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Distributional tax analysis in theory and practice: Harberger meets Diamond-Mirrlees☆

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ABSTRACT

This paper proposes a new framework to study the distribution of current taxes and the effects of tax reforms. For *current taxes*, labor taxes are assigned to the corresponding workers, capital taxes to the corresponding asset owners, and consumption taxes to the corresponding consumers. Current taxes capture the wedges between pre-tax prices (relevant for production) and after-tax prices (relevant for the work, saving, and consumption decisions of households) as well as the direct equity effects of taxes while being silent about efficiency. Our method does not require structural assumptions, is internally consistent, and maximizes the comparability of tax progressivity and inequality over time and across countries. Applying this methodology to the United States, we find that the effective tax rate of the top 1% has declined from about 50% in the early 1950s to 32% in 2021. It is through the corporate tax that a high degree of tax progressivity was achieved in the middle of the 20th century. To analyze the distributional effects of *tax reforms*, mechanical changes in tax liability by income groups and aggregate revenue effects due to household (but not firms') behavioral responses are sufficient statistics in the neoclassical optimal tax model of Diamond and Mirrlees (1971). The effects of taxes on pre-tax prices at the heart of classical tax incidence analysis are normatively irrelevant.

1. Introduction

Who pays taxes, and how tax reforms would affect the different socioeconomic groups, are arguably some of the most important questions in modern democratic societies. Governments of high-income countries collect 30% to 50% of national income in taxes. These tax payments have a first-order effect on the disposable income of households. To inform lawmakers and voters, it is thus critical to have a sound and practical way to allocate taxes across income groups and to analyze who would gain or lose from proposed changes to the tax system.

Theoretically, classical tax incidence aims at measuring the welfare burden of taxes, taking into account behavioral responses to taxes and how, as a result, taxes can be shifted through pre-tax price effects.[1] Because of behavioral responses to taxes, counterfactual incomes absent taxes differ from actual incomes and the welfare burden of taxes generally exceeds taxes actually paid–the deadweight burden of taxation. Tax incidence results are also sensitive to assumptions about behavioral responses.

Empirically, distributional tax analysis of the full tax system was first produced in the United States following the foundational work of Colm and Tarasov (1941), Musgrave et al. (1951), and Pechman and Okner (1974). Building on this work, US government agencies and think tanks have developed sophisticated frameworks to analyze the distribution of federal taxes.[2] The results of these models are published on the

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[1] See Kotlikoff and Summers (1987) and Fullerton et al. (2002) for surveys.

[2] See US Congressional Budget Office (2018), US Joint Committee on Taxation (1993), US Joint Committee on Taxation (2019), US Treasury (2019), and Tax Policy Center (2022) for detailed descriptions and Barthold (1993) for a summary of the practical use of such statistics by the US Congress.

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form of distributional tax tables that have a large impact in the public debate.[3] This empirical approach is a pragmatic mixed approach that ignores behavioral responses in some cases (e.g., assumes that taxes do not affect GDP) and assumes that taxes are shifted in other cases (e.g., the corporate tax falls in part on labor) and is therefore conceptually inconsistent.

This paper proposes a new framework grounded in optimal tax theory that is conceptually coherent and simple to apply empirically. Our starting point is that distributional tax analysis serves two purposes. First, it provides information on the current distribution of income and tax payments by income groups, which is crucial to quantify income inequality, pre-tax and post-tax, and the direct effects of taxes. From now on, we call this analysis *distributional current-tax analysis*. Second, it is used to simulate how a change to the tax system would affect the different socioeconomic groups. From now on, we call this *distributional tax-reform analysis*. In the conventional approach, the allocation of existing taxes and the simulation of tax reforms are done using the same models of tax incidence. However, the two types of analyses, we argue, require distinct methodologies, each different from the one conventionally used. This paper presents these methodologies, applies them to the United States, and provides a practical guide for their implementation globally.

Distributional current-tax analysis. We propose a novel distributional tax analysis for *current* taxes that is less ambitious but simpler than classical tax incidence. Our question is the following: How should we assign *existing* taxes and incomes across individuals in the most economically meaningful way? That is, if we restrict ourselves to income and taxes as they currently exist and without taking a stand on counterfactuals absent taxes, what is the most meaningful way to assign taxes and incomes across individuals? Economically, taxes create a wedge between pre-tax prices (relevant for production) and post-tax prices (relevant for the work, saving, and consumption decisions of households). Therefore, we propose to assign taxes based on labor income to the corresponding workers, taxes based on capital or capital income to the owners of the corresponding assets, and taxes based on consumption to the corresponding consumers.[4] This approach differs from simply following statutory incidence. For example, both employer and employee payroll taxes are a tax on labor, and hence are assigned to workers. Who remits the tax to the government (e.g., whether the income tax on earnings is withheld at source by employers vs. paid ex-post by individuals) is also irrelevant. Therefore, our current-tax analysis is consistent with economic modeling: it describes the price distortions created by the tax system, as one writes a model of optimal taxation. It is also consistent with national accounting: pre-tax labor income is the total labor cost paid by employers for hiring labor including all payroll taxes; pre-tax corporate profits are measured profits before any corporate tax is paid, etc. Therefore, our approach respects the macro level split of capital vs. labor income.[5] Our approach just describes the economy as it is and hence is internally consistent; it maximizes the comparability of inequality and tax progressivity over time and across countries with different legal systems; and it is much simpler to implement, because it does not depend on assumptions about behavioral responses to taxes.

