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FISCAL DRAG WITH MICROSIMULATION: EVIDENCE FROM SPANISH TAX RECORDS*

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ABSTRACT: Fiscal drag arises when nominal tax parameters remain unchanged despite nominal income growth, thereby increasing effective tax rates and revenue. We use Spanish administrative tax records and a detailed microsimulation model to examine fiscal drag in personal income taxation through two complementary approaches. First, we estimate tax-to-base elasticities to assess the progressivity of the tax system and potential fiscal drag under homogeneous income growth. We uncover significant heterogeneity in elasticities across income sources, across the individual income distribution and in the underlying mechanisms. Second, we conduct counterfactual simulations to quantify the actual impact of fiscal drag from 2019 to 2023, finding it accounts for about a third of revenue growth. Our findings offer insights for public finance modelling, revenue forecasting, and tax policy design.

JEL Codes: D31, E62, H24
Keywords: Inflation, taxes, progressivity, indexation, bracket creep

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1 Introduction

Fiscal drag occurs when the nominal parameters of a progressive tax system remain unadjusted despite growth in the nominal tax base. As a result, tax revenue increases more than proportionally relative to the growth of the tax base, leading to higher average effective tax rates. In the context of personal income taxation (PIT), these parameters include the bracket thresholds that define the tax schedule, the nominal amounts of deductions and credits, as well as the values that determine eligibility for these tax benefits.

Understanding fiscal drag is crucial for evaluating its broader implications for public finances, including the modelling of government revenue, the redistributive impact of personal income taxes, and optimal tax design. In a context of tensioned public finances and evolving fiscal frameworks, fiscal drag has emerged as an increasingly relevant policy lever in some countries. The recent surge in inflation has only heightened this relevance, prompting renewed interest in the topic among policymakers and analysts.[1]

In this paper, we use rich administrative tax records and a detailed microsimulation model to provide a comprehensive exploration of fiscal drag in Spain. Our approach combines two complementary analytical strategies. First, we estimate the degree of progressivity embedded in the tax system at a given point in time, which determines the *potential* increase in tax revenue that would occur if incomes rise but tax parameters remain unchanged. Second, we estimate the *actual* fiscal drag realised over the recent period, accounting for both observed income growth and changes in tax legislation.

In the first step, we quantify the system's progressivity by estimating tax-to-base (TTB) elasticities. These elasticities measure the relative change in tax revenue resulting from a homogenous increase in the tax base, holding tax parameters constant. They thus represent the hypothetical or potential fiscal drag that would occur in the absence of indexation. This analysis provides a detailed understanding of the mechanisms driving fiscal drag and of the heterogeneity underlying these elasticities. One key output of this approach is the estimation of microsimulated TTB elasticities, which are central to fiscal projection models.

To do this, we apply a microsimulation model using 2019 administrative tax data and legislation to estimate TTB elasticities.[2] Specifically, we compute the percentage

[1]See for example recent cross-country overviews from OECD (2023), the IMF (Balasundharam et al., 2023) and work from the European Commission on wage indexation (Leventi et al., 2024). See also the Institute for Fiscal Studies for the U.K. (Waters and Wernham, 2022), Bundesbank (2022) for Germany and the IMF's selected issue on Spain's tax revenues (IMF, 2024).

[2]We also estimate TTB elasticities for 2022 and 2023 using updated microdata based on observed aggregate growth rates.

change in tax revenue induced by a uniform 1% increase in household incomes. We then decompose these elasticities into contributions from nominally defined tax parameters (e.g., brackets, deductions, and credits). We also explore heterogeneity across income sources (labour, capital, and self-employment) and across income groups, yielding a granular view of fiscal drag and its implications for both tax collection and inequality.

Our results show an aggregate TTB elasticity of 1.84 in 2019, implying that a 1% increase in income leads to a 1.84% increase in tax revenue. Just over half of this elasticity above 1 is driven by *bracket creep* (i.e., the non-indexation of tax brackets), with the remainder explained by the erosion of deductions and credits (i.e. the absence of indexation of the nominal values that determine their size or eligibility thresholds). Elasticities vary across income sources, with higher values for self-employment (2.10) and labour incomes (1.86), and lower values for capital incomes (1.58). Across the income distribution, elasticities peak in the middle centiles due to the diminishing relative value of tax deductions and credits, while they decline at higher income levels. We also explore the impact of fiscal drag on progressivity and inequality and, consistent with previous studies (Immervoll, 2005; Paulus et al., 2020), we find that it reduces tax progressivity while also lowering income inequality, largely because its impact on low-income individuals —who remain zero-tax payers— is minimal.

In the second step, we estimate the actual fiscal drag that occurred over the recent period. We incorporate observed income growth and legislative changes between 2019 and 2023 and run counterfactual simulations under alternative indexation scenarios (based on lagged CPI, contemporaneous CPI, and nominal income growth) and under no-indexation scenarios. This analysis provides a detailed characterisation of actual or realised fiscal drag, measured through its impact on tax revenue and average effective tax rates. This approach offers a transparent estimation of fiscal drag and evaluates the effects of policy measures in mitigating it. These findings are particularly relevant for policymakers aiming to design or assess fiscal consolidation strategies.

In particular, we use uprated 2019 microdata to simulate tax revenue in 2023 under two polar scenarios: one in which 2019 legislation is kept unchanged without parameter updates, and another in which the same legislation is adjusted annually using one of the three indexation benchmarks (lagged CPI, concurrent CPI and nominal income growth). We then compare the actual revenue collected in 2023 to the alternative indexation scenarios to estimate the size of fiscal drag during the 2019–2023 period.

We find that fiscal drag had a significant impact on tax revenue and average effective tax rates between 2019 and 2023. Had tax parameters been fully indexed to any of the three indices considered, tax revenue in 2023 would have been between €10.3 and

€12.9 billion lower—representing roughly one-third of the PIT revenue growth in that period. Moreover, fiscal drag accounted for approximately half of the increase in the PIT revenue-to-GDP ratio over the same time frame (i.e. around 0.7–0.8 percentage points). Average effective tax rates increased from 12.8% in 2019 to 14.4% in 2023, with the lack of indexation explaining approximately 1.3 percentage points of that rise.

This paper contributes to the limited but growing literature on fiscal drag using microdata. Our first contribution is to integrate two complementary approaches within a unified framework: the characterisation of *potential* fiscal drag due to built-in progressivity, and the estimation of *actual* fiscal drag, accounting for accounting for policy changes and observed income growth over a specific period. In doing so, we bridge two strands of literature: one that focuses on characterizing the progressivity of the PIT system at a given point in time and its potential effects in the absence of indexation (Immervoll, 2005; Price et al., 2015 and Leventi et al., 2024)[3] and another that evaluates the realised impact of fiscal drag over time (Paulus et al., 2020 and Waters and Wernham, 2022).[4]

Our second contribution is the use of high-quality administrative data paired with a detailed microsimulation model. To the best of our knowledge, only two recent papers exploit administrative tax records to study fiscal drag. Moriana-Armendariz (2023) estimates fiscal drag between 1979 and 1987 in Spain to evaluate its impact on tax collection and redistribution,[5] while Hack (2024) studies the macroeconomic effects of fiscal drag in Germany for the period 2002–2018. Our paper focuses on a more

[3]Although Immervoll (2005) does not explicitly compute TTB elasticities given its emphasis on inequality, its methodology is similar to our first methodological approach, using EUROMOD and survey data for the Netherlands, UK, and Germany to assess the impact of bracket creep on tax progressivity and tax revenues. Price et al. (2015) explicitly calculate the elasticities of various revenue items across OECD countries, such as personal income taxes, with respect to their bases. However, they base this analysis on a few hypothetical households rather than a representative sample, and their main focus is on revenue responses to the output gap. Meanwhile, Leventi et al. (2024) examine the effects of wage indexation across Europe on direct taxation and public benefits, rather than zooming in on the PIT as we do.

[4]Paulus et al. (2020) examine the extent to which indexation policies offset fiscal drag across multiple countries and its effects on aggregate inequality measures. Waters and Wernham (2022) focus on the recent freeze of tax parameters in the U.K. and document its impact across the income distribution.

[5]Other studies have examined fiscal drag in Spain. Sanz-Sanz and Arrazola (2024) calibrate a model to evaluate the impact of the lack of indexation in Spain in the recent period using the same data as we do. Fuenmayor et al. (2005) employ a microsimulation model based on the European Community Household Panel to estimate fiscal drag in 1999 and after the 2003 reform. Creedy and Sanz-Sanz (2010) derive analytical expressions for the elasticity of revenue to taxable income and estimate an elasticity of 1.3 for 2002. Martínez-López (2017) applies a microsimulation approach to estimate an elasticity of approximately 1.9 following the 2007 personal income tax reform. Onrubia-Fernández and Sanz-Sanz (2009) use fiscal drag as an instrument to study income elasticity to marginal tax rates.

recent period marked by sharp price and income growth and places greater emphasis on estimating and decomposing TTB elasticities across the distribution. Compared to survey-based studies, our use of administrative data improves model accuracy and reduces potential bias due to underreporting or underrepresentation of high-income individuals in surveys.

Finally, our work also relates to the literature on fiscal drag that uses time series methods (e.g. Boschi and d'Addona, 2019; Mourre and Princen, 2019; Hayo et al., 2023) which often focus explicitly on the estimation of TTB elasticities. We contribute by providing microsimulated TTB elasticities. We see microsimulated elasticities as a promising complement to those derived from aggregate time series data.[6]

This paper is organised as follows: Section 2 provides an overview of the structure of personal income taxes in Spain and its indexation practices, including international comparisons. Section 3 describes the data and the microsimulation tool used in our analysis. Sections 4 and 5 present the methodology and findings from our two complementary microsimulation approaches. Section 6 concludes.

2 Institutional background

2.1 The Spanish personal income tax

The Spanish Personal Income Tax (PIT) is a tax levied on the income of residents in Spain. It is withheld at source, and taxpayers must file a tax return between April and June each year based on the total income of the previous calendar year. The calculation of the tax liability is relatively complex, as it depends on the type of income, numerous tax deductions and credits and different tax schedules, all interacting with each other, with implications for tax progressivity and fiscal drag.[7]

Although the tax is subject to annual variations depending on changes in the tax legislation, the general structure is as follows: the tax is calculated on the basis of different sources of income, including labour, capital and self-employment income. Each of these income sources is reduced by a number of deductible expenses, such as social

[6] A related body of research studies tax-buoyancy, a broader concept than tax-to-base elasticities, as it captures the relationship between tax revenues and nominal GDP growth (or other macroeconomic aggregates), incorporating both the responsiveness of tax bases to GDP and discretionary fiscal policy changes over time. For recent work see Dudine and Jalles (2018), Lagravinese et al. (2020) and Cornevin et al. (2024).

[7] For a more detailed characterisation of personal income tax, see García-Miralles et al. (2019)

security contributions payable by the employee, or the earned income tax deduction.[8] The resulting income is then grouped into two categories: the 'general' tax base, which mainly includes income from employment, self-employment and real estate; and the 'savings' tax base, which includes income from movable capital (e.g. realised capital gains, dividends, and interests). Several deductions are afterwards applied to the general tax base (e.g. deductions for joint filing[9] or for contributions to private pension plans).[10] If the amount of these deductions is larger than the total general tax base, the remaining deductions are applied to the savings tax base.

