYSTEM AND HOUSEHOLD INCOME TAX

ARTICLES

Taxation of Couples and Marital Status – Simulation of Three Reforms of the Marital Quotient in France

Guillaume Allègre*, Hélène Périvier* and Muriel Pucci**

Abstract – In France, married couples or couples in civil partnerships must declare their resources jointly and are allocated two tax units. This tax system, referred to as the marital quotient, represents a financial package of around 10 billion euros. Using the Ines microsimulation model, we simulate three reforms of this system: an individualisation of taxation, a reduction of marital quotient to 1.5 tax units while allowing married couples/couples in civil partnerships to opt for individual taxation and, finally, the capping of the marital quotient at the same level as the family quotient. Individualisation results in the highest tax gain (around 7 billion), compared with 3.8 billion when the marital quotient is reduced to 1.5 tax units and 3 billion with the marital quotient cap. With these reforms, 46%, 45% and 7% of couples lose out, respectively. The median losses correspond to 1.5%, 1.3% and 2.6% of the disposable income of the households concerned, respectively. Finally, 60%, 64% and 83% of the losses are in the last three standard of living deciles, respectively.

JEL Classification: H24, H31, D31
Keywords: microsimulation, income tax, marital quotient

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In France, in 2017, income tax[1] represented around 12% of tax revenue.[2] While the majority of households are required to pay the Generalised Social Contribution (*Contribution Sociale Généralisée* – CSG),[3] 43% of households are subject to income tax. The latter takes into account family configuration and, in particular, the marital status of couples: married couples or couples in civil partnerships must declare their resources jointly and are allocated two tax units (the system is known as the marital quotient), whereas cohabiting couples (common law partnerships) are considered as two separate tax households and declare their resources separately. The switch to withholding tax in January 2019 allows the tax to be paid directly on individual payslips. The method of levying income tax has been individualised, but it is still calculated based on the couple's income for those who are married or in a civil partnership. This system, which dates back to 1945,[4] was designed to take account of family solidarity between married partners in a context in which single-income couples, with the husband having a job and the wife being responsible for the housework and child-rearing, was the norm in public policy. It was also intended to encourage couples to get married. Around eight in every ten couples are married or in a civil partnership, and are therefore affected by the marital quotient. This tax system represents a financial package of around 10 billion euros.

This method of taxation is the subject of many controversies: some argue for individualisation of taxation or a reform of the marital quotient, deeming it unfair, because the tax advantage provided by the marital quotient (where it exists) grows with the couple's income, and ineffective, in that it disincentivises married women from working (Glaude, 1991 ; Lanquetin *et al.*, 2004 ; Landais *et al.*, 2011), and others defend the system as it is, in the name of the principle of horizontal equity (Sterdyniak, 1992). This debate is important and sensitive, on the one hand because it raises questions about the principles of justice on which income tax is based (tax justice between different types of households, as well as in terms of gender equality); on the other hand, because family configurations have diversified as a result of the increase in common-law partnerships, divorces and family reconfigurations: it is claimed that this system is no longer suitable for this greater level of individual freedom, compared with a single family norm. Finally, the marital quotient represents a political choice, the consequences of which in terms of tax revenues and redistributive effects are difficult to ascertain and change due to the effect of successive modifications to the rules on income tax.[5] This is partly due to the complexity and lack of clarity of the income tax system.

Some work has evaluated the advantages of marriage and civil partnerships, compared to common-law partnerships. These studies most often use two complementary approaches: a case study approach to understand the interaction between different tax and social mechanisms and microsimulation, which makes it possible to map the losers and winners and calculate the cost or gain of possible reforms by simulating their redistributive effects (Glaude, 1991 ; Amar & Guérin, 2007 ; Legendre & Thibault, 2007 ; Haut Conseil à la Famille, 2011 ; Eidelman, 2013 ; André & Sireyjol, 2019). This work shows that the marital quotient system associated with marriage and civil partnerships is most often beneficial to couples. In addition, the advantage linked to joint taxation increases with standard of living and the wealthiest 15% of the population are those who benefit from it the most (André & Sireyjol, 2019). Less often, work has been carried out to analyse the effect of the marital quotient or joint taxation in terms of how it disincentivises women from working (Jaumotte, 2003 ; Carbonnier, 2007). Other work has simulated the redistributive effects of switching to individualised taxation, taking into account, through different hypotheses, the change in women's work behaviour (Echevin, 2003).

This article is in line with work combining case study analysis and microsimulation evaluations to assess the effects of the marital quotient on the amount of tax couples must pay, incorporating income tax reforms up to 2016 (particularly the abolition of the employment premium, the reform of the rebate and the introduction of the exceptional payment for high earners and the means-tested tax reduction). Beyond updating existing work, this article presents three reforms of the marital quotient, two of which are original and had never been examined before. Each of them responds to the main criticisms levelled at the marital quotient.

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1. A single annual personal income tax shall be established for the specified natural persons, referred to as income tax, French General Tax Code, Article 1.
2. Social security contributions are not included in this revenue.
3. Only pensioners with a low income (€11,128 per year for a single person, in 2018) are exempt.
4. Article 8 of the Law of 15 July 1914 already specified that each head of family is a taxable person, in respect of both his personal income and that of his wife and other family members living with him. However, the marital quotient system dates back to 1945.
*5. Such as, for example, the introduction of the PPE (*prime pour l'emploi *– a means tested employment premium) in 2002, followed by its abolition in 2016; the introduction of the rebate in 1982, then reformed in 1987, 2002, 2015 and 2016; the introduction of the means-tested tax reduction in 2017; the introduction of the exceptional payment for high earners, with two brackets in addition to the progressive tax scale.*

After presenting how the marital quotient works and the problems it raises, we assess three reform scenarios: individualisation of income tax, decreasing the number of tax units granted to married couples/couples in civil partnerships from 2 to 1.5 with the option of individualisation, with this new tax system being opened up to cohabiting couples, and, lastly, capping the advantage associated with the marital quotient at the same level as that of the family quotient. These simulations reveal the sums involved in the redistribution carried out by the marital quotient and the alternatives for distributing the tax burden between households differently.

1. Taxation of Couples and the Marital Quotient

1.1. The Basic Principles of Income Tax

The income tax system is based on the constitutional principles of equality before the law (Article 6 of the 1789 Declaration of the Rights of Man and of the Citizen)[6] and equality before public offices, according to which the tax burden should be equitably distributed among all the citizens in proportion to their means (*id.* Article 13).[7] The latter principle requires taxation to progress in accordance with income and requires that family responsibilities be taken into account. However, the principle remains broad enough to be respected in multiple ways (Collet, 2014).[8] Under the current system, income tax is based on two principles:

(i) The progressivity of the tax, which is ensured by applying a progressive tax scale to taxable income. In 2018, it is composed of 4 tax brackets, the rates of which are 14%, 30%, 41% and 45%, respectively;[9] in addition to which is the exceptional payment for high earners, which includes two brackets of 3% and 4%. Without this progressivity, imposing taxation at individual or household level would be equivalent.

(ii) Taxation not of the individual's income but of the income of the tax household to which the individual belongs, in accordance with the number of people in the tax household.

The calculation of the tax takes into account the composition of the household by applying a family tax quotient system that allocates a number of tax units determined by the number of people present in the same tax household, the family configuration (single parent or couple) and the marital status of the couple. Quotient taxation consists of applying the progressive taxation scale not to total income but to income divided by the number of tax units. For the same income, a tax household with a higher number of tax units may be subject to a lower marginal rate. The amount of tax per unit is then multiplied by this number of units to obtain the amount of tax due from the tax household. Therefore, under this mechanism, two tax households with the same income per unit are subject to the same marginal tax rate (Online Appendix C1. Link to Online Appendices at the end of the article).

These general principles seek to achieve a form of tax neutrality:[10] with a comparable initial standard of living, two households of different compositions must have the same standard of living after tax. With the principle of horizontal fairness interpreted in this manner, individuals with the same ability to pay must be treated equally. The tax must therefore not alter the relative position of households of different configurations in the distribution of standards of living. The explanatory memorandum of the draft law introducing the family tax quotient in 1945 makes this argument: "It is unfair that, despite the deductions granted for dependents, a household with children should pay a higher general income tax than a household without children, taking into account the expenses it is obliged to incur".[11] Beyond the horizontal fairness argument, the marital quotient system was also intended not to favour cohabiting couples over married couples, as shown in the explanatory memorandum of the draft law introducing the family tax quotient in 1945: "It is immoral to levy a progressive tax on total household income on the head of the family, thereby benefiting cohabitation".[12]

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6. Law is the expression of the general will. Every citizen has a right to participate personally, or through his representative, in its foundation. It must be the same for all, whether it protects or punishes. All citizens, being equal in the eyes of the law, are equally eligible to all dignities and to all public positions and occupations, according to their abilities, and without distinction except that of their virtues and talents. [translated from the French].

7. A common contribution is essential for the maintenance of the public forces and for the cost of administration. This should be equitably distributed among all the citizens in proportion to their means.

8. While the Constitution does require income tax to be progressive and take into account the family responsibilities of each individual, it does not require that it be levied on the resources and responsibilities of the household as a whole (Collet et al.*, Le Monde, 2015).*

9. In 2015, the first bracket, which had a rate of 5%, was abolished.

10. Pierre Laroque said: "Unlike the tax measures in the Family Code, which were designed to encourage families to have three or more children, and to discourage single people from staying single and couples from not having children, the family quotient aims to secure distributive justice. The aim is to make income tax as neutral as possible, in relation to the consumption capacities of families according to their unequal burdens." [translated from the French].

11. https://www.legifrance.gouv.fr/affichJuriSaisine.do;jsessionid=DF4C05BCCD35872603AABB260AD6912F.tpdjo14v_3?idTexte=CONSTEXT000017667929

12. « Il est immoral de frapper d'une taxe progressive les revenus du ménage réunis sur la tête du chef de famille, avantageant ainsi le concubinage » *https://www.legifrance.gouv.fr/affichJuriSaisine.do;jsessionid=DF4C05BCCD35872603AABB260AD6912F.tpdjo14v_3?idTexte=CONSTEXT000017667929.*

1.2. How Does the Marital Quotient Work?

Income tax imposes a tax regime on couples that depends on their marital status. Currently, married people and people in a civil partnership constitute a single tax household and are required to jointly declare all of their resources in order to take into account family solidarity. Until 1982,[13] taxation was based on the head of the family, i.e. the husband, with the wife being considered his dependent. Since 2005, the same regime applies to couples in civil partnerships.[14] Both partners report a single taxable income composed of all the couple's income. In contrast, people living in common-law relationships report their income separately and constitute two separate tax households.

Married couples and couples in civil partnerships without dependents are attributed two tax units. This system is commonly known as the "marital quotient" and, strictly speaking, it differs from the family tax quotient, which refers to the tax units attributed for dependent children and dependents more generally (Table 1). The units allocated in respect of children do not depend on the parents' marital status: the first two children of the tax household grant an entitlement to half tax unit each, from the third child onwards, each grants an entitlement to one tax unit.[15]

Unlike the marital quotient, the family tax quotient is not mandatory: parents can decide not to attach their children to their tax household beyond a certain age, particularly if they start working.[16] Cohabiting couples report their income separately and can choose to allocate the units related to their dependent children between their respective tax households, so as to reduce the total amount of tax payable by the household, which married couples/couples in civil partnerships cannot do.

Where both partners have similar incomes, the marital quotient and separate taxation lead to an equal level of tax, except for couples who benefit from the tax rebate and/or the means-tested tax reduction. In contrast, where the two incomes are very different, joint taxation is more advantageous than separate taxation (it applies the marginal rate to the average income and not to each of the incomes, see Online Appendix C1). No country other than France applies a system of tax units, except for the United States. The U.S. tax system allows married couples to report their income individually or jointly. Since the tax brackets are doubled for married couples who file jointly, this system has the same properties as the marital quotient (except for the final bracket, which is not doubled, thus capping the advantage granted to married couples). Only a few countries have a completely separate income tax system without dependent partner compensation. Certain countries offer a possible transfer of income from one partner to the other, others offer a tax credit or deduction for a dependent (Online Appendix C2).

1.3. Simulation of the Advantage Associated with the Marital Quotient

The issue of tax treatment of couples in accordance with their marital status has been the subject of some pieces of work aimed at assessing the advantages associated with marriage (Amar & Guérin, 2007 ; Legendre & Thibault, 2007 ; Haut Conseil à la Famille, 2011 ; Eidelman,

13. It was not until 1982 that the concept of the head of family was removed from the General Tax Code: https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000000503959

14. Before 2005, the taxation of couples in civil partnerships was separate for the first three years and then joint thereafter.

15. Other situations may give rise to the receipt of an additional or half tax unit (e.g. an additional half unit is granted to single parents, war widows, households including a disabled person, etc.).

16. Not attaching children living in the household can only be advantageous if they have their own income.

Table 1 – **Number of tax units and consumption units(*) according to family configuration**

		Married couple/couple in civil partnership	Person living in a cohabiting couple taking responsibility for the couple's children (+ partner's unit)	Single
0 children	Tax units	2	1 (+1)	1
	Consumption units	*1.5*	*1.5*	*1*
1 child	Tax units	2.5	1.5 (+1)	2
	Consumption units	*1.8*	*1.8*	*1.5*
2 children	Tax units	3	2 (+1)	2.5
	Consumption units	*2.1*	*2.1*	*1.8*
3 children	Tax units	4	3 (+1)	3.5
	Consumption units	*2.4*	*2.4*	*2.1*

(*) the number of consumption units is calculated using the OECD-modified equivalence scale for children aged under 14.
Reading Note: 2 tax units are allocated to a married couple or couple in a civil partnership without children, while that couple represents 1.5 consumption units.

2013 ; André & Sireyjol, 2019). These studies combine a case study approach to understand the interaction between different fiscal mechanisms and microsimulation, which makes it possible to calculate the figures associated with possible reforms and simulate their redistributive effects. The counterfactual scenario used most often is an individualisation of the tax, with underlying assumptions that vary from one study to the next.

We calculate the advantages associated with the marital quotient based on a simplified model of the socio-fiscal system in place in accordance with the 2018 legislation. This makes it possible to simulate the amount of tax due from a household, in accordance with its family configuration and the couple's marital status. The advantage associated with the marital quotient is the difference between the sum of the two tax amounts due from the partners of a cohabiting couple and the tax due from a married couple/couple in a civil partnership, with the same individual income structure.

The marital quotient system is much more advantageous for married couples/couples in a civil relationship, compared to cohabiting couples, when the incomes of the partners are different, which is due to the logic behind the system. In addition, income tax is characterised by numerous mechanisms that are not necessarily marital, or are not marital in the same way as the marital quotient: the rebate that spreads the amount of tax due on entry into force of the tax scale and which was amended in 2015, can benefit cohabiting couples (Online Appendices C1 and C3), while the means-tested tax reduction introduced in 2017 and the exceptional payment for high earners, introduced in 2011 and renewed in 2018, have complex effects (Online Appendix C3). Finally, whereas cohabiting couples can divide the units allocated for children between the two tax households so as to minimise the total amount of tax due, married couples/couples in civil partnerships who form a single tax household, cannot.

By design, the amount of tax paid by married couples/couples in a civil partnership does not depend on the income structure between partners. In contrast, the amount of tax paid by both cohabiting partners depends on their respective incomes. Thus, when income is divided equally between the two partners, separate taxation and joint taxation lead to the same amount of tax for the couple, except in certain cases: couples in which each partner earns 1.5 times the French minimum wage (SMIC) pay less tax if they live in a common-law relationship and declare their income separately than a married couple with an identical individual income structure. In fact, in such case, the rebate benefits cohabiting couples.[17] Until 2015, the threshold was the same for single people (or cohabiting people) and married couples/couples in civil partnerships, and the threshold applied to taxable income without taking into account the number of tax units. In 2015, the rebate trigger threshold was raised and a threshold for married couples/couples in civil partnerships was introduced. Nevertheless, this "couple's" threshold is not twice that of single people. Thus, cohabiting couples in which each earns 1.5 times the French minimum wage pay less tax than married couples with the same level and structure of income. In contrast, for single-income couples, the marital quotient leads to a lower amount of tax for a married couple/couple in a civil partnership than for a cohabiting couple: the associated tax reduction ranges from approximately €2,250 per year for a couple in which one of the partners earns two times the French minimum wage, to €5,700 for a couple in which one of the partners earns five times the French minimum wage.

For single-income couples, the marital quotient is either neutral compared with a common-law situation or provides an advantage (for couples without children, this advantage starts for incomes situated in the middle of the 2nd decile). For couples without children in which one of the partners earns twice as much as the other, the couples that lose out due to the marital quotient have incomes situated in the 8th decile: joint taxation causes them to lose the rebate to which the partner earning the least would still be entitled if they declared their income separately. For couples with the same income structure but with two dependent children, the losses are greater and appear for incomes situated in the 8th decile, as married couples/couples in civil partnerships, unlike cohabiting couples, cannot optimise the tax units granted for children (Online Appendix C4, Figures C4-I and C4-II).

Generally speaking, the advantage associated with the marital quotient, where it exists, increases with income and is capped once the taxable income per unit is situated in the final bracket of the exceptional payment for high earners. The maximum advantage provided by the marital quotient (i.e. €32,350 per year) is reached for single-income couples with a very

17. When there are dependent children and cohabiting parents are able to optimise the distribution of tax units according to their taxable income, the configurations in which total tax is lower for cohabiting couples than for married couples or couples in civil partnerships are more frequent.

high income, over 70 times the French minimum wage. On entering the 10th decile (for single-income couples), the advantage provided is €5,700 per year. Such cases are not frequent relative to the population as a whole; nevertheless, 13% of married couples aged 25 to 54 whose incomes are situated in the 10th decile for standard of living are single-income couples.[18] This is partly explained by the attractiveness of the marital quotient for this income configuration.

2. Why Reform the Marital Quotient?

Several forms of criticism are levelled at the marital quotient. The proposed and simulated reforms seek to correct the system so as to respond to such criticism, at least in part.

2.1. The Tax Unit of Reference: the Individual or the Couple?

2.1.1. Solidarity Within Cohabiting Couples is Not Recognised

The fiscal unit in the marriage tax quotient system is the couple in the case of married couples or couples in civil partnerships and it is the individual in the case of cohabiting couples. This is based on the principle of pooling the resources of married couples or couples in civil partnerships, which implies that no form of solidarity is recognised within cohabiting couples. Nevertheless, the system is ambiguous because, since 1996, cohabiting parents who declare that they have one or more dependent children no longer benefit from the additional half tax unit allocated to single parents, which implies a form of recognition of family solidarity in the case of cohabiting couples with regard to child-related expenses (cf. Table 1). In addition, in the case of the ISF (*Impôt de solidarité sur la fortune* – a tax on wealth), a joint declaration is compulsory for "known cohabitees" who, in this case, are considered as a single tax household, without the marital quotient system. The aim of this is to avoid partners sharing their wealth as a couple in order to remain below the current tax threshold of 1.3 million euros, with the threshold being the same for single people or for a couple.[19] Similarly, the calculation of entitlements to social benefits (such as the *Revenu de solidarité active*, RSA – the minimum income) takes into account the couple's income regardless of their marital status. Thus, tax law is sometimes inconsistent in the case of cohabiting couples, whereas civil law has extended the legal notion of a "couple" to include cohabiting couples (Cavalier, 2013) and social benefits are based on the total income of partners, whether married, in a civil partnership or cohabiting. Since 1945, family aspirations and lifestyles have changed (common-law partnerships, divorce, family reconfiguration, female employment, etc.), but the principle of taxation of couples has not been amended, except for the extension of joint taxation to couples in civil partnerships from 2005 onwards.

2.1.2. Do Married Couples Actually Pool Their Resources?

In 2010, 74% of married couples declared that they pooled all their resources, compared with 30% of couples in civil partnerships and 37% of cohabiting couples. Thus, couples in civil partnerships are thought to be more like cohabiting couples than married couples.[20] The practice depends on income level: while 72% of couples in the first income quartile declare that they pool all of their resources, this is the case for only 58% of couples in the final quartile (Ponthieux, 2012). Unlike the family tax quotient, which is limited to €1,500 per year and per half unit, the advantage provided by joint taxation is not capped, except mechanically for households with an income per unit situated in the final tax bracket, and the higher the couple's resources, the less often the partners pool their resources. Thus, the marital quotient seems inappropriate given that the tax advantage it provides is greater the higher, and therefore less shared, the couple's income and that it is not available to cohabiting couples with low resources. In contrast, couples in civil partnerships, who rarely pool their resources, benefit from joint taxation.

In response to these criticisms, two reforms are possible. The first of these reforms is to open up the right to joint taxation to cohabiting couples.[21] The second reform consists of abolishing joint taxation by individualising income tax. In this case, each partner, whether married, in a civil partnership or cohabiting, would declare their income separately and would be taxed on that basis. Incomes common to both partners would

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18. See Online Appendix C5 for a description of the characteristics of couples according to their standard of living decile.

*19. The treatment of cohabiting couples in respect of the IFI (*Impôt sur la Fortune Immobilière *– a tax on real estate assets) is not consistent with how they are treated in respect of Income Tax. The tax threshold for the IFI could be lower in the case of an individual declaration than in the case of a joint declaration when declaring the value of the assets.*

20. However, this result must be put into perspective: couples in civil partnerships are on average younger and newer than married couples (both because the possibility of entering into a civil partnership is recent and because a civil partnership is often a step towards marriage) and younger and newer couples are less likely to pool all of their resources.

21. Some cohabiting couples may then be tempted to declare their income separately when it is more favourable. In order to avoid this tax optimisation, and to establish the joint declaration obligation for all couples, the life of the couple should be checked, as the social services do for the payment of the RSA.

be shared between the two new tax households. The tax units allocated to children can either be divided equally between the two parents (individualisation without optimisation), or allocated in such a way as to reduce the total amount of tax to be paid by each parent (individualisation with optimisation).

2.2. Ability to Pay and Number of Tax Units Allocated

The French Constitution states that taxation must take into account the ability of citizens to pay. The entire issue is to determine how this "ability to pay" is understood. With the same income, a person living alone has a higher standard of living than a couple, but not twice as high due to the economies of scale provided by living as a couple. In 1945, the administration was undoubtedly incapable of accurately calculating the standard of living of households of different sizes and, therefore, of assessing their respective ability to pay. Today, equivalence scales are used to compare the standard of living of families of different sizes. Even though they can be criticised in many ways (Martin, 2017 ; Martin & Périvier, 2018), they are a reference tool for measuring standards of living (Bourguignon, 1993 ; Hourriez & Olier, 1997). INSEE applies the so-called OECD-modified equivalence scale, which allocates 1.5 consumption unit to couples and 1 unit to single people, then 0.3 of a unit for each child aged under 14 and 0.5 of a unit for children aged 14 and over. According to this scale, a couple with a disposable income of €3,000 thus has the same standard of living as a single person with income of €2,000. The marital quotient allocates 2 tax units to married couples or couples in a civil partnership and 1 tax unit to singles. The standard of living of couples is therefore underestimated by 33% relative to people living alone, and therefore they are not taxed according to their ability to pay (defined as their standard of living).[22] This is because the aim of achieving horizontal fairness is undermined by the desire to avoid encouraging couples to remain in common-law partnerships. Similarly, the decision regarding the number of tax units allocated to children according to the number of children was not made with the sole aim of guaranteeing the principle of horizontal fairness, but was partly guided by a desire to encourage births, as demonstrated by the additional 0.5 tax unit per child granted from the 3rd child onwards, introduced in 1980 (Bloch *et al.*, 2005). The principle of horizontal fairness is thus not respected and, given that the tax advantage grows with household resources, the principle of vertical fairness is not respected either. The advantage associated with the marital quotient increases with income and is only capped when the taxable income per unit reaches the final tax bracket, and that of the exceptional tax on high income (Online Appendix C4). This is not the case for the family tax quotient, for which the advantage afforded has been capped since 1982. This cap was lowered in 1998, in 2012 and in 2013 (in 2018 the tax advantage associated with the family tax quotient was capped at €1,527 per half tax unit). If the tax advantage afforded by the family tax quotient is capped, that associated with the marital quotient should also be capped.

Where one partner is employed or has a lower income than their partner, the partner with the lower income does not constitute a dependent as such, even if the partner with the higher income is able to increase their partner's standard of living by assuming a greater share of the common expenses. Where one partner is unemployed, he or she (in practice it is most often women) contributes to the household resources through their domestic and family work. For example, in the model of "Mr Breadwinner and Mrs Housewife", the unemployed wife provides a service through the domestic and family work she does. This domestic production (childcare and education, cleaning, cooking, etc.) has an economic value that is not taxed. Thus, single-income couples are treated more favourably than dual-income couples, who have to outsource part of their domestic and family tasks and have a lower standard of living for the same income. Allègre *et al.* (2015) show that single-income couples spend about one hour more per day on domestic tasks than their dual-income counterparts. Valued, for example, at the French net hourly minimum wage, this hour of domestic work corresponds to an annual amount of €2,700 (Allègre *et al.*, 2015), which could justify a tax adjustment that would take account of this advantage for single-income couples or this disadvantage for dual-income couples. Finally, the marital quotient discourages the wife from working (see below) which, combined with gender norms, reinforces the gendered nature of the division of labour within couples and gender inequalities. At the time of a divorce, women's lesser investment in the labour market means that they suffer a greater loss of standard of living than their ex-partner, despite public and private transfers (Bonnet & Garbinti, 2015 ; Bonnet *et al.*, 2016).

22. The social scale of the RSA follows the consumption units of the OECD-modified equivalence scale.

To address the shortcoming in the number of tax units allocated to couples in accordance with their marital status, the number of tax units allocated to married couples or couples in a civil partnership could be reduced to 1.5 from its current level of 2, while allowing the possibility of opting for separate taxation. This choice between joint taxation with 1.5 tax units for the couple or separate tax declarations could also be offered to cohabiting couples.

2.3. Disincentives to Work for Married Women

With the marital quotient system, the same tax rate applies to the individual incomes of both partners, which are declared together. If there is an income gap between the partners, the partner with the lowest income bears a higher tax rate than if they were to declare their income separately and the partner with the highest income bears a lower marginal rate than if they were single.[23] The marital quotient discourages the partner with the lowest income, most often the woman (three out of four women in couples earn less than their partner, see Morin, 2014), from working, while it incentivises the other partner to work more. It therefore encourages specialisation within the household (paid work for Mr and domestic work for Mrs) and is a potential or real obstacle to the employment of married women or women in civil partnerships. Beyond differences in wage, which favour men, it should be remembered that the percentage of parental leave used up by women is 94.8% in 2017 (CAF, 2019): when there are children present, the decision to stop or reduce work is still one taken by the vast majority of women. It is thus legitimate to assume that women remain additional workers.

Furthermore, the literature shows that women's labour supply is more elastic than men's: women, particularly married women and/or those with young children, respond to financial incentives more than men do (Briard, 2017). By increasing the marginal tax rate applied to the partner with the lowest income, most often women, and by reducing the marginal tax rate applied to the partner with the highest income, the marital quotient could reduce the overall labour supply.

Based on international comparisons, research shows that separate taxation is more favourable to female participation in the labour force than joint taxation (Jaumotte, 2003; Thomas & O'Reilly, 2016). Crossley & Jeon (2007) have evaluated the impact of the switch from joint taxation to separate taxation for married couples in Canada. Their results show that the reform has led to a large increase in the labour supply from married women, who now benefit from lower marginal tax rates. In France, by integrating behavioural changes into a simulation of the individualisation of taxation, Echevin (2003) finds that separate declaration has positive effects on the participation of married women in the labour market (it is most often women who have lower incomes). Finally, Carbonnier (2007) shows that application of income tax to the family as a unit encourages married women/women in civil partnerships to stay out of the labour market. Thus, the marital quotient contributes to the reproduction of economic inequalities between women and men.

The current system means that the marginal tax rate applied to the partner with the lowest income in a cohabiting couple is less than the marginal rate applied to the income of a married couple/couple in a civil partnership (Online Appendix C4, Figure C4-III). Applying the average rate for the married couple/couple in a civil partnership to the individual income of the partner with the lowest income gives an estimate of the average amount of tax that partner must pay. This amount is theoretical since these couples are supposed to pool their resources and expenses. Nevertheless, this allows for a comparison of the average amount of tax paid by two people with the same income, both of whom are the partners with the lowest income in their respective couples, but one person is married and the other is living in a common-law partnership.

Another way of understanding the potentially disincentive nature of the marital quotient on the labour supply of married women/women in civil partnerships is to calculate the gain in disposable income resulting from full-time minimum wage employment for the inactive partner, in accordance with marital status. This gain is simulated in accordance with the income of the individual's partner for a couple without children and then for a couple with two children (aged 8 and 6). Indeed, the presence of children in the household is an obstacle to women working, which can be reinforced by the marital quotient system. This family configuration is conducive to the withdrawal from work of women who struggle to find a balance between work and family life. The gain from returning to employment is always

23. Since the reform of the withholding tax (2019), the tax payable by the partner with the lowest income is calculated based on their income alone when the partners opt for the individualised rate. The tax payable by the other partner is then defined as a balance, based on the amount of tax payable by the couple.

lower in the case of a married couple/couple in a civil partnership than for a cohabiting couple (Figure I). The financial incentives to take a job are therefore lower for a married woman than for a woman living in a common-law partnership. This gap increases if the couple has two dependent children.

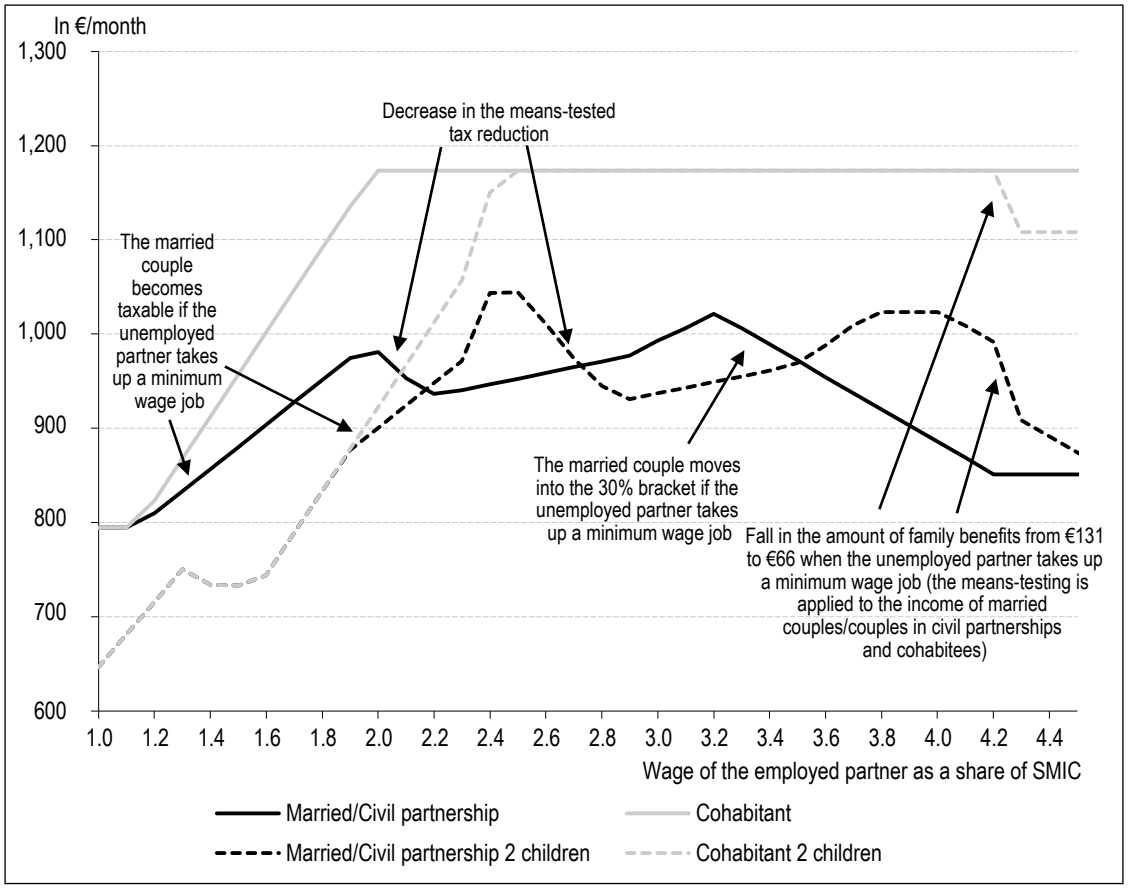
Only the switch to an individual tax system can fully address this criticism by ensuring that the individual income of each partner is taxed separately and not at the marginal rate corresponding to the average income of the couple.

3. How Should the Marital Quotient Be Reformed? Three Possible Scenarios

The reform of the taxation of couples can take multiple forms, depending on the principles chosen and how they are applied. The first principle is selection of the tax unit of reference: the couple or the individual. Then, if the tax unit remains the couple, the question of marital status arises: do we wish to tax married couples/couples in a civil partnership and cohabiting couples differently? In other words, is tax recognition given to cohabiting couples or are they considered to be two single people (and therefore two separate tax households)? The number of tax units allocated to couples may also be modified to be more in line with standards of living, as calculated using the usual equivalence scales. Finally, the advantage associated with the marital quotient could be capped, in the same way as the advantage associated with the family tax quotient.

Our simulations aim to evaluate reform scenarios that address one or more criticisms of the marital quotient and leave open the question of how the resulting additional tax revenues would be used. Furthermore, a reform of the taxation of couples could have an effect on labour supply, particularly for married women who are potentially disincentivised from working because of the marital quotient: for example, an unemployed wife may take a job in response to individualisation of taxation, or increase her working

Figure I – **Gain on one partner returning to full-time minimum wage employment, according to the income of their partner and the couple's marital status. Case of a couple without children and of a couple with 2 children (aged 8 and 6).**



Note: 2018 legislation, authors' computation.
Reading Note: The available income of a single-income couple without children in which the employed partner earns 3 times the French minimum wage and in which the unemployed partner takes up a minimum wage job (€1,174 per month) increases by €993 for a married couple/couple in civil partnership, compared with €1,174 for a cohabiting couple.

hours (Echevin, 2003). Similarly, a reform of the taxation of couples may cause behavioural changes with regard to decisions concerning marital status. For example, the opening up of joint taxation to couples in civil partnerships in 2005 made civil partnerships more attractive (Leturcq, 2012). The calculations do not take into account behavioural changes relating to employment or those relating to decisions concerning marital status that the three simulated reforms could induce.

Three reform scenarios are proposed, with the family quotient remaining unchanged in all cases:

1) Individualisation of income tax with optimisation. In other words, the tax unit becomes the individual and ceases to be the married couple/couple in a civil partnership and, like cohabiting couples, married couples/couples in civil partnerships can divide the tax units associated with dependents between their two respective fiscal households so as to limit the total amount of tax they have to pay. This reform addresses the criticism made regarding the tax unit of reference. In this case, any potential pooling of resources between partners is no longer taken into account.

2) The allocation of 1.5 tax units to married couples/couples in civil partnerships instead of 2 tax units, while allowing these couples to opt for a separate tax declaration if this is more advantageous. This reform makes it possible to align the tax units granted to married couples or couples in civil partnerships and the usual equivalence scales. The opening up to cohabiting couples of this choice between a separate declaration and a joint declaration with 1.5 tax units for the couple also makes it possible to take into account solidarity between cohabitees.

3) Capping the tax advantage associated with the marital quotient at the same level as that associated with the family tax quotient (€1,527 per half unit, or €3,054 for the partner's entire unit). This reform reduces the anti-redistributive nature of the marital quotient by limiting the advantage it affords to the wealthiest households.

To evaluate these three scenarios, we use the Ines microsimulation model, provided by INSEE, DREES and the CNAF. The model reproduces the socio-fiscal legislation of 2016 and is based on the 2014 ERFS (*enquête Revenus fiscaux et sociaux*, a survey on tax and social income) "aged" for 2016.

The three scenarios lead to an increase in the tax revenue provided by income tax, which can be used in several ways:

- To avoid increasing the tax burden on households, the reforms can be carried out while returning a constant level of tax yield. To achieve this, the gains in tax revenues would be redistributed within income tax: either to all taxpayers (lowering marginal rates, raising the thresholds of the different brackets, etc.); or to couples only (through various mechanisms by calibrating the parameters for taking into account the partner such as, for example, a tax reduction for the partner or a tax credit); or to married couples/couples in civil partnerships only.

- The tax gains resulting from these reforms could be used to finance public policies related to the family and gender equality (childcare, parental leave, etc.).

A combination of these two options is also possible. We do not explore these different avenues and simulate the reforms by calculating the gain in tax revenue they would generate (Table 2).

Individualisation with optimisation would mean additional tax revenue of 7 billion. Reduction of the number of units to 1.5 for married couples/couples in civil partnerships with the option of individualisation would lead to a gain in tax revenue of 4.8 billion euros. The opening up of this choice to cohabiting couples would cost around 300 million euros. Thus, this combination of reforms would lead to an increase in tax revenue of 4.5 billion euros. Finally, the capping of the marital quotient would increase tax revenues by around 3 billion euros.

Table 2 – **Summary of the effects of the three simulated scenarios**

	Scenario 1	Scenario 2			Scenario 3
		Married couple or couple in civil partnership	Cohabiting couple	Total	
Variation in tax revenue in billions of euros	7.2	3.8	-0.3	3.5	2.9
(%)	*(+9.9)*	*(+5.2)*	*(-0.4)*	*(+4.8)*	*(+4.0)*
Proportion of winners (as a %)	20	20	12	19	-
Average gain (in euros)	448	448	932	498	-
Proportion of losers (%)	46	40	-	33	7
Average loss (in euros)	1 405	941	-	941	3 232

Individualisation of taxation without optimisation[24] would generate a gain of 10 billion (Online Appendix C6); this scenario is not proposed as a possible reform as such, but it is the reference used to simulate the capping of the marital quotient. In addition, it makes it possible to evaluate the cost of the marital quotient or the gain resulting from its abolition and shows the budgetary stakes underlying the debate on the taxation of couples.

For each reform, we estimate the percentages of losers and winners per standard of living decile, as well as the average and median loss or gain. For each standard of living decile, we also calculate the median ratio between the gain (respectively the loss) and the disposable income of the winners (losers). Comparing the gain (loss) with the disposable income of the household is consistent with the calculation of the standard of living deciles.[25] For all three reforms, the proportion of married couples or couples in civil partnerships that lose out is higher in the final standard of living decile, with a higher average loss; this is because couples in the final deciles have higher incomes and therefore have more to lose from these reforms (see Figures II, III and IV). In contrast, for the first two scenarios, the median value of the loss/available income ratio per standard of living decile is higher in the intermediate deciles. Only the capping of the marital quotient leads to a median loss and a higher median loss/disposable income ratio for the final decile. In Scenario 2, the optional opening up of joint taxation with 1.5 tax units to cohabiting couples would create winners mainly in the intermediate deciles.

3.1. Scenario 1 – Individualisation of Income Tax with Optimisation of Tax units

Two reforms are possible to address the criticism of the current system relating to the tax unit of reference. The first of these reforms involves making the couple the tax unit of reference, which means aligning the tax regime for cohabiting couples with that used for married couples/couples in civil partnerships. They benefit from 2 tax units but would be obliged to jointly declare their resources. The obligation for cohabiting couples to make a joint declaration would cost more than 500 million euros, would increase the amount of tax due for 23% of cohabiting couples and would reduce it for 30% of couples (Online Appendix C7). Nevertheless, this scenario is not used as it extends the problem of disincentivising women from working to those living in common-law partnerships. The second option is to make the individual the tax unit of reference, with partners reporting their income separately regardless of marital status. Each adult represents a tax household to which children or other dependents are attached. The units allocated in respect of dependents may then be freely distributed between the two partners. This is the reform that we simulate in Scenario 1.

The simulation of the tax gain associated with such a reform and its redistributive effects depend on the assumptions used (Online Appendix C6). These assumptions are necessary because the information available in the ERFS survey does not allow a perfectly accurate individualisation of income, nor of the various tax credits and deductions. In addition, the complexity of the current system is such that certain mechanisms are difficult to individualise. In our simulations, incomes that cannot be individualised are shared between the two partners. These incomes represent only 3.8% of all taxable income of married couples/couples in civil partnerships (with a maximum of 8.5% in the final decile). Therefore, the assumption regarding the sharing of these incomes has no significant effect on the results. Three separate categories of income that cannot be individualised are:

- income from property and life annuities, which represents almost 65% of income that cannot be individualised;

- financial income, including capital gains, investment income and income from life insurance), which represent 32% of income that cannot be individualised;[26]

- income from dependents, which represents 3% of income that cannot be individualised.

The tax units allocated to dependents have been divided between partners so as to minimise the amount of tax payable by the two tax households.[27] The capping of the marital quotient is still applied at household level, it is not doubled with the individualisation of income tax. The individualisation of income tax with optimisation of tax units creates additional tax revenue

24. It is assumed that in order to apply the cap, the administration calculates an individual tax by dividing between the married couple or couple in a civil partnership the number of tax units linked to dependents as well as income that cannot be individualised.

25. For complex households that include multiple tax households, this calculation is not accurate, as it is equivalent to comparing the gain (loss) of a tax household with the disposable income of the household to which it belongs and not to the income of the tax household itself. Excluding complex households from the evaluations has no significant effect on the results.

*26. Since the introduction of the Flat Tax (*prélèvement forfaitaire unique*) in 2018, income from financial capital is no longer taxed in the income tax scale.*

27. In reality, as the system is highly complex, it is not certain that couples subject to separate taxation will minimise the amount of tax they pay, especially if they do not pool all of their resources.

of 7.2 billion euros. 46% of married couples/couples in civil partnerships would lose out with this reform, which is around 6 million households, for which tax would increase by an average of €1,400 per year. 20% of these couples, which is 2.6 million households, would pay less tax as a result of this reform, while the average gain would be €450 per year and the median gain would be €480. The median gain/disposable income ratio would be 1%, i.e. half of those who benefit from the reform would see their disposable income increase by less than 1%. Finally, around 4.3 million households are unaffected by this reform, with half of them not being taxable before the reform.

The reform creates people who lose out in all standard of living deciles, but they are concentrated at the top of the distribution: 60% of those who lose out fall into the final 3 deciles, compared with 6% falling into the first 2 deciles (Figure II). The percentage of people who lose out is greater in the ninth and tenth deciles, with a high average loss amount (€1,117 and €2,184 per year, respectively). In contrast, the median loss amounts are significantly lower, showing an uneven distribution of losses within each standard of living decile: the losses are greater in the top decile. However, expressed as a percentage of disposable income, the median loss rate is lower for the ninth and tenth decile (less than 1%), while it reaches almost 3% in the intermediate deciles (Table 3).

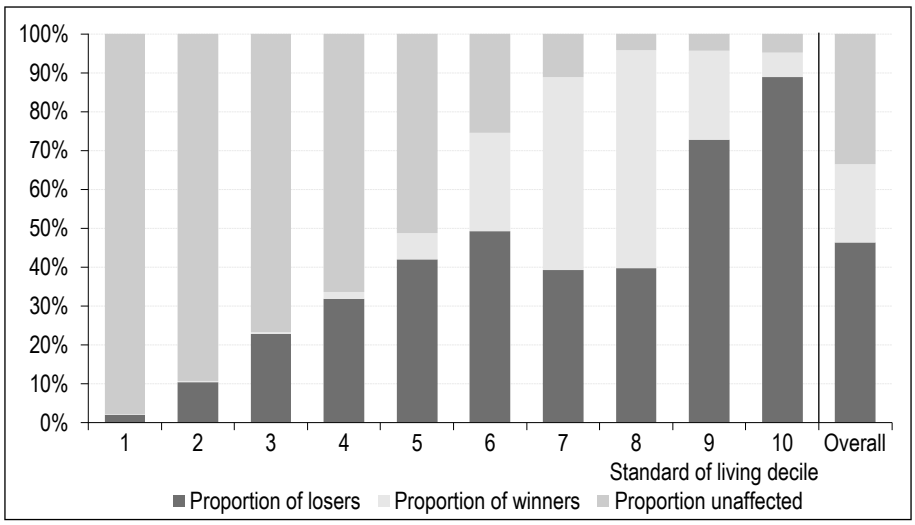
Losses in the upper deciles are explained by the fact that the higher the incomes, the greater the income gap between partners; therefore, the advantage afforded by the marital quotient increases as the couple's income rises (Figure II). In practice, the abolition of the marital quotient means a high average loss for these couples. Furthermore, as these couples have high incomes,

Table 3 – **Losses and gains for married couples or couples in civil partnerships, by standard of living decile – Scenario 1**

Standard of living decile	1	2	3	4	5	6	7	8	9	10	Total
Average loss	*ns*	-671	-827	-1,022	-1,086	-1,083	-1,151	-1,227	-1,117	-2,184	-1,405
Median loss	*ns*	-462	-689	-901	-916	-853	-836	-762	-526	-715	-729
Median loss to disposable income ratio (%)	*ns*	-1.9%	-2.6%	-3.0%	-2.9%	-2.2%	-2.0%	-1.4%	-0.9%	-0.9%	-1.5%
Average gain	*ns*	*ns*	*ns*	*ns*	351	428	506	475	365	281	448
Median gain	*ns*	*ns*	*ns*	*ns*	371	484	546	508	322	135	481
Median gain to disposable income ratio (%)	*ns*	*ns*	*ns*	*ns*	0.8%	1.0%	1.1%	1.0%	0.6%	0.1%	1.0%

Notes: The standard of living deciles are estimated for the total population. *ns*: not significant as the number of observations is less than 50 couples.
Reading note: In the second standard of living decile, the available income of couples that lose out decreases by an average of €671. Half of these couples lose less than €462 per year and less than 1.9% of their disposable income.
Source and Coverage: INSEE, ERFS 2014 (updated 2016); INSEE-DREES-Cnaf, Ines 2016 ; married couples or couples in civil partnerships, Metropolitan France. Authors' computations.

Figure II – **Losers, unaffected couples and winners among married couples or couples in civil partnerships, by standard of living decile – Scenario 1**



Note: The standard of living deciles are estimated for the total population.
Source and Coverage: INSEE, ERFS 2014 (updated 2016); INSEE-DREES-Cnaf, Ines 2016 ; married couples or couples in civil partnerships, Metropolitan France. Authors' computations.

the advantage associated with the family tax quotient is more often saturated, which limits the possibilities of optimising the units linked to dependent children between the two fiscal households. Those who lose out and are in the first deciles are single-income couples who become taxable as a result of the individualisation of taxation. Households that benefit are concentrated in deciles 6, 7, 8 and 9, which contain 90% of those that benefit. These couples are those for whom the optimisation of tax units between the two fiscal households makes it possible reduce the total amount of tax payable by the couple.

3.2. Scenario 2 – Change to the Number of Units with the Option of Individualisation

This reform consists in applying tax units in accordance with the OECD-modified equivalence scale and thus makes it possible to address the criticism regarding inconsistency between tax units and implicit ability to pay in the measurement of standards of living. First, we study the effect of a decrease in the number of tax units allocated to married couples or couples in civil partnerships from 2 to 1.5, while leaving the tax household unchanged. In order to avoid excessively penalising married couples or couples in civil partnerships, with the knowledge that cohabitees each have the right to one unit, the choice of whether to declare their income jointly or separately is opened up to married couples and couples in civil partnerships. This reform brings income tax more in line with the principle of horizontal fairness, relying on the usual equivalence scales, and makes it possible to take into account economies of scale from living as a couple in line with the social system (a couple receives 1.5 times the amount of the individual RSA). It thus addresses the criticism relating to the ability to pay and the number of units allocated. This reform limits the advantage associated with the marital quotient for married couples or couples in civil partnerships, but it does not resolve the problem of not taking into account the situation of cohabitees. This is why we have also evaluated the effects of opening up to cohabiting couples this option of choosing between separate declaration and joint declaration with 1.5 tax units for the couple.

To simulate this reform for married couples or couples in civil partnerships, we have changed the number of units associated with the marital quotient by allocating them 1.5 tax unit instead of 2 units, with the other half units linked, in particular, to dependents remaining unchanged. In order to allow them to opt for a separate declaration, we simulate an individualised tax in which the tax units allocated in respect of dependent children minimises the total amount of tax payable.

The reduction of the number of units granted for married couples or couples in civil partnerships with the option of individualisation would lead to an increase in tax revenue of 4.8 billion euros. 45% of the couples would lose out with this reform, which is around 5.8 million households, for which tax would increase by an average of €1,000 per year; the median loss would be €680 and half of the couples would lose less than 1.3% of their disposable income. 17% of the couples, which is 2.2 million households, would pay less tax as a result of this reform, while the average gain would be €430 per year; the median gain would be fairly similar at €435 which is less than 1% of the disposable income (Figure III-A).

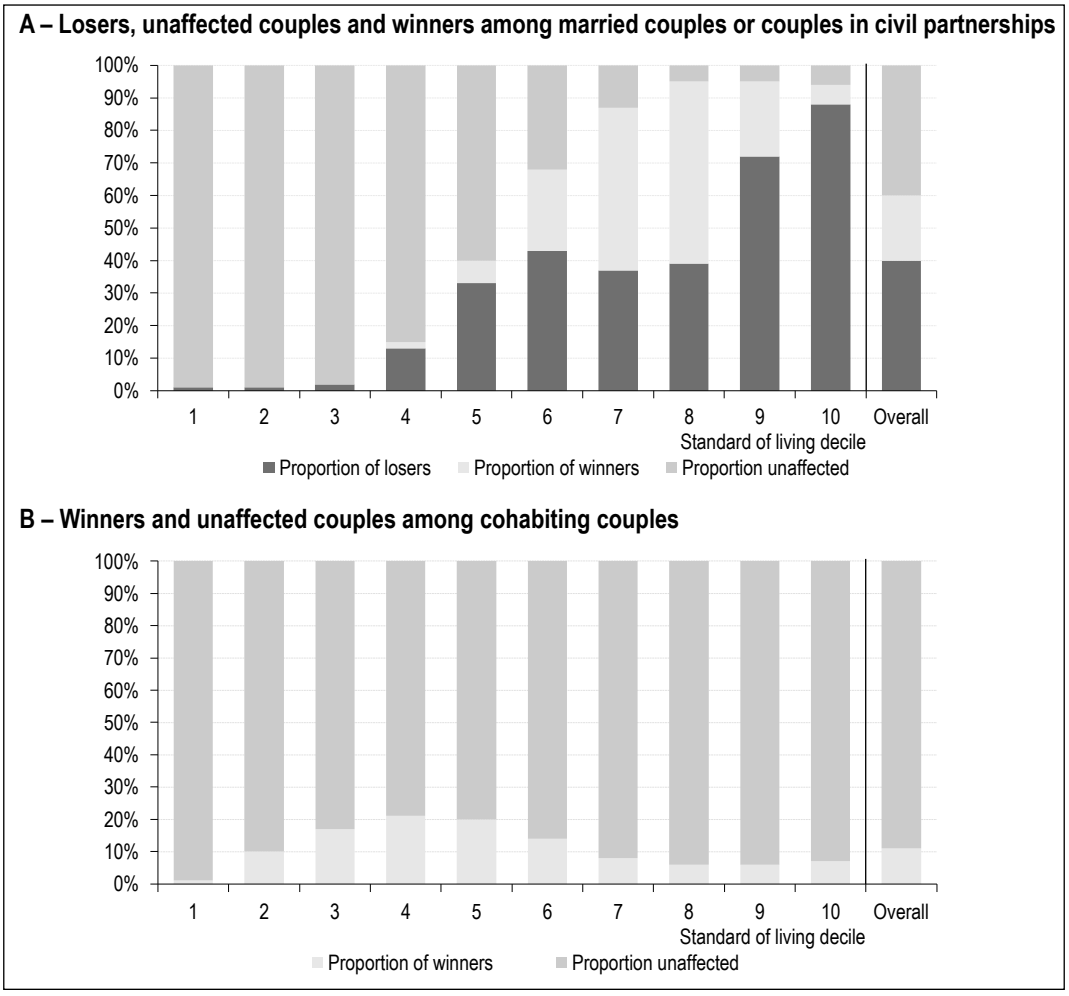
Households that benefit are concentrated in deciles 7, 8 and 9 (which contain 80% of households that benefit). These are couples that opt for individualisation of taxation and are thus able to allocate the tax units associated with children so as to reduce their tax liability, which they could not do under the mandatory marital quotient system. The households that lose out appear in the 3rd decile, with a median loss of €430 per year, which is 1.2% of the disposable income. 64% of households that lose out fall into the final three deciles and they are particularly concentrated in the 9th and 10th deciles, with an average loss of around €900 per year and €1,530 per year, and the median weight of the loss as a percentage of disposable income would be around 1% (Table 4-A). The reform leaves almost 5 million households in the same situation as before, with 57% not being taxable prior to the reform.

Secondly, we align the tax regime for cohabiting couples with that used for married couples or couples in civil partnerships. Thus, they also have the option of jointly declaring their resources and receiving 1.5 tax units. Only 11% of them would obtain an advantage from opting for joint taxation and would thus benefit from an average tax reduction of €930 and a median tax reduction of €682 (Figure III-B and Table 4-B), implying a fall in tax revenue of just under €300 million.

3.3. Scenario 3 – Capping the Marital Quotient at 3,054 Euros

To address the criticism regarding the pooling of resources of married couples/couples in civil partnerships and to limit the advantage of the marital quotient for high earners, a cap on the marital quotient at the same level as that of

Figure III – **Impact of Scenario 2 by standard of living decile**



Note: The standard of living deciles are estimated for the total population.
Source and Coverage: INSEE, ERFS 2014 (updated 2016); INSEE-DREES-Cnaf, Ines 2016 ; married couples or couples in civil partnerships, Metropolitan France. Authors' computations.

Table 4 – **Losses and gains for couples, by standard of living decile – Scenario 2**

A – Married couples or couples in civil partnerships

Standard of living decile	1	2	3	4	5	6	7	8	9	10	Total
Average loss	ns	ns	ns	-467	-632	-705	-701	-717	-752	-1,040	-941
Median loss	ns	ns	ns	-335	-578	-673	-679	-679	-519	-679	-621
Median loss to disposable income ratio (%)	ns	ns	ns	-1.2%	-1.8%	-1.8%	-1.6%	-1.3%	-0.9%	-0.9%	-1.2%
Average gain	ns	ns	ns	ns	350	428	505	475	365	281	448
Median gain	ns	ns	ns	ns	365	485	546	508	322	135	481
Median gain to disposable income ratio (%)	ns	ns	ns	ns	0.8%	1.0%	1.1%	1.0%	0.6%	0.1%	1.0%

Reading note: In the fifth standard of living decile, the available income of couples that lose out decreases by an average of €632 and half of these couples lose less than €578 per year, which is less than 1.8% of their disposable income.

B – Cohabiting couples

Standard of living decile	1	2	3	4	5	6	7	8	9	10	Total
Average gain	ns	ns	892	801	873	787	ns	ns	ns	ns	932
Median gain	ns	ns	795	579	821	646	ns	ns	ns	ns	682
Median gain to disposable income ratio (%)	ns	ns	3.2%	1.8%	1.8%	1.4%	ns	ns	ns	ns	1.9%

Reading note: In the sixth standard of living decile, the available income of cohabiting couples would increase by an average of €787 per year if they have the option of opting for joint taxation with a marital tax quotient of 1.5 units. Half of the cohabiting couples in the sixth decile would gain more than €646 per year, more than 1.4% of their disposable income.
Note: The standard of living deciles are estimated for the total population. ns: not significant as the number of observations is less than 50 couples.
Source and Coverage: INSEE, ERFS 2014 (updated 2016); INSEE-DREES-Cnaf, Ines 2016 ; married couples or couples in civil partnerships, Metropolitan France. Authors' computations.

the family tax quotient can be proposed. The fiscal unit remains the married couple or couple in a civil partnership, the unit system remains the same (2 tax units for a married couple/couple in a civil partnership) and the tax advantage associated with the marital quotient is capped under the same terms as the family quotient, i.e. at €1,527 per half tax unit for 2018 or €3,054 per full unit (partner). As with Scenario 2, this reform has never been simulated. It does not change the basic principles of the current system and therefore avoids debates crystallising around the individualisation of income tax and ability to pay. It is easy to explain, as it is a question of capping the tax advantage related to having a dependent partner in the same way as that related to the presence of dependents such as children. The situation remains unchanged for the least wealthy couples (including those with a specialised organisation); only the wealthiest couples will be affected.

However, this reform does not address the issue of taking into account couples living in a common-law partnership. It does not address the family-oriented principles behind income tax. It does not change the incentives to work for secondary workers, who are most often women, particularly for couples in the first deciles, in which the proportion of single-income couples is highest. In deciles 1 and 2, half of the couples are single-income couples (Online Appendix C5). This reform does not allow for the reduction of the gendered division of labour within couples. Nevertheless, the gains in tax revenue associated with this reform could finance a family policy (parental leave, early childcare arrangements) that would make it possible to reduce the gendered division of labour. It can also be seen as a step in the gradual transformation of the taxation of couples.

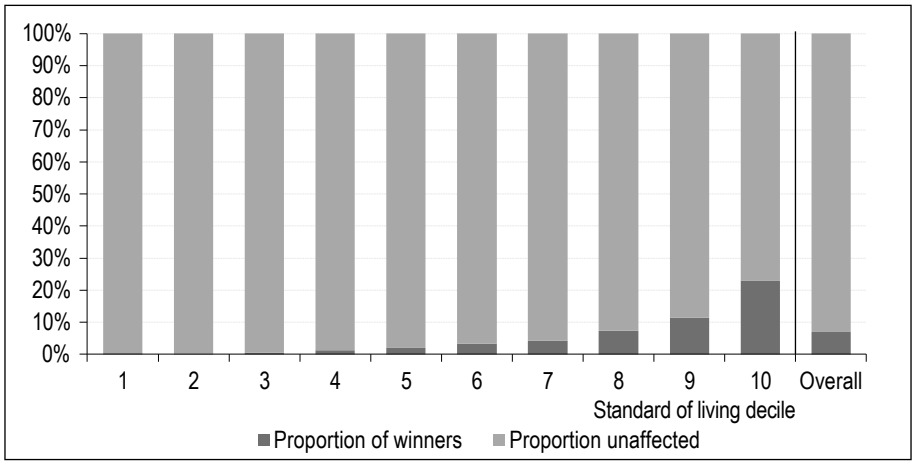
The capping of the marital quotient at the same level as the family tax quotient creates additional tax revenue of 2.9 billion euros. 7% of couples would lose out with this reform, which is fewer than one million households, for which tax would increase by an average of €3,232 per year (Table 5, Figure IV); the median loss is €1,800 per year and half of the couples lose less than 2.6% of their disposable income. No couples would be better off under this reform. It entails a greater average loss than the other two reforms, which is concentrated at the top of the distribution of standards of living. Households in the first 4 deciles are not affected. The loss is

Table 5 – **Losses and gains for married couples or couples in civil partnerships, by standard of living decile – Scenario 3**

Standard of living decile	1	2	3	4	5	6	7	8	9	10	Total
Average loss	ns	ns	ns	ns	-1,049	-1,162	-1,151	-1,670	-1,966	-4,926	-3,232
Median loss	ns	ns	ns	ns	ns	-824	-670	-1,093	-1,509	-3,024	-1,793
Median gain to disposable income ratio (%)	ns	ns	ns	ns	ns	-1.8%	-1.4%	-2.2%	-2.6%	-3.3%	-2.6%

Reading note: In the sixth standard of living decile, the available income of the couples decreases by an average of €1,162. Half of the couples lose less than €824 per year, which is less than 1.8% of their disposable income.
Source and Coverage: INSEE, ERFS 2014 (updated 2016); INSEE-DREES-Cnaf, Ines 2016 ; married couples or couples in civil partnerships, Metropolitan France. Authors' computations.

