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IZA DP No. 16112

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Marie-Noëlle Lefebvre
ESPI2R Research Unit and CRED

Etienne Lehmann
CRED, CEPR, IZA and CESIfo

Michaël Sicsic
CRED

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ISSN: 2365-9793

IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

Estimating the Laffer Tax Rate on Capital Income: Cross-Base Responses Matter!*

We theoretically express the Laffer tax rate on capital income as a function of the elasticities of capital income (the "direct" elasticity) and of labor income (the "cross" elasticity) with respect to the net-of-tax rate on capital income. We estimate these elasticities using salient capital tax reforms that took place in France between 2008 and 2017. Graphical evidence and Instrumental variables (IV) estimates confirm the existence of significant responses of both capital and labor income to capital tax reforms. Both approaches lead to positive cross responses, in contrast to the prediction of income-shifting models but in line with the two-period "working and saving" model. We obtain a direct elasticity around 0.76 which is robust across specifications. Ignoring the cross elasticity leads to a Laffer rate around 56%. However, since labor incomes are much larger than capital incomes, the Laffer tax rate is especially sensitive to the cross elasticity. Using our estimated positive cross elasticity dramatically reduces the Laffer tax rate on capital income to around 44%, taking income tax on labor income into account.

JEL Classification: H21, H24, H31, C23, C26

Keywords: capital income taxation, optimal tax, Laffer tax rate, instrumental variables

Corresponding author:
Etienne Lehmann
CRED (TEPP)
University Panthéon-Assas Paris 2
12 Place du Panthéon
75 231, Paris Cedex 05
France

E-mail: etienne.lehmann@gmail.com

* A previous version circulated under the title "Capital Incomes are more Elastic that Labor Incomes." We thank numerous persons for their valuable comments and suggestions, especially Ashley Craig, Anne Epaulard, Alain Trannoy, Eddy Zanoutene and participants at Committees at France Stratégie and Paris workshops in Taxation Economics, participants at ASFE/Trésor 2019, IIPF 2020 and EEA 2020 congresses. This research benefits from funding by France Stratégie for which we are deeply grateful. This work is supported by a public grant overseen by the French National Research Agency (ANR) as part of the "Investissements d'Avenir" program (reference: ANR-10-EQPX-17 - Centre d'accès sécurisé aux données – CASD).

I Introduction

Arthur Laffer's famous napkin[1] launched many controversies. When a tax rate is above a certain point, hereafter referred to as the "Laffer rate", increasing this tax rate further might compress the corresponding tax base so much that the government's revenue actually decreases. Hence, it is crucial for the design of fiscal policy to verify that actual tax rates are below the Laffer rate, and for this purpose, to estimate the Laffer rate. This is especially the case for capital incomes that are likely among the most responsive tax bases. This paper estimates the Laffer rate on capital income in France and argues this Laffer rate is very sensitive to the cross elasticity of labor income to the marginal net-of-tax rate[2] on capital income.

Our theory emphasizes that the Laffer rate on capital income depends not only on the *direct* elasticity of capital income with respect to its own net-of-tax rate, but it also dramatically depends on the *cross* elasticity of labor income with respect to the net-of-tax rate on capital income. As labor incomes are actually much larger than capital incomes, even a small cross elasticity matters a lot for tax revenues. In such a case, a given capital tax reform results in much larger effects on labor income tax revenues than on capital income tax revenues. It is therefore crucial to estimate not only the direct elasticity but also the cross elasticity.

The sign of the cross elasticity is theoretically ambiguous. On the one hand, income-shifting models predict a positive direct and a negative cross elasticity. In such a model, a tax cut on capital (i.e., a rise in the marginal net-of-tax rate on capital) induces a shift from labor to capital incomes. Such a negative cross elasticity tends to increase the Laffer tax rate on capital because the surge in the capital income is mitigated by the decline in labor income. On the other hand, two-period models in which taxpayers work and save in the first period and consume in the second period predict both elasticities to be positive. In such a case, a tax cut on capital increases the return of "working and saving", i.e., of working for the purpose of increasing future consumption. A tax cut on capital thus increases both the capital and the labor income in such a case. A positive cross elasticity thus leads to a lower Laffer rate on capital. Hence, whether taking into account the cross elasticity increases or decreases the Laffer rate on capital income can not be assessed theoretically

[1] According to the popular view, the Laffer curve was created by Arthur Laffer on a napkin at a Washington DC restaurant, September 13th 1974. This napkin is actually exhibited at the National Museum of American History. Blinder (1981) points out that this view does not give justice to Jules Dupuit, who wrote in 1844: "If a tax is gradually increased from zero up to the point where it becomes prohibitive, its yield is at first nil, then increases by small stages until it reaches a maximum, after which it gradually declines until it becomes zero again"

[2] The marginal net-of-tax rate is the complement of the marginal tax rate. It shows how much an after-tax income increases when before-tax income increases by 1. For example, if the marginal tax rate is 35%, the marginal net-of-tax rate is 65%.

and can only be determined by estimating empirically the cross elasticities of labor income to the capital net-of-tax rate.

For this purpose, we use a panel of French taxpayer records (POTE).[3] This administrative database covers the universe of taxpayers and contains an identifier[4] that allows us to track the evolution of tax returns from 2008 to 2017. Based on this data, we estimate both direct and cross elasticities using several salient capital tax reforms that took place in France between 2008 and 2017. In particular, taxpayers were allowed between 2008 and 2012 to exclude their dividends and interest incomes from their taxable income, in which case these capital incomes were taxed at a flat rate named the PFL.[5] Among the reforms that we use to identify direct and cross elasticities are changes in the PFL rates between 2009 and 2012 and the removal of the PFL option from 2013 onwards.

We first provide graphical evidence of behavioral responses to the removal of the PFL from 2013 onwards. For this purpose, we contrast the evolution of incomes in a group of treated taxpayers that opted for PFL before 2012 to the evolution of incomes in a control group of taxpayers. We obtain a substantial reduction of capital income in the treated group. Conversely, we find a weak reduction of labor incomes in the treated group compared to the control group. This suggests that if income-shifting took place in response to the removal of the PFL, these responses were not dominant in explaining the cross responses of labor incomes to capital tax reforms and the cross elasticity is more likely positive in France.

The 2013 reform can hardly be extrapolated to other reforms or periods. This may cast doubts about the external validity of results derived graphically from the 2013 removal of the PFL. We therefore go further than the graphical evidence by estimating elasticities of capital and labor income with respect to marginal net-of-tax rates of both labor income and capital incomes to be able to estimate sufficient statistics to implement the laffer formula. To circumvent the endogeneity of net-of-tax rates, we use an Instrumental Variable approach. Following Auten and Carroll (1999) and Gruber and Saez (2002), our instruments are changes in marginal net-of-tax rates that taxpayers would have experienced if their incomes had not changed in real terms. These instruments keep only the part of changes in tax rates that are caused by tax reforms, ignoring changes in tax rates induced by idiosyncratic shocks on incomes.

[3]This is the POTE database which has been available on the Secure Data Access Centre (CASD) since June 12, 2019.

[4]This identifier does not allow us to retrieve the identify of taxpayers, thereby securing statistical and fiscal anonymity, but is sufficient to follow the same tax units across time.

[5]For *Prélèvement Forfaitaire Libératoire*.

We obtain a direct elasticity of capital income around 0.77, which appears robust across specifications and robustness checks. Ignoring cross response, this estimate leads to a Laffer rate on capital income around 57%. Moreover, we obtain slightly positive and statistically significant cross elasticities of labor income with respect to marginal net-of-tax rate on capital incomes. These results suggest that the cross elasticity are not predominantly explained by income-shifting but rather by the impact of capital taxation on the incentive to work and save. Our estimated cross elasticities decreases substantially the Laffer rate to 43% taking into account income tax on labor income. The Laffer rate on capital income being so sensitive to the estimated cross elasticity, our paper invites future research to further investigate cross responses of labor incomes to capital tax reforms.

This paper is part of the literature estimating the behavioral responses of taxable income to tax reforms.[6] In this literature, Kleven and Schultz (2014) and Hermle and Peichl (2018) find that capital incomes are more elastic than labor incomes in Denmark and Germany. We contribute to this literature by studying the responses of labor incomes not only with respect to their own marginal tax rate but also to the capital marginal net-of-tax-rate.[7]

We also contribute to the empirical literature on the taxation of capital income. Chetty and Saez (2005) and Yagan (2015) estimate the effect of the 2003 dividend tax cut in the United States using firms' data. Boissel and Matray (2022) estimate the response of firms to an increase in social security contributions applying to executives of some businesses (namely SARL) that occurred in France from 2013. Bach et al. (2019) estimate behavioral responses to dividend taxation using recent French reforms on dividends, using difference-in-differences methods with both households' and firms' data. Chetty and Saez (2005), Yagan (2015) and Boissel and Matray (2022) obtain elasticities of about 0.5 on dividends with respect to the marginal tax rate, while Bach et al. (2019) find a much higher elasticity. Our contribution to this literature is threefold. First, we estimate not only the direct elasticity of capital income but also the cross elasticity of labor income. Second, we estimate these elasticities using two methods, namely difference-in-differences and instrumental variables, a robustness that is reassuring about the sign of cross-elasticity we estimate. In particular, since the IV approach does not rely on a single reform, we are more confident about its external

[6]See Feldstein (1995), Auten and Carroll (1999), Gruber and Saez (2002), Saez (2003), Kopczuk (2005), Saez et al. (2012) and Weber (2014) on US data, Kleven and Schultz (2014) on Danish data and Piketty (1999), Lehmann et al. (2013), Cabannes et al. (2014), Sicsic (2022) on French data among many others.

[7]Kleven and Schultz (2014) find the elasticity of labor income to capital taxation is zero over the entire period of interest in the study, and slightly negative for the main reform only.

validity. Finally, we use households' tax records instead of firms' data, which complement previous studies for the sake of robustness.

Several studies have highlighted income-shifting behaviors.[8] Our results, in line on this point with Boissel and Matray (2022) and Bach et al. (2019) suggest the absence of such behavior in France in response to capital tax reforms.

Our article is also part of a series of recent works studying behavioral responses to tax reforms in France. Guillot (2019) is concerned with the 75% tax on rate on earnings above 1,000,000 € in 2013 and 2014. Pacifico (2019) investigates the effects of lower ceiling of the tax advantage due to children in 2013 and 2014. Sicsic (2022) compares the estimated elasticities of labor income with respect to, on the one hand, personal income tax reforms and, on the other hand, to social transfers. Aghion et al. (2019) highlight the divergence after 2013 between the trend in the incomes of taxpayers belonging to the upper percentile after 2012 compared to other taxpayers. Conversely, the present paper uses several different capital tax reforms to estimate behavioral elasticities and therefore the Laffer rate. Finally, Bach et al. (2019) study the effect of the 2013 reform on dividends. In their difference-in-differences on household data, their treatment group is composed of taxpayers that opt for PFL on dividends in 2012. Conversely, our treatment group for our graphical evidence is composed of taxpayers that opt for PFL on dividends or on interests in 2008, 2009, 2010 and in 2011, and sample selections are also different.