The general and savings tax bases are taxed under two coordinated schemes: one corresponding to the Central and another to the Regional Government (Autonomous Communities).[11] Tax rates are progressive, meaning that higher incomes are subject to higher rates. The tax schedule applied to the general tax base is more progressive and features higher rates than the one applied to the savings tax base.[12]

As a final step, different tax credits such as a family allowance (that depends on the personal and family characteristics of the taxpayer)[13] or a child credit (for mothers with children below 3 years old) are subtracted from the total tax payable (the amount

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[8]The Spanish Earned Income Tax Deduction (or "Reducción por Rendimientos del Trabajo") is a tax benefit aimed at reducing the tax burden on workers with low and moderate incomes. Unlike the refundable Earned Income Tax Credit (EITC) in the U.S., the Spanish system provides a non-refundable deduction from the taxable base, which effectively lowers the amount of income subject to taxation.

[9]Taxpayers filing income taxes jointly can benefit from a 3,400 euro deduction if they are married, or 2,150 if they are not.

[10]Other tax deductions and credits include the deduction for contributions to private pension plans and refundable tax credits for employed mothers with children under the age of three.

[11]The collection and administration of half of the personal income tax revenue is transferred to the Autonomous Communities — the largest administrative subdivisions in Spain — which have authority to design their own tax schedules and implement region-specific deductions and credits.

[12]In 2019, the Central Government's tax schedule for the general tax base consisted of five brackets, with a top marginal rate of 22.5%, while the schedule for the savings base included three brackets with a top rate of 11.5%. Since 2021, the number of brackets for the general base has increased to six and the top rate has risen to 24.5%; for the savings base, the number of brackets has been raised to four in 2022 and five in 2023, with the top rate reaching 14%. Regional schedules vary across Autonomous Communities but generally remain close to those of the Central Government.

[13]The "mínimo personal y familiar" (personal and family allowance) in the Spanish income tax system is a tax-free threshold, designed to ensure that a certain amount of income deemed necessary to cover basic personal and family living expenses, is exempt from taxation. For a single taxpayer without dependents, the allowance is 5,550 euros. This amount can then be increased depending on the characteristics of the taxpayer (age, number of dependent children or parents, and their disability status). The reduction in tax liability is computed by applying the general tax schedule to the family allowance amount. For instance, if the total family allowance amounts to €5,500—falling within the lowest tax bracket—the reduction in tax liability would be calculated as €5,500 $\times$ 0.095 = €522.50. Here, 0.095 corresponds to the marginal tax rate of the first bracket in the general tax schedule. In cases where the taxpayer's general taxable income is lower than the family allowance, the unused portion of the allowance can be applied to reduce the gross tax liability from savings taxable income.

resulting from applying the Central and Regional Government rates to the general and savings tax bases) to obtain the final tax liability.

2.2 Indexation practices

The Spanish PIT has undergone several changes over the years, allowing the parameters of the tax to be broadly adjusted to cumulative inflation (García-Miralles et al., 2019; Ortega Carrillo and Ramos, 2024). However, these adjustments have been made in a discretionary manner, both in deciding which parameters to modify and in the choice of the magnitude of the update. In the recent inflationary period, however, these adjustments have not occurred with sufficient frequency or intensity to keep pace with price increases or household income growth.

From an international perspective, this upsurge in inflation has led to renewed interest in the indexation practices of different countries to update their tax parameters. In a recent IMF report, Balasundharam et al. (2023) document that most countries update parameters on a discretionary basis. Focusing on Europe and North America, the OECD (2023) finds that around half of the countries follow a discretionary updating method (e.g. Spain, Italy, and Portugal), while slightly less than half do so automatically or according to pre-established rules (e.g. the Nordic countries, the US, and Belgium).

It should be noted that having a discretionary indexation system does not necessarily imply it is less reactive to inflation. In several countries, although adjustments are made on a discretionary basis, there is a well-established process through which governments regularly update tax parameters and benefits to reflect inflation.[14]

Another relevant aspect is the reference indicator used to implement such updates. The most widespread indicator is the consumer price index (CPI), but others are also used, such as the producer price index, wage growth or customised indices constructed for the sole purpose of updating the tax.[15] The choice of the reference indicator affects both the magnitude and the timing of adjustments.

The final aspect to be taken into account for the assessment of indexation policies

[14]For example, in Germany, tax parameters are adjusted periodically based on the findings of two reports published every two years by the Federal Government, ensuring that subsistence income remains exempt from personal income tax. In France, tax parameters are typically updated annually; however, in certain years—such as 2012 and 2013—they remained unchanged as part of a fiscal consolidation plan. In Ireland, the Government has committed to indexing deductions and tax brackets annually, provided that the economy continues to grow.

[15]For instance, Denmark and Lithuania index only to wages, while in other countries the indicator varies. In Finland, the tax is adjusted according to whichever indicator has increased the most between prices and wages.

is the period over which the benchmark indicator is measured and the frequency of adjustments. Countries typically adjust the tax parameters on an annual basis, often based on lagged CPI data. More than half of OECD countries adjust their income taxes according to changes in the reference indicator recorded before the start of the tax year in question. Other countries, such as France, use a "nowcasting" approach to forecast the current year's annual inflation level during budget preparations in the last months of the year.

3 Data and the microsimulation tool

3.1 Data

3.1.1 Administrative microdata data on tax-fillers

We use detailed microdata on personal income tax (PIT) returns from 2019,[16] provided by the Spanish Institute of Fiscal Studies and the Spanish Tax Agency. The dataset contains a stratified random sample of PIT declarations from Spanish taxpayers under the common fiscal regime, which excludes Navarra and the Basque Country, as they have independent tax systems.

The 2019 sample consists of 3,315,632 tax returns, representing approximately 15% of the Spanish tax-filing population. The sample design follows a stratified random approach, with three levels of stratification: geographic region (46 provinces plus Ceuta and Melilla), income levels (12 brackets), and filing type (individual or joint returns). This stratification ensures that the sample is representative across different income groups and filing statuses. The dataset includes a wide array of fiscal and socio-demographic variables, capturing almost all information reported in tax returns.

This dataset does not include non-filers, which could limit our ability to characterise the lowest part of the income distribution and prevent us from documenting the impact on those individuals who would be "dragged" into paying some tax. In any case, these individuals have a very small impact in terms of aggregate revenue. Besides, García-Miralles et al. (2019) document that more than 80% of Spanish taxpayers who are not required to file income tax returns, still choose to do so, given that they are likely to get a refund due to tax credits.

We restrict the sample by excluding taxpayers whose gross income from all different

[16]The cross-sectional dataset of 2020 income tax returns is also available; however, we selected 2019 as the reference year, as the 2020 figures are less representative due to the impact of the pandemic. See López et al. (2022) for further details on the data.

sources (labour, capital, and self-employment) is equal to zero (given that we compute tax-to-base elasticities by uniformly increasing declared incomes and simulating tax liabilities, therefore, we are not able to compute elasticities for these individuals). This restriction affects about 2.7% of all taxpayers in the sample.

3.1.2 Aggregate tax data

We also utilise highly detailed aggregate data on PIT from the Spanish Tax Agency, for the period 2002 to 2023. This dataset includes comprehensive information on tax revenue, the tax base, the number of declarations, and over 100 variables related to tax liability computation, covering various income sources, tax deductions, and credits.

We use this information to compute growth rates that we use to update the 2019 tax microdata used in the microsimulator to simulate later years (mainly the incomes from different sources and tax deductions determined exogenously). Since the variables in the microdata align with those in the aggregate dataset, this offers great accuracy in our calculations for years beyond 2019, and facilitates the accurate prediction of total tax revenue, as illustrated in our results section.

3.2 A register-based microsimulation tool

A key component of our analysis is the use of a microsimulation tool that models Spanish personal income taxes, developed by the Bank of Spain and described in detail in Bover et al. (2017). This tool is built on tax filers' administrative microdata and allows for the simulation of individual tax liabilities under various hypothetical scenarios. The model is entirely programmed in Stata and uses information on taxpayers' gross incomes and personal characteristics to compute each individual's tax liability, integrating almost all specificities of the Spanish personal income tax code. As a result, this tool enables highly accurate simulations, with margins of error below 0.05% (Bover et al., 2017).

The microsimulation model adopts an arithmetic approach, capturing the immediate 'morning after' effects of tax reforms. Specifically, it calculates changes in tax liabilities that occur immediately following a tax change, before accounting for behavioural responses such as adjustments in labour supply.

We use this tool to simulate changes in tax parameters, income growth, and their combined effects. This enables us to analyse fiscal drag by examining how individual tax liabilities evolve when incomes increase, depending on whether tax parameters remain unchanged or are adjusted according to alternative indexation references.

4 Potential fiscal drag: progressivity through tax-to-base elasticities

4.1 Methodology

Our first step to studying fiscal drag is to estimate the progressivity built in the PIT system, as it provides a measure of *potential* fiscal drag. That is, how much tax liabilities would increase as a result of nominal income growth if tax parameters are not updated accordingly.

To do this, we calculate tax-to-base elasticities. As noted earlier, the nominal growth of the tax base can result in disproportionately higher increases in tax revenue due to the progressivity of the PIT, if the parameters governing this tax instrument are defined in nominal terms, and are not fully adjusted to account for income growth. Technically, this would mean that the tax-to-base elasticity (ε) defined below is greater than one:

$$\varepsilon_i = \frac{y_i}{t_i} \cdot \frac{\partial t_i}{\partial y_i} = \frac{\partial t_i / \partial y_i}{t_i / y_i} = \frac{MTR_i}{ATR_i} > 1 \tag{1}$$

where t_i is the tax liability, y_i is the tax base, MTR_i is the marginal tax rate and ATR_i is the average tax rate for each filer i.

This larger-than-one elasticity leads to an increase in effective tax rates, as additional income is subject to higher marginal rates than the average rate. This is due both to the progressivity of tax bracket thresholds (a phenomenon known as *bracket creeping*), and tax deductions and credits (which are often designed so that they diminish as income rises) losing value relative to income. These features are both common in personal income tax systems and contribute to their progressivity. However, if income does not grow in real terms (i.e., it fails to outpace inflation), taxpayers' purchasing power will remain unchanged (or even decrease). In such cases, the fiscal drag effect, which raises their effective tax rates, will lead to a reduction in taxpayers' real after-tax income.

The first step of our analysis is to simulate the tax liabilities of each individual, using information on their gross incomes and personal characteristics relevant for its computation, and applying the tax legislation. We then compare the predicted tax liability with the observed amount to ensure that the microsimulation model accurately predicts taxes due. The simulated tax liabilities obtained using 2019 tax microdata exhibit an estimation error of less than 0.05%.[17]

We then estimate the tax-to-base elasticities by increasing all gross incomes uniformly by 1% and simulating tax liabilities again. Gross income recorded in data from income tax forms can be grouped into labour,[18] self-employment, and capital income,[19] with the latter taxed differently, as explained in section 2.1.

The TTB elasticity for each filer is calculated as the relative change in its individual tax liabilities, divided by the relative change in its tax base. Once the individual elasticities have been calculated, they can be aggregated to obtain the aggregate tax-to-base elasticity, defined as the average of the individual elasticities, weighted by the share of the tax liability of each taxpayer in total revenue (a *bottom-up* approach). Alternatively, the aggregate elasticity can be calculated as the relative change in aggregate revenues, divided by the relative change in aggregate incomes (a *top-down* approach). Both approaches are equivalent.

Note that when we increase gross incomes by 1%, we also increase certain items eligible for tax exemptions or deductions that are not included in total gross income, but would mechanically increase with income and affect tax liabilities. These include social security contributions paid by employees, which are fully deducted from labour income under Spanish tax law to determine taxable earnings.[20,21]

We also compute tax-to-base elasticities specific to each type of income (labour, capital and self-employment) by separately increasing by 1% each of these categories, and computing the resulting tax liabilities and elasticities. An increase in the different income components might yield different tax-to-base elasticities because they are subject to different tax schedules and different deductions,[22] or because the composition of the individuals earning such income is different.