Applying this framework to the United States, we find that the effective tax rate of the top 1% of the income distribution has declined from nearly 50% in the early 1950s to 32% in 2021. Thanks to a consistent treatment of business profit taxes,[6] we illuminate the dramatic changes in the taxation of top-end business income over the last century. Rich business owners faced significant price distortions in terms of pre-tax vs. after-tax returns to capital in the 1950s: they paid half or more of their profits in corporate taxes, before facing the progressive individual income tax on distributed income. We show that it is through the corporate tax that the US tax system achieved its high degree of progressivity in the middle of the 20^{th} century—not through the individual income tax, which has absorbed a relatively constant fraction of the pre-tax income of top earners since 1930.

In contrast to classical incidence, our proposed current-tax analysis captures only the equity aspect of existing taxes. Conceivably, the high tax rates on business income at mid-century might have been detrimental to workers. Perhaps middle-class wages would have been even higher with lower corporate taxes. Our current-tax analysis does not provide information on counterfactual levels of income absent any tax, and hence is silent about the efficiency costs of taxation. However, it provides a crucial input to quantify these efficiency costs and to assess the desirability of tax reforms. It is also consistent with the classic dichotomy between equity vs. efficiency effects that arise in all optimal tax models.

Distributional tax reform analysis. Our second contribution is to use optimal tax theory to identify the sufficient statistics needed to conduct distributional tax-reform analysis in neoclassical models. In the optimal tax models of Mirrlees (1971) and Diamond and Mirrlees (1971), all that is needed to assess the desirability of a small tax reform is: (i) mechanical changes in tax liability by income groups—as in our current-tax analysis—weighted by social marginal welfare weights to reflect the distributional preferences of society, and (ii) the aggregate tax revenue effects of the reform due to household behavioral responses, keeping pre-tax prices fixed. Revenue effects due to behavioral responses do not have to be broken down by income groups: behavioral responses matter only for their aggregate effect on the government budget. The effect of taxes on pre-tax prices—effects that are the heart of classical tax incidence analysis since Harberger (1962, 1964)—turn out to be irrelevant normatively because they can be offset at no fiscal cost with an additional tax adjustment. To understand the intuition, consider a tax on capital. If the tax hurts wages, it also correspondingly increases the rate of return for capitalists. Because this extra capital income can be taxed away to make workers whole, the change in factor prices is irrelevant from an optimal tax perspective. In a nutshell, in our paper, Harberger at long last meets Diamond and Mirrlees—and it is the Diamond-Mirrlees insights that turn out to matter most for tax reform policy advice.

The rest of this paper proceeds as follows. Section 2 presents our distributional current-tax methodology. We provide an application to the study of the evolution of tax progressivity in the United States in Section 3. Section 4 describes the theoretical foundation of our tax reform analysis within the general Diamond and Mirrlees (1971) optimal tax model. Section 5 applies our distributional tax-reform framework to an increase in the corporate tax rate and the individual income tax for the top 1%. Section 6 concludes.

2. Distributional current-tax analysis

2.1. General principles and objectives

We perform distributional current-tax analysis where we propose measures of individual pre-tax incomes, taxes, and after-tax incomes

[3] A large and growing body of academic work also mobilizes the tools of distributional tax analysis globally (with variation in methods used) to estimate inequality and study tax progressivity. See Aaberge et al. (2021) in Norway, Advani et al. (2023) in the United Kingdom, Atria and Otero (2021) and De Rosa et al., 2024 in Latin America, Bach et al. (2023) in France, Blanchet et al. (2022) in Europe, Bruil et al. (2022) in the Netherlands, Guzzardi et al. (2022) in Italy, and Saez and Zucman (2019) in the United States.

[4] This leaves out taxes on intermediate goods (such as tariffs) which are small in practice and that we pragmatically assign to final consumption goods.

[5] The current approach of US government agencies which shifts a fraction of the corporate tax onto workers does not.

[6] The current approach of US government agencies treats businesses differently depending on whether they are subject to the corporate tax (C-corporations) or not (pass-through businesses).

as they exist in the current economy, and are consistent with standard economic modeling.