The rest of the paper is organized as follows. Section II outlines the conceptual framework. Section III presents the data. Section IV describes the institutional context and section IV.2 provides graphical evidence about the evolution of French taxpayers' incomes during the period studied. Section V exposes the methodology and the results of the IV approach. Section VI offers some political implications about Laffer rates. The last section concludes.

II Conceptual framework

In this section, we clarify how cross-base responses impact the Laffer tax rate on capital incomes. We first present the conceptual framework we use. Second, we derive the optimal Laffer tax rate on capital income and discuss how it is impacted by the cross-base elasticity of labor incomes to marginal net-of-tax rates on capital incomes. Finally, we provide micro-founded examples where cross-base responses can be signed.

[8] See (Romanov, 2006) in Israel, (Alstadsæter and Wangen, 2010) in Norway, (Pirttilä and Selin, 2011, Harju and Matikka, 2016) in Finland, (Alstadsæter and Jacob, 2016) in Sweden and Tazhitdinova (2020) in the UK

II.1 Preferences

The population is composed of N taxpayers indexed by $i = 1, ..., N$. Let y_1 denote (pre-tax) labor income and y_2 denote (pre-tax) capital income. To earn these incomes, a taxpayer needs to provide some effort in one form or another. For instance, longer working hours or working more intensively increase labor earnings y_1. Larger capital income y_2 today requires more savings in the past, i.e., lower consumption in the past. All in all, preferences of taxpayer i between after-tax income (or consumption for short) c, labor income y_1 and capital income y_2 are described by a twice-continuously differentiable utility function $\mathscr{U}^i : (c, y_1, y_2) \mapsto \mathscr{U}^i(c, y_1, y_2)$ defined on $\mathbb{R}^3_+$ which is increasing in consumption c and decreasing in labor income y_1 and capital income y_2, i.e.: $\mathscr{U}^i_c > 0 > \mathscr{U}^i_{y_1}, \mathscr{U}^i_{y_2}$.

Combining the various tax schedules, let t_1 denote the marginal tax rate on labor income, t_2 the tax rate on capital income and let R be the demogrant defined such that the linearization of the budget constraint around the taxpayer's optimum is $c = (1 - t_1)y_1 + (1 - t_2)y_2 + R$. The taxpayer chooses her efforts, equivalently her labor and capital pre-tax income, to solve:

$$\max_{y_1, y_2} \qquad \mathscr{U}^i\left((1 - t_1)y_1 + (1 - t_2)y_2 + R, y_1, y_2\right)$$

The first-order conditions

$$1 - t_1 = -\frac{\mathscr{U}^i_{y_1}}{\mathscr{U}^i_c} \qquad 1 - t_2 = -\frac{\mathscr{U}^i_{y_2}}{\mathscr{U}^i_c}$$

equate, on the left-hand side, the marginal net-of-tax-rates (NTR) which capture the marginal increase of after-tax income from one additional euro of pre-tax income $j = 1, 2$, with, on the right-hand sides, the marginal rates of substitution (MRS) between pre-tax income $j = 1, 2$ and consumption, which capture the utility cost in monetary terms from one additional euro of pre-tax income $j = 1, 2$.

II.2 The Laffer Rate formula

We define the Laffer rate on capital income as the linear tax rate that maximizes the government's revenue given the tax schedule on earnings. For this purpose, we denote by $T_1(\cdot)$ the potentially nonlinear tax schedule on labor earnings and by t_2 the linear tax rate on capital income. All else being equal, taxpayer i chooses efforts and obtains labor incomes $Y_{1,i}(t_2)$ and capital incomes $Y_{2,i}(t_2)$ that are differentiable functions of the linear tax rate on capital income.[9] Cross-base

[9] To save on notation, we omit $t_{1,i} \stackrel{\text{def}}{\equiv} T'_1(y_{1,i})$ and $R \stackrel{\text{def}}{\equiv} T(y_1) - (y_{1,i})T'((y_{1,i}))$ in the arguments of functions $Y_{1,i}(\cdot)$ and $Y_{2,i}(\cdot)$.

responses arise whenever labor earnings depend on the capital tax rate, i.e., whenever $\frac{\partial Y_{1,i}}{\partial(1-t_2)} \neq 0$. Finally, we denote by $\mathcal{Y}_1(t_2) \overset{\text{def}}{\equiv} \sum_{i=1}^{N} Y_{1,i}(t_2)$ aggregate labor earnings and by $\mathcal{Y}_2(t_2) \overset{\text{def}}{\equiv} \sum_{i=1}^{N} Y_{2,i}(t_2)$ aggregate capital income. The government's revenue is given by:

$$\mathcal{R}(t_2) \overset{\text{def}}{\equiv} \sum_{i=1}^{N} T_1\left(Y_{1,i}(t_2)\right) + t_2\, \mathcal{Y}_2(t_2)$$

The first term corresponds to tax liabilities on labor earnings and the second to tax revenue from capital incomes. An infinitesimal variation of the capital tax rate implies a marginal variation of tax revenue given by:

$$\frac{\partial \mathcal{R}}{\partial \tau_2} = \underbrace{\sum_i y_{2,i}}_{\text{Mechanical Effect}} \underbrace{- \tau_2 \sum_i \frac{\partial y_{2,i}}{\partial(1-\tau_2)}}_{\text{Capital Responses}} \underbrace{- \sum_i T_1'(y_{1,i}) \frac{\partial y_{1,i}}{\partial(1-\tau_2)}}_{\text{Labor Responses}} \tag{1}$$

A unit increase in the capital tax rate affects the government's revenue in three ways. The first term corresponds to the *mechanical* increase in tax liabilities if tax bases were exogenous. This term is equal to aggregate capital income in the economy:

$$\text{Mechanical effect} = Y_2 \overset{\text{def}}{\equiv} \sum_i y_{2,i}$$

The second term results from the responses of capital income. A rise in the capital income shrinks the capital income tax base, thereby reducing tax revenue. Denoting by:

$$e_2 \overset{\text{def}}{\equiv} \frac{1-\tau_2}{Y_2} \sum_i \frac{\partial y_{2,i}}{\partial(1-\tau_2)} = \sum_i \frac{y_{2,i}}{Y_2} \frac{\partial \log y_{2,i}}{\partial \log(1-\tau_2)}$$

the capital income-weighted average of direct elasticity, the capital response term is equal to:

$$\text{Capital responses} = -\frac{\tau_2}{1-\tau_2}\, e_2\, Y_2$$

The last term is novel and appears because of the response of labor incomes to capital tax reform. It sums, for each taxpayer, the product of her response $-\frac{\partial y_{1,i}}{\partial(1-\tau_2)}$ to the capital tax reform to the marginal tax rate $T_1'(y_{1,i})$ she faces. It is worth noting that there is here nothing specific to labor income, which should be more broadly interpreted as all income excluded from the tax schedule specific to capital income.

To go further, let us assume the labor income tax schedule is piecewise linear, with $J \geq 1$ brackets indexed by $j = 1, ..., J$. Let $\tau_{1,j}$ denote the tax rate in the j^{th} bracket. Let $Y_{1,j} = \sum_{i \in j} y_{1,i}$ denote aggregate labor income for all taxpayers belonging to the j^{th} bracket. Finally, let:

$$e_{1,j} \overset{\text{def}}{\equiv} \frac{1-\tau_2}{Y_{1,j}} \sum_{i \in j} \frac{\partial y_{1,i}}{\partial(1-\tau_2)} = \sum_{i \in j} \frac{y_{1,i}}{Y_{1,j}} \frac{\partial \log y_{1,i}}{\partial \log(1-\tau_2)}$$

denote the labor income-weighted average of the cross elasticity among taxpayers located in the j^{th} bracket. Labor Income responses induce a variation in the government's revenue of:

$$\text{Labor responses} \quad = \quad -\sum_{j=1}^{J} \frac{\tau_{1,j}}{1-\tau_2}\, Y_{1,j}\, e_{1,j}\, \mathrm{d}\tau_2 = -\frac{\tau_2}{1-\tau_2} \sum_{j=1}^{J} \frac{\tau_{1,j}\, Y_{1,j}}{\tau_2\, Y_2}\, e_{1,j}\, Y_2\, \mathrm{d}\tau_2$$

Equation (1) can be rewritten as:

$$\frac{\partial \mathcal{R}}{\partial \tau_2} = \underbrace{Y_2}_{\text{Mechanical Effect}} - \underbrace{\frac{\tau_2}{1-\tau_2}\, e_2\, Y_2}_{\text{Capital Responses}} - \underbrace{\frac{\tau_2}{1-\tau_2} \sum_{j=1}^{J} \frac{\tau_{1,j}\, Y_{1,j}}{\tau_2\, Y_2}\, e_{1,j}\, Y_2}_{\text{Labor Responses}}$$

which leads to the Laffer rate on capital incomes:

$$\tau_2 = \frac{1}{1 + e_2 + \sum_{j=1}^{J} \frac{\tau_{1,j}\, Y_{1,j}}{\tau_2\, Y_2}\, e_{1,j}} \qquad (2)$$

The Laffer rate on capital incomes depends on the direct (capital income-weighted) elasticity e_2 of capital income and on the (labor income-weighted) cross elasticities $e_{1,j}$ specific to each bracket. For each income tax bracket j, the cross-elasticity $e_{1,j}$ is scaled by the ratio of the corresponding marginal tax rate $\tau_{1,j}$ times labor income of taxpayers located in the j^{th} bracket over tax revenue due to capital income $\tau_2\, Y_2$. This scaling factor shows up because how an elasticity matters depends on the size Y_i of the corresponding tax base. Moreover, the larger the marginal tax rate $\tau_{1,j}$, the larger a given response of labor income translate into a larger change in tax revenue.[10]

II.3 Two examples where the cross elasticity has opposite signs

While the direct elasticity is obviously expected to be positive, the sign of the cross elasticity is a priori unclear. To illustrate this point, we successively consider two different specializations of the general model to explore what the sign of the cross elasticity is in each of these two micro foundations. In both models, the direct elasticity is positive. However the cross elasticity is negative in the first, income-shifting example while it is positive in the second example.