Figure IV – **Losers and unaffected couples among married couples or couples in civil partnerships, by standard of living decile – Scenario 3**



Note: The standard of living deciles are estimated for the total population.
Source and Coverage: INSEE, ERFS 2014 (updated 2016); INSEE-DREES-Cnaf, Ines 2016 ; married couples or couples in civil partnerships, Metropolitan France. Authors' computations.

Table 6 – **Profiles of winners, losers or unaffected married couples or couples in civil partnerships in the three simulated reforms of the marital quotient (MTQ) (%)**

	Individualisation			MTQ 1.5 units and choice of individualisation			MTQ capping	
	Winners	Unaffected	Losers	Winners	Unaffected	Losers	Unaffected	Losers
All couples	*20*	*34*	*46*	*20*	*38*	*40*	*93*	*7*
By family configuration								
Couples without children	20	28	52	20	36	44	94	6
Couples with one child	24	30	46	24	35	41	93	7
Couples with 2 children	24	39	37	24	45	31	92	8
Couples with 3 or more children	7	62	31	7	65	28	89	11
By partners' employment status								
Dual-income couples	25	28	47	25	32	43	94	6
Single-income couples	13	41	47	12	49	39	87	13
Unemployed couples	18	36	46	18	44	38	95	5
By age of the reference person								
Aged 18-29	24	44	32	24	49	27	99	1
Aged 30-39	23	40	37	23	44	33	95	5
Aged 40-49	20	39	41	20	42	38	91	9
Aged 50-59	20	25	55	20	31	49	91	9
Aged 60+	18	32	49	18	40	42	94	6

Reading note: In the case of individualisation of taxation of married couples or couples in civil partnerships, 53% of couples without children would face increased tax and would lose out due to the reform.
Source and Coverage: INSEE, ERFS 2014 (updated 2016); INSEE-DREES-Cnaf, Ines 2016 ; married couples or couples in civil partnerships, Metropolitan France. Authors' computations.

greatest for the 10th decile (with a median loss of €3024 per year, which is 3.3% of disposable income), which contains the highest proportion of couples that lose out, 31%. Almost 12 million couples are unaffected by this reform, with 27% of them not being taxable before the reform. This percentage is lower than for the other two reforms, as all taxable couples for whom the advantage afforded by the marital quotient is below the cap are also unaffected by the reform.

Table 6 shows the breakdown of those better off, worse off and unaffected by the three reforms, in accordance with the characteristics of the household. Both individualisation of taxation and the second scenario have little effect on couples with 3 or more children, who are over-represented among non-taxable households. Single-income couples are under-represented among those better off as a result of individualisation of taxation. The capping of the marital quotient particularly impacts single-income couples (13% lose out). Single-income couples without children are over-represented among those that lose out due to individualisation of taxation.

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The marital quotient is a mechanism that is poorly understood by the general public. The stakes in terms of tax justice, efficiency or redistributive choices are thus little discussed in the democratic debate. However, it is the subject of much criticism and controversy among economists. It is not adapted to new family configurations because it does not take into account the private solidarity between cohabiting couples. It potentially disincentivises married women from working, as it mounts to applying a higher marginal tax rate to the income of the secondary workers than in the case of individualised taxation. It does not conform to the principle of the households' ability to pay as the tax units associated with it do not comply with the equivalence scales usually used to measure standards of living. Finally, the tax reduction associated with the marital quotient increases with the couple's income and is only capped for very high earners, which alters the redistributive capacity of income tax.

To address these criticisms, we simulate three reform scenarios that partially correct these problems. The proposed approach is static and does not take into account behavioural changes in respect of decisions concerning marriage or employment. Using the Ines microsimulation model, we estimate the gains in tax revenue that these reforms would generate and show that those who lose out are concentrated in the upper deciles of standards of living.

Individualisation results in the highest gain in tax revenue (around 7 billion euros), compared with

3.8 billion when the marital quotient is reduced to 1.5 tax units and 3 billion with the marital quotient cap. In the first two scenarios, around 45% of couples lose out, compared with 7% for Scenario 3. The median losses correspond to 1.5%, 1.3% and 2.6% of the disposable income of the households concerned, respectively. Finally, the capping of the family quotient (Scenario 3) makes it possible to concentrate those who lose out at the top of the distribution of standards of living, as 83% of those who lose out fall into the final three deciles, compared with around 60% for the other two reforms.

To avoid increasing the tax burden on households, the reforms can be carried out while returning a constant level of tax yield by calibrating income tax reductions so as to distribute the gains among taxpayers (such as, for example, a tax reduction, changes to tax bracket thresholds, reform of the rebate, etc.). All or part of the additional tax revenue could be used to strengthen family policy.

The microsimulation work presented in this article indicates that the marital quotient, as it exists, implies a choice regarding the distribution of the tax burden, which is particularly favourable to households in the final standard of living decile. A reform of this mechanism could be considered in the context of a review of the taxation of household income aimed at making it simpler, clearer, more redistributive and more focused on gender equality. □

Link to Online Appendices:
https://insee.fr/en/statistiques/fichier/5349534/ES_Allegre-et-al_Online-Appendix.pdf

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Redistributive Effects of the Taxation of Couples and Families: A Microsimulation Study of Income Tax

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Abstract – This study examines the budgetary and redistributive effects of marital and family income taxation in France. On the basis of the INES microsimulation model, it proposes a complete methodology for individualising incomes and the various tax schemes targeting couples and families. By comparing income tax in 2017 with a fictitious situation in which it would have been applied on an individual basis, the effects of marital and family taxation are seen to be significant and overwhelmingly beneficial: 13 million households gain, benefiting from a total of 27.7 billion euros. 1.1 million households lose out, primarily those for which marital taxation is not offset by gains from family taxation. 40% of the total effect is due to marital taxation and 60% is due to family taxation. The wealthiest 15% of people are those who benefit the most from marital taxation (48% of the gains, compared with less than 25% for the poorest 50%).

JEL Classification: H23, H24, H30, H31, J12, J16
Keywords: income tax, family tax quotient, redistribution, inequality, microsimulation

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Within the French tax system, income tax is one of the main instruments used for vertical redistribution, i.e. along the standard of living scale. The progressive nature of its scale reduces the standard of living of wealthier people to a greater extent than it does for poorer people. However, due to the marital and family components included in its calculation, income tax also brings about horizontal redistribution, based on the configuration of the households and regardless of their income on the one hand, towards couples who are married or in a civil partnership and, on the other hand, towards families with children (see Échevin, 2003). These marital and family income tax mechanisms have been the subject of political debates and have undergone significant change in recent years: in 2013 and 2014, the effects of the family tax quotient were mitigated by lowering its cap, and between 2012 and 2017, the tax relief scheme was partly aimed at couples. In 2017, Emmanuel Macron's programme proposed allowing couples to choose whether or not to be taxed on an individual basis, according to a right to choose scheme.

This study aims to estimate the budgetary and redistributive effects of the tax schemes targeting couples who are married or in a civil partnership and families with dependants. The redistributive effects are indeed important for the evaluation of the socio-fiscal system. The study starts by presenting the general marital tax schemes before evaluating their effects on tax revenue and on redistribution by examining the changes in the distribution of standards of living that result from the existence of these tax schemes. It aims both to present the distribution of households that would gain and that would lose out in the event that these schemes did not exist, estimations of the budgetary amounts that they represent, and how these effects are spread across the marital and family taxation schemes. The analysis is based on the 2017 version of the Ines microsimulation model.

This study contributes to the literature on this subject in a number of ways. Firstly, it adopts a broad approach to marital and family taxation by integrating the tax quotient schemes, as well as secondary fiscal rights, and decomposes their effects under clear and straightforward assumptions. The taxation of families is examined including all the schemes relating to dependants rather than just the family quotient scheme. The analysis is conducted within a coherent framework that distinguishes the effects of family and marital taxation without the need for assumptions regarding household behaviour. In order to achieve his, we implement a sequential estimation of the effects of marital taxation, then the effects of family taxation. This methodological innovation offers two main advantages. On the one hand, it allows the estimated effects to be summarised in the sense that all current income tax schemes can be determined by adding together the effects of marital taxation and family taxation. On the other hand, it provides a novel estimation of marital taxation, since it isolates its effect without having to make assumptions regarding the distribution of family schemes within couples. In addition, the study deviates from some of the usual assumptions regarding the distribution of income within couples in that it distributes non-individualisable income in proportion to individual income, whereas most studies split it equally between the partners.[1] This approach to estimating the marital schemes nonetheless allows us to adopt a method similar to that used in the existing literature for the effects of family taxation; in particular, recent institutional reports (Haut conseil à la famille, 2010; Conseil des prélèvements obligatoires, 2011; Assemblée nationale, 2014) have documented some of the impacts of the marital and family tax quotients. This study therefore provides an update for 2017, since the income tax legislation has recently changed. Finally, it provides detailed results by family configuration and standard of living categories.

The marital and family tax schemes benefit the vast majority of households, and the effects are significant: 13 million households gain, with the benefit totalling 27.7 billion euros. 1.1 million households lose out, primarily those for which marital taxation is not offset by the benefits of family taxation. Around 40% of the total effect is due to marital taxation and 60% is due to family taxation. Those households that benefit gain an average of 2,120 euros per year, while those that lose out lose 400 euros. Due to the progressivity of income tax, the wealthiest 15% of people benefit the most from marital taxation: they receive 48% of the total gains, while the poorest 50% receive less than 25% of the gains.

The rest of this article begins with a quick description of the principle of marital and family taxation in France (Section 1). Section 2 is dedicated to describing a new method for estimating the gains and losses associated with

1. This assumption has only a small impact on the results, due to the small proportion of income that is non-individualisable. Conversely, it appears to be more consistent with the results of Frémeaux & Leturcq (2019), who show that the wealth held by couples has changed significantly during the period between 1998 and 2010, leading to the individualisation of wealth and an increase in wealth inequality between partners.

the marital and family income tax schemes. Particular attention is paid to the assumptions regarding the individual distribution of income within couples and the calculation of tax credits and reductions. The effects of marital and family taxation are then studied together and then separately (Section 3), and conclusions are presented in the final section.

1. Marital and Family Taxation

1.1. Principles and Foundations of Income Tax in France

In France, the income tax is paid at the level of tax households and takes account of the number of children; it is therefore referred to as marital and family taxation: the amount of tax paid depends on both marital status and the number of dependants. One the one hand, couples who are married or in a civil partnership must be taxed jointly, which means that they pool their declared income and their tax is calculated at the level of the tax household to which the two partners belong. On the other hand, each child reduces the amount of tax paid by his or her family. These two characteristics of the French tax system are rare, even exceptional, at the global or European level (Collombet, 2013).

Couples and families taxation is largely based on the mechanism of the tax quotient, i.e. the number of tax units taken into account. The allocation of one tax unit to each partner of a couple who is married or in a civil partnership makes it possible to calculate the average income tax for the couple. The number of tax units also increases with the number of children. These two schemes are referred to as the marital tax quotient and the family tax quotient, respectively. They were introduced at the initiative of Adolphe Landry[2] in 1945. They result from the constitutional requirement to take account of contributory capacity at the family level. Indeed, the progressive nature of the income tax scale and the calculation based on the number of tax units within a fiscal unit can benefit couples who are married or in civil partnerships, as well as families with children, by reducing the amount of tax that they pay. The general family quotient scheme also includes specific situations, such as the care of disabled persons or being a single parent, as well as an increase from the third dependant and is therefore particularly advantageous for large families. Other indirect mechanisms, such as the pooling of tax credits and reductions, or even certain types of non-individualisable income, can accentuate or attenuate the effects of the marital and family tax quotients.

In order to calculate taxable income, the income is pooled at the level of the tax household (the fiscal unit) and divided by the number of tax units: one unit for each partner in the couple who are married or in a civil partnership,[3] a half-tax unit for the first two children and an additional tax unit from the third child onwards (Table 1). The progressive income tax scale is then applied to this ratio; the amount of tax by unit is then multiplied by the number of tax units. The number of tax units taken into account with the family quotient is calculated on the basis of the number of dependants in the household. This relates to children under the age of 21 or those aged under 25 who are in education, as well as to disabled children living within the fiscal unit, regardless of their age. In cases where children alternate their place of residence, the tax units that relate to them are divided by two and shared between the parents. In addition, additional half tax units are granted to single parents, i.e. those who take care of children or disabled persons alone. Each disabled person within a household gives rise to an entitlement to an additional half tax unit.

Due to the progressive nature of the income tax, couples with unequal incomes and families pay lower tax than they would if they were taxed individually in the case of a household with no tax credits or reductions and not affected by the tax relief scheme.

Although the general principle behind the calculation of income tax for couples and families has remained unchanged since 1945, the tax legislation has changed frequently with regard to specific schemes for couples and families. In particular, two schemes that impact upon the

2. French politician and economist who was also behind the roll-out of family benefits in 1931 and the creation of the Family Code in July 1939.
3. Couples who are not married or in a civil partnership are not considered to be couples for the purposes of tax legislation. The study adopts this convention such that partners of cohabiting couples are considered as two distinct fiscal units.

Table 1 – **Number of tax units by family configuration of the household**

Configuration of the household	Single			Couple			From the 3rd child onwards
	No children	1 child	2 children	No children	1 child	2 children	
Number of allowances	1	1.5	2	2	2.5	3	+1

effects of the marital tax quotient have been changed recently: tax relief and the employment premium (*prime pour l'emploi*, PPE). These were the two main schemes that incorporated components that related only to individual characteristics and not to the household, which could make joint taxation unfavourable, as shown by Eidelman (2013): in 2011, 21% of jointly taxed couples would have benefited from reporting their income separately, mainly as a result of these schemes. The effects that we would expect to see with the 2017 legislation are therefore different due to these changes in the way that the tax is calculated. Two other changes have had an impact on the effects of marital and family taxation as a result of their more or less progressive nature.

On the one hand, the cap on the family tax quotient was lowered from 2,236 euros to 2,000 euros in 2013, and then to 1,500 euros in 2014; the last reduction had been in 1998.[4] In 2017, the reduction in tax brought about by the family tax quotient could not exceed 1,512 euros per half tax unit.

On the other hand, the rates and thresholds of the tax brackets have also changed. In 2017, there were five brackets with marginal rates ranging from 14% to 45% above 152,260 euros of taxable income. Since 2000, three main changes have been made:

- in 2007, the number of brackets was reduced from seven to five, with an upper rate of 40% and a lower rate of 5.5%. The upper rate was 54% and the lower rate was 9.5% in 2000;

- in 2013, a sixth bracket was created, bringing the upper limit to 45%;

- in 2015, the number of brackets was reduced to five again by increasing the rate for the first bracket to 14% and raising its threshold from 6,011 euros to 9,690 euros.

The legal framework for general income taxation has undergone significant change since 1945, most notably with the creation of the CSG[5] in 1991 (for a description of the history of legislative developments, particularly with regard to the scale, over the long term, see André & Guillot, 2014). The CSG, which is a wholly individualised tax, is not taken into account in this study. Changes have also recently been made to the way in which capital income is taxed, with it being partially integrated into the progressive income tax scale between 2013 and 2017, followed by a flat-rate deduction of 30%, which *de facto* individualises the taxation of income from wealth (see André, 2019, on the changes in the effects of marital taxation between 2012 and 2017).

1.2. Debates on the Characteristics of Income Tax

The characteristics of income tax have been the subject of many studies. Marital and family taxation are at the centre of the debates regarding the objectives and impacts of the tax instrument through the comparison, in particular, of horizontal redistribution (between different types of household with the same standard of living) and vertical redistribution (between households with different standards of living). The direct effects depend on how progressive the income tax scale is. The greater the vertical redistribution of the scale, the greater the horizontal redistribution of the marital and family tax quotients. In the case of a proportional tax scale, the marital and family tax quotient schemes would have no effect. One of the characteristics of income tax is that it places a greater burden on higher-income households in terms of their contributions, thereby playing a part in the vertical redistribution effected by the socio-fiscal system as a whole. By convention, we will refer to this characteristic as "vertical redistribution".

Grobon & Skandalis (2014) provide a summary of the issues at stake in the debate by providing the main critical references (e.g. Landais *et al*., 2012) alongside arguments that justify these family tax schemes (cf. Sterdyniak, 2012). The article by Allègre *et al*. (2021) in this issue offers a detailed and up-to-date discussion of this.

Firstly, the mandatory joint declaration and the consideration of family responsibilities have existed since 1945. Since then, social norms have changed, as have the characteristics of the French economy. In particular, among people aged 15-64, women's participation rate has increased from around 50% in the 1970s to 65% in 2010 (and 68% in 2020), while that of men has fallen from 83% in 1975 to around 75% since 2010. And, up until the 1960s, wives needed their husband's permission to work or to open a

4. This capping scheme limits the effects of tax gains resulting from dependants by fixing the maximum benefit that can result from the family quotient. Introduced in 1983, it has changed in line with the general scale, being adjusted for inflation each year, with the exception of 2011 due to the freezing of the scale between 2011 and 2013. Other capping parameters exist for single people, widows/widowers and divorcees with dependent children.

*5. The general social contribution (*contribution sociale généralisée*, CSG) is based on a broader tax base than income tax and rates that are proportional to different types of income. Deducted at source, the CSG is often ignored to the point that some people state that households that are not subject to income tax do not pay any tax: in reality, the average tax rate (income tax plus CSG) of the poorest households has been around 5% since 2000.*

bank account. The socio-fiscal system has also been changed, most notably through the creation of tax expenditure aimed at families, benefiting non-parental forms of childcare.

The socio-demographic characteristics have also changed over the long term, such as the increase in the level of education among women. According to Bouchet-Valat (2018), in the majority of couples in France in 2016, the woman was the most highly educated of the partners; this was not so case prior to the 1960s. The pooling of resources within couples has also changed (see Frémeaux & Grégoire-Marchand, 2018). However, this pooling is not always complete among couples who practice it (Ponthieux, 2012). The marital and family tax scheme is therefore based on ways of life that have changed. Couples who are not married or in a civil partnership are not considered as couples for tax purposes; the study into the redistributive effects of income tax will make it possible to highlight those who benefit from these schemes and to what extent.

Another aspect of the debates concerns the incentive schemes resulting from a lower marginal tax rate to the wealthier spouse than they would have been subject to if taxed individually. On the one hand, this can be interpreted as a subsidy for couples with differing incomes. On the other hand, this favours domestic specialisation within the couple by making the trade-off more unfavourable to the secondary contributor, i.e. the member of the couple who does not work or whose salary is lower. However, three quarters of women in couples earn less than their partner (Morin, 2014). Therefore, the marital tax quotient taxes the labour supplied by women more heavily than that supplied by men (Échevin, 2003). Carbonnier (2007) estimates a negative elasticity, i.e. the probability of a partner being active in the labour market decreases with the rate at which their potential salary will be taxed. According to André (2019), the mandatory joint taxation of couples increases the marginal tax rate of the secondary contributor, three-quarters of whom are women, by 5.9 points. Kalíšková (2014) estimates, on the basis of Czech data, that the introduction of joint taxation in 2005 was followed by a drop of three percentage points in the employment rate of married women with children, which is comparable to the two percentage points that LaLumia (2008) estimated for the 1948 reform in the United States. Taking account of these derivative effects within the scope of a static microsimulation approach would require behavioural assumptions to be made that are beyond the scope of this study. In addition, the tax unit scheme differs from the number of consumption units and is therefore non-neutral with respect to the usual statistical convention used to measure equivalence scales. Indeed, INSEE uses consumption units to measure poverty and inequality.[6] The effects along the standard of living scale are analysed based on the usual framework of monetary redistribution: in order to compare households of different sizes or composition, disposable income is measured as a ratio of the total household income to the number of consumption units. The standard of living measured in this way incorporates the benefits of being in a couple (whether it be a legal or common-law union), due in particular to economies of scale in joint expenditure. Disposable income is the result of both the distribution of the primary income received by households and the application and redistribution performed by the socio-fiscal system. However, Martin & Périvier (2018) show that the standard of living of single-parent families and single persons is overestimated by the usual consumption units and therefore underestimates their poverty rate. These are the same family configurations that are not affected by the gains resulting from marital taxation.[7]

Furthermore, there is a relative inconsistency between social entitlements and tax law in so far as, unlike income tax, social security benefits do not take account of the marital status.[8] However, unlike the gains associated with the family tax quotient, which were capped at 1,512 euros per half-tax unit in 2017, there is no legal cap on the gains resulting from the marital tax quotient.[9] The current tax system is often criticized for its complexity, which stems in particular from the calculation of the number of tax units, since tax expenditure is sometimes based on married couples and sometimes on families. In order to illustrate the effects at play, the current situation will be compared with a more simple

6. The scale used (known as the OECD scale) is based on the following weighting: 1 consumption unit (CU) for the first adult in the household and 0.5 CU for any additional individuals aged over 14, and 0.3 CU for children aged under 14. Allègre et al. *(2021) propose an evaluation of a reform in which the number of tax units for a couple would correspond to their number of consumption units.*

7. The theoretical studies by Moyes & Trannoy (1999) highlight the fact that the quotient scheme within the French tax system is consistent with a measure of independence between the reduction in inequality brought about by a tax system and the use of single people as a reference when comparing types of families (relative Lorenz criterion).

8. See in particular Table 4 in Allègre et al. *(2021).*

9. They may be mechanically capped in the case of very high incomes, for example in the polar case where one member of the household has no income and the other has an income double the threshold for triggering the exceptional payment for high earners, i.e. reference tax income of one million euros. In this case, the couple's income is taxed at the highest marginal rate of the tax system and an increase in the income of the primary contributor does not result in any further gain from the marital tax quotient.

scenario involving a uniform tax credit for each dependant.

Finally, the mandatory nature of joint taxation is also discussed. France presents an exception in this respect: the majority of countries either apply fully separate taxation (the most common system within EU countries, see Collombet, 2013) or take account of partners' income in a different form, by means of a tax credit or a tax reduction. Some allow people living in a couple to choose between being taxed individually or jointly. Only Switzerland still adopts a system equivalent to that applied in France, with Luxembourg having introduced the right to choose in 2018, following in the footsteps of Portugal, which did so in 2016. Germany and Spain apply joint taxation with the option to choose to be taxed individually. Belgium, Italy, the United Kingdom and Canada include tax expenditure in different forms for a spouse with lower income. Other countries, such as Austria, Finland, Greece and Sweden practice strict individual taxation.[10]

Although it is advantageous for the majority of couples, the mandatory nature also results in some losing out, in so far as it may be in a couple's interest to declare their income separately as a result of individualised schemes within the system used to calculate income tax (see Amar & Guérin, 2007 and Eidelman, 2013). This study also proposes an update of such similar studies, and a quantification of the number of couples declaring their tax jointly, in spite of the fact that this may lead to losses in terms of their disposable income. This results in an attenuation of Eidelman's (2013) findings due to changes in the way in which income tax is calculated; however, some couples who are married or in a civil partnership still lose out as a result of this compulsory joint taxation.

As regards the tax advantage related to children, some countries apply tax credits or flat-rate deductions for dependants. Schemes that run independently of parents' income prioritise vertical redistribution, i.e. to the relative benefit of the poorest people; other countries aim to reconcile the standards of living of couples with different incomes and family responsibilities. Portugal and Luxembourg are the two other countries that implement the tax unit-based family tax quotient system (see Collombet, 2013). In 2013, Germany, Greece, Luxembourg, the Netherlands, Portugal and the United Kingdom allowed childcare costs to be deducted. The measurement of the fiscal cost of the family forms part of a broader framework of the measurement of society's expenditure on children. This social effort by the Nation was estimated at 4% of GDP in 2013 (see André & Solard, 2015).

In 2017, income tax amounted to 73 billion euros, or 24.6% of total tax revenue. In spite of the size of the financial sums involved, the redistributive effects of marital and family taxation are only partially documented. The main recent source is the report by the Haut conseil à la famille (HCF, 2011) and its Appendix 3 in particular, which presents simulations of reforms carried out by the Directorate-General of the French Treasury using the Saphir[11] model. The findings presented in our study can be compared with these estimations for a similar methodology, i.e. for the effects on families, but not for the effects of marital taxation, which differ due to the sequential calculation in our study. There are three other sources of methodological discrepancies with comparable studies within the existing literature, namely the year of estimation (in this case, 2017), the method used to allocate non-individualisable income (in this case, on a *pro-rata* basis) and the scope of the schemes included (in this case, all schemes that are dependent on marital status and dependants).

2. Estimation of the Impact of Income Tax on Married Couples and Families

2.1. Microsimulation Using the Ines Model

The Ines model simulates the effects of French social and fiscal legislation (for a detailed description of the model, see Fredon & Sicsic, 2020). We use the 2017 version of the model for this study. The model is based on INSEE's *enquête Revenus fiscaux et sociaux* (data based on tax and social sevenue – ERFS), which brings together socio-demographic information from the *enquête Emploi* (the French Labour Force Survey), and data from the CNAF, CNAV and CCMSA, and details of income declared to the tax authorities for the purposes of calculating income tax. The 2015 ERFS is based on a sample of approximately 50,000 households or around 130,000 individuals, representative of the population living in ordinary housing in metropolitan France. These individual data are "aged" and adjusted on the basis of aggregated auxiliary information gathered from other sources in order to reflect the structure and income of the

10. See, for example, Table 2 in Allègre et al. *(2021), which lists the different systems applied in OECD countries.*
11. This microsimulation model is similar to the Ines model used in this study. It relies in particular on data from the ERFS.

population in 2017. They therefore become representative of the 28 million ordinary households in metropolitan France in 2017.

The model is based on the assumption that households do not change their behaviour in terms of marriage and labour supply in response to legislative or regulatory changes, and that such changes do not have any short-term impact on prices.

The evaluation of the budgetary and redistributive effects consists of comparing a reference situation, in this case a fictitious individualised tax, with the legislation in force for the tax paid in 2017 on income from 2016. Household gains and losses are then calculated as the difference between the two situations. The aggregated effects are then obtained on the basis of individual effects using the weightings within the Ines model. The method is referred to as microsimulation, since it calculates a fictitious situation for each observation, in which the legislation is modified.

The calculation assumptions used for microsimulation studies are often crucial and allow for a better understanding of the simulated effects. Below we will describe the way in which income and tax expenditure (tax credits and reductions) are individualised. From a methodological point of view, the approach allows the effects of marital and family taxation to be decomposed. The method used to simulate these separate effects is described below.

Generally speaking, we adopt a broad vision of the marital and family schemes. The first difference with most of the literature concerns the individualisation of tax. Rather than retaining an equal distribution between the partners, non-individualisable income is distributed on a *pro-rata* basis, i.e. proportional to the partners' individual incomes; the same applies to certain tax credits and reductions. Unlike other studies, the aim is to capture income inequalities within couples who are married or in a civil partnership in greater detail (additional estimates to test the sensitivity to this assumption are presented in the Online Appendix – link at the end of the article).

In addition, the approach adopted seeks to incorporate effects that are not usually taken into account, most notably family arrangements as a whole, in order to provide a comprehensive estimate of the marital and family income tax schemes. In practice, we extend these concepts of marital and family taxation to tax credits and reductions, as well as to tax relief. In the case of individual taxation, eligibility for a tax credit or reduction is determined for each partner by comparing an individual cap with their individual incomes. Likewise, the amount paid is not dependent on marital status.

Finally, we propose a sequential calculation of the marital tax quotient based on an individualised tax and then of the family tax quotient based on a marital tax. This implies that there will be discrepancies with the results of other studies that would assess the marital and family tax quotients separately by comparing them with the real situation. By focusing on the internal consistency of its assumptions, this method makes it possible to avoid making behavioural assumptions when assessing the marital tax quotient: with the marital tax simulated in this way, it is not necessary to distribute family schemes, such as additional tax units for dependants, between the two partners of a couple. This innovative method therefore offers the advantage of being robust, as it does not require assumptions regarding the distribution of family mechanisms between parents. It allows the overall effect to be decomposed as the sum of two distinct sub-effects. Nevertheless, the consequence of this is that it inflates the effect that is usually estimated[12] for the marital schemes, since the estimates for these schemes depend on the order in which they are simulated. This method therefore measures two mechanisms *(i)* the gain brought about by marital taxation in a theoretical situation in which there are no family schemes and *(ii)* the gain brought about by family taxation within a system that is already based on marital taxation.

In addition, the precision of the results depends in particular on the quality of the income tax simulation within the Ines model. If we do not include settlement payments by the self-employed and the flat-rate levy, and if we take account of tax credits and reductions, the amount of tax simulated by the Ines model is 66.2 billion euros for 2017 for ordinary households in metropolitan France. If we include the flat-rate levy and the settlement payments made by the self-employed and extend the coverage to all households in France, the amount of income tax estimated by the Ines model is 73.7 billion euros for 2017, which is very close to the 74 billion euros actually received by the tax authorities that year. We will now describe the main assumptions of the simulation, and in particular those that concern the distribution of income and tax expenditure.

12. The studies in the literature usually compare the real situation to a counterfactual situation where only one type of scheme is absent, considering the family or marital schemes in isolation.

2.2. Individualisation of Income and Tax Credits and Reductions

In order to evaluate the effects of the marital and family tax quotients, a counterfactual situation is required in which taxes are individualised. The tax that would be paid in the event that each member of a fiscal household is taxed as if they were living alone and without dependants must therefore be calculated. This fictitious tax individualises income and neutralises all the tax units, as well as all other marital and family-based schemes used to calculate tax (for methodological details, see the Online Appendix). Household gains and losses are calculated as the difference between the disposable income of the households under the two situations.

The first step allocates to each member of the fiscal household the share of the income that relates to them. Wages, pensions, annuities and self-employed income are processed without any specific assumptions, since they are declared in a box linked to the individual in the household who receives that income. Conversely, income from securities and investments, capital gains and property income are declared at the level of the household and cannot be individualised on the basis of the simple information included in the tax returns. Here, we distribute this income between the partners on a *pro-rata* basis according to their individual incomes. The proportion of income that cannot be individualised amounts to an average of 3% of gross household income.[13] However, a dependant household member with their own income is not allocated a share of the non-individualisable income.

Once these individual incomes have been distributed, tax is simulated separately for each member of the household in the same way as it would be calculated for a single person. Tax, tax relief, tax credits and tax reductions are calculated separately for each member of the household. The caps on eligibility for tax credits and reductions are also individualised. As regards tax credits and reductions, the way in which their benefits are shared between partners is determined according to three scenarios:

(1) if it depends on the receipt of individualisable income, it is calculated at individual level;

(2) if it depends on financial or real estate acquisitions, it is distributed according to the key used to distribute non-individualisable income;

(3) if it depends on expenditure relating to joint household expenses (e.g. energy-efficiency improvements, home help), it is divided equally between the partners.

This set of assumptions assumes that no behavioural changes take place, particularly in the distribution of non-individualisable income (for example by paying income from wealth to the partner with the highest income, which could reduce the total amount due if the partners were taxed separately).

More generally, we assume that no behavioural change takes place with regard to the distribution of tax credits and reductions between partners. This choice is consistent with the framework of the Ines model, which assumes the absence of short-term behavioural reactions. It is straightforward and easy to read and provides an overall effect without the need for a set of additional behavioural assumptions. It is also justified by the existence of legal constraints, such as ownership of a flat or a savings account, which provide the couple with some fixed income from wealth in the short term. As a result, this fictitious simulation is not a complete description of what a fully individualised tax would look like.

2.3. Decomposition of the Effects of Marital and Family Taxation

The study therefore simulates a counterfactual individual tax: the effects of marital and family taxation are deducted by establishing the difference between that and the tax observed in the reference situation involving individualised taxation. This section explains how the gains and losses resulting from the marital and family tax quotients are decomposed.

In order to evaluate marital taxation, the income of partners who are married or in a civil partnership is grouped within the fiscal household, and any income earned by dependants is disregarded. The tax is then calculated in the same way as in the real situation for 2017 for couples who were married or in a civil partnership, as if they had no dependent children. This means that the caps on tax credits and reductions are multiplied by two for the couples and the tax relief is applied jointly. Conversely, income earned by dependants other than the partners continues to be considered individually, and the presence of dependants is not taken into account when assessing eligibility for tax credits and reductions. The amounts of the gains and losses brought about by marital taxation are then calculated as the difference between this marital taxation and individual taxation.

13. Around 50% of households do not receive any non-individualisable income. The proportion is below 10% for 90% of households. It exceeds 62% for 1% of households.

At the marital tax stage, all amounts paid are made independent of the number of dependants. Finally, the tax schemes that are fully associated with family taxation (reduction for married dependants and deductions for child support paid) are considered out of scope and cancelled.

We therefore consider the following to form part of the family tax quotient: the reduction for married dependants, which replaces the increase in the family tax quotient in the event that of a married child within the fiscal household; the deduction for child support paid to children and increases in the tax credit or tax reductions depending on the number of dependants.

In order to simulate the effects of the family tax quotient, income earned by dependants is then added to the household income, and the corresponding half-tax units are included in the tax calculation. The caps on eligibility for tax credits and reductions depend on the number of dependants. The tax calculated in this manner corresponds to tax as it was applied in 2017 in France and simulated by the Ines model without any variation in legislation. The effects brought about purely by family taxation are therefore calculated as the difference between this and the marital tax presented above.

This method is sequential, since it first simulates marital taxation on the basis of individual taxation and then simulates family taxation. This makes it possible to identify the effects brought about by marital taxation alone, without taking into account the family component, which is intrinsic in the real tax. For this purpose, the tax units corresponding to dependants are not split between the partners, as the counterfactual situation is that of an individual without children or dependants.

3. The Redistributive Effects of Marital and Family Tax

This section presents the main results regarding the effects of the marital and family taxation schemes.

3.1. Tax Structure and Aggregated Effects

Firstly, the schemes assessed in this study have effects on the distribution of taxes. Fiscal revenue from income tax and the distribution of households subject to taxation differs depending on the scenario (Table 2). A household is shown as taxable in the case of individualised taxation if one of its members is subject to taxation. Marital and family taxation renders 4.7 million households non-taxable (one in six households). All of these tax schemes bring about a reduction in tax of 27.7 billion euros when compared with the fictitious situation in which they do not exist. In the absence of these schemes and without changing the way in which tax is calculated or household behaviour, the total real tax in 2017 increases by 42%. Average tax changes in the same way, by 412 euros in the fictitious individual case and by 395 euros in the real case. Two-thirds of households are subject to taxation in the case of the fictitious tax, compared with one half in the current situation. Around 40% of the total effect is due to marital taxation and 60% is due to family taxation.

The marital and family tax quotients therefore have very significant budgetary effects. By way of a comparison, all tax credits and reductions subject to the general cap amount to 8.7 billion euros, i.e. three times less than those devoted to couples and families in the broader sense.

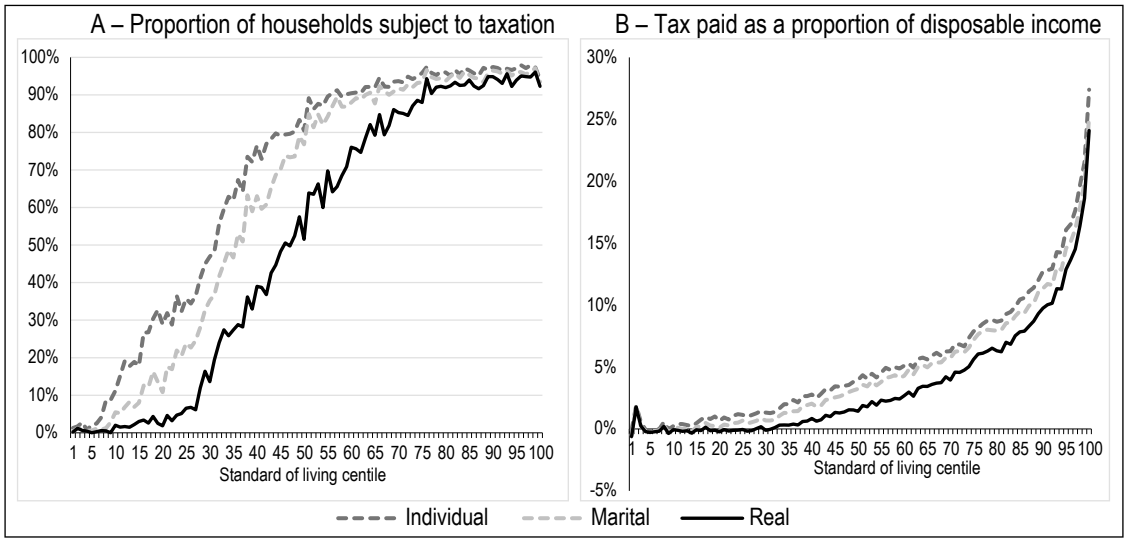
The proportion of households subject to taxation and the proportion of disposable income paid out in tax varies significantly depending on standard of living for each of the different scenarios considered (individualised, marital and real). When applied together (real tax), the marital and family tax schemes render a large proportion of households non-taxable, an effect that is marked from the first standard of living categories (Figure I-A). The effects of marital taxation drop off from the median standard of living upwards, while the family schemes play a role up to the eighth

Table 2 – **Households subject to taxation and tax paid, by scenario**

Income tax	Households subject to taxation		Tax paid	
	In million	In %	Total in billion euros	Average per month in euros
Individual	19.1	67.6	93.7	412
Marital	17.4	61.5	82.6	402
Real	14.4	50.8	66.0	395

Notes: The structure of the households is assumed to remain unchanged in the case of all types of tax. A household is deemed to be subject to taxation in the case of individualised taxation if at least one of its declaring members is subject to taxation.
Sources and Coverage: INSEE, ERFS 2015 updated in 2017; INSEE-DREES, Ines model, metropolitan France, ordinary households whose income is positive or nil and where the household reference person is not a student. Calculations by the authors.

Figure I – **Households subject to taxation and tax paid according to standard of living**



Notes: The standard of living is that calculated according to the income tax in force in 2017, referred to as real tax. The averages are calculated based on all of the households in the sample.
Reading note: At the median standard of living, 80% of households are subject to tax under individual taxation, but only 52% under family taxation. The wealthiest 5% devote 26% of their disposable income to tax when taxed as individuals (20% in the real case, with marital and family schemes).
Sources and coverage: See Table 2.

decile.[14] These effects stem in particular from the different distributions of family configurations along the distribution of standards of living (see below). As regards the tax reduction resulting from these schemes, it is particularly marked for households above the median standard of living (Figure I-B).

More precisely, the isolated effect of the scale accounts for the vast majority of the overall effect linked to marital and family taxation. The remaining effects consist of the effect of tax relief and the effect of tax credits and reductions (see André & Sireyjol, 2019).

The number of households that gain and lose out under the various schemes, as well as the associated gains and losses, are presented in Table 3. By convention, households are considered to have gained or lost out in the event that their annual tax changes by more than ten euros.[15]

Thirteen million households (46% of all households) gain in the sense that they pay less tax. 1.1 million households lose out as a result of the mandatory taxation of couples who are married or in a civil partnership.[16] The losses suffered by the households that lose out are smaller (401 euros per year on average) than what other households gain (average gain among households that benefit of 2,160 euros): the net average effect of marital and family taxation is 1,953 euros.

3.2. The Heterogeneity of Effects and Redistribution

Households that gain and lose out under the dual system of both marital and family tax are

14. Individuals are classified according to the disposable income of the household to which they belong. The deciles are the values that divide this distribution into ten equal parts. Therefore, the first decile (marked D1) is the standard of living below which the poorest 10% of people are positioned; the ninth decile (marked D9) is the standard of living below which 90% of individuals are positioned.

15. This assumption makes it possible to consider households whose simulated tax only changes as a result of rounding at the various stages of calculation to be considered as neutral. In the absence of simulation constraints on rounding, it would be necessary to measure the effects from the first euro.

16. A legally married couple may lose out on marital taxation when the sum of their incomes exceeds the cap for benefiting from tax relief in the case of joint taxation, but where the difference in income between the two partners is sufficiently large for the partner with the lowest income to have benefited from it if they had been taxed separately. In this case, the sum of the tax paid by the two partners if they were to be taxed separately would be lower than the tax paid if the couple were to be taxed jointly, since the loss brought about by the absence of tax relief for the couple exceeds the gain resulting from the marital tax quotient. In addition, a loss associated with the tax relief may also arise if both partners benefit jointly from the tax relief, as the cap for a couple is less than double the individual cap.

Table 3 – **Effects of the marital and family tax schemes in 2017**

	Thousands of households		Euros per year		
	Who gain	Who lose out	Gain	Loss	Net effect
Marital taxation	7,054	2,531	1,696	-367	1,151
Family taxation	9,333	29	1,782	-671	1,775
Marital and family taxation	13,015	1,140	2,160	-401	1,953

Notes: The effects are calculated based on the household concerned.
Sources and Coverage: See Table 2.

distributed differently along the standard of living scale. The proportion of households that gain increases with standards of living; those that lose out are particularly concentrated between deciles 6 and 8. The average amount that the households gain increases in line with standards of living: it is 812 euros on average for the 145,000 households subject to taxation among the poorest 10% that gain and 4,549 euros on average, i.e. 5.6 times more, for the 1.9 million households belonging to the wealthiest 10% that gain.

Figure II-A shows the proportion of households for which individual taxation is or is not in their interest according to their standard of living. Figure II-B shows the average amounts of gains and losses for each standard of living segment. The proportion of gains increases up to the median households, and then stabilises at around 60% of households among the wealthiest 50% of households. The losses are concentrated around the fifth decile. The vast majority of the losses are linked to marital taxation (see André & Sireyjol, 2019).

When looked at in relation to the standard of living of households, the gains are greater for the wealthiest households and increase in line with standards of living. For the poorest 20%, the average gains made by the households that benefit are below 2% of standard of living (Figure II-B). Indeed, the majority of these households are not subject to taxation under the two situations in question. For the wealthiest 15%, the gains increase significantly and exceed 5% of standard of living on average. Relative to standard of living, the gains made by the wealthiest 5% of households that benefit are twelve times higher than those made by the poorest 5% of households. Looking at marital taxation only, these gains are even higher among very high earners, as can be seen in the comprehensive tax data (see André, 2019). By way of a comparison, the wealthiest 15% pay 74% of the real tax, while the poorest 50% pay 1.3%.

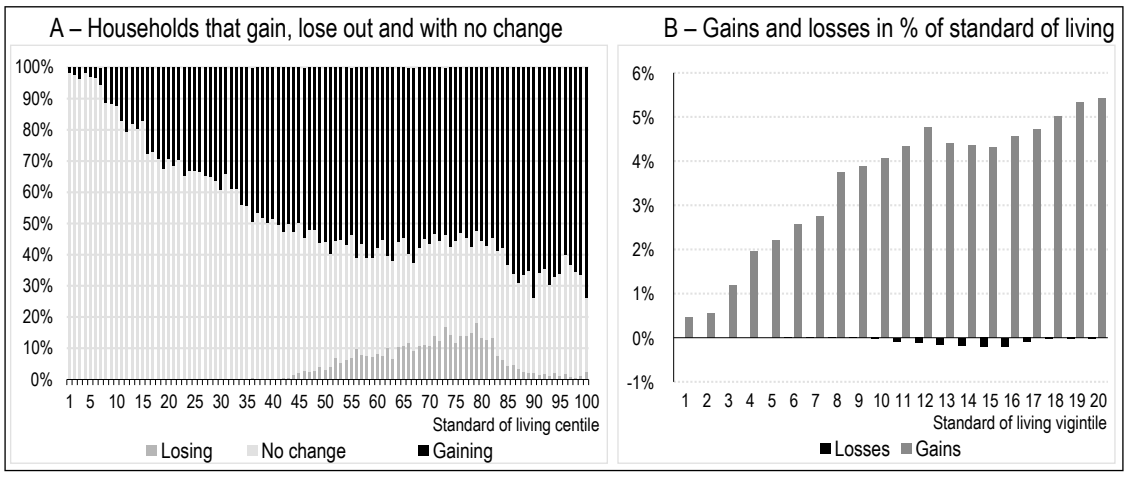
In addition, the average losses of households that lose out are significantly smaller, below 0.2% of standard of living, and show a bell-shaped profile when compared with the standard of living of the household. They are zero for the poorest 50% and negligible for the wealthiest 20%. While remaining low, the losses are greater between the 6th and 8th deciles, reaching a maximum of 0.2% of standard of living on average around the eighth decile.

The concentration of gains results from two effects. The gains brought about by marital taxation are greater the bigger the gap between the income of the two partners and the higher the sum of the couple's income.

The effects of marital taxation are anti-redistributive in the sense that it is the wealthiest households that benefit more from it. The same is true of family taxation, from which wealthier households benefit more due to the family quotient scheme. This results from the differences in family configurations by standard of living and the greater presence of couples at the top end of the scale, as well as mechanically, since without the effect of the tax base or tax credits and reductions, the wealthier a household is, the more tax they pay (see André & Sireyjol, 2019).

According to Morin (2014), the differences in income within couples, including both earned

Figure II – **From individual taxation to marital and family taxation**



Notes: The standard of living is that calculated according to the income tax in force in 2017.
Reading note: Of the median households in the 50th centile, 3.2% lose out, 40.7% see no change and 56.0% gain. The median households positioned between the 10th and 11th vigintiles that gain benefit from a 4.1% lower reduction in their standard of living due to marital and family taxation.
Sources and coverage: See Table 2.

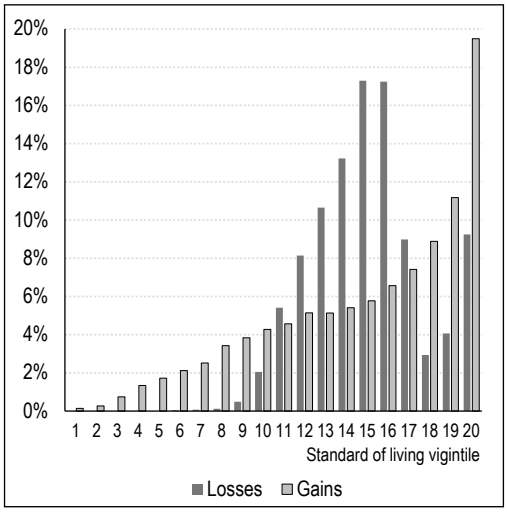
income and replacement income, are more pronounced among poor and wealthy households and are therefore less pronounced among couples with intermediate or relatively high incomes. In addition, inequalities are more pronounced among married couples or couples with children than among other couples. Within couples who are married or in a civil partnership, the proportion of income declared by the secondary contributor represents 35% of household income on average (André, 2019). Among those couples, 75% of the main contributors are male and 22 female, while 3% had equal incomes.

Ultimately, the wealthiest households benefit from a greater share of the gains linked to the marital and family characteristics of income tax: the wealthiest 15% obtain 40% of the total gains, while the poorest 50% share 20% of the gains (Figure III).

It is possible to calculate a poverty threshold[17] and standard of living inequality indicators in the simulated situations (marital or individual taxation). Table 4 presents a decomposition of the effects of marital and family taxation on the main poverty and inequality indicators. The poverty rate increases by 0.9 points and the Gini index by 0.004 when compared with the fictitious situation in which tax is individualised. This effect results from the relative measure of poverty. Indeed, the marital and family income tax increases the poverty threshold and therefore the median standard of living. Reducing taxes, particularly for the wealthiest households, actually deforms the distribution of standards of living and increases poverty and inequality when compared with a situation in which those schemes do not exist.

However, these effects should be interpreted with caution, since the tax revenues in the situations being compared are not the same. Indeed, these are partial effects that do not reflect what the situation would be if there were a constant budgetary envelope (see below for a fictitious scenario that changes the method of taxation with a constant budgetary envelope). However, the effects of a socio-fiscal scheme on inequality and poverty are heavily dependent on the intensity with which the transfers are targeted and the volume of the sums redistributed.

Figure III – **Distribution of gains and losses by standard of living**



Reading note: The wealthiest 5% of households (highest vigintile) account for 9.2% of the losses and 19.5% of the gains.
Sources and coverage: See Table 2.

3.3. Effects by Type of Family

The marital and family income tax schemes apply to tax households comprising a couple or those with dependent children. Given the difference that exists between the concept of the tax household and that of the household as defined by INSEE (a group of people living in the same dwelling), some single-person households may benefit: for example, where a child is linked to the household for tax purposes, but their primary residence is elsewhere. It is therefore possible to benefit from tax reductions for adult dependants within a fiscal household, without them belonging to the same household. Conversely, partners who are not married or in a civil partnership and who submit their tax declarations separately do not benefit from the marital or family income tax schemes, since they belong

17. The poverty threshold is equal to 60% of the median of the standards of living calculated in these two situations.

Table 4 – **Poverty and inequality standard of living indicators, by scenario**

	Individual	Marital	Real	Real – individual
Poverty rate (as a %)	12.2	12.2	13.1	0.9
Poverty gap (as a %)	16.6	17.1	17.2	0.7
Gini index	0.277	0.279	0.281	0.004
D9/D1	3.18	3.21	3.27	0.01
P95/P5	4.72	4.79	4.86	0.15
Poverty threshold (euros)	12,110	12,212	12,516	406

Sources and coverage: See Table 2.

to two different tax households. Aside from this observation, households comprising a couple with children are very heavily over-represented among the households that gain, in so far as they potentially benefit from both mechanisms.

As the effects largely result from the application of the scale, i.e. the family quotient scheme, they are highly dependent on the family configuration. Tables 5, 6 and 7 list the numbers of people concerned, together with the gains and losses for each type of family. They make it possible to describe the horizontal redistribution brought about by the tax quotient system.

Of the 13 million households that gain, 39% are couples with one or two children, even though they only account for 21% of the population. Single people as defined by INSEE make up 35% of households, but only 11% of the households that gain.[18] Almost half of single-parent families benefit (1.2 million of 2.5 million); 79% of the 1.5 million couples with three or more children gain, compared with 49 of the 8 million couples without children (Table 5).

Of the 2.5 million households that lose out as a result of marital taxation, 1.4 million are covered by the family schemes, such that the number of households that lose out under both schemes combined is 1.1 million (Table 6).

18. The number of single people who benefit is not zero, since the family quotient scheme includes adult, student or disabled children who do not necessarily live in the household, but belong to the same tax household. Around one in five of the single people who gain also only benefit from the deduction for child support. The rest are single people with additional tax units, primarily as a result of the half-tax unit for disability or previously being a single parent, for example.

Table 5 – **Households that gain by family configuration**

Family configuration	All households		Marital taxation		Family taxation		Real	
	thousands	%	thousands	%	thousands	%	thousands	%
Single people	9,936	35.1	106	1.5	1,384	14.8	1,471	11.3
Single-parent families	2,471	8.7	34	0.5	1,196	12.8	1,210	9.3
Couples without children	8,057	28.5	3,417	48.4	1,201	12.9	3,917	30.1
Couples, 1 or 2 children	6,053	21.4	2,670	37.9	4,460	47.8	5,074	39.0
Couples, 3+ children	1,477	5.2	735	10.4	948	10.2	1,165	9.0
Complex households	283	1.0	92	1.3	145	1.6	177	1.4
Total	28,277	100.0	7,054	100.0	9,333	100.0	13,015	100.0

Sources and coverage: See Table 2.

Table 6 – **Households that lose out by family configuration**

Family configuration	All households		Marital taxation		Family taxation		Real	
	thousands	%	thousands	%	thousands	%	thousands	%
Single people	9,936	35.1	14	0.6	10	29.9	18	1.6
Single-parent families	2,471	8.7	n.s	n.s	n.s	n.s	n.s	n.s
Couples without children	8,057	28.5	1,252	49.5	11	39.0	1,005	88.1
Couples, 1 or 2 children	6,053	21.4	1,059	41.8	n.s	n.s	111	9.7
Couples, 3+ children	1,477	5.2	175	6.9	0	0.0	n.s	n.s
Complex households	283	1.0	27	1.1	0	0.0	n.s	n.s
Total	28,277	100.0	2,531	100.0	29	100.0	1,140	100.0

Notes: ns stands for not significant.
Sources and coverage: See Table 2.

Table 7 – **Annual tax, average gain and total gain, by family configuration**

Family configuration	Average gain (euros)	Total gain		Average loss (euros)	Total loss	
		million euros	%		million euros	%
Single people	1,206	1,774	6.3	-449	-8	1.7
Single-parent families	1,737	2,102	7.5	-3,314	-10	2.1
Couples without children	1,765	6,912	24.6	-388	-390	85.2
Couples, 1 or 2 children	2,432	12,341	43.9	-439	-49	10.7
Couples, 3+ children	3,901	4,545	16.2	-158	0	0.0
Complex households	2,436	432	1.5	-350	n.s	n.s
Total	2,160	28,106	100.0	-401	-458	100.0

Notes: ns stands for not significant.
Sources and coverage: see Table 2.

In total, 44% of the gains benefit couples with one or two children, a family configuration that benefits from both the marital and family schemes (Table 7). The latter gain an average of 2,432 euros from marital and family taxation. 85% of the losses are incurred by couples without children, for whom marital taxation would not be in their interest as a result of the individual schemes still being used to calculate their tax (see André, 2019).

Figure IV shows the share of disposable income that is devoted to tax by family configuration and by standard of living, split into twenty categories, each comprising the same number of individuals. There is little change to the profile for single people. The proportion of their standard of living that is devoted to tax is significant from the fourth standard of living decile upwards. It exceeds 15% for the wealthiest 5% and changes little with the application of different scenarios. Conversely, marital and family taxation brings about a significant change in these profiles for other family configurations.

In the absence of the marital tax quotient, the profile of taxes paid as a proportion of disposable income would be similar between couples and single people, with the exception of those in the wealthiest standard of living categories due to the higher average income of couples.

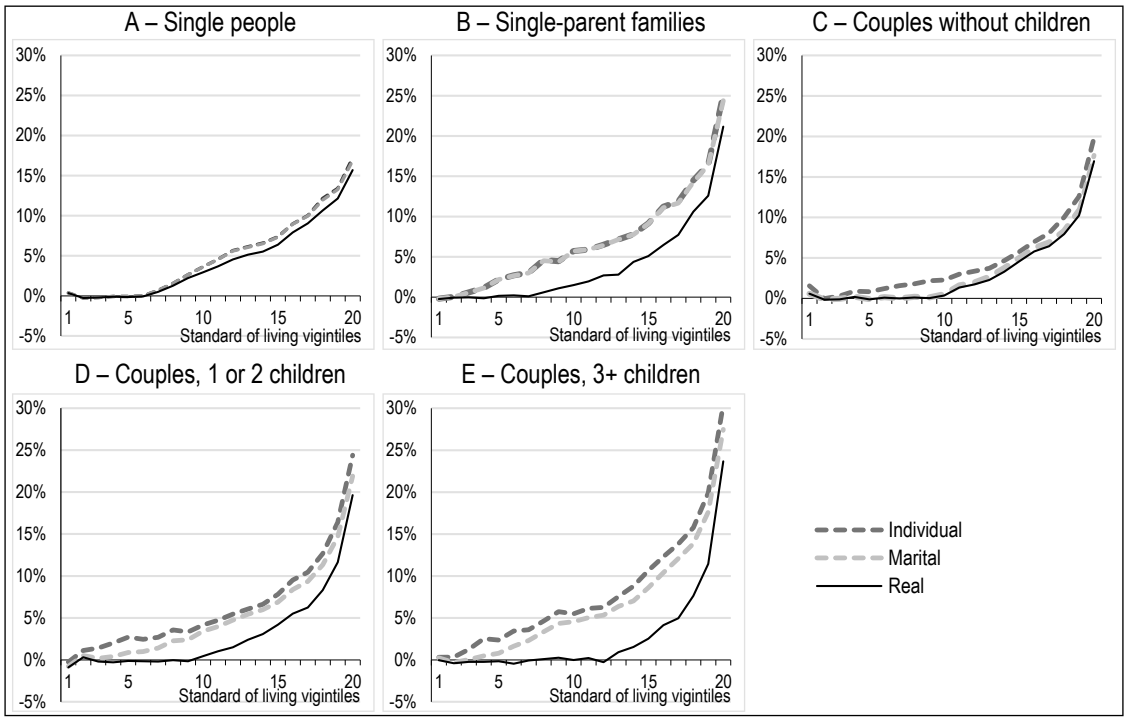
3.4. The Effects of Marital and Family Taxation

The above findings highlight significant monetary and redistributive effects. When looked at in combination, marital and family taxation brings about a significant horizontal redistribution between the different types of families. In this section, we will analyse the decomposition of these effects by isolating the schemes linked solely to the marital tax schemes.

The gains from marital taxation largely only concern couples with or without children (96.3% of the gains), while those from family taxation also benefit single-parent families for a total of 2 billion euros (12.2% of the gains) and 11.3 billion euros for couples with children, or 68.2% of the gains (Table 8).