Finally, we unpack these elasticities by calculating the contribution of each nominally-

[17]This is in line with Bover et al. (2017), who report an estimation error of -0.2 % using data for the year 2013.

[18]As per the Spanish income tax law, income from labour includes income from pensions, unemployment and other social benefits. That is why we do not consider benefits as a separate concept.

[19]Including income from dividends, interest, realised capital gains, rental income and net imputed rents (with the exception of main residences).

[20]Social security contributions are capped, and while this cap has been increased over time, this adjustment is not systematic. Since this is not a PIT parameter, we assume a 1% increase in line with labour income growth.

[21]Other components not classified as gross income but assumed to grow proportionally with income include: deductible expenses such as union dues, income generated over periods exceeding two years, contributions to private pension plans, exempt income from double taxation treaties, and deductions related to child support annuities.

[22]As explained in 2.1, part of the income from capital, fundamentally that from real estate rents, is taxed through the "general" tax schedule, whereas the vast majority of income from dividends, interest and realised capital gains is subject to the "savings" tax schedule -which is less progressive-.

defined tax parameter. To do this, we offset the 1% increase in incomes by sequentially indexing in the same proportion tax brackets, and each tax deduction and credit.[23]

4.2 Results

Aggregate tax-to-base elasticity. We estimate an aggregate tax-to-base elasticity of 1.84 for 2019, based on 2019 legislation and 2019 microdata. That is, a homogenously distributed 1% increase in household income leads to a 1.84% increase in tax revenue in the absence of changes to tax parameters —with the excess above the unitary elasticity being attributable to the progressivity of the system. This implies a large potential fiscal drag, as income growth that is not accompanied by an update of tax parameters of similar proportion will induce a significant increase in effective tax rates and tax collection.

We obtain similar elasticities when updating incomes and performing the same analysis using the 2022 and 2023 tax legislation, yielding elasticities of 1.82 and 1.84, respectively. This outcome is expected, as tax legislation during these years remains largely consistent with that of 2019.[24]

Tax-to-base elasticity by income source. We document differences in the TTB elasticities depending on the source of income growth, as reported in Table 1. We observe a lower tax-to-base elasticity for capital income (1.58) compared to labour (1.86) and self-employment incomes (2.10). This difference is driven by two different factors. First, the less progressive taxation of capital income (see section 2.1) under the Spanish personal income tax system (the marginal tax rate for this type of income is closer to the average tax rate). Second, top-income earners often have a larger share of capital income, and, as we show in the next section, they tend to have lower TTB elasticities since their marginal tax rates are closer to their average tax rates.

It is worth noting that TTB elasticities are an essential parameter for modelling personal income taxes. The availability of a disaggregated estimate by income source allows for better projection models, as they enable differential elasticities for the different macroeconomic aggregates (such as aggregate earnings, households' surplus, or

[23] The most relevant ones in terms of magnitude are: the earned income tax deduction, the family allowance, and the deduction for joint filing (see Section 2.1 for more information).

[24] To conduct this analysis, we update 2019 incomes using observed growth rates in both real and nominal income tax bases. For the 2022 income update, we rely on data from the Spanish Tax Agency, incorporating regional growth in the number of taxpayers along with detailed information on the growth of each of the items that determine the tax base. To project incomes for 2023, we use the Bank of Spain's forecasts on the growth rates of various National Accounts aggregates, which serve as proxies for the personal income tax base. For more details see section 5.2.

public benefits) used to approximate the PIT tax base.

Mechanisms. We further explore our estimated TTB elasticities by breaking down the different features of the tax legislation that affect the elasticity. As shown in panel B of Table 1, increasing the bracket thresholds by 1% reduces the elasticity to 1.51. Thus, 39% of the over-proportional elasticity is estimated to be determined by the lack of indexation of bracket thresholds ((1.84-1.51)/(1.84-1)=0.39). The remaining tax deductions and credits explain 54% of the over-proportional elasticity. Specifically, 12% is explained by Earned Income Tax Deduction, 28% is explained by family allowance,[25] and 3% is explained by the joint filing reduction. Indexing all remaining nominal parameters further explains 11% of the excess elasticity. Note that the remaining 7% is unexplained, as indexing all nominal parameters reduces the elasticity to 1.06, but not to 1 exactly. We interpret this as a residual elasticity resulting from interactions between income growth and the tax code that cannot be fully offset with the nominal parameters considered.

While fiscal drag is often linked to the progressivity of tax schedules (or 'bracket creeping'), in the Spanish context, the main driving forces are tax deductions and credits. Among these, the effect is concentrated on two large deductions, the Earned Income Tax Deduction and the family allowance, which have a similar design to deductions present in other countries. These, have a stark impact on the distribution of the elasticity across individuals, as illustrated next.

Individual heterogeneity by income level. A key advantage of our microsimulation approach is that it allows for a careful exploration of how the elasticity, and its drivers, vary across the income distribution.

Figure 1a presents the average TTB elasticity across income centiles,[26] along with the contribution of each tax parameter to the elasticity of each centile. Additionally, the chart shows each centile's contribution to total tax revenue and its share of total income.

Elasticities vary significantly across the income distribution. At the lower end, elasticities are close to zero, as tax liabilities for most individuals in these income groups are zero and remain unchanged after the 1% increase in their income. Moving toward the middle of the distribution, the diminishing relative value of tax deduc-

[25] As explained in section 2.1, the family allowance reduces tax liabilities by applying the general tax schedule to a fixed nominal amount. Therefore, to fully offset the effect of income growth in our simulations, we index both the nominal value of the family allowance and the tax brackets used to compute the corresponding tax relief.

[26] The underlying data for Figure 1a can be found in Table A.1.

tions—particularly the Earned Income Tax Deduction (*Reducción por Rendimientos del Trabajo*)—leads to sharp increases in the elasticity, reaching a peak of 45 at the 31st centile.

Notably, the highest elasticities are observed around the 30th centile. This pattern arises because, at this income level, tax liabilities transition from zero to positive for certain individuals. As a result, some taxpayers experience only a small nominal income increase but move from paying no taxes to paying a positive amount. For these individuals, the difference between their marginal tax rate (MTR) and average tax rate (ATR) is particularly high, resulting in an exceptionally large TTB elasticity, as shown in Equation 1. Figure 2a shows the average and marginal tax rates across the income distribution. Consistent with the distribution of the TTB elasticity, we observe that the difference between marginal and average tax rates increases most sharply between the 30th and 45th percentiles.

To better evaluate the relative contribution of each tax parameter to the elasticity of each income group, Figure 1b normalises the size of the elasticity from each centile and breaks down the contribution of each component to the "over-proportional" elasticity. We clearly observe that, up to the 43rd centile, the Earned Income Tax Deduction accounts for the largest share of the elasticity.[27] On its part, the family allowance (*mínimo personal y familiar*) emerges as another key factor influencing elasticities across the entire distribution.[28]

We observe that average elasticities decline at higher income centiles. This is primarily because the relative loss in tax deductions represents a much smaller share of taxable income for these taxpayers. While the relative contribution of bracket creeping increases with income, elasticities are particularly low at the very top of the income distribution (top 1%). This is partly due to the composition of taxable income among high-income taxpayers, where capital income constitutes a significant share, and partly to the higher average tax rate faced by these tax fillers, which gets closer to their

[27] All wage earners are entitled to a general deduction of €2,000, with additional deductions available under specific criteria. In 2019, taxpayers with labour income below €13,115 received an additional €5,565 deduction, which phased out for incomes between €13,115 and €16,825. The substantial contribution of the Earned Income Tax Deduction to elasticities between the 30th and 45th percentiles is primarily driven by the phase-out of this additional deduction (see Table A.2 for mean incomes by centile). At higher income levels, this deduction continues to influence total elasticities, as the fixed €2,000 deduction loses value relative to total income.

[28] Unlike the Earned Income Tax Deduction, which predominantly affects middle-income taxpayers, the family allowance applies to all taxpayers, reducing taxable income based on personal and family circumstances (e.g., number of dependents, age, or disability status). Its impact is more evenly spread across the income distribution, contributing substantially to the elasticity estimates at all levels. The erosion of its relative value as incomes rise plays a crucial role in shaping the overall distribution of tax-to-base elasticities.

marginal rate, as shown in Figure 2a.[29] Figure A.1 illustrates this observation. The upper panel presents the distribution of various income sources across income centiles, distinguishing between capital incomes taxed under the general and savings tax schedules. The lower panel displays the proportion of each income type relative to the total income of each centile. With the exception of those at the very top of the distribution (particularly the top 1%), most taxpayers derive the majority of their taxable income from labour. The top 1% concentrate a larger share of total income, with capital income —especially that taxed under the "savings" tax schedule— representing a significant portion of their total income.

We also estimate the distribution of tax-to-base elasticities across income centiles by weighting individual elasticities within each percentile according to each taxpayer's contribution to total tax revenue. This allows us to compute the mean weighted elasticity by centile.[30]

Figure A.2 follows a similar pattern to Figure 1a, with one key difference: lower percentiles exhibit higher elasticities. This occurs because the mean elasticity of each centile is primarily driven by individuals with positive tax liabilities. However, in these lower-income groups, fewer than 10% of taxpayers actually owe taxes (see Figure A.3). The elasticities in these percentiles -with mean incomes close to zero- are largely explained by the declining relative value of the family allowance, a deduction based solely on individual characteristics—such as the number of dependents or disabilities—rather than income. As income rises, other deductions and credits gain more importance.

Impact on progressivity and inequality. We analyze how fiscal drag affects both the progressivity of the tax system and income inequality by examining changes in key distributional metrics. Specifically, we compare income distribution measures before and after a 1% uniform increase in incomes, while keeping tax legislation constant.

To assess the impact of fiscal drag on tax progressivity, we follow Benabou (2002) and Heathcote et al. (2017) in estimating a parametric function that links gross income to average tax rates, capturing the progressivity of the system. The function is specified as follows:

$$f(\tilde{I}) = 1 - \lambda \cdot \tilde{I}^{-\tau} \tag{2}$$

[29] As discussed in Section 2.1, much of this capital income is taxed under the "savings" tax schedule, which is less progressive.

[30] Aggregating this "bottom-up" elasticity (i.e., the average of individual elasticities weighted by each taxpayer's share of total tax revenue) yields an overall elasticity of 1.84, which is equivalent to the aggregate elasticity obtained using the "top-down" approach—defined as the relative change in aggregate revenues divided, by the relative change in aggregate incomes.

where $\tilde{I}$ are multiples of gross incomes, $1 - \lambda$ is the average tax rate, and τ is a parameter representing the progressivity of the tax. This function takes the value zero for observations under a threshold $\tilde{I}$, chosen to minimise the mean-squared error, so as to account for the fact that a significant number of Spanish taxpayers face a zero tax rate.

The estimation results for this function are presented in Panel A of Table 2. The first column reflects the baseline distribution observed in the data, while the second column corresponds to the scenario in which all incomes increase uniformly by 1%. First, we observe that as a result of income growth, the average effective tax rate $(1-\lambda)$ increases. Figure 2b illustrates this result by showing the two estimated parametric functions, before and after the 1% increase in incomes, as well as the difference in average effective tax rates across the income distribution.

Second, we observe that the progressivity of the tax system decreases as a result of income growth, given the same unadjusted tax legislation. Specifically, the estimated parameter τ, which captures the progressivity of the tax, is smaller in the simulation where the income of filers increases, from 0.1411 in the baseline scenario to 0.1398 when the income of filers is 1% higher.[31] Figure 2b shows that average tax rates grow more for the middle part of the distribution than for the top, resulting in a lower redistributive capacity of the tax system within those taxpayers with positive tax liabilities, leading to a decrease in progressivity. These patterns are in line with those shown for the distribution of TTB elasticities in the previous subsection.