The income-shifting model

Let us first consider an income-shifting model where effective labor income $x_1 > 0$ and effective capital income $x_2 > 0$ are exogenous. In such a framework, taxpayers have the ability at some

[10]The form of the scaling factor $\frac{\tau_{1,j}\, Y_{1,j}}{\tau_2\, Y_2}$ is due to the identity $Y_2 \times \frac{\tau_2}{1-\tau_2} \times \frac{\tau_{1,j}\, Y_{1,j}}{\tau_2\, Y_2} = \tau_{1,j} \times \frac{Y_{1,j}}{1-\tau_2}$. It therefore transforms the average cross elasticity $e_{1,j}$ among taxpayers located in the j^{th} bracket into an average derivative times the same scaling factor $Y_2 \times \frac{\tau_2}{1-\tau_2}$ as the average direct elasticity.

monetary cost denoted $\Sigma(d)$ to declare an amount d of labor income as capital income, where the cost function Σ is twice differentiable, convex and verifies $\Sigma(0) = \Sigma'(0) = 0$. Hence, taxable labor income is $y_1 \stackrel{\text{def}}{\equiv} x_1 + d$, taxable capital income is $y_2 \stackrel{\text{def}}{\equiv} x_2 - d$ and disposable income is $(1-t_1)y_1 + (1-t_2)y_2 + R - \Sigma(d) = x_1 + x_2 + R + (t_2 - t_1)d - \Sigma(d)$. The optimal amount of income shifted is determined by the first-order condition $\Sigma'(d) = t_2 - t_1$, which implies

$$0 > \frac{\partial d}{\partial(1-t_2)} = \frac{\partial y_1}{\partial(1-t_2)} = -\frac{\partial y_2}{\partial(1-t_2)}$$

A two-period example

Consider now the case where taxpayers live two periods. In the first period, labeled "Today", taxpayers work and earn y_1, save s and consume d_{tod}. In the second period, labeled "Tomorrow", savings become capital income $y_2 = \rho\, s$, where ρ stands for the gross return on savings and is typically greater than one. Labor incomes are taxed in the first period at rate t_1 with a demogrant R, so the first-period budget constraint is:

$$d_{Today} = (1-t_1)y_1 + R - s.$$

Capital incomes are taxed in the second period at rate t_1, so the second-period budget constraint is:

$$d_{Tomorrow} = (1-t_2)y_2 + R_2 = \rho\,(1-t_2)\, s.$$

Finally, let us assume taxpayers' preferences over the consumption in both periods and labor $(d_{Today}, d_{Tomorrow}, y_1)$ are described by a utility function that generalizes the usual quasilinear utility function for exogenous saving rates: $\mathscr{U}_i(d_{Today}, d_{Tomorrow}, y_1) = d_{Today}^{1-\beta_i} d_{Tomorrow}^{\beta_i} - v_i(y_1)$, with $v_i', v_i'' > 0$. The taxpayer thus chooses labor income y_1 and savings s to solve:

$$\max_{y_1, s} \qquad [(1-t_1)y_1 + R - s]^{1-\beta_i}\,[\rho\,(1-t_2)\,s]^{\beta_i} - v_i\,(y_1)$$

The first-order conditions imply that the savings level s is a fraction β_i of after-tax labor income $(1-t_1)y_1 + R$. Hence, capital income $y_2 = \rho(1-t_2)s$ decrease with the capital tax rate t_2 and the direct elasticity with respect to the capital net-of-tax rate is positive, i.e. $\frac{\partial y_2}{\partial(1-t_2)} > 0$. Moreover, the utility cost of labor should be equal to the marginal return of working. However, a fraction β_i of this return is saved and occurs in the next period. Hence we obtain:[11]

$$(1-t_1)(1-t_2)^{\beta_i} = \frac{v_i'(y_1)}{(1-\beta_i)^{1-\beta_i}(\beta_i\,\rho)^{\beta_i}}$$

Earning one more unit of income today enables $\beta_i(1-t_1)$ additional units of savings, which eventually leads to $(1-t_1)(1-t_2)\rho$ additional units of consumption tomorrow. Hence, in this specific example, the marginal net-of-tax rate on capital income has a positive impact on the incentive to work, which leads to $\frac{\partial y_1}{\partial(1-t_2)} > 0$. While the quasi-linearity assumption simplifies the analysis, it enables us to clarify that people work to consume not only today but also tomorrow, so a higher tax rate on savings decreases not only the incentive to save, but also the incentive to work, which eventually leads to a positive cross-base response, i.e.:

$$0 < \frac{\partial y_1}{\partial(1-\tau_2)}$$

III Data

We use the POTE database[12] produced by the General Direction of Public Finance (DGFIP) on the CASD. The POTE database contains all the income tax records (forms 2042 and 2042 complementary) in France for all taxpayers. It also includes various processing variables used to calculate income tax. The database includes an encrypted identifier for each tax household and another identifier for each individual.[13] These encrypted identifiers enable researchers to compare the tax record of the same household across years, while maintaining fiscal confidentiality. Most items of the income tax record are third-party reported[14] and pre-filled.

Each year, the definition of declared income changes, leading to changes in the definitions of the various items of the income tax records. It is therefore necessary to take into account these changes to maintain a stable and and consistent definition of the different types of incomes used

[11]The first-order conditions are:

$$s: \quad (1-\beta_i)\left(\frac{d_{Tomorrow}}{d_{Today}}\right)^{\beta_i} = \beta_i\,\rho\,(1-t_2)\left(\frac{d_{Tomorrow}}{d_{Today}}\right)^{\beta_i-1} \qquad y_1: \quad (1-t_1)(1-\beta_i)\left(\frac{d_{Tomorrow}}{d_{Today}}\right)^{\beta_i} = v_i'(y_1)$$

The first condition leads to:

$$\frac{d_{Tomorrow}}{d_{Today}} = (1-t_2)\frac{\beta_i\,\rho}{1-\beta_i}$$

Plugging the latter equality into the first-order condition on y_1 yields the result.

[12]Fichier Permanent des Occurrences de Traitement des Émissions

[13]In France, income tax is computed at the tax unit (*Foyer fiscal*) level, which more or less corresponds to the household level. Income tax is not individualized over the period concerned.

[14]Wages are reported by employers. Early retirement benefits, unemployment benefits, daily sickness benefits, exempt overtime, pensions and income from movable capital received and are by pension funds, public employment service, payroll tax administration or banks.

in this study. To do so, we use the definitions of INSEE (French National Institute of Statistics and Economics Studies). INSEE provides documentation defining various categories of income from the tax returns, whether taxable or not ("Bilan de production ERFS"). We use these documents to define labor income $y_{1,t}$ and capital income $y_{2,t}$ consistently across years. Labor income $y_{1,t}$ is the sum of wages, unemployment benefits, pensions, farm incomes and self-employed incomes. Capital income $y_{2,t}$ includes dividends (of different kinds), bonds and other interest incomes. See Appendix A.2 for more details on data and incomes.

We build a balanced panel of tax returns using the encrypted identifiers corresponding to household. We exclude from our study households that experienced divorce, death or marriage between 2008 and 2017.[15] Our study focuses on households whose Reference Tax Income[16] (RFR) is above 30 000 € . Firstly, because this selection avoids very serious mean reversion problems at the bottom of the income distribution. Secondly, because we target family units with significant capital income.[17] We only keep households who reported positive labor and capital income over the whole period (2008-2017). We remove from our sample extreme values in terms of annual changes in capital income.[18] Our baseline sample includes more than 2.2 million households each year and is described in Table 1.

Descriptive statistics	$y_{1,2011}$	$y_{2,2011}$	*Reference tax income in 2011*
	2 294 332 Households		
Mean	68 009	6 474	73 107
Standard deviation	58 008	101 937	168 881
P75	73 918	2 285	73 554
Median	54 704	525	52 545
P25	43 666	82	41 498

Table 1: Descriptive statistics of household incomes in 2011

Marginal Tax Rate Simulation

In order to simulate marginal effective tax rates on different types of incomes, we compute, each year, the amount of income tax and social security paid. To do this, we partly use the tax block and the parameters of the INES microsimulation model co-managed by INSEE and the French

[15] Including PACS, a type of union equivalent to marriage for fiscal purposes.

[16] The Reference Tax Income (*Revenu Fiscal de référence - RFR*) is defined in order to have a better image of the entirety of household income. It plays a role in France similar to the Adjusted Gross Income (AGI) in the US.

[17] On average, family units with an RFR below 30 000€ report capital incomes of 230 € and more than 50% of them declare none. Family units with an RFR above 30 000€ report 3 479€ of capital income on average.

[18] We remove from our sample households who experienced annual variations in capital income below the 5^{th} or above the 95^{th} centile.

Ministry of Health and Solidarity, and freely available since 2016.[19] We thus impute over the period 2008-2017 the income tax brackets, income tax advantage due to children and its ceiling, and the main deductions to reconstitute a income-based tax from reported incomes. We also impute the flat taxes CSG and CRDS[20] on labor and capital incomes over the period 2008-2017 (based on the applicable tax rates, after simulating employee contributions for high earners[21]). To calculate the effective marginal tax rates on each income, we increase in turn the different incomes by 5%. We then compute marginal tax rates from the difference between the modified tax paid and the one simulated in the initial scenario. We build the different instruments according to the method of Auten and Carroll (1999) and Gruber and Saez (2002) by recovering incomes in previous years and applying inflation rates to them.[22]

IV Policy Variations

In this section, we first describe the main policy variations that we used for our identification. Second, we highlight graphical evidence of the behavioral reaction to the main reform.

IV.1 Reforms

Between 2008 and 2012, for most of their capital income (especially dividends and interest income), taxpayers could choose between two options of taxation.[23] Taxpayers can opt to include these incomes in the personal income tax base. In this case, the dividends benefit from a 40% discount.[24] Moreover, dividends benefited from an additional lump sum discount of 1 525 € for singles and 3 050 € for couples from 2008 to 2011. Alternatively, they could opt for the flat tax,

[19]See https://www.insee.fr/fr/information/2021951 for a quick description or the more detailed presentation in https://adullact.net/projects/ines-libre.

[20]CSG and CRDS are flat taxes dedicated to the financing of the social security.

[21]The simulation of employee social security contributions is crude and does not take into account the nonlinearity of the schedule, and in particular, the scale depending on the annual social security ceiling (see Sicsic (2022)). We presume that all the individuals in our sample are located in the last bracket of the social security contribution schedule.

[22]This calculation is simple for dividends or business income, but it is more complicated for "fixed-income investment products". These were included in box 2EE of the income tax return, but this box also includes other types of income (life insurance products with a duration of less than 8 years, solidarity savings products and fixed-income investment products paid in an uncooperative state). These incomes were subject to a flat tax and remained in box 2EE after 2013, while the fixed-income investment products included in the personal income tax base were reported in box 2TR from 2013 onward. We estimate that 83% of income previously reported in 2EE was reported in 2TR as a result of the reform, which we use to impute the instruments between 2013 and the years before 2012.

[23]Life insurance is subject to a withholding tax. Other capital incomes are not subject to the PFL, mainly the taxable share of unlisted securities held in a stock saving plan (PEA) and dividends from individual, commercial or agricultural enterprises or liberal professions. Note also that a flat-rate withholding tax in full discharge already existed before 2008 for some types of capital income such as that from fixed-income investment products.

[24]Except some income such as bond products, debt fund products of over 5 years, loans and advances received by the partners of capital firms, or fees earned by company directors.

namely the *Prélèvement Forfaitaire Libératoire* (PFL). Incomes declared under the PFL are then excluded from the personal income tax base. Instead they are taxed at a flat rate, which is different for interests and dividends. Whether taxpayers opt for the PFL or not, capital incomes are also subject to social contributions ("prélèvements sociaux", PS hereafter). The PFL and social contribution rates gradually increased in 2011 and 2012 (see Appendix A.2).

In 2013, the PFL option was removed and dividends and interests were included in the personal income tax base between 2013 and 2017. Flat taxes were maintained for life insurance contracts and some specific tax-advantaged assets.[25] The 40% discount on dividends was maintained to compensate for the fact that interests were deductible from corporate income tax.