In order to perform a more detailed analysis of the effects of marital taxation on the one hand and the effects of family taxation on the other hand, Figure V shows the proportion of households subject to taxation by standard of living for each family configuration. It highlights that the tax quotient schemes have a massive effect on the extent to which families are subject to taxation and have different effects on different types of family. Couples below the fifth decile benefit from the marital tax quotient. The effects

Figure IV – **Tax paid, in % of the standard of living, by scenario and family configuration**



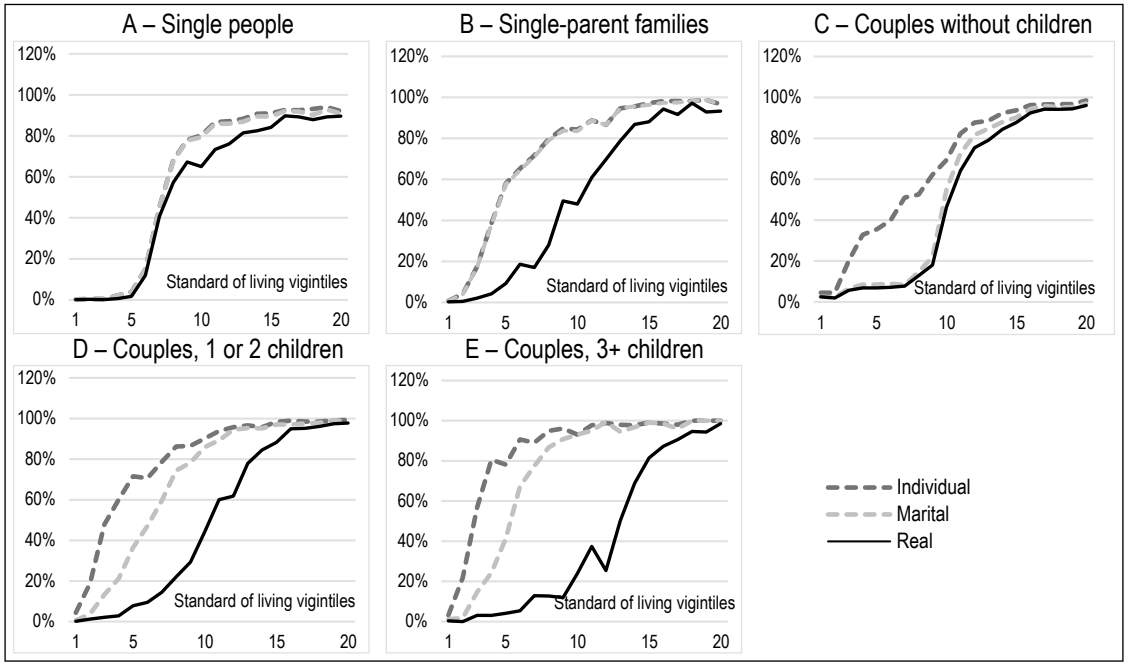
Notes: The standard of living is that calculated according to the income tax in force in 2017. The standard of living categories are calculated on the basis of all individuals and remain fixed.
Reading note: See Figure I-B.
Sources and coverage: See Table 2.

Table 8 – **Total gain from the two schemes by family configuration**

Family configuration	Marital taxation		Family taxation	
	million euros	%	million euros	%
Single people	218	1.8	1,558	9.4
Single-parent families	72	0.6	2,033	12.2
Couples without children	5,606	46.9	1,430	8.6
Couples, 1 or 2 children	4,472	37.4	8,162	49.1
Couples, 3+ children	1,434	12.0	3,171	19.1
Complex households	159	1.3	282	1.7
Total	11,961	100.0	16,636	100.0

Notes: Due to the differences between households as defined by INSEE (cohabiting in the same dwelling) and fiscal households (persons linked to the same tax return), some families without children as defined by INSEE can be seen to be benefiting from family taxation: this is because they can link dependants who do not live with them. In the case of marital taxation, there are also people who can be observed to be benefiting from these schemes, even though they are not living as a couple: this is due to the fact that they may have separated during the year and therefore continue to benefit from this even though they are living alone. Likewise, some cohabiting couples who are neither married nor in a civil partnership are neutral with respect to these schemes from the point of view of taxation, but are viewed as couples by INSEE.
Sources and Coverage: See Table 2.

Figure V – **Proportion of households subject to taxation by scenario and family configuration**

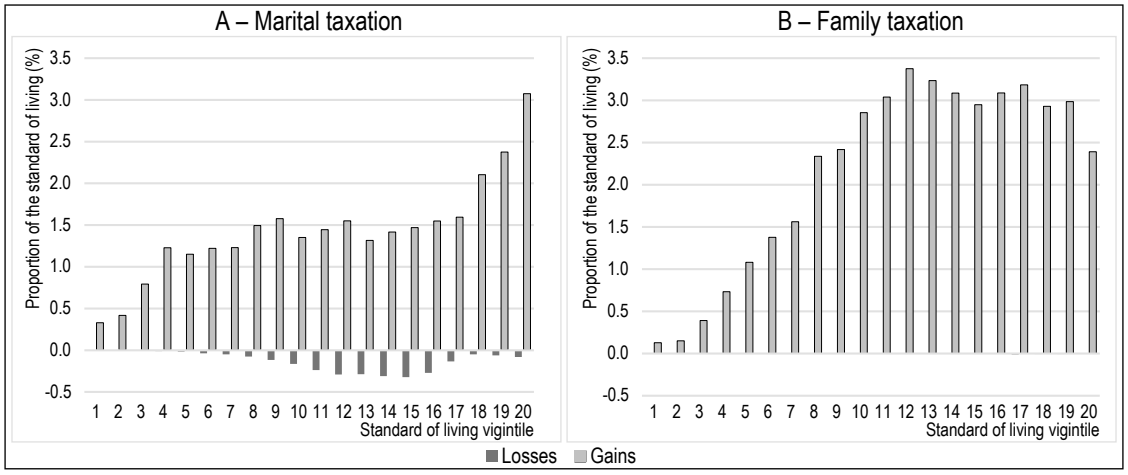


Notes: The standard of living is that calculated according to the income tax in force in 2017.
Reading note: See Figure I-A.
Sources and coverage: See Table 2.

of the family tax quotient are observed up to the eighth decile and are especially evident when it comes to the extent to which couples with three or more children are subject to taxation.

This difference in the effects of marital and family taxation can be seen through the decomposition of the gains and losses by standard of living (Figure VI). Due to the difference in the cap on the number of tax units for dependants, but not for couples who are married or in a civil partnership, the effects of marital taxation increase among the wealthiest 15%, while the effects of family taxation decrease. Indeed, unlike the gains associated with the family tax quotient, which were capped at 1,512 euros per half-tax unit in 2017, there is no legal cap on the gains resulting from the marital tax quotient. The cap on the family tax quotient is a scheme that is primarily concentrated on the top end of the standard of living distribution. It concerns fewer than 3.5% of the poorest 75% of households, while 86% of the households affected by the cap belong to the wealthiest 20%, with 28% of those falling into the wealthiest 5%. Therefore, unlike the marital tax quotient, the concentration of the gains linked to the family tax quotient is reduced as a result of this cap. The effects of marital taxation are more anti-redistributive in the sense that the relative benefit is greater for the wealthiest households (see a breakdown of

Figure VI – **Average gains and losses by standard of living**



Notes: The standard of living is that calculated according to the income tax in force in 2017.
Reading note: The average gains from marital taxation schemes exceed 3% of standard of living for the wealthiest 5% of households.
Sources and coverage: See Table 2.

households that win, lose and are neutral under marital taxation on the one hand, and under family taxation on the other hand in the Online Appendix).

3.5. Vertical or Horizontal Redistribution of Family Taxation: Illustration with a Flat-Rate Tax Credit For Each Dependant

Assessing the redistributive effects of the socio-fiscal schemes primarily relies on the counterfactual scenarios selected. There are potentially many such reference situations, but if they are to be compared with one another, they must be presented within the same envelope. Here, we will present the redistributive effects of a marital tax with a single tax credit for each dependant. We have chosen an identical amount for illustrative purposes in order to simply highlight the scale of the budgetary amounts involved.

More precisely, the tax calculation being simulated here corresponds to a tax that would work in the same way as it would have under the French system in 2017 for the marital tax quotient, but with the family tax quotient removed and replaced with a single tax credit that would benefit all tax households with dependants, regardless of whether they are taxed or not. We are therefore comparing two systems of marital taxation with identical budgetary envelopes, one where the marital quotient scheme remains unchanged (real tax) and the other where it is replaced by a uniform tax credit for each dependant. The amount of this credit that would ensure an unchanged budgetary envelope, i.e. that would bring in the same tax revenue as the tax that was actually in force in 2017, is estimated at 1,021 euros. In other words, the family-only (and not marital) income tax schemes correspond to a total that would amount to 1,021 euros per dependant for each household.

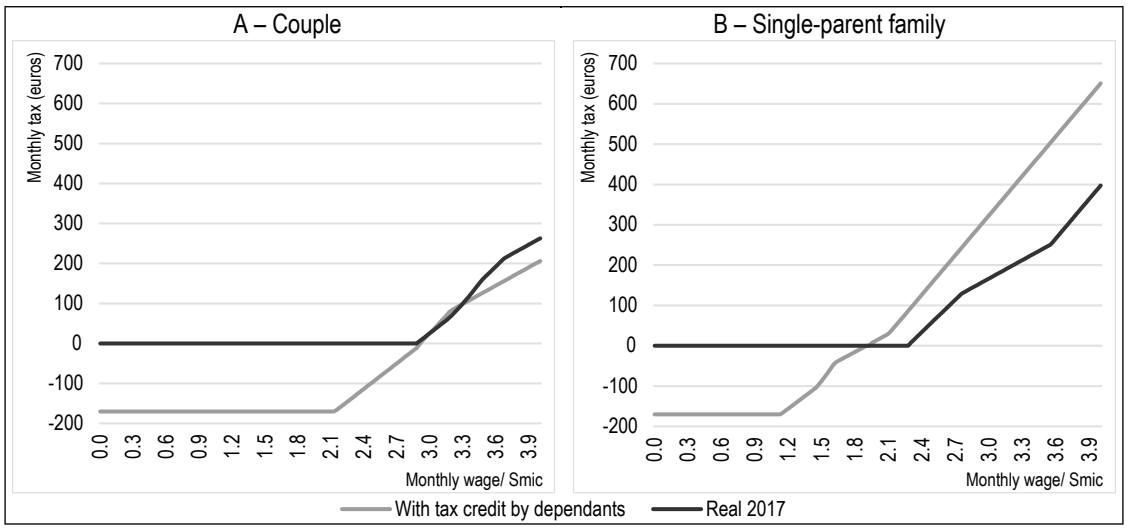
In the variety of possible cases, the simulated fictitious scenario seeks to illustrate the scale of the vertical redistribution brought about by the current family tax quotient system. One objective of a counterfactual calculation of this type is to assess the relative scale of horizontal and vertical redistribution with tax revenue remaining unchanged. From a redistributive point of view, a flat-rate tax credit is equivalent to a benefit[19] that is not dependent on income; in this sense, it changes the progressivity of the socio-fiscal system. This fictitious scenario demonstrates that there is a wide range of schemes that take account of family responsibilities and that vertical redistribution is not necessarily at odds with horizontal redistribution.

The equal tax credit for all dependants greatly poor families who benefit from the tax credit since it is paid to families who do not pay tax and do not benefit from the family tax quotient as they are not subject to taxation. Figure VII shows, for example, the impact on the amount of tax paid by families with two children.

For couples with two children, all tax households benefit in the scenario involving a single tax credit (Figure VIII). Employees earning between 0 and 2.4 times the minimum wage benefited the

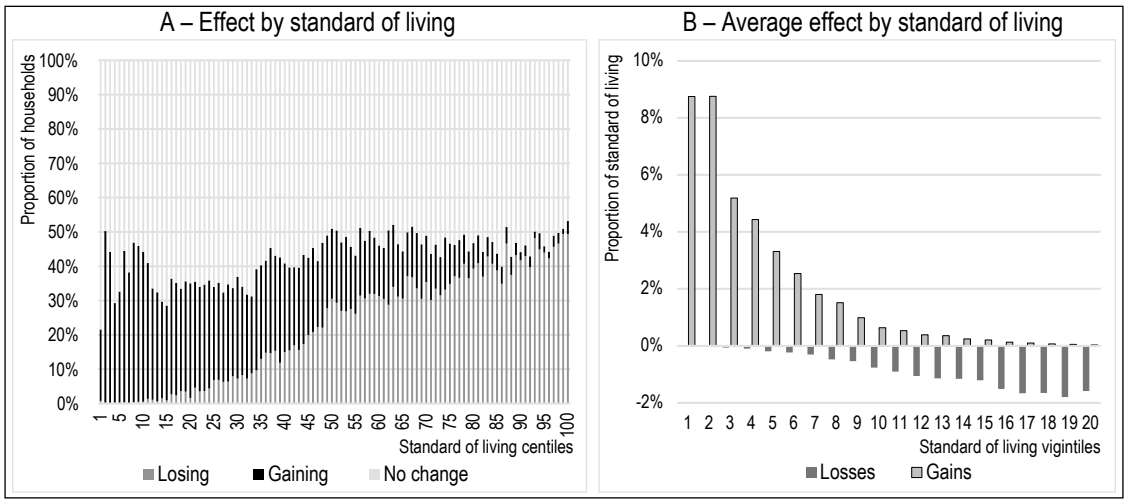
19. A benefit is considered to be redistributive if its proportion in relation to primary income decreases in line with standard of living or increases more slowly than income. A deduction is said to be redistributive if its proportion in relation to income increases with standards of living. It is considered to be neutral in terms of inequality if it is proportional to income.

Figure VII – **Monthly tax based on net wage as a proportion of the minimum wage (Smic) for a household with two children**



Sources: DREES case study model, authors' calculations.

Figure VIII – **Effect of the tax credit per dependant scenario**



Notes: The standard of living is that calculated according to the income tax in force in 2017.
Sources and coverage: See Table 2.

most. After this, the gain reduces as the amount of tax paid by households increases and where the family tax quotient applies in the counterfactual situation.

In the case of single-parent families, the gains are greater among the poorest households. However, losses occur among those earning in excess of 2.1 times the minimum wage. Indeed, these households do not benefit from the marital tax quotient and lose the benefit arising from the increase in the family tax quotient for single persons.

In this scenario, which involves the introduction of a flat-rate tax credit for each dependant, the number of households subject to taxation is 54.4%, an increase of 3.7 points. The effects on the poverty and inequality indicators are massive. The poverty rate falls to 11.0% (-2.2 points) and the poverty gap to 15.4% (-1.8 points). The Gini index falls by 11.4 points. The D9/D1 interdecile ratio (and the P95/P5 intervingtile ratio, respectively) falls from 3.16 to 3.05 (and from 4.76 to 4.53, respectively).

* *
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In 2017, the marital and family tax schemes in the broad sense reduced tax revenue by 27.7 billion euros in metropolitan France. As a result of these schemes, 5 million households were no longer subject to taxation, 13 million households saw a reduction in their tax bill and 1 million households saw their tax bill increase when compared with a situation in which these

schemes would not exist. These estimations are made on the basis of unchanged behaviour or, more precisely, on the basis of the behaviour observed among the people in question according to the tax legislation in force and without adapting this to a change in the way that tax is calculated.

Sixty per cent of the gains associated with these schemes benefit couples with children. In addition, half of these gains are obtained by the wealthiest 25% of households due to the progressive nature of income tax. Indeed, the number of households that benefit and their average gains increase in line with standards of living, particularly as a result of the effect of the marital tax quotient, which is not legally capped. The average losses incurred by households that lose out are significantly smaller, below 0.03% of standard of living, and show a bell-shaped profile when compared with the standard of living. The average gains are higher, but increase sharply with standards of living: from less than 2% of standard of living for the poorest 20%, they exceed 4% of standard of living for the richest 50%. The wealthiest 10% see their standard of living increase by more than 5%.

Generally speaking, the redistributive effects of the socio-fiscal schemes are heavily dependent on who they are targeted at and the size of their budget. In order to extend the analysis, it would be necessary to simulate scenarios involving legislative variants inspired by foreign cases with a constant budgetary envelope. The findings presented in connection with family taxation remind us that the vertical and horizontal redistributive effects are strong, but underline that the horizontal and vertical dimensions can be reconciled to the degree decided upon by the legislator. An example in which there is a trade-off between horizontal and vertical redistribution is the cap that is only applied to the family tax quotient. As mentioned in the HCF report (2011), a plethora of possibilities can be envisaged (use of consumption units rather than tax units, flat-rate reduction or tax reduction that is proportional to income, consideration of the ranking of children or the partner's income, etc.). Conversely, the effects measured in this study are primarily based on the characteristics of income tax: the more progressive the scale, the greater the effects. However, recent changes in taxation have seen a shift in income taxation from income tax to the CSG (André & Guillot, 2014). This other income tax is not progressive and is paid on an individual basis. Therefore, the recent reductions in income tax in favour of increases in the CSG have lessened the effects of marital and family taxation within the tax system. □

Link to the Online Appendix:
https://www.insee.fr/en/statistiques/fichier/5430846/ES-526-527_Andre-Sireyjol_Online-Appendix.pdf

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COMMENT

Family-Based Tax and Transfer System – Issues for Income Tax and Other Public Policies

Clément Carbonnier*

Abstract – The articles by Allègre *et al.* (2021) and André & Sireyjol (2021) document in detail, using microsimulations, the redistributive impacts of the familialization of the income tax, and thus contribute to the important debate on this specific system of household income taxation in France. To discuss their results, we first propose to review the history of this specificity, which refers to the question of contributory capacity and its origin in the 1789 *Déclaration des Droits de l'Homme et du Citoyen*. We question its interpretation through the concepts of decreasing marginal utility and equivalence scale and its scope of application, the income tax or the whole system of taxes and transfers. Finally, we question the unit of evaluation: the individual or the family.

JEL Classification: D31, H24, H30, H31, J12, J16
Keywords: income tax, family tax quotient, marital quotient, redistribution, inequality

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This short thematic section brings together two papers assessing the distributional impacts of the family-based income tax system in France. Guillaume Allègre, Hélène Périvier and Muriel Pucci (Allègre *et al*., 2021) focus on the marital tax quotient (joint taxation of couples who are married or in a civil partnership) without analysing the scheme for dependants. They carry out three simulations of reforms altering the form of this joint taxation. Mathias André and Antoine Sireyjol (André & Sireyjol, 2021) analyse the effect, without simulating any alternative reform, of both the marital and family tax schemes (taking dependants into account).

These two papers closely document the redistributive aspect of this specific system for taxing household income in France, and thus contribute to the important debate about these schemes. The argument often put forward for defending the latter is 'fiscal neutrality' between families of an identical composition (two families of the same composition earning the same income pay the same tax) or the argument that the schemes allow each household – regardless of their composition – to be taxed according to their ability to pay (which is a constitutional principle). Conversely, they are also criticised for perhaps not being so neutral in their effect, even in regard to identically constituted households, and for not properly matching ability to pay when considering households of differing compositions (Carbonnier, 2016 and Allègre *et al*., 2021). These schemes are also particularly favourable to the wealthiest households, which lessens the progressive nature of the tax (Allègre *et al*., 2021 and André & Sireyjol, 2021). Lastly, a side effect of the marital tax scheme is to discourage women who are married or in civil partnerships from playing a part in the labour market (Carbonnier, 2020).

In order to discuss the results of these microsimulation analyses, it is interesting to look back at the history of this specific income tax scheme in France. This helps understanding of the different motives that governed the construction of this system in order to interpret the results of both papers in light of these objectives. It also serves to inform debate about conceptions of taxation and fiscal justice. In order to do this, firstly we reconsider the issue of contributory capacity or ability to pay and its origin in the 1789 *Déclaration des Droits de l'Homme et du Citoyen*. We question it in several ways: firstly as regards its interpretation through the concepts of decreasing marginal utility and equivalence scale; and then in regard to its scope, income tax or the entire tax and transfer system. Lastly, we examine the unit of assessment: the individual or the family.

Payment of Taxes According to Ability to Pay

The primary motivation for establishing the tax system based on the marital tax quotient (QC) and family tax quotient (QF) is to take into account the ability to pay as measured at family level. This consideration is of a constitutional nature as it is inscribed in the 1789 *Déclaration des Droits de l'Homme et du Citoyen*, appended to the constitution of 1958, which is currently in force in France. However, within the whole constitution, the part relating to this issue is limited: "A common contribution is essential for the maintenance of the public forces and for the cost of administration. This should be equitably distributed among all the citizens in proportion to their means".[1]

So, constitutionality is dependent above all on the Constitutional Council's interpretation of distribution in proportion to means. Such a principle can be interpreted in very different ways. Even prior to the Déclaration of 1789, Adam Smith (1776) wrote about a similar principle: "The subjects of every state ought to contribute towards the support of the government, as nearly as possible, in proportion to their respective abilities; that is, in proportion to the revenue which they respectively enjoy under the protection of the state."

While the first part of Adam Smiths' sentence is almost identical to the French constitutional principle, the second differs greatly from the current idea of ability to pay. In fact, the 19th century saw great debate on this matter and, consequently, on the proportionality or progressive nature of the tax, as recounted in detail at the end of the century by Seligman (1896). Aside from the proponents of a contribution in accordance with the benefit received (partially picking up on Smith's argument as, given public service mainly concerns security, it is proportional to protected income), the important point of the debate is what we now call the decreasing marginal utility of income. Developed mainly at the end of the 19th century by the founders of Marginalism (William S. Jevons, Carl Menger, Léon Walras and then Alfred Marschall), its main arguments were already evident in Daniel

1. *Translated from 1789* Déclaration des Droits de l'Homme et du Citoyen, *Article 13.*
https://www.legifrance.gouv.fr/contenu/menu/droit-national-en-vigueur/constitution/declaration-des-droits-de-l-homme-et-du-citoyen-de-1789

Bernoulli's solution to the 'Saint Petersburg Paradox', back at the start of the 18th century. The principle is that the utility of a euro is not the same for everyone: a person who is richer than someone else has already provided for all their greatest needs before spending their last euro, so the utility of that final expenditure is therefore lower for this wealthy person than for a poorer person who is using it to pay for more basic consumption.

This argument lies behind the conception of a capacity to contribute to public finances that increases proportion to one's income, leading to the progressive nature of the tax. Now, as is clearly explained by Allègre *et al*. (2021) and André & Sireyjol (2021), the marital and family tax quotients only have meaning within the framework of a progressive income tax. It can thus be seen that conceptions alter with changes in society and it must be understood that what underpins the current tax scheme is clearly the modern interpretation of a text, which was interpreted differently when written 250 years ago.

The revolutionary interpretation was, indeed, closer to that of Adam Smith and the idea of proportionality. Eager to put an end to multiple taxes, and to indirect taxes in particular, the revolutionaries sought to introduce a single contribution, as proportionate to income as possible. To avoid any breach of household privacy (a criticism still made in parliamentary debates when introducing progressive income tax at the start of the 20th century), a set of four taxes based on the external signs of wealth were chosen: an occupancy tax on the value of accommodation (gradually changed to the recently abolished housing tax); a land tax (leading to the *taxe foncière*, property tax); a trading licence (trade tax which was changed in 1976 to the business tax which in 2009 in turn became the *Contribution Économique Territoriale*, local business tax), and the now-abolished tax on doors and windows. These taxes were not progressive but attempted to take ability to pay into account through a principle of proportionality in relation to the external signs of wealth.

So, it was only in 1914, slightly after but following straight on from other industrialised countries, that France introduced a progressive income tax. The question then arose of the applicable unit when levying this tax. The strong family basis of the social structure led to the household being chosen as the applicable unit. Initially, the family was only taken into account through tax cuts, rebates and allowances. It was only in 1945 that the major reform introduced the principle of the marital tax quotient and family tax quotient, therefore constituting a relatively new mechanism (in respect of Article 13 of the *Déclaration des Droits de l'Homme et du Citoyen*) in tax history, even though it may seem quite old in view of the major social changes that have taken place since World War II, as noted by André & Sireyjol (2021).

Equivalence Scales

Consideration of the progressive ability to pay at household level leads to the matter of equivalence scales. Just as foregoing 5% of your income when you have €1,000 a month to live on has more impact than foregoing 5% of your income when you are earning €10,000 (progressivity principle), a 5% reduction in the income of a couple earning €3,000 a month has a greater impact for them than for a single person earning the same total amount of €3,000. With their €2,850, a single person can meet more of their major needs than a couple with this same total income. That is why household-based systems put mechanisms in place to reduce taxation of couples. From 1914 to 1945 in France, this was a matter of tax allowances and cuts; since then, it has concerned the principle of the marital tax quotient.

However, the current marital tax quotient amounts to regarding the 5% levied on a single person earning €1,500 as being as having the same impact on them as the 5% levied on a couple earning €3,000, which amounts to saying that a couple gets the same satisfaction from their consumption of €3,000 as a single person gets with €1,500. Now this is not the case, due to economies of scale: a couple does not need to spend twice as much as a single person on their housing to derive the same satisfaction, as there is no need to double the amount of electrical appliances, have two internet subscriptions, twice the amount of heating, etc. Equivalence scales are normally used in order to take these economies of scale into account, with the standard, according to the modified OECD scale, being to regard a couple as needing one and a half times the income of a single person to derive the same utility from consumption. That is why Allègre *et al*. (2021) test the effect of a reform that would retain a marital tax quotient but aligning it with this equivalence scale. They thus find that the current system gives couples an advantage and, due to the progressive nature of the tax, to a greater extent, the wealthier they are.

Of course, this equivalence scale standard is only a convention and much debated in the

literature, as noted by Allègre *et al*. (2021). As shown above, it depends primarily on the composition of the basket of consumer goods and the proportion of goods that can be shared within it. Housing is a form of such goods with a significant impact on household budget, thus strongly governing the equivalence scale. And there is great variation between households in the proportion of their budget accounted for by housing costs.

Firstly, housing is a staple and, as demonstrated by Carbonnier (2019), the ratio for the rental value of the occupied property to household income decreases considerably with level of income. Moreover, the proportion of budget accounted for by housing costs varies greatly by region within France (Carbonnier, 2021), leading not only to large differences in living costs but also to large regional differences in equivalence scale. The income tax is designed to compensate for the differences in standard of living related to family composition, but not to the household's geographic location, even though the two interact.

In addition, occupancy status (tenant *vs.* homeowner) is not taken into account. But when comparing two households of the same composition and the same income, the one that owns their own home obviously has a higher standard of living (and ability to pay) than the one having to use part of their income to pay their rent. In other words, a household's income exceeds its simple monetary income and includes income from capital in kind, constituted by the housing services from which the household benefits due to its property wealth. If income is defined as the sum of consumption and variation in wealth, living in one's own home clearly constitutes income in the sense that this consumption of housing services does not reduce the stock of property wealth. For this reason, some income tax systems seek or have sought to include this income – known as net implicit rental income – in the tax base. This is still the case in Switzerland and was the case in France up until 1965.

Coverage of the Constitutional Principle

The French income tax system strives hard to apply the principle of Article 13 of the *Déclaration des Droits de l'Homme et du Citoyen* to differences in family composition but not to regional differences in the cost of living or differences in ability to pay depending on home occupancy status. This endeavour is not new: back in the 17th century, through an edict issued in 1666, Colbert exempted young married couples under the age of 21 and families with more than ten surviving children from the tax known as the '*Taille*' (Clamageran, 1867, p. 623). With the creation of the income tax in 1914, schemes relating to family were significant: besides tax allowances and cuts, there were heavy penalties for single people over the age of 30 and for couples who remained childless more than two years after the date of their marriage (Piketty, 2001).

It is evident in these examples that consideration of the family in tax matters goes far beyond the question of fiscal neutrality and includes motivations connected with morality and the promoting of a higher birth rate. Indeed, the citation from Allègre *et al*. (2021) of the explanatory memorandum for the 1945 Bill introducing the marital tax quotient includes the term 'immoral' and not 'unfair' or 'non-neutral'.

Returning to the example of differing ability to pay depending on family composition and region, it is notable that public policies seek to compensate for regional inequality but consider this to be done through mechanisms others than the income tax, whereas it is hard to conceive of an income tax not taking family composition directly into account. Now it does not seem absurd to think that the principle of Article 13 of the *Déclaration des Droits de l'Homme et du Citoyen* does not specifically concern income tax but rather the entire tax and transfer system.

At the time this Article 13 was written, no similar tax to income tax existed and, what is more, levies were conceived as having to be proportionate to income and not progressive. Public spending was seen as relatively simple – "maintenance of the public forces and (…) the cost of administration" – and monetary transfers only concerned the mandatory levies to finance this expenditure. So, Article 13 applies to these mandatory levies as a whole, referring to them in the singular as "a common contribution". Today, it appears that taking account of families' ability to pay is focused on income tax and not on the other mandatory levies (VAT, the CSG General Social Contribution, corporate tax, property tax, etc.). However, the income tax only represents a small proportion of funding for public spending: the Finance Bill for 2020,[2] the last one prior to the Covid-19 crisis, measured or estimated revenue from income tax as just 3% of GDP, or

2. *Finance Bill for 2020, Economic, Social and Financial Report, 2019. https://www.tresor.economie.gouv.fr/Articles/913ca061-93bb-44c7-a860-04468507d5bb/files/b1ac7248-60bc-4094-9029-1761bae604c2*

5.8% of public revenue and 6.9% of mandatory levies for each of the three years from 2018 to 2020.

Above all, public spending is made up of allowances, not just "maintenance of the public forces and [the] cost of administration". Now allowances account for a significant proportion of redistribution, more than that generated by mandatory levies, not only in France but also in most industrialised countries (Guillaud *et al*., 2020). One might therefore regard the modern interpretation of Article 13 of the *Déclaration des Droits de l'Homme et du Citoyen* as not concerning the rate of income tax according to ability to pay but rather the overall redistributive characteristics – vertical redistribution according to standard of living and horizontal redistribution according to taxpayer characteristics – of the tax and transfer system as a whole.

The various social welfare schemes, which are in fact more redistributive than the income tax, consider household composition in a very different way. Bargain *et al*. (2017) measure the implicit equivalence scale for several transfers in France. They find a weighting of 1 for the spouse or civil partner in the case of the marital tax quotient, 0.5 if childless and 0.3 if there is a child for the *prime d'activité* (an in-work benefit); with the single parent allowance, this weighting can change to 0.22 if childless, 0.09 with one child and -0.04 with two children; and for housing benefits, they find a weighting of 0.28 if childless and 0 if there is a child.

Isolated Impact of a Mechanism versus Overall Modification of the Transfer System

Not only do these various components of redistribution apply different equivalence scales but they are even applied to different units. Income tax only takes married couples and those in civil partnerships into consideration, whereas social welfare benefits consider cohabiting partners in general. That is also why Allègre *et al*. (2021), in their simulations of potential reforms, alter this rule to allow cohabiting partners to access the same tax benefits as couples who are married or in a civil partnership (a half-tax unit for the spouse or a cap on the advantage gained). This in fact generates less tax revenue due to the reform (tax gains for the cohabiting taxpayers concerned). This is one of the reasons why these measurements are not directly comparable with those of André & Sireyjol (2021), who focus on measuring the advantage gained under the current system (with a wholly individualised reference).

This question of taking account of redistribution in relation to the tax and transfer system as a whole, rather than to a given mechanism poses another question concerning the interpretation of the results of the two papers commented on here. The budget is not kept constant for the reforms that are simulated either explicitly (Allègre *et al*., 2021) or implicitly (André & Sireyjol, 2021) and in reality they would therefore necessitate some form of counterbalance – e.g. cuts in other public revenue or increased spending – which in turn would have a notable and variable impact on distribution depending on the choice of cuts. We understand that the authors do not prejudge such choices and concentrate on the specific effects of the marital and family tax quotients, but it is important not to forget this when interpreting their results.

One of the case studies, however, does maintain a constant budget: this involves turning the family tax quotient into a flat-rate tax credit, estimated by André & Sireyjol (2021). In this simulation, abolishing the family tax quotient generates an increase in income tax revenue – paid by families due to the loss of the tax incentive – which is redistributed to families in a flat-rate way, i.e. regardless of their income (a form of non-means-tested family allowance). The heavily regressive aspect of the family tax quotient then becomes apparent: such a reform would not lead to any households at the very bottom of the standard of living distribution being worse off nor would any at the very top be any better off (with a gradual reduction in winners and gradual increase in losers along this standard of living distribution). Average gains would be very strong for the poorest households (up to 8.5% of income) whereas losses at the top of the distribution would be shared out more (up to 1.5% of income).

On this matter of transfers to compensate for the cost of children, Favrat *et al*. (2015) measure the distributive profile for taxes and transfers as a whole. It appears that means-tested mechanisms (family allowances or taking children into account when determining social welfare benefits) compensate for the regressivity of the family tax quotient, leading to virtually constant total amounts per child throughout the standard of living distribution. However, splitting a constant allowance between various mechanisms, including some that are progressive and others regressive, is not neutral in its effect as the social stigma attached to these various mechanisms – and consequently to the different household types benefiting from them – are not the same.

Unit of Assessment of the Constitutional Principle

In conclusion, it is impossible not to deal with an essential point raised by these two papers, namely the place of the family in public policies and in our society more generally. Both papers describe the socio-demographic changes, in particular the increasing participation by women in the labour market and the growth in child-care provision for young children and infants. More generally, it is society as a whole that has changed. While the family is still an important level in the social structure, it is no longer the inevitable intermediary between the individual and the community. For example, couples are a long way from pooling their entire resources (Ponthieux, 2012). In 2010, 36% of them were not doing so, with that figure rising to 42% for the wealthiest couples. That trend seems more pronounced among "younger" couples: 55% of couples who have been living together for five to ten years do not pool all their resources, rising to 69% in the case of couples who have been living together for less than five years.

There is also an ever-increasing number of separations (INSEE, 2020, pp. 26–27). So, the choices made in the context of marriage or a civil partnership are not permanent. As a result, basing public policies on the family is not without consequences for individual freedoms. Choices made notably in response to the joint income tax assessment system for couples in marriages or civil partnerships may prove costly following a separation. Although the marital tax quotient is in principle gender-neutral, it has a heavy impact on women's choice of participation in the labour market. This has been confirmed both statistically (see the references cited in the two papers and more recently by Carbonnier, 2020) and in the context of ethnographic research. In their analysis of divorce negotiations, Bessière & Gollac (2020) recount, in particular, a statement made by one woman in a conciliation session in divorce proceedings: "We decided together that I would work part-time. So as not to give even more to the tax man as we're already paying a lot. I'm not about to start working full time at the age of 54."

This statement illustrates not only the choice but also the long-term consequences of that choice. These long-term consequences are also observed in the statistics, with Lequien (2012) showing that giving up work to care for children has very long-term consequences on mothers' careers, even long after they have returned to work. Admittedly, statutory provisions at the time of the ruling are supposed to provide compensation, but Bessière & Gollac (2020) show that this compensation is difficult and rarely achieved in practice.

Other effects of public policies' emphasis on the family are evident not only when couples separate but also when they set up home together as a couple. The National Assembly recently held a debate on this subject, specifically concerning the joint assessment of a couple's income in regard to the *Allocation Adulte Handicapé* (AAH, an allowance for adults with disabilities). Indeed, for this allowance, as for the welfare system as a whole, the notion of a couple includes common-law partnerships, i.e. unmarried couples, not in a civil partnership. So if a disabled person entitled to the AAH decides to live with their partner, they lose all or part of their allowance, depending on said partner's income. For any cohabiting couple, this amounts to taxing the partner of the disabled person for the latter's care, so they cover the cost of care instead of and in place of the welfare system. That creates a very strong barrier of responsibility in the process involved in setting up home as a couple and therefore puts a strong break on conjugality for people with disabilities who receive the AAH.

Various opposition parties met on 17th June 2021 to propose abolishing the joint assessment of a couple's income for AAH purposes, but it was rejected by the government majority. During the debates, while recalling the main grievances concerning the joint income assessment for AAH purposes, a majority Deputy accounted for the government's refusal to abolish the joint income assessment procedure by referring to a commitment to a social model based on the family and not on individuals: "[The AAH] works like other minimum social security benefits, which always take household resources into account. (...) We are hearing reports on the ground, from organisations and our fellow citizens, that some people with disabilities are abandoning the idea of setting up home with their partner so as not to suffer a reduction in or even loss of their disability benefit. We also hear that this operation can lead to a situation of financial dependence within couples and a possible drift towards ill-treatment of the benefit recipient. (...) If we calculate minimum social security benefits on the basis of individual income, what impact will this have on our social model which is currently founded on the household and marital position? (...) The La République en Marche group could not bring itself to call national solidarity into question – I'm talking here of values and not of rights – as much out of our conviction and

commitment to family values as out of the need to continue our efforts in favour of an inclusive society. The calculation of tax and benefits based on individual rather than joint income is a political, philosophical and technical issue that completely changes not only our model of society but also our operators' organisation."[3]

Similar effects of the assessment of income at the couple's level in regard to social security benefits can be found in the case of single mothers who may be forced to choose between welfare support and living with a partner: Bessière & Gollac (2020) devote part of their book to the case of the *Allocation de Soutien Familial* (ASF, a family support allowance), which can kick in if a father does not pay child maintenance for his children – or supplement it if it is too low – but which the mother then loses if she sets up home with a partner again. The need for any potential partner to take up where welfare benefits leave off is thus similar to the case of AAH and therefore places significant constraints on the potential for conjugal life for benefit recipients.

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It therefore appears that continuing to take the family as the unit of application for French social welfare policies, in the context of a society where individual freedom within the family is increasingly important, may lead to the creation of constraints on citizens' individual development. The two papers commented here concur in their illustration of this as regards the taxation of income. Aside from some opposite effects on a minority, the marital and family tax quotient system benefits families to a greater extent, in overall terms, the wealthier they are. □

3. Translated from the statement by Véronique Hammerer, La République en Marche Deputy (majority), member of the Law Committee, in the first session on Thursday 17th June 2021 at the National Assembly. https://www.assemblee-nationale.fr/dyn/15/comptes-rendus/seance/session-ordinaire-de-2020-2021/premiere-seance-du-jeudi-17-juin-2021#2556693

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Income Inequality across the French Departments over the Last 100 Years

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Abstract – This paper analyses the change in spatial income inequality across the departments (the French *Départements*) of metropolitan France since 1922. Its most significant contribution is the reconstruction of average fiscal income per department, before and after the payment of income tax, based on an unprecedented use of archives from the Ministry of Finance. We highlight the following stylised facts: *(i)* a very significant reduction in interdepartmental average fiscal income inequality over the last century, with two periods of continuous decline, between 1922 and 1939 and from 1948 onwards; *(ii)* a significant contribution, albeit varying over time, of income tax to the reduction in inter-departmental inequality; *(iii)* an improvement in the situation in all departments lying along a line running from Calvados to Gard since 1948.

JEL Classification: N34, N94
Keywords: spatial inequality, French departments, fiscal income, income tax

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The election results and recent social movements in several developed countries have sparked growing interest in the question of spatial inequality. What is sometimes termed the "regional split" refers to a process of divergence between the metropolitan areas making an ever greater contribution to the generation of wealth and the rest of the national territory. Deinstrustrialisation and the emergence of a service and knowledge economy contribute to polarising business activity in some regions. The aim of this paper is to provide a historical perspective on this development, using a new reconstruction of interdepartmental income inequality since 1922.

The departmental level (the French *Départements* level) is useful and relevant. Useful because the departments' areas have been relatively stable since their creation in 1789, which makes it easier to conduct a historical comparison of departmental data. Relevant because this is the level at which certain regional development policies in the health, social, education and planning sectors are deployed. It is also relevant because people are attached to this level, as illustrated by various anecdotes: strong opposition to the plan to remove the department number from vehicle registration plates in 2008, strong proportion of *gilet jaunes* Facebook groups that include a reference to the department (20% according to Boyer *et al.*, 2019), etc. Historical reconstructions of income at smaller scales, such as commune or canton, are possible, but these come up against difficult issues surrounding the spatial development of these units, which was very significant over the 20th century, and the disconnection between the places where the people live and where they work.

In this paper, we document the development in interdepartmental income inequality before and after payment of income tax. Our first contribution is to have reconstructed average income for each of the 90 French departments (excluding overseas departments and the new departments formed from the splits that took place in the 1960s and 1970s). We have based our work on a new database of average tax income in each department of metropolitan France since 1922, developed from the digitisation of the archives of the Ministry of Finance. These fiscal data on income tax, combined with Bonnet & Sotura's (2021) database on the income distribution of each department and Bonnet's (2020) database on the population of each department broken down by age, allow us to measure average standards of living in each department in a new and more direct way. Based on the average tax income per department calculated using a regression before and after payment of income tax for each year since 1922, we develop indicators of inequality across departments that allow us to analyse the change in inequality over the last century.

The study of spatial inequality in France is, of course, not new; however, to date, historians and researchers in social science have only had indirect and piecemeal measures of long-term local standards of living. Several works (Combes *et al.*, 2011; Bazot, 2014) have since then taken departmental reconstructions of the value added per inhabitant as a basis. The latter allows us to study the change in location of productive activities and spatial differences in productivity, yet it still runs the risk of providing a biased measure of inequality in terms of standards of living due to the monetary transfers that take place between regions. Furthermore, other works complement these by looking into income dynamics across broader regional areas (see, for example, Behaghel, 2008).

Based on our data, we can see, on the whole, a very significant reduction in average tax income inequality, specifically over the periods 1922-1939 and 1948-2015. The period from 1922 to 1948 is characterised by a fall in relative income in the departments in the north-east arc around Paris and in the majority of the departments along the Atlantic coast, the Loire Valley and, to a lesser extent, Île-de-France. The reduction in inequality since 1948 can be likened to a phenomenon of convergence between the majority of departments. However, the departments of the three large metropolitan areas of Paris, Lyon and Marseille have experienced a deterioration in their relative situation. This trend is particularly noteworthy given the known phenomenon of productivity growth in large metropolitan areas and highlights the disconnection between a department's value added per inhabitant and its average income. Since the 1990s, income inequality between the departments has fallen considerably less sharply, in line with the global trend in income inequality (Blasco & Picard, 2019).

We can also observe that income tax significantly reduced interdepartmental inequality over three distinct periods: up to the start of the 1950s, the reduction was small; it then increased progressively up to the end of the 1980s, reaching its maximum level in 1989, when the national tax rate was at its highest; since then, the reduction has been much smaller. Finally, in terms of spatial income distribution in France, the very strong concentration trend seen in the 1940s

and 1950s was erased over the following two decades. However, since the end of the 1970s, income concentration has remained unchanged. But even here, this trend is in contrast with that of the increased spatial concentration of value added over the course of the last few decades (see Sanchis *et al*., 2015).

This paper falls within two fields of economic literature. Firstly, that of income inequality, in which we find Piketty's seminal paper (2001) on high incomes in France, followed by numerous works studying income inequality in other countries, such as Atkinson (2005) for the United Kingdom, Atkinson & Salverda (2005) for the Netherlands, Alvaredo (2009) for Portugal, or more recently Garbinti *et al*. (2018) for France. We are therefore expanding this literature to include local trends, which provide a greater understanding of the national dynamic due to their diversity. Our article also falls within the literature on regional convergence and divergence processes. Based on an analysis of regional income for a series of countries, including France, Williamson (1965) showed that the spatial trend in inequality followed a bell curve until the middle of the 20th century. During a country's initial development phases, regional differences increase because the most advanced regions benefit the most from development: they become relatively more productive and a growing proportion of production concentrates here. Following this, during the second phase, production factor mobility and decreasing returns create a process of convergence. A bell curve mapping spatial concentration is also found in the new economic geography literature started by Krugman (1991). The empirical literature that followed (Felice & Vecchi, 2015, on Italy between 1860 and 2010; Badia-Miro *et al.*, 2012, on Portugal between 1890 and 1980; Buyst, 2010, on Belgium between 1896 and 2000; Enflo & Rosés, 2015, on Sweden in the 20th century) confirmed this analysis using data on regional value added reconstructed using the method proposed by Geary & Stark (2002), i.e. based on national sectoral value added and regional employment by sector.

In the case of France, economists working on these issues used a different type of methodology to reconstruct the value added per department and only did this for a limited number of years. Toutain (1992-1993) reconstructed the departmental value added in 1860 and 1930 based on surveys on agriculture and industry, and census data. Combes *et al*. (2011) use Toutain's data (1992-1993) and those generated by INSEE for the 1980s and 2000s; Bazot (2014) reconstructed value added data every 10 years between 1840 and 1911 using Toutain's data (1992-1993) and trade tax data (a tax on non-agricultural businesses); Caruana-Galizia (2013) developed an econometric model based on the sectoral composition of the departments ; and lastly, Sanchis *et al.* (2015) supplement the data from Combes *et al.* (2011) with INSEE data for the 2000-2014 period. These authors note a strong departmental divergence in value added per inhabitant since the 2000s. This divergence is found in the literature on urban economics, which provides analyses of local job markets since the 1980s: Moretti (2012) and Diamond (2016) on metropolitan areas of the United States, and Lessmann (2014) and Lessmann & Seidel (2017) who found that inequality between regions increases gradually.

The rest of this paper is structured as follows: the first section provides details on the data, the methodological choices made to construct them, and the variables and indicators used; the second section is dedicated to the trends in interdepartmental inequality between 1922 and 2015.

1. Data, Methods and Variables

Here, we are interested in the changes in two variables within each department: average tax income and income after tax. Tax income is the total income declared by all households (whether taxable or not) within the department before any reduction to which they may be entitled are taken into account. We define the average tax income of the department as the ratio between that tax income and the department's adult population. We define the adult population as all people aged 20 or above, following Piketty (2001), so as to remain unaffected by changes in legislation on the age of legal majority. Income after tax is the difference between the tax income and the amount of income tax paid in each department. The two variables are measured for each department and each year between 1922 (first year for which we have fiscal data and population data for all metropolitan departments) and 2015.

The geographic scope of the study covers 90 French departments. In order to retain a stable geographic structure throughout the period, we made several methodological choices. Firstly, we kept the boundaries that were in place before the department reorganisations that took place in the 1960s and 1970s. In 1964, the decision was made to reorganise the Paris region and to split (from 1968) the Seine department into four departments (Hauts-de-Seine, Paris, Seine-Saint-Denis and Val-de-Marne) and the

Seine-et-Oise department into three (Essonne, Val-d'Oise and Yvelines).[1] In 1975, Corsica was split into two departments (Corse-du-Sud and Haute-Corse). From those dates onwards, we use the data on the newly created departments to reconstruct data for the populations of the initial departments. Secondly, overseas departments are not included in the analysis because the statistical series are only available for a period that is too recent. The list and map of the 90 departments studied are given in the Appendix (Figure A-I).

1.1. Database Construction

The construction of our database is based on: *(i)* the use of two recent departmental databases from which we have derived the average tax income for the years 1960-1969, 1986-1998 and 2001-2015; *(ii)* other departmental fiscal information collected for the years 1922-2015; and *(iii)* an estimation procedure allowing us to estimate the tax income for the years 1922-1959, 1970-1985 and 1999-2000. We will now explain this procedure.

Our first statistical source is the database built by Bonnet & Sotura (2021). Using administrative archives produced by the tax services, the authors estimated the distribution of tax income in each department and for each year of the following periods: 1960-1969, 1986-1998 and 2001-2015. We have used the total tax income (excluding capital gains) of each department. The second statistical source is the database built by Bonnet (2020), which provides an annual estimate of the population of each department broken down by age. Combining these two sources therefore gives us the average tax income for each department for the years 1960-1969, 1986-1998 and 2001-2015.

Furthermore, we also gathered new data for our estimation. These new data include the following variables for each of the 90 departments and all years from 1922 to 2015: the number of taxed households, total taxable income declared by those households and total income tax paid by those households.

We digitised the statistical tables contained in the archives of the Ministry of Finance held at the Savigny-le-Temple site. For the period from 1922 to 1974, we digitised the tables from the *Renseignements Statistiques Relatifs aux Impôts Directs* (RSRID, a set of volumes from between 1930 and 1975 on direct taxes). For 1975 and the period from 1978 to 2000, we digitised the tables from the *Annuaire Statistique de la Direction Générale des Impôts* (ASDGI, statistical yearbook of the Directorate-General for Taxes, volumes for 1976 and 1979-2002). We also retrieved data from the tax tabulations digitised by Bonnet & Sotura (2021). The data on taxable income are not available for the years 1978-1985 and the data on the number of taxed households are unavailable for the years 1986-1989. For all years from 2003 onwards, we used the ASDGIs available online on the website of the Directorate-General for Public Finance (volumes for 2004 and subsequent years).

In addition to the missing years, several other years pose problems. Between 1939 and 1945, there are no data for the three occupied departments (Bas-Rhin, Haut-Rhin and Moselle). The data have been imputed as follows: for each of the three departments and each of the three relevant variables, we calculated the ratio between the variable for the department and the variable for Vosges in 1938 and 1946 and interpolated in a linear fashion. In 1954, the data in the RSRIDs are not very credible because the taxes collected were ridiculously low, which is possibly due to a deliberate undervaluation in response to fiscal protest at the time.

The relevant year is the income year (and not the year in which the data was collected). Note that these variables only relate to the income of taxed households and do not therefore give the department's total tax income. Indeed, since the creation of the income tax at the start of the 20th century, only a portion of households has been taxable. According to Piketty (2001), the proportion of taxed households was around 10-15% between the two world wars, and only reached around 50-60% in the 1960s-1970s. Above all, up to 1986, only taxed households filled out an income tax return; therefore, we only have fiscal information for these taxed households for the years prior to 1986. The aim of our methodology is therefore to enable us to estimate average tax income, by department, of all taxed and non-taxed households.

1.2. Calculation of Average Tax Income

The average tax income values for the years 1960-1969, 1986-1998 and 2001-2015 have been obtained using two simple econometric models. The explained variable, y_{it}, is the average tax income of department i in year t relative to the average tax income calculated based on all 90 departments in year t. The series of numerator

1. The area following the split did not fully match the area before the split (some communes changed department) but the percentage of the population that moved as a result of the reorganisation is minimal. Furthermore, we have drawn up a robustness analysis that includes the seven departments of the Paris region.

values comes from Bonnet & Sotura (2021) while the denominator series has been developed on the basis of data from Garbinti *et al*. (2019).[2] We regress the average tax income of a department on the fiscal variables collected and demographic variables that enable us to take into account the trend in income (and in tax paid) over the life cycle.

To determine the average tax income for the periods 1922-1959 and 1970-1975, the estimated model is written as follows:

$$y_{it} = \sum_{a=1}^{7} \alpha_a p_{ait} + \beta r_{it} + \gamma r_{it} \times s_t + \delta_i + \theta + \varepsilon_{it} \qquad (1)$$

where p_{ait} represents the share of age category a in the population of department i (the seven age categories taken into consideration are: 0-19, 20-29, 30-39, 40-59, 60-64, 65-79, 80+) relative to the share of age category a in the population of the 90 departments; r_{it} is the average tax income of the taxed households of department i relative to the average tax income of taxed households in all 90 departments; s_t is, for all departments, the ratio between the total income declared by taxed households and tax income; δ_i is a fixed departmental effect; θ is a constant; and ε_{it} is an error term. We interact r_{it} with s_t to take account of the fact that the share of the tax income subject to income tax changes over time and that it is likely to affect the value of coefficient β. Model (1) is estimated for different periods depending on the year for which we want to determine the tax income. For example, the estimation of income for the period 1922-1944 is based on an equation estimated with values observed over the period 1960-1969, while income for 1945-1959 and 1970-1975 is estimated using the values for 1960-1969 and 1986-1998.

To determine the average tax income for the periods 1978-1985 and 1999-2000, for which the data on taxable income of taxed households are available, the estimated model is written as follows:

$$y_{it} = \sum_{a=1}^{7} \alpha_a p_{ait} + \beta t_{it} + \gamma tu_{it} + \delta_i + \theta + \varepsilon_{it} \qquad (2)$$

where t_{it} represents the average amount of tax of department i relative to the average amount of tax for all 90 departments and tu_{it} is the number of taxed households per adult in department i relative to the number of taxed households per adult in all 90 departments. Model (2) is estimated based on the values for 1960-1969 and 1986-1998 to predict the missing income for years 1978 to 1985 and on the values for 1986-1998 to predict the income for 1999 and 2000. The data from Bonnet & Sotura (2021) for 2001-2015 are not used to predict the preceding years due to a break in the data caused by a change in legislation on tax declaration in the year in which marital status changes.

In total, four estimations were made: for each, the model almost exactly estimates the ratio between the tax income of a department and the income of the 90 departments, as shown by the R^2 of the estimates (Table 1; see also Appendix, Table A-1 for the detailed results). Here, we can see, in particular, that the absence of fixed effects in the regressions only marginally changes the predictive power of the models.

Three years have not been predicted using the models, due to the lack of reliable information in the archives of the Ministry of Finance: 1954, 1976 and 1977. Here, we therefore used a linear interpolation of the ratio between the average tax income of each department and the average tax income of the 90 departments, before uniformly readjusting the variable obtained for the numerator in order to ensure that the total obtained for the 90 departments corresponded to the values given in Garbinti *et al*. (2019). Table 2 shows the source of our valuation of the tax income of the 90 departments under consideration for each year of the reference period.

1.3. Variables and Indicators

We use several inequality indicators. We start with the Gini indicator, which has the advantage of taking into consideration the entire income distribution and of being independent of the average. It allows us to understand whether there has been any convergence of income between the departments; this 'sigma convergence' is more robust than an analysis that regresses growth rates on the initial conditions. In addition to this, we also analyse the distribution of the average tax income of the 90 departments. We assess the share

2. *We have not used the same variable as Garbinti* et al. *(2019) because they include overseas departments. Hence we keep the geographical scope constant.*

Table 1 – **Specifications of the estimations**

Estimation	#1	#2	#3	#4
Data	1960-69	1960-69; 1986-98	1960-69; 1986-98	1986-98
Model	(1)	(1)	(2)	(2)
R^2	0.993	0.989	0.984	0.993

Table 2 – **Estimation or source used by period**

Years	
1922-44	Forecast based on estimate #1
1945-53	Forecast based on estimate #2
1954	Interpolation
1955-59	Forecast based on estimate #2
1960-69	Bonnet & Sotura (2021)
1970-75	Forecast based on estimate #2
1976-77	Interpolation
1978-85	Forecast based on estimate #3
1986-98	Bonnet & Sotura (2021)
1999-2000	Forecast based on estimate #4
2001-15	Bonnet & Sotura (2021)

of certain 'quantiles' of departments in the total average tax income of the 90 departments, such as that of the nine wealthiest departments (for which the average tax income is the highest) or the 18 least wealthy departments (for which the average tax income is the lowest). By considering the average income of the departments and not their total income, we do not need to weight the departments based on population when comparing them against each other. The analysis of the change in the share of various quantiles allows us to assess the distortion of the distribution.

We also relate our income variables to the surface area (in km^2) of each department to assess a sort of "regional performance". The differences between the departments in terms of this performance are likely to reflect inequality in the concentration of business activity. Indeed, income relative to surface area is the same as the product of average income and density. While these two terms have a positive correlation, we expect income inequality per km^2 to be greater than that of average income.

Furthermore, where our inequality indicators aggregate average income, they are not weighted. This allows us to focus on the differences between the relevant entities, which, for this work, are the departments. Furthermore, this also means that we do not need to implicitly assume that income is equally distributed within the department, an assumption which would be very far from reality (see Bonnet & Sotura, 2021). However, by not weighting, our results are more susceptible to geographical division. Therefore, the Appendix also contains our indicators with the income weighted by the adult population of each department. Our qualitative results are not affected by that hypothesis. In the case of income relative to department surface area, our observations are weighted by surface area (which is, of course, fixed in time) in order to look at the trend in income concentration gaps in metropolitan France.

However, the Gini or interdecile indicators are not affected by any spatial permutation of the departments and do not take their spatial proximity into account. To overcome this restriction, we also show our variables on maps of France. The departmental income is therefore given relative to the average income for all the departments.

2. Results

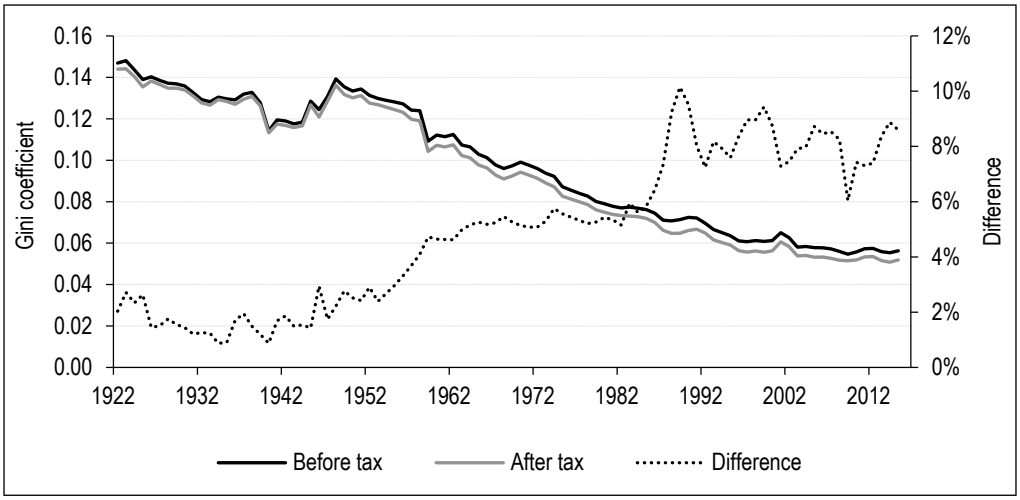
We will now detail the changes observed over the last century, firstly the trend in inequality by presenting aggregated indicators at national level, then the trends in dynamics by department, shown using maps.

2.1. Change in Inequality

Figure I shows the trend in interdepartmental average tax income inequality. The change over the last century is clearly downward. The Gini indicator was above 0.14 at the start of the period and is now below 0.06. We can see two periods of almost continuous decline: from 1922 to 1939 and from 1948 to 2015. Between 1948 and 1990, the decline was almost linear and the indicator fell, on average, by 1.4% per year. The decline is less rapid after, averaging -0.3% per year since 2000.

The period covering World War II and the few years that followed was more turbulent. It begins with a sharp drop, linked to the disorganisation of the urban departments and the increase in the relative weight of agriculture in the French economy during the war. This drop is offset by a very steep rise in inequality between 1944 and 1948, returning to levels seen in the mid-1920s. The wartime years caused significant population movements between departments along the Eastern border and the rest of France (Bonnet, 2021), which also led to a significant spatial redistribution of income. During the war,

Figure I – **Gini coefficient for average tax income before and after income tax, 90 departments, 1922-2015**



Notes: Gini coefficients are computed for average tax income per adult in the departments of metropolitan France before and after income tax, respectively. There is no weighting.
Reading note: In 1922, the Gini coefficient for the average tax income before income tax was 0.147.
Sources: Tax archives and calculations by the authors.

statistical data on both income and population were a lot more fragile. For this reason, our analyses focus on the periods 1922-1939 and 1948-2015.

Figure I also shows the change in inequality in tax income after income tax. Income tax significantly reduces interdepartmental inequality, but the magnitude of that reduction varies considerably over the period in question. We can distinguish three distinct periods. Until the start of the 1950s, the reduction in interdepartmental inequality resulting from the income tax was small, always below 3% of initial inequality. The reduction gradually increased until the end of the 1980s. It reaches its peak in 1989 (see Appendix, Figure A-II). Since 1989, the fall in interdepartmental inequality brought about by this tax fluctuates between 6 and 9%.

The change in interdepartmental income inequality is very different from that seen in other works, for example Combes *et al.* (2011) and Sanchis *et al*. (2015), for economic activity indicators such as value added measured at departmental level. Table 3 shows, for three key years, the Gini coefficient of average tax income after payment of income tax as shown in Figure I and the Gini coefficient of average departmental value added calculated based on data from Combes *et al*. (2011) and INSEE for our classification of departments and, for reasons of robustness, for that used by Combes *et al*. (2011).[3] Table 3 shows that the Gini coefficient of value added follows a U-shape trend: the stability of the last two decades of the 20th century was followed by an increase in equality from 2000 onwards. From this, we can infer that all the social and fiscal transfers, which represent a large proportion of tax income, make a significant contribution to reducing the inequality caused by the concentration of economic activities. Today, the Gini index is two times lower for income than for value added.