However, a large fraction of individuals with a zero tax liability remain zero-tax payers after the 1% increase in their income. This result, which can be seen both on the distribution of TTB elasticities in Figure 1a and in Figure 2b has implications for inequality. Despite the reduction in progressivity, inequality is also *reduced* as a result of increasing incomes across the entire distribution, since only the average tax rates of middle and top incomes grow, while those with low incomes continue to have a near-zero average tax rate. [32]

Panel B of Table 2 evaluates the impact of fiscal drag on inequality using two approaches and two widely used income inequality metrics: the Gini index and the

[31] For reference, the parameter τ is estimated at 0.18 for Italy, 0.2 for the United Kingdom, 0.22 for Germany and Sweden and 0.26 for Denmark (Holter et al., 2019). For Spain, using 2015 data, it was estimated at 0.15 (García-Miralles et al., 2019).

[32] This finding is in line with Immervoll (2005), who observes that bracket creep is shown to reduce the progressivity of the tax system, but also leads to a decrease in post-tax incomes for positive taxpayers. This reduction in income inequality between zero-taxpayers (concentrated at the lowest part of the distribution) and those who pay a positive amount, outweighs the reduction in progressivity, leading to more equally distributed incomes.

90:10 ratio (the ratio between the income shares of the top 10% and the bottom 10% of the distribution). The results from both methods and metrics lead to the same conclusion.

In the first approach, we estimate the net-of-tax Gini index and 90:10 ratio for both the baseline income distribution and the alternative scenario in which gross incomes increase by 1%. We find that, under a given tax system, a uniform 1% increase in all incomes results in a lower post-tax Gini index and a lower 90:10 ratio—indicating a reduction in income inequality.[33]

We refine the previous approach to partial out the effect that income growth has *per-se* on income inequality. Notably, individuals with zero income do not experience a 1% increase, meaning that income growth alone influences inequality before the effects of tax progressivity and the lack of indexation come into play. To account for this, we estimate the percentage change in the reduction of inequality measures (Gini index and 90:10 ratio) before and after taxes. This allows us to assess how the tax system reduces inequality under different income distributions. Our results show that inequality decreases more in the simulation where gross incomes increase by 1% than in the baseline scenario.[34]

5 Actual fiscal drag: counterfactual simulations under alternative indexation

While Section 4 estimated the *potential* fiscal drag arising from the inherent progressivity of the tax system –assuming fixed tax parameters– this section assesses the *actual* fiscal drag observed in recent years, incorporating both income growth and tax policy changes.

[33]The differences in both, the Gini and the 90:10 ratio, in the baseline and the income increase scenario are small, but so is the magnitude of the income change, of only 1%.

[34]The percentage reduction in the Gini index increases from 11.88% to 11.90%, while the reduction in the 90:10 ratio rises from 18.25% to 18.39%. Again, while these differences are small, they align with the marginal nature of the simulated income increase.

5.1 Methodology

We implement the analysis for the period 2019-2023.[35] This period is particularly relevant due to the sharp rise in inflation and income growth since 2021. Consumer Price index reached year-on-year growth rates above 10% in mid 2022 and wages reached a peak growth of 6.6% in 2023 (Banco de España, 2025). The analysis proceeds in four main steps:

Step 1: Uprating the microdata. We update the 2019 microdata using observed growth rates for each income source. We rely on data from the Spanish Tax Agency covering labour earnings, capital income, self-employment income, benefits, and deductions such as social security contributions and pension plan payments. We also account for changes in the number of tax filers.

As detailed individual-level growth data are unavailable for this period, we assume uniform growth rates by income source. Heterogeneity in individual income growth is introduced in our analysis only through variation in income composition—i.e. the mix of labour, capital, and self-employment income. Accordingly, this section does not examine inequality or heterogeneity in detail, as was done in Section 4. Nonetheless, the lack of individual-level heterogeneity in income growth is unlikely to have any significant impact on aggregate revenue estimates, since most tax revenue is concentrated in the upper deciles (see Figure A.1), which largely determine the average growth rates used.

Step 2: Incorporating tax legislation. We introduce the personal income tax rules in effect each year. In 2022 and 2023, several Autonomous Communities updated tax parameters to partially account for inflation. The Central Government also enacted reforms in 2023, including an expanded deduction for labour income earners, aimed particularly at low-wage workers affected by the rise in the minimum wage.

These measures are integrated into our simulations by applying the uprated incomes alongside the corresponding legislation in force for each year, allowing us to simulate the observed tax revenue. While they do not constitute formal indexation, several of these measures had similar effects to *fiscal-drag-offsetting* policies.[36]

[35] We choose 2019 as the baseline year because 2020 is the most recent year for which administrative microdata is available, but it was an exceptional year due to the COVID-19 pandemic and thus less suitable for establishing an informative baseline. The analysis extends to 2023, the latest year for which we had full information on legislative changes, allowing us to implement them in the microsimulation model.

[36] Regional Governments adopted different measures: some updated brackets and deductions using CPI or income growth references, while others modified the bracket structure or deduction formulas. At the national level, the most significant measure was an increase in the labour income deduction, combined with changes to nominal parameters and structural rules. Other reforms included a one-percentage-point increase in the top marginal rate on capital income and a reduction in the deduction cap for private pension contributions.

Step 3: Running the microsimulation model. Once the data are uprated and legislation implemented, we use the microsimulation model to compute individual tax liabilities and aggregate PIT revenue for each year. As shown in Section 3.2, the model replicates observed aggregates with errors below 0.05%.

This gap arises primarily due to tax withholdings from individuals who are not required and *do not* file a tax return, and are therefore excluded from the dataset used in the simulation. To address this, we rescale all baseline simulations to match the observed tax revenue and apply the same adjustment to the counterfactual simulations presented next. As shown in the results section, this rescaling remains minor across all modelled years.

Step 4: Constructing counterfactual scenarios. To estimate fiscal drag, we simulate four scenarios:

(i) Baseline (D19L19P19): 2019 data, 2019 legislation, 2019 nominal parameters. Represents observed 2019 tax collection.

(ii) No indexation (D23L19P19): 2023 income data, 2019 legislation, tax parameters with nominal values as of 2019. Estimates the upper bound of tax revenue in the absence of any indexation or reform.

(iii) Full indexation (D23L19P23): 2023 income data, 2019 legislation, parameters updated annually by a selected index. Represents the lower bound.

(iv) Actual policy (D23L23P23): 2023 income data, 2023 legislation and parameters. Reflects actual revenue in 2023. This estimate will be affected by indexation reforms (parameter updating) and other reforms enacted between 2019 and 2023.

Figure 3 illustrates these simulations. We measure **actual fiscal drag** as the difference between D23L23P23 (the estimated tax revenue using 2023 incomes and legislation) and D23L19P23 (the simulated counterfactual in which 2019 legislation is held fixed, but incomes and tax parameters are uprated annually to offset fiscal drag based on a selected index). This difference can be expressed in relative terms—either as a share of the total revenue growth between 2019 and 2023, or as a share of ***potential* fiscal drag** (i.e. the difference between the no-indexation scenario, D23L19P19, and the full-indexation scenario, D23L19P23). The inverse of the latter ratio provides a measure of the extent to which fiscal drag was offset by indexation or other policy reforms.

Choice of index. We test three indexation benchmarks:[37]

- *Lagged CPI:* Specifically, to update the tax parameters of year t, we use the price growth observed between December of $t-2$ to November of $t-1$, consistent with Spanish pension indexation.
- *Concurrent CPI:* The same measure, shifted one year forward.
- *Income growth:* Observed nominal growth in taxable income. While this specific measure is unlikely to be used in practice (as it cannot be known until taxes have been paid) it approximates the indexation rate that would fully offset fiscal drag.[38]

The choice of index does not significantly affect our main conclusions for the 2019–2023 period, although results may differ in specific years when inflation and income growth diverge.

5.2 Results

Figure 4 presents the results of our simulations. Each panel displays a different outcome of interest: (a) total tax revenue, (b) the tax revenue-to-GDP ratio, and (c) average effective tax rates. The grey lines show the observed historical series from 2014 to 2023, while black markers indicate the baseline simulations for each year from 2019 to 2023, rescaled to match observed aggregates. For comparison, unadjusted baseline simulations are shown with light grey markers in panel (a).

For 2023, we present several counterfactual scenarios using earlier legislation under different indexation schemes. These include a scenario where 2019 tax parameters are kept fixed (red marker) and scenarios where those parameters are updated annually using three different indices: lagged CPI (blue marker), concurrent CPI (green marker), and income growth (yellow marker).

As shown in Figure 4 and Appendix Table A.3), we find that full indexation using any of the three benchmarks would have resulted in significantly lower tax revenues,

[37]In practice, as discussed in section 2, countries that update their parameters with reference to a given index often use the CPI index (whether the CPI from the previous year, or an estimate of the CPI in the current year) but other indicators are also used, such as the growth in wages, or the actual growth in the tax base.

[38]If all types of incomes grow uniformly for all individuals, indexing tax parameters by the same rate should offset fiscal drag. Of course, this is a simplistic approximation, as in real life incomes grow heterogeneously, there are composition effects in the growth of taxpayers, and there might be features of the tax system that cannot be indexed. Nevertheless, using nominal taxable income growth for updating tax parameters remains a useful conceptual exercise to study fiscal drag.

tax-to-GDP ratios, and average effective tax rates. This confirms the substantial role of fiscal drag during the 2019–2023 period.

Using income growth as the benchmark (yellow marker), we estimate that tax revenue in 2023 would have been approximately €10.6 billion lower under full indexation. This accounts for nearly one-third of the total increase in PIT revenue between 2019 and 2023, with the remainder explained by real and nominal tax base growth.

We also find that fiscal drag accounts for about half of the increase in the tax revenue-to-GDP ratio over this period: 0.73 percentage points (pp) of the total 1.36 pp increase. The rest is largely attributable to PIT base expansion—i.e. more taxpayers and higher incomes. Similarly, the average effective tax rate would have been 13.1% under full indexation, compared to the observed 14.4%, and much closer to the 2019 value of 12.8%.

Indexation based on the previous year's CPI (blue marker) yields nearly identical results to those obtained using income growth, implying a similar fiscal drag effect (0.71 pp of GDP). In contrast, using concurrent CPI (green marker) produces lower tax revenue and a larger fiscal drag effect (0.89 pp of GDP), as it reflects more recent inflation, which was higher due to the exclusion of the low-CPI period from 2019.

In the absence of any indexation since 2019 (red marker), tax revenue would have increased only marginally—highlighting that the actual policies implemented have produced results close to a very mild indexation. Our methodology allows us to quantify how much of the *potential* fiscal drag (i.e. the vertical distance between the no-indexation and full-indexation scenarios) was offset by policy action. We estimate that only about 14–17% of the potential fiscal drag was neutralised, depending on the index used.

This relative measure of realised versus potential fiscal drag provides a normalised summary of indexation policy, potentially facilitating comparisons across countries and time periods.[39]

6 Conclusion

This paper presents a comprehensive characterization of fiscal drag in Spain during the recent period, leveraging rich administrative tax microdata and a microsimulation approach. Our analysis is articulated through two main complementary methodological approaches. The first approach focuses on estimating the progressivity of the tax sys-

[39] As discussed in Section 2, most of the PIT changes implemented in Spain during this period can be viewed as indexation measures —albeit discretionary and ad hoc in nature.

tem at specific points in time through the estimation of tax-to-base elasticities. These elasticities reflect the *potential* fiscal drag that would occur if nominal tax parameters are not updated in line with nominal income growth. The second approach estimates actual fiscal drag over the recent period by accounting for changes in tax legislation and observed income growth.