On top of this PFL reform, several other reforms were implemented during the same period, the most salient ones being:

- The removal of the lump-sum reduction on dividends from 2011 onward: in 2011 the amount of the annual fixed tax rebate was set at 1,525 € for singles and 3,050 € for couples subject to comprehensive taxation. There was no more such rebate from 2012 onward.
- The inclusion of capital gains on securities in personal income tax from 2013 onward (which was previously subject to a flat tax).
- A more restrictive ceiling of the tax advantage due to children in 2013 and 2014: the ceiling was reduced from 2 336 € per additional half fiscal-share[26] to 2 000 € in 2013 and 1 500 € in 2014, see Pacifico (2019) for a detailed description.
- The creation of an income tax bracket with a marginal rate of 45% for income above 150 000 € in 2013.
- The implementation of a Special Tax on High Income, namely CEHR *for Contribution Exceptionnelle sur les Hauts Revenus*) in 2012. The CEHR depends on the reference tax income (RFR): 3% RFR above 250 000 € for singles and 5 000 000 € for couples and 4% for an RFR above 500 000 € for singles and 1 000 000 for couples. This led to a top MTR of 49%.

[25]The PFL was maintained for solidarity savings products given within the framework of a solidarity-based automatic payment mechanism (PFL at a reduced rate of 5%) and interest paid to a non-cooperative State or territory (with PFL at a rate of 75%). It should also be noted that the income tax and PFL exemption of regulated savings books and contractual savings products were not affected by the reform: these products have remained exempted like life insurance. Life insurance policies held for 8 years or more are always subject to a PFL of 7.5%, and those held for less than 8 years are subject to a PFL of 15 or 35% (depending on whether they are more or less than 4 years old).

[26]The two first children are each associated to a half fiscal share. From the third children onward, each additional children gives one more fiscal share to the household.

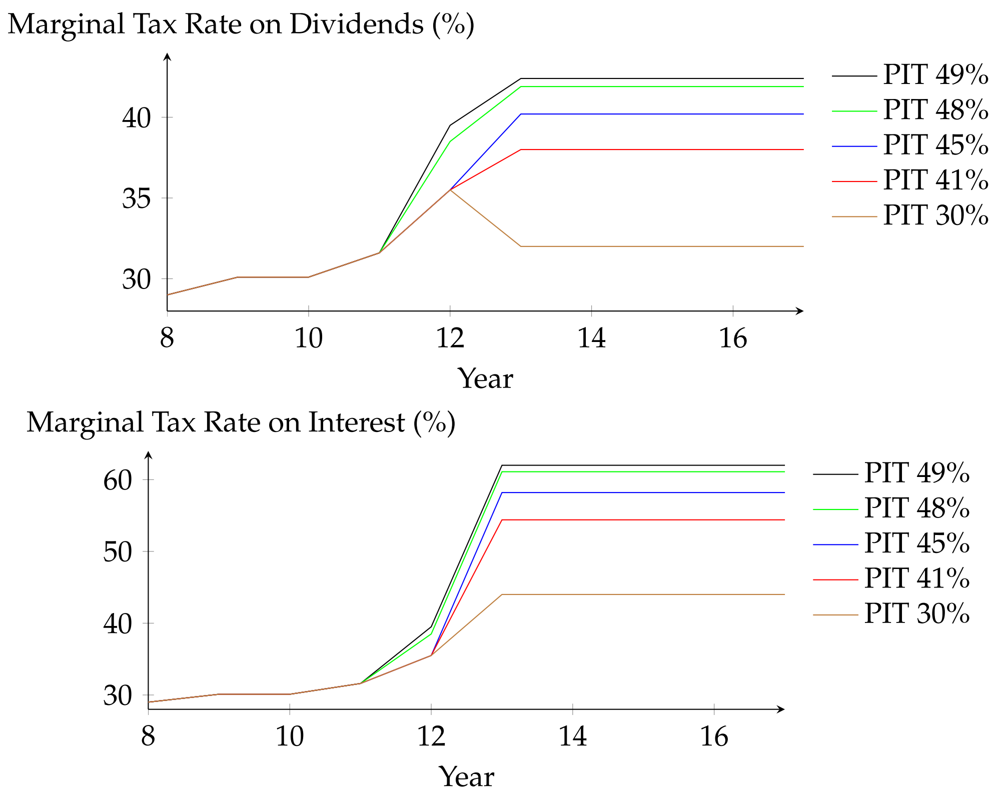

Figure 1: Evolution of marginal tax rates on dividends and interests as a function of the marginal Personal Income Tax (PIT) rate. The graph is built under the assumption taxpayers opt for the PFL before 2012.

- An increase in social security contributions applying to executives of some businesses (namely SARL) in 2013, see Boissel and Matray (2022) for a detailed description.
- The introduction in 2013 and 2014 of a 75 % tax on salaries over 1 000 000 € , see Guillot (2019) for detailed description.

For taxpayers belonging to the 49% income tax bracket who opted for the PFL in 2011, the removal of the PFL option increased the marginal tax rate on dividends from 31.6% [27] to 42.4% in 2013 [28] and the marginal tax rate on interests from 31.6% to 61% ,[29] excluding tax exemptions. Figure 1 illustrates the evolution of the tax rate on dividends and interests for taxpayers who opted for the PFL option before its removal.

[27] Which corresponds to the sum of the PFL of 19% and the 12.6% for social security contributions (SSC) on capital income.

[28] This corresponds to the application of the marginal tax rate of 49% (45% + CEHR) on the 60% of taxable dividends, taking into account a 40% tax rebate on dividends plus 15.5% SSC, taking into account the 5.1% CSG deduction

[29] Which corresponds to the application of the marginal tax rate of 49 % plus 15.5 % SSC, taking into account the rebate of 5.1 % of CSG.

IV.2 Graphical evidence

We now provide graphical evidence of taxpayers' responses to the 2013 reform. The suppression of the PFL flat-tax option in 2013 can be considered as an exogenous and salient shock for taxpayers who opted for the PFL option before. We thus want to compare how the variations of taxpayers' income across time differ according to their exposure to the 2013 reform. For this purpose, we define a treatment and a control group. The treatment group includes all taxpayers who systematically opted for the PFL for their dividends, interests or both between 2008 and 2011.[30] The control group includes all other tax taxpayers. To have homogeneous groups, we restrict the population to tax households that remained in the top income tax bracket in 2008, 2009, 2010 and 2011. We also restrict ourselves to tax households that declared positive labor earnings (wages and self-employed) and positive dividends over the entire period. Descriptive statistics of the population studied are presented in Table B.1 in Appendix B.

Figure 2 depicts the evolution of capital and labor income for the treatment group and the control group over a period of 10 years. Before 2012, both groups had a similar trend in their evolution, for both capital and labor income. However, after 2012, the evolution of the two groups diverged for both income. From 2012, and particularly 2013 onward, the treatment group (taxpayers who opted for the PFL before 2013) experienced a significant decrease in their capital income compared to the control group, suggesting that the 2013 tax reform had a causal effect on capital income. Using a difference-in-differences method (see Appendix B and Table B.2), we estimate that the PFL reform resulted in around 30% decrease in capital income by 2016.[31]

Turning now to labor incomes, Figure 2 suggests the two groups of taxpayers experienced different trends in labor incomes after the reform. In particular, labor income grew more rapidly in the control group than in the treatment group after 2013. This trend difference identifies a slightly negative causal effect of the 2013 reform on labor incomes. This result is not consistent with the theoretical predictions of the income-shifting model for the cross-base responses, but it is

[30] The PFL reform took place in 2013, but it was explicitly included in François Hollande's electoral platform for the presidential election in May 2012. Thus, even though it was implemented in 2013, it is plausible that households with high capital incomes and a majority of dividends changed their behavior in anticipation as early as 2012. This anticipation effect could have been reinforced by the increase in marginal tax rates that occurred in 2011 and 2012. These are the reasons why we use 2011 and not 2012 as the reference year for our difference-in-differences exercise.

[31] $-0.295 \simeq \exp(-0.35) - 1$. See Table B.2 in Appendix B for the estimate. The coefficients of interest are β_k. They indicate how much belonging to the treatment group at date k affects the dependent variable, compared to the difference in 2011. We verify the common trend assumption by testing that coefficients β_k are not statistically significant for years k before 2011. When this is the case, we interpret coefficients β_k for years k after 2011 as the average treatment effect of the 2013 reform in year k. Table B.2 indicates that the common trend assumption is not rejected before the reform: there is no statistically significant divergence in the evolution of capital incomes between the two groups from 2008 to 2011, and thus we can interpret coefficients β_k after 2011 as the average treatment effect of the 2013 reform on capital income.

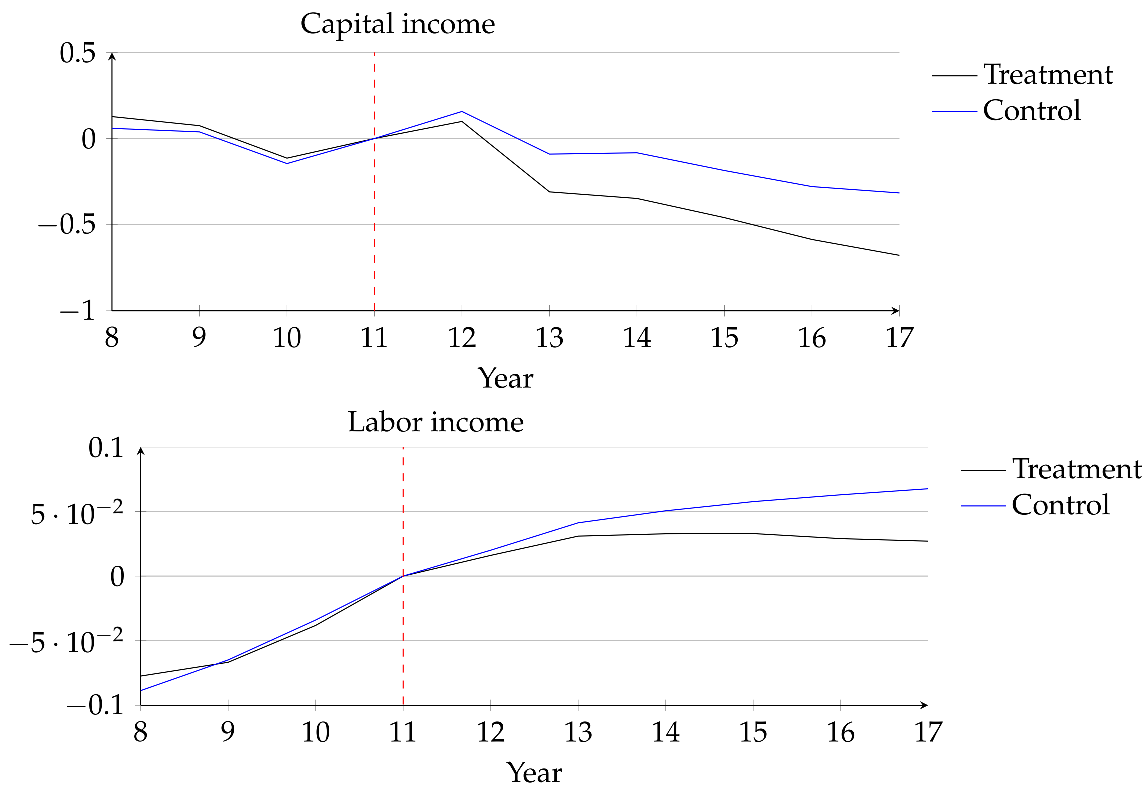

Figure 2: Evolution of control and treatment group on capital and labor income

consistent with the predictions of the two-period model. The coefficient from the DiD regressions on labor income are indeed of the same sign as that of capital income, but much lower (see Table B.2 in Appendix B). Ben Jelloul et al. (2019), Lefebvre et al. (2021) and Boissel and Matray (2022) and Bach et al. (2019)) also investigate the effects of 2013 reforms and reject the income-shifting explanation. [32]