The trend shown by the Gini indicator can be supplemented by indicators specific to certain

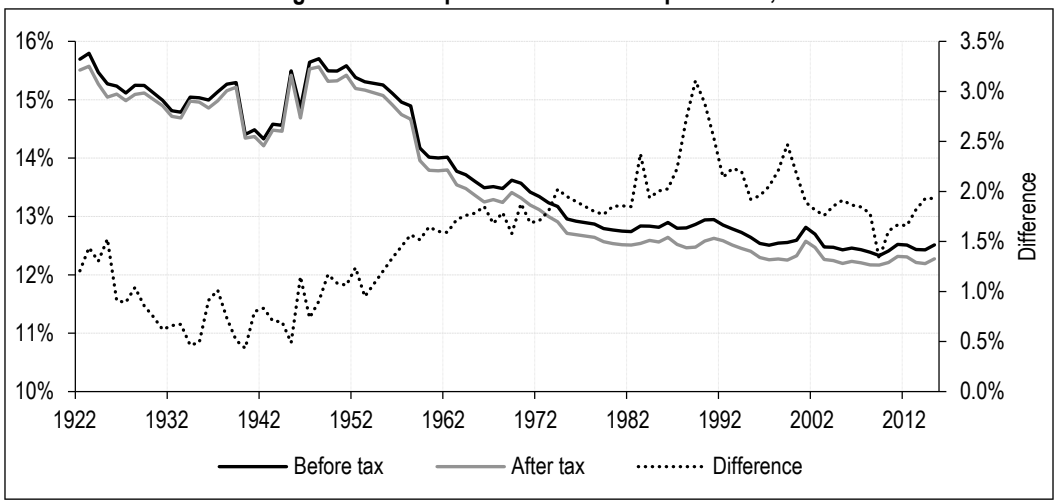
3. Combes et al. *(2011) only have aggregated values for the departments of Meurthe-et-Moselle, Moselle, Haut-Rhin and Territoire de Belfort, and have no values for Corsica in 1930 and 1982. To keep our classification, we did some imputations using the distribution formula that was predominant in the year 2000.*

Table 3 – **Gini indicators, 90 departments**

	1930	1980	2000	2014
Income after income tax	0.140	0.075	0.061	0.052
Value added				
Our classification	0.121	0.103	0.097	0.111
Combes *et al.* (2011) classification	0.118	0.104	0.098	0.113

Notes: The table shows the Gini coefficient of departmental average tax income per adult after payment of income tax as shown in Figure I and the Gini coefficient of average departmental value added calculated based on data from Combes *et al.* (2011) and INSEE. We give two value added Gini calculations: one is calculated using our classification of the departments (90 departments); the other using the classification used by Combes *et al.* (2011). There is no weighting.
Reading note: In 1930, the Gini of the average tax income of the departments before income tax was 0.140.
Sources: Tax archives, Combes *et al.* (2011), INSEE and calculations by the authors.

Figure II – **Share of the nine wealthiest departments in the average tax income per adult of the 90 departments, 1922-2015**

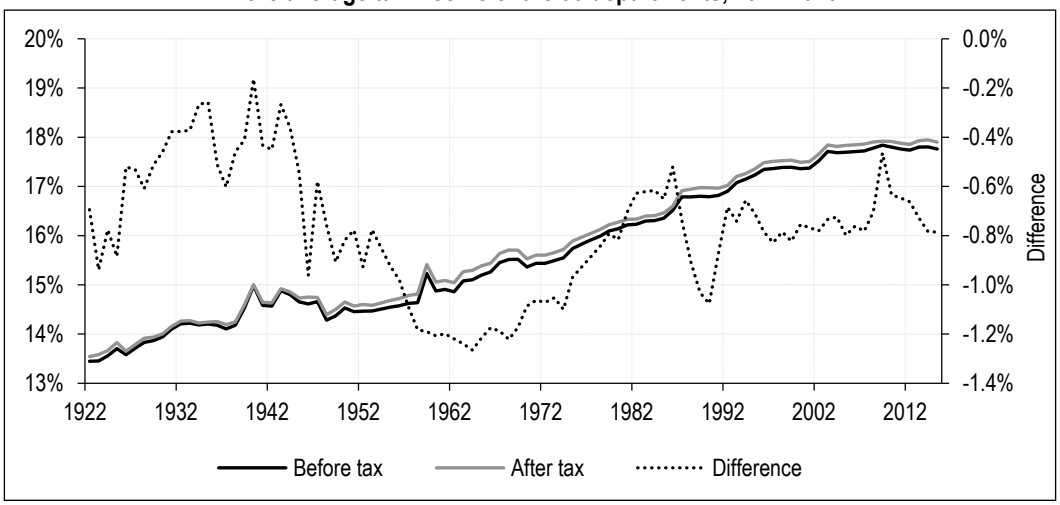


Notes: The share of the 9 wealthiest departments in terms of average tax income (P90-P100) is calculated based on tax income per adult before and after income tax, respectively. There is no weighting.
Reading note: In 1922, the share of tax income before income tax held by the 9 wealthiest departments in the total tax income of the 90 departments was 15.7%.
Sources: See Table 3.

parts of the distribution. Figure II shows the change in the share of average income held by the nine wealthiest departments in the total average income of the 90 departments. The time profile of the indicator is quite similar to that of the Gini indicator; however, we can see a sharp slowdown in the reduction from the 1970s onwards and a stabilisation of inequality from 2007. The role of income tax also changed over the period. Between 1954 and 1998, it increasingly reduced the share of income in the national income of the departments belonging to the upper income decile, with a maximum of 3.2% in 1989. Since then, the effect of income tax has fallen considerably, returning in 2015 to levels seen at the end of the 1970s (i.e. 1.9%).

Conversely, the least wealthy departments (which are not necessarily the same every year) underwent a significant catching-up process. Figure III shows that the share of average income held by the 18 least wealthy departments has continuously increased since the end of World War II. This increase seems to have levelled at 18% since the start of the 21st century. As is the case for the nine wealthiest departments, the level of inequality stabilised at the end of this period (from 2003 onwards). Likewise, after following an upward trend, the contribution of income tax

Figure III – **Share of income of the 18 least wealthy departments in the average tax income of the 90 departments, 1922-2015**



Notes: The share of the 18 least wealthy departments in terms of average tax income (P0-P20) is calculated based on tax income per adult before and after income tax, respectively. There is no weighting.
Reading note: In 1922, the share of average income before income tax held by the 18 least wealthy departments was 13.4%.
Sources: See Table 3.

to the increase in the share of the 18 least wealthy departments has fluctuated around -0.8% since the end of the 1970s.[4]

In total, Figures II and III show a situation that is far less unequal today than it was in the past. We can see that the wealthiest 10% of departments now hold 12.5% of total average income compared with 15.5% a hundred years ago; at the other end of the scale, the least wealthy 20% of departments hold almost 18% of the total compared with 14% a century ago. In other words, nowadays, the wealthiest 10% of departments have 25.5% more than the income they would have had if the distribution was equal, while the least wealthy 20% receive 11.3% less than they would in a context of equality. After payment of income tax, these percentages fall to 23.1% and 10.6%, respectively.

The changes over time shown in Figures I, II and III are partly based on estimations (cf. Table 2). As the evaluations are necessarily less accurate for the periods for which average income is evaluated using estimated coefficients, we have calculated 95% confidence intervals for the years in question and for the three distributions (indicator of income inequality before and after income tax and the gap between the two).[5] This calculation allows us to confirm that possible measurement errors would not change the trend described (see Appendix, Figures A-III, A-IV and A-V).

It is also important to note that the lack of weighting of the departments in the calculation of inequality indicators is of no consequence here. Weighting the departments by adult population gives a similar change over time in the Gini coefficients and shares of the various quantiles to that obtained using non-weighted indicators (see Appendix, Figures A-VI, A-VII and A-VIII). The weighting used, however, does not account for infra-departmental inequality, which has certainly changed over the period.

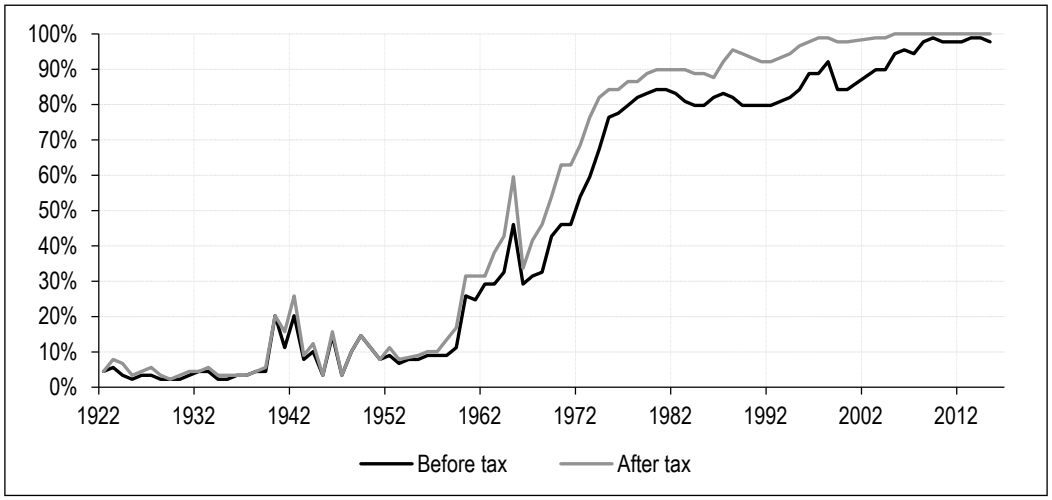
Likewise, whether or not the current departments of Île-de-France region are taken into account, which today accounts for around 30% of French GDP, barely changes the trend in the inequality dynamic, with the time profile of the Gini indicator remaining similar (see Appendix, Figure A-IX). Taking into consideration the seven departments of Île-de-France that resulted from the 1968 reorganisation likewise does not change the overall finding: the indicator calculated on the basis of the 95 departments fell sharply until the start of the 1980s and thereafter at a steadier rate, which is a dynamic similar to that found when looking at 90 departments (see Appendix, Figure A-X).

An alternative way of presenting the convergence of the departments is to measure their distance to the department with the highest income, which, at the end of the period in question, was the Seine department. For each year, we therefore

4. The tax increases the share of the 18 least wealthy departments, which contributes to reducing inequality. The contribution is nevertheless computed as in the other figures, which implies that a positive contribution is associated with a negative number.

5. The confidence intervals were calculated using a bootstrap method with 100 repetitions. At each repetition, the coefficients used to forecast tax income based on models 1 and 2 were taken at random following a normal distribution, the average and standard error of which are those taken from our regressions. We then repeated the procedure described in Section 1 in its entirety.

Figure IV – **Share of departments with average tax income above 60% of that of the Seine department, 1922-2015**



Reading note: In 1922, 4.5% of departments (i.e. 4 departments) had an average tax income per adult before income tax above 60% of that of the Seine department.
Sources: See Table 3.

calculate the share of departments for which average income was over 60% of that of the Seine department. Figure IV shows this trend. At the start of the 1950s, less than 10% of departments were above this threshold; since 2000, over 90% have crossed it. It we consider income after tax, 90% of departments had income above 60% of that of the Seine department from the start of the 1990s.

This trend can be explained by a fall in the relative income of the Seine department compared with the 89 other departments. In 1950, the average tax income of the department was 80% higher than the national average; by 2015, it was only 35% higher and only 27% higher payment of income tax. By way of comparison, the average value added in the Seine department was 114% higher than the average value added at national level in 2014.

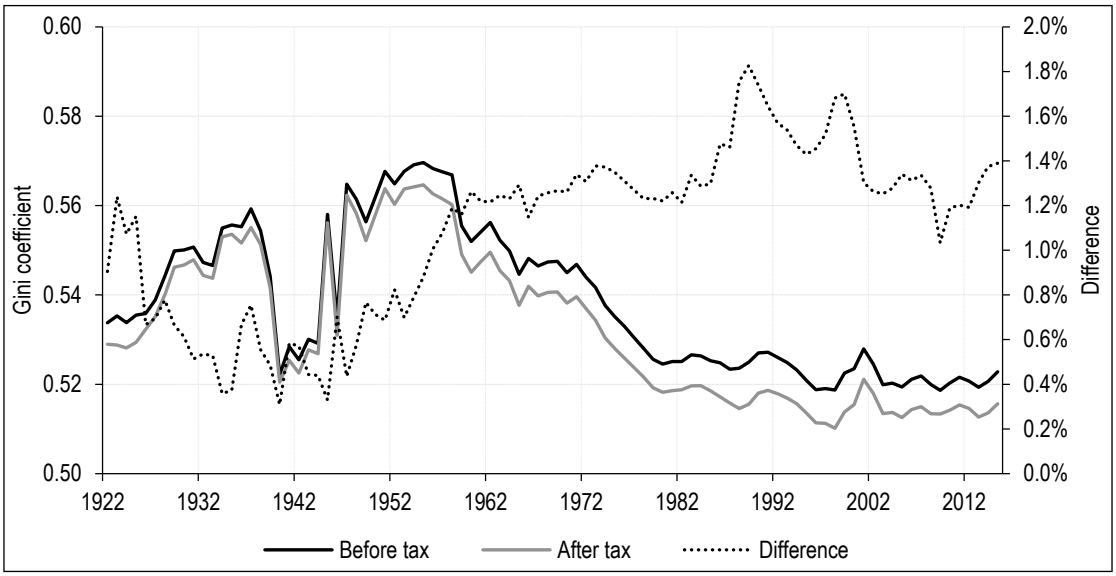
When the departmental income is related not to the number of people aged 20 and above but to the department's surface area, the measure of inequality accounts for the department's density (Figure V). With this approach, the inequality level firstly appears to be much higher, which is due to the fact that the French population has concentrated to a very significant extent over the last century (Bonnet, 2019). We also see an overall upward shift in inequality until the end of the 1950s, which was erased over the following two decades. Inequality has been unchanged since the end of the 1970s.

2.2. Heterogeneity of the Dynamics and Convergence

The above indicators aggregate the dynamics of the different departments and mask their own developments. To analyse the geographic dispersion of income in metropolitan France and its reconfiguration over the last 100 years, we have identified three key years (1922, 1948 and 2015) and represented for each one the ratio between tax income per adult in each department and the overall average tax income for all departments. In 1922 (Figure VI-A), we can see that the north of France was particularly wealthy: with the exception of Pas-de-Calais, all departments had an average tax income that was at least equal to the national average (100 or 110% of national income), with the Seine and Seine-et-Oise departments recording the highest level (125% of the national average). The neighbouring departments (Eure, Eure-et-Loir, Loiret, Meuse, Haute-Marne and Côte-d'Or) had an average tax income at around the national average (between 100 and 110%). To the south of this area, almost all the departments had an average tax income of less than 90% of the overall average tax income. The geographical areas with the lowest levels of income (average tax income of less than 75% of the national average) were in Brittany, the South West, the Alpes du Sud region and Corsica. In the south, the major exceptions to this trend were Rhône and Bouches-du-Rhône, which have large regional centres, and Alpes-Maritimes.

In 1948, the geography of income in France had not changed much (Figure VI-B). Overall, the

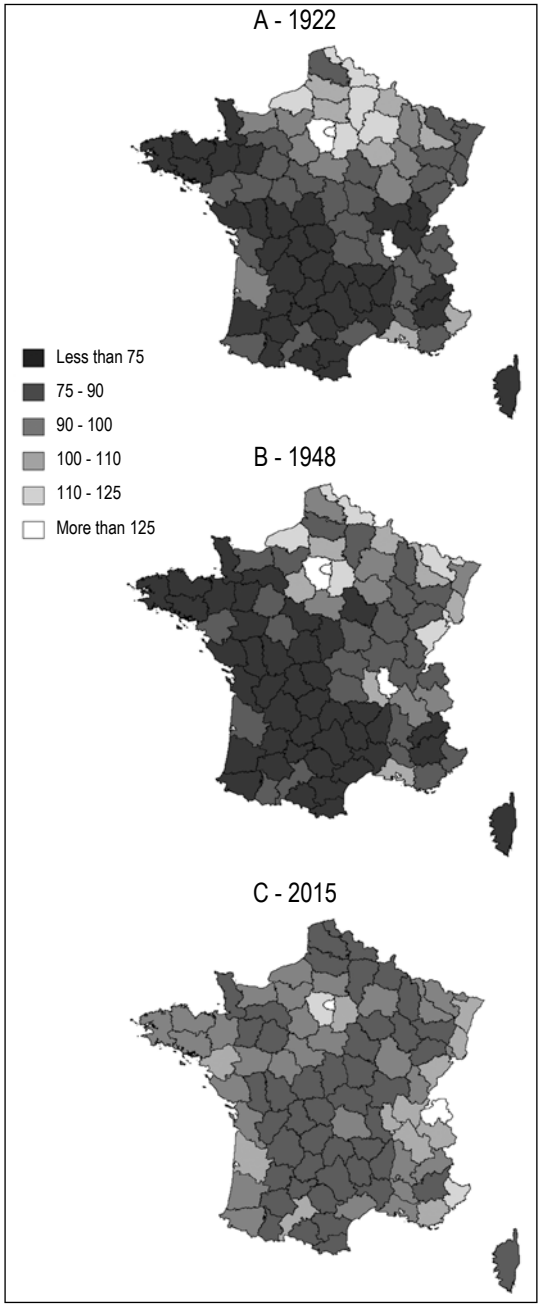
Figure V – **Gini coefficient of tax income per km² for 90 departments, 1922-2015**



Notes: The black and grey solid-line curves represent the Gini coefficient of departmental tax income per km² before and after income tax, respectively. There is no weighting.
Reading note: In 1922, the Gini coefficient of departmental tax income per km² before income tax was 0.534.
Sources: See Table 3.

departments with an average tax income above the national average were still those in the north of France. However, this area was much less homogenous than in 1922; departments such as Somme, Aisne, Marne and Aube had an average tax income below the national average, while departments bordering Switzerland, such as Doubs and Haut-Rhin, had an average tax income above the national average. In the south-west, almost all departments had an average tax income below the national average, with the vast homogenous area stretching from Brittany to the south of the Cevennes, lagging far behind in terms of income. Bouches-du-Rhône and Rhône remained the exceptions, and we also see the emergence of Loire, home to Saint-Etienne and its industries.

Figure VI – **Average tax income of each department as a percentage of the overall average tax income of the 90 departments**



Reading note: In 1922, the average tax income for Corsica was less than 75% of the average tax income of the 90 metropolitan departments.
Sources: See Table 3.

In 2015, we first see the disappearance of areas with relatively low income (Figure VI-C): no departments had an average tax income below 75% of the national average, which corroborates the decline in inequality documented above.[6] Furthermore, the departments with average tax income above the national average are no longer in the north of France, but close to the Swiss border, in the Parisian region and those in some regional centres such as Lyon, Nantes and Toulouse. We also note that the departments with average tax income between 75 and 90% of the national average lay along the diagonal line from the Spanish border to the Belgian border, with two branches in the north of the country and in Normandy. Although we are looking here at a measure of low income, these are also the departments that lie along the so-called "*diagonale du vide*" (a strip of French territory going in a diagonal from the north-east to the south-west, where population densities are lower than the rest of France). Conversely, the Atlantic coast has become a homogeneous zone with standards of living around the same level as the national average. The maps we have just examined clearly show this shift in the "low income diagonal", formerly extending from the north-west to the south-east but now stretching from the north-east to the south-west.

To show the heterogeneity of the dynamics, we have also classified the change in the average tax income of the departments relative to the national average into six categories, drawing from the literature on local population dynamics (see Oswalt & Rieniets, 2006):

- 'upward divergence' represents the departments in which average income was above the national average and where the gap has widened (for example, Alpes-Maritimes, where relative income grew from 100% in 1922 to 110% in 2015);

- 'emergence' represents those departments in which the average income was below the national average and has now exceeded this average (for example, Haute-Savoie, where the

6. This observation would not be called into question if we disaggregated the Seine department. For example, in 2015, the tax income per adult in Seine-Saint-Denis accounted for 84% of the average income.

relative average tax income grew from 76% in 1922 to 133% in 2015);[7]

- 'convergence from the top' represents those departments in which the average income was below the national average, has remained so, but where the gap has narrowed (for example, Oise, where the relative income was 110% in 1922 and was approaching 100% in 2015);

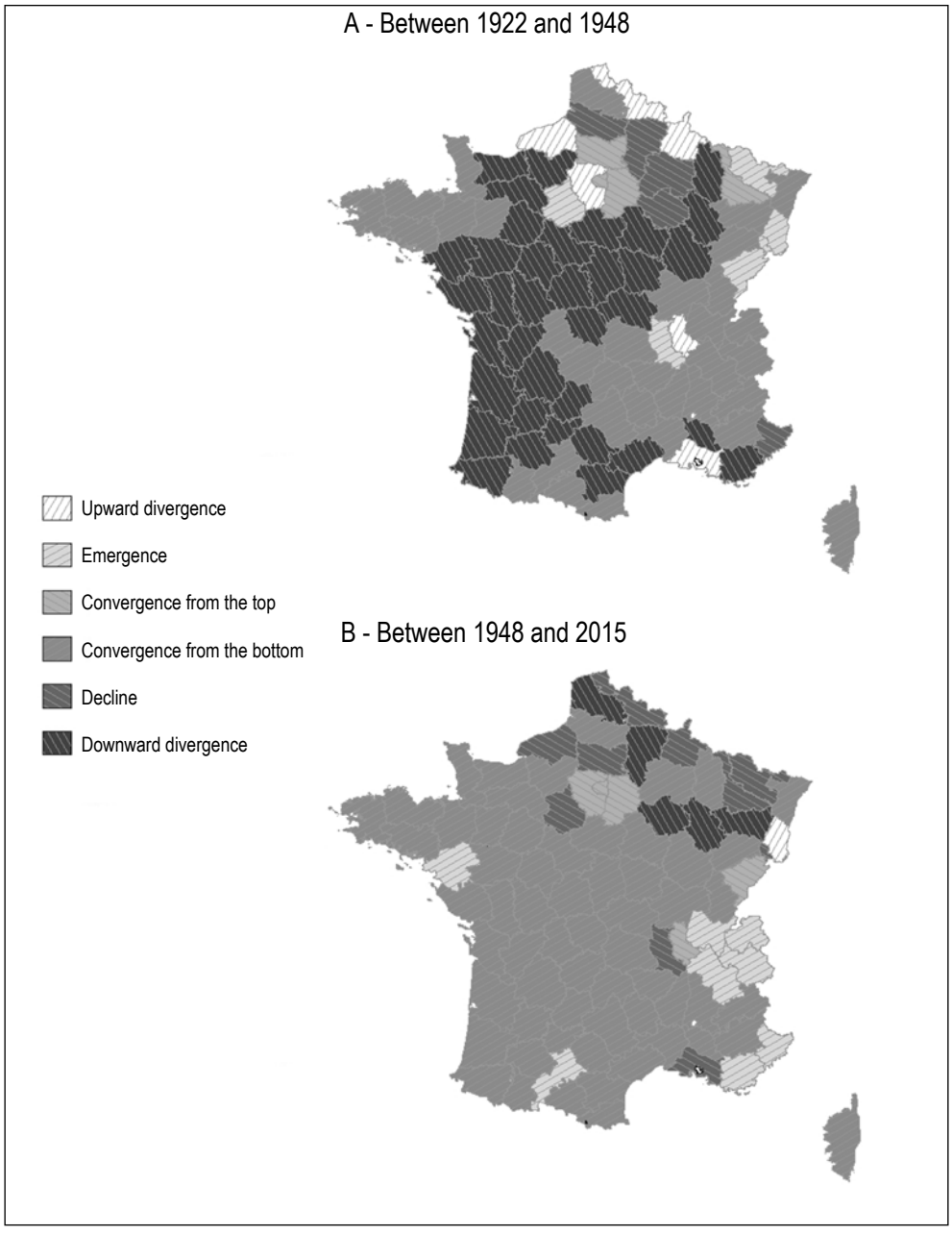
- 'convergence from the bottom' represents those departments in which the average income was above the national average (for example, Lozère, where the average tax income was 45% of the national average in 1922 and rose to 83% in 2015);

- 'decline' represents those departments in which the average income was above the national average but has fallen below (for example, Meurthe-et-Moselle, where the relative average income has fallen from 110% in 1922 to 90% in 2015);

- 'downward divergence' represents those departments in which average income was below the national average and where the gap has widened (for example, Haute-Marne, where

7. This is probably due to cross-border workers, the number of which has risen significantly over the last two decades (Debouzy & Simon, 2020).

Figure VII – **Categorisation of the departments by relative change**



Reading note: Between 1922 and 1948, Finistère underwent convergence from the bottom.
Sources: See Table 3.

relative income fell from 90% in 1922 to 83% in 2015).

The departments, as categorised above, are shown in Figure VII-A for the period 1922-1948 and VII-B for the period 1948-2015. The first period allows us to compare the departments over a quarter of a century from the post-WWI period to the post-WWII period. The majority of the departments along the Atlantic coast and the lower Loire Valley saw a downturn in their relative situation; the downturn was less pronounced but still present in Île-de-France, while a north-eastern arc of departments surrounding Paris underwent a decline.

Overall, the 90 departments studied underwent a continuous process of convergence between 1948 and 2015. The map here is radically different. All the departments on the line joining Calvados to Gard experienced an improvement in their relative situation. Along this "Caen-Nîmes" line, the departments of Toulouse and Nantes stand out in particular. Conversely, the departments of the three large metropolitan areas of Paris, Lyon and Marseille saw a deterioration in their relative situation, with a decline for Bouches-du-Rhône and convergence from the top for Seine and Rhône. For these latter two departments, this situation results rather from improvements in the departments situated to their east. Outside of the three large metropolitan areas, the departments that witnessed a deterioration were primarily situated to the north-east of a line from Calvados to Jura, with the notable exception of the departments in the Alsace region. These departments were once home to flourishing sectors and have since undergone a long decline.

* *
*

This article presents the change in interdepartmental inequality since 1922, based on a new database of average tax income in each department of metropolitan France, developed from the digitisation of the archives of the Ministry of Finance. The intention behind the article is to describe the situation, but the original database could be used for more causal approaches seeking, for example, to analyse the factors of regional development.

Our indicators of inequality between the departments have shown a very strong convergence of income over the period under consideration. This reduction in inequality has been particularly remarkable since 1948 and, even though there has been a slowdown in the rate of reduction since the 2000s, inequality reached its lowest level for a century in 2015. Today, all the departments of metropolitan France have an average tax income after income tax of above 60% of that of the Seine department. In 1950, only 10% were above this threshold. This interdepartmental convergence is similar to the process analysed by Bonnet & d'Albis (2020) for life expectancy but contrasts with the process described by Combes *et al.* (2011) for value added. This sheds light on the role played by public transfers in levelling standards of living, more than compensating for the divergent force resulting from the concentration of economic activities in certain areas of France, in particular the large metropolitan areas. The role of income tax is significant here. It considerably reduces inequality between regions: the nine wealthiest departments have an average tax income that is 25.5% higher than the national tax income per adult; this relative benefit falls to 23.1% after payment of income tax. However, income tax is only one of these public transfers, and would be interesting to assess the contribution of other transfers, such as that generated by the pension system. Indeed, it is likely that the gap between the very economically dynamic departments and those with a significant proportion of the population in retirement would narrow when we consider all income and not just employment income. Furthermore, the average tax income after income tax allows us to understand the effect of income tax on spatial inequality, but it would be useful to supplement this analysis by assessing the effect of other taxes paid by households, even if that effect is *a priori* weaker. The progressive nature of income tax at the individual level means that, overall, some departments are proportionally subject to higher taxation than others. This calculation method creates a type of spatial redistribution but, without information about how this tax is spent and allocated between the different departments, we cannot carry out an overall analysis of its redistributive effect.

Furthermore, the income convergence process has been of benefit to numerous departments, which have seen their relative situation improve, but the deterioration in the relative situation of other departments must not be ignored. Very simply, France is bisected by a diagonal line running from Calvados to Gard; since World War II, the "winners" have often been situated on the south-west side of this line, while the "losers" have been located on the north-east side. The decline experienced by some is likely to create a feeling of unhappiness among the

public and a rupture in national cohesion, despite income convergence.

Our work can be extended in three directions. The first is to conduct an analysis in terms of purchasing power. However, this would require the calculation of long-term consumer price indexes at departmental level, which is not easy given information currently available. The second is to consider intra-departmental inequality and to break down the trend in national inequality into intra- and inter-departmental inequality. This would require the use of decomposable indicators. The third consists in comparing the change in regional inequality between countries. However, there are currently almost no databases equivalent to ours, with the exception of a database for the 51 US states, in which income since 1917 has been reconstructed by Franck (2015). Figure A-XI, in the Appendix, compares the change in our Gini coefficient for tax income with the one that we calculated based on data from Franck (2015). The reduction in inequality began much earlier in the United States, around 1933, but it ended in the mid-1990s, and has increased considerably since then. Inequality between the US states has now returned to the level of the beginning of the 1960s. Inequality in this country is also significantly higher as the Gini coefficient was 0.11 in 2014. It would be relevant and interesting to extend this comparison to other European countries. □

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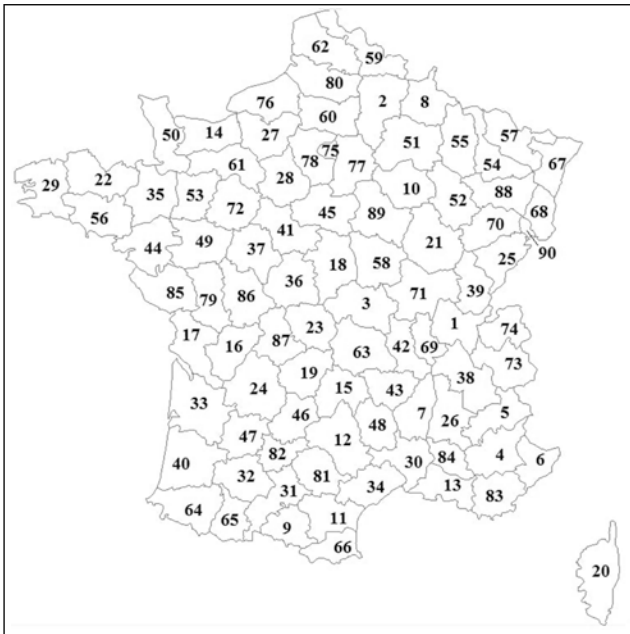
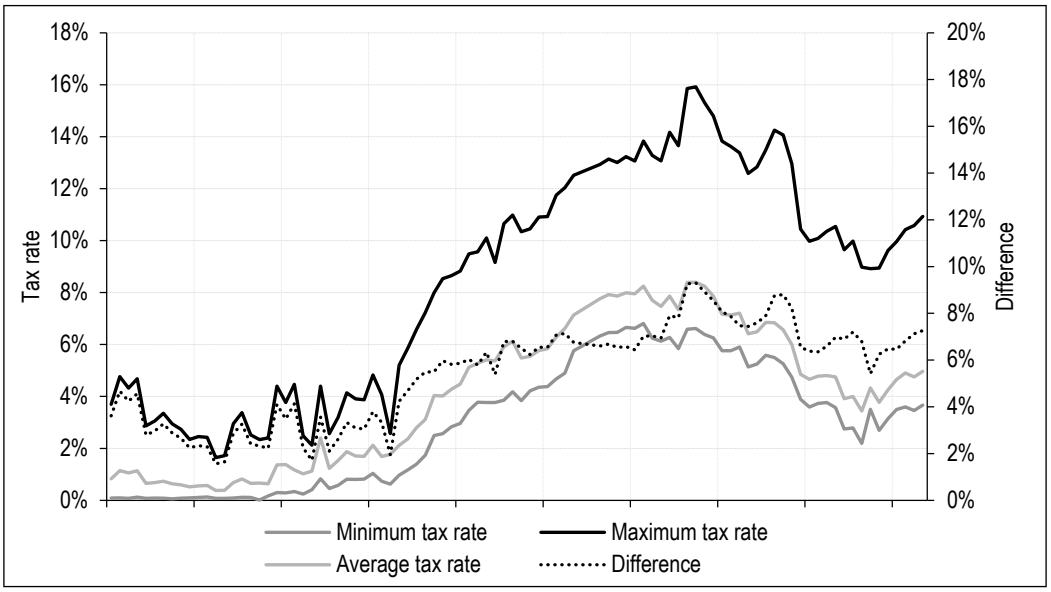
APPENDIX

Figure A-I – **Map and list of the 90 French departments studied in the article**



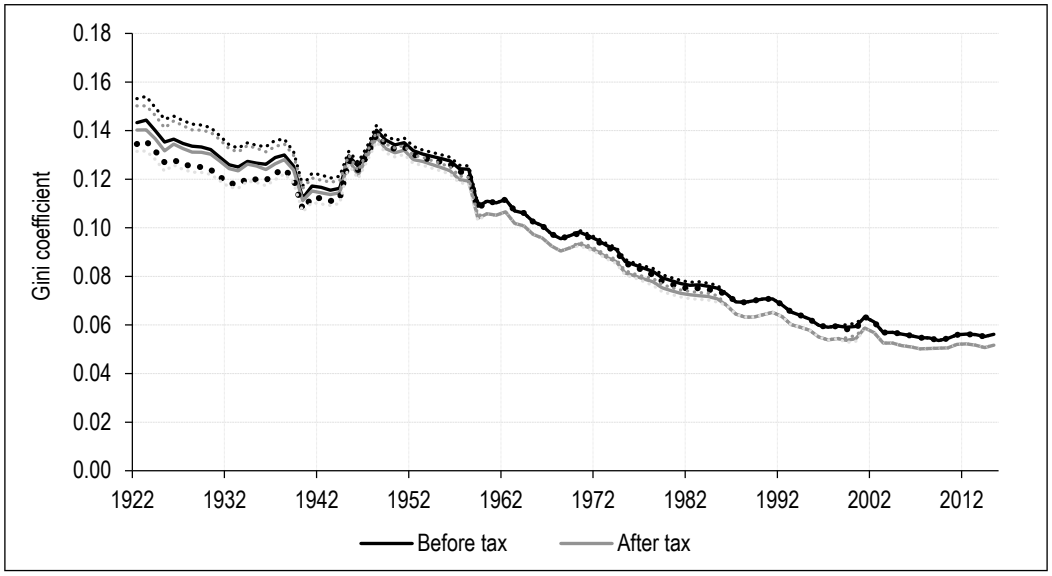
1 Ain	31 Garonne (Haute)	61 Orne
2 Aisne	32 Gers	62 Pas de Calais
3 Allier	33 Gironde	63 Puy de Dôme
4 Alpes (Basses)	34 Hérault	64 Pyrénées (Basses)
5 Alpes (Hautes)	35 Ille et Vilaine	65 Pyrénées (Hautes)
6 Alpes Maritimes	36 Indre	66 Pyrénées Orientales
7 Ardèche	37 Indre et Loire	67 Rhin (Bas)
8 Ardennes	38 Isère	68 Rhin (Haut)
9 Ariège	39 Jura	69 Rhône
10 Aube	40 Landes	70 Saône (Haute)
11 Aude	41 Loir et Cher	71 Saône et Loire
12 Aveyron	42 Loire	72 Sarthe
13 Bouches du Rhône	43 Loire (Haute)	73 Savoie
14 Calvados	44 Loire Inférieure	74 Savoie (Haute)
15 Cantal	45 Loiret	75 Paris
16 Charente	46 Lot	76 Seine Inférieure
17 Charente Maritime	47 Lot et Garonne	77 Seine et Marne
18 Cher	48 Lozère	78 Seine et Oise
19 Corrèze	49 Maine et Loire	79 Sèvres (Deux)
20 Corse	50 Manche	80 Somme
21 Côte d'Or	51 Marne	81 Tarn
22 Côtes du Nord	52 Marne (Haute)	82 Tarn et Garonne
23 Creuse	53 Mayenne	83 Var
24 Dordogne	54 Meurthe et Moselle	84 Vaucluse
25 Doubs	55 Meuse	85 Vendée
26 Drôme	56 Morbihan	86 Vienne
27 Eure	57 Moselle	87 Vienne (Haute)
28 Eure et Loir	58 Nièvre	88 Vosges
29 Finistère	59 Nord	89 Yonne
30 Gard	60 Oise	90 Territoire de Belfort

Figure A-II – **Average, maximum and minimum tax rate, 1922-2015**



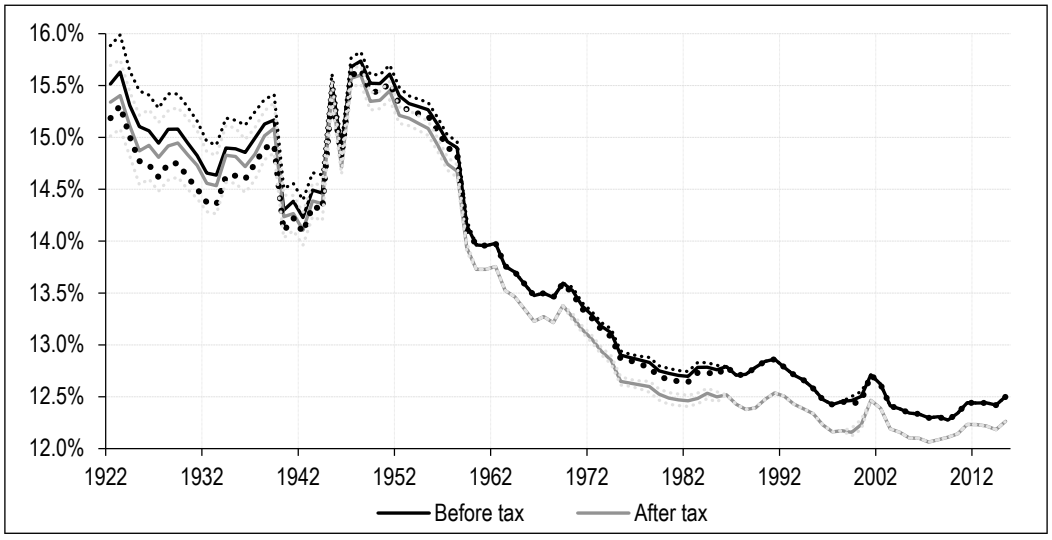
Notes: The tax rate of the department is itself an average rate over all taxpayers. There is no weighting of the departments.
Reading note: In 1922, the maximum departmental income tax rate was 3.7%. The gap between the maximum and minimum rates was 3.6 percentage points in 1922.
Sources: See Table 3.

Figure A-III – **Gini coefficient of the average tax income of 90 departments, 1922-2015 with 95% confidence intervals for the years in which income is estimated**



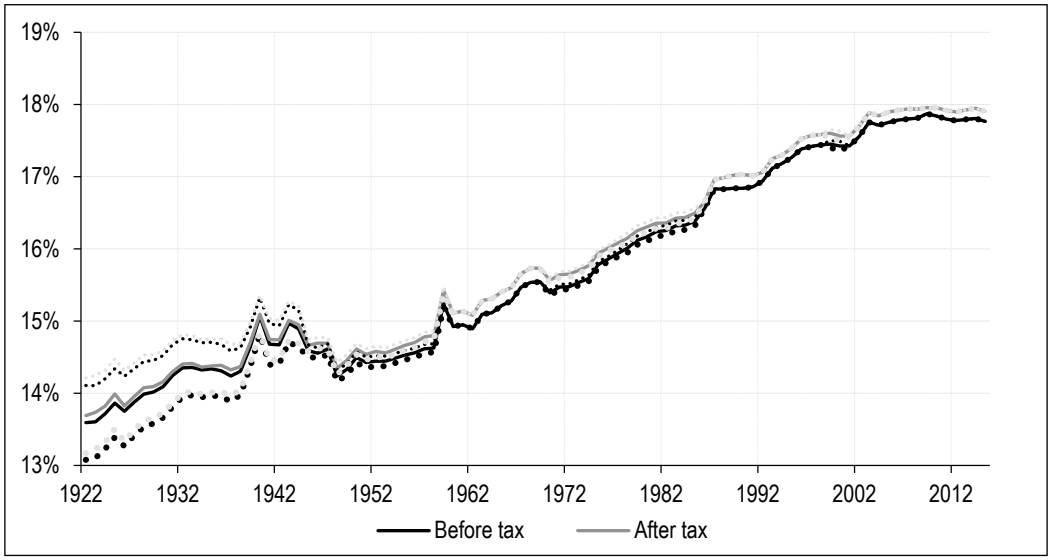
Notes: The black and grey solid-line curves represent the Gini coefficient of average tax income per adult in the departments of metropolitan France before and after income tax, respectively. The dotted curves represent the 95% confidence intervals obtained by bootstrapping (1,000 repetitions) for the periods in which tax income is estimated using models (1) and (2).
Reading note: In 1922, the Gini of the average tax income before income tax was 0.147, with a 95% confidence interval of between 0.134 and 0.153.
Sources: See Table 3.

Figure A-IV – **Proportion of the nine wealthiest departments in the average tax income of 90 departments, 1922-2015, with 95% confidence intervals for the years in which income is estimated**



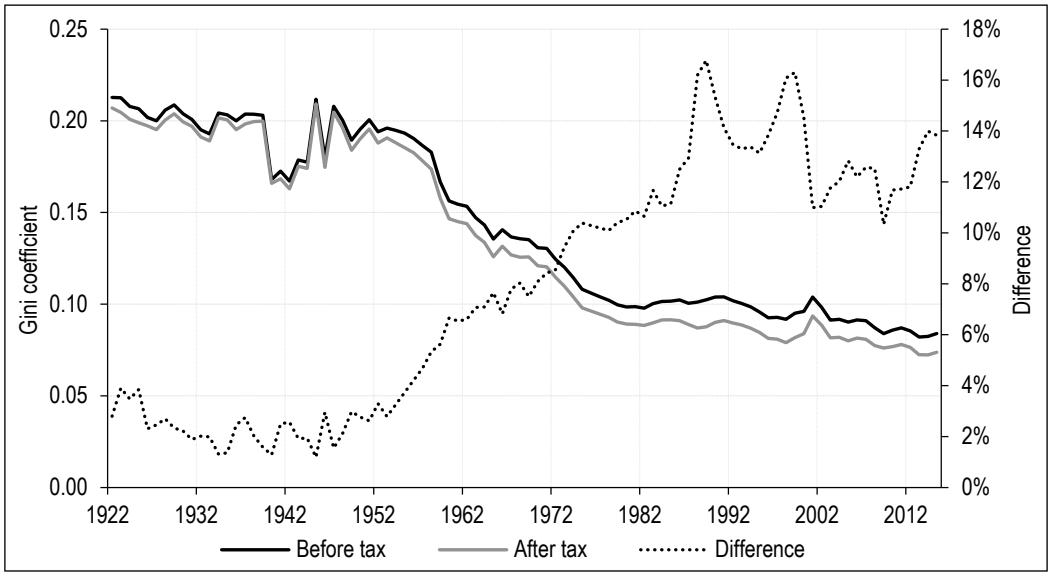
Notes: The black and grey solid-line curves represent the change in the share of average income per adult held by the nine wealthiest departments (P90-P100) in the total average income of the 90 departments before and after income tax, respectively. The dotted curves represent the 95% confidence intervals obtained by bootstrapping (1,000 repetitions) for the periods in which tax income is estimated using models (1) and (2).
Reading note: In 1922, the share of average tax income before income tax held by the nine wealthiest departments in the total average tax income of the 90 departments was 15.7%, with a 95% confidence interval of between 15.19% and 15.89%.
Sources: See Table 3.

Figure A-V – **Proportion of the 18 poorest departments in the average tax income of 90 departments, 1922-2015, with 95% confidence intervals for the years in which income is estimated**



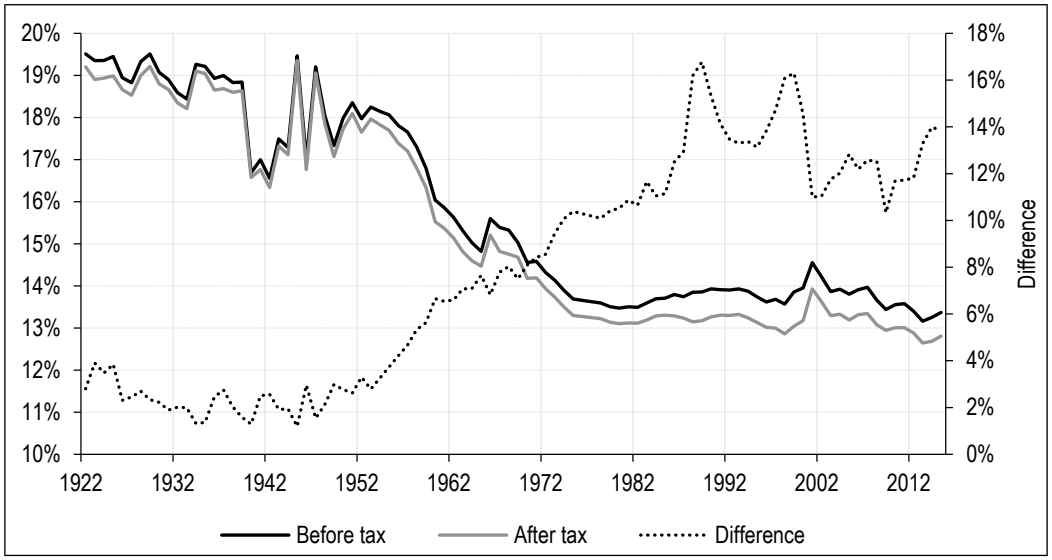
Notes: The black and grey solid-line curves represent the change in the share of average income per adult held by the 18 least wealthy departments (P0-P20) before and after income tax, respectively. There is no weighting. The black dotted curve represents the difference between the two curves. The dotted curves represent the 95% confidence intervals obtained by bootstrapping (1,000 repetitions) for the periods in which tax income is estimated using models (1) and (2).
Reading note: In 1922, the share of average income before income tax held by the 18 least wealthy departments was 13.4% with a 95% confidence interval of between 13.08% and 14.11%.
Sources: See Table 3.

Figure A-VI – **Gini coefficient of the average tax income of 90 departments weighted by their adult population, 1922-2015**



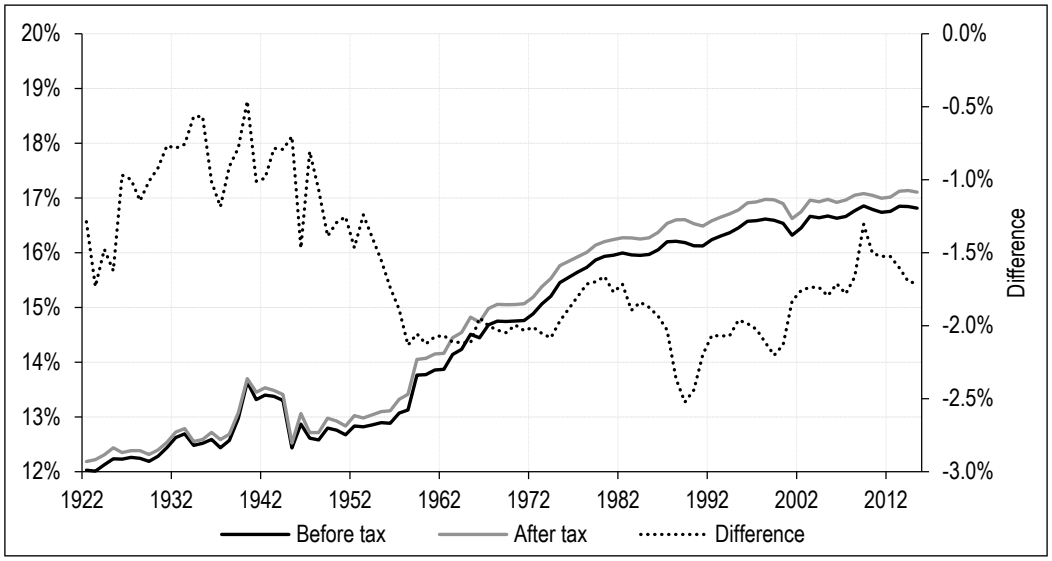
Notes: The black and grey solid-line curves represent the Gini coefficient of tax income, weighted by the adult population of each department, before and after income tax, respectively.
Reading note: In 1922, the Gini coefficient of departmental tax income before income tax, weighted by adult population, was 0.213.
Sources: See Table 3.

Figure A-VII – **Proportion of the 9 wealthiest departments in the average tax income of 90 departments weighted by their adult population, 1922-2015**



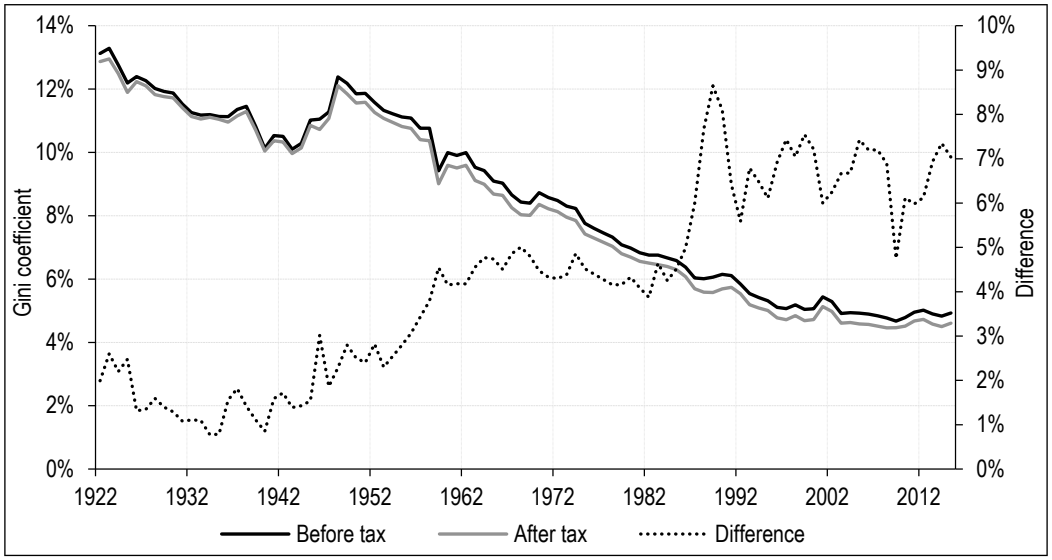
Notes: The black and grey solid-line curves represent the change in the share of average income per adult held by the nine wealthiest departments (P90-P100) in the total average income of the 90 departments before and after income tax, respectively, with the departments weighted by their adult population.
Reading note: In 1922, the share of average tax income before income tax, weighted by adult population, held by the nine wealthiest departments, was 19.5%.
Sources: See Table 3.

Figure A-VIII – **Proportion of the 18 poorest departments in the average tax income of 90 departments weighted by their adult population, 1922-2015**



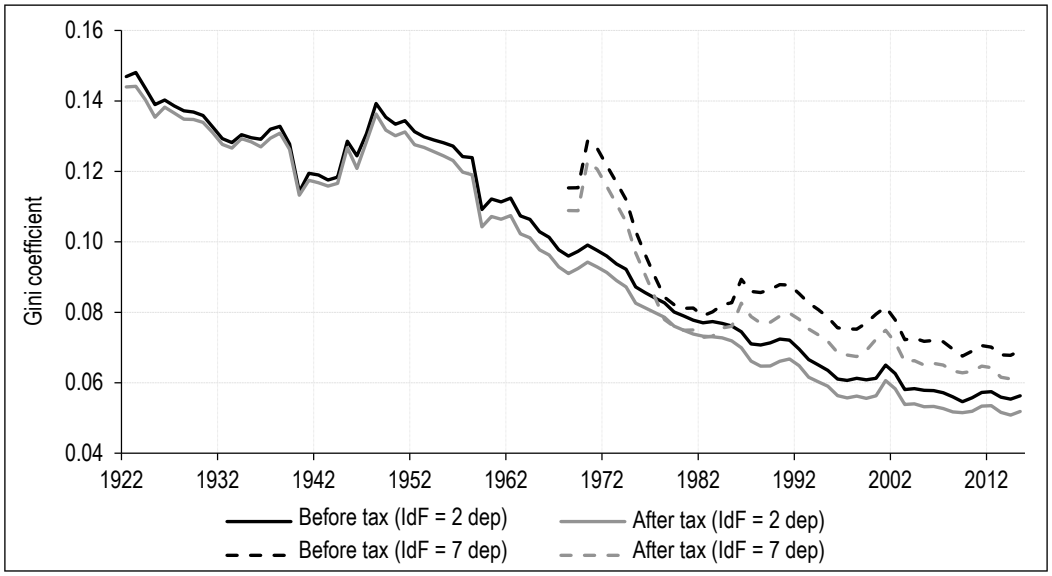
Notes: The black and grey solid-line curves represent the change in the share of average income held by the 18 least wealthy departments (P0-P20) before and after income tax, respectively, with the departments weighted by their adult population. There is no weighting. The black dotted curve represents the difference between the two curves.
Reading note: In 1922, the share of average income, weighted by adult population, held by the 18 least wealthy departments, before income tax, was 12.0%.
Sources: See Table 3.

Figure A-IX – **Gini coefficient of the average tax income of 87 departments excluding those in Île-de-France (Seine, Seine-et-Marne and Seine-et-Oise), 1922-2015**



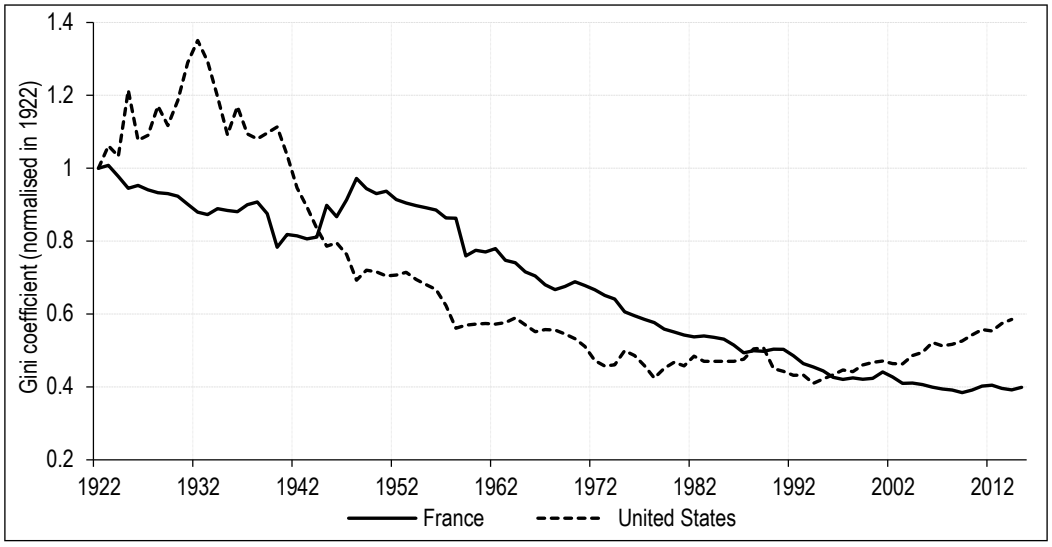
Notes: The black and grey solid-line curves represent the Gini coefficient of the average tax income of the 87 metropolitan departments, excluding those of Île-de-France (Seine, Seine-et-Marne and Seine-et-Oise) before and after income tax, respectively. The black dotted curve represents the difference between the two curves.
Reading note: In 1922, the Gini coefficient of the average tax income before income tax of the 87 metropolitan departments, excluding those of Île-de-France, was 0.131.
Sources: See Table 3.

Figure A-X – **Gini coefficient of the average tax income of 90 departments (1922-2015) and 95 departments (1968-2015) after the reorganisation of the Seine and Seine-et-Oise departments**



Notes: The black and grey solid-line curves represent the Gini coefficient before and after income tax, respectively, of the average tax income of the 90 metropolitan departments under the former system before the reorganisation of the Île-de-France departments. The dotted curves represent the Gini coefficient of the average tax income of the 95 metropolitan departments under the subsequent system following the reorganisation of the Île-de-France departments but before the reorganisation of Corsica.
Reading note: In 2015, the Gini coefficient of average tax income before income tax of the 90 departments was 0.56, while that of the 95 departments was 0.69.
Sources: See Table 3.

Figure A-XI – **Gini coefficient of the average tax income in France and United States (1922=1)**



Reading note: In 1922, the Gini coefficient of the average tax income before income tax of the departments of France was 0.14.
Sources: See Table 3 and Franck (2015).

Table A-1 – **Results of regressions for the four periods under consideration (least squares method)**
Explained variable: average tax income per adult of the departments

Estimation	#1		#2		#3		#4	
Data	1960-1969		1960-1969 ; 1986-1998		1960-1969 ; 1986-1998		1986-1998	
Model	(1)		(1)		(2)		(2)	
0-19 years	0.5391	0.927	-0.24	0.047	-0.355	0.123	-0.4756	-0.346
	(0.018)	(0.0125)	0	(0.1499)	0	(0.0044)	0	0
20-29 years	0.3178	0.237	-0.0779	-0.083	-0.0299	-0.041	-0.2925	-0.327
	(0.0005)	(0.0834)	0	0	(0.1471)	(0.0762)	0	0
30-39 years	0.6488	0.495	-0.0261	-0.008	0.0294	0.067	-0.1129	-0.522
	0	(0.0017)	(0.1452)	(0.7352)	(0.2423)	(0.0342)	(0.0231)	0
40-49 years	0.3593	0.25	-0.1759	-0.038	-0.1213	0.028	-0.1052	-0.22
	(0.0006)	(0.0592)	0	(0.0213)	0	(0.2227)	(0.0074)	0
50-64 years	0.5058	0.397	-0.1916	-0.055	-0.2093	-0.1	-0.2635	-0.285
	(0.0002)	(0.0477)	0	(0.0098)	0	(0.0008)	0	0
65-79 years	0.1103	0.242	-0.2062	-0.09	-0.1917	-0.031	-0.2606	-0.302
	(0.1778)	(0.083)	0	0	0	(0.2385)	0	0
80+	0.1596	0.093	0.0444	0.006	0.0851	0.023	-0.0188	-0.118
	0	(0.0092)	0	(0.3821)	0	(0.0085)	(0.5308)	0
Income per adult	0.3495	0.673	0.6001	0.777				
	0	0	0	0				
Share of income	-0.0329	-0.15	-0.2042	-0.313				
	(0.068)	0	0	0				
Share of taxes					0.2511	0.274	0.0893	0.2
					0	0	0	0
Taxable units					0.2268	0.341	0.2314	0.505
					0	0	0	0
Interaction	-2.0075	-2.237	1.3536	0.602	1.2908	0.311	2.1591	2.399
	(0.0068)	(0.053)	0	0	0	(0.031)	0	0
Fixed effects	Yes	No	Yes	No	Yes	No	Yes	No
R^2	0.993	0.968	0.989	0.975	0.984	0.963	0.993	0.978

Notes: The table shows the regression results over four periods. The variable to be explained is the departmental average tax income per adult relative to the average tax per adult of the 90 departments. p-value in parentheses.
Reading note: For the period 1960-1969, an increase of one percentage point in the share of the 0-19 age range in the population of a department means a relative average tax income per adult of 0.5391 percentage points (for the specification without departmental fixed effect).
Sources: See Table 3.