Our methodology provides a framework aimed at informing both public finance scholars and policymakers. It enables improved modelling and forecasting of tax revenue using tools that account for heterogeneity across income sources and along the income distribution. We also present a distributional analysis that extends beyond aggregate inequality indices by examining mechanisms and effects throughout the income distribution—insights that are critical for understanding inequality dynamics and guiding tax policy design.

Overall, we document that the progressivity of the Spanish tax system can potentially induce significant fiscal drag. We estimate an overall tax-to-base elasticity of 1.84, indicating that, in the absence of parameter adjustments, a uniform 1% nominal increase in the tax base would raise tax revenue by 1.84%. Elasticities are slightly lower for capital income (1.58%) and slightly higher for labour and self-employment income (1.86% and 2.10%, respectively). We also find significantly higher elasticities in the middle of the income distribution (particularly among positive-taxpaying households), driven mainly by the erosion of two key deductions that together explain nearly half of the overall elasticity. As a result, while fiscal drag reduces the progressivity of the tax system, it may still reduce overall inequality due to the large share of zero-taxpaying households who remain unaffected by marginal income gains.

When assessing actual fiscal drag, we find that policy changes during the 2019–2023 period have only partially offset the effect. We estimate that roughly 30% of potential fiscal drag in 2023 was offset by policy adjustments, relative to a counterfactual scenario in which tax parameters had been fully indexed each year since 2019. As a result, tax revenue in 2023 was approximately €10.6 billion higher—equivalent to 0.73% of GDP—than it would have been under full indexation.

These findings underscore the fiscal and distributional importance of fiscal drag, particularly in systems like Spain's, where indexation is not systematized. In such contexts, fiscal drag leads to an increase in effective tax rates that is not transparent and does not reflect deliberate policy design. This may result in unintended distributional consequences.[40] Conversely, fiscal drag can serve as a policy instrument to raise revenue passively and to function as an automatic stabiliser (Immervoll, 2006; Dolls et al., 2012). Partial indexation of selected parameters can also help mitigate unintended distributional outcomes. The approach developed in this paper offers a practical and generalisable framework for quantifying these effects, contributing to current debates on tax indexation beyond the Spanish case.

[40]This situation is comparable to that of other European countries such as Italy, Portugal, or Ireland, but contrasts with systems in Germany, France, the U.K., or the U.S., where indexation is standard practice and a freeze in tax parameters is typically viewed as an explicit fiscal policy choice. Nevertheless, even in those systems, relying on frozen parameters is not equivalent to a deliberate and well-structured tax reform, as the effects are driven by pre-existing legislation and its interaction with income growth (Waters and Wernham, 2022).

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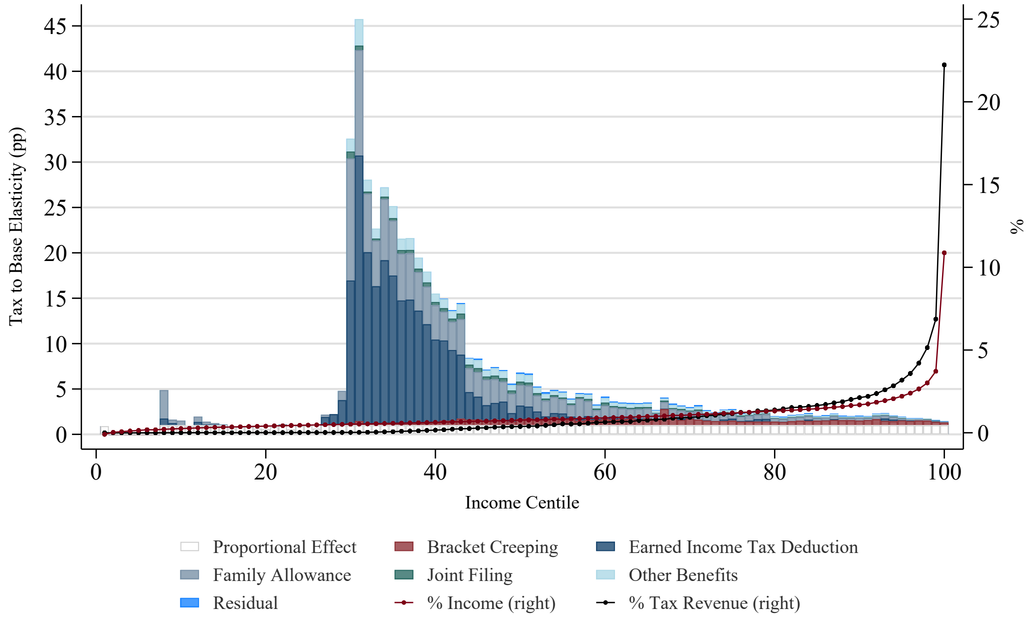
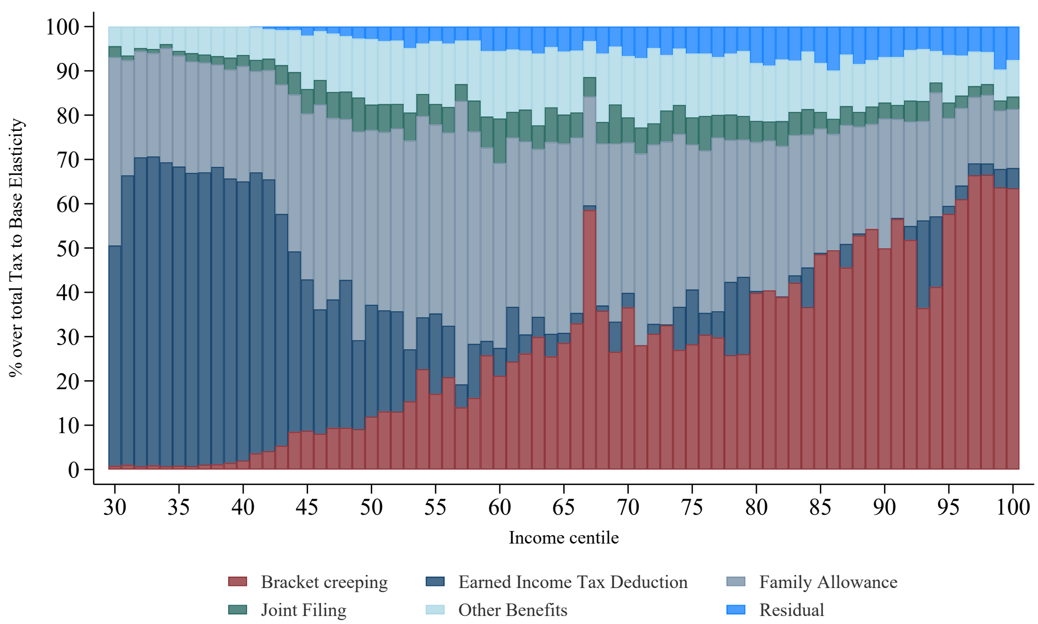
Figure 1: Tax to Base Elasticity Decomposition Across the Income Distribution

(a) Decomposition of Total Elasticity



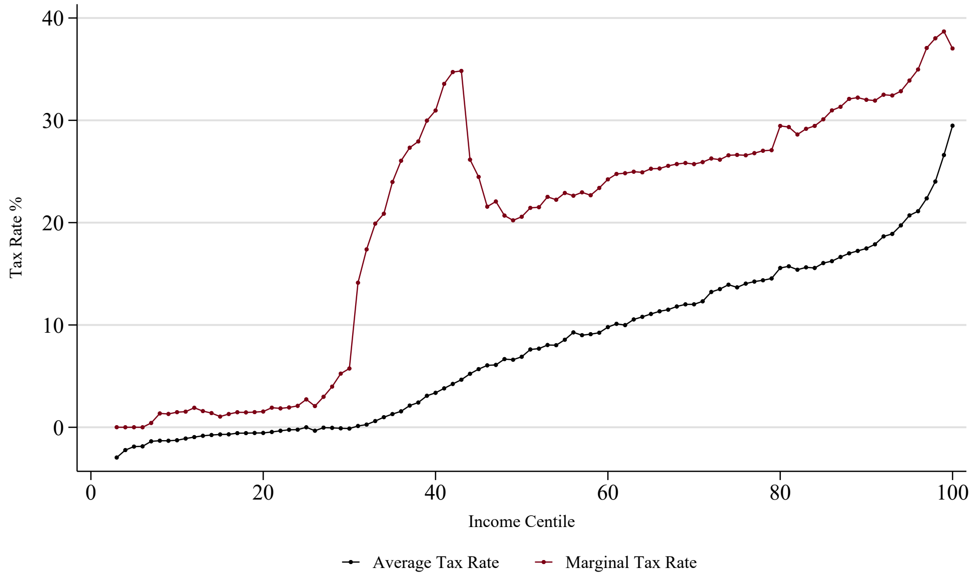
(b) Contribution of Each Tax Parameter to the Total Fiscal Drag Effect



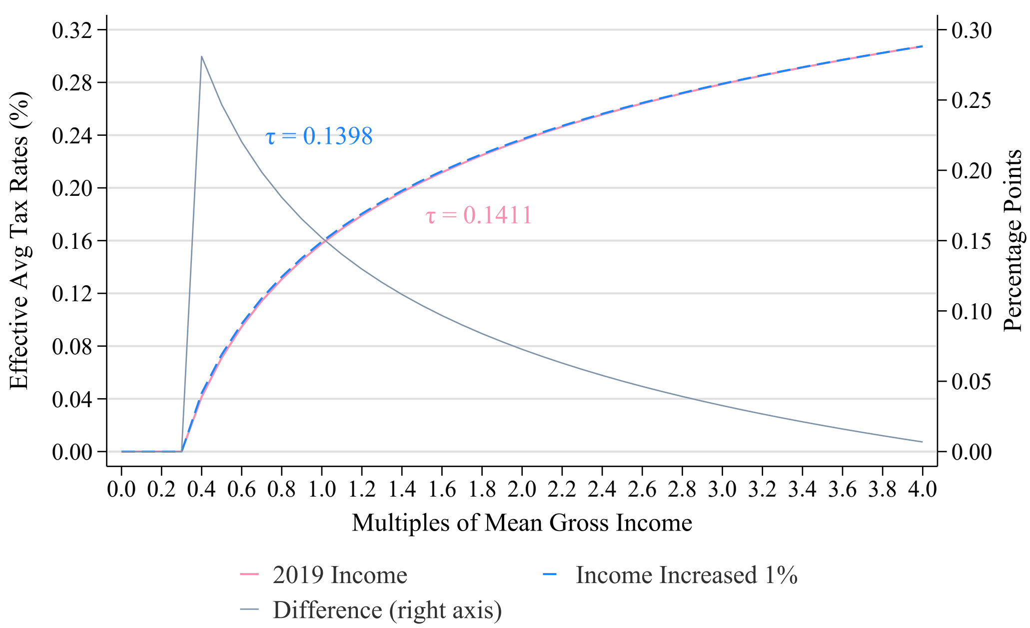
Notes: The tax-to-base elasticity is defined as the percentage change in tax liability resulting from a 1% increase in the taxable income. Panel 1(a) shows the average elasticity by percentile, with the breakdown of the contribution of each tax parameter to the total tax to base elasticity (in percentage points). The right axis shows the income share and the contribution to aggregate tax revenues of each percentile. Panel 1(b) shows the share of the contribution of each parameter to the total tax to base elasticity of each percentile.