Figure 2 only illustrates some suggestive evidence about the behavioral response to one salient capital tax reform. This difference-in-differences method is, in our view, particularly convincing in terms of internal validity to demonstrate the existence of a causal effect, but it has less external validity. That is because these results only apply to one reform, the re-inclusion of dividends in the income tax base from 2013 onward, while the decrease in capital income may be linked to other reforms before 2013 and in 2013: for instance the increase in the PFL between 2009 and 2012 or the increases in the top marginal tax rate in 2012 and 2013. To compute the Laffer tax rate, we

[32] These papers highlight a slight negative effect of the reform on labor income. Two of these papers (Ben Jelloul et al. (2019) and Lefebvre et al. (2021)) consider as a treatment group the taxpayers that declared dividends (and not capital income) to the PFL. This leads to the common trend test being accepted more easily (in our setting, the common trend assumption is accepted in 2010 but slightly violated in 2008 and 2009 (at 1%)). In our paper, we remain on the more general categorizations of the incomes of the theoretical part (capital income).

conversely need to estimate both the direct elasticity of capital income and the cross elasticity of labor income to the marginal net-of-tax rate of capital income, using all the reforms. For this reason, we use an Instrumental Variable (IV) approach inspired by Auten and Carroll (1999) and Gruber and Saez (2002) to also take into account the changes in marginal tax rates generated by all the reforms over the period 2008-2017. From this point of view, we believe the IV method generates results with higher external validity which provide more reliable estimates than those obtained using the graphical evidence to compute the Laffer tax rate. The next section is devoted to this IV approach.

V Estimation of elasticities

V.1 Estimation Strategy

To estimate the sufficient statistics highlighted in the theoretical section (the elasticity of income k to the marginal net-of-tax rate of capital income $1-\tau^2$), we estimate the following equation:

$$\ln\left(\frac{y^k_{i,t+1}}{y^k_{i,t}}\right) = \alpha + \beta^1 \ln\left(\frac{1-\tau^1_{i,t+1}}{1-\tau^1_{i,t}}\right) + \beta^2 \ln\left(\frac{1-\tau^2_{i,t+1}}{1-\tau^2_{i,t}}\right) + \mu_{i,t} \tag{3}$$

This (log) difference specification has the advantage of eliminating individual fixed effects that capture time-invariant heterogeneity across taxpayers. However, an ordinary-least-squares estimation of Equation (3) would capture not only the effects of tax variables on income, but also the effect of different types of income on the marginal tax rates faced by taxpayers given the progressiveness of taxes. To correct for these simultaneity biases, a two-stage least-squares estimator is implemented, using the instrumentation strategy originally proposed by Auten and Carroll (1999) and Gruber and Saez (2002). The instruments correspond to changes in the (log) marginal-net-of tax-rate (MNTR) that would have occurred if taxpayer's income had been kept unchanged between years $t+1$ and t in real terms, also called mechanical MNTR, i.e.:

$$\ln\left(\frac{1-\overline{\tau}^k_{i,t+1}}{1-\tau^k_{i,t}}\right) \qquad \text{where :} \qquad \overline{\tau}^k_{i,t+1} \stackrel{\text{def}}{\equiv} \frac{\partial T_{t+1}(y^1_{i,t}, y^2_{i,t})}{\partial y^k} \tag{4}$$

where $\overline{\tau}^k_{i,t}$ represents the partial derivative of the tax liability of the year t with respect to the k^{th} income, evaluated at the income of the year $t-1$. It is therefore the mechanical variation of the (log of the) marginal net-of-tax rate that is only caused by changes in tax codes, which captures how much tax unit i is "treated" by tax reforms between years t and $t+1$.

However, it is well known that mean reversion and heterogeneous trends between different income groups are a serious challenge to the validity of this IV approach (Kopczuk, 2005, Saez et al., 2012, Weber, 2014). The first problem causes a negative correlation between the level of income and its variation in the following period. The second problem proved particularly daunting on US data given the context of persistently rising inequality. Thus, when the wealthiest taxpayers experience both faster income growth and a sharp decline in their marginal tax rate, how can one distinguish between faster income growth caused by tax reforms and that caused by trends towards income divergence and increased inequality? To address these issues, Auten and Carroll (1999) add to the right-hand side of the equation (3) the log of the income in year t, while Gruber and Saez (2002) add a richer nonparametric specification based on splines per deciles of income. Kopczuk (2005) and Saez et al. (2012) have, however, shown how, on US data, the results are extremely sensitive to the specifications used to control these phenomena. It is therefore essential to check the robustness of the results to a change in specification.

In this study, we use different functions of the reference tax income (RFR)[33] of the years t and $t-1$ to control for these phenomena. Finally, we believe it is essential to add temporal indicators to the control variables to control for macroeconomic effects. Hence, we estimate by the 2SLS method:

$$\ln\left(\frac{y^k_{i,t+1}}{y^k_{i,t}}\right) = \beta^1 \ln\left(\frac{1-\tau^1_{i,t+1}}{1-\tau^1_{i,t}}\right) + \beta^2 \ln\left(\frac{1-\tau^2_{i,t+1}}{1-\tau^2_{i,t}}\right) + \Phi\left(RFR_{i,t}\right) + \sum_{k=2009}^{2016} \delta_k \, \mathbb{1}_{t=k} + \mu_{i,t} \tag{5}$$

where $\Phi(\cdot)$ is either the log function as in Auten and Carroll (1999) or the specification originally proposed by Gruber and Saez (2002) consisting of introducing a 10-piece spline in log first period reference tax income.

Finally, Weber (2014) used instruments similar to those of Auten and Carroll (1999) and Gruber and Saez (2002) but based on $t-1$ incomes rather than t.[34] Formally, she replaces the instruments described in Equation (4) with the log-variation of marginal retention rates between t and $t+1$ if incomes in t and $t+1$ were to remain the same (in real terms) as incomes in the year $t-1$:

$$\ln\left(\frac{1-\dfrac{\partial T_{t+1}(y^1_{i,t-1}, y^2_{i,t-1})}{\partial y^k}}{1-\dfrac{\partial T_{t}(y^1_{i,t-1}, y^2_{i,t-1})}{\partial y^k}}\right) \qquad \text{for} : k = 1,2 \tag{6}$$

If the trends are heterogeneous by income group or in the presence of mean reversion, the income at date t becomes correlated with the explanatory variable and thus with the residuals. Hence, instruments like (4) which are functions of date t income would become endogenous. This problem

[33] RFR is the concept of taxable income before deduction that is similar to AGI in US data

[34] Lehmann et al. (2013) also proposed such an instrumentation strategy.

of endogeneity is less severe with instruments depending on income in $t-1$. Therefore, we need to check that the estimates of the equation (5) are robust to a change in the specification $\Phi(\cdot)$ of income controls (Kopczuk, 2005) and to the use of instruments *à la* Weber (2014) described in (6) instead of those *à la* Auten and Carroll (1999) described in (4).

V.2 Baseline results

The results of the estimations of Equation (5) are reported in Table 2. These results are obtained by two-stage least-squares, using the instruments given by Equation (4).

Specification	Cross elasticities $e_{1,j}$ (a)					Direct elasticity e_2 (b)
	0%	5.5%	14%	30%	41%	
Spline RFR_t	$0,036$ (0,052)	$0,062^{***}$ (0,006)	$0,059^{***}$ (0,001)	$0,048^{***}$ (0,001)	$0,083^{***}$ (0,011)	$0,767^{***}$ (0.011)

Table 2: Equation (5) Estimates

The first row of Table 2 displays estimates of Equation (5) with our preferred specification. The first stage results of the baseline regression are displayed in Appendix C and ensure instruments are not weak. Column (b) of Table 2 presents estimates of the direct elasticity of capital incomes with respect to their own MNTR. This elasticity is around 0.77. These results are slightly above the estimations of $0.5-0.6$ obtained by Chetty and Saez (2005), Yagan (2015) and Boissel and Matray (2022).

Columns (a) display the estimates for the labor income cross elasticities with respect to the capital income MNTR for each income tax bracket. Cross elasticities are positive, statistically significant, are increasing in income within the short interval [0.036,0.083]. We obtain a positive cross elasticity, in contrast to the predictions from income-shifting models.[35] Our finding of a positive cross-based elasticity is consistent with the predictions due to the "work and save" mechanism of the two-period model. This is also consistent with our previous graphical evidence section IV.2. Note that this is especially true for households with a high marginal rate on labour (columns (a) of Table 2), and that for these households, cross elasticities of labor income with respect to the capital income MNTR are about ten times lower than the direct elasticity.

[35] A decrease in the marginal tax rate on capital income implies an increase in the marginal net-of-tax rate τ_2 on capital income. The income-shifting mechanism predicts that taxpayers will respond by shifting labor income into capital income, which would *increase* capital income (i.e., $\frac{\partial \log y_2}{\partial \log \tau_2} > 0$) and *decrease* labor income (i.e., $\frac{\partial \log y_1}{\partial \log \tau_2}$ <0). Our finding of a positive cross-based elasticity is thus consistent with the absence of significant income-shifting effects following a change in the marginal rate of capital.

V.3 Robustness check

The method of Auten and Carroll (1999) and Gruber and Saez (2002) for estimating income elasticity to the marginal net-of-tax rate has been the subject of intense criticism in the literature (Saez et al., 2012). The difficulty is that this method has often been used in a context where the wealthiest taxpayers benefited from the largest reductions in marginal tax rates and simultaneously experienced faster income growth than other taxpayers (Gruber and Saez, 2002, Weber, 2014, Jakobsen and Søgaard, 2022). It is therefore especially difficult to disentangle whether a difference in income growth across income groups is due to tax reforms or to a trend of increasing inequality (Saez et al., 2012). Kopczuk (2005) showed in particular how estimates on U.S. data were particularly sensitive to the specification of income controls (the $\Phi(\cdot)$ function in the equation (5)). Table 3 presents other estimated results we carried out in changing the specification of income controls.