Distributional tax wedges. To implement this analysis, the starting point is that, in economic models, taxes are wedges between pre-tax prices (relevant for production decisions) and post-tax prices (relevant for work, saving, and consumption decisions of households). Because the government charges taxes on labor, producers pay labor costs in excess of what workers receive as net compensation. Because of taxes on assets and capital income, owners receive less than the full capital income generated by their assets. Due to consumption taxes, buyers of goods and services pay more than what producers receive.

Current-tax analysis allocates these wedges to individuals as follows. Labor taxes (which include payroll taxes and taxes on wage income—i.e., the full wedge between pre-tax labor costs and net-of-tax compensation) are assigned to the corresponding workers.[7] Capital taxes are allocated to the corresponding asset owners: taxes on corporate profits to the individual owners of corporations, taxes on the profits of unincorporated businesses (e.g., partnerships) to the owners of unincorporated businesses, residential property taxes to the owners of residential properties, business property taxes to the owners of business property, individual income taxes on dividends, interest, rents, capital gains, and royalties to the individuals who earn this income. Assets, their income flows, and the taxes on those assets or their income are all allocated to the ultimate owners of the assets. For instance, corporate taxes paid by companies owned by pension funds are allocated—like the corresponding profits—to the underlying individual owners. Consumption taxes are allocated to the corresponding consumers.[8]

Economic meaning of tax wedges. First, even though it does not involve the specification of behavioral responses, this approach is more than accounting, because it respects the incentives of economic actors and follows from the standard modeling of supply and demand functions. Labor taxes are allocated to workers as opposed to employers, because what matters for workers' labor supply decisions is after-tax compensation, while what matters to employers' labor demand is pre-tax labor costs. Capital taxes are similarly allocated to the respective capital owners as opposed to capital users, because what matters for capital supply is the after-tax capital return, while capital demand depends on pre-tax returns. Consumption taxes are allocated to consumers as opposed to producers, because the demand for goods and services depends on post-tax prices, while production decisions depend on pre-tax prices.

Side of the market irrelevance. Second, this approach differs from statutory incidence—who nominally remits the tax to the government. The analysis of tax incidence often starts from the fact that which side of the market has to legally remit the tax is not relevant, so that the question "who pays?" does not have an obvious answer. The canonical example is employer vs. employee payroll taxes. Our distributional current-tax analysis also features this side-of-the-market irrelevance. Both employer and employee payroll taxes are assigned to the corresponding workers (even though part of payroll taxes are nominally paid by employers and part by employees), because both contribute to the wedge between pre-tax labor costs and post-tax compensation. Retail sales taxes are similarly assigned to final consumers regardless of whether the tax is nominally paid by consumers or retailers.

Neutrality with respect to income classification for tax purposes. Third, in our framework a tax on a given income is allocated in the same way no matter how the income is reported for tax purposes. This mimics a key principle underlying national accounts data, namely that economic statistics shouldn't be affected by purely legal changes in income reporting. Applying this principle maximizes comparability of tax progressivity over time and across countries.

To illustrate this point, consider the case of a consultant. This worker can choose to earn labor income as a salaried worker, as an unincorporated self-employed, as a self-employed individual using a pass-through company (S-corporation or partnership in the United States), or as a self-employed individual incorporated in a company subject to the corporate tax (C-corporation in the US). In our framework, taxes paid on this consulting income are, in all cases, allocated in the same way—to the consultant.

Consistency with macroeconomic series. Fourth, our framework also ensures consistency between distributional analysis and macroeconomic analysis. Macroeconomics is concerned with the distribution of aggregate income across labor and capital. For the computation of factor shares, all pre-tax corporate profit—including 100% of the corporate tax—is considered capital income. In our approach, individual and (properly weighted) group-level capital shares add up to the macro capital share. Our approach is similarly consistent with the literature that estimates effective tax rates on factor incomes and consumption, following the influential work of Mendoza et al. (1994). In these macro series, the effective tax rate on capital, for example, is the ratio of all capital taxes (corporate tax, property taxes, dividend taxes, etc.) divided by all capital income (corporate profits, housing rents, etc.).[9] Our framework in essence extends this work to incorporate the distributional dimension. By design, our group-level capital tax rates add up to the macro capital tax rate.[10]

Link with distributional national accounts. Last, current-tax analysis is a necessary input for the production of distributional national accounts—inequality statistics that allocate all pre-tax and post-tax national income across socio-economic groups (see, e.g., Blanchet et al., 2021).[11] However, it can also be applied independently of the distributional national accounts framework. For instance, one may be interested in allocating only federal taxes (as opposed to all taxes at all levels of government as in distributional national accounts). One may also wish to consider specific definitions of income (that differ from the pre-tax national income or post-tax national income concepts central to distributional national accounts). In all these cases, the principles described here carry over.