Undeclared Work – Evidence from France

Laila AitBihiOuali* and Olivier Bargain**

Abstract – This study quantifies undeclared work patterns in France using a unique pilot survey which collects data on households' demand and supply of undeclared work (*Enquête pilote auprès des ménages sur la fraude*). It also proposes an international comparison at the European level using Eurobarometer data. Socio-demographic characteristics fail to explain the variance in undeclared work, while subjective factors are strongly associated with households' supply and demand for undeclared work. This suggests the underlying influence of intrinsic, extrinsic and peer effects. Similar results from the Eurobarometer allow for a cross-validation of the two surveys. We obtain similar correlates for undeclared work in France and countries where undeclared work is also a supplementary income (Denmark and Germany). This suggests homogeneous patterns across European countries.

JEL Classification: E26, H26, J46, O17
Keywords: undeclared work, informal work, declared work, underground economy, shadow economy

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The informal economy is composed of all commercial goods and services whose production is deliberately concealed from public authorities, in order to avoid *(i)* the payment of taxes or social security contributions, *(ii)* labour market regulations and *(iii)* certain administrative procedures (Slemrod & Weber, 2012; Schneider & Enste, 2013). Undeclared work falls within this scope as it escapes the system of taxation and social security contributions. Thus, undeclared work contributes to both a reduction in public income and an imbalance in public accounts (for the case of France, see the Farriol report, 2014). It is also detrimental to the workers who undertake such work, as they are not afforded legal protection (Bajada & Schneider, 2009).[1] We propose here an analysis of undeclared work that we define as activities that are legal but not declared to social, tax and labour authorities.

Undeclared work is a phenomenon that varies in scale but is never negligible in any European country (Schneider, 2002):[2] on the labour supply side, 4.6% of individuals in the euro area report having made use of undeclared work in 2013 (Eurobarometer). On the demand side, 7.3% of households reported having paid for undeclared personal services. The personal services sector, which is set to grow because of an ageing society, is often associated with high rates of non-declaration. This is occuring despite the development of financial incentives (e.g., tax credits, or the *chèque emploi service universel*, which is a scheme to facilitate the use and declaration of personal services). Therefore, it is important to understand the institutional and cultural factors and those associated with labour market conditions that may influence levels of undeclared work. The respective roles of these factors may strongly influence the public policies to be implemented to combat this phenomenon.

We base our work on a pilot household survey on fraud (*Enquête pilote auprès des ménages sur la fraude,* hereafter EPMF). The joint use of the EPMF and the CRÉDOC survey on living conditions provides information on the supply of undeclared work in France as well as the demand as it collects information on the use of undeclared personal services.[3] This article first proposes a quantification of undeclared work based on the EPMF; this quantification is in line with the recent literature on the measurement of undeclared work and more generally of tax evasion. While part of this field of research aims to detect indirect evidence of underground economic activities (Slemrod & Weber, 2012), the present study relies on the direct analysis of individual responses regarding fraudulent behaviour. We highlight the obvious risks of under-reporting of these behaviours and propose a sensitivity analysis which is itself based on the joint analysis of several variables from *(i)* the EPMF and *(ii)* another sample with a very comparable structure: the France module of the Eurobarometer survey.

We then propose a series of estimates of undeclared work on a set of correlates that are potential determinants of undeclared work. We use the socio-demographic and economic characteristics provided in the EPMF as well as the richness of that survey in relation to subjective aspects: civic values, fraud fraud acceptability, perception of fraudulent behaviours of peers and relatives, and finally, the perceived risk and penalties associated with undeclared work and other fraudulent behaviours. This analysis shows that the two types of variables have complementary effects on the propensity to resort to undeclared work. In other words, the subjective elements (values, perceptions, etc.) do not reflect the behaviour of specific socio-demographic groups but capture an additional degree of subjective heterogeneity that complements the description of the individuals who are engaged in undeclared work well. In the absence of an exogenous variation of these factors, our analysis does not allow the causes to be identified. Nevertheless, the correlations obtained can be interpreted in the light of the literature and simple intuitions in relation to the potential mechanisms of the undeclared labour supply.

Finally, we replicate our statistical estimations using the French module of the Eurobarometer. This sample is smaller than the EPMF, yet some of the results obtained are similar between the EPMF and the Eurobarometer. This provides an implicit cross-validation of the two databases. We can then make a European comparison with estimates for some nearby countries or for the whole euro area, plus the UK, Sweden and Denmark. The impact of socio-demographic characteristics on undeclared work is of comparable magnitude in France, Germany and some Nordic countries. The effects of subjective

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1. The latter point mainly relates to fully concealed employment, which is relevant for countries with barriers to entry into the formal sector (Perry et al.*, 2007), and is less about undeclared supplementary work as in France.*

2. See the CNIS report (Tagnani, 2017) for a very thorough review of undeclared work in France.

3. The EPMF is the result of a joint initiative by the Délégation Nationale à la Lutte contre la Fraude *(DNLF) and the* Direction Générale des Entreprises *(DGE), which we thank for access to the data. We are particularly grateful to Nadia Joubert for her coordination role and to Christine Rigodanzo and Alain Fourna for their comments and suggestions.*

heterogeneity (i.e. the fraud acceptability and the perceived risk of sanctions associated with fraud) on undeclared work practices are also similar between these countries. Germany and the Scandinavian countries seem to be closer to France in terms of undeclared work and tax fraud than in terms of social benefit fraud (Algan & Cahuc, 2009).

1. Undeclared Work in the Literature

A large strand of literature aims to quantify the size and monetary value of the underground economy and informal work. Since no direct measurement is possible, some studies' methodology consists in measuring the gap between consumption levels and income levels, with the latter assumed to be underestimated due to undeclared activities (Pissarides & Weber, 1989; Lyssiotou *et al*., 2004). Others measure the gap between income levels reported in household surveys (assumed to be correct) and that known from administrative data (Benedek & Lelkes, 2011). The gaps seem to be significant in sectors in which income is difficult to control, namely agriculture and self-employment. Other work nonetheless observes how tax returns react to randomised audits (Kleven *et al*., 2011) or changes in legislation (Fack & Landais, 2016).

The literature also seeks to identify the determinants of any underground activity. Theoretical studies (e.g., Cowell, 1985), have characterised taxation and legal constraints as factors increasing the risk of income concealment through undeclared work. Many empirical studies explicitly model these behaviours using structural models and taking into account taxation or charges on formal work (Lacroix & Fortin, 1992; Frederiksen *et al*., 2005; Fortin *et al*., 2004; Lemieux *et al*., 1994). Others use natural experiments using variations in the level of taxation, for example between regions (Brülhart & Parchet, 2014). In our analysis, we take into account a measure of perceived tax pressure.

The monitoring system and the risk of sanctions involved are emphasised in some work on extrinsic motivations (Andreoni *et al*., 1998); so is the quality of institutions (Torgler & Schneider, 2009). It is perception that is important: that of the effective intensity of monitoring (Trandel & Snow, 1999) or the often overestimated level of punishment (Chetty *et al*., 2009). We will use two variables on the perception of risk and potential sanctions. The perception of the tax system is also influenced by the people around the individual, with potentially important peer effects (Feld & Tyran, 2002). Experimental methods reveal the influence of virtuous behaviour around us (Fortin *et al*., 2007). Studies also analyse peer effects on the demand for undeclared work for French companies (Joubert, 2003). Bellemare *et al*. (2012) and Galbiati & Zanella (2008) show their impact on corporate social fraud. In our study, we use a variable relating to the perception of fraudulent behaviour in one's direct surroundings and beyond.

More recently, the literature has also focused on intrinsic motivations such as moral satisfaction (warm glow), fiscal morality or civic values (Luttmer & Singhal, 2014). Surveys such as the Eurobarometer (as well as the World and European Values Surveys) or the EPMF make it possible to isolate these values (along with variables such as the fraud acceptability) and their correlation with undeclared work behaviour. Numerous studies use international variation (Williams & Horodnic, 2016), the role of home culture (Halla, 2012; Algan & Cahuc, 2009) or institutional choices, for example the fact that a broad tax base can deter opportunistic behaviour (see Kleven, 2014). Experimental approaches test responses to alternative messages emphasising morality, peer effects or the weight of penalties (Haynes *et al*., 2012); they highlight the high level of heterogeneity in the influence of intrinsic and extrinsic motivations (Dwenger *et al*., 2016). Using a representative survey, we confirm the importance of all these factors, which, together, explain a not insignificant proportion of undeclared work.

2. Data and Quantification of Undeclared Work

In this study, undeclared work covers the scope of activities that are legal but not declared to social, tax and labour authorities. In order to quantify it and identify the correlates, we use the EPMF and supplement it with the Eurobarometer. We first present these two surveys, followed by an initial descriptive approach to undeclared work.

2.1. The Data

The EPMF survey is collected jointly with the CRÉDOC *Conditions de Vie et Aspirations* survey (a French survey on living conditions and attitudes). It was conducted face-to-face in June 2015 for 2004 respondents aged 18 and over living in metropolitan France. It provides information on decisions to engage in undeclared work in 2015 in the month preceding the survey as well as over the period 2012-2015. It also records information on the hiring behaviour of

households in the field of personal services, and on the intentions to under-declare income linked to the perceived level of compulsory levies. The EPMF also includes subjective questions on the acceptability of various fraudulent behaviours, the associated perceived risk and penalties, and finally the perceived presence of fraudsters around the individual and in the country.

The questionnaire gradually leads respondents to sensitive questions in order to encourage them to reveal behaviour related to undeclared work or tax avoidance.[4] However, the risk of under-reporting cannot be overlooked for these types of issues. We therefore compare various measures. Firstly, reports of undeclared work in the short term are compared with those for the period 2012-2015, as individuals are more likely to reveal previous fraudulent behaviour than current fraudulent behaviour. We also compare the EPMF measures with those from Eurobarometer data for the year 2013.

The Eurobarometer's survey structure is comparable to that of the EPMF and gradually addresses the most sensitive aspects in order to encourage the disclosure of fraudulent behaviour in a section on undeclared work and the use of personal services. The questions on subjective perceptions or the fraud acceptability are worded in the same way as in the EPMF, or in a very similar manner. Our analysis focuses on the countries of the euro area, the United Kingdom, Sweden and Denmark.

As with the CRÉDOC data, the EPMF aims to be representative of the French population. A comparison of the average characteristics of the respondents with the data from the population census (Appendix, Table A-1) shows good representativeness in terms of demographic structure, as well as by type of activity.[5] Regarding the Eurobarometer data collected for France, the representativeness is slightly less good due to the small sample size. The p-values of the tests of equality of means or proportions between the two sources show rejection for certain demographic variables (age and married) and activity statuses (retired and at home). As the EPMF corresponds to the year 2015 and the Eurobarometer corresponds to 2013, this may explain a (small) part of the differences.

Finally, it should be noted that information on the frequency of undeclared work or on the motives of undeclared workers should be treated with caution: on the one hand, the non-response rate is high and, on the other hand, the interpretation of motives can be tricky. The estimations therefore focus only on the probability of engaging in undeclared work (a binary variable).

2.2. Descriptive Statistics and Measurement of Undeclared Work

Among the 2004 individuals surveyed in the 2015 EPMF, 3.8% reported having engaged in undeclared work in the month prior to the survey (Table 1). With a sample size of 2004 observations, the proportion of undeclared work falls within a 95% confidence interval of 3.0%-4.6%, which is an acceptable margin of

4. As with any survey, the data are anonymous, and the interviewers make a point of emphasising this fact during the collection process.
5. Education levels should be treated with caution as in the EPMF we had to recreate categories based on the number of years of education. The most reliable category is "baccalaureate and higher", so it is therefore the one we report and use in the estimates.

Table 1 – **Quantification of undeclared work**

	EPMF 2015	Eurobarometer 2013		Differences	
	France (1)	France (2)	Europe* (3)	France (1) – France (2)	France (1) – Europe (3)
Supply of undeclared work					
Undeclared work**	0.038	0.044	0.048	-0.006	-0.010
	(0.192)	(0.205)	(0.213)	*0.297*	*0.33*
Undeclared work in 2012-2015	0.088	-	-	-	-
	(0.283)				
Demand for undeclared (personal services) work					
Use of personal services	0.118	-	-	-	-
	(0.323)				
Use of undeclared personal services	0.018	0.023	0.030	-0.005	-0.012
	(0.133)	(0.151)	(0.180)	*0.73*	*0.166*
Use of undeclared personal services in 2012-2015	0.048	-	-	-	-
	(0.214)				

*Euro area, Great Britain, Sweden & Denmark. **Undeclared work in the previous month (EPMF) or year (Eurobarometer).
Notes: The standard deviations are shown in brackets, with the p-values of difference tests shown in italics.
Sources: EPMF 2015 and Eurobarometer 2013.

error for a rather poorly assessed phenomenon also subject to underreporting. Therefore, it is important to compare this measurement with other indicators. Firstly, we can compare these results with the answers to another question in the EPMF on engaging in undeclared work in the period 2012-2015.[6] The rate of undeclared work is 8.8% (within a 95% confidence interval of 7.6%-10%); the difference is notable but primarily reflects the cumulative probability over the longer term. Unsurprisingly, undeclared work levels are lower in the (smaller) time window that is the month preceding the survey. This problem of infrequency is all the more important as undeclared work may be of a one-off nature (supplementary income). The second measure may also benefit from better disclosure of fraudulent behaviour, as it relates to past behaviour that is easier to admit. The range provided by the two statistics is therefore interesting: the former provides a cross-sectional view of undeclared employment in France while the latter, covering a longer period, by nature collects information on more opportunities for fraud and suffers less from under-reporting. We use both variables in our estimations.

With the Eurobarometer, undeclared work is measured over the last 12 months. Therefore, an intermediate statistic is expected. This is indeed the case: the rate is 4.4% (confidence interval of 3.5%-5.3%). This is closer to the "snapshot" measure provided by the EPMF (see also Table A-1 in the Appendix for the comparison of the characteristics). It should be noted that the Eurobarometer covers the year 2013, which may somewhat limit the comparison with the EPMF figures for 2015. Nevertheless, in the absence of major shocks over the period, it is reasonable to assume that this rate has not changed much between these two years. The equality comparison with the average proportion of the EPMF is not rejected. It can also be noted that the average of the countries in the comparison group is very similar: 4.8%. The difference with France is not statistically rejected; in other words, fraudulent behaviour in France is not significantly different from the European average.

A final set of comparisons uses statistics provided in the CNIS (National council for statistical information) report on undeclared work (Tagnani, 2017) and figures from INSEE's National accounts. This report provides comparisons in terms of lost revenue for the public finances. A measurement resulting from random checks by ACOSS (the central French agency for social security bodies) places the loss of revenue from social security contributions at between 1.5% and 1.9%. The INSEE figures relate to unreported value added (VA), as identified by controls and corrected for the probability of control; the share of concealed VA that can be attributed to undeclared work is between 3.2% and 3.7% of the total wage bill received by households. Based on simple assumptions about the income in question, the rate of undeclared work in the EPMF (3.8%) converted into undeclared income would represent between 1.4% and 2.3% of the total wage bill.[7] This order of magnitude is relatively close to the other two statistics, given the significant uncertainties in the various estimates. The relative closeness of these figures supports the idea that the snapshot measure of the EPMF does not suffer from massive under-reporting.[8]

The second half of Table 1 presents figures for the proportion of households using personal services (11.8%, or 237 observations) and those using undeclared personal services (1.8%) in 2015. These figures relate to three main categories of services: housework, childcare and domestic help. They represent an undeclared hiring rate of about 15%. Due to the small sample size (237 observations), the 95% confidence interval is wide (10.6%-19.8%); it nevertheless provides an interesting order of magnitude for a rarely available statistic, which is a contribution of the present study: in France, undeclared personal services are difficult to identify using URSSAF inspections.[9] For the reasons mentioned above, one would expect the rate of use of undeclared personal services to be higher in the Eurobarometer; it is (2.3%), but the difference in comparison with the EPMF is

6. More specifically, the survey asks individuals whether they engaged in more or less concealed work in 2015 than in 2012. Whether or not the respondent has engaged in undeclared work at least once over the period 2012-2015 can be inferred from the responses to this question.

7. The proportion of people reporting having undertaken undeclared work would be 3.9% (source: EPMF), which represents 1.9 million individuals when this rate is extended to the total population aged 18 and over. The proportion of persons having worked undeclared hours is then 7.1% after referring these 1.9 million individuals to the total population in employment as defined by national accounts (27 million people). It is assumed that those who worked only undeclared hours worked on a full-time basis (1600 hours/year), and that those who worked both declared and undeclared hours worked the equivalent of one quarter of a full time job (400 hours/year) in undeclared hours. With these assumptions, the concealed wage bill amounts to €16 billion for those who work only undeclared hours and €3.6 billion for the others, i.e. €19.6 billion in total, which represents 2.3% of the total wage bill received by households as estimated in national accounts.

8. In France, the legal liability in relation to undeclared work lies with the employer – who can be penalised – but not with the employee. De facto, *people's perception of the risk of being caught (and the penalties) might be low, but it is also possible that people are not aware of the law. In any case, the impact of perception must differ between undeclared work and undeclared hiring (personal services) because it is more obvious to a household that it is directly responsible for undeclared hiring.*

9. Even though these inspections intend to cover the entire field of contributors, the inviolability of the private home is an obstacle to an URSSAF inspection of private employers. Note that the upper end of the range obtained is close to the estimate obtained by DARES through an indirect source matching approach in 2011.

not significant. This rate is also relatively close to the European comparison group average (3%) and is not statistically different from the French rate. Finally, for France with the EPMF, the rate is found to be higher (4.8%) over the period 2012-2015 than in the "snapshot" in the month preceding the survey.[10]

To refine the description, we also compare the socio-demographic characteristics of individuals who do or do not make use of undeclared work, as either suppliers or employers (Table 2). Differences are found when it comes to family structure characteristics (presence of children, marital status and age), as well as the influence of respondents' peers and relative (more precisely, whether the individual knows at least one person who has ever made use of undeclared work). Finally, there are slight differences regarding the impact of the number of hours worked. In most cases, those who engage in undeclared work are in full-time (declared) employment: 78% of people who have engaged in undeclared work once work at least 35 hours a week. On first glance, undeclared work in France thus appears to be a supplementary activity.[11]

An examination of underlying motives at the root of the decision to undertake undeclared work is consistent with this conclusion. The EPMF includes a question on the main and secondary reason for non-declaration. This question is asked of all respondents, regardless of whether or not they reported having engaged in undeclared work (in 2015, or in the three years preceding the survey). The vast majority state that their

10. However, the survey does not provide the number of households using personal services over this period. This implies that it is not possible to verify the existence of significant differences in demand levels for concealed work across samples.

11. This is confirmed by the CNIS report (Tagnani, 2017) which cross-checks several sources – including the EPMF – and indicates that, in most cases, undeclared employment in France represents a part-time activity which generates a supplementary income. It is an income that supplements wages (40% of cases) or income from self-employment (13%). For the rest, it supplements replacement income (unemployment benefits) or minimum income (the RSA).

Table 2 – **Characteristics of suppliers and employers**

	Demand for work		Supply of work	
	Declared	Undeclared	Declared	Undeclared
Socio-demographic characteristics				
Female (0/1)	0.53 (0.50)	0.42 (0.50)	0.52 (0.50)	0.42 (0.50)
Age	49.4 (17.70)	34.7 (13.90)	48.8 (17.82)	50.4 (16.25)
Married (0/1)	0.54 (0.50)	0.31 (0.47)	0.54 (0.50)	0.42 (0.50)
No of people in the household	2.50 (1.39)	2.74 (1.63)	2.51 (1.40)	2.44 (1.38)
Presence of children (0/1)	0.72 (0.45)	0.45 (0.50)	0.71 (0.45)	0.86 (0.35)
Education				
No educational qualification	0.08 (0.27)	0.06 (0.25)	0.08 (0.27)	0.03 (0.17)
Below baccalaureate level	0.45 (0.50)	0.49 (0.50)	0.46 (0.50)	0.33 (0.48)
Baccalaureate or higher	0.47 (0.50)	0.44 (0.50)	0.47 (0.50)	0.64 (0.49)
Occupation/Activity status				
Executive/Manager	0.08 (0.27)	0.06 (0.25)	0.08 (0.27)	0.14 (0.35)
White-collar worker	0.14 (0.34)	0.18 (0.39)	0.14 (0.34)	0.22 (0.42)
Manual worker	0.11 (0.31)	0.18 (0.39)	0.11 (0.31)	0.06 (0.23)
Student	0.05 (0.22)	0.18 (0.39)	0.06 (0.23)	0.00 (0.00)
Retired	0.29 (0.45)	0.05 (0.22)	0.28 (0.45)	0.36 (0.49)
Job seeker	0.09 (0.28)	0.19 (0.40)	0.09 (0.29)	0.00 (0.00)
Self-employed worker	0.04 (0.19)	0.06 (0.25)	0.04 (0.19)	0.08 (0.28)
Employed person	0.48 (0.50)	0.53 (0.50)	0.48 (0.50)	0.61 (0.49)
Employed, open-ended contract (*vs.* fixed-term contracts)	0.13 (0.34)	0.22 (0.42)	0.13 (0.33)	0.35 (0.49)
Full time (*vs.* part time)	0.82 (0.39)	0.78 (0.42)	0.82 (0.39)	0.68 (0.48)
Number of hours worked				
Less than 20 hrs	0.05 (0.22)	0.10 (0.30)	0.05 (0.23)	0.09 (0.29)
Between 20 hrs and 35 hrs	0.14 (0.35)	0.12 (0.33)	0.14 (0.35)	0.23 (0.43)
35 hrs	0.36 (0.48)	0.27 (0.45)	0.36 (0.48)	0.27 (0.46)
Between 35 hrs and 39 hrs	0.15 (0.36)	0.17 (0.38)	0.15 (0.36)	0.18 (0.39)
40 hrs and over	0.27 (0.44)	0.34 (0.48)	0.27 (0.45)	0.23 (0.43)
Context (peer effects)				
Knows at least one undeclared worker (Yes=1)	0.42 (0.49)	0.77 (0.43)	0.43 (0.49)	0.72 (0.45)

Notes: The standard deviations are shown in brackets.
Sources: EPMF 2015.

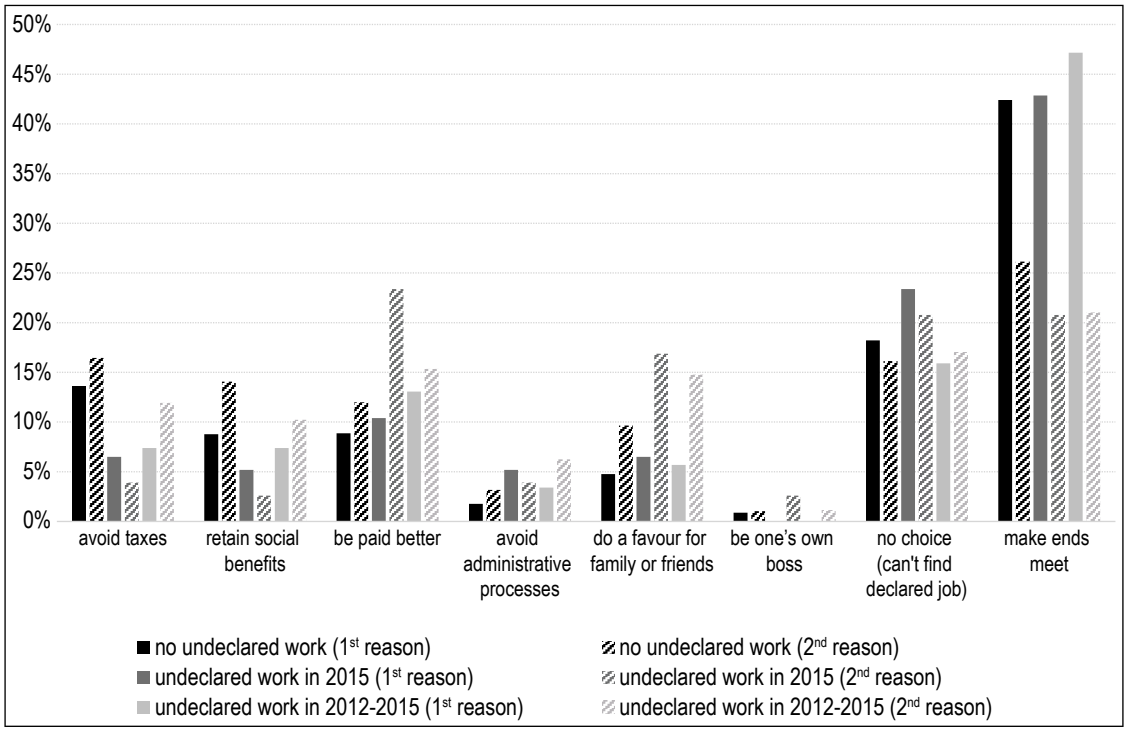
main motivation is the need to make ends meet; when combined with the similar motive of "to be paid more", this reaches between 50% and 60% of responses in all cases. The next most popular reason is a lack of regular employment, which represents 15% to 20% of responses. This view seems to be widely shared, as evidenced by the surprising closeness between the declarations of fraudsters and those of non-fraudsters. There is just a little more divergence between the two groups for minor reasons: for example, respondents who did not engage in undeclared work more often cite that evading taxes is fraudsters' main motivation, whereas undeclared workers cite other financial (to be paid more) or personal (doing a favour for a friend or relative) motives instead of tax avoidance (Figure I).

Finally, it should be noted that the distribution of the acceptability of undeclared work, whether on the demand or supply side, is comparable across all the samples used, i.e. respectively between the EPMF and the Eurobarometer for France and between France and Europe using the Eurobarometer (Table 3).

2.3. Elements Used for Comparison at European Level

Eurobarometer data allows us to compare France and other European countries. We report a set of comparison points which are computed for several groups. We first use an average point of comparison which is the level of undeclared work for the European group composed of the euro area, the UK, Sweden and Denmark; we also report averages for countries comparable to France that are the UK and Germany. Finally, we report averages for countries from contrasting groups that are *(i)* Nordic countries and *(ii)*

Figure I – **Stated underlying motives for undeclared work**



Reading note: Among respondents who engaged in undeclared work in the period 2012-2015, 47% cite "making ends meet" as their main reason and 21% cite it as a secondary reason.
Source: EPMF 2015.

Table 3 – **Acceptability of undeclared work**

Acceptability...	EPMF 2015	Eurobarometer 2013		Differences	
	France (1)	France (2)	Europe* (3)	France (1) – France (2)	France (1) – Europe (3)
... of undertaking undeclared work	3.02 (2.37)	2.91 (2.27)	3.60 (2.65)	0.11 *0.059*	-0.58 *0*
... of hiring an undeclared worker	3.53 (2.58)	2.00 (1.77)	2.25 (1.93)	1.53 *0*	1.28 *0*

*Euro area, Great Britain, Sweden & Denmark.
Notes: The standard deviations are shown in brackets, with the p-values of difference tests shown in italics. Acceptability is scored on a scale from 1 to 10.
Sources: EPMF 2015 and Eurobarometer 2013.

southern European countries. France seems to be similar to its European neighbours (Figure II). However, European statistics are surprising, with relatively high rates of undeclared work in two Scandinavian countries and lower rates in the southern countries. The size of the underground economy as a percentage of GDP (shown in the graph) is more in line with what would be expected instinctively.[12]

One explanation for the differences in rates of undeclared work across European countries could be related to practices: for example, in Denmark – or even in Sweden and France – undeclared work mainly encompasses supplementary activities and more rarely constitutes the main employment situation. Conversely, in Eastern and Southern European countries, it is more often a case of jobs that are completely undeclared, which may lead to under-declaration even in the European survey.[13] Although the Eurobarometer variable on this issue is not fully completed, it does show that around 60% of undeclared work constitutes extra hours worked in north-western and Scandinavian Europe (61% and 58% respectively), compared with 27% in eastern and southern European countries. To take these elements into account, our estimations for all European neighbours will be weighted using various Z_i factors to increase the influence of nearby countries: we will use the weights $f(Z_i) = Z_{max} - \text{abs}(Z_{France} - Z_i)$ for each country i, so as to give a lighter weighting to those that differ from France. The factors used are the percentage of undeclared work corresponding to undeclared additional hours worked, GDP per capita and the unemployment rate.

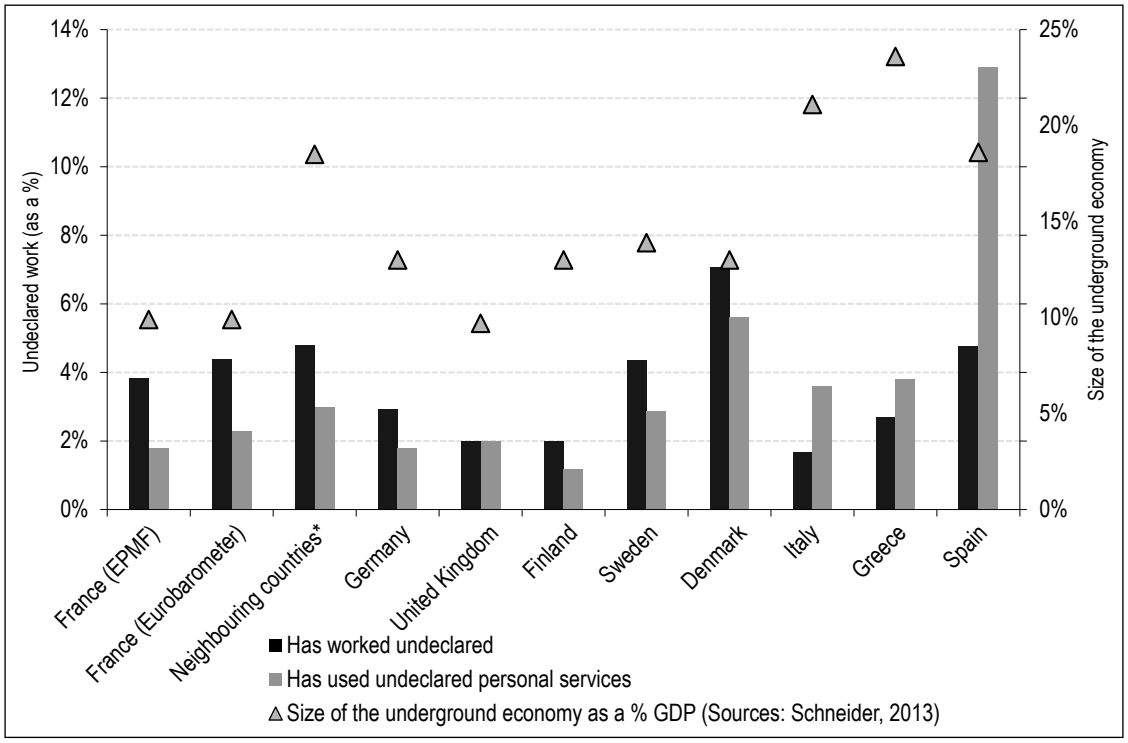
2.4. Acceptability of Fraudulent Behaviour

Undeclared work practices are also in line with the wider perceptions of the acceptability of fraudulent behaviour. Table 3 reports the average response to a question on the acceptability of undeclared work ("holding a job without declaring it to tax authorities or public bodies") and the use of undeclared personal services. Responses are given on a scale from 1 ("totally unacceptable") to 10 ("totally acceptable") in the EPMF and Eurobarometer. For France, the average is around 3 in both surveys, which is

12. In Figure II, data on the size of the underground economy, expressed as a percentage of GDP, are taken from Schneider (2013). The underground economy is measured using a MIMIC (Multiple Indicators and Multiple Courses) estimation, which is presented in detail in Schneider (2011). Undeclared work is only one part of the underground economy, which also includes undeclared turnover and the proceeds of criminal activities and economic crimes. As regards undeclared personal services, Figure II shows similar rates for France and neighbouring countries. There are notable differences between countries – the very high rate in Spain is consistent with the size of the informal economy in that country.

13. The "Undeclared Work in the European Union" Report (Eurobarometer, 2014) indicates between 60 and 100 hours/year of undeclared work in Northern and Western Europe, compared to 330-350 hours in Southern Europe.

Figure II – **Quantification of undeclared work demand and supply in Europe**

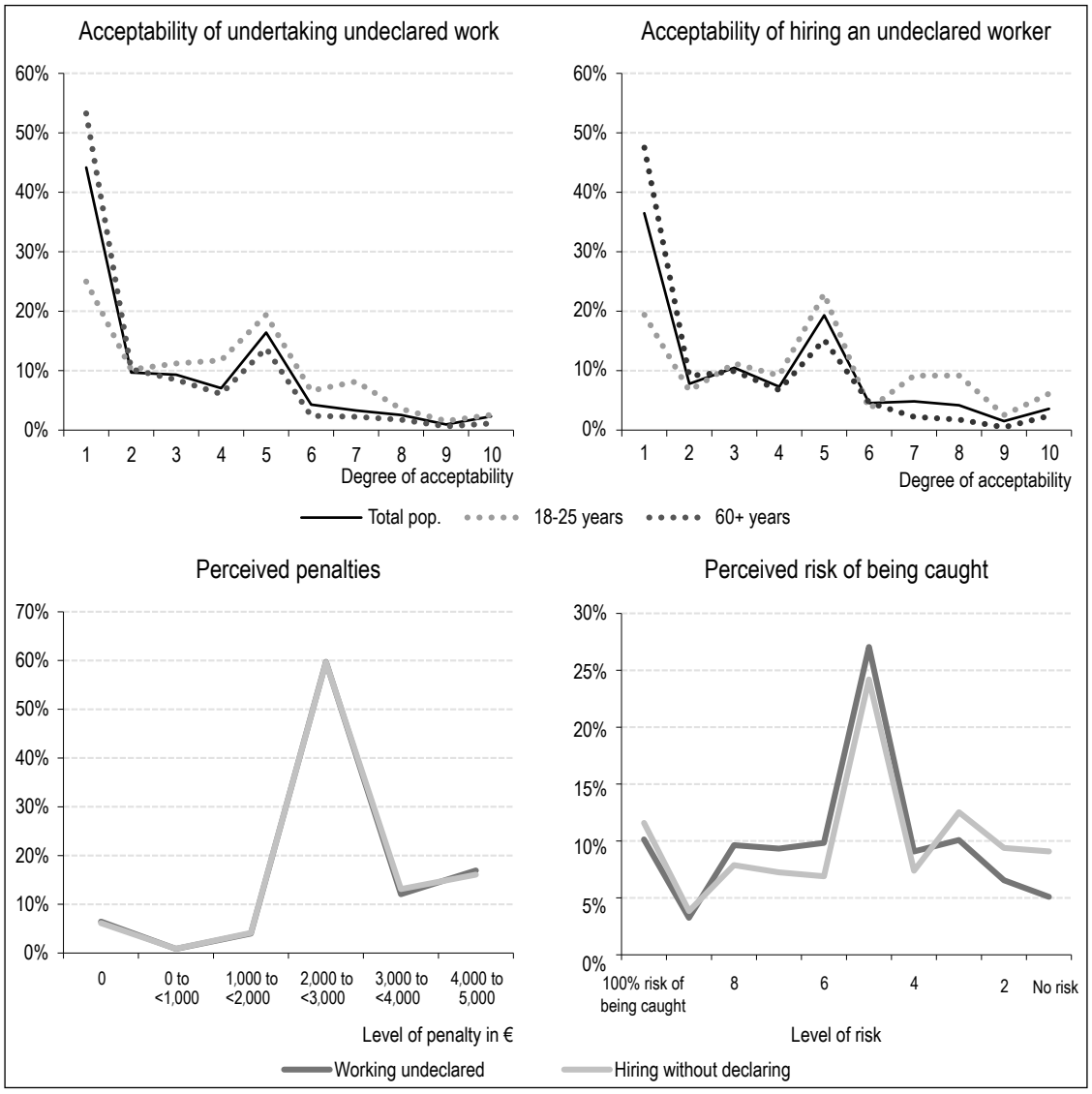


*Euro area, Great Britain, Sweden & Denmark.
Sources: EPMF 2015 for France, Eurobarometer 2013 for France and other countries.

slightly lower than the European average. We will mainly use this variable as an explanatory variable (civic value) in the estimation of undeclared work, alongside other variables on fraudulent behaviours related to "not declaring all one's income to the authorities" (tax fraud) or "receiving social benefits without being entitled to them" (social fraud). A majority of respondents consider each of the fraudulent behaviours to be unacceptable (response 1 on the scale of 1 to 10, Figure III). The distribution of responses on the acceptability of various fraudulent behaviours appears to be very similar both in the EPMF and in the Eurobarometer (Appendix, Figure A-I). The only exception is in the perception of hiring someone for personal services: the distributions are somewhat less comparable, perhaps due to the small proportions of people using personal services in the data.

For other countries, most respondents also consider all the aforementioned fraudulent behaviours to be totally unacceptable, yet the profile of acceptability appears to vary with respect to the type of fraud (Appendix, Figure A-II). When it comes to social fraud and undeclared hiring for personal services, the distribution highlights significant differences between Nordic countries and Southern European countries, with higher tolerance levels being recorded for the latter (see Algan & Cahuc, 2009). However, North-South differences do not necessarily highlight consistent virtuous behaviour in one area compared to the other: when it comes to undeclared work and the non-declaration of all income, reflecting the differences in the nature of undeclared work across the countries compared (informal employment in the South, supplementary

Figure III – **Distribution of the acceptability of undeclared work and the perceived associated penalties and risks**



Sources: Eurobarometer 2013.

employment elsewhere). France and Germany are ranked in the middle for all types of fraud. Moreover, it is important to mention that North-South differences are not recorded for all items either. A more detailed statistical analysis is provided in the Online Appendix (link at the end of the article).

3. Analysis of Undeclared Work in France

Our analysis is based on econometric estimations of the characteristics of those who supply undeclared work. These estimations allow us to study the nature of the association between undeclared work and various relevant factors previously identified in the literature. It should be noted that the current study is undertaken in a non-experimental setting – therefore, it is not possible to determine causality patterns.

We use a probit model with the following specification for binary dependent variables Y_i (e.g. the indicator for undeclared work in 2015):

$$P(y_i = 1 | X_i \; Z_i) = \Phi(\alpha + D_i\beta + S_i\gamma)$$

Several sets of explanatory variables are used: the vector D_i includes socio-demographic (age, marital and family status and education) and economic (main occupational category and income) characteristics and the vector S_i includes individual subjective characteristics (perception of the people around the individual, perceived risk and penalties, civic values and perceived tax pressure). To detect strong correlations between the regressors, we introduce the variables in an incremental manner (stepwise). This approach allows us to gauge the multicollinearity that can affect our estimates.[14] Omitted variables may influence both the propensity to engage in undeclared work and the explanatory variables (e.g. sector). Therefore, here we will discuss potential correlates or determining factors of undeclared work. We can, however, sketch the profile of households undertaking undeclared work and study the role of heterogeneity regarding subjective factors that may influence practices (morality, perceived risks and penalties and people around the individual).

3.1. The Influence of Socio-Demographic and Economic Variables on Supply

Our estimates focus on two dependent variables, respectively undeclared work in 2015 and undeclared work in the three years preceding the survey. We gradually introduce the following explanatory variables: demographic variables (model 1), age (model 2), education (model 3), income level (model 4) and main occupational category (model 5). The results are presented in Table 4. We report the marginal effects of probit

14. In addition, an analysis by variance inflation factor (not reported) for the following set of estimations does not suggest any problematic collinearity between the regressors.

Table 4 – **Estimation of the supply of undeclared work: socio-demographic and economic variables (probit models)**

	2015					2012-2015				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Family circumstances (*ref.*: single female)										
Single male	0.0209*	0.0133	0.0106	0.0110	0.0106	0.0558***	0.0411**	0.0385**	0.0389**	0.0371**
	(0.0120)	(0.0119)	(0.0119)	(0.0117)	(0.0122)	(0.0179)	(0.0177)	(0.0178)	(0.0176)	(0.0181)
Single mother	-0.00888	-0.0157	-0.0178	-0.0197	-0.0186	0.0107	-0.00744	-0.00929	-0.0167	-0.0155
	(0.0204)	(0.0206)	(0.0205)	(0.0202)	(0.0198)	(0.0320)	(0.0315)	(0.0314)	(0.0314)	(0.0307)
Single father	0.00327	-8.29e-05	-0.00458	0.000137	-0.000794	0.0334	0.0175	0.0149	0.0255	0.0187
	(0.0277)	(0.0283)	(0.0277)	(0.0273)	(0.0281)	(0.0458)	(0.0450)	(0.0448)	(0.0450)	(0.0460)
Married female no child	-0.0412**	-0.0309	-0.0312	-0.0270	-0.0273	-0.0549**	-0.0320	-0.0321	-0.0211	-0.0201
	(0.0203)	(0.0208)	(0.0208)	(0.0208)	(0.0205)	(0.0257)	(0.0262)	(0.0261)	(0.0263)	(0.0261)
Married female with child(ren)	-0.0425*	-0.0451**	-0.0462**	-0.0436*	-0.0415*	-0.0690**	-0.0775**	-0.0777**	-0.0706**	-0.0671**
	(0.0222)	(0.0223)	(0.0222)	(0.0225)	(0.0225)	(0.0345)	(0.0337)	(0.0337)	(0.0344)	(0.0342)
Married male with child(ren)	-0.0638***	-0.0450**	-0.0472**	-0.0421*	-0.0412*	-0.0588**	-0.0148	-0.0188	-0.00431	-0.00675
	(0.0225)	(0.0228)	(0.0230)	(0.0227)	(0.0231)	(0.0230)	(0.0238)	(0.0238)	(0.0243)	(0.0245)
Married male without children	-0.00939	-0.00679	-0.00951	-0.00671	-0.00814	-0.0157	-0.0144	-0.0163	-0.00602	-0.0130
	(0.0204)	(0.0205)	(0.0201)	(0.0204)	(0.0209)	(0.0335)	(0.0325)	(0.0323)	(0.0332)	(0.0334)
N. of dependent children	-0.00370	0.00402	0.00379	0.00300	0.00323	-0.0255**	-0.00853	-0.00916	-0.0112	-0.0106
	(0.00671)	(0.00607)	(0.00617)	(0.00633)	(0.00627)	(0.0126)	(0.0114)	(0.0114)	(0.0119)	(0.0116)
N. of people in the household	0.00947***	-0.000191	-0.000178	0.00181	0.00138	0.0204***	0.000647	0.000888	0.00629	0.00667
	(0.00340)	(0.00419)	(0.00420)	(0.00442)	(0.00442)	(0.00542)	(0.00636)	(0.00638)	(0.00656)	(0.00654)

➔

Table 4 – *(contd.)*

	2015					2012-2015				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Age (*ref.*: < 25 years)										
25-40 years		-0.0154	-0.0184	-0.0151	-0.0169		-0.0265	-0.0300	-0.0271	-0.0379
		(0.0142)	(0.0142)	(0.0144)	(0.0149)		(0.0211)	(0.0210)	(0.0210)	(0.0232)
40-60 years		-0.0398***	-0.0435***	-0.0405***	-0.0438***		-0.0747***	-0.0796***	-0.0731***	-0.0841***
		(0.0143)	(0.0146)	(0.0148)	(0.0153)		(0.0212)	(0.0215)	(0.0217)	(0.0236)
60-70 years		-0.0734***	-0.0764***	-0.0735***	-0.0826***		-0.149***	-0.154***	-0.149***	-0.157***
		(0.0213)	(0.0214)	(0.0214)	(0.0181)		(0.0284)	(0.0285)	(0.0283)	(0.0298)
> 70 years		-0.108***	-0.112***	-0.107***	-0.117***		-0.172***	-0.177***	-0.174***	-0.183***
		(0.0297)	(0.0286)	(0.0286)	(0.0308)		(0.0299)	(0.0300)	(0.0302)	(0.0372)
Education (*ref.*: Baccalaureate and higher education)										
Unqualified			0.0117	0.00836	0.00454			0.00471	-0.00507	-0.00940
			(0.0165)	(0.0176)	(0.0179)			(0.0247)	(0.0260)	(0.0262)
Qualification below baccalaureate level			-0.00365	-0.00404	-0.00824			-0.0153	-0.0124	-0.0165
			(0.0115)	(0.0113)	(0.0113)			(0.0166)	(0.0166)	(0.0170)
Income (*ref.*: Less than 900 €/month)										
€900-€1,499				-0.0273*	-0.0281*				-0.00524	-0.00833
				(0.0150)	(0.0151)				(0.0222)	(0.0222)
€1,500-€2,299				-0.0225	-0.0216				-0.0209	-0.0237
				(0.0146)	(0.0148)				(0.0225)	(0.0227)
€2,300-€3,099				-0.0308*	-0.0302*				-0.0626**	-0.0656***
				(0.0159)	(0.0159)				(0.0246)	(0.0248)
€3,100-€3,999				-0.0334*	-0.0321				-0.0522*	-0.0564*
				(0.0196)	(0.0196)				(0.0292)	(0.0295)
€4,000 and more				-0.0233	-0.0198				-0.0241	-0.0265
				(0.0197)	(0.0197)				(0.0290)	(0.0298)
Self-employed (Yes=1)					0.0533					0.0438
					(0.0414)					(0.0420)
Occupation/Activity status										
Executive/Manager					-0.0143					-0.00397
					(0.0181)					(0.0275)
Intermediate profession					-0.0207					-0.0128
					(0.0138)					(0.0224)
Manual worker					0.00350					0.0146
					(0.0166)					(0.0232)
Retired					-0.00936					-0.0194
					(0.0134)					(0.0201)
Job seeker					0.00541					-0.00251
					(0.0191)					(0.0267)
R2 of a linear probability model	0.021	0.037	0.040	0.043	0.049	0.040	0.073	0.075	0.080	0.083
Number of observations					2,004					

Notes: Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.
Sources: EPMF.

estimates, as well as the R^2 of linear probability models; these remain small, regardless of the specification. Socio-demographic and economic variables alone ultimately explain relatively little of the variance in undeclared work, which is a minimum of 2% under model 1 providing a "snapshot" and a maximum of 8% under model 5 for the period 2012-2015. This improved ability to provide an explanation can be linked to two reasons: firstly, people are more likely to reveal a "past" fault (with the 2012-2015 variable being less prone to under-reporting); secondly, the 2012-2015 variable contains better information on regular undeclared work practices, which would be more linked to the socio-demographic characteristics of the individuals.

The definition of specific family status groups that we have adopted was intended to further break down the type of people who might engage in undeclared work. However, there is no strong demographic profile, except for the "married

woman with child(ren)" variable, which comes out negatively and in a statistically significant manner in most models. It is thought that this group is less affected by undeclared work, which is as expected and can be explained by their lower participation in the labour market in general. The magnitude of this reduced coefficient in the specification also checks for effects associated with main occupational categories. We also see a propensity to engage in undeclared work among single men, though it is less strong among the over-40s; these results are unaffected whether or not we add social-professional categories, or include the coefficient associated with retirement. Further estimation reveals no significant effect of education (high school level and above).

The introduction of monthly household income levels does not provide very clear information as almost 40% of the variance in income is itself explained by the demographic and education variables.[15] The middle-income levels, however, appear to be less affected by undeclared work. The variables related to the main occupational categories do not appear significant. The results indicate that wages influence the propensity to engage in undeclared work more significantly than the type of occupation held by the respondent. The negative and significant coefficient associated only with the €2,300-€3,999 income bracket implies that individuals do not necessarily engage in undeclared work solely depending on their income level. The scale and significance of the coefficients indicate that individuals with incomes below €2,300 appear to be more likely to engage in undeclared work, which is moreover mostly a supplementary activity (see Table 2).

3.2. The Influence of Subjective Factors

We will now focus on the subjective factors – perception of the people around the individual, perceived risks and penalties, and acceptability – while still controlling for the socio-demographic and economic characteristics discussed above.

Subjective variables are defined in a way that facilitates the interpretation of their correlation with undeclared work: a positive coefficient reflects a potential positive impact on undeclared work. Acceptability is already defined in this way in the survey as it is measured on an increasing scale (from 1 to 10). The variable for the perception of the people around the individual indicates the proportion of people engaging in undeclared work in France and in the people around the individual as perceived by the respondent. The risk variable is set on a scale of 1 (100% chance of being caught) to 10 (0%), and the penalty amount variable is calculated as the difference between €5,000 and the amount of penalty the person considers they would face if they worked for an undeclared wage of €1,000. We also use an indicator concerning the perception of a contribution level that is too high. The results are presented in Table 5, again for undeclared work in the previous month in 2015 and for the period 2012-15.

An initial question consists of determining whether or not these subjective factors reflect particular socio-demographic profiles (e.g. whether the effect of perceived risk disappears by including age).[16] The coefficient for the different subjective factors is significant and has a positive or negative influence that can be interpreted intuitively: undeclared work is positively and significantly correlated with *(a)* the perceived extent of the spread of undeclared work within the people around the individual, *(b)* the degree of acceptability of such behaviour, *(c)* the weakness of the perceived risk, *(d)* the weakness of the perceived penalty, and *(e)* the perception that compulsory contributions are too high (significant only for the 2012-15 measure).[17] Additional estimates (not reported) that control only for marital and family status yield similar results (the coefficients are simply lower, between one-half and two-thirds, as are the R^2). This allows us to answer the above question in the negative: the

15. The wording of the question on income is as follows: "In total, how much is your total household income per month, i.e. wages, pensions, unemployment benefits, self-employed income, spouse's income, family benefits, other income, etc.?" We assume here that, given the general tendency to under-report, respondents do not include any undeclared income.

16. The Online Appendix C1 presents an intermediate step: the estimation of subjective factors for socio-demographic and economic variables. These variables appear to provide little explanation of subjective heterogeneity. Nevertheless, young people and those on very low incomes perceive a higher level of undeclared work among the people around them, perhaps because their labour market situation brings them more into contact with such situations. The perceived risk increases with economic fragility and age, while the penalties are perceived more strongly by younger people and those on low incomes. The fraud acceptability in general (tax, social contributions and labour market) decreases with age and seems to be higher for the self-employed than for any socio-demographic group.

17. We stress again that our interpretations are not causal. There are potentially omitted variables, reverse causalities and measurement errors leading to bias. For example, in relation to the perception of the people around the individual, errors may come from under-reporting which affects both the concealed activity of the person and the people around them. Reverse causality is simply declaring someone around you to be a fraud to justify your own fraudulent behaviour. The omitted variables correspond to unobservable circumstances common to an individual and the people around them (e.g. sharing a feeling of mistrust towards the state). The coefficient for the variable concerning the perception of the people around the individual thus overestimates implicit peer effects, which limits interpretation and leads us to speak only of potential correlates or determining factors of undeclared work but not of a coefficient indicating and quantifying a causal relationship.

Table 5 – **Correlates of the supply of undeclared work: subjective factors (probit estimation)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
						2015					
Perception of the % of concealed work											
in France	0.0499**		0.000098								0.00195
	(0.0243)		(0.0257)								(0.0256)
among people around		0.141***	0.141***								0.107***
the individual		(0.0241)	(0.0262)								(0.0250)
Acceptability (1-10)				0.00845***			0.00791***		0.00836***	0.00782***	0.00600***
				(0.00154)			(0.00152)		(0.00153)	(0.00152)	(0.00146)
Perceived low risk					0.00578***		0.00451***	0.00576***		0.00450***	0.00335**
(1 – probability of being caught)					(0.00167)		(0.00164)	(0.00166)		(0.00163)	(0.00159)
Perceived weak penalty						0.00954**		0.00947**	0.00894**	0.00890**	0.00755**
(€5,000 – penalty)						(0.00397)		(0.00392)	(0.00387)	(0.00383)	(0.00361)
Thinks that mandatory contributions are too high											0.00948
											(0.0104)
R2 of a linear probability model	0.051	0.074	0.074	0.065	0.055	0.052	0.069	0.057	0.068	0.071	0.089
Number of observations						2,004					
						2012-2015					
Perception of the % of concealed work											
in France	0.0932***		0.0177								0.0219
	(0.0348)		(0.0363)								(0.0350)
among people around		0.248***	0.241***								0.166***
the individual		(0.0379)	(0.0402)								(0.0380)
Acceptability (1-10)				0.0176***			0.0168***		0.0175***	0.0167***	0.0142***
				(0.00219)			(0.00220)		(0.00220)	(0.00221)	(0.00216)
Perceived low risk					0.0108***		0.00877***	0.0107***		0.00870***	0.00701***
(1 – probability of being caught)					(0.00248)		(0.00248)	(0.00248)		(0.00248)	(0.00244)
Perceived weak penalty						0.00883*		0.00852	0.00823	0.00787	0.00799
(€5,000 – penalty)						(0.00533)		(0.00519)	(0.00506)	(0.00494)	(0.00488)
Thinks that mandatory contributions are too high											0.0337**
											(0.0147)
R2 of a linear probability model	0.086	0.108	0.108	0.115	0.091	0.084	0.121	0.092	0.116	0.122	0.138
Number of observations						2,004					

Notes: Probit estimations with controls for socio-demographics, education, income and occupation. Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.
Sources: EPMF.

weak association between socio-demographic variables and subjective correlates (see Online Appendix) means that the explanatory role of the latter changes very little when the former are added to the model.[18] In other words, subjective heterogeneity concerning the people around the individual (potentially the effect of a local norm), acceptability (potentially reflecting the role of "fiscal morality" and civic values) and the perceived risk or penalties is added.

A second question assesses the interdependencies between these potential determinants: are they independent of each other or, on the contrary, are they strongly correlated, and can they replace each other in explaining undeclared work? Answering this question enables us to refine the interpretation of these variables' inherent influence. Indeed, acceptability may refer to a moral dimension, but may also depend on the norm perceived by those around us. The incremental approach chosen in this study allows us to provide some elements of response. Subjective factors seem to play differentiated roles: their coefficients remain fairly stable whether we introduce these variables one at a time or combine them in different ways (e.g. acceptability and risk in model 7 compared to models 4 and 5). Model 11 shows that these coefficients' magnitude decreases by only one quarter to one third when all variables are taken into account simultaneously, compared

18. In the most comprehensive specification (model 11), the adjusted R^2 increases little when all controls are included.

to specifications where each variable is introduced alone. Alternative estimates (not reported) indicate that the contribution of each of these variables (people around the individual, risk, penalty and acceptability) to the R^2 is fairly similar (around 0.03 each) when the models do not include any control variables.

We then use another approach to assess interdependency between the variables, which consists in including interaction terms for the aforementioned factors. Table C2-1 in the Online Appendix presents the coefficients on the interaction terms between *(i)* the respondent's relatives fraud behaviour and the acceptability of fraud, *(ii)* between acceptability and risk, and *(iii)* between risk and the effect of the people around the individual. The coefficients obtained are all positive and significant: this suggests there are complementarity dynamics between these factors.

To sum up, the subjective factors seem to have the main explanatory role and are quite complementary with each other. The full empirical model explains about 9% of the total variance in undeclared work for the month prior to the survey in 2015; the results are qualitatively similar over the extended period 2012-2015, but the effects are stronger in total because the information content is certainly higher (the R^2 is then around 0.14).[19]

Finally, one can ask whether subjective factors reflect general components at the root of any fraudulent behaviour or if these correlates are specific to undeclared work. To answer this question, the Online Appendix (Table C2-2) presents a detailed analysis of the demand for undeclared personal services and tax fraud. This enables the analysis of the the extent to which fraudulent behaviours are determined by people's general perceptions with respect to fraud. Results show that cross-effects exist: for example, the acceptability of tax fraud explains both undeclared work and the acceptability of undeclared work. Similarly, the acceptability of undeclared work explains tax fraud as much as its acceptability. These results are consistent with those of Dwenger *et al*. (2016) which show that the intrinsic aspect of compliance with the rules is found across the board: our results indicate that individuals who reject any form of fraud (tax, social, etc.) are also less likely to participate in undeclared work, both as suppliers and as employers. The estimates also suggest that there is complementarity between the acceptability of undeclared work and tax fraud to a degree. These two correlates act cumulatively and indicate that the different aspects of tax morality are complementary for a single individual. The same is true of tax fraud: the acceptability of undeclared work is positively correlated with the acceptability of tax evasion.[20] Overall, results presented in Table 5 indicate that the act of considering undeclared work totally acceptable (answer of 10 on a scale of 1 to 10) rather than totally unacceptable (answer 1) increases the probability of engaging in undeclared work in 2015 by around 0.3 percentage points (8%) (for an average engagement figure of 3.8%). This substantial difference implies that the perception of (moral) values is the source of substantial differences in people's behaviour, which is reflected in a positive association between the level of acceptability of undeclared work and the propensity to engage in it.

4. Comparisons at the European Level

This final section proposes a comparison of the influence of socio-demographic characteristics on individual perceptions of undeclared work, comparing France and some neighbouring countries, as well as the group made up of the euro area, Great Britain, Sweden and Denmark. To achieve this, we use the variables that are strictly common to both the EPMF and the Eurobarometer in terms of definition, and therefore slightly different specifications than those presented so far. The results are presented in Table 6.

First we cross-check the validity of both sources. For the EPMF, with the variables redefined in line with the Eurobarometer, the results confirm that the propensity to engage in undeclared work is lower for married women with children and the over 25s, and higher for the self-employed. Once again, the role of perceived risk, fraud acceptability and the perception of the people around the individual can be seen. To some extent, the results for the Eurobarometer-France are along the same lines, not only for the effect of age, but also of civic values and of the perception of the people around the individual. The estimates are less precise due to the small sample size. To increase the sample size and the statistical strength of the model, we stacked the observations from both databases (while

19. The most important difference seems to be the fact that the effect for acceptability and risk is up to two times greater. The effects relating to penalties tend to disappear. One possible interpretation is that morality and risk aversion are more entrenched and persistent factors than perceptions concerning the people around the individual or penalties.

20. This is not true for undeclared personal services: the acceptability of different types of fraud are exchangeable in this case. In relation to the perceived penalties, the perception of undeclared work and the perception of tax fraud tend to be cumulative.