	Specification	Cross elasticities $e_{1,j}$ (a)					Direct elasticity e_2 (b)
		0%	5.5%	14%	30%	41%	
(1)	Without controls	0.035^{***} (0.051)	0.059^{***} (0.006)	0.054^{***} (0.001)	0.050^{***} (0.002)	0.096^{***} (0.012)	1.016^{***} (0.011)
(2)	$\ln RFR_t$	$0,041^{***}$ (0.051)	0.060^{***} (0.006)	0.051^{***} (0.001)	0.048^{***} (0.001)	0.078^{***} (0.011)	0.811^{***} (0.011)
(3)	**Splines of $\ln \mathbf{RFR_t}$**	**$0,036^{***}$ (0,052)**	**$0,062^{***}$ (0,006)**	**$0,059^{***}$ (0,001)**	**$0,048^{***}$ (0,001)**	**$0,083^{***}$ (0,011)**	**$0,767^{***}$ (0.011)**
(4)	$\ln RFR_{t-1}$	0.046^{***} (0.051)	0.060^{***} (0.006)	0.057^{***} (0.001)	0.050^{***} (0.001)	0.090^{***} (0.011)	1.138^{***} (0.011)
(5)	Splines of $\ln RFR_{t-1}$	0.049^{***} (0.051)	0.061^{***} (0.006)	0.051^{***} (0.001)	0.051^{***} (0.001)	0.091^{***} (0.011)	1.092^{***} (0.011)
(6)	$\ln\left(\frac{RFR_t}{RFR_{t-1}}\right)$	0.056^{***} (0.051)	0.052^{***} (0.006)	0.048^{***} (0.001)	0.048^{***} (0.001)	0.096^{***} (0.011)	1.174^{***} (0.011)
(7)	Splines of $\ln\left(\frac{RFR_t}{RFR_{t-1}}\right)$	0.065^{***} (0.050)	0.055^{***} (0.006)	0.043^{***} (0.001)	0.050^{***} (0.001)	0.095^{***} (0.011)	0.956^{***} (0.011)
(8)	$\ln RFR_t$, $\ln\left(\frac{RFR_t}{RFR_{t-1}}\right)$	0.057^{***} (0.051)	0.054^{***} (0.006)	0.051^{***} (0.001)	0.048^{***} (0.001)	0.087^{***} (0.011)	1.127^{***} (0.011)
(9)	Splines of $\ln RFR_t$ and of $\ln\left(\frac{RFR_t}{RFR_{t-1}}\right)$	0.076^{***} (0.051)	0.058^{***} (0.006)	0.053^{***} (0.001)	0.051^{***} (0.001)	0.092^{***} (0.011)	0.988^{***} (0.011)
(10)	Splines of $\ln RFR_{t-1}$ and of $\ln\left(\frac{RFR_t}{RFR_{t-1}}\right)$	0.081^{***} (0.050)	0.058^{***} (0.006)	0.051^{***} (0.001)	0.052^{***} (0.001)	0.094^{***} (0.011)	0.979^{***} (0.011)

Table 3: Equation (5) estimates, with various controls on taxable income, using Instruments (4)

There is no income control in the first row. The second row adopts the specification of Auten and Carroll (1999) depending on the logarithm of the base income. The third row adopts the specification of Gruber and Saez (2002) consisting in using log-linear 10-piece splines per decile of reference tax income. The two specifications in lines (2) and (3) are designed to control for the fact that trend income growth may vary along the income distribution. Rows (4) and (5) differ from rows (2) and (3), respectively, by using the reference tax income of year $t-1$ instead of year t to mitigate the risks of correlation between the explanatory variables, and the residual income growth rate between dates t and $t+1$ (i.e., the residual of equation (5)). Rows (6) and (7) use functions of the income growth rate between years $t-1$ and t in order to more specifically control for mean-reversion. Finally, the last three lines are specifications that aim to control both the heterogeneity of trends along the income distribution and the mean reversion phenomenon. All these specifications are directly inspired by Kopczuk (2005).

The sign of the different elasticities, their orders of magnitude and their significance at 1% are robust to the different specifications used. In particular, the elasticity of capital income to its marginal net-of-tax rate shows few variations and remains in the interval $[0.76, 1.17]$. The elasticities of labor income to the MNTR of capital income also vary little in the interval $[0.034, 0.097]$ (the largest cross-elasticity being always obtained within the highest income tax bracket). This robustness strengthens the reliability of our results. This can be explained by the fact that since inequalities are much less dynamic in France, the problem of trend heterogeneity between income groups is likely less severe in France than in the US. Moreover, since we are dealing with an increase in marginal tax rates, ignoring the effects of a possible increase in inequality would tend to underestimate the effects instead of overestimating them in the usual context of US tax reforms where the wealthiest experiences the largest tax cuts.

As a robustness check we use the instruments proposed by Weber (2014) based on year $t-1$ and described in the equation (6). Results are summed up in Table 4, which also displays different specifications depending on income control (including Kopczuk (2005) specification) in the same spirit as Table 3. The use of the instruments of Weber (2014) decreases slightly the estimates of the direct elasticities of capital income (from around 0.7 to around 0.5). The estimates of the cross-elasticities of labor incomes to the marginal retention rate of capital slightly increase when using Weber's instruments.

VI Policy implications: the Laffer Rates

In this section, we use our estimates to compute the capital income tax rate that would maximize government revenues: the Laffer tax rate. For this purpose, we use Equation (2) and the estimates obtained (see of Table 2). Neglecting the cross-responses, the Laffer rate would be equal

	Specification	Cross elasticities $e_{1,j}$ (a)					Direct elasticity e_2 (b)
		0%	5.5%	14%	30%	41%	
(1)	Without controls	0.205 (0.315)	0.034^{**} (0.010)	0.026^{***} (0.001)	0.040^{***} (0.002)	0.123^{***} (0.020)	0.790^{***} (0.017)
(2)	$\ln RFR_t$	0,217 (0.290)	0.045^{***} (0.009)	0.026^{***} (0.001)	0.039^{***} (0.003)	0.117^{***} (0.020)	0.556^{***} (0.017)
(3)	**Splines of $\ln \mathbf{RFR_t}$**	**0.128** **(0.261)**	$\mathbf{0.044}^{***}$ **(0.009)**	$\mathbf{0.037}^{***}$ **(0.001)**	$\mathbf{0.040}^{***}$ **(0.002)**	$\mathbf{0.127}^{***}$ **(0.020)**	$\mathbf{0.508}^{***}$ **(0.017)**
(4)	$\ln RFR_{t-1}$	0.203 (0.318)	0.036^{**} (0.010)	0.032^{***} (0.001)	0.037^{***} (0.002)	0.104^{***} (0.020)	0.300^{***} (0.017)
(5)	Splines de $\ln RFR_{t-1}$	0.200 (0.317)	0.033^{**} (0.010)	0.043^{***} (0.001)	0.038^{***} (0.003)	0.111^{***} (0.020)	0.221^{***} (0.017)
(6)	$\ln\left(\frac{RFR_t}{RFR_{t-1}}\right)$	-0.079 (0.280)	0.058^{***} (0.010)	0.019^{***} (0.002)	0.036^{***} (0.002)	0.114^{***} (0.020)	0.274^{***} (0.017)
(7)	Splines of $\ln\left(\frac{RFR_t}{RFR_{t-1}}\right)$	-0.003 (0.274)	0.055^{***} (0.006)	0.043^{***} (0.001)	0.050^{***} (0.001)	0.095^{***} (0.011)	0.956^{***} (0.011)
(8)	$\ln RFR_t$, $\ln\left(\frac{RFR_t}{RFR_{t-1}}\right)$	-0.027^{***} (0.275)	0.059^{***} (0.010)	0.031^{***} (0.002)	0.039^{***} (0.002)	0.118^{***} (0.021)	0.493^{***} (0.018)
(9)	Splines of $\ln RFR_t$ and of $\ln\left(\frac{RFR_t}{RFR_{t-1}}\right)$	0.016 (0.247)	0.059^{***} (0.010)	0.038^{***} (0.002)	0.037^{***} (0.002)	0.117^{***} (0.021)	0.316^{***} (0.019)
(10)	Splines of $\ln RFR_{t-1}$ and of $\ln\left(\frac{RFR_t}{RFR_{t-1}}\right)$	0.084 (0.260)	0.057^{***} (0.010)	0.038^{***} (0.002)	0.038^{***} (0.002)	0.114^{***} (0.021)	0.285^{***} (0.018)

Table 4: Equation (5) estimates, with various controls on taxable income, using Instruments (6)

to $\tau_2 = 56\% \simeq 1/(1+0,77)$, given our estimate of 0.77 for the direct elasticity of capital income.

But this first calculation, ignores the effects of the taxation of capital on labor incomes. The higher the cross elasticity $\frac{\partial \ln Y_1}{\partial \ln(1-\tau_2)}$, the greater the decrease not only in capital income, but also in labor income in response to the higher tax rate on capital income, and therefore in the taxes levied on the latter. However, since labor income represents a much higher tax burden than capital income,[36] the Laffer tax rate appears to be particularly sensitive to the estimation of the cross elasticity $\frac{\partial \ln Y_1}{\partial \ln(1-\tau_2)}$ of labor income to the marginal net-of-tax rate on the capital income.

This sensitivity is illustrated by Figure 3, which shows how much the Laffer rate decreases with cross elasticities $\frac{\partial \ln Y_{1,j}}{\partial \ln(1-\tau_2)}$. The blue curve represents the Laffer tax rate, taking into account the cross responses of labor income to the taxation of capital income.[37] The Laffer rate are represented in the y axis and the x-axis depicts the mean of these cross elasticities weighted by the labor income in each tax bracket. The case with no cross base response is represented at $x = 0$, with a Laffer rate

[36] In our sample, the sum of Y_2 is 14 855 675 443 € while the sum of Y_1 îs 156 035 073 290 € (excluding social security contributions). See appendix C.1 for a breakdown of labor income by income tax brackets.

[37] To display this graph we assume that capital income and labor income in each income tax bracket are isoelastic functions of $1 - t_2$.

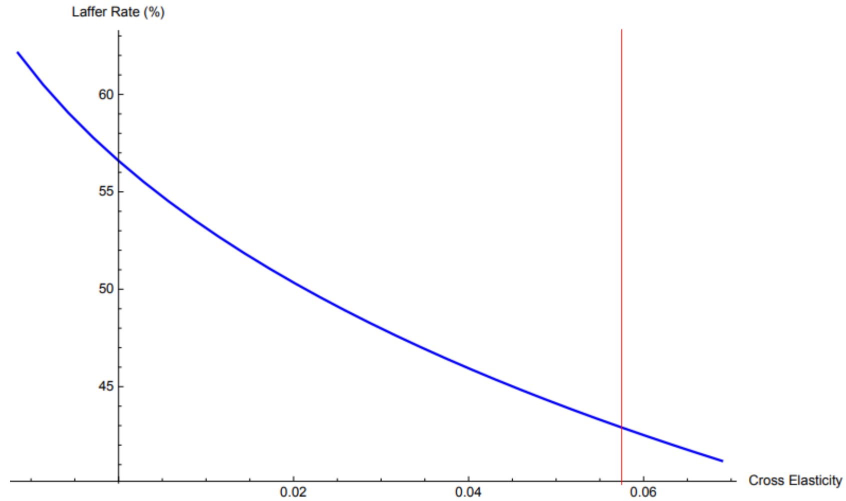

Figure 3: Laffer tax rates as a function of the cross elasticity $\frac{\partial \ln Y_1}{\partial 1-\tau_2}$.

at 56.6%. The case with our estimates of cross elasticities for each tax bracket corresponds to the red vertical line, with a Laffer rate at 42.9%. Otherwise, we rescale all the cross elasticities $e_{1,j}$ by the same factor from our estimates of Table 2. It is worth noting that, had we integrated employee and employer social contributions on top of personal income tax to the computation, the variation in tax revenues would have been larger, so we would have obtained even lower Laffer rates with our estimated cross responses. It should be noted that if the cross-elasticity were negative, which would be in line with the income-shifting mechanisms, the Laffer rates would become higher. Hence, if one still believe cross-base responses are negative despite our estimations (which may be the case in other circumstances, periods or countries), one would obtain higher Laffer rate than the 56.6% as depicted by the blue curve in the left part of the vertical axis.