Figure 2: Average and Marginal Tax Rates, and Parametric Function

(a) Average and marginal tax rates by percentile of income

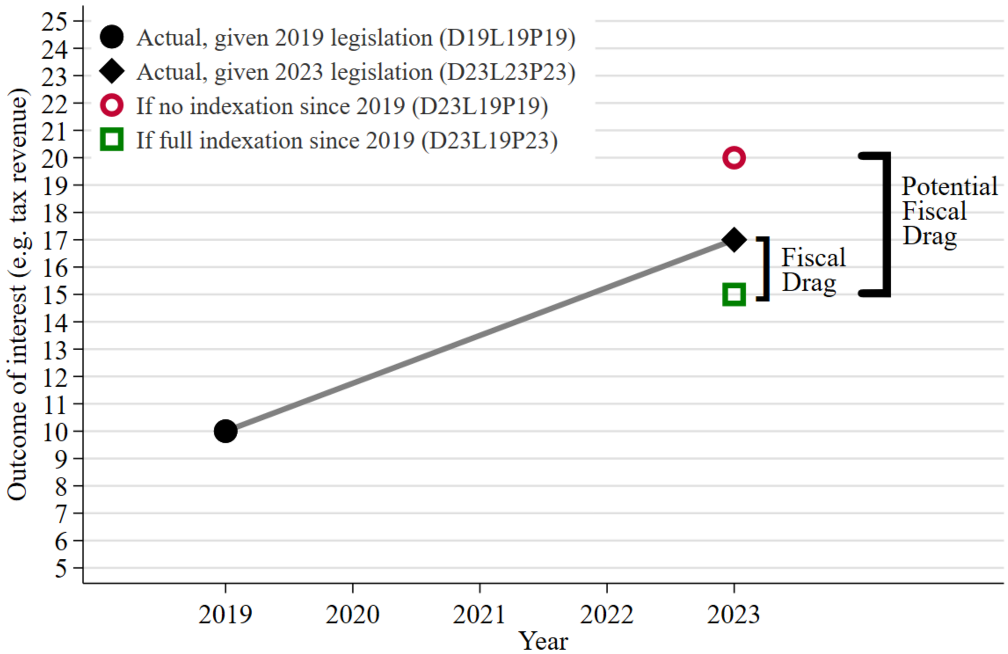


(b) Average Tax Rates as a Function of Multiples of Mean Gross Income



Notes: Panel A presents average tax rates across the gross income distribution based on 2019 administrative data, computed as the ratio of taxes paid to taxable income. It also displays marginal tax rates, defined as the change in taxes paid resulting from a 1% increase in income. Panel B shows the estimated parametric function, which takes the form: $f(\tilde{I}) = 1 - \lambda \cdot \tilde{I}^{-\tau}$ where $f(\tilde{I})$ are effective average tax rates, and $\tilde{I}$ are multiples of average gross income. $f(\tilde{I}) = 0$ if $\tilde{I} < \bar{I}$. Based on Benabou (2002) and Heathcote et al. (2017).

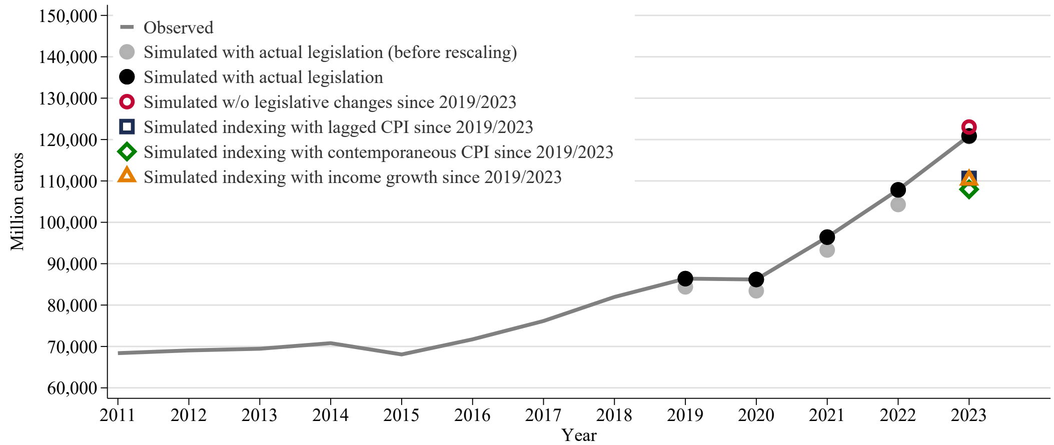
Figure 3: Illustration of methodology to estimate potential and actual fiscal drag



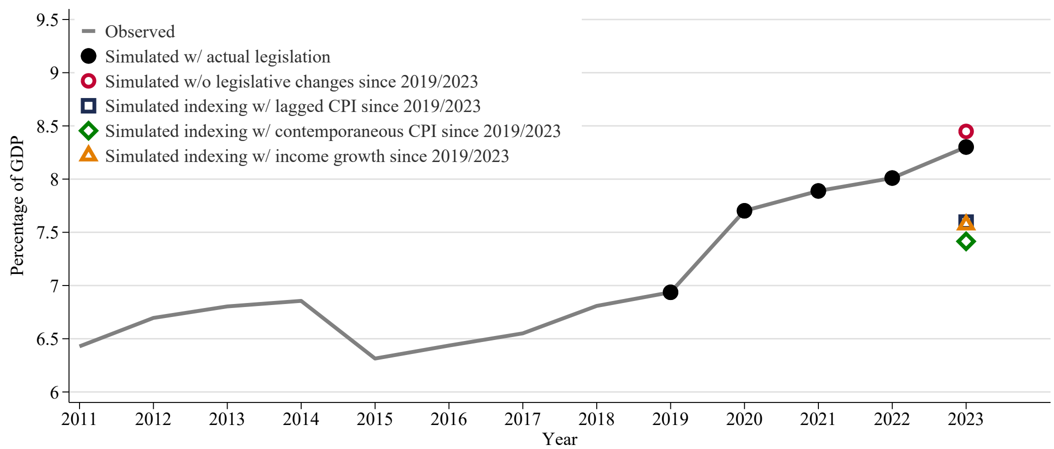
Notes: This figure illustrates the empirical approach for the estimation of fiscal drag in practice, as described in subsection 5.2

Figure 4: Tax revenue counterfactuals

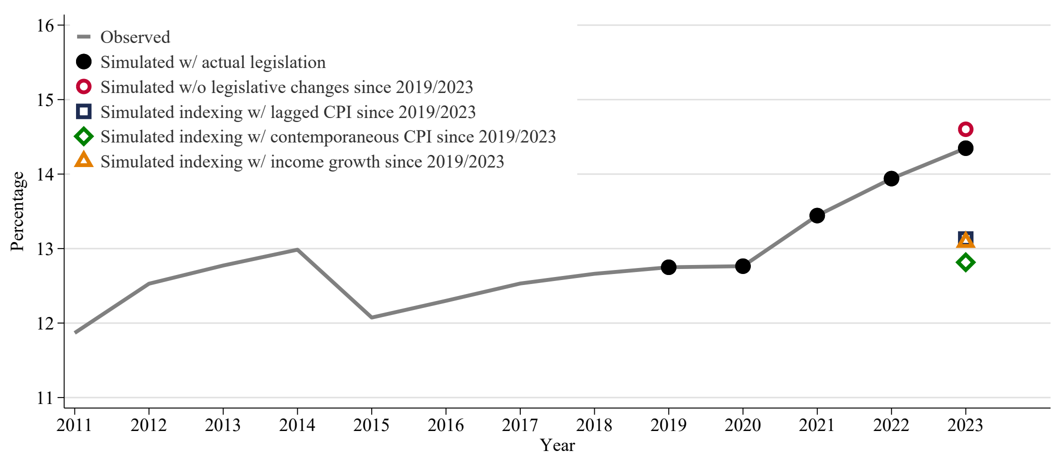
(a) Revenue



(b) Revenue to GDP ratio



(c) Average effective tax rate



Notes: Each of these panels shows, for a different outcome, their observed evolution over time (grey line), our baseline simulations for each year (black markers) and different counterfactual simulations (coloured hollow markers). Note that all baseline and counterfactual simulations are rescaled to match the observed value in each year. The baseline simulation without rescaling is shown in the first panel as grey markers (2023 coincides with the observed amount). The underlying numbers are reported in Appendix Table A.3

Table 1: Summary of tax-to-base elasticity and mechanisms

A. Tax-to-base Elasticity	Elasticity	% in Total Income
All incomes	1.84	–
Labour income	1.86	83.26%
Self-employment income	2.10	10.04%
Capital income	1.58	6.71%
B. Mechanisms	Elasticity	Contribution
Indexing bracket thresholds	1.51	39%
Indexing bracket thresholds & tax deduction/credit 1	1.41	12%
Indexing bracket thresholds & tax deduction/credit 1 & 2	1.17	28%
Indexing bracket thresholds & tax deduction/credit 1 & 2 & 3	1.15	3%
Indexing bracket thresholds & all tax deductions & credits	1.06	11%

Notes: Panel A presents the tax-to-base elasticity resulting from a 1% increase in each income source, along with their contributions to the fiscal drag effect when all income sources rise by the same amount. Panel B illustrates the elasticity achieved by sequentially indexing each parameter, showing each parameter's contribution to the overall fiscal drag effect. As detailed in Section 4.1, we estimate each parameter's contribution by calculating the tax-to-base elasticity after offsetting the 1% income increase with a corresponding 1% indexation of each parameter. Tax deduction/credit 1 refers to the Earned Income Tax Deduction, tax deduction/credit 2 to the family allowance, and tax deduction/credit 3 to the deduction for joint filing. The residual effect, which accounts for 7% of the total fiscal drag, represents the excess over the unitary elasticity after indexing brackets and applying all tax benefits.

Table 2: Impact of Fiscal Drag on income tax progressivity and inequality

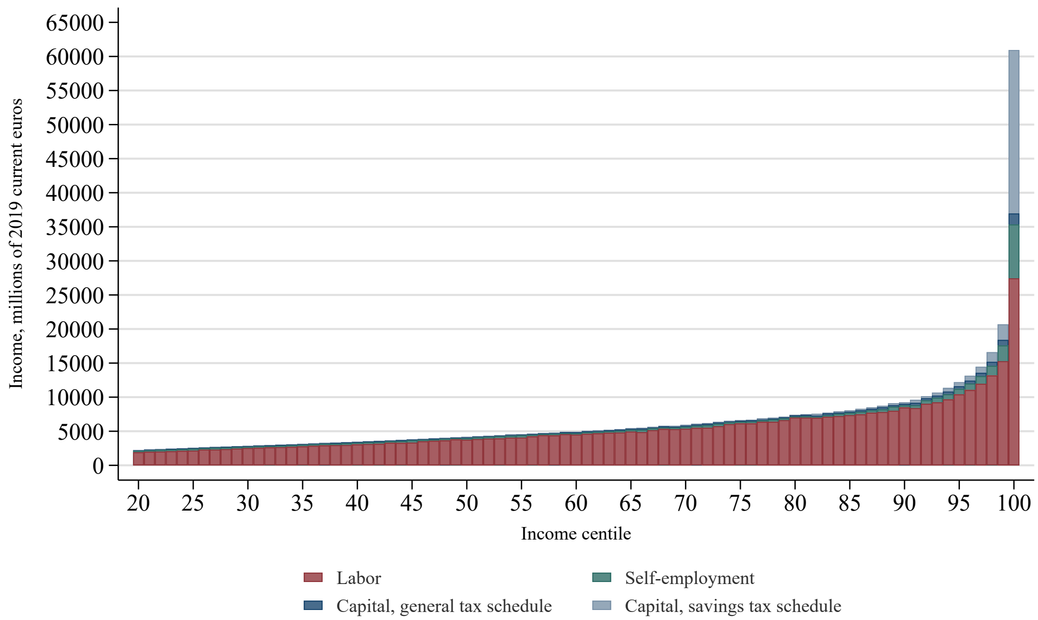
		2019 Income	2019 Income increased by 1 %
Parametric estimation	Complement of average tax rate (λ)	0.8423 (0.0000)	0.8408 (0.0000)
	Progressivity parameter (τ)	0.1411 (0.0001)	0.1398 (0.0001)
	Threshold positive tax liability ($\tilde{I}$)	30%	29%
	Mean squared error	0.001405	0.001385
Inequality measures	Gini income net of taxes	0.3789	0.3788
	Change in Gini from gross to net income	11.88%	11.90%
	Ratio 90:10 income net of taxes	5.5760	5.5662
	Change in ratio 90:10 from gross to net income	18.25%	18.39%

Notes: Estimated function is $f(\tilde{I}) = 1 - \lambda \cdot \tilde{I}^{-\tau}$ where $f(\tilde{I})$ are effective average tax rates, and $\tilde{I}$ are multiples of average gross income. $f(\tilde{I}) = 0$ if $\tilde{I} < \bar{I}$. Based on Benabou (2002) and Heathcote et al. (2017).