Table 6 – **Estimation of the determining factors of undeclared work**

	France						European neighbours	
	EPMF	Euro-barometer	EPMF+Euro-barometer	Germany	United Kingdom	Denmark	(a)	(b)
Female	-0.0290**	-0.000222	-0.00771	0.0147*	-0.0202**	-0.0410***	-0.0154***	-0.0154***
	(0.0139)	(0.0134)	(0.00792)	(0.00868)	(0.00784)	(0.0151)	(0.00301)	(0.00301)
Married	-0.0525***	-0.00458	-0.0246***	-0.00368	-0.0214**	0.0324*	-0.0101***	-0.00805**
	(0.0160)	(0.0116)	(0.00858)	(0.0105)	(0.00910)	(0.0196)	(0.00323)	(0.00323)
Presence of child(ren)	-0.0396**	0.0210	0.000653	0.0111	-0.000203	0.0509	-0.00405	-0.00654
	(0.0172)	(0.0268)	(0.0118)	(0.0158)	(0.0153)	(0.0370)	(0.00505)	(0.00504)
N. of people in the household	0.00440	-0.00629	0.00199	-0.00940**	0.00432	-0.0290**	-0.00237	-0.00150
	(0.00783)	(0.00786)	(0.00481)	(0.00460)	(0.00502)	(0.0124)	(0.00179)	(0.00179)
Age (*ref.*: < 25 years)								
25-40 years	-0.0634*	-0.0633*	-0.0436*	-0.0449*	-0.00916	-0.150**	-0.0232***	-0.0226***
	(0.0368)	(0.0362)	(0.0225)	(0.0238)	(0.0237)	(0.0609)	(0.00774)	(0.00772)
40-60 years	-0.111***	-0.0743**	-0.0647***	-0.0462**	-0.00911	-0.143**	-0.0429***	-0.0438***
	(0.0354)	(0.0340)	(0.0212)	(0.0220)	(0.0230)	(0.0570)	(0.00719)	(0.00719)
60-70 years	-0.162***	-0.0648	-0.0739***	-0.0807***	-0.0259	-0.155**	-0.0496***	-0.0521***
	(0.0355)	(0.0440)	(0.0233)	(0.0237)	(0.0240)	(0.0618)	(0.00815)	(0.00819)
> 70 years	-0.173***	-0.0838*	-0.0871***	-0.0705***	-0.0256	-0.182***	-0.0505***	-0.0550***
	(0.0367)	(0.0428)	(0.0233)	(0.0250)	(0.0247)	(0.0631)	(0.00824)	(0.00828)
Baccalaureate or higher	-0.0107	0.00135	-0.00607	-0.131	-0.00138	-0.0154	-0.00949*	-0.0130**
	(0.0222)	(0.0141)	(0.0124)	(0.114)	(0.0302)	(0.0361)	(0.00498)	(0.00512)
Self-employed	0.0335	0.0489	0.0345	0.0121	0.000510	0.144***	0.0174**	0.0187***
	(0.0364)	(0.0537)	(0.0263)	(0.0197)	(0.0266)	(0.0489)	(0.00692)	(0.00692)
Occupation/Activity status (*ref.*: white collar)								
Executive/Manager	0.00603	0.00654	-0.00242	0.00549	-0.0186	-0.0441	-0.00510	-0.00860
	(0.0263)	(0.0342)	(0.0159)	(0.0297)	(0.0193)	(0.0410)	(0.00804)	(0.00815)
Intermediate profession	-0.00908	-0.0492***	-0.0307***	-0.00528	-0.0201	-0.0258	-0.0194***	-0.0206***
	(0.0209)	(0.0145)	(0.00968)	(0.0134)	(0.0125)	(0.0246)	(0.00554)	(0.00562)
Manual worker	0.0260	-0.0190	-0.00178	0.0167	0.00521	0.0697*	0.0112*	0.0108*
	(0.0274)	(0.0223)	(0.0153)	(0.0186)	(0.0181)	(0.0359)	(0.00597)	(0.00594)
Retired	0.0145	-0.0107	0.00216	0.0180	0.00805	0.00939	-0.00991**	-0.00854*
	(0.0178)	(0.0295)	(0.0130)	(0.0155)	(0.0154)	(0.0280)	(0.00478)	(0.00481)
Job seeker	0.0220	-0.00579	0.00797	0.0227	0.0136	0.00580	0.0366***	0.0367***
	(0.0289)	(0.0297)	(0.0175)	(0.0230)	(0.0248)	(0.0400)	(0.00724)	(0.00728)
Lowness of perceived risk	0.0147***	0.00293	0.00908***	0.00720	-0.00443	0.0182	0.00939***	0.00946***
	(0.00564)	(0.00885)	(0.00350)	(0.00625)	(0.00510)	(0.0118)	(0.00184)	(0.00189)
Acceptability of concealed work	0.0157***	0.0135***	0.00808***	0.00712***	0.00750*	0.0178***	0.00659***	0.00559***
	(0.00373)	(0.00501)	(0.00234)	(0.00250)	(0.00393)	(0.00434)	(0.000788)	(0.000802)
Acceptability of tax fraud	0.00644	0.0116*	0.00742**	0.00491	0.00108	0.00396	0.0111***	0.0121***
	(0.00424)	(0.00664)	(0.00290)	(0.00387)	(0.00493)	(0.00692)	(0.00123)	(0.00125)
Undeclared work around	0.0587***	0.0486***	0.0363***	0.0598***	0.112***	0.0584***	0.0761***	0.0762***
	(0.0125)	(0.0132)	(0.00706)	(0.0131)	(0.0258)	(0.0150)	(0.00348)	(0.00354)
"EPMF" indicator			-0.00617					
			(0.00786)					
Country fixed effect	-	-	-	-	-	-	YES	YES
Number of observations	2,004	1,027	3,031	1,499	1,006	1,016	20,180	20,180
R2	0.126	0.116	0.082	0.093	0.136	0.072	0.099	0.105

(a) Euro area, Great Britain, Sweden & Denmark. (b) Countries weighted in accordance with *Z* with f(*Z*)=*Zmax*-abs(*ZFrance* - *Zi*), where *i* is the percentage of undeclared work due to supplementary hours in each country.
Note: Probit estimation of undeclared work (binary variable). Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. EPMF: undeclared work over the period 2012-2015; Eurobarometer: undeclared work in 2013.
Sources: EPMF 2015 and Eurobaromètre 2013.

introducing an "EPMF" indicator to take into account the average differences – notably the temporal effect, as the two sources do not cover the same year). The two databases do not contradict each other: on the contrary, the important effects remain (age, acceptability of tax fraud

and undeclared work, low risk and fraudulent people around the individual). Some coefficients become significant, such as the expected contribution of the self-employed to undeclared work.

This validation of the Eurobarometer for France allows us to use it with a little more confidence for making a European comparison. With this source, the results for France are shockingly close to those of neighbouring countries, in particular Germany and Denmark: the same positive or negative influence and a significant coefficient for age, acceptability of undeclared work, the people around the individual and for some occupational categories, e.g. intermediate professions. In some cases, the values of the coefficients are themselves comparable (acceptability and people around the individual).[21] Equally surprising, the estimates for the European comparison group give effects that are even more similar to those for France[22] for age, marital status, self-employed status and all subjective factors. These results therefore suggest that the correlates of undeclared work are similar in countries where the nature of such activity is similar (supplementary work), as well as with subjective factors that reflect to some extent regularities in terms of fiscal morality, civic values, risk and peer effects. The residual country effect (fixed effect), designed to identify specific institutional or cultural aspects not taken into account in the rest of the model, is rather marginal: it explains 13% of the R^2, compared to 20% for the socio-demographic variables and 67% for the subjective variables. Finally, in order to improve this estimate, we weight the countries by a measure of proximity to France in terms of the nature of the undeclared work. As indicated above, we use the weights $f(Z_i)=Z_{max} - abs(Z_{France}-Z_i)$ with Z_i as the percentage of undeclared work due to supplementary hours worked in country *i*. This assigns greater importance to nearby countries such as the northern European countries, in which undeclared work is most often associated with supplementary income. The last column of the table shows that this correction has little effect on the previous conclusions (this is also true when we use other criteria for Z, such as GDP per capita or the unemployment rate).

* *
*

This article proposed an analysis of undeclared work in France based on the EPMF survey conducted in 2015. We also used Eurobarometer data to successively conduct a cross-validation of the results obtained for France, and then to perform a European comparison. The main findings of this study highlight the role of socio-demographic and economic variables on the one hand. Results also indicate the impact of subjective factors (fraud acceptability, perceived risk and level of sanctions and the frequency of undeclared work in the family). The first conclusion is that these two sets complement each other, explaining between 9% and 14% of the variance of undeclared work. Secondly, socio-demographic characteristics and perceptions appear to be correlated, yet they do not cancel each other out. Thirdly, subjective factors appear to be complementary with each other. For example, acceptability only marginally accounts for the perception of illegal work in the people around the individual and would therefore seem to represent only moral or civic values. Finally, we note the cross-cutting nature of intrinsic motivations: individuals' higher tolerance for tax fraud is positively associated with their propensity to engage in undeclared work just as much as their tolerance for undeclared work itself. However, to a certain extent, these effects are cumulative: the likelihood of engaging in undeclared work will thus be higher among those who tolerate different types of fraud than among those who find only undeclared work acceptable.

The replication of our estimates with the Eurobarometer, that structure is comparable to that of the EPMF, leads to similar conclusions; the cumulation of the two samples, which allows for more precise results, also leads to very similar results for the correlates of undeclared work in neighbouring countries. European comparisons confirm the importance of subjective components, which seem to play a similar role in undeclared work practices – despite its more or less *ad hoc* or widespread nature, depending on the country in question. Socio-demographic characteristics do not homogeneously influence undeclared employment in Europe, with the exception of age and some occupational categories (self-employed). The influence of other observable factors (income and qualification levels), which are undoubtedly linked to local labour markets, is less homogeneous. The results of the estimates for France are

21. The value of the coefficients of the perceived risk and perceived penalties variables is more difficult to compare as it is itself relative to the legal and tax system of the country in question. These coefficients indeed reflect the arbitrary perception of the individual, as well as the reality of local institutions.

22. The estimates include country fixed effects. An alternative estimate with fixed regional effects (north-western, southern, eastern Europe) gives similar results.

similar to those obtained for countries in which undeclared work corresponds to supplementary income, in particular Germany and Denmark. On the issue of social benefits, the literature has highlighted the potential difficulty of importing policies from these countries (e.g., "flexicurity") due to an excessively large difference in civic values (Algan & Cahuc, 2009). Here, in relation to undeclared work or the acceptability of tax fraud, France does not seem so different from Scandinavian countries.

Nevertheless, there are several fundamental issues that need to be considered from a public policy perspective. Firstly, the EPMF survey does not make it possible to assess the extent to which undeclared work, even when occasional, is chosen or suffered by households because of a major financial constraint or poor access to sufficiently remunerative full-time jobs. Secondly, our analysis does not claim to be causal. Some correlations may reflect reverse causality and measurement errors – for example, if the response regarding the acceptability of fraudulent behaviour (or the perception of the behaviour of people around the individual) reflects a degree of justification of one's own actions. The coefficients of the statistical model may also be biased due to omitted variables that affect both these factors and the probability of engaging in undeclared work. This is typically the case for subjective variables related to risk and penalties: highly risk-averse individuals tend to overestimate the probability of being caught and, at the same time, are less likely to engage in undeclared work. Thus, even if our findings overlap with the results of the experimental literature and propose a profile of potential fraudsters in France, it is difficult to draw precise recommendations in terms of the fight against undeclared work. To identify the most effective action levers, it would be necessary to compare the role of intrinsic (moral and civic values) and extrinsic (risk and penalties) motivations on behaviour, for instance by using random draws of employees subjected to messages emphasising one aspect or the other. These experiments would make it possible to better calibrate the official communication of administrative bodies such as ACOSS, the MSA or the DGFiP, for instance using personalised emails or inserts on the personal page of taxpayers on the website of these administrative bodies, with the objective being to reduce fraudulent behaviour. □

Link to Online Appendix:
https://www.insee.fr/en/statistiques/fichier/5430850/ES-526-527_AitBihiOuali-Bargain_Online-Appendix.pdf

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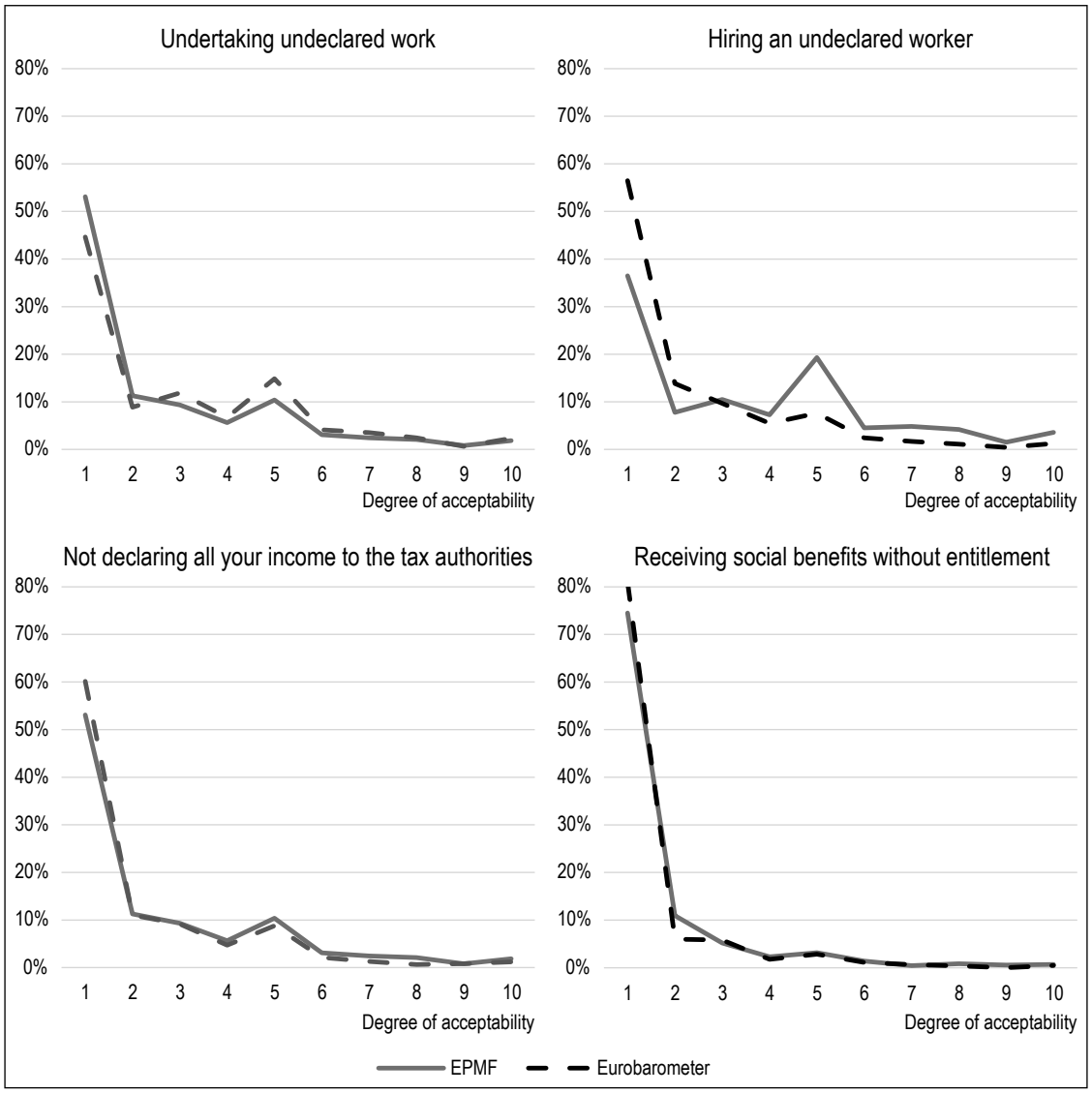
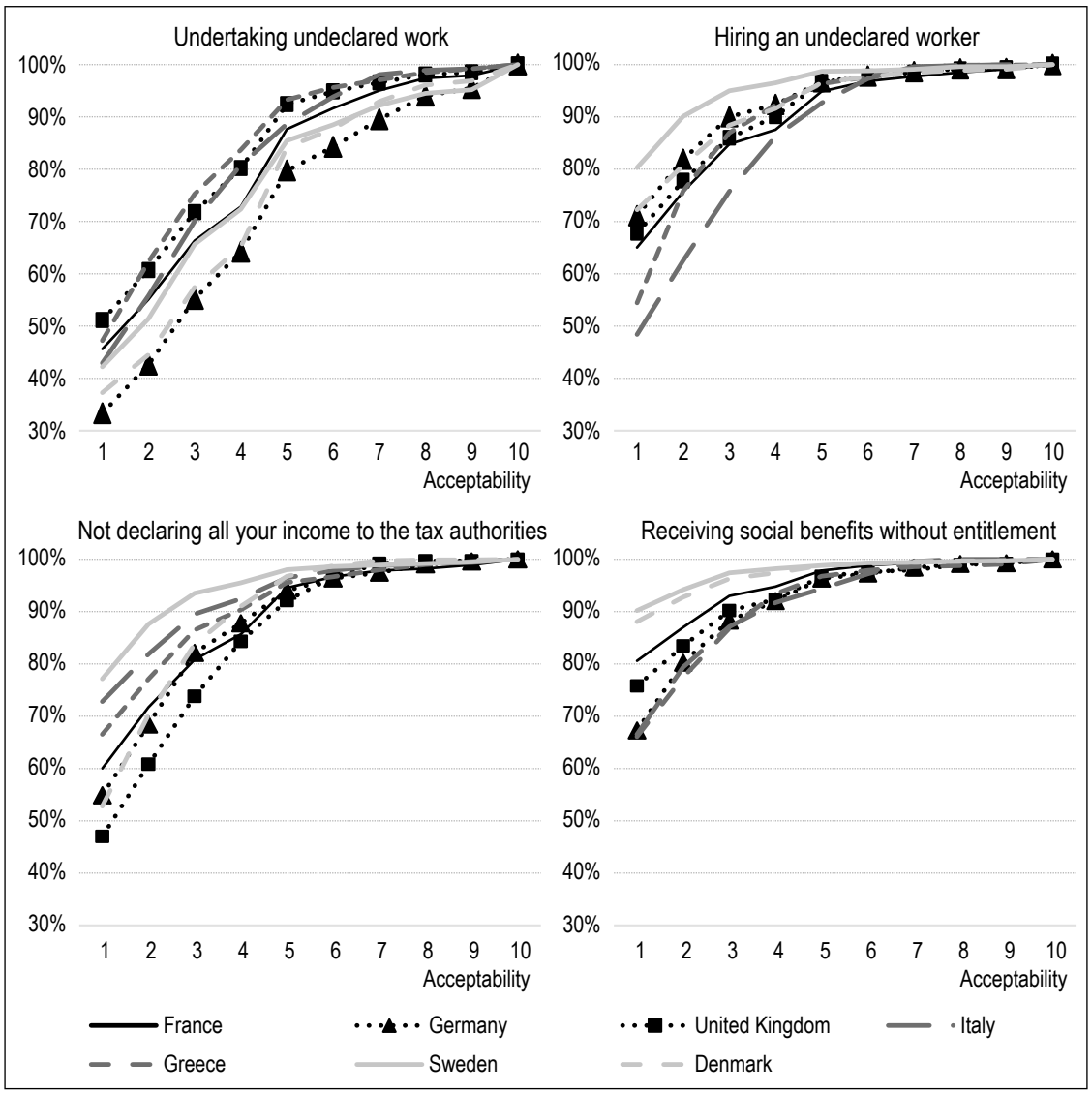
Figure A-I – **Distribution of the acceptability of fraudulent behaviour, France EPMF and Eurobarometer**



Reading note: For most individuals, all fraudulent behaviours are deemed to be unacceptable (response 1 on a scale from 1 to 10).
Sources: EPMF 2015 and Eurobarometer 2013.

Figure A-II – **Cumulative distributions[a] of the acceptability of different types of fraud, France and European countries**



[a] this presentation allows for differences between countries to be distinguished, which would not be possible because of the high concentration of the response "totally unacceptable" in all countries, making the distribution curves flattened in a similar fashion, hence undiscernible (value 1 on the acceptability scale of 1 to 10).
Source: Eurobarometer 2013.

Table A-1 – **Comparison of sources**

	EPMF (2015)	Eurobarometer (2013)		Differences		Census France 2015 (INSEE)
	France	France	Europe*	France (EPMF) - France (Eurobaro.)	France (EPMF) - Europe (Eurobaro.)	
Socio-demographic characteristics						
Female	0.52	0.54	0.54	-0.02	-0.02	0.52
	(0.50)	(0.50)	(0.50)	*0.29*	*0.09*	
Age	48.8	50.2	49.2	-1.4	-0.4	49.3
	(17.79)	(18.97)	(18.33)	*0.05*	*0.34*	
Married	0.47	0.42	0.51	0.05	-0.04	0.46
	(0.50)	(0.49)	(0.50)	*0.008*	*0*	
Number of people in the household	2.51	2.55	2.57	-0.04	-0.06	2.22
	(1.40)	(1.45)	(1.39)	*0.46*	*0.07*	
Baccalaureate and higher diploma	0.47	0.47	0.46	0	0.01	0.45
	(0.5)	(0.5)	(0.5)	*1*	*0.39*	
Self-employed worker	0.04	0.04	0.07	0	-0.03	0.04
	(0.19)	(0.19)	(0.26)	*1*	*0*	
Occupation/Activity status						
Manual worker	0.14	0.1	0.11	0.04	0.03	0.13
	(0.12)	(0.30)	(0.31)	*0.001*	*0*	
Retired	0.28	0.36	0.30	-0.08	-0.02	0.28
	(0.45)	(0.48)	(0.46)	*0*	*0.058*	
Executive/Manager	0.09	0.14	0.11	-0.05	-0.02	0.09
	(0.28)	(0.34)	(0.31)	*0*	*0.003*	
Intermediate profession	0.16	0.03	0.05	-0.03	0.11	0.14
	(0.37)	(0.17)	(0.23)	*0*	*0*	
White-collar worker	0.16	0.19	0.20	-0.03	-0.04	0.17
	(0.37)	(0.39)	(0.40)	*0.04*	*0*	
Homemaker, unemployed, other inactive	0.16	0.19	0.23	-0.03	-0.06	0.08
	(0.37)	(0.39)	(0.42)	*0.04*	*0*	
Number of observations	2,004	1,027	20,180			

*Euro area, Great Britain, Sweden & Denmark.
Notes: The standard deviations are shown in brackets, with the p-values of difference tests shown in italics.
Sources: EPMF 2015 and Eurobarometer 2013

The Tightening of Employment Conditions and Access to Jobs in Artistic Occupations in France – The case of Dance and Circus Arts (2006-2016)

Samuel Julhe* and Émilie Salaméro**

Abstract – The aim of this article is to analyse the degree of segmentation and restriction within the French artistic jobs system by studying the example of dance and circus arts. On the basis of the distribution of job structure and volume of work, it investigates the conditions of inclusion within a "professional core", including the associated effects on continued activity. We use data from Pôle Emploi relating to monthly employer statements (AEM) and single simplified declarations (DUS). These data allow us to exhaustively process the 8.5 million employment contracts for the 100,000 individuals who worked in one of the two selected artistic fields during the 2006-2016 period. In both fields, albeit in varying proportions and at varying rates, we see more restrictive conditions of employment and access to the segment of artists likely to benefit from the "intermittent" status, an unemployment benefit system specific to artistic workers due to the irregular nature of their work. And yet, trends show that potential workers are being increasingly excluded from these two labour markets.

JEL codes: J21, Z11
Keywords: intermittent workers in the entertainment industry, cohorts, employment conditions, employment contract, professional career

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The system of intermittent employment specific to the live performing arts sector has given rise to many social science-related studies since the 1990s. More of these works appeared during the first half of the 2000s, particularly following the high tensions surrounding the renegotiation of Annexes VIII and X to the unemployment insurance convention in 2003 (hereafter Annexes VIII & X). The most well-known published works include those of Menger (1989; 2011) and of researchers affiliated with the CSA/CESTA/CESPRA laboratory (P. Coulangeon, M. Jouvenet, O. Pilmis, V. Cardon, ...). These works, in particular, used statistics to paint an unprecedented picture of the sector, labelling it "hyper flexible", "uncertain" and even "disorganised" compared to other sectors, and they highlighted certain "dead ends" present in its approach to insurance (Menger, 2011). Investigations have also covered more diverse questions, ranging from an analysis of the effects of multi-jobs employment (Pilmis, 2007) to studies into lifestyles (Sinigaglia-Amadio & Sinigaglia, 2017) or the entry into retirement of artists (Cardon, 2017). Nevertheless, quantifying the employment system and its developments seems to have been put on the backburner in research circles to some degree and consigned to entities affiliated with the social partners.[1] At the same time, given the data available in the early 2000s, the statistical observations made at that time were not without blind spots, which may have stirred up major controversy (Grégoire, 2010). As noted by Menger, for example: "A detailed longitudinal study would be the only way to measure more directly the respective effects of both cyclical variations in employment in the entertainment sector and changes in insurance regulations on the composition of the workforce by age and experience level, and it would lead to an investigation of whether, in times of shrinking growth in a given entertainment sector, intermittence acts more as an accelerator of turnover or whether, on the contrary, it offers a degree of flexibility and a variety of possible arrangements that provide greater protection, whereas less flexible employment contracts, once broken, lead to a more resounding exclusion from the labour market." (Menger, 2011, p. 239). This article intends to answer this line of questioning.

Based on changes to the statistical recording system that Pôle Emploi has been using since 2004, our aim is to describe the evolution of one segment of the artistic jobs system and to understand the factors that influence individuals' positions and career paths – whether assisted by Pôle Emploi or not. The analysis will therefore focus on dance and circus arts – two sub-fields of live performing arts which have been the subject of fewer studies than other sub-fields, especially statistical studies (Rannou & Roharik, 2006; David-Gibert *et al.*, 2006). More precisely, the analysis will examine the nature of segmentation of these employment sectors, a process that is addressed in the social science literature in two distinct yet complementary ways.

Following an initial approach, the theory of segmentation broadly proposes a dual vision of the labour market (Doeringer & Piore, 1971; Amossé *et al.*, 2011), illustrated in the example of the employment system for the live performing arts in France through the contrast between a primary segment – made up of insiders whose volume of work enables them to benefit from social protection under a specific scheme – and a secondary segment – made up of outsiders who are not able to claim such benefits because they do not carry out enough work. However, the sole criterion of the volume of work and associated degree of social protection is not enough in itself. Indeed, it has also been demonstrated that professional segments are distinguished as much by the "shared situational structure" (statuses, places of employment, types of public, etc., see Bucher & Strauss, 1961) as by the "subjective meaning" given to the professional activity (Hénaut & Poulard, 2018). In this respect, although the Pôle Emploi data make it difficult to understand the meaning given to a particular job, it is still possible to approach it through its structure (Gouyon, 2011; Perrenoud & Bataille, 2017), either within a clearly identified artistic speciality or its dilution across multiple jobs within the sector, as is common in the entertainment sector (Rannou & Roharik, 2006; Bureau *et al.*, 2009). On these grounds, our analyses aim to understand these two aspects of the segmented artistic labour market – job structure and volume of work – whereby the challenge lies in understanding the relevance of these segmentation factors and the determinant factors that place individuals in a given segment. Furthermore, we also seek to measure the level of porosity between segments. The hardships encountered when coping with the "triple challenge" presented by "attempting, returning, and staying" – stages that mark all career paths – is a

1. See the annual employment-related publications issued by the Commission Paritaire Nationale Emploi Formation du Spectacle Vivant *(the French joint committee for the live performing arts sector, CPNEF-SV), for example.*

visible manifestation of this partial permeability in the arts sector (Buscatto, 2008).

In terms of methodology, this article is based on data from Pôle Emploi's information system (Box 1).[2] These data cover all employment contracts falling within the scope of Annexes VIII & X prior to 2017 for anyone who held at least one contract relating to the "dancer" and/or "circus artist" professional group(s) (see Appendix) between 2006 and 2016. This period was selected because consistent methods were applied to calculate the artists' working time.[3] This has resulted in a 'de-duplicated' file that includes all information relating to 8,550,938 employment contracts, 201,537 employers and 100,007 employees. The structure of the original file, with only the characteristics of the 8.5 million contracts, was first modified so that the information on employers and employees could be extracted and then arranged in chronological order. In other words, a matrix (8,550,938×58) presenting a "series of contracts" (contract dates, type of employment, employer location, wages paid, etc.) has been matched to a matrix (100,007×374) detailing information on the volume of work and job structure for each individual over the 2006-2016 period (date of entry into the artistic employment system,[4] activity status over the various years, annual working time, breakdown of work by artistic type, types of employer, wages, etc.). This allows us to not only analyse the annual demographic changes for both sectors over the reference period, but to carry out a cohort-based analysis as well.

2. All of the graphs and tables in this article are based on this source.
3. The data do not include any information regarding unemployment compensation. This is specifically covered by the Fichier national des allocataires *(national file of unemployment compensation recipients) held separately from the AEM and DUS databases.*
4. Although we are focusing on the 2006-2016 period, the available data nevertheless provide information about intermittent work that individuals may have held prior to 2006, which helps to create "new entrant" cohorts or to calculate "seniority" within the sector (see Box 2 for further details).

Box 1 – **System of Information for Contracts of Intermittent Workers in the Entertainment Industry**

Any employer in France calling upon the services of an employee covered by Annexes VIII and X to the general regulations annexed to the Unemployment Insurance Convention has to declare each customary fixed-term employment contract for temporary work to Pôle Emploi, together with the Nominative Social Declarations (formerly DADS), since 1979 and following the inclusion of performers in those annexes, which were established in 1964 and 1967, respectively (Grégoire, 2013). Depending on the nature of the principal activity conducted by the employer (APE), these declarations are fed into two separate databases:

- the AEM database, corresponding to monthly employer statements made by employers whose sector of activity falls within the field of entertainment (e.g. NAF code 90.01Z "Live performing arts", 90.02Z "Support for live performing arts" or 90.04Z "Management of entertainment venues");
- the DUS database, corresponding to the single simplified declarations made by employers whose sector of activity does not fall within the entertainment sector and which use the *Guichet Unique du Spectacle Occasionnel* (GUSO, the Agency for irregular entertainment administration) to declare the employment of performers or technical staff.

The fields of these two databases are similar and provide detailed information about each employment contract:

- identity of the employee (the NIRPP, with no possibility of duplicate entries or ambiguity due to use of the employee's social security number), date of birth, post code of residential address, etc.;
- identity of the employer (SIRET, with no possibility of duplicate entries or ambiguity due to use of the computerised system for company registrations in France for legal entities or the NIRPP for persons), NAF/APE code, post code of registered office, etc.;
- period of the contract (start and end dates of the employment contract) and the associated workload (number of hours worked and/or the number of shifts);
- gross salary paid before and after deduction of professional expenses;
- the "simple" name of the job held (e.g. guitarist, fire-eater, tango artist, etc.), this field being subsequently coded by Pôle Emploi in order to correspond to one of the 1,388 codes in the jobs classification system created by Pôle Emploi together with CPNEF-SV (see Appendix).

Among this information, the information relating to the length of the contract is essential. In order to be eligible for unemployment compensation, performers and technical staff in the entertainment industry must be able to prove that they have carried out the equivalent of 507 hours of declared work over a given period – the calculation window having shifted from 10 months (between 2004 and 2016) to 12 (before 2004 and after 2016) due to changes in regulations. Although it depends on the circumstances, the AEM and DUS declarations may directly include a number of hours worked or indicate a number of *cachets* (shifts remunerated at a flat rate), which can in turn be converted into hours worked. This is why Pôle Emploi distinguished between two types of *cachet* up until 2016: "isolated" shifts for periods of work for the same employer that are shorter than 5 consecutive days, and "grouped" shifts for periods lasting longer than 5 consecutive days. "Isolated" shifts equated to 12 hours of work and "grouped" shifts equated to 8 hours. Since 2017, all *cachets* have been counted as 12 hours of work. In the article, everything relating to contract length has been converted into working hours, as Pôle Emploi also does, in order to estimate both volume of work and eligibility for unemployment compensation.

The first section of the article focuses on the analysis of the annual characteristics of the populations working in the fields of dance and circus arts; the second section focuses on modelling of the variables that influence the individual "employment profiles"; the third section presents à modelling of eviction rates of the sector using a cohort-based approach.

1. Demographic Growth and More Restrictive Employment Conditions

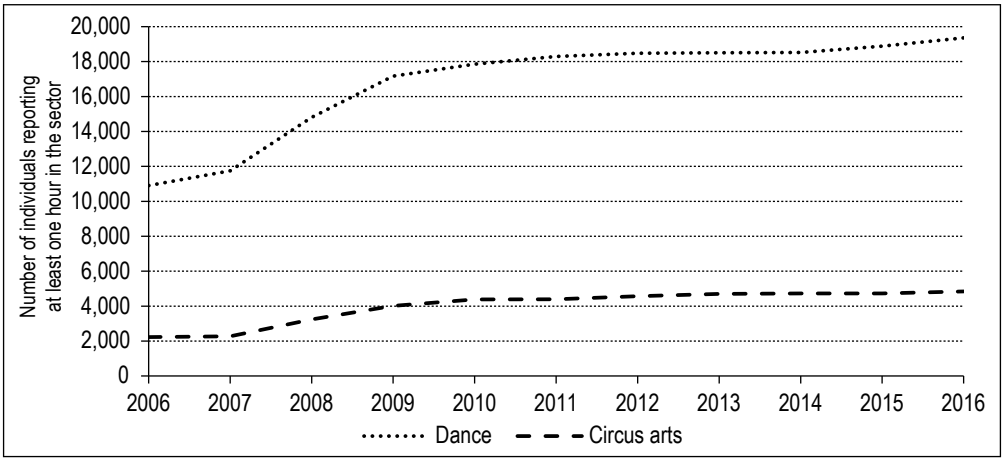
Based on a very broad definition that includes anybody on a dance or circus arts contract who worked for at least one hour during the year (see Appendix), we observe an increase in the number of people in both fields. Between 2006 and 2016, the dance population increased from 10,899 to 19,361 and the circus arts population from 2,231 to 4,845 (Figure I). With an overall increase of +77.6% and +117.2% in 10 years and an average annual growth rate of +5.9% and +8.1%, respectively, dance and circus arts follow the general trend for the live performing arts sector (Pôle Emploi, 2018). However, the differing growth rates show the discrepancy between the two fields in terms of how well established they are. Nevertheless, it is notable that this growth appears much more sustained between 2007 and 2009, a period during which the *Fonds de Professionnalisation et de Solidarité* (FPS, a specific professional and social fund) was introduced[5] and which preceded a period of more gentle growth up until 2016.

The socio-demographic characteristics of the populations in both dance and circus arts are also changing in a number of ways (Table 1). Although distribution by gender remains particularly stable throughout the decade studied, with the proportion of women hovering around 62% in dance and 37% in circus arts, there are two significant changes in the geographical distribution of the workers' areas of residence and their age. On the geographical front, a very large proportion of dancers live in the region of Île-de-France (between 40% and 47%, depending on the year), similar to what has already been observed (Rannou & Roharik, 2006, pp. 110-121). This is far less pronounced for circus arts workers (between 18% and 29% reside in Île-de-France, depending on the year). This can be explained by the fact that the work of the circus companies has always been nomadic in nature (David-Gibert *et al.*, 2006). A steady decline in the proportion of workers residing in Île-de-France can be seen over this period, particularly for the circus arts sector, where the proportion of individuals having worked in this sector who lived in Île-de-France fell from 28.6% in 2006 to 19.9% a decade later. This can be explained by a regional model network that is built around the development of professional schools and national circus hubs established at regional level (Salaméro, 2018).

The significant increase in average age in both fields is more unexpected. This increases from 32.8 to 35.6 years in dance and from 33.7 to 36.3 years in circus arts over the 2006-2016

5. In 2004, the French government established a Fonds provisoire *(Provisional fund) designed to alleviate the exclusionary impact resulting from the calculation methods used. These methods derived from the 2003 agreements reforming Annexes VIII and X to the unemployment insurance convention. The fund offsets lower compensation or compensates performers and technical staff whose unemployment insurance rights have lapsed. This initial fund was replaced by a* Fonds transitoire *(Transitional fund) in 2005, which in turn was replaced by the FPS in 2006, which the Minister for Culture consequently wanted to render permanent. The FPS, which entered into force on 1 April 2007, includes a mechanism to compensate performers and technical staff in a position of "professional vulnerability" and a professional and social mechanism designed to support career development.*

Figure I – **Change in populations working in dance or circus arts**



Sources and Coverage: Pôle Emploi, monthly employer statement (AEM) and single simplified declaration (DUS) databases. All workers who claimed to have completed at least one hour of dance or circus-related work during the year.

Table 1 – **Socio-demographic characteristics**

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Number of people											
Dance	10 899	11 750	14 807	17 171	17 856	18 291	18 476	18 502	18 525	18 886	19 361
Circus arts	2 231	2 272	3 241	4 012	4 387	4 390	4 565	4 701	4 727	4 724	4 845
Average age (years)											
Dance	32.8	33.0	33.0	33.2	33.5	33.7	33.7	34.0	34.3	35.1	35.6
Circus arts	33.7	34.2	35.2	35.1	34.8	35.1	35.3	35.6	35.9	36.7	36.3
Proportion of women (%)											
Dance	61.6	61.5	62.1	62.2	61.7	62.6	61.7	62.4	61.7	60.1	61.0
Circus arts	36.0	36.8	35.5	36.5	37.3	36.4	36.4	37.4	38.6	39.8	38.7
Area of residence (%)											
Dance											
Île-de-France	46.0	46.8	44.2	42.3	41.3	42.2	40.3	40.8	40.9	44.0	45.2
Other regions	54.1	53.3	55.8	57.7	58.7	57.8	59.7	59.2	59.1	56.0	54.8
Circus arts											
Île-de-France	28.6	29.1	24.7	22.0	21.0	22.6	22.4	20.9	20.9	18.7	19.9
Other regions	71.4	70.9	75.3	78.0	79.0	77.4	77.6	79.1	79.1	81.3	80.1

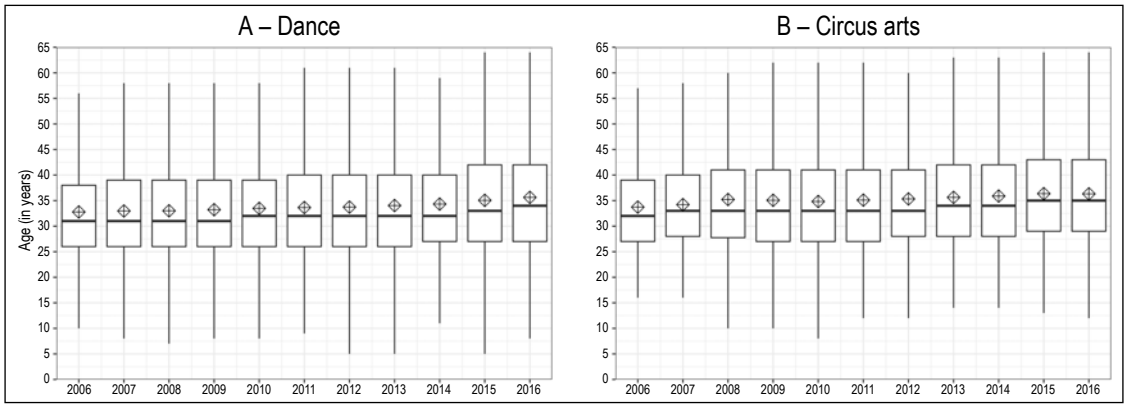
Reading Note: In 2006, the average age of the 10,899 workers who claimed to have completed at least one hour of work in the dance sector was 32.8 years. Of these, 61.6% were women and 46.0% lived in Île-de-France.
Sources and Coverage: Pôle Emploi, monthly employer statement (AEM) and single simplified declaration (DUS) databases. All workers who claimed to have completed at least one hour of dance or circus-related work during the year.

period, producing relatively constant interquartile ranges (Table 1 and Figure II). As we shall see later, this ageing of both populations has no direct link to either prolonged careers in the arts, as was the case in the 1980s (Ministère de la culture, 2003), or the general ageing of the French population. Rather, a better explanation is a decrease in the number of young "new entrants" over the course of the decade studied.

In terms of employment, the first observation concerns the distribution of the volumes of work associated with dance and circus arts. Only a small fraction of individuals reached 500 annual hours of declared work from these types of contracts alone. Between 13.5% and 18.0% of dance workers achieved this figure, depending on the year, resulting in an average volume of work in dance ranging from 208 to 247 hours. For circus arts workers, this achievement rate was between 11.0% and 15.4%, resulting in an average volume of work ranging from 171 to 225 hours (Figure III and Table 2).

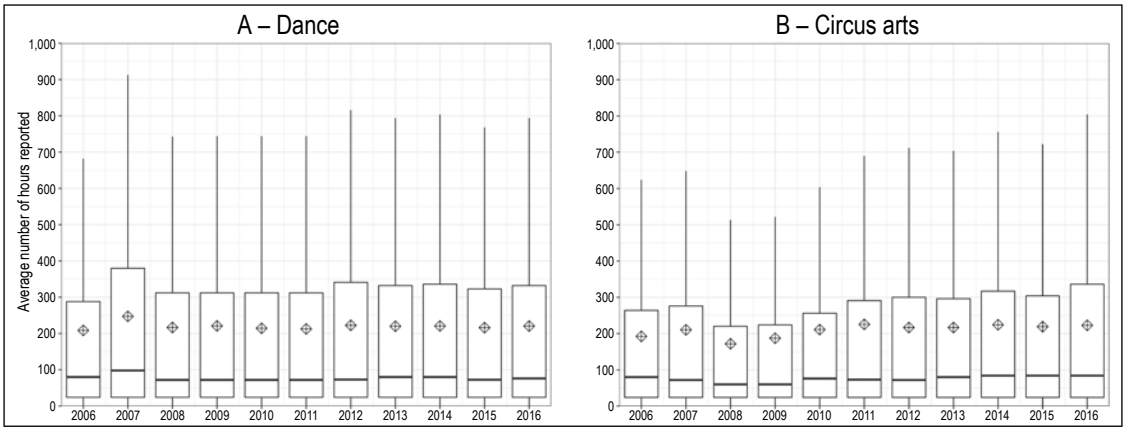
In other words, the proportion of individuals who can claim intermittence for working in only one of the fields in the entertainment industry is relatively small. We can therefore assume that jobs and contract types covered by Annexes VIII and X need to be diverse in order to maximise the volume of work, which is in line with the studies conducted on the performance of multiple jobs in the arts (Bureau *et al.*, 2009) and which is examined below. The persistent nature of other phenomena observed in previous work is also notable, in particular the fact that the number of available jobs (number of individuals) is outstripping demand (number of working hours

Figure II – **Dance and circus arts population age distribution**



Reading Note: In 2006, the average age of the 10,899 workers who claimed to have completed at least one hour of work in the dance sector is 32.8 years, whereby Q1 = 26; Q2 = 31; Q3 = 38.
Sources and Coverage: See Figure I.

Figure III – **Distribution of the volumes of dance and circus arts work (2006-2016)**



Reading Note: In 2006, the 10,899 workers who claimed to have completed at least one hour of work in the dance sector worked for an average of 208.4 hours in this field. The quartile values are as follows: Q1 = 24; Q2 = 80; Q3 = 288.
Sources and Coverage: See Figure I.

Table 2 – **Volume of work carried out in dance and circus arts (2006-2016)**

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
A – Dance											
Volume of work (hours)											
Median	80	98	72	72	72	72	73	80	80	72.5	76
Mean	208.44	247.13	216.55	220.87	214.35	212.58	222.50	219.92	220.71	215.94	220.38
Proportion of individuals who carried out ≥ 500 hours of dance-related work (%)											
	13.5	18.0	15.7	15.6	15.8	15.9	16.8	16.1	16.2	16.1	16.1
B – Circus arts											
Volume of work (hours)											
Median	80	72	60	60	76	73	72	80	84	84	84
Mean	192.33	210.23	171.78	187.18	210.92	225.34	216.65	216.68	224.23	219.00	222.75
Proportion of individuals who carried out ≥ 500 hours of dance-related work (%)											
	13.1	13.6	11.0	11.2	12.6	14.9	15.4	14.4	14.8	14.7	15.2

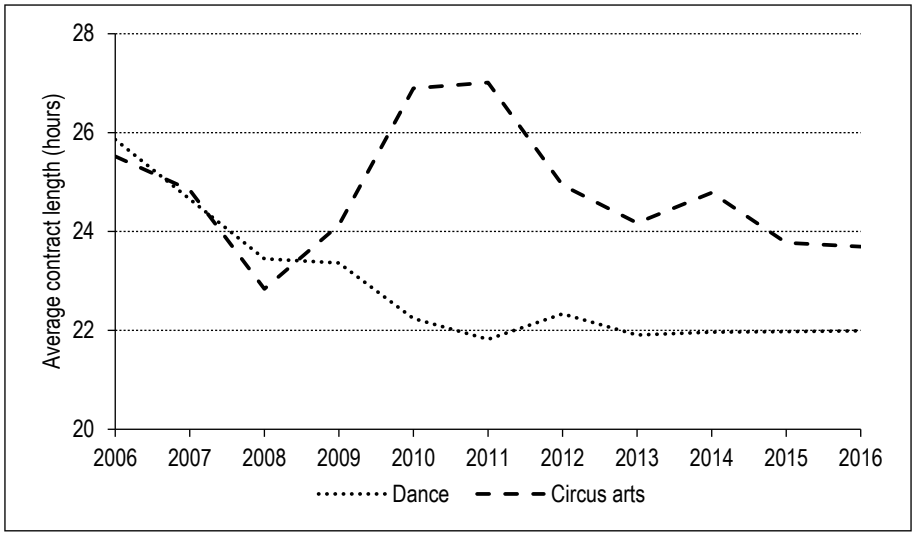
Reading Note: In 2006, 13.5% of workers who claimed to have completed at least one hour of dance-related work completed at least 500 hours of work based exclusively on dance-related contracts.
Sources and Coverage: See Table 1.

and number of contracts), resulting in a shortening of average contract length over the years (Gouyon & Patureau, 2014). This means that more and more contracts need to be concluded in order to achieve the same volume of work from one year to the next. As a result, the average contract length fell from 25.9 hours to 22 hours for dance-related jobs between 2006 and 2016, which equates to an average annual decrease of -1.1%. The same trend is seen in the circus arts sector, albeit at a different rate, with the average contract length falling from 25.5 hours to 23.7 hours over the same period, which equates to an average annual decrease of -0.5% (Figure IV).

In addition, there is a change in wages that does not offset the effects of inflation (Figure V). Prior to a reversal in the trend in 2014, the analysis of the work income breakdown by type of employment, in constant euros (2006 as the base year), effectively shows a relative decline in the levels of hourly pay in both fields studied, although this fall is not as steep in dance (-0.3% average annual decrease over the period studied) as it is in circus arts (-1.2%). For an individual who achieves a consistent volume of work and focuses exclusively on dance or circus arts, the trend is therefore that their work income has fallen gradually. However, much like the overall volume of work, which sets the conditions for access to any compensation, hourly pay is important because it is included in calculations to determine compensation levels. Again, heightened pressure to diversify work falling within the relevant scope of Annexes VIII and X can be assumed.

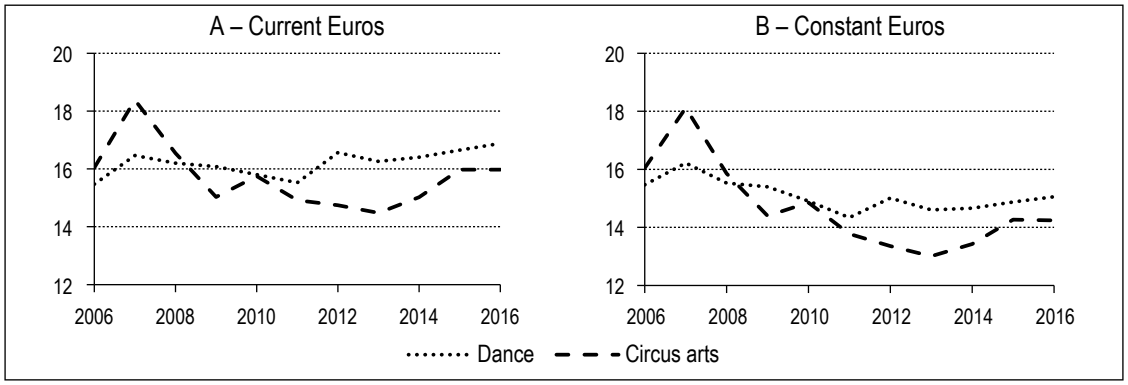
Like other artistic fields, dance and circus arts are therefore characterised over the ten-year period from 2006 to 2016 by a set of cumulative employment-related restrictions, which are growing in magnitude: volumes of work, the distribution of which only allows a small minority to claim "intermittence" based on these specialities alone; a shorter average contract length leading to a more frenzied "race to sign contracts", reduced hourly pay that can have a negative impact on

Figure IV – **Average contract length in dance and circus arts (2006-2016)**



Reading Note: In 2006, the average length of a dance contract is 25.88 hours.
Sources and Coverage: See Figure I.

Figure V – **Average hourly pay under dance or circus arts contracts (2006-2016)**



Reading Note: In 2006, the average hourly pay for a dance contract is €15.47 (gross).
Sources and Coverage: See Figure I.

the whole work income and the level of any compensation. In this context, where employment tends to be more fragmented while paying less, it seems relevant to question the way in which the population is divided by their overall volume of work – as a criterion distinguishing outsiders and insiders with respect to intermittence – and by the structure of their job, i.e. the proportion of time that they commit to work in the field of dance or circus arts – as a criterion distinguishing outsiders and insiders with respect to the "dancer" and "circus artist" professions.

2. Access Factors for the "Core Professional" Segment

One approach to the segmentation of the artistic labour market is to look at the distribution of annual workloads and the share of work related to the selected arts sector. Although 70% to 75% of people in the "dance" population carry out fewer than 500 hours of work per year (combining all types of employment falling within the scope of Annexes VIII and X) and this work mainly relates to dance (70 to 80%) (Table 3), there is nevertheless a very wide range of personal situations (Figure VI). The space for alternative situations is just as diffuse among the "circus arts" population. 58% to 70% of individuals in this group carry out fewer than 500 hours of work per year, most of which relates to circus arts (80%).

To go further, it is possible to categorise the position of individuals in this space by combining job structure and volume of work. For this purpose, and in order to enable a chronological comparison, it seemed more relevant to use a categorisation based on discretisation and concatenation of variables instead of an automatic classification system (Gouyon, 2011). The job structure takes into account all contract types carried out (dance, circus arts, other arts, technical professions) and distinguishes between "dance specialists" (carrying out more

Table 3 – **Volume of work and proportion of work committed to dance or circus arts (2006-2016)**

A – Dance	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Individuals within the sector											
	10,899	11,750	14,807	17,171	17,856	18,291	18,476	18,502	18,525	18,886	19,361
Total volume of work (hours)											
1st quartile	44.0	48.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	42.0	48.0
Median	204.0	216.0	144.0	156.0	168.0	168.0	180.0	184.0	192.0	216.5	240.0
Mean	318.5	329.1	285.0	287.2	294.0	302.5	304.3	302.2	313.7	333.4	348.1
3rd quartile	550.5	564.0	508.0	504.0	522.0	536.0	538.0	528.0	544.3	576.0	588.0
Proportion of individuals who carried out ≥ 500 hours of work in total (%)											
	29.3	30.5	25.5	25.3	26.8	27.6	28.1	27.5	28.6	31.6	32.4
Proportion of subjects who carried out ≤ 48 hours of work in total (%)*											
	28.5	26.7	32.0	31.6	31.2	31.4	31.2	30.1	29.6	27.8	26.6
Proportion of work committed to dance (%)											
1st quartile	42.9	59.6	70.6	66.7	66.7	62.0	63.5	63.6	60.0	50.0	40.8
Median	95.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean	72.2	77.0	80.6	79.8	79.2	78.6	78.9	78.6	77.8	75.3	73.2
3rd quartile	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Proportion of individuals for whom the proportion of dance-related work is ≥ 50 (%)											
	71.1	77.5	79.9	78.9	78.5	77.5	77.9	77.7	77.0	74.2	71.8

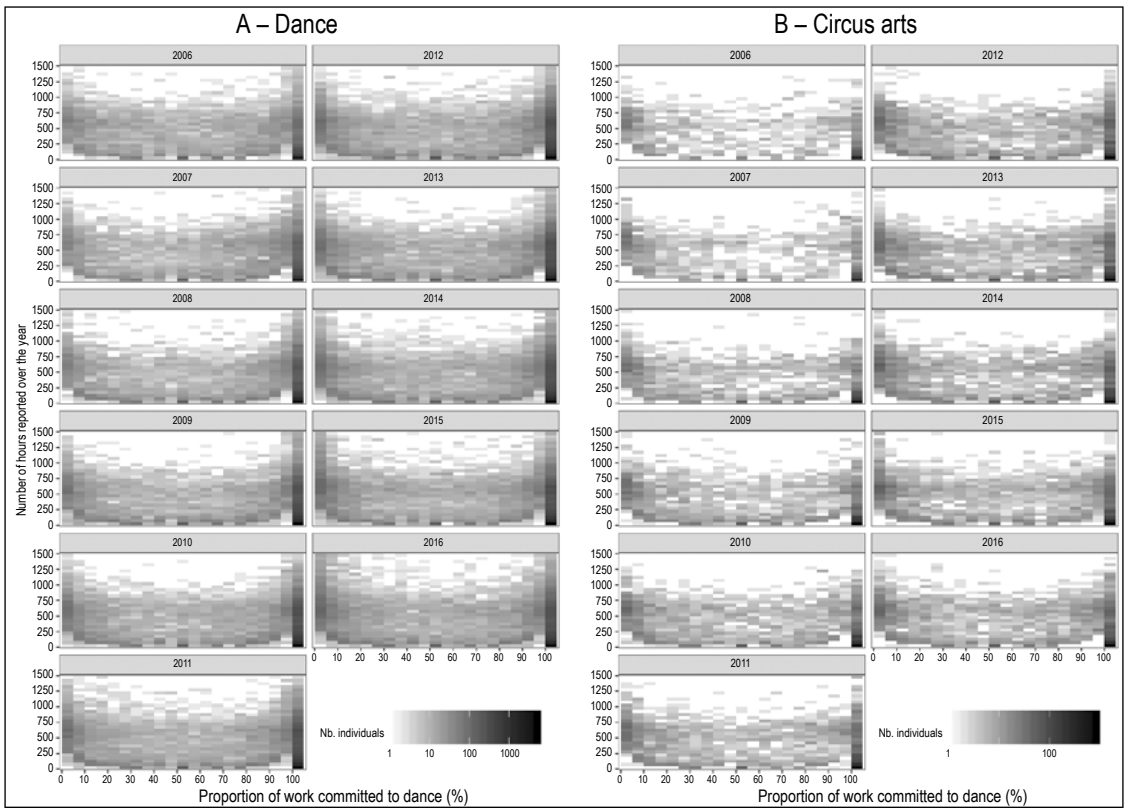
B – Circus arts	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Individuals within the sector											
	2,231	2,272	3,241	4,012	4,387	4,390	4,565	4,701	4,727	4,724	4,845
Total volume of work (hours)											
1st quartile	84.0	104.0	60.0	52.0	60.0	60.0	60.5	64.0	72.0	72.0	69.0
Median	346.0	404.0	252.0	223.0	252.0	300.0	324.0	292.0	320.0	331.5	336.0
Mean	387.4	419.3	341.3	329.8	342.0	363.0	371.6	356.4	373.9	378.2	378.2
3rd quartile	624.0	659.0	576.0	564.0	581.8	603.0	612.5	592.3	610.0	612.0	620.0
Proportion of individuals who carried out ≥ 500 hours of work in total (%)											
	37.9	42.7	33.4	30.5	32.6	35.0	36.3	34.3	37.7	37.5	37.3
Proportion of individuals who carried out ≤ 48 hours of work in total (%)											
	20.2	16.5	24.0	24.5	22.9	22.0	21.8	21.5	20.1	19. 7	21.4
Proportion of work committed to circus arts (%)											
1st quartile	19.2	14.0	22.7	25.0	25.6	24.5	24.5	24.6	22.7	23.1	25.9
Median	72.2	57.1	72.8	77.3	80.0	80.9	79.6	79.4	76.9	78.1	80.0
Mean	60.5	56.0	62.0	63.7	64.5	64.4	63.8	64.2	63.1	63.2	64.7
3rd quartile	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Proportion of subjects for whom the proportion of circus-related work is ≥ 50 (%)											
	84.4	80.0	82.1	82.7	80.2	80.1	80.0	81.8	80.4	79.6	79.7

* The threshold that enables the proportion of individuals with a "low" level of activity in the intermittence sector to be measured varies according to the work. In this table, we have selected the threshold used in CPNEF-SV and Pôle Emploi publications.
Reading Note: In 2006, one quarter (Q1) of the workers in the dance field claimed to have completed fewer than 44 hours of work in total over the year and one quarter (Q3) claimed to have completed more than 550.5 hours, which produced a median value of 204 hours and a mean value of 318.5 hours.
Sources and Coverage: See Table 1.

than 50% of their working hours in this field, labelled "D"), "circus specialists" (labelled "C"), "specialists in another art" (labelled "A"), "technical specialists" (labelled "T") and cases whereby the job structure has no precedent (labelled "Z"). Volume is split into four groups: [1;250], [250;500], [500;750] and [750;+ ∞], denoted as categories "1", "2", "3" and "4" in the tables and graphs that follow. By linking these two variables, we can establish an employment profile in 20 categories, the distribution of which shows the main segmentation lines for these two fields and their evolution over time (Figure VII).