VII Conclusion

In this paper, we have shown that the cross-base responses matter when it comes to calculating the Laffer tax rates on capital income. We derived a formula to estimate the Laffer tax rates and highlighted what sufficient statistics are needed to compute Laffer rates. We then estimated these statistics using reforms between 2008 and 2017 in France and adopting an instrumental variables method. Our period of interest includes the 2013 capital tax reform, which is a very salient reform as we illustrate with difference-in-differences graphical evidence. It also includes the increase in the flat tax rate between 2009 and 2012, allowing us to have many sources of identification. The Laffer rate would be equal to 57%, given our estimate of 0.77 for the direct elasticity of capital income, which appears robust. But we show that since labor income represents a much higher tax base than capital income, the Laffer tax rate is particularly sensitive to the estimation of the cross elasticity of labor income to the marginal net-of-tax rate on the capital income. We estimate this cross-elasticity to be positive, which causes the Laffer tax rate to be lower than the value obtained using only the direct elasticity, around 43% when we take into account income tax on labor income.

However, these calculations of Laffer tax rates must be treated with caution. First, it should be remembered that our estimates relate only to capital income flows and exclude financial capital gains. Next, our calculations of Laffer tax rates presuppose homogeneous elasticities across taxpayers receiving financial income, a simplifying hypothesis whose empirical relevance and consequences for the calculation of the Laffer tax rate are beyond our control.[38] Moreover, if we obtain a lower Laffer rate by taking into account cross-responses, it is because our econometric exercises lead us to a positive estimate for this cross-elasticity. This econometric result may be surprising because it is contrary to the intuitions inspired by income-shifting mechanisms. A positive elasticity is nevertheless theoretically consistent with the following idea (formalized in Section II.3): an increase in the marginal tax rate on capital reduces the benefit of earning additional income from activity in order to save. Thus, an increase in the taxation of capital income would reduce incentives to earn earned income. However, our estimate of a positive cross-elasticity would benefit from further empirical confirmation. Moreover, while the sign of the elasticities we have estimated seems robust, we should not underestimate the remaining uncertainty about the exact values of the elasticities.

Finally, it is likely that a significant proportion of the behavioral elasticities that we have estimated reflects tax optimization behavior. Reducing tax optimization opportunities, allowed in particular by certain tax expenditures, would then have an effect on the elasticities, and thus on the Laffer tax rates. Nevertheless, this argument assumes that tax optimization mechanisms are sufficiently well understood to know what changes in the tax code and tax collection techniques are necessary to reduce tax optimization opportunities and thus increase Laffer tax rates. However, our understanding of the mechanisms by which taxpayers react to capital tax reforms unfortunately remains limited. This is why it seems interesting and important, beyond the limits inherent to this exercise, to simulate which Laffer tax rates are induced by the elasticities we have estimated.

[38] Kumar and Liang (2020) explain how neglecting the heterogeneity of elasticity could lead to significant biases in the estimates of behavioral responses while Jacquet and Lehmann (2021) show how it affects the computation of optimal tax rates.

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Appendix

A Data and institutional background on capital income taxation

In this section, we give more details on tax legislation and income data. We start with the institutional background, since data depend on the legislation.

A.1 Institutional Background

Personal Income Taxation. Income tax in France is calculated at the level of the tax household. This is a joint income taxation system where spousal incomes and any income that the couple's children might have are jointly taxed along with the husband's income. The declared income of all members of the tax unit is added up, and different tax base deductions are applied to the total declared income. First, the total declared income is adjusted for personal circumstances by allowing tax base deduction for some income (for instance a 10% deduction for wage income to take into account personal expenses), and then other deductible expenses are subtracted (alimony, various deductions, etc.) and finally tax base deduction (for elderly or disabled persons or for dependent children who are married or in a civil union) are applied to get the taxable income. The taxable income of the household unit is divided by the number of tax shares (or tax unit, "part fiscale" in French) to determine the taxable income per tax unit taxed the following year. A certain number of tax shares is allocated to each tax household according to its composition (a single taxpayer has one share and a couple has 2 shares). The taxable income per tax unit is then taxed according to a traditional progressive tax scale. Finally, the tax on the income of the tax household is computed by multiplying the taxable income per tax unit by the number of tax unit. Because of the joint taxation and application of the quotient familial, taxation diminishes the tax of households with more dependent persons. Given the convexity of the income tax schedule, the income-splitting mechanism reduces the income tax burden of households if the number of share is larger than one. Since 1981, this reduction has been capped and the amount of this ceiling is revalued at the same rate as the thresholds of the tax brackets. We take into account all these features of the income tax in our simulation of marginal tax rates.

Reference Taxable Income ("Revenu Fiscal de Référence") is another important income aggregate (along with taxable income) that we use since it is used for different purposes by the fiscal administration (as an income criterion for certain taxes or exemptions or for social benefits). The reference taxable income is constructed by adding income taxed at a flat rate, exempt income, and the retirement savings contribution deduction, to the taxable income previously defined.

Capital income taxation. Between 2008 and 2012, taxpayers could choose between two options of taxation for most of their capital income (Life insurance are subject to a withholding tax, while other capital incomes are not subject to the PFL, mainly taxable share of unlisted securities held in a stock saving plan (PEA) and dividends from individual, commercial or agricultural enterprises or liberal professions). Taxpayers can opt to include these incomes in the personal income tax base. In this case, dividends benefit from a 40% tax discount.[39] Moreover, dividends benefit from an additional lump sum discount of 1 525 € for singles and of 3 050 €for couples from 2008 to 2011. Alternatively, they could opt for the flat tax, namely the *Prélèvement Forfaitaire Libératoire* (PFL). Incomes declared under the PFL were then excluded from the personal income tax base. Instead they were taxed at a flat rate, which was different for interests and dividends. The PFL rates gradually increased in 2011 and 2012 (see table A.1). Whether taxpayers opted for the PFL or not, capital incomes were also subject to a social contribution ("prélèvements sociaux", PS hereafter and in table A.1). The rate of the PS increased in the period, leading to a total tax rate of 30.1% in 2008 and 36.5% in 2012.

In 2013, the PFL option was removed and dividends and interests were included in the personal income tax base between 2013 and 2017. The PFL remained only for life insurance contracts and some specific tax-advantaged assets[40] The 40% discounts on dividends was maintained to compensate the fact that interests were deductible from the corporate income tax. The reform lead *de facto* dividends and fixed-income investment products obtained in the year t to be taxed comprehensively with the income tax base in the year $t+1$. The table A.1 shows the tax rate for each level of income. Note, however, that a mandatory withholding flat-tax (PFO) under the same conditions as the PFL (rebate and rate) was maintained from 2013 and was to be deducted from the income tax payable in the following year. This PFO was essentially designed to avoid a cash-flow problem in 2013 but had no effect on the taxation of capital income. It should be noted, however, that the law provides that taxpayers whose tax income is below a certain threshold may apply for an PFO exemption in 2013 on distributed income and income from fixed-income investments. The finance law for 2013 also introduced the possibility of opting for a flat tax of 24% for income below 2,000

[39] Except for some incomes such as bond products, debt fund products of over 5 years, loans and advances received by the partners of capital firms, fees earned by company directors (box 2TS).

[40] The PFL was maintained for solidarity savings products given within the framework of a solidarity-based automatic payment mechanism (PFL at a reduced rate) and interest paid to a non-cooperative State or territory (whose PFL was higher). **It should also be noted that the income tax and PFL exemption of regulated savings books and contractual savings products was been affected by the reform: these products have remained exempted.**

		2008	2009	2010	2011	2012
Dividends	PFL	18,0%	18,0%	18,0%	19,0%	21,0%
	PS *	11,0%	12,1%	12,1%	12,6%	14,5%
	Total	29,0%	30,1%	30,1%	31,6%	35,5%
Fixed capital incomes	PFL	18,0%	18,0%	18,0%	19,0%	24,0%
	PS *	11,0%	12,1%	12,1%	12,6%	14,5%
	Total	29,0%	30,1%	30,1%	31,6%	38,5%

Table A.1: Tax Rates on flat tax PFL by Type of Capital Income from 2008 to 2012

* PS = "Prélèvements Sociaux" = Social contribution rates are calculated here as annual averages (some rate increases occurred in the middle of the year: from 12.1% to 12.3% increase in November 2011 and from 13.5% to 15.5% in July 2012)

euros. To summarize, between 2013 and 2018, capital income in the year t was taxed in income tax in the year $t+1$ (with a mandatory lump-sum levy collected in the year t and refunded as a tax credit in the year $t+1$, for certain households).

A.2 Data

Database. We use a file called POTE, a panel of income tax returns produced by the General Direction of Public Finance (DGFIP). These files contain all the elements of taxpayers' 2042 tax returns and of the 2042 complementary tax returns in France, as well as various processing variables used for the calculation of the income tax, for each of the near 40 million French tax units, and from the years 2006 to 2019. Tax units have to report all types of income, including from self-employed activities, received in the previous year. Tax units (defined as an individual, their spouse, and their children under 18, 21 or 25 years old) are followed over time thanks to an anonymous unique identifier for each tax unit between years. The forms of the data change every year according to changes in the fiscal legislation. Tax filling is mandatory for individuals who live in France or have their main professional activity located in France, and even if the tax unit is not taxable.

Capital Income. In POTE data, dividends, bonds and other interest incomes are reported in different boxes according to they way they are taxed. For instance, dividends are reported in box 2FU for those not eligible to the PFL flat tax, 2DA for those eligible to the PFL and tax allowances if taxpayers opt to include these incomes in the personal income tax base (in this case, declared dividends are raw dividends, without deduction of any tax allowances), and 2TS for those which are not eligible to tax base allowances. After 2013, dividend are declared in the 2DC box, as the form does not distinguish between the two types anymore. Other capital incomes (bonds, life insurance, interest, PEA) are placed in different boxes (2CH, 2DH, 2EE, 2FU) depending on their taxation and whether they are subject to withholding flax tax. This changed in 2013 and we take into account the tax box definition changes and the fact that some income was reported in different tax boxes (especially, the amount of income in box 2EE increased).

It should be noted that the capital income taken into account in our analysis is the taxed income, present in the tax data. Other capital income is not taxed, such as income from different passbooks (livret A, LDD, etc.) and some life insurance and PEA income. However, as the taxation of these incomes did not change over the period considered, we are fairly confident their omission essentially reduces the total amount of capital incomes without qualitatively affecting our empirical estimates.