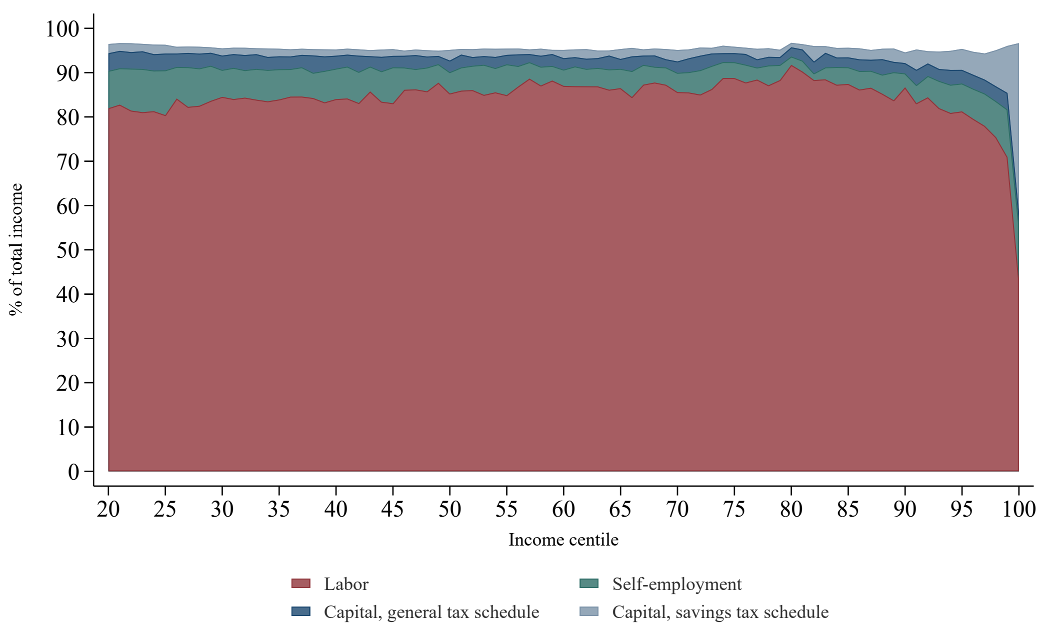
Appendix A Supplementary Figures and Tables

Figure A.1: Distribution of income and income sources

(a) Distribution of income by source



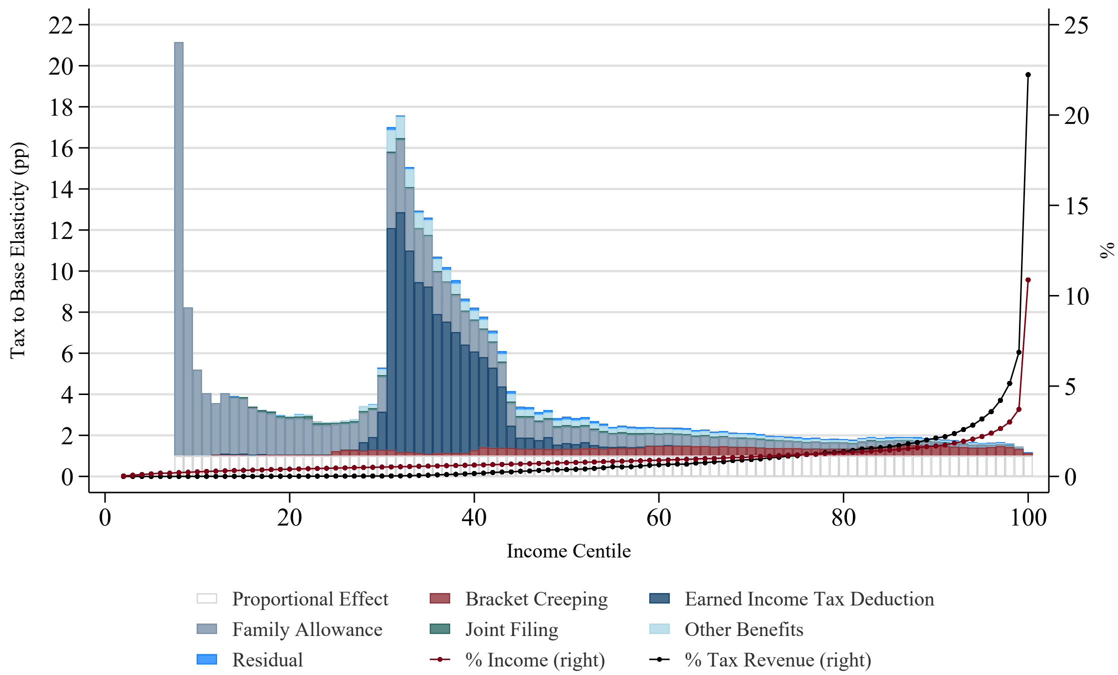
(b) Share of income source by centile



Notes: Panel A.1(a) shows the total income by percentile and source of income. Panel A.1(b) shows the share of each income source over total income by percentile.

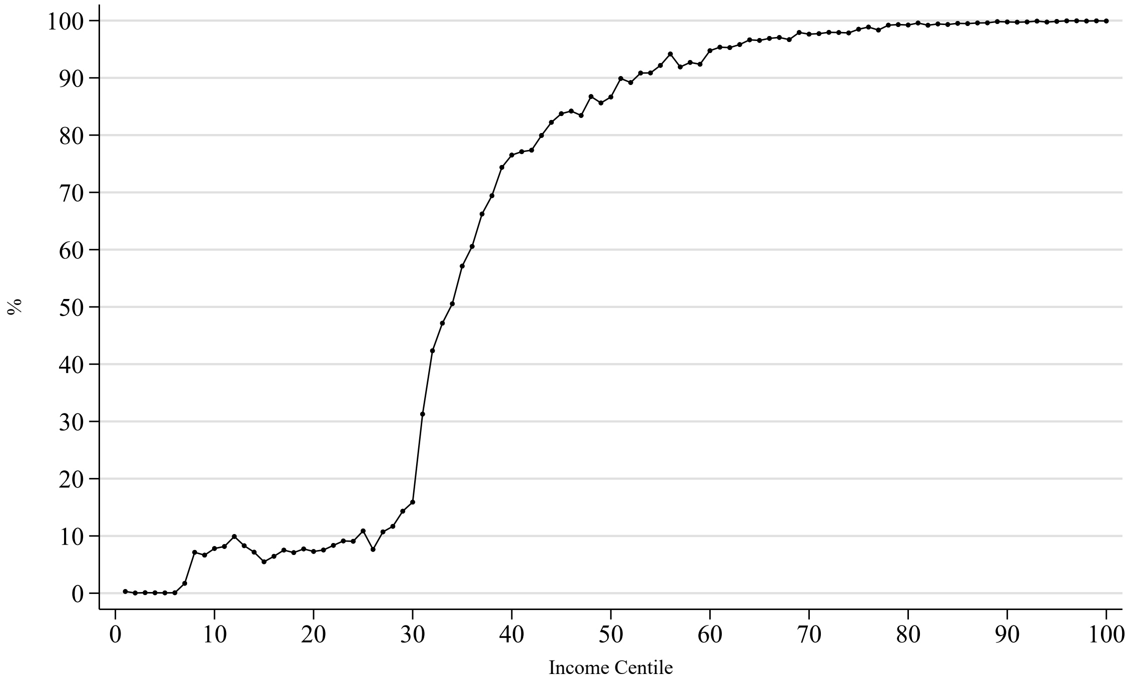
Figure A.2: Tax to Base Elasticity Decomposition Across the Income Distribution

(Weighted average by individual contribution to total tax revenue)



Notes: The tax-to-base elasticity is defined as the percentage change in tax liability resulting from a 1% increase in the taxable income. The average tax-to-base elasticity for each percentile is calculated as a weighted average where the weights are the contribution of each individual to total revenue. The weighted average of the elasticity by percentile is equal to the elasticity for the population of all taxpayers. Top values of each percentile have been winsorized at the 99.5th percentile to mitigate the influence of extreme observations on the total weighted mean elasticity.

Figure A.3: Share of taxpayers with positive tax liability, by centile



Notes: This figure shows the percentage of individuals with positive tax liabilities over total taxpayers of each percentile. Taxpayers in lower percentiles have a much lower rate of individuals with positive taxes paid. These data do not include non-filers. However, García-Miralles et al. (2019) document that more than 80% of Spanish taxpayers who are not required to file income tax returns, still choose to do so, given that they are likely to get a refund due to tax credits.

Table A.1: Tax to Base Elasticity Decomposition by Centile

Centile	Tax to Base Elasticity	Brackets	Earned Income Tax Deduction	Family Allowance	Joint Filing	Other Benefits	Residual
1	0.91	0.00	0.00	0.00	0.00	0.00	0.00
2	0.01	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	4.87	0.03	0.71	3.13	0.00	0.00	0.00
9	1.61	0.02	0.21	0.38	0.00	0.00	0.00
10	1.52	0.00	0.04	0.49	0.00	0.00	0.00
11	0.95	0.00	0.00	0.00	0.00	0.00	0.00
12	1.96	0.03	0.35	0.59	0.00	0.00	0.00
13	1.38	0.00	0.09	0.29	0.00	0.00	0.00
14	1.23	0.00	0.07	0.16	0.00	0.00	0.00
15	1.05	0.00	0.05	0.00	0.00	0.00	0.00
16	0.68	0.00	0.00	0.00	0.00	0.00	0.00
17	0.84	0.00	0.00	0.00	0.00	0.00	0.00
18	0.85	0.00	0.00	0.00	0.00	0.00	0.00
19	0.64	0.00	0.00	0.00	0.00	0.00	0.00
20	0.57	0.00	0.00	0.00	0.00	0.00	0.00
21	0.81	0.00	0.00	0.00	0.00	0.00	0.00
22	1.08	0.00	0.08	0.00	0.00	0.00	0.00
23	0.55	0.00	0.00	0.00	0.00	0.00	0.00
24	0.94	0.00	0.00	0.00	0.00	0.00	0.00
25	0.96	0.00	0.00	0.00	0.00	0.00	0.00
26	0.64	0.00	0.00	0.00	0.00	0.00	0.00
27	2.16	0.04	0.87	0.25	0.00	0.00	0.00
28	2.22	0.03	1.19	0.00	0.00	0.00	0.00
29	4.78	0.05	2.71	1.02	0.00	0.00	0.00
30	32.58	0.25	15.70	13.45	0.75	1.41	0.00
31	45.75	0.47	29.25	11.63	0.48	2.93	0.00
32	28.04	0.19	18.87	6.48	0.19	1.31	0.00
33	22.67	0.20	15.11	5.06	0.21	1.10	0.00
34	27.21	0.19	17.99	6.76	0.23	1.04	0.00
35	25.14	0.20	16.30	6.05	0.26	1.33	0.00
36	21.54	0.16	13.60	5.17	0.38	1.24	0.00
37	21.63	0.23	13.61	5.11	0.37	1.31	0.00
38	19.48	0.21	12.41	4.27	0.34	1.23	0.01
39	17.94	0.25	10.87	4.16	0.46	1.19	0.01
40	15.52	0.29	9.15	3.78	0.37	0.93	0.00
41	14.94	0.50	8.84	3.19	0.35	1.02	0.03
42	13.66	0.52	7.77	3.12	0.32	0.85	0.07
43	14.47	0.72	7.05	3.94	0.59	1.07	0.11
44	8.43	0.63	3.03	2.63	0.38	0.70	0.06
45	8.32	0.64	2.50	2.74	0.41	0.89	0.15
46	7.11	0.49	1.72	2.83	0.34	0.68	0.06
47	7.41	0.60	1.86	2.62	0.38	0.84	0.11
48	7.08	0.57	2.03	2.21	0.38	0.76	0.13
49	5.58	0.42	0.92	2.16	0.35	0.61	0.13
50	6.81	0.69	1.47	2.29	0.33	0.86	0.16