The "professional core", consisting of individuals who combine a high volume of work with a high degree of specialisation (categories D3|D4 for dance and C3|C4 for circus arts), remains relatively marginal across both fields, regardless of the year studied. Between 18% and 22% of people in the field of dance carry out more than 500 hours of work each year of which at least 50% are carried out in the dance sector. This

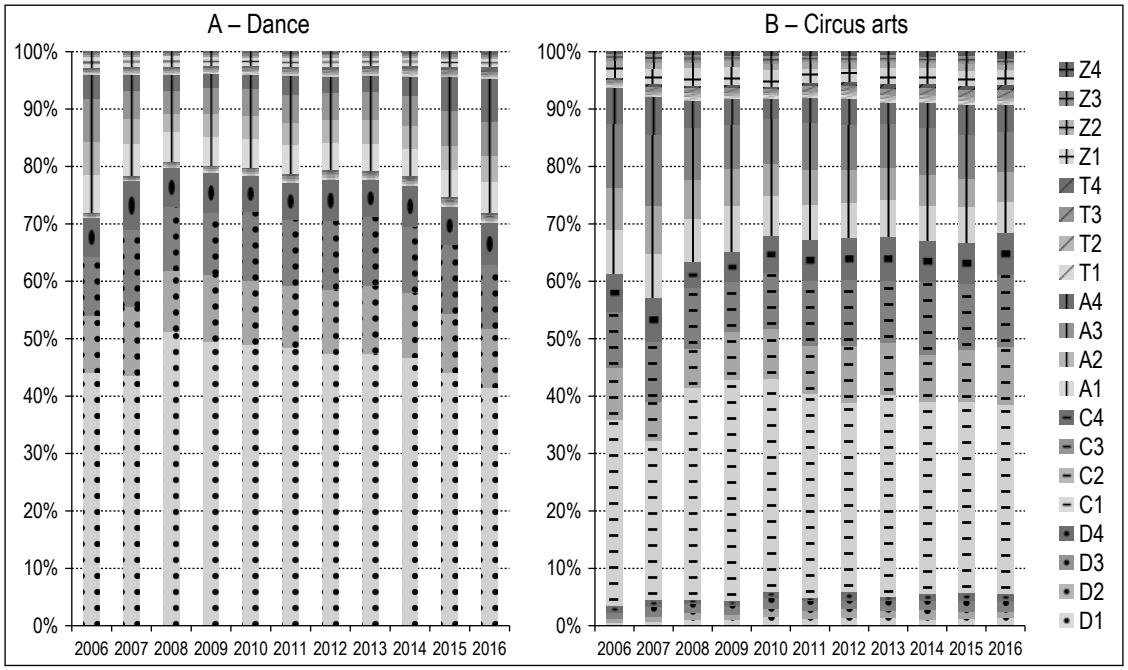
Figure VI – **Concentration of workers by total volume of work and proportion of work committed to the sector**



Reading Note: The density diagrams show the distribution of the workers according to their coordinates on the plane that intersects total annual volume of work and the proportion of work committed to dance (VI-A) or circus arts (VI-B). The darker the cell, the more workers it contains. Outliers are not shown on these graphs to aid overall comprehension.
Sources and Coverage: See Figure I.

figure is between 14% and 20% for those in the circus arts. Various peripheral strands of activity can be seen alongside this relatively low-key segment. On the one hand, we see a concentration of individuals with "specialised reduced activity" profiles (fewer than 500 hours

Figure VII – **Distribution of employment profiles**



Reading Note: In 2006, among all workers who claimed to have completed at least one hour of work in the dance sector, 44.1% claimed to have worked for fewer than 250 hours whereby more than 50% of the hours involved dance related work (category D1).
Sources and Coverage: See Figure I.

per year yet at least 50% of hours falling within the dance or circus arts sector, i.e. segments D1|D2 or C1|C2), which, depending on the year, account for between 55% and 64% of people in dance and between 36% and 49% in circus arts. On the other hand, some carry out multiple jobs for whom their dance or circus-related work is supplementary to their main job in another artistic discipline (segments A1, A2, A3 and A4). Between 15% and 24% of individuals in dance and between 23% and 35% in the circus arts fall into this category. Describing people falling into this category as "circus artists" or "dancers" would appear to be objectively more difficult because their main artistic activity tends to be that of "actor" or "dramatic artist". Given this variety in employment profiles, our aim is to understand the factors that explain whether or not they belong to the "professional core". Multinomial logistic regression was used to model this. The results of this modelling are given in Table 4.

The first thing we see is that gender plays a significant role in the likelihood of belonging to the "professional core": there is a higher proportion of men in specialised segments with a high volume of work. In dance, they account for 44.3% and 45.1% of those in segments D1 and D2, compared to 49% and 52.6% for segments D3 and D4. In circus arts, the gender gap is slightly less pronounced but still remains significant, with men representing 61.9% and 60.0% of those in segments C1 and C2, compared to 61.5% and 67.2% for segments C3 and C4. Similarly, workers are more likely to be included in the "professional core" by virtue of having worked for a large-scale employer specialising in the field[6] during the reference year, a criterion that is somewhat an indicator of the individual's reputational credit (Menger, 2011, pp. 58-59). 52.5% of those in segment D1, 83.3% of those in segment D2, 88.9% of those in segment D3 and 91.4% of those in segment D4 had previously worked for a large-scale employer on at least one occasion. For the circus arts segments C1-C4, these percentages are 43.3% (C1), 71.6% (C2), 76.7% (C3) and 78.8% (C4). This indicates an interaction between age and experience within the profession. This means that inclusion within the youngest age group (under-25s) combined with prior experience (more than two years in the sector) strongly increases the probability of belonging to the "core". However, the change in the odds-ratios shows that experience stops compensating for advanced age beyond a certain point. For dance workers of equal experience, the probability of being included in segments D3|D4 therefore dips after the age of 50. Both of these trends are also observed in the circus arts field. Lastly, there is a notable relative decrease in the odds ratios over the period studied. All else being equal, workers are therefore increasingly less likely to join the D3|D4 or C3|C4 segments, year by year. Given the marginal and heterogeneous variation of the proportion among both populations over time (18% to 22% in dance; 14% to 20% in circus arts), we can deduce that the "professional core" increasingly gathers the most qualified individuals (men, those already recognised in the sector, those working for the most prominent employers, etc.), as employment conditions become more restrictive. For example, in the data for the dance field at the beginning of the period studied, 80% to 85% of individuals in segments D3|D4 have at least two years of experience in the sector. By the end of the period, this figure is between 85% and 90%. These ranges are generally consistent with those of the C3|C4 segments in the circus arts field. In this respect, however, it must be considered that changes over time logically give rise to a form of selection bias among the population, in the sense that, among experienced men and women, only those with a sufficient level of activity and volume of work (i.e. granting continuous access to unemployment compensation) remain and continue to work. This assumption is confirmed by the longitudinal analysis of the "new entrant" cohorts, which is presented in the following section.

3. Greater Difficulties Faced by "New Entrant" Cohorts in Terms of Integration

The cohort-based approach aims to track the development of individuals who entered the field under given circumstances (Box 2). From this point of view, the size of the various cohorts is an initial indicator that allows us to see how the number of new entrants in both dance and circus arts has changed. In other words, it allows us to determine how many are "attempting" to enter the world of work in the arts (Buscatto, 2008). Following a period of strong growth between 2007 and 2008, the volume of new entrants is steadily declining, with an average annual decrease of -7.3% for dance between 2008 and

6. The 201,537 employers surveyed were categorised on the basis of the total number of working hours offered over the 2006-2016 period and the level of specialisation required to complete the work covered by the contracts offered. The first variable is split into four categories according to a logarithmic scale – [1;100]; [100;1,000]; [1,000;10,000]; [10,000;+∞], denoted as categories "1", "2", "3" and "4", respectively – while the second variable distinguishes between "dance specialists" (those carrying out more than 50% of their working hours in this field), "circus specialists", and "others". 12 distinct "types" of employer emerge as a result.

Table 4 – **Odds ratios from the multinomial logistic regression model***

	Dance population Employment profile: D1|D2 *vs*…			Circus arts population Employment profile: C1|C2 *vs*…		
	… D3|D4	... other profiles 1|2	... other profiles 3|4	… C3|C4	... other profiles 1|2	... other profiles 3|4
Constant	0.07 ***	0.18 ***	0.03 ***	0.11 ***	0.46 ***	0.14 ***
Period (*Ref.* 2006-2007)						
2008-2009	0.30 ***	0.39 ***	0.14 ***	0.25 ***	0.45 ***	0.12 ***
2010-2011	0.27 ***	0.33 ***	0.13 ***	0.24 ***	0.35 ***	0.08 ***
2012-2013	0.25 ***	0.31 ***	0.12 ***	0.21 ***	0.30 ***	0.07 ***
2014-2016	0.23 ***	0.33 ***	0.16 ***	0.20 ***	0.27 ***	0.07 ***
Gender (*Ref.* Female)						
Male	1.16 ***	1.80 ***	2.11 ***	1.08 *	1.00	1.12 ***
Area of residence (*Ref.* Île-de-France)						
Other regions	1.14 ***	0.78 ***	0.77 ***	1.10 *	0.81 ***	0.68 ***
Age (*Ref.* Under 25)						
25-29 years	1.21 ***	1.50 ***	2.50 ***	1.08	1.45 ***	2.43 ***
30-34 years	1.23 ***	1.56 ***	4.01 ***	1.49 *	1.61 ***	3.23 ***
35-39 years	1.24 ***	1.77 ***	5.00 ***	1.68 **	1.71 ***	3.74 ***
40-44 years	1.48 ***	2.21 ***	6.85 ***	1.73 *	1.64 ***	4.48 ***
45-49 years	1.66 ***	2.08 ***	6.50 ***	1.53 *	1.63 ***	2.63 ***
50+ years	1.24 **	2.00 ***	5.94 ***	0.64	1.33 *	1.55 ***
Experience within the sector (*Ref.* Less than one year)						
One year	3.32 ***	2.18 ***	1.79 ***	4.08 ***	2.86 ***	6.48 ***
Two or more years	6.34 ***	3.64 ***	11.98 ***	6.01 ***	4.01 ***	25.61 ***
Experience × Age						
One year of experience and aged...						
... 25-29 years	0.83 **	0.72 ***	0.63 **	0.45 **	0.63 **	0.55 *
... 30-34 years	0.88	0.81 *	0.51 ***	0.58 *	0.57 ***	0.44 **
... 35-39 years	0.92	0.74 **	0.49 ***	0.68 *	0.69 *	0.51 **
... 40-44 years	0.99	0.71 **	0.44 ***	0.80	0.75	0.45 **
... 45-49 years	1.06	0.88	0.54 ***	0.79	0.90	0.74
... 50+ years	0.92	0.81	0.62 ***	0.70	0.75	0.72
Two or more years of experience and aged...						
... 25-29 years	1.07	0.77 ***	0.70 **	1.22	0.77 *	0.60 *
... 30-34 years	1.19 *	0.87	0.74 *	1.31	0.84	0.66 *
... 35-39 years	1.36 ***	0.90	0.80 *	1.41 *	0.91	0.74
... 40-44 years	1.70 ***	1.26 **	1.06	2.28 **	1.05	0.72
... 45-49 years	1.38 **	0.95	0.86	1.37	1.11	1.16
... 50+ years	1.34 ***	0.83 *	0.69 **	1.23	1.01	1.26
Has been employed by a size 3 or 4 organisation specialised in the dance sector (*Ref.* No)						
Yes	4.59 ***	0.84 ***	1.79 ***	2.86 ***	3.45 ***	6.20 ***
Has been employed by a size 3 or 4 organisation specialised in the circus arts sector (*Ref.* No)						
Yes	2.53 ***	5.79 ***	11.98 ***	4.08 ***	0.72 ***	1.44 ***

* For both populations studied, the model presented has been selected following a step-by-step procedure that aims to avoid using the Akaike information criterion to compare quality across models as far as possible.
Notes: ***, **, * corresponds to $p < 0.001$, $p < 0.01$, $p < 0.05$.
Reading Note: All else being equal (i.e. once the estimated effects for the other variables introduced into the model have been tested), a man is 1.16 times more likely to be included in the D3|D4 segment rather than the D1|D2 segment compared to a woman. In other words, all else being equal, a man working in dance is 16% more likely to be part of the "professional core" segment than a woman.
Sources and Coverage: See Table 1.

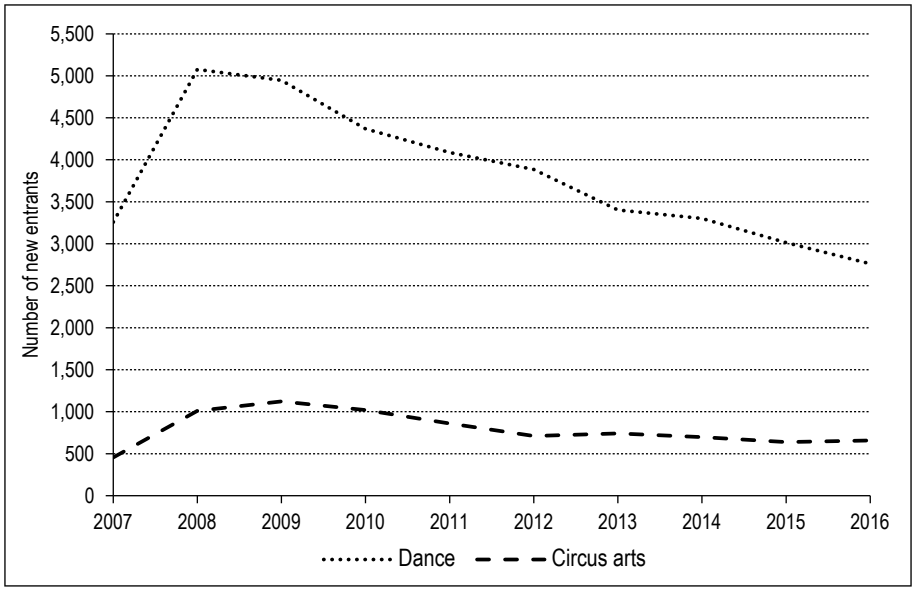
2016, and of -5.2% for circus arts over the same period (Figure VIII). In other words, while both populations continue to grow, the turnover rate seems to be stalling, which implies that the populations are ageing.

Looking at it in greater detail, we see that the average age increases in both sectors studied. For dance, it rises from 33 years to 35 years, with an average annual increase of +0.6%. For circus arts, it rises from 34.2 years to 36.4 years, with an average annual increase of +0.8% (Table 5). However, this observation needs to be qualified with regard to the general ageing of the French population. Between 2007 and 2015, this

Box 2 – **Structure and Characteristics of the Cohorts**

The cohort for year *N* is composed of subjects who carried out at least 1 hour of work covered by Annex VIII or Annex X during year *N* but no work at all during the years prior to this. In this respect, the available data make it possible to limit left-censorship bias to a huge extent as we have information about contracts prior to the observation period (2006-2016) and more specifically the date of the first contract registered with Pôle Emploi (with the oldest contracts dating back to 1997). However, the retrospective nature of the data is only fully ensured from 2007 onwards, when the AEM and DUS databases were consolidated. In fact, the 2006 cohort was excluded from the analysis because no guarantee can be given that this cohort is exclusively composed of "genuine" new entrants, unlike cohorts for subsequent years. Likewise, 2016 is only given as an estimate, as the outcome for individuals in 2017 is only partially known. On this basis, the dataset allows us to create 20 cohorts of varying size, composed exclusively of "genuine" new entrants and designed on the basis of the following indicators: a) subjects present for the first time in year *N* (2007 to 2016, i.e. 10 annual cohorts); b) subjects carrying out at least one hour of work in the dance or circus arts sector during year *N* (i.e. 2 fields of activity).

Figure VIII – **Change in the volume of new entrants**



Reading Note: In 2007, the number of workers not included in the database in previous years who claimed to have completed at least one hour of dance related work is 3,257. This figure is 3,014 in 2016.
Sources and Coverage: Pôle Emploi. All workers covered by Annexes VIII & X for the first time who claimed to have completed at least one hour of work relating to the dance or circus arts sector during the year.

population's average age rose from 39.6 years to 40.9 years, with an average annual increase of +0.4% (INSEE, 2020). The trend observed in the population of arts workers is therefore part of this general movement, even though other factors are at play. Furthermore, these prospective arts workers have specific characteristics compared to those who are already active in the field. While the average age of new entrants is, unsurprisingly, 5 to 7 years lower than the overall population and remains stable over the period studied, we also see that women are slightly over-represented among these cohorts, with differences ranging from +0.5 to +5%. However, the main difference relates to the employment profiles, as the extreme majority of prospective arts workers are confined to the "specialised reduced activity" segments (fewer than 500 hours worked over the year of which more than 50% in the selected field), which is the case for 85% to 90% of new entrants in the dance labour market and 75% to 85% of new entrants in circus arts. The proportion of those entering the "professional core" directly from their first year of work is therefore very limited, which highlights how seldom new entrants quickly integrate themselves fully into the profession.

Given the propensity of new entrants to be peripheral figures in the arts labour market – at least initially – we need to understand what proportion of them manages to last in the sector despite all the challenges they face. For descriptive purposes, a series of length-of-service curves was constructed for each of the cohorts using the Kaplan-Meier method (figure IX).[7] As a

7. Anyone who claimed to have completed at least one hour of work during year N *and zero hours during subsequent years is considered to be excluded from the scope of Annexes VIII & X. The end date of the last known contract can be used to determine effective exit dates. This makes it possible to measure working periods using continuous time (fraction of a year in which the worker was active) rather than discontinuous time (full year in which the worker was active).*

Table 5 – **Characteristics of the entrant cohorts with regard to annual populations**

A – Dance	2007	2008	2009	2010	2011	2012	2013	2014	2015
Individuals in the sector	11,750	14,807	17,171	17,856	18,291	18,476	18,502	18,525	18,886
Entrants during year *N*	3,257	5,076	4,946	4,368	4,087	3,885	3,403	3,302	3,014
Entry rate during year *N* (%)	27.7	34.3	28.8	24.5	22.3	21.0	18.4	17.8	16.0
Average age									
Individuals in the sector	33.0	33.0	33.2	33.5	33.7	33.7	34.0	34.3	35.1
Entrants during year *N*	29.1	30.4	29.9	29.0	28.9	28.5	28.9	28.6	28.2
Proportion of women (%) among									
Individuals in the sector	61.5	62.1	62.2	61.7	62.6	61.7	62.4	61.7	60.1
Entrants during year *N*	62.9	66.5	66.7	65.4	67.2	65.6	64.8	64.1	60.8
Employment profile of individuals within the sector (%)									
D1|D2	55.6	61.8	61.2	60.2	59.3	58.7	59.3	58.1	54.4
D3|D4	21.9	18.0	17.7	18.3	18.0	19.1	18.4	18.5	18.6
Other 1|2	12.8	11.7	12.4	12.2	12.3	12.4	12.2	12.1	12.2
Other 3|4	9.7	8.5	8.7	9.3	10.5	9.8	10.1	11.3	14.9
Employment profile of entrants during year *N*									
D1|D2	86.6	89.7	88.6	90.6	91.4	90.8	89.7	90.9	89.8
D3|D4	4.6	2.9	4.2	4.0	3.0	4.1	4.4	3.9	4.6
Other 1|2	8.0	7.1	6.7	4.9	5.0	4.6	5.2	4.9	4.9
Other 3|4	0.9	0.3	0.5	0.5	0.7	0.4	0.7	0.3	0.7
Retention rate of year *N* entrants during year *N*+1 (%)									
	56.7	66.3	59.1	55.5	53.3	53.3	49.7	47.0	46.6
B – Circus arts	2007	2008	2009	2010	2011	2012	2013	2014	2015
Individuals in the sector	2,272	3,241	4,012	4,387	4,390	4,565	4,701	4,727	4,724
Entrants during year *N*	456	1,010	1,123	1,020	860	711	741	698	639
Entry rate during year *N* (%)	20.1	31.2	28.0	23.3	19.6	15.6	15.8	14.8	13.5
Average age (years)									
Individuals in the sector	34.2	35.2	35.1	34.8	35.1	35.3	35.6	35.9	36.4
Entrants during year *N*	30.6	36.0	32.0	30.2	30.9	29.9	29.7	30.2	29.8
Proportion of women (%) among									
Individuals in the sector	36.8	35.5	36.5	37.3	36.4	36.4	37.4	38.6	39.8
Entrants during year *N*	37.5	34.4	38.7	36.0	36.1	36.0	39.5	41.7	43.5
Employment profile of individuals within the sector (%)									
C1|C2	34.5	43.8	46.9	45.9	43.9	42.8	44.1	41.6	42.3
C3|C4	18.1	15.1	13.9	16.2	18.5	18.8	18.4	19.8	18.8
Other 1|2	22.1	22.1	21.7	20.6	19.8	19.7	20.0	19.1	18.8
Other 3|4	25.4	19.1	17.5	17.4	17.9	18.8	17.5	19.4	20.2
Employment profile of entrants during year *N*									
C1|C2	74.6	81.7	81.2	80.9	82.8	80.3	83.3	85.0	86.5
C3|C4	5.9	2.9	2.4	5.9	7.1	7.2	5.3	4.9	5.2
Other 1|2	17.1	14.2	14.6	12.2	8.8	11.0	10.8	9.2	7.4
Other 3|4	2.4	1.3	1.8	1.1	1.3	1.6	0.7	1.0	0.9
Retention rate of year *N* entrants during year *N*+1 (%)									
	62.1	69.4	65.6	60.7	57.6	56.6	53.4	44.3	43.5

Reading Note: In 2007, 11,750 individuals completed at least one hour of work in the dance sector, 3,257 (27.7%) of whom were new entrants. During the following year, 56.7% of the workers in this latter group were still carrying out work covered by Annexes VIII & X (whether in dance or another art). This was the case for 33.4% of the workers five years later. The remainder had not completed any declared work in the sector at that point in time.
Sources and Coverage: See Table 1.

result, we see that the rate of exclusion increases steadily over the years, with the exception of 2008 – an outlier in which retention rates are at their highest levels.[8] This acceleration is more pronounced during the first year of work. In other words, while the number of new entrants tends to decrease, which could theoretically limit the phenomena created by competition between prospective arts workers, the probability of remaining in the sector decreases over the period, in line with a trend that remains rarely

8. *This year was marked by the full entry into force of the FPS (see above).*

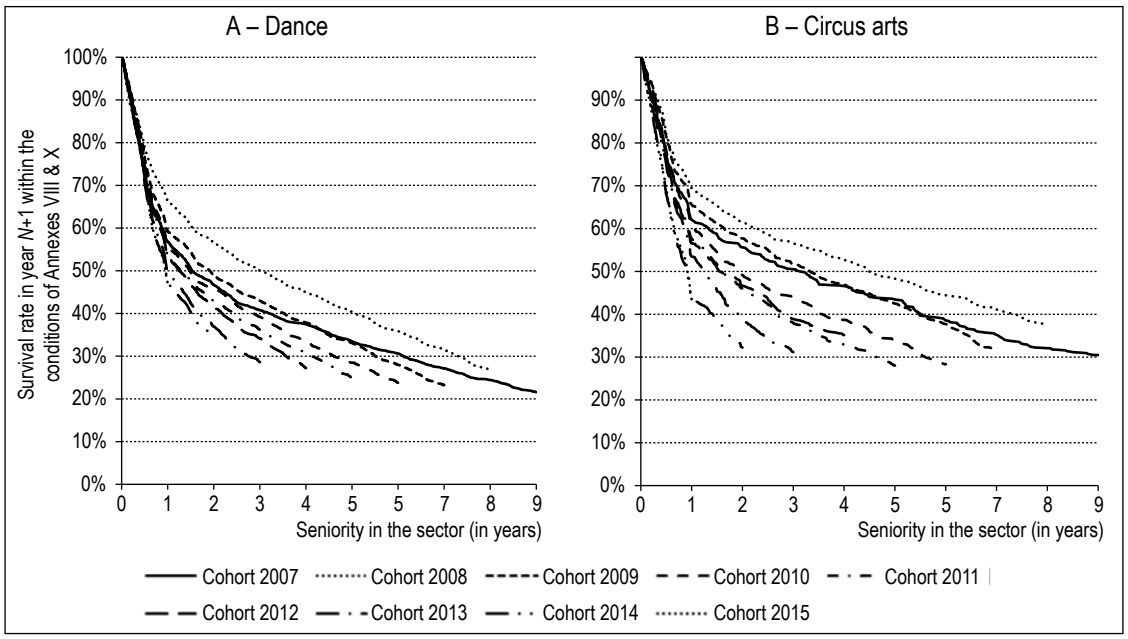
documented in the literature. To understand this phenomenon in greater detail as well as the conditions under which individuals can continue working on a long term basis, and avoiding right-censoring bias, only the cohorts from 2007 to 2011 have been retained for the remainder of the analysis. To make the cohorts fully comparable, they were first shortened by including only the first five years of work (Figure X). These five cohorts were then subjected to double modelling to determine which factors maximise "longevity" in the entertainment sector (Box 3).

The parameters of the accelerated failure time (AFT) and proportional hazard (PH) models with time-dependent effects and covariates[9] converge and confirm the finding derived from the Kaplan-Meier curves (Table 6). The exclusion phenomena are accelerating across the cohorts, an acceleration that is greater in the circus arts than in dance, even though the average exclusion rates are more marked within the dance sector. Compared to the 2007 cohorts taken as a reference, the probability of employees ceasing work during the first five years is 1.5 times higher for the 2010-2011 dance cohorts and 2.2 times higher for the 2010-2011 circus arts cohorts. Furthermore, as evidence of the variability of the covariates' effects over time, it appears that the returns to belonging to the "professional core" increases during the first years of employment. This then falls as of the fifth year in the sector. According to a ratio approaching +0.5, compared to inclusion in segments D1|D2 or C1|C2, inclusion in segments D3|D4 or C3|C4 during the first year of work is a factor that lowers the probability of exclusion during the following year. In the dance sector, 50% to 64% of new entrants belonging to the D1|D2 segments during the first year continue to work in their second year, compared to 74% to 84% of those in the D3|D4 segments. In the circus arts sector, these figures range from 52% to 64% and from 68% to 85%, respectively. This protective effect increases further in years 2 to 4, logically demonstrating that a worker's rapid and strong professional integration protects them from exclusion. However, this effect dissipates in the fifth year of work, implying that the employment profile is no longer the only variable to influence retention within the sector, with other factors (such as advancing age, type of employer, reputation, health, maternity/paternity) visible in our data to varying degrees coming into play from year 5 (Bourneton *et al.*, 2019).

In a nutshell, employment conditions which are becoming more restrictive year on year mean that "new entrant" cohorts are finding it increasingly difficult to stay in employment even though there are fewer of them. The lower level of competition between those who are "attempting" to access

9. The Schoenfeld residuals-based analysis (not presented here) on PH models carried out in accordance with the standard method, show that the proportional relative hazards-related assumption is incorrect for the data used, which makes it necessary to use more complex models.

Figure IX – **Survival rates of the dance and circus arts cohorts (2007 to 2015)**



Reading Note: of the 3,257 workers who entered the field of dance in 2007, 21.6% are still carrying out work covered in Annexes VIII & X nine years later, in 2016.
Sources and Coverage: see Figure VIII.

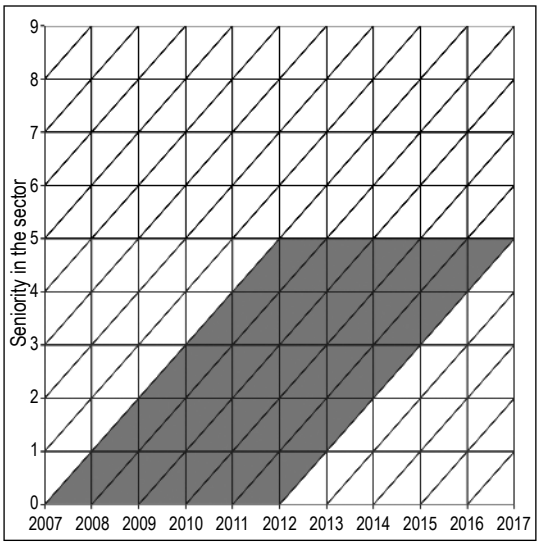
Box 3 – **Parametric and Semi-parametric Event History Analysis Models**

Event history analysis is used to statistically model the time factor (t) in the likelihood of a given event (death, marriage, birth, exit from labour market, etc.) occurring before the end of the observation phase at time T, such that $S(t) = Pr\{T > t\}$. It distinguishes between two main groups of continuous time-based methods:

- parametric methods (such as accelerated failure time (AFT) modelling) which model the time preceding a given event (Kalbfleisch & Prentice, 2002); and
- semi-parametric methods (such as the Cox proportional hazards (PH) model) which model the occurrence of the event (Therneau & Grambsch, 2002).

While AFT models can be interpreted intuitively, one drawback is that they have to rely on the *a priori* specification of the basic instantaneous risk distribution function (λ_0). This function, which may follow a Weibull, exponential, logistic or log normal distribution, among others, is unknown in most cases, which leads to a process of trial and error and a comparison of models based on different distribution laws. Conversely, PH models refrain from any guesswork with regard to the distribution of the basic hazard (λ_0) but they have the drawback of being based on the assumption of proportionality of the effects of the co-variates as a function of time and temporal invariability of the value of those co-variates. However, this is not always the case. PH models of greater complexity (stratified and/or with time-dependent explanatory factors) can be used to overcome this problem, as this analysis has done.

Figure X – **Lexis Diagram illustrating the cohorts selected to model continued activity**



Note: The data and outcomes for the cohort entering the scope of Annexes VIII & X in 2007 are available up until the end of 2016. However, the data kept for the continued activity analysis relate only to the first five years of activity in the sector (2007 to 2011). The same monitoring time-frame of five years is used for subsequent cohorts, up until the cohort for 2011 (i.e. 2011 to 2015).

the sector therefore has no impact on competition with those already active and "established" in the sector. In other words, competition within the secondary segments is coupled with competition between secondary and primary segments, the latter tending to operate as a form of internal market (Doeringer & Piore, 1971).

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The aim of this article was to describe two of the segmentation factors in the artistic jobs system – job structure and volume of work – and to observe how these have changed over time in the fields of dance and circus arts in France. While highlighting the fact that employment conditions have generally become more restrictive throughout the 2006-2016 period, the results presented also clearly illustrate the division between the primary segment – which includes the "established" artists – and the secondary segment – composed of the most vulnerable artists, primarily those who are "attempting" to enter the sector (Buscatto, 2008). The two artistic fields studied are stuck in a kind of paradox. The overall number of artists continues to grow, yet turnover rates are falling and the conditions for new entrants to remain in work are becoming increasingly challenging. While it is difficult to provide a direct answer to the question put forward by Menger (2011) concerning the respective effects of cyclical variations and regulatory changes, the fact remains that the 2007-2008 period – which was marked by the entry into force of the FPS – appears to be unique in terms of both the observable employment profiles and the high retention rates of workers who entered the sector in this context. There appears to be a lag as the data for subsequent years "catch up" with what went before. The subsequent question, which we still cannot answer due to the lack of a sufficient observation window and long series data, concerns the possible existence of cyclical effects, where there is a high influx of new entrants benefiting from an "advantageous" regulatory system, followed by a decline of this influx in so far as the prospective workers would be faced with competition from "established" artists from the previous phase, followed by relatively large-scale turnover due to the end of the performance careers of artists from the first phase, etc. This would thus add a procedural and temporal aspect to the analysis of the

Table 6 – **Estimation of the continued activity of the 2007-2011 cohorts**

	Dance population		Circus arts population	
	Generalised gamma AFT (exp^{coef})	Cox model (exp^{coef})	Generalised gamma AFT (exp^{coef})	Cox model (exp^{coef})
Time of entry into the sector (*Ref.* 2007)				
2008-2009	0.96	1.05	0.78*	1.33*
2010-2011	0.67***	1.49 ***	0.49***	2.21***
Gender (*Ref.* Female)				
Male	1.02	0.99	1.00	1.00
Age at point of entry into the sector (*Ref.* Under 25))				
25-29	0.99	1.02	1.03	0.98
30-34	1.00	1.00	1.03	0.97
35-39	0.95	1.06	0.87	1.17
40-44	1.00	1.00	0.87	1.19
45-49	0.96	1.04	0.94	1.08
50 or over	0.77***	1.29 ***	0.79**	1.32**
Area of residence at point of entry into the sector (*Ref.* Île-de-France)				
Other regions	1.00	1.00	1.10	0.90
Employment profile during year *N* (*Ref.* D1|D2 or C1|C2)				
D3|D4 or C3|C4 – Year 1	2.16***	0.44 ***	1.50*	0.65*
Year 2	4.75***	0.20 ***	1.69**	0.55**
Year 3	8.86***	0.11 ***	4.94***	0.17***
Year 4	11.11***	0.09 ***	6.94***	0.13***
Year 5	7.29***	0.16 ***	2.04*	0.47*
Other 1|2 – Year 1	2.55***	0.37 ***	2.65***	0.33***
Year 2	4.28***	0.23 ***	2.73***	0.34***
Year 3	4.04***	0.26 ***	1.89***	0.51***
Year 4	3.95***	0.28 ***	1.66**	0.60**
Year 5	3.04***	0.37 ***	1.37	0.72
Other 3|4 – Year 1	3.68***	0.24 ***	2.41*	0.36*
Year 2	5.04***	0.19 ***	4.21***	0.21***
Year 3	9.41***	0.10 ***	6.35***	0.13***
Year 4	17.02***	0.06 ***	6.82***	0.13***
Year 5	10.11***	0.11 ***	2.81*	0.33*
Has been employed by a size 3 or 4 organisation specialised in the dance sector (*Ref.* No)				
Yes	1.20***	0.83***	1.30*	0.76*
Has been employed by a size 3 or 4 organisation specialised in the circus arts sector (*Ref.* No)				
Yes	1.67***	0.59***	1.00	1.01
Number of subjects	21,734		4,469	
Number of right-censored subjects	7,038		1,750	

Note : significant at p < 0.001 ***, p < 0.01 **, p < 0.05 *.
Reading Note: The AFT models presented use a generalised gamma link function with the parameters μ = 1.01; σ= 1.10; k = 0.72 for dance data and μ = 1.48; σ = 1.00; k = 0.78 for circus arts data. With all else being equal (i.e. workers from the 2007 cohort, under 25 years of age, living in Île-de-France, etc.), the length of time a man remains in work is 2% (1.02-1) higher than for a woman within the dance sector. And yet, the probability of a man exiting the sector within the first 5 years of employment is 1% (1-0.99) higher than for a woman. These two example deviations are not statistically significant.
Sources and Coverage: Pôle Emploi. All workers covered by Annexes VIII & X for the first time who claimed to have completed at least one hour of work relating to the dance or circus arts sector during the year.

segmentation of these labour markets. Beyond the data processing already carried out, the data used could also be examined using sequence analysis (Robette, 2011) that aims to produce indicators of "stability" for the career paths and a typology of these paths in order to test how their distribution is altered by the changes in regulation. If "multiple disciplines" are part and parcel of artistic professions (Bureau *et al.*, 2009; Gouyon, 2011; Perrenoud & Bataille, 2017), it can then be assumed that this is more or less encouraged, favoured, or even caused by the regulatory framework and the restrictive nature of the conditions of access to the "professional core" segment. This sheds light on the underlying mechanisms for implementing a support policy for artists, in a country that regularly declares its commitment to culture and its

actors, stating, for example, that "culture cannot exist without creation. And nothing gets created without artists. We need culture, which means we need artists".[10] Rhetoric aside, defining the conditions that enable professional artistic work to be carried out over the long term is the real issue here. □

10. Speech to promote French creative endeavours delivered by F. Riester, Minister for Culture, at the Cité internationale des arts *artist residency centre on 19 March 2019.*

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APPENDIX

NOMENCLATURE OF ARTISTIC AND TECHNICAL JOBS IN THE ENTERTAINMENT INDUSTRY

In the early 2000s, Pôle Emploi and the CPNEF-SV, with the assistance of a team from the Marcel Mauss Institute (formerly CSA and CESTA, then CESPRA), produced a classification system for jobs in the entertainment industry. The purpose of this system was to promote standardised statistical recording of working situations (Menger *et al.*, 2001).

In order to achieve a more or less fine "grain" of definition, this nomenclature, which has been revised yet is still in force, lists the following organisational hierarchy: 3 branches (artists, technical staff, administrative staff); 18 fields of activity (professionals in props, professionals in the circus and visual arts, choreography professionals, etc.); 60 professional groups (sound technician, costume designer, musician, lighting director, circus artist, etc.); and 1,388 job codes that cover the smallest work unit identified in the AEM and DUS databases (ballet dancer, music hall dancer, variety show dancer, juggler, trapeze artist, high-wire artist, etc.).

The job codes that correspond to the professional groups of "dancers" and "circus artists" and which set the limits of our survey are as follows:

Professional group	Job code
Dancer	Choreographer or choreographic artist
	Revue performer
	Entertainer
	Music hall performer
	Ballet artist
	Dancer
	Ballet or company dancer
	Music hall dancer
	Variety show dancer
	Solo dancer
	Ballet extra
	Principal dancer
	Stripper
Circus artist	Acrobat
	Foot juggler
	Circus artist
	Falconry artist
	Bolas juggler
	Boleadoras circus artist
	Circus rider
	Clown
	Contortionist
	Tamer
	Trainer
	Stilt-walker
	Equilibrist
	High-wire artist
	Tightrope walker
	Juggler
	Trapeze artist
	Acrobat

An Evaluation of the Innovation Tax Credit

Simon Bunel* and Benjamin Hadjibeyli**

Abstract – The Innovation tax credit (*crédit d'impôt innovation*, CII) is an extension of the Research tax credit (*crédit d'impôt recherche*, CIR) intended to boost the incentive effect of the latter on SMEs to encourage them to engage in the creation of new products *via* the development of prototypes or pilot plants. Introduced in 2013, it represented €120 million of tax credit in 2014 for some 5,300 recipients. This article seeks to measure the impact of the introduction of this scheme on its beneficiaries over the period from 2013 to 2016. Using a difference-in-differences method following propensity score matching, we find a greater increase in employment in the short term for firms benefiting from the scheme, along with a more pronounced increase in their turnover in the medium term. A greater increase in the number of new products produced by the beneficiaries is also observed. Finally, the introduction of the CII went along with a reduction in the research expenditure reported under the CIR.

JEL Classification: C21, D22, H32, L25, O31, 038
Keywords: innovation, tax credit, evaluation, products

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Research, development and innovation (RDI) is now a priority for public authorities, as shown by the EU's target of devoting 3% of GDP to R&D and innovation and the launch of the "Innovation Union" initiative as part of the Europe 2020 strategy. Economic theory suggests that RDI activities should be supported since they have a positive impact on growth and multiple market failures result in firms under-investing in these activities. Nevertheless, there is much debate about how supportive policies can be implemented. In particular, the question as to the optimal balance between direct support and tax incentives remains central.

In France, tax incentives account for more than two-thirds of the 10 billion euros worth of RDI support granted annually. The Research tax credit (CIR, *Crédit d'impôt recherche*), which was introduced in 1983 and substantially reformed in 2008, is the principal scheme in this regard (around 6 billion euros worth of tax credits each year). Numerous evaluations of the CIR have been produced (for a summary, see Cnepi, 2019). The main question that these evaluations seek to answer relates to the impact of the CIR on R&D expenditure. The most recent studies, whether they be based on structural models (Lopez & Mairesse, 2018; Mulkay & Mairesse, 2018) or on difference-in-differences methods (Bozio *et al.*, 2019), converge on the fact that the firms that were already benefiting from the CIR before the 2008 reform have increased their R&D expenditures by an amount equal to or slightly above the amount of tax support received. The impact on employment appears to be more moderate (Bozio *et al.*, 2019). Some studies (Bozio *et al.*, 2019; Lopez & Mairesse, 2018) also looked at the impact of the CIR reform on innovation, revealing an increase in the probability of filing patents, but no increase in the number of patents conditional on having filed a patent in the past, together with an increase in the likelihood to innovate. Finally, Lopez & Mairesse (2018) looked at the impact in terms of productivity, showing that, while the impact on the probability of innovating is smaller for large firms, the impact on productivity increases with the size of the firm.

Other French RDI support schemes have also been evaluated. Firstly, the "young doctors" (*jeunes docteurs*) scheme, which forms part of the CIR, has been the subject of two specific evaluations (Margolis & Miotti, 2015; Giret *et al.*, 2018). These two studies reveal a positive impact on the employment of young doctors, but no impact on the quality of employment. The "young innovative firm" (*jeunes entreprises innovantes*, JEI) scheme has also been evaluated three times (Lelarge, 2008, 2009; Hallépée & Houlou-Garcia, 2012; Bunel *et al.*, 2020). In particular, these evaluations point to a positive impact on employment. As regards participation in competitiveness clusters (*Pôles de compétitivité*), it has been shown that this has a positive impact on R&D expenditures (Bellégo & Dortet-Bernadet, 2014) using a matching method and a difference-in-differences estimation, but this impact is expected to differ depending on the type of cluster (Ben Hassine & Mathieu, 2017). More generally, other studies have focused on the overall impact of French R&D support schemes. By combining a labour demand model with a matching method, Dortet-Bernadet & Sicsic (2015) show that R&D support has a positive impact on skilled employment within SMEs. Other evaluations of French innovation support schemes have also been carried out as part of the evaluation plan of the French RDI state aids (see Charpin, 2020), including those of Bpifrance's innovation support or R&D projects support.

In 2013, the CIR was extended to include innovation expenditures by SMEs through the innovation tax credit (CII). The CII tax base is made up of expenditure on prototypes design or pilot plants for new products up to a limit of 400,000 euros per firm per year; it has a rate of 20%. In particular, this tax credit covers personnel costs and depreciation expenses linked to these activities. However, the tax bases considered for the CIR and the CII are disjointed, as they refer to different types of activities: one further upstream in the RDI process and the other further downstream. The purpose of the CII is to supplement the CIR by promoting the economic development of a technology once the CIR has promoted its experimental development. During its first two years of existence, the CII reached 6,574 SMEs with a total amount of 203 million euros in tax credits and an average annual claim of 22,000 euros.

Since the CII is a recent scheme, as far as we are aware it has not yet been evaluated. This evaluation aims to fill this gap. We start by looking at the broader economic development of the beneficiary firms by comparing them to similar SMEs that have not benefited from the CII. We study the effects of the introduction of the scheme on aspects such as employment, turnover and investment. Since the aim of the CII is to contribute to the development of the innovation activities of firms and the introduction of new products onto the markets, we go on to analyse

the differences in the changes in the number of products produced by firms that benefited from the scheme and comparable firms that did not benefit from it. To the best of our knowledge, an empirical study looking at the impact of a public R&D and innovation support scheme on the introduction of new products onto the market is the first of its kind within the literature. Looking beyond the methodological innovation, which is based on the use of product data, this aspect is particularly important for studying the CII, which is aimed at encouraging its beneficiaries to create new products. Finally, the question as to the position of this scheme within the very dense panorama of French RDI support is essential for guiding public policies. That is why we are interested in the way in which it interacts with the CIR, in particular to measure whether there has been a possible substitution effect between the two schemes.

Section 1 describes the scheme and provides a few descriptive statistics. Section 2 describes the methodology used in this evaluation: difference-in-differences after matching. Finally, Section 3 describes our findings.

1. Description of the Scheme

1.1. Measurement

The innovation tax credit (CII) is an extension of the research tax credit (CIR) aimed at SMEs;[1] its base is made up of innovation expenditure relating to prototypes design or pilot plants for new products up to a limit of 400,000 euros per firm per year and at a rate of 20%. This tax base includes internal expenditures, particularly in relation to employment and fixed assets, as well as subcontracted expenditures. The declaration to the tax authorities is made alongside the CIR one, but the tax bases for the eligible expenditures of the two schemes are separate. In addition, if the tax credit received under the CIR or the CII exceeds the amount of corporate tax, the surplus (or the entire amount if the SME is exempt from paying tax) gives rise to a refund by the Directorate-General for Public Finance (*Direction Générale des Finances Publiques*, DGFiP). This refund can be paid immediately if the beneficiary SME applies to the tax authorities.[2]

The new product that is the result of the innovation process entitling the firm to the CII must be distinguishable from reference products on the market (the firm's competitors) by virtue of its superior performance in terms of technology, functionality, ergonomics or eco-design at the date on which work began. Innovations with regard to services, processes, organisation or marketing methods are excluded from the scheme. The aim of the CII is therefore to help to improve the performance of a product with a view to launching it on the market, while the CIR aims to remove a technological barrier by advancing the state of scientific and technical knowledge available at the start of the work. The CII therefore supplements the CIR by promoting the economic development of a technology once the CIR has promoted its experimental development. As a result, the CII appears to come into play further downstream of the innovation process, while the CIR is more upstream. By design, these two tax credits are therefore, *a priori*, complementary. However, although positive externalities seem to be brought about by the CIR, via the conditioning of the eligibility of expenditure on the objective of progressing scientific and technical knowledge of a technology, the existence of these externalities seems more difficult to envisage in the case of the CII, which is aimed at the design of a prototype or a pilot plant for a new product within a firm. Overall, the CII is an original support scheme for R&D and innovation, from the point of view of its main objective of product development, the nature of the expenditures that are eligible, which arises relatively late in the R&D process, and the small number of positive externalities generated around the beneficiaries.

The main objective of the CII, as expressed in the French Finance Act for 2013, by means of which the scheme was introduced,[3] is to "boost the competitiveness of innovative SMEs" by encouraging the creation of new products and thereby promoting the economic value of research and development (R&D) activities. In particular, on this second point, the need to develop innovation efforts was illustrated by the 2011 Innovation Scoreboard within the European Union, according to which "fewer than one third of French SMEs have implemented a product or process innovation, compared with 54% of German SMEs", a gap that remains significant to this day. This gap can be partly explained by sectoral considerations, since the German economy is more heavily weighted towards the manufacturing industry when compared with

1. The CII is reserved for firms that meet the definition of micro, small and medium-sized firms given in Annex I to Commission Regulation (EU) No 800/2008, i.e. firms that employ fewer than 250 people and that have an annual turnover of no more than 50 million euros or an annual balance sheet total not exceeding 43 million euros.

2. 70% of those who benefited from the CII in 2013 or 2014 made use of this immediate repayment option.

3. Review of the first part of the draft French Finance Act for 2013 – Volume II: General conditions for financial balance.

other European countries, and manufacturing is a highly innovative sector. Although, for example, Balcone & Schweitzer (2019) show that sectoral composition has a strong impact on the level of R&D expenditures, sectoral composition seems less relevant to explain differences in terms of innovation, as suggested by Duc & Ralle (2019). Indeed, German firms are generally more innovative and introduce more new products than those in other European countries, but the sectoral structure only seems to explain a small part of this gap, as does the structure in terms of firm size. The propensity of SMEs to launch new products is therefore more likely to be explained by factors related to the innovation process. Supporting innovation expenditures with a tax incentive remains a peculiarity, even if some countries have introduced similar schemes, particularly Spain, which provides a tax credit of 12% on technological innovations.

1.2. Data

We have the list of firms that have benefited from the CIR or the CII and the amount of the tax credit granted to them each year, as well as all of the information contained within their CIR declarations (CIR management database, Gecir). This allows us to identify the beneficiaries of the CII, as well as the SMEs that have benefited from the CIR but did not apply for the CII following its creation. The R&D survey also allows us to identify firms that were likely to conduct innovation activities prior to the creation of the CII. We match these data with the firm's annual accounting data (turnover, total assets, gross operating surplus, investment, debt, etc.) taken from the Fare files in order to study the effects of the scheme on these variables. These data are enriched by the annual social data declarations (DADS), which provide data on employment and wages for each firm. Possible group membership is taken into account by making use of the financial links between firms (Lifi). Finally, the use of data from the *Atlas des brevets* (Patent atlas) allows us to study the innovation activity of firms, and the *Enquête annuelle de production* (Annual production survey) allows us to study the change in the number of products manufactured by categories of products and by firm within the manufacturing industry. These various data sources are described in more detail in the Online Appendix C1 (link at the end of the article).

1.3. Descriptive Statistics

The annual amount of the CII increased between 2013 and 2014, as did the number of beneficiaries (Table 1), reflecting the gradual appropriation of the scheme by firms. The increase in the total amount of CII granted can be explained by both the increase in the number of beneficiaries and the increase in the average amount: the total amount increased by 40% between 2013 and 2014, yet the number of beneficiaries only increased by 29%, while the average amount increased by 12% over the same period. The total amount of innovation expenditures declared was 635 million euros in 2014; the proportion of firms reaching the cap for innovation expenditures of 400,000 euros was low (3%), which resulted in an effective average tax credit rate of 23%. It is therefore mainly small SMEs that benefit from the CII, for which the amount received is economically significant: for SMEs with fewer than 5 employees, which represented 27% of the beneficiaries in 2014, the amount of the CII represents 8% of their turnover on average.

In 2014, three industries received 87% of the total amount of the CII (Table 2): information and communication (38% of the total amount of the CII), manufacturing (28%) and professional, scientific and technical activities (21%). If we look at the number of beneficiaries, 84% of them belong to one of these three industries: 32% belong to information and communication, 30% to manufacturing and 22% to professional, scientific and technical activities. These three industries are also the ones that have the highest proportion of innovative firms according to Insee's Innovation survey (Clément & Petricã, 2017). Although the three industries receiving the greatest amounts from the CII are also the ones that receive the greatest amounts from the CIR, their weightings differ depending on the type of tax credit considered. Indeed, in the case of the CIR, the professional, scientific and technical activities industry receives 37% of the CIR granted to SMEs, while the information and communication industry receives 27% and the manufacturing industry 25%.

Table 1 – **Number of beneficiaries and annual amounts of CII**

	Number of beneficiaries	Total tax credit granted (€ million)	Average tax credit granted (€ thousand)
2013	4,092	83	20
2014	5,286	120	23

Sources: DGFiP-MESRI, GECIR database (2013-2014).

Table 2 – **Sectoral distribution of beneficiaries of the CII and amounts of CII and CIR granted to SMEs in 2014 (as a %)**

	Number of beneficiaries of the CII	Amount of CII granted	Amount of CIR granted to SMEs
Information and communication	32	38	27
Manufacturing	30	28	25
Professional, scientific and technical activities	22	21	37
Wholesale and retail trade, repair of motor vehicles and motorcycles	8	7	5
Other	8	6	5
Total	100	100	100

Sources: DGFiP-MESRI, GECIR database, Insee, FARE database.

In 2014, the average amount of tax credit received by each firm benefiting from the CII was 23,000 euros (Table 3). These beneficiary firms have a median workforce of 10 employees and are generally larger than other SMEs. In comparison, firms with fewer than 10 employees represent 93% of the SMEs across the whole French economy. Across the economy as a whole, the total workforce employed by the firms benefiting from the CII is 106,000. The median age of a firm benefiting from the CII is 10 years.

Of the firms benefiting from the CII, 57% also declare R&D expenditures within the scope of the CIR, which corresponds to an average amount of 82,000 euros for the CIR. All in all, these SMEs that combine the CIR with the CII account for 15% of the amount of the CIR granted to SMEs. They have a higher level of employment than those that benefit solely from the CII. SMEs that benefit solely from the CII are smaller than those that benefit solely from the CIR.

The firms that benefited from the CII in 2014 had an average turnover of 3.6 million euros (Table 4), which represents a total turnover of 18.6 billion euros. Almost a quarter (22%) of that total turnover is achieved through exports. Those same firms generate a total value added of 7.1 billion euros, corresponding to 0.33% of GDP. Of those firms, 64% have a positive gross operating surplus and 91% generate positive value added. These figures are slightly higher than those for SMEs benefiting solely from the CIR in 2014, 58% of which had a positive gross operating surplus and 87% generated positive value added.

The average investment ratio[4] was 6%. The aggregated investment ratio for all beneficiaries of the CII was 8%, compared to 9% if all of the SMEs benefiting from the CIR are taken into account. These figures are lower than the investment ratio for all business sector in 2014,

4. The investment ratio is defined as the ratio of gross tangible investments excluding contributions to value added.

Table 3 – **Main characteristics of SMEs benefiting from the CIR or the CII in 2014**

	Number of beneficiaries	Age (years)	Number of employees (FTE)		Amount of CIR granted (€ thousand)	Amount of CII granted (€ thousand)
	Total	Median	Mean	Median	Mean	Mean
CII	5,286	10	21	10	47	23
of which CII only	*2,272*	*10*	*16*	*7*	-	*24*
of which CIR and CII combined	*3,014*	*11*	*25*	*13*	*82*	*22*
CIR only	12,992	10	22	9	107	-

Sources and Coverage: DGFiP-MESRI, GECIR database, Insee, DADS, FARE, SIRUS. SMEs benefiting from the CIR or the CII in 2014.

Table 4 – **Accounting data and financial ratios of firms benefiting from the CII in 2014**

	Mean	Median	Standard deviation
Turnover (€ thousand)	3,576	1,246	6,092
Export sales (€ thousand)	784	15	2,542
Gross operating surplus (€ thousand)	158	39	1,086
Value added (€ thousand)	1,367	593	2,217
Debt (€ thousand)	566	139	1,742
Equity (€ thousand)	1,405	427	5,233
Investment rate (%)	6.2	1.9	12.0

Sources: DGFiP-MESRI, GECIR database, Insee, FARE. SMEs benefiting from the CII in 2014.

which stood at 18% (Insee, 2016). However, this difference can probably be explained by the fact that those benefiting from CII are SMEs, which generally invest less than intermediate-sized firms and large firms. In 2014, 61% of firms with between 1 and 9 employees had non-zero investment, compared with 96% of firms with 250 or more employees (Insee, 2016). This low investment ratio could also be explained by investments that are more targeted on intangibles for the less advanced stages of product development. Finally, it should be noted that 30% of those benefiting from the CII in 2014 belonged to a fiscal group.

2. Methodology

This section details the methodology applied in our evaluation, which is based on usual public policy evaluation methods (Givord, 2014).

2.1. Empirical Approach

When assessing the effect of a scheme on various indicators, it is not enough to simply compare the changes in these indicators for beneficiaries of the scheme to the changes for those that did not benefit, since the very fact of benefiting from the scheme is often not random: it is often the most dynamic firms that have the greater probability to ask for a tax credit. In order to correct for this selection bias, methods have been developed to control for observable differences between beneficiaries and non-beneficiaries.

In this evaluation of the CII, the treated firms ($T_i = 1$) are defined as those that benefited from the CII in 2013 or 2014 and the non-treated firms ($T_i = 0$) are those that did not benefit. We have accounting and employment data, as well as data relating to patents or CIR, which allows us to control for observable differences between the beneficiaries (treated firms) and non-beneficiaries (non-treated firms) in an attempt to identify a causal effect of the CII on the beneficiary firms. This requires that the following conditional independence assumption be met:

$$Y_i^0 \perp T_i \mid X_i$$

where Y_i^0 is the variable Y when firm i is not treated and X_i is a vector of observables relating to firm i. This means that, conditionally on the observable characteristics X, the evolution of firms that have not benefited from the scheme provide a good prediction of the potential evolution of the beneficiaries, had they not benefited of the scheme. This is a strong assumption. It reflects the fact that, apart from the observable characteristics X, there are no other characteristics that influence both future developments and the choice of treatment.

In order to control for observable characteristics, we use observable matching methods, which allow us to establish a control group that is close, in statistical terms, to the treated firms. This will allow us to evaluate the impact of the scheme on the treated firms by comparing the differences in the evolutions of the variables of interest in the two groups following the treatment. Due to the vast array of data and in order to make the best use of the information in order to create a control group, we have chosen to use propensity score matching methods (Rosenbaum & Rubin, 1983). The propensity score is defined as the probability of being treated depending on the observable characteristics $p(X_i) = \mathbb{P}(T_i = 1 \mid X_i)$. Rosenbaum and Rubin (1983) show that if the outcome variable Y^0 is independent of the treatment T conditionally on the observable characteristics X, it is also independent from T conditionally on the propensity score $p(X)$. The matching method therefore consists of matching treated firms with non-treated firms that have similar propensity scores.

2.2. Control Group and Data Cleaning

The CII is a tax credit aimed at SMEs that are likely to engage in innovative activities; however, this ability to engage in innovation cannot be observed empirically. In order to build a control group of firms *a priori* of this type, before matching, we restrict ourselves to SMEs that benefited from the CIR at least once between 2009 and 2012 and/or that appeared in the R&D survey at least once between 2004 and 2012. Since the sampling frame for the R&D survey was established in such a way as to only select firms that undertake R&D activities by identifying them on the basis of the public support that they receive (CIR, ANR, JEI, etc.), the inclusion of a firm within that survey reflects its proximity to the innovation process.

In order to study the effect of the scheme, we need to follow the evolution of a set of variables, both among the beneficiaries (treated firms) and non-beneficiaries (non-treated firms). As a result, the overall sample is limited to firms for which data are available for each year of the period from 2009 to 2016. The choice of 2009 as the first year of our panel results from a trade-off between having a number of years before the introduction of the CII that is *(i)* sufficient to test the assumption that there is a common trend between the treated group and the control group, and *(ii)* small enough to still include a

large enough number of beneficiaries. We therefore finally end up with a balanced panel for the period from 2009 to 2016 with one fewer year for employment data (2009-2015). This restriction is not without consequence for the sample of beneficiary SMEs actually studied in the rest of this article. Indeed, according to tax data, 6,574 SMEs benefited from the CII at least once in 2013 or 2014. Of those 6,574 SMEs, 5,594 appear in the DADS and Fare databases for the year 2012. By applying the condition of the availability of data relating to 2009-2016, the number is limited to 2,908 beneficiary SMEs. These latter two sub-samples of treated firms are described in Table 5. The firms that are ultimately selected are older on average, with the year of creation shifting from 1998 in the raw sample to 1993 in the cleaned sample. With the exception of debt and the amount of the CIR, all of the economic characteristics set out in the table are greater in magnitude in the final sample than in the raw sample: employment, turnover, gross operating surplus, equity and investment. As regards the non-recipient firms, these conditions reduce the size of the sample from 24,295 to 12,844 units.

Nevertheless, the condition of proximity to the innovation process referred to above is not adequate to ensure a similar dynamic between the treated group and the control group established in this manner prior to the introduction of the CII. Indeed, Figure I shows the changes in employment and turnover within the group of CII beneficiaries and in the control group before matching. It can quite clearly be seen that, prior to the introduction of the CII, the characteristics of the two groups do not follow the same trend, which justifies the need to make use of a matching method.

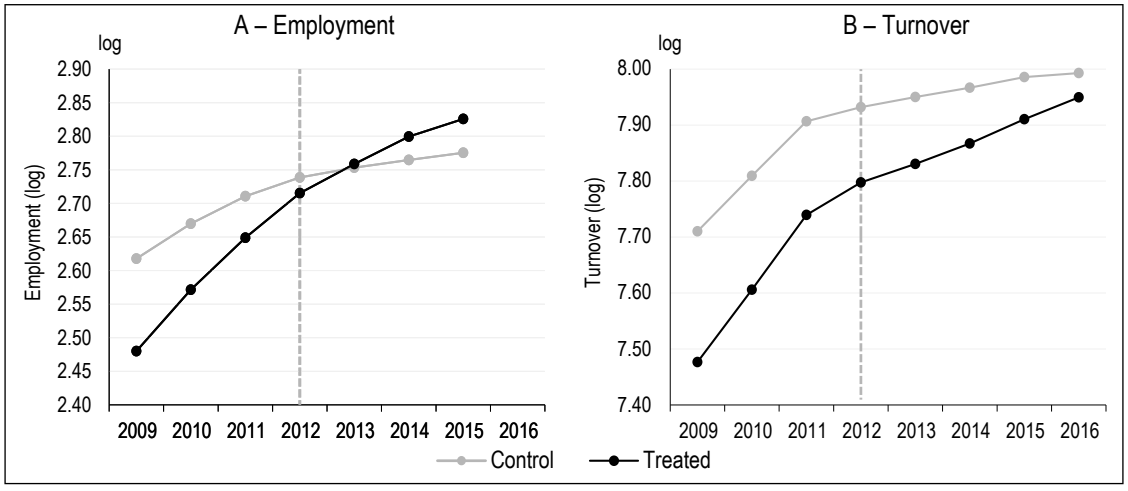
In order to calculate the propensity score, we use level variables, calculated over the year 2012, and change variables, over the period 2009-2012. The control variables used are listed in Table 6. These controls include standard variables relating to employment, accounting data and the intrinsic characteristics (sector, age) of the firms. Since the CII is an extension of the CIR,

Table 5 – **Descriptive statistics for the beneficiaries**

	Raw data			Final data		
	Mean	Standard deviation	Median	Mean	Standard deviation	Median
Turnover (€ thousand)	3,766	6,532	1,374	4,937	6,294	2,521
Gross operating surplus (€ thousand)	189	954	52	358	814	129
Workforce (FTE)	21	30	10	27	31	15
Debt (€ thousand)	525	1,598	113	521	1,020	151
Equity (€ thousand)	1,370	5,812	404	1,687	2,713	751
Investment (€ thousand)	113	595	14	140	390	27
Date of creation	1998	14	2002	1993	15	1997
Amount of CIR granted (€ thousand)	56	141	21	55	101	24
Number of observations	5,594			2,908		

Notes: Gross tangible investments, excluding contributions are taken into consideration here.
Sources: DGFiP-MESRI, GECIR database, Insee, FARE (2012).