Labor Income. Labor income is one of the more stable incomes. In our definition, we include as income of both spouses (and possibly dependents): labor income (mainly boxes 1AJ to 1FJ), self-employment income (several dozen boxes that we will not specify here), unemployment income (boxes 1AP, 1BP, 1CP, 1DP, 1EP, 1FP). Also, overtime hours were moved out from boxes 1AJ and 1BJ in 2008 (to different boxes: 1AU, 1BU, 1CU, 1DU) and reintroduced between 2013 and 2017. We take into account these changes by adding the boxes to the definition between 2008 and 2012.

Despite the attention paid to the stability of the definitions, some inconsistencies remain due to changes in legislation we cannot deal with. For instance, specific schemes on pension increases for retirees having raised at least 3 children and the employer and employee contributions to the collective contracts for complementary health care in the declared incomes $y_{1,t}$ from 2014 onward. However, we are fairly confident these changes have little effects on the results of this study, and on the contrary, reinforces our conclusions on the absence of income-shifting. Indeed, these changes could lead us to consider an increase in income $y_{1,t}$ in 2014 to be linked to the reform; on the contrary, we find that the reform would have a negative (but very small) effect on this income, which indicates that this change in the box should not worry us, and on the contrary, reinforces our conclusions.[41]

[41] Moreover, for pension increases, robustness tests on retirees show no effect of the reform on this population, so this change in the tax box contour should have no effect on our conclusions.

B Difference and difference

Descriptive statistics of treatment and control group is given in table B.1. We estimate a difference-in-differences equation of the form:

$$\ln(y_{i,t}) = \alpha_i + \sum_k \delta_k \, \mathbb{1}_{t=k} + \sum_{k \neq 2011} \beta_k \, \mathbb{1}_{t=k} \times \mathbb{1}_{i \in Treated} + \sum_j \gamma_j \, X^j_{i,t} + v_{i,t} \tag{7}$$

where i is an index relating to the taxpayers, and t is a time dummy. The dependent variable $y_{i,t}$ can be labor or capital income. The variable $\mathbb{1}_{i \in Treated}$ is equal to 1 if tax unit i belongs to the treatment group and is equal to zero otherwise. Coefficients α_i are individual fixed effects capturing time-invariant heterogeneities between households. Coefficients δ_k capture common trends, $X_{i,t}$ are control variables and $v_{i,t}$ are the unobserved residuals. The coefficients of interest are β_k. They indicate how much belonging to the treatment group at date k affects the dependent variable, compared to the difference in 2011. We verify the common trend assumption by testing that coefficients β_k are not statistically significant for years k before 2011. When this is the case, we interpret coefficients β_k for years k after 2011 as the average treatment effect of the 2013 reform in year k. Instead of estimating the fixed effects α_i in (7), which is computationally very demanding, we actually estimate the difference between (7) and its version for $t = 2011$, i.e.:

$$\ln\left(\frac{y_{i,t}}{y_{i,2011}}\right) = \sum_k \widetilde{\delta}_k \, \mathbb{1}_{t=k} + \sum_k \beta_k \, \mathbb{1}_{t=k} \times \mathbb{1}_{i \in Treated} + \sum_j \gamma_j \, \left(X^j_{i,t} - X^j_{i,2011}\right) + u_{i,t} \tag{8}$$

where $\widetilde{\delta}_k = \delta_k - \delta_{2011}$ and $u_{i,t} = v_{i,t} - v_{i,2011}$.

We add different controls in the regression $X_{i,t}$: family configuration, and other reforms that took place during the reference period and that we mentioned in the section IV.

Descriptive statistics	$y_{1,2011}$	$y_{2,2011}$	*Reference tax income in 2011*	*Tax units*	*Age in 2011*
Treatment group	228 496 households				
Mean	91 782	16 009	107 657	2,5	47,6
Standard deviation	89 327	186 075	275 765	0,9	7,6
P75	102 599	5 255	108 484	3	54
Median	69 313	1 351	68 647	2,5	48
P25	51 504	342	49 356	2	42
Control group	386 370 households				
Mean	66 480	4 140	65 401	2,6	46,5
Standard deviation	39 792	85 789	109 216	0,8	7,2
P75	782	9 884	69 815	3	52
Median	56 648	127	51 870	2,5	47
P25	46 519	14	41 888	2	41

Table B.1: Descriptive statistics of household's incomes in 2011 - Sub-sample used for difference in difference estimation strategy.

	y_1		y_2	
	No controls (1)	Controls (2)	No controls (3)	controls (4)
β_{2008}	0.046^{***} (0.007)	0.040^{***} (0.007)	0.030 (0.032)	-0.036 (0.033)
β_{2009}	0.026^{**} (0.007)	0.026^{***} (0.007)	0.076 (0.033)	0.078 (0.034)
β_{2010}	0.019^{*} (0.007)	0.015^{**} (0.007)	-0.011 (0.032)	-0.006 (0.033)
β_{2012}	-0.022^{*} (0.008)	-0.019^{*} (0.007)	-0.020 (0.038)	-0.044 (0.039)
β_{2013}	-0.024^{*} (0.007)	-0.026^{**} (0.007)	-0.162^{***} (0.033)	-0.196^{***} (0.035)
β_{2014}	-0.021^{*} (0.007)	-0.026^{**} (0.007)	-0.193^{***} (0.033)	-0.250^{***} (0.034)
β_{2015}	-0.043^{***} (0.007)	-0.066^{***} (0.007)	-0.227^{***} (0.033)	-0.288^{***} (0.035)
β_{2016}	-0.075^{***} (0.007)	-0.100^{***} (0.007)	-0.285^{***} (0.034)	-0.350^{***} (0.035)

Table B.2: Results of estimating the β_k coefficients of equation (8), with and without controls.

C Additional Tables

This appendix gives additional tables on the instrumental variable estimation strategy's results.

Descriptive statistics	$\sum y_{1,2011}$	$\sum y_{2,2011}$	N
$MTR = 0\%$	68 800 228	43 212 555	2 092
$MTR = 5.5\%$	3 861 497 056	126 666 291	86 960
$MTR = 14\%$	67 319 660 410	2 642 918 829	1 302 391
$MTR = 30\%$	65 168 469 235	6 907 061 190	807 831
$MTR = 41\%$	19 616 646 361	5 135 816 578	95 058
$MTR = 41\%$	19 616 646 361	5 135 816 578	95 058
Total	156 035 073 290	14 855 675 443	2 294 332

Table C.1: Descriptive statistics of household's incomes in 2011 according MTR on labor income - Using for weighted average cross elasticities.

Dependent Variables	$\ln\left(\frac{1-\tau^1_{i,t+1}}{1-\tau^1_{i,t}}\right)$	$\ln\left(\frac{1-\tau^2_{i,t+1}}{1-\tau^2_{i,t}}\right)$
$\ln\left(\frac{1-\overline{\tau}^1_{i,t+1}}{1-\tau^1_{i,t}}\right)$	0.696^{***} (0.001)	-0.053^{***} (0.001)
$\ln\left(\frac{1-\overline{\tau}^2_{i,t+1}}{1-\tau^2_{i,t}}\right)$	-0.068^{***} (0.001)	0.602^{***} (0.001)
F stats	148 328	268 237

Table C.2: First stage results of e_2 estimation in the baseline, Instruments (4)

Dependent Variables	$\ln\left(\frac{1-\tau^1_{i,t+1}}{1-\tau^1_{i,t}}\right)$	$\ln\left(\frac{1-\tau^2_{i,t+1}}{1-\tau^2_{i,t}}\right)$
$\ln\left(\frac{1-\overline{\tau}^1_{i,t+1}}{1-\tau^1_{i,t}}\right)$	0.681^{***} (0.031)	-0.042 (0.041)
$\ln\left(\frac{1-\overline{\tau}^2_{i,t+1}}{1-\tau^2_{i,t}}\right)$	-0.105^{***} (0.017)	0.603^{***} (0.022)
F stats	60	99

Table C.3: First stage results of e_1 if $MTR = 0\%$ estimation in the baseline, Instruments (4)

Dependent Variables	$\ln\left(\frac{1-\tau^1_{i,t+1}}{1-\tau^1_{i,t}}\right)$	$\ln\left(\frac{1-\tau^2_{i,t+1}}{1-\tau^2_{i,t}}\right)$
$\ln\left(\frac{1-\overline{\tau}^1_{i,t+1}}{1-\tau^1_{i,t}}\right)$	0.779^{***} (0.003)	-0.019^{***} (0.004)
$\ln\left(\frac{1-\overline{\tau}^2_{i,t+1}}{1-\tau^2_{i,t}}\right)$	-0.059^{***} (0.002)	0.742^{***} (0.002)
F stats	8 065	12 419

Table C.4: First stage results of e_1 if $MTR = 5.5\%$ estimation in the baseline, Instruments (4)

Dependent Variables	$\ln\left(\frac{1-\tau^1_{i,t+1}}{1-\tau^1_{i,t}}\right)$	$\ln\left(\frac{1-\tau^2_{i,t+1}}{1-\tau^2_{i,t}}\right)$
$\ln\left(\frac{1-\overline{\tau}^1_{i,t+1}}{1-\tau^1_{i,t}}\right)$	0.708^{***} (0.003)	-0.154^{***} (0.001)
$\ln\left(\frac{1-\overline{\tau}^2_{i,t+1}}{1-\tau^2_{i,t}}\right)$	-0.075^{***} (0.002)	0.769^{***} (0.002)
F stats	61 505	181 748

Table C.5: First stage results of e_1 if $MTR = 14\%$ estimation in the baseline, Instruments (4)

Dependent Variables	$\ln\left(\frac{1-\tau^1_{i,t+1}}{1-\tau^1_{i,t}}\right)$	$\ln\left(\frac{1-\tau^2_{i,t+1}}{1-\tau^2_{i,t}}\right)$
$\ln\left(\frac{1-\overline{\tau}^1_{i,t+1}}{1-\tau^1_{i,t}}\right)$	0.376^{***} (0.002)	-0.270^{***} (0.002)
$\ln\left(\frac{1-\overline{\tau}^2_{i,t+1}}{1-\tau^2_{i,t}}\right)$	-0.036^{***} (0.001)	0.769^{***} (0.001)
F stats	5 085	97 141

Table C.6: First stage results of e_1 if $MTR = 30\%$ estimation in the baseline, Instruments (4)

Dependent Variables	$\ln\left(\frac{1-\tau^1_{i,t+1}}{1-\tau^1_{i,t}}\right)$	$\ln\left(\frac{1-\tau^2_{i,t+1}}{1-\tau^2_{i,t}}\right)$
$\ln\left(\frac{1-\overline{\tau}^1_{i,t+1}}{1-\tau^1_{i,t}}\right)$	0.842^{***} (0.002)	-0.083^{***} (0.004)
$\ln\left(\frac{1-\overline{\tau}^2_{i,t+1}}{1-\tau^2_{i,t}}\right)$	-0.038^{***} (0.002)	0.403^{***} (0.003)
F stats	8 317	4 448

Table C.7: First stage results of e_1 if $MTR = 41\%$ estimation in the baseline, Instruments (4)