Table A.1 (continued)

Centile	Tax to Base Elasticity	Brackets	Earned Income Tax Deduction	Family Allowance	Joint Filing	Other Benefits	Residual
51	6.71	0.75	1.30	2.30	0.36	0.81	0.19
52	5.27	0.56	0.97	1.76	0.24	0.61	0.14
53	4.63	0.56	0.43	1.71	0.23	0.53	0.18
54	4.90	0.88	0.46	1.77	0.19	0.45	0.15
55	4.70	0.63	0.67	1.58	0.17	0.53	0.12
56	3.94	0.61	0.34	1.28	0.17	0.42	0.11
57	4.54	0.50	0.18	2.27	0.13	0.35	0.11
58	4.49	0.56	0.43	1.67	0.24	0.48	0.11
59	3.29	0.59	0.07	1.00	0.16	0.34	0.13
60	4.16	0.67	0.20	1.32	0.32	0.48	0.17
61	3.63	0.64	0.32	1.01	0.15	0.37	0.14
62	3.50	0.65	0.11	1.09	0.18	0.33	0.14
63	3.47	0.74	0.11	0.94	0.13	0.40	0.15
64	3.42	0.62	0.12	1.05	0.19	0.33	0.11
65	3.51	0.72	0.06	1.07	0.16	0.36	0.14
66	2.69	0.56	0.04	0.67	0.09	0.24	0.09
67	4.04	1.78	0.03	0.75	0.13	0.25	0.10
68	3.39	0.86	0.03	0.88	0.12	0.37	0.15
69	3.18	0.58	0.15	0.88	0.19	0.29	0.10
70	3.01	0.73	0.07	0.68	0.11	0.28	0.13
71	3.22	0.62	0.00	0.96	0.13	0.35	0.16
72	2.66	0.51	0.04	0.67	0.08	0.28	0.08
73	2.42	0.46	0.00	0.59	0.10	0.18	0.09
74	2.74	0.47	0.17	0.68	0.11	0.22	0.09
75	2.77	0.50	0.22	0.58	0.11	0.25	0.11
76	2.34	0.41	0.07	0.49	0.10	0.19	0.08
77	2.42	0.42	0.08	0.56	0.07	0.18	0.10
78	2.57	0.41	0.26	0.50	0.09	0.22	0.10
79	2.62	0.42	0.28	0.50	0.09	0.24	0.09
80	2.02	0.41	0.00	0.34	0.05	0.13	0.08
81	1.93	0.38	0.00	0.32	0.04	0.12	0.08
82	2.14	0.45	0.00	0.39	0.06	0.16	0.08
83	2.19	0.50	0.02	0.38	0.06	0.14	0.09
84	2.33	0.49	0.12	0.40	0.08	0.17	0.07
85	2.02	0.50	0.00	0.29	0.04	0.11	0.08
86	2.10	0.54	0.00	0.29	0.04	0.12	0.11
87	2.29	0.59	0.07	0.35	0.05	0.15	0.08
88	2.05	0.55	0.00	0.25	0.03	0.11	0.09
89	2.02	0.55	0.00	0.24	0.04	0.11	0.08
90	2.05	0.52	0.00	0.31	0.04	0.11	0.07
91	2.01	0.57	0.00	0.23	0.03	0.11	0.07
92	2.28	0.66	0.04	0.30	0.06	0.15	0.07
93	2.34	0.49	0.26	0.30	0.06	0.16	0.07
94	2.08	0.44	0.17	0.30	0.02	0.08	0.06
95	1.94	0.54	0.02	0.19	0.03	0.10	0.06
96	1.77	0.47	0.02	0.14	0.02	0.07	0.05
97	1.78	0.52	0.02	0.12	0.02	0.06	0.04
98	1.75	0.50	0.02	0.12	0.02	0.05	0.04
99	1.59	0.38	0.02	0.08	0.01	0.04	0.06
100	1.47	0.30	0.02	0.06	0.01	0.04	0.04

Notes: This table shows the results that underlie Figure 1a.

Table A.2: Mean income by percentile and income source, in euros

Centile	Mean Income	Labour	Capital	Self-employment
1	-2711	622	58	-3416
2	778	296	325	138
3	1926	955	523	404
4	3055	1747	562	656
5	4035	2491	590	832
6	4857	3390	517	825
7	5414	3880	525	876
8	5996	4117	639	1068
9	6590	4713	640	1023
10	7184	5382	622	931
11	7759	5810	641	1016
12	8316	6296	583	1122
13	8832	7064	510	945
14	9232	7598	527	821
15	9582	8249	425	660
16	9921	8286	507	827
17	10281	8453	590	913
18	10652	8736	654	907
19	11019	9013	726	917
20	11389	9335	691	961
21	11746	9724	666	966
22	12087	9843	691	1147
23	12425	10075	702	1214
24	12766	10378	747	1174
25	13104	10538	755	1326
26	13420	11295	609	958
27	13719	11288	639	1232
28	14019	11570	682	1185
29	14314	11972	594	1136
30	14617	12357	709	891
31	14918	12538	679	1051
32	15216	12836	768	946
33	15520	13022	720	1080
34	15834	13225	767	1124
35	16146	13554	745	1105
36	16463	13926	731	1027
37	16789	14204	701	1112
38	17122	14428	914	976
39	17451	14535	848	1243
40	17781	14942	770	1223
41	18119	15252	730	1308
42	18468	15356	938	1299
43	18825	16148	697	1057
44	19202	16024	939	1322
45	19576	16268	800	1590
46	19961	17192	762	1007
47	20338	17537	896	934
48	20723	17778	809	1114
49	21099	18514	637	884
50	21475	18317	1078	1036

Table A.2 (continued)

Centile	Mean Income	Labour	Capital	Self-employment
51	21866	18789	909	1150
52	22245	19146	833	1222
53	22616	19220	826	1539
54	23048	19721	1003	1265
55	23452	19916	829	1636
56	23821	20693	940	1105
57	24191	21449	695	899
58	24599	21426	1000	1044
59	25045	22097	905	827
60	25467	22161	1130	936
61	25899	22517	992	1161
62	26351	22904	1174	1038
63	26812	23301	1050	1118
64	27246	23471	1165	1253
65	27741	23999	1236	1211
66	28267	23884	1475	1662
67	28799	25139	1003	1291
68	29372	25782	1212	1045
69	29922	26110	1238	1175
70	30515	26127	1572	1326
71	31143	26637	1597	1431
72	31743	27001	1622	1749
73	32393	27953	1322	1695
74	33058	29358	1218	1188
75	33713	29935	1174	1208
76	34393	30192	1318	1383
77	35100	31046	1483	953
78	35870	31263	1392	1607
79	36591	32318	1257	1255
80	37275	34206	1146	705
81	37847	34149	1410	936
82	38479	33988	2364	589
83	39243	34728	1878	1062
84	40181	35067	1727	1611
85	41178	36015	1808	1554
86	42342	36490	2164	1779
87	43491	37664	2043	1663
88	44700	38106	2614	1925
89	46152	38667	2474	2920
90	47773	41422	2259	1498
91	49624	41238	3975	2047
92	52083	43983	2905	2511
93	54740	44881	3631	3362
94	58402	47249	4474	3722
95	62482	50773	4871	3940
96	67693	53855	5641	4617
97	74787	58321	6763	5464
98	85141	64204	9824	6938
99	104968	74457	15097	11277
100	307142	133695	124726	38489

Table A.3: Revenue, Revenue to GDP ratio, and Average effective tax rates

	2019	2023	2025
A. Revenue (million euros)			
(0) Simulated (before rescaling)	84,396	120,724	
(1) Simulated	86,394	120,882	
(2) Simulated w/o legislative changes since 2019/2023		123,022	138,885
(3) Simulated indexing with lagged CPI since 2019/2023		110,612	132,815
(4) Simulated indexing with contemporaneous CPI since 2019/2023		107,972	134,017
(5) Simulated indexing with income growth since 2019/2023		110,264	134,323
(6) = (1)-(3) Fiscal Drag		10,269	
(7) = (1)-(4) Fiscal Drag		12,909	
(8) = (1)-(5) Fiscal Drag		10,617	
(9) = (2)-(3) Potential Fiscal Drag		12,410	6,071
(10) = (2)-(4) Potential Fiscal Drag		15,050	4,868
(11) = (2)-(5) Potential Fiscal Drag		12,758	4,562
(12) = ((9)-(6))/(9) Offset Fiscal Drag		0.172	
(13) = ((10)-(7))/(10) Offset Fiscal Drag		0.142	
(14) = ((11)-(8))/(11) Offset Fiscal Drag		0.168	
B. Revenue to GDP ratio			
(1) Simulated	6.94	8.30	
(2) Simulated w/o legislative changes since 2019/2023		8.45	8.78
(3) Simulated indexing with lagged CPI since 2019/2023		7.60	8.40
(4) Simulated indexing with contemporaneous CPI since 2019/2023		7.42	8.47
(5) Simulated indexing with income growth since 2019/2023		7.57	8.49
(6) = (1)-(3) Fiscal Drag		0.71	
(7) = (1)-(4) Fiscal Drag		0.89	
(8) = (1)-(5) Fiscal Drag		0.73	
(9) = (2)-(3) Potential Fiscal Drag		0.85	0.38
(10) = (2)-(4) Potential Fiscal Drag		1.03	0.31
(11) = (2)-(5) Potential Fiscal Drag		0.88	0.29
C. Average effective tax rate			
(1) Simulated	12.75	14.35	
(2) Simulated w/o legislative changes since 2019/2023		14.60	14.92
(3) Simulated indexing with lagged CPI since 2019/2023		13.13	14.27
(4) Simulated indexing with contemporaneous CPI since 2019/2023		12.82	14.40
(5) Simulated indexing with income growth since 2019/2023		13.09	14.43
(6) = (1)-(3) Fiscal Drag		1.22	
(7) = (1)-(4) Fiscal Drag		1.53	
(8) = (1)-(5) Fiscal Drag		1.26	
(9) = (2)-(3) Potential Fiscal Drag		1.47	0.65
(10) = (2)-(4) Potential Fiscal Drag		1.79	0.52
(11) = (2)-(5) Potential Fiscal Drag		1.51	0.49

Notes: This table shows the results that underlie Figure 4.