Figure I – **Changes in variables in the treated and control groups**



Sources and Coverage: DGFiP-MESRI, GECIR database; Insee, DADS, FARE. SMEs that are and are not benefiting from the CII before matching.

Table 6 – **Control variables for estimating the propensity score**

Variable	Specification	Source
Employment	2012 level and change from 2009 to 2012	DADS
Share of technical employment	2012 level and change from 2009 to 2012	DADS
Turnover	2012 level and change from 2009 to 2012	FARE
Total assets	2012 level and change from 2009 to 2012	FARE
Debt ratio	2012 level and change from 2009 to 2012	FARE
Investment ratio	2012 level and change from 2009 to 2012	FARE
Gross operating surplus	2012 level and change from 2009 to 2012	FARE
Business sector	Categorical variable	FARE
Year of creation	Quantitative variable	FARE
Fiscal group membership	Indicator for fiscal group membership 2009-2012	LIFI
Number of patents	Mean and change from 2009 to 2012	*Atlas des brevets*
Amount of CIR granted	Total amount for 2009-2012	GECIR
Beneficiary of the CIR	Indicator for beneficiaries of the CIR 2009-2012	GECIR
Exposure to the CICE	Share of wages below 2.5 times the minimum wage in 2012	DADS

the propensity to benefit from the CII risks being strongly linked to the fact of benefiting from the CIR, which is why we control for the amount received from the CIR and an indicator for firms benefiting from the CIR. Finally, we also control for the number of patents filed, whether or not the firm belongs to a group, and exposure to the tax credit for competitiveness and employment (*crédit d'impôt pour la compétitivité et l'emploi*, CICE; exposure is defined as the share of the wage bill that corresponds to jobs for which the salary is below 2.5 times the minimum wage as of 2012). The interactions between these variables are incorporated into the model used to estimate the propensity score.

More precisely, the propensity score is estimated using a linear *logit* model:

$$\hat{p}(X) = \frac{1}{1 + e^{-\hat{\beta}X}}$$

Once the propensity score has been estimated for each SME, there are several methods that can be used to establish a control group that is effectively comparable to the treated group (Quantin, 2018). For each treated firm, we select the non-treated firm with the nearest propensity score, with a strict condition that it belongs to the same business sector as the treated firm. In order to test the robustness of our results, we will propose other matching methods that link more than one non-treated firm to a treated firm. Balance tests allow us to verify the quality of matching. Rosenbaum & Rubin (1985) introduce in particular the standardised difference in mean values between the treated group and the control group:

$$\frac{\overline{X_t} - \overline{X_c}}{\sqrt{\frac{s_t^2 + s_c^2}{2}}}$$

where $\overline{X_t}$ and $\overline{X_c}$ correspond to the means for the variable X respectively within the treated group and the control group, while s_t^2 and s_c^2 are the variances within these two groups for the variable X. The standardised difference in the mean values is used in particular as, unlike statistical tests on the difference in mean values, no account is taken of the size of the sample. Since matching significantly reduces the size of the control group, a measure that allows us to disregard the sample size seems indispensable. Quantin (2018) also suggests comparing the variance ratios before and after matching in order to more closely analyse the distribution of the covariates. The thresholds of 0.2 and 2 are often used to consider the balancing property to be verified for the standardised difference in means and the variance ratio, respectively (Rubin, 2001).

The level variables that are strictly positive (employment, turnover) are considered in logarithmic form, as is the total amount of CIR received between 2009 and 2012. The intensive variables (share of technical employment, debt ratio, investment ratio) are considered directly in the matching. Technical employment is defined as the sum of the number of employees in the "engineers and firm technical executives" (38) and "technicians" (47) socio-professional categories. The debt ratio is defined as the ratio of total debt to the firm's equity, while the investment ratio is defined as the ratio of gross tangible investments excluding contributions to value added. The sample of 2,908 beneficiary SMEs referred to above only includes those firms that have investment and debt ratios that are positive or zero. Observations for which the debt ratio has not been defined (zero equity) are also removed. The gross operating surplus variables take on positive or negative values.

Annual deciles are therefore constructed for this variable. Finally, other variables (year of creation, fiscal group membership, business sector, number of patents, share of technical employment, beneficiary of the CIR between 2009 and 2012, exposure to the CICE) are used without adjustment.

Each beneficiary firm is matched with a non-beneficiary firm via the estimated propensity score, with an additional condition that the business sectors are strictly equal at NACE level A10. The assumption of common support prior to matching is verified (cf. Figure A-I in the Appendix). If there are no SMEs within the control group that belong to the same business sector and have a propensity score that is sufficiently similar to that of a treated unit (difference of less than 0.05 times the standard error of the propensity score), the beneficiary SME is not retained. In addition, in the event that several SMEs within the control group have propensity scores that are extremely close (difference of less than 10^{-20}), the close units are selected and weighted by the inverse of the number of units within the control group selected for the same firm within the beneficiary group. We end up with 2,860 beneficiary firms compared with 2,870 within the control group, 20 of which are weighted at 0.5.

Figure II shows the checks carried out on the balancing property of matching for all of the variables described in Table 6, in levels for 2009-2012. The standardised difference in mean values between the two groups is presented for each variable, before and after matching. The balancing property for all of the pre-treatment observable variables is verified.[5]

2.3. Estimation of the Effects of the Scheme

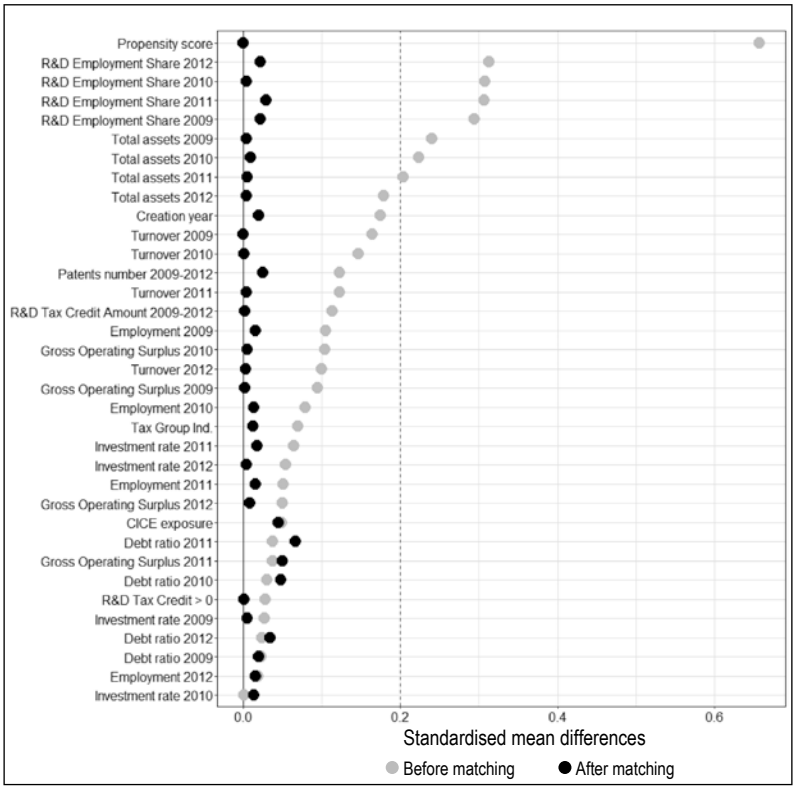
Once the control group has been built, an estimate is made of the differences in the changes in the variables of interest between beneficiaries and non-beneficiaries using the difference-in-differences method. The specification used is as follows:

$$log\, Y_{it} = \alpha + \beta_t T_{it} + \mu_t + \lambda_i + \epsilon_{it} \quad (1)$$

where T_{it} corresponds to the fact that the firm i belongs to a treated group and that the observation is taken at year t. In order to measure the cumulative impact with respect to the year in which the treatment was implemented (2013), the variable T_{i2012} is omitted from the regression.

5. We have also verified the similarity of the distributions of the two groups after matching by means of Kolmogorov-Smirnov tests. For all of the variables shown in Figure II, the similarity between the distributions of the two groups can never be rejected, except for the debt ratio.

Figure II – **Standardised difference in mean values before and after matching**



Notes: The dotted line at 0.2 corresponds to the maximum value of the differences recommended by Rubin (2001).
Sources: DGFiP-MESRI, GECIR database; Insee, FARE.

This specification serves two purposes. Firstly, it allows us to estimate an average impact of the treatment on the treated firms for each year: we can therefore identify different dynamics depending on the variable of interest under consideration. Secondly, it allows us to verify that the treatment does not have any impact prior to the introduction of the scheme and therefore to verify that the common trend assumption, which is central to difference-in-differences models, is duly verified. In addition, the term λ_i allows us to control for characteristics that are non-observable and remain stable over time for each firm, and the time fixed effect μ_t allows us to control for temporal and non-observable heterogeneity that could affect all firms in t, in so far as the assumptions inherent in the propensity score matching methods are verified. The coefficient β_t therefore represents the effect of the treatment on the beneficiaries for the year t.

As we have previously mentioned, the estimates are only based on a sub-sample of firms benefiting from the scheme. The firms that are excluded are young firms created between 2009 and 2012, which represent 22% of all those benefiting from the CII, or firms that ceased to exist before the end of the period (cessation of activity, buyout),[6] which represent 4.8% of all those benefiting from the CII, or firms created after the introduction of the CII, which represent 0.8% of all those benefiting from the CII. The other firms are excluded from the analysis due to a one-off lack of data. As a result, the data cleaning mainly leads to the exclusion of firms less than 3 years old created prior to the introduction of the CII from the analysis.

3. Results

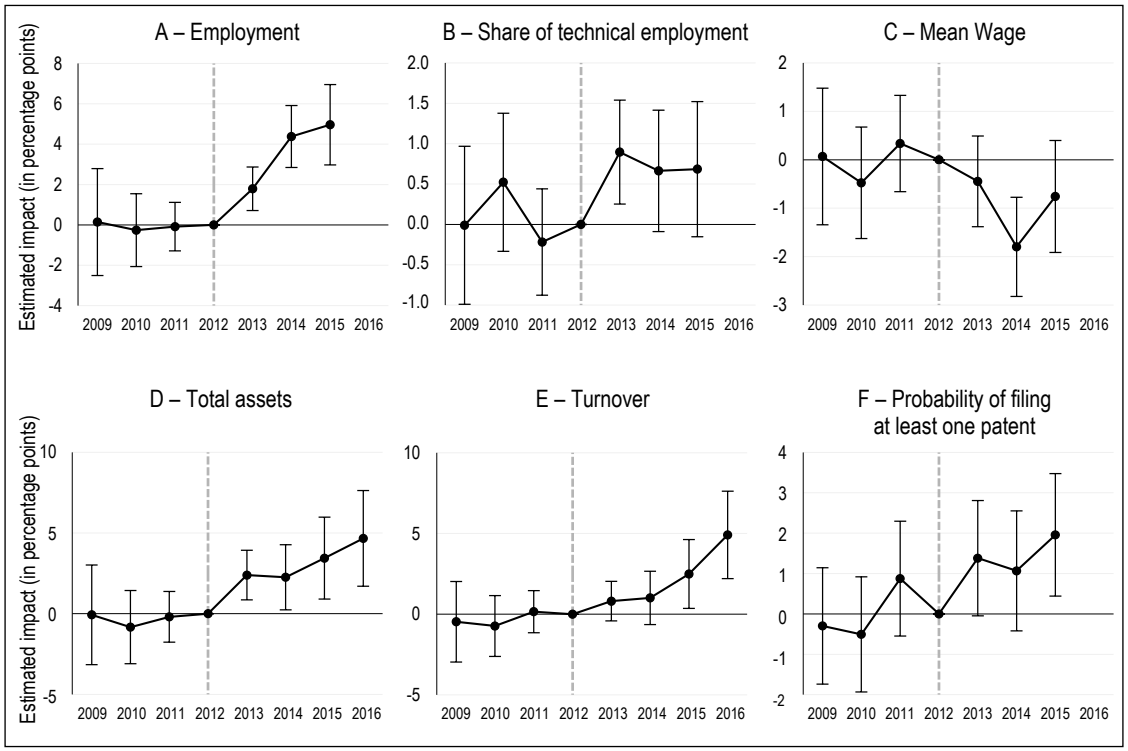
In this section, we present our findings with regard to the various indicators selected and the associated robustness checks.

3.1. Economic Development of Beneficiary Firms

We start by looking at the economic development of the firms benefiting from the scheme in the broad sense. The differences between the treated group and the control group are estimated based on the regression equation (1). Figure III shows the estimates obtained. The coefficients correspond to the mean impact of treatment on the treated firms for a given year t. The coefficients for 2009, 2010 and 2011 are statistically non-significant and allow us to test the assumption of

6. Our criterion for this point is that the firm no longer appears in the Fare file with effect from a given year, any time after 2012.

Figure III – **Estimation of the effects**



Reading note: The vertical bars represent the 95% confidence intervals. The vertical dotted line indicates the last year before the introduction of the CII (2013).
Sources and Coverage: DGFiP-MESRI, GECIR database; Insee, DADS, FARE; MESRI, Atlas des Brevets, authors' calculations. SMEs benefiting from the CII and comparable non-beneficiaries.

a common pre-treatment trend for the variables of interest. Figure A-II in the Appendix shows the development of six variables of interest in the treatment group and the control group and Table A-1 shows the results of the regression.

As 93% of the expenditure declared within the scope of the CII in 2014 was linked to personnel costs (cf. Figure A-III in the Appendix), we start by looking at the impact on employment. Figure III-A shows the estimates regarding the change in the employment gap between the matched beneficiary and non-beneficiary firms. A higher level of employment is observed from the first year of the scheme for the beneficiary firms. The gap between the two groups widens over time, increasing from 1.8 percentage point in 2013 to 4.4 percentage points in 2014 and 5.0 percentage points in 2015.

Figure III-B shows the estimates for the change in the share of technical employment, i.e. the proportion of employees likely to undertake RDI activities (technicians, engineers and firm technical executives). This proportion increases more rapidly for the group that benefited in 2013. This difference between the beneficiary group and the non-beneficiary group becomes insignificant at the 5% threshold from 2014 onwards, although the magnitude of the coefficient remains the same. Conversely, the mean wage (Figure III-C) increases more slowly in beneficiary firms than it does in the others, with a significant gap in 2014 of around 1.8 percentage points. Knowing that the beneficiary firms demonstrated a greater increase in employment than the others; that lower increase in wages may stem from the fact that the new employees hired have lower average wages than existing employees.

As regards the financial development of the firms, Figure III-D shows the change in the total assets. As with employment, an immediate, stronger change can be observed within the beneficiary group, which increases over time from 2.4 percentage points in 2013 to 4.7 percentage points in 2016.

We observed a greater increase in the turnover of the beneficiary firms, which increases in magnitude over time: insignificant in 2013 and 2014, it increased to 2.5 percentage points in 2015 and then to 4.9 percentage points in 2016 (Figure III-E). In the medium term, it therefore appears that those benefiting from the CII are experiencing greater increases in their sales. The slow emergence of the gap between the two groups could be the result of the time needed to produce a prototype and then bring a new product to market.

With the exception of the share of technical employment, the variables studied so far are not *a priori* directly linked to the implementation of an innovation process within the firms. For that reason, we will now turn our attention to the interaction between the CII and RDI activity. The filing of patents is a possible outlet for the innovation activity promised by the CII and, as such, expenditure on filing and defending patents is included in the eligible expenditures under the CII. Although the filing of patents does not capture all of a firm's innovation activity, it is still an interesting indicator. Figure III-F shows that the change in the probability of filing at least one patent between 2012 and 2015 is slightly higher for the beneficiary firms when compared with matched non-beneficiary firms.

3.2. Robustness

We saw in Section 2.2 that the sectoral matching was carried out at level A10 of the NACE classification of activities. Although the choice of classification level may seem coarse, it results from a trade-off between having sufficient sectoral similarity between beneficiaries and non-beneficiaries and having a sufficient number of non-beneficiary firms within each sector that have a propensity score that is close enough to each beneficiary for the two groups to be effectively comparable. In order to ensure that the findings presented are not solely due to this choice of classification level, we repeat our estimates taking into consideration a stricter matching at the finest level of the NACE in each case. The findings (presented in the Appendix in Table A-2) are very close to those obtained in Table A-1. However, we still see a positive impact on the investment ratio in the short term. Since the nature of investments is specific to each business sector, it is possible that the overly coarse classification level leads to a failure to highlight an impact on the investments made by beneficiary firms in the short term. A second way to test the robustness of the findings obtained is to match each treated firm with several firms from the control group. We therefore perform matching on the closest 2 and 3 neighbours for each firm that benefited from the CII (Tables A-3 and A-4 in the Appendix). The assumptions of a common trend from 2009 to 2012 are verified, with the exception of the probability of filing a patent in 2011-2012 in the matching with 3 closer neighbours. Once again, the findings obtained are broadly similar to those presented in Table A-1; however, there is a gap, which in this case persists over time, between the beneficiary

and non-beneficiary groups with regard to the share of technical employment.

As mentioned above, the CII is an extension of the CIR to cover innovation expenditure. Although an indicator showing participation in the CIR is present in the calculation of the propensity score, there is no *a priori* guarantee that the matched SMEs actually behaved in the same way as regards the CIR prior to 2012. We therefore add a strict condition to the matching regarding the fact of benefiting from the CIR at least once between 2009 and 2012 (Appendix, Table A-5). The assumptions of a common trend from 2009 to 2012 are verified, and the estimates obtained are similar with, once again, a slight difference regarding the continuing effect of the share of technical employment.

We then use an alternative matching method to the nearest neighbours on the basis of propensity scoring, namely the weighted adjustment method (Quantin, 2018). This approach makes use of all of the non-treated units within the control group, i.e. all of the non-beneficiary SMEs for which the propensity score has been estimated. For this approach, the units within the control group are weighted by $p(X)/(1-p(X))$ in order to estimate the impact of the treatment. With this specification, the common trend assumption is no longer verified for employment, the total assets and the investment ratio (see Appendix, Table A-6). The findings obtained for the other variables remain close to those presented in Section 3.1 with a few exceptions: once again, a significant positive difference remains between the treated group and the control group as regards the share of technical employment and the likelihood of filing a patent. The difference in the mean wage is negative and significant across the entire period from 2013 to 2015.

As we saw in Section 2.2, the fact that we studied the period from 2009 to 2015 significantly reduced our sample of beneficiary firms, which fell from 5,594 units to 2,908. In order to increase the number of beneficiary SMEs taken into account, we slightly relaxed this condition and worked only with the period from 2011 to 2015. For this period, we only require the existence of the employment variables, the total assets, the turnover, the creation date and the business sector. Our sample of beneficiary SMEs increases by around 1,000 units, growing to 3,821 SMEs, 3,808 of which are effectively matched. For this new sub-population of beneficiaries, the common trend assumption for 2011-2012 is verified for all of the variables (Appendix, Table A-7). In this case, the difference in employment growth between the treated group and the control group during the period from 2012 to 2015 is 7.3 percentage points, compared with 5.0 percentage points in the main specification (see Table A-1). Once again, the gap in the share of technical employment persists over time. No significant difference is observed between the treated group and the control group in connection with the probability of filing a patent. The positive and significant differences in the total assets and the turnover are observed once again. The estimated impact is slightly greater than for the main specification, which confirms the assumption that it underestimates the relative impact on all of the beneficiary firms since it is restricted to larger firms.

3.3. New Products

The evaluation prior to the introduction of the CII[7] stresses the importance of "boosting the competitiveness of innovative SMEs [...] by means of a targeted measure allowing them to benefit from the CIR in respect of expenditure on the creation of prototypes or pilot plants for new products". Therefore, looking beyond the overall economic development of the beneficiary firms, an expected purpose of the CII is the development of new products by the beneficiary firms.

In order to examine this angle, we make use of data from the *Enquêtes Annuelles de Production* (Annual Production Surveys, EAP). A product can be defined at different levels of the PRODFRA nomenclature. More specifically, the nomenclature in which the products manufactured are recorded comprises four levels; we are studying the finest three of these levels. It is possible to illustrate these different levels using an example: the finest level of the nomenclature, the Product level (hereinafter referred to as the fine level) will distinguish between "Terracotta floor and wall tiles" and "Earthenware floor and wall tiles", the products classes level (hereinafter referred to as the intermediate level) will group them together into the "Ceramic tiles" class. The products groups level (hereinafter referred to as the aggregated level) will consider "Terracotta construction materials" as a whole. In order to monitor the products in a homogeneous manner, we establish stable product envelopes at each nomenclature level. During the period from 2009 to 2016, this amounts to 4,429 distinct products at the fine level, 243 at the intermediate level and 98 at the aggregated level.

7. *Preliminary evaluations of the Articles of the draft French Finance Act for 2013 – Article 55.*

In accordance with the coverage of the EAP surveys, we limit ourselves to the industrial sector, which, of course, reduces the number of observations in the treated group. In addition, we impose the condition that the firms must be present every year from 2009 to 2016 in order to obtain a balanced panel, as we did for the previous sections. These beneficiary firms are described in Table 7. It can be seen, for example, that the average level of employment among beneficiary firms in the manufacturing sector is 45, compared with 27 for beneficiaries in all sectors considered together. The firms benefiting from the CII manufactured an average of 2 products in 2012, regardless of the nomenclature level considered.

As before, we perform matching across all of the economic variables presented in Section 2.2 and described in Table 6, before then adding the number of different products manufactured by the firm. The verification of the balancing property before and after matching is shown in the Appendix (Figure A-IV). As was the case in Section 3.1, we then estimate the impact using the equation (1).

The findings of these regressions are presented in Figure IV and in Table A-8 in the Appendix. Regardless of the aggregation level considered, it can be seen that the common trend assumption is duly verified. At the fine level (Figure IV-A), the difference is never significant at 5%. For the intermediate and aggregated levels of the product definition (Figures IV-B and IV-C, respectively), the difference is positive and significant from 2015 onwards and remains so until 2016, when it reaches 0.0977 more products at the intermediate level and 0.0827 more products at the aggregate level among the beneficiaries of the CII. By using the alternative weighting adjustment method (Appendix, Table A-9), the estimated coefficients remain significant at the intermediate and aggregated product definition levels, but not at the fine level.

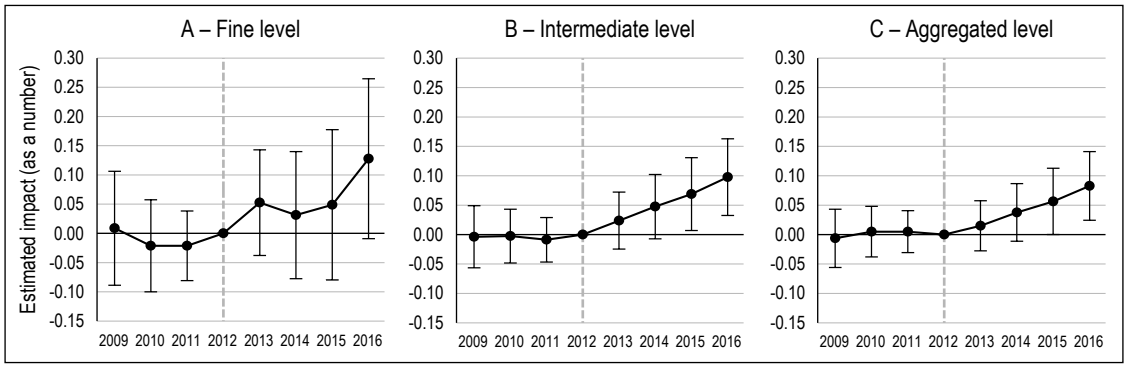
These results reflect the ability of the beneficiary firms to offer additional products that are fairly different (within the meaning of the nomenclature used) from the products they offered prior to the introduction of the CII. Indeed, the gap remains and even increases in magnitude at the lowest level of aggregation, which suggests that

Table 7 – **Descriptive statistics for the beneficiaries – Industrial Sector (2012)**

	Mean	Standard deviation	Median
Turnover	8,566	7,131	6,392
Gross operating surplus	599	1,089	284
Employment	45	35	35
Debt	924	1,275	458
Equity	2,980	3,489	1,769
Investment	272	501	106
Date of creation	1,983	19	1,988
Amount of CIR granted	61	96	32
Number of products – fine level	2	2	2
Number of products – intermediate level	2	1	1
Number of products – aggregated level	2	1	1
Number of observations	818		

Sources: DGFiP-MESRI, GECIR; Insee, DADS, FARE, EAP.

Figure IV – **Estimation of the number of products**



Reading note: The vertical dotted line indicates the last year before the introduction of the CII (2013).
Sources and Coverage: DGFiP-MESRI, GECIR database; Insee, DADS, FARE, EAP; authors' calculations. SMEs benefiting from the CII and comparable non-beneficiaries.

it is not simply variations of existing products that are being introduced, but products that are substantially different.

The use of the EAP survey therefore makes it possible to highlight a different change in the number of products. This is a new finding within the economic literature on the subject of RDI support schemes. However, the significantly higher number of new products among CII beneficiaries since 2015 may come as a surprise, since one would expect to have to wait longer before any impact would be seen on the number of products. The interpretation of these differences as a causal effect of the CII on the creation of new products, or on other economic variables, is not fully established due to the unobserved differences that remain between beneficiary and non-beneficiary firms. While we discuss this point again in the conclusion, an instrumental variable approach has also been implemented (see Online Appendix C2). The questions raised in this section as to the validity of the instrument lead us to consider this approach as an extension of the thinking relative to the endogeneity of the treatment rather than being fully a result of the study.

3.4. Interactions between CII and CIR

Unlike the CIR, the CII is aimed solely at SMEs. Nevertheless, although the CIR and CII declarations are submitted at the same time, the SMEs receiving the CIR do not necessarily also receive the CII and vice versa: in 2014, 43% of those benefiting from the CII were not benefiting from the CIR, as was discussed earlier. Since the CIR and CII are two *a priori* complementary schemes, we will now look at the interaction between these two schemes.

In order to study the consequences of the introduction of the CII, we will take into consideration those SMEs that benefited from the CIR in 2011 and 2012. The total amount of research expenditures declared under the CIR by all SMEs is constantly increasing; however, due to an attrition effect, it falls when we limit ourselves to this sub-group of firms: indeed, the total amount of research expenditures declared by SMEs increases thanks to new firms using the scheme, but for a fixed set of firms this expenditure decreases since some of them stop using it. When a distinction is made depending on whether a firm is benefiting from the CII, behaviours can be observed that appear to be different: of the SMEs that benefited from the CIR in 2011 and 2012, those that went on to benefit from the CII in 2013 experienced a drop in the amount of research expenditures they declared of 12% during that same year, while those that did not receive the CII experienced a smaller drop of 6%. As a result, the introduction of the CII is reflected by a fall in the declared research expenditure under the CIR for those firms that also declare innovation expenses under the CII.

This first descriptive statistic cannot guarantee that the observed differences cannot be simply explained by distinct dynamics between the two samples. Indeed, as we saw earlier, the two populations do present some intrinsic differences, with those that benefit from the CII generally being smaller than those that benefit from the CIR, as well as belonging to different sectors. We therefore perform matching again, using a method similar to that described in Section 2, by limiting ourselves to just those SMEs that benefited from the CIR in the past; due to the smaller number of observations, our study period prior to the introduction of the CII is also reduced to 2011-2012. Following this matching, the sample contains 2,070 SMEs that benefited from the CII. The balancing property is duly verified for all of the pre-treatment variables. A negative and statistically significant difference can be observed with regard to research expenditure between the group that benefited from the CII after 2013 and the group that did not benefit (see Table 8). In addition, the coefficient, which is not significant for the year 2011, shows that the common trend assumption is duly verified (Figure V).

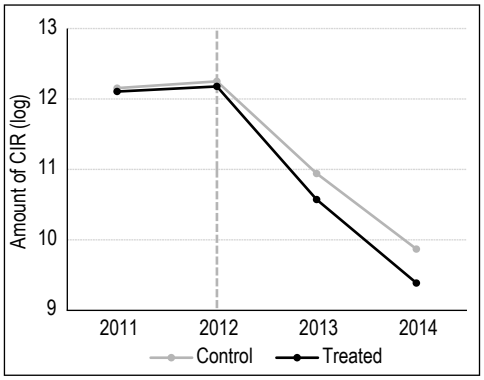
A first possible interpretation of this finding could be that the R&D process may come to an end to make way for a market launch phase, thereby replacing the research expenditures supported by the CIR with innovation expenditure supported by the CII. This seems all the more plausible

Table 8 – **Estimation of the mean impact on treated firms**

	Research expenditure declared for the CIR
$T_{i,2011}$	0.0302
	(0.0186)
$T_{i,2013}$	-0.290**
	(0.118)
$T_{i,2014}$	-0.408***
	(0.150)
Constant	12.21***
	(0.0291)
Observations	16,560
R^2	0.161

Notes: Standard error shown in brackets. Estimation with cluster at the level of the firms. * : p < 0.1, ** : p < 0.05, *** : p < 0.01.

Figure V – **Amount of CIR - estimates**



Reading note: The dotted vertical line corresponds to the last year before the introduction of the CII (2013).
Sources and Coverage: DGFiP-MESRI, GECIR database; Insee, DADS, FARE, EAP; authors' calculations. SMEs benefiting from the CII and comparable non-beneficiaries.

given that the beneficiaries of the CII are SMEs, which are undoubtedly working on fewer projects in parallel than intermediate-sized firms and large firms. A second interpretation would be that a share of the research expenditures is being relabelled as innovation expenditures. In reality, it would actually be the innovation expenditures that is relabelled: since the rate of the CII (20%) is lower than that of the CIR (30%), there is no financial incentive for firms to relabel their expenditures as innovation expenditures if that is not what the money has actually been spent on.

* *
*

This article provides the first evaluation of the CII. This scheme, which is an extension of the CIR, aims in particular to encourage SMEs to launch new products onto the market.

Using propensity score matching methods, we have looked at three groups of variables of interest. First, as regards economic development in the broad sense, we observe a greater increase in employment among the firms that benefited from the scheme, coupled with an increase, at least in the short term, in the share of technical positions. A negative change is observed with regard to mean wages after two years, but this is not statistically significant after three years. As regards the accounting variables, the total assets show a greater increase among beneficiaries of the scheme from the first year onwards; turnover also shows a more pronounced increase among the beneficiaries, but from two years after the introduction of the scheme, whereas no difference is observed in the investment ratio. Next, as regards the innovation activity of the firms, a greater increase is seen in the probability of filing a patent among beneficiaries of the scheme. If we limit ourselves to looking at firms within the manufacturing industry, an increase can also be seen in the number of products manufactured by the beneficiaries.

Nevertheless, the interpretation of these results as causal effects of the CII on the variables presented must be qualified. Indeed, matching methods allow for the correction of observable pre-treatment differences, but they do not provide any guarantee as to the balance of non-observable variables. Persistent differences in the latter could lead to a misinterpretation of the findings presented above. Moreover, it is important to keep in mind that there is a significant risk of endogeneity with regard to the use of the CII, since these are the firms that have chosen to use it. In this respect, and even if many observables are taken into account during matching to limit this risk, the possibility that some firms may make use of the scheme on the pretext of eligible innovation expenditures that would have taken place with or without the existence of the CII cannot be completely ruled out.[8] As a result, the absence of certainty regarding the balance of non-observable variables coupled with the potential existence of a partial deadweight effect suggests that the estimates presented should be interpreted as an upper bound of the impact of the CII on the beneficiary firms.

Lastly, we highlight a fall in the amount of research expenditures declared under the CIR, which is linked to the introduction of the CII. This fall could be interpreted either in terms of the cyclical nature of innovation activities, or in terms of the relabelling of research expenditures as innovation expenditures.

Finally, the most significant changes observed for the beneficiary firms across the majority of the variables of interest investigated in this study seem to combine a causal effect from the CII, which induces certain firms to engage in an innovation process and a self-selection process among the most dynamic firms under the CII, for which these greater changes in the variables of interest would have been seen regardless of whether or not the CII was introduced. □

8. See Online Appendix C2, which shows an attempt at an instrumental variable approach.

Link to the Online Appendix:
https://www.insee.fr/en/statistiques/fichier/5430852/ES-526-527_Bunel-Hadjibeyli_Online-Appendix.pdf

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APPENDIX

ADDITIONAL FIGURES AND ESTIMATIONS

Figure A-I – **Propensity Score Distribution**

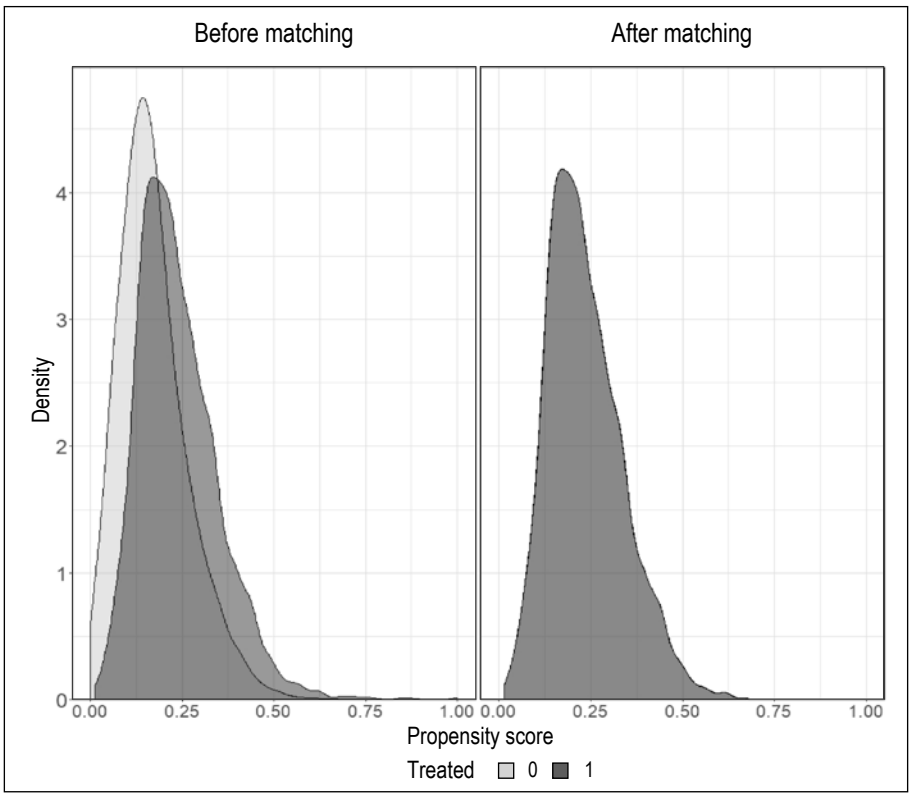
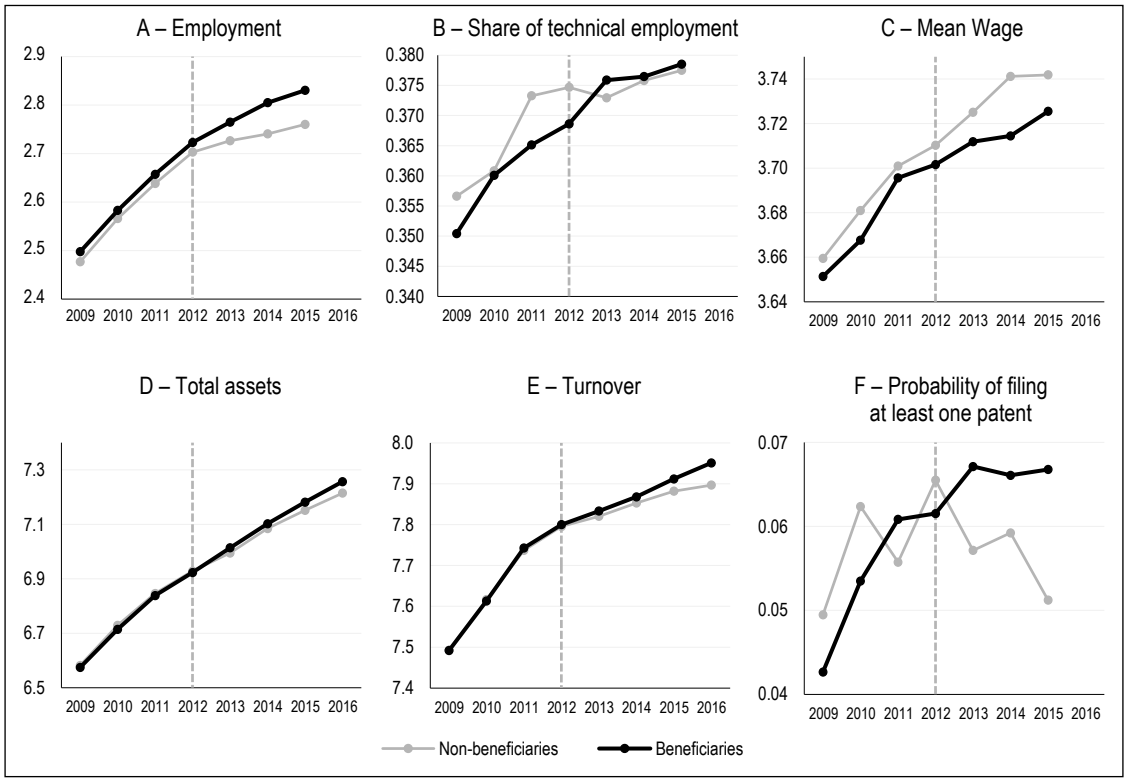
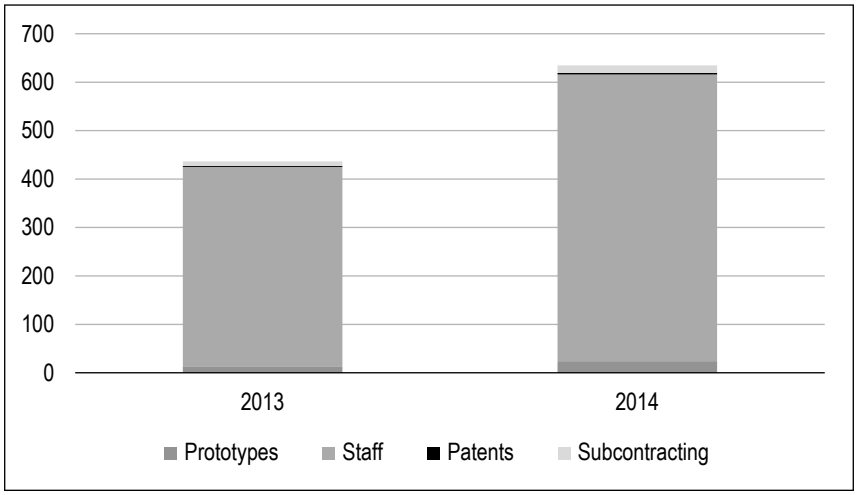


Figure A-II – **Changes in the variables of interest**



Sources and Coverage: DGFiP-MESRI, GECIR database; INSEE, DADS, FARE; MESRI, Atlas des Brevets. SMEs benefiting from the CII and comparable non-beneficiaries.

Figure A-III – **Nature of the expenditure declared under the CII**



Sources and Coverage: DGFiP-MESRI, GECIR database. SMEs benefiting from the CII.

Figure A-IV – **Balancing Property – Products**

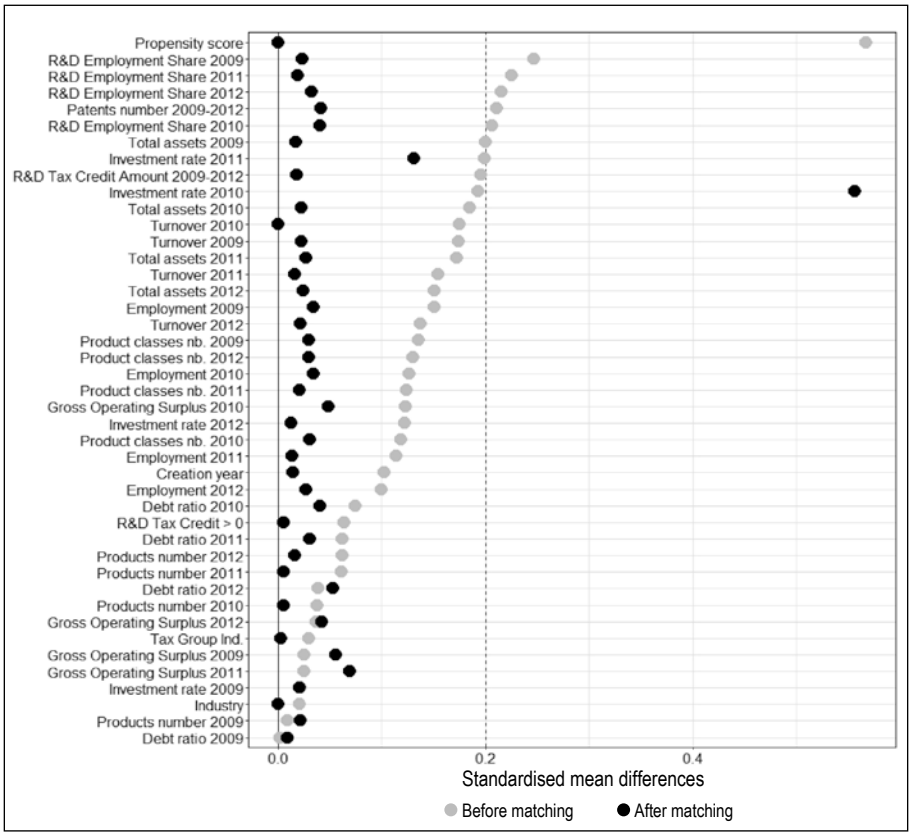


Table A-1 – **Estimates on the overall economic variables**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employment	Share of technical employment	Mean wage	Total assets	Investment ratio	Turnover	Probability of filing a patent
T_{i2009}	0.00140	-0.000113	0.000670	-0.000708	0.00470	-0.00470	-0.00297
	(0.0135)	(0.00499)	(0.00720)	(0.0157)	(0.00653)	(0.0127)	(0.00735)
T_{i2010}	-0.00264	0.00522	-0.00476	-0.00832	0.0102	-0.00730	-0.00507
	(0.00920)	(0.00436)	(0.00588)	(0.0116)	(0.0156)	(0.00960)	(0.00727)
T_{i2011}	-0.000862	-0.00219	0.00336	-0.00197	-0.00324	0.00157	0.00874
	(0.00614)	(0.00336)	(0.00507)	(0.00802)	(0.00542)	(0.00666)	(0.00725)
T_{i2013}	0.0179***	0.00895***	-0.00447	0.0239***	0.00173	0.00809	0.0138*
	(0.00550)	(0.00329)	(0.00478)	(0.00783)	(0.00413)	(0.00625)	(0.00728)
T_{i2014}	0.0438***	0.00663*	-0.0180***	0.0226**	0.00649	0.0101	0.0107
	(0.00783)	(0.00384)	(0.00522)	(0.0103)	(0.00540)	(0.00843)	(0.00759)
T_{i2015}	0.0496***	0.00684	-0.00757	0.0344***	-0.00519	0.0249**	0.0196**
	(0.0102)	(0.00427)	(0.00590)	(0.0130)	(0.00593)	(0.0109)	(0.00774)
T_{i2016}				0.0467***	-0.00415	0.0491***	
				(0.0151)	(0.00607)	(0.0138)	
Constant	2.713***	0.372***	3.706***	6.926***	0.0650***	7.798***	0.0635***
	(0.00221)	(0.00119)	(0.00163)	(0.00309)	(0.00166)	(0.00256)	(0.00242)
Observations	40,110	40,110	40,110	45,840	45,840	45,840	40,110
R^2	0.130	0.006	0.028	0.261	0.000	0.176	0.001

Notes: Standard error shown in brackets. Estimates with clusters at the level of the firms. * p < 0.1, ** p < 0.05, *** p < 0.01.
Reading note: The difference in the changes in employment between the treated group and the counterfactual group over the period from 2012 to 2015 is 4.96 percentage points.

Table A-2 – **Estimates – strict sectoral matching at the finest level of NACE classification**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employment	Share of technical employment	Mean wage	Total assets	Investment ratio	Turnover	Probability of filing a patent
T_{i2009}	-0.00754	-0.00254	0.00364	-0.0127	-0.00175	-0.0112	0.00264
	(0.0148)	(0.00561)	(0.00823)	(0.0172)	(0.00513)	(0.0145)	(0.00699)
T_{i2010}	-0.0103	0.00453	-0.00108	-0.0202	0.0206	-0.0122	-0.00309
	(0.0102)	(0.00495)	(0.00681)	(0.0127)	(0.0193)	(0.0106)	(0.00718)
T_{i2011}	-0.0105	0.00310	0.00789	-0.0112	0.00134	-0.00524	-0.00309
	(0.00666)	(0.00390)	(0.00561)	(0.00888)	(0.00647)	(0.00721)	(0.00731)
T_{i2013}	0.0209***	0.00667*	0.000811	0.0248***	0.00850*	0.00922	0.0141**
	(0.00631)	(0.00360)	(0.00564)	(0.00883)	(0.00461)	(0.00749)	(0.00719)
T_{i2014}	0.0481***	0.00804*	-0.00809	0.0450***	0.0135**	0.0122	0.0141*
	(0.00885)	(0.00449)	(0.00581)	(0.0119)	(0.00639)	(0.00979)	(0.00766)
T_{i2015}	0.0594***	0.00532	-0.00742	0.0611***	0.00462	0.0363***	0.0198***
	(0.0113)	(0.00493)	(0.00659)	(0.0150)	(0.00589)	(0.0120)	(0.00761)
T_{i2016}				0.0720***	0.00570	0.0652***	
				(0.0173)	(0.00683)	(0.0155)	
Constant	2.674***	0.405***	3.727***	6.852***	0.0589***	7.714***	0.0421***
	(0.00252)	(0.00134)	(0.00194)	(0.00358)	(0.00210)	(0.00294)	(0.00235)
Observations	31,766	31,766	31,766	36,304	36,304	36,304	31,766
R^2	0.117	0.007	0.028	0.240	0.000	0.165	0.002

Notes: Standard error shown in brackets. Estimates with clusters at the level of the firms. * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A-3 – **Two nearest neighbours**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employment	Share of technical employment	Mean wage	Total assets	Investment ratio	Turnover	Probability of filing a patent
T_{i2009}	-0.00241	-0.00208	0.00255	-0.00453	0.00112	-0.00312	-0.00142
	(0.0116)	(0.00435)	(0.00650)	(0.0135)	(0.00664)	(0.0110)	(0.00614)
T_{i2010}	-0.00936	0.00327	-0.00396	-0.00641	0.00782	-0.0106	-0.000709
	(0.00800)	(0.00386)	(0.00511)	(0.00988)	(0.0160)	(0.00811)	(0.00625)
T_{i2011}	-0.00528	0.000664	0.00433	-0.00571	-0.00553	-0.00340	0.00910
	(0.00541)	(0.00296)	(0.00451)	(0.00690)	(0.00525)	(0.00565)	(0.00628)
T_{i2013}	0.0147***	0.0103***	-0.00248	0.0237***	0.00126	0.00735	0.0155**
	(0.00482)	(0.00288)	(0.00427)	(0.00671)	(0.00365)	(0.00538)	(0.00633)
T_{i2014}	0.0375***	0.0106***	-0.0156***	0.0208**	0.00251	0.00941	0.0121*
	(0.00672)	(0.00334)	(0.00440)	(0.00890)	(0.00508)	(0.00740)	(0.00657)
T_{i2015}	0.0405***	0.0119***	-0.00762	0.0360***	-0.00517	0.0234**	0.0191***
	(0.00867)	(0.00367)	(0.00515)	(0.0112)	(0.00488)	(0.00942)	(0.00669)
T_{i2016}				0.0507***	-0.00543	0.0428***	
				(0.0146)	(0.00557)	(0.0113)	
Constant	2.706***	0.374***	3.708***	6.921***	0.0646***	7.791***	0.0586***
	(0.00177)	(0.000977)	(0.00135)	(0.00264)	(0.00139)	(0.00211)	(0.00195)
Observations	59,255	59,255	59,255	67,720	67,720	67,720	59,255
R^2	0.122	0.004	0.031	0.225	0.000	0.170	0.001

Notes: cf. Table A-2.

Table A-4 – **Three nearest neighbours**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employment	Share of technical employment	Mean wage	Total assets	Investment ratio	Turnover	Probability of filing a patent
T_{i2009}	-0.00381	-0.00164	0.00134	-0.00113	-0.00141	0.00106	0.000803
	(0.0107)	(0.00409)	(0.00600)	(0.0126)	(0.00644)	(0.0102)	(0.00575)
T_{i2010}	-0.0109	0.00225	-0.00309	-0.00767	0.00497	-0.00728	-0.000862
	(0.00750)	(0.00367)	(0.00482)	(0.00923)	(0.0160)	(0.00755)	(0.00586)
T_{i2011}	-0.00630	-0.000461	0.00439	-0.00482	-0.00597	-0.00137	0.0108*
	(0.00514)	(0.00281)	(0.00441)	(0.00645)	(0.00507)	(0.00527)	(0.00593)
T_{i2013}	0.0141***	0.00813***	-0.0000262	0.0243***	0.0000421	0.0107**	0.0173***
	(0.00457)	(0.00272)	(0.00408)	(0.00628)	(0.00333)	(0.00498)	(0.00598)
T_{i2014}	0.0391***	0.00827***	-0.0115***	0.0312***	0.00297	0.0176**	0.0139**
	(0.00633)	(0.00315)	(0.00408)	(0.00838)	(0.00482)	(0.00690)	(0.00620)
T_{i2015}	0.0473***	0.0107***	-0.00690	0.0467***	-0.00506	0.0316***	0.0217***
	(0.00816)	(0.00345)	(0.00490)	(0.0105)	(0.00450)	(0.00883)	(0.00635)
T_{i2016}				0.0604***	-0.00387	0.0531***	
				(0.0131)	(0.00522)	(0.0106)	
Constant	2.720***	0.372***	3.706***	6.927***	0.0637***	7.803***	0.0584***
	(0.00154)	(0.000840)	(0.00116)	(0.00229)	(0.00118)	(0.00184)	(0.00166)
Observations	78,463	78,463	78,463	89,672	89,672	89,672	78,463
R^2	0.115	0.004	0.030	0.222	0.000	0.160	0.001

Notes: cf. Table A-2.

Table A-5 – **Strict condition concerning CIR prior to 2012**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employment	Share of technical employment	Mean wage	Total assets	Investment ratio	Turnover	Probability of filing a patent
T_{i2009}	-0.00399	0.000398	0.00347	0.0134	0.00734	0.000831	0.000705
	(0.0134)	(0.00496)	(0.00803)	(0.0156)	(0.00679)	(0.0128)	(0.00735)
T_{i2010}	-0.00919	0.00485	-0.00588	0.00124	0.0105	-0.00431	-2.79e-15
	(0.00911)	(0.00443)	(0.00605)	(0.0115)	(0.0157)	(0.00980)	(0.00721)
T_{i2011}	-0.00688	-0.00133	0.00492	0.00188	-0.00813	0.00307	0.00829
	(0.00620)	(0.00343)	(0.00523)	(0.00794)	(0.00596)	(0.00666)	(0.00719)
T_{i2013}	0.0139**	0.0105***	-0.000511	0.0206***	0.00105	0.0163**	0.0187***
	(0.00545)	(0.00327)	(0.00464)	(0.00757)	(0.00455)	(0.00639)	(0.00725)
T_{i2014}	0.0356***	0.00831**	-0.0122**	0.0261**	0.00935*	0.0180**	0.0120
	(0.00774)	(0.00378)	(0.00499)	(0.0103)	(0.00525)	(0.00867)	(0.00763)
T_{i2015}	0.0466***	0.00919**	-0.00820	0.0456***	-0.00245	0.0313***	0.0197**
	(0.0102)	(0.00414)	(0.00598)	(0.0131)	(0.00594)	(0.0112)	(0.00767)
T_{i2016}				0.0567***	0.00478	0.0585***	
				(0.0151)	(0.00550)	(0.0142)	
Constant	3.046	0.417	4.169	6.934	0.0653	7.791	0.0822
	(128019.7)	(47648.6)	(153458.4)	(15660.9)	(2858.9)	(21974.3)	(27908.4)
Observations	39,725	39,725	39,725	45,400	45,400	45,400	39,725
R^2	0.128	0.006	0.025	0.262	0.000	0.168	0.002

Notes: cf. Table A-2.

Table A-6 – **Inverse probability weighting of the treatment**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employment	Share of technical employment	Mean wage	Total assets	Investment ratio	Turnover	Probability of filing a patent
T_{i2009}	-0.00591	-0.000590	-0.00134	-0.00507	0.00259	-0.00710	-0.000650
	(0.0117)	(0.00427)	(0.00654)	(0.0135)	(0.00793)	(0.0113)	(0.00619)
T_{i2010}	-0.0120	0.00324	-0.00384	-0.0148	0.0000190	-0.0134	0.00191
	(0.00795)	(0.00378)	(0.00513)	(0.00989)	(0.0159)	(0.00828)	(0.00608)
T_{i2011}	-0.0102**	-0.000328	0.00226	-0.0132**	-0.00908*	-0.00606	0.00953
	(0.00521)	(0.00291)	(0.00435)	(0.00668)	(0.00513)	(0.00545)	(0.00618)
T_{i2013}	0.0211***	0.00684**	-0.00697*	0.0202***	-0.00685	0.00848	0.0197***
	(0.00454)	(0.00274)	(0.00407)	(0.00649)	(0.00481)	(0.00537)	(0.00618)
T_{i2014}	0.0449***	0.00744**	-0.0158***	0.0366***	-0.000966	0.0168**	0.0182***
	(0.00643)	(0.00322)	(0.00410)	(0.00858)	(0.00492)	(0.00723)	(0.00641)
T_{i2015}	0.0539***	0.00750**	-0.0106**	0.0503***	-0.00688	0.0341***	0.0225***
	(0.00828)	(0.00356)	(0.00484)	(0.0107)	(0.00454)	(0.00936)	(0.00654)
T_{i2016}				0.0613***	-0.00792	0.0530***	
				(0.0125)	(0.00538)	(0.0108)	
Constant	2.716***	0.369***	3.702***	6.923***	0.0662***	7.798***	0.0661***
	(0.00190)	(0.00102)	(0.00142)	(0.00261)	(0.00170)	(0.00219)	(0.00206)
Observations	110,264	110,264	110,264	126,016	126,016	126,016	110,264
R^2	0.133	0.006	0.025	0.253	0.000	0.174	0.002

Notes: cf. Table A-2.

Table A-7 – **Period from 2011 to 2015**

	(1)	(2)	(4)	(6)	(7)
	Employment	Share of technical employment	Total assets	Turnover	Probability of filing a patent
T_{i2011}	-0.00794	-0.00149	0.00511	-0.00214	-0.00446
	(0.00578)	(0.00326)	(0.00973)	(0.00799)	(0.0112)
T_{i2013}	0.0299***	0.00992***	0.0204**	0.0237***	0.00131
	(0.00545)	(0.00295)	(0.00855)	(0.00692)	(0.0112)
T_{i2014}	0.0577***	0.0165***	0.0436***	0.0354***	0.00643
	(0.00814)	(0.00363)	(0.0114)	(0.00930)	(0.0111)
T_{i2015}	0.0725***	0.0167***	0.0596***	0.0458***	0.0185
	(0.0108)	(0.00397)	(0.0147)	(0.0117)	(0.0113)
Constant	2.620***	0.371***	6.795***	7.656***	0.0923***
	(0.00224)	(0.00106)	(0.00324)	(0.00257)	(0.00351)
Observations	38,180	38,180	38,180	38,180	38,180
R^2	0.044	0.002	0.096	0.040	0.000

Notes: cf. Table A-2.

Table A-8 – **Products**

	(1)	(2)	(3)
	Fine level	Intermediate level	Aggregated level
T_{i2009}	0.00877	-0.00376	-0.00627
	(0.0497)	(0.0269)	(0.0252)
T_{i2010}	-0.0213	-0.00251	0.00501
	(0.0402)	(0.0233)	(0.0220)
T_{i2011}	-0.0213	-0.00877	0.00501
	(0.0304)	(0.0193)	(0.0181)
T_{i2013}	0.0526	0.0238	0.0150
	(0.0461)	(0.0247)	(0.0217)
T_{i2014}	0.0313	0.0476*	0.0376
	(0.0554)	(0.0279)	(0.0250)
T_{i2015}	0.0489	0.0689**	0.0564**
	(0.0655)	(0.0316)	(0.0287)
T_{i2016}	0.128*	0.0977***	0.0827***
	(0.0698)	(0.0332)	(0.0298)
Constant	2.231***	1.560***	1.496***
	(0.0159)	(0.00806)	(0.00737)
Observations	12,776	12,776	12,776
R^2	0.015	0.029	0.028

Notes: cf. Table A-2.

Table A-9 – **Inverse probability weighting of the treatment**

	(1)	(2)	(3)
	Fine level	Intermediate level	Aggregated level
T_{i2009}	-0.0153	-0.0144	-0.0225
	(0.0521)	(0.0268)	(0.0252)
T_{i2010}	-0.0318	-0.0246	-0.0194
	(0.0385)	(0.0233)	(0.0218)
T_{i2011}	-0.0199	-0.0106	0.000838
	(0.0274)	(0.0180)	(0.0170)
T_{i2013}	0.0562	0.0218	0.0159
	(0.0427)	(0.0219)	(0.0193)
T_{i2014}	0.0813	0.0554**	0.0455**
	(0.0509)	(0.0258)	(0.0230)
T_{i2015}	0.0702	0.0633**	0.0535**
	(0.0607)	(0.0290)	(0.0261)
T_{i2016}	0.0976	0.0668**	0.0614**
	(0.0644)	(0.0306)	(0.0275)
Constant	2.315***	1.600***	1.529***
	(0.0148)	(0.00765)	(0.00702)
Observations	35,472	35,472	35,472
R^2	0.013	0.029	0.029

N° 517-518-519 (2020) – **AU-DELÀ ET AUTOUR DU PIB : QUESTIONS A LA COMPTABILITÉ NATIONALE /** ***BEYOND AND AROUND GDP: QUESTIONS TO NATIONAL ACCOUNTING***

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