2.2. Comparison with the conventional approach

Although our approach may seem obvious, it is in fact markedly different from the conventional practice of distributional tax analysis which builds in tax incidence effects based on assumptions about behavioral responses to taxes, shifting some taxes across production factors.

In practice both we and the conventional approach assign labor and individual income taxes to the corresponding income earners, and consumption taxes to consumers. The key difference is that we assign the

[7] A tax or subsidy on labor use, even if administered through the corporate income tax, should also be assigned to labor income.

[8] Besides taxes on labor, capital, and consumption, there are also taxes on intermediate goods such as tariffs, business turnover taxes, or fossil fuel taxes. In online appendix A.1, we argue that the simplest approach is to assign those taxes downstream to the final consumers of goods produced using such taxed intermediate goods.

[9] See, e.g., Eurostat (2021) for cross-country series in high-income countries, and Bachas et al. (2023) for a global panel.

[10] Our approach also resembles the social accounting approach sometimes applied to distributional analysis (see, e.g., Wolff and Zacharias (2007). But we come to it using economic reasoning rather than abstracting from it. The social accounting approach also focuses separately on different sectors (household, corporate, etc.) and hence cannot distribute corporate taxes, for example.

[11] Online appendix A.2 discusses the application of current-tax analysis in the context of distributional national accounts.

corporate tax to shareholders instead of shifting it to different economic actors.[12] Specifically, CBO and JCT assign 75% of the corporate tax to capital owners nationally, proportionally to reported taxable capital income (dividends, interest, rents, and realized capital gains, but excluding capital income earned on pension accounts for CBO while JCT includes pensions in its assignment) and 25% to workers nationally, proportionally to reported labor income. The US Treasury and the Tax Policy Center used to follow the same rule but since the 2010s have assigned about 60% of the corporate tax to shareholders, and the remaining 40% half to labor income and half to capital income nationally.[13] One may think that if only the allocation of the corporate tax varies, the choice of a particular methodology may not matter much practically. But this choice has in fact large implications for the measurement of trends in overall US tax progressivity as we show in Section 3.2. Conceptually, our methodology has four main advantages.

Internal consistency. First, it is internally consistent. In the conventional practice, the assignment of current taxes is based on a thought experiment: "what would incomes be if all taxes were removed?" The corporate tax is partly allocated to workers because it is assumed to reduce wages relative to this no-tax counterfactual. The actual pre-tax income of workers is increased by the amount of shifted corporate tax. When analyzing the current economy, the conventional approach thus captures the distribution of some unobservable counterfactual income—not of actual pre-tax income.

The logical problem is the following. In the no-tax counterfactual world, pre-tax incomes might well be higher than in the existing world, for example if people worked or saved more. But because these counterfactual pre-tax incomes absent any tax are abstract and uncertain, the conventional approach generally assumes that taxes do not affect aggregate income (only how the actual amount of aggregate income is distributed across groups), while nonetheless shifting the corporate tax. Shifting taxes from capital to labor while keeping aggregate income constant is logically inconsistent, however, because shifting precisely originates from behavioral responses to taxes that affect aggregate income. Our current-tax methodology that measures actual (not counterfactual) incomes does not suffer from this issue.

Consistent trends in tax progressivity. Second, our methodology allows one to study trends in tax progressivity and in inequality consistently, in contrast to official practice which can lead to biased trends. Consider the CBO methodology that allocates 25% of the corporate tax to workers (vs. 75% to capital owners) and 100% of the individual income tax to the corresponding individuals. If a C-corporation (subject to the corporate tax) elects to be treated as an S-corporation (subject solely to the individual income tax of its owners), then in the CBO treatment the tax system becomes more progressive and pre-tax income inequality increases, even though nothing real has changed in the tax system or in the economy. The tax system becomes more progressive because taxes that used to be partly allocated to workers are now fully allocated to firm owners, who are higher up in the income distribution. Income inequality increases because income that was previously partly assigned to workers is now fully assigned to firm owners. As shown in Section 3.2, this bias turns out to be significant in the United States, given the rise of pass-through businesses over the last decades.[14]

Individual-level analysis. Third, our framework allows us to estimate meaningful tax rates at the individual level, in particular at the very top of the distribution. In the conventional approach, the corporate tax is spread across all workers and capital owners nationally, proportionally to their wage income and reported taxable capital income. There is no link between what a company pays in tax, and how much corporate tax is allocated to its owners. By contrast, our methodology assigns firm owners their share of corporate profits and corporate tax payments (de facto treating all corporations as pass-through businesses). This delivers high tax rates for the owners of corporations that pay high tax rates, and low rates for the owners of tax-avoiding corporations.[15]

Simplicity. Last, our current-tax methodology is much simpler than the conventional approach, as it does not require making assumptions about behavioral responses to taxes or specifying counterfactuals. In the conventional approach, calibrating the shifting of the corporate tax requires complex assumptions (e.g., on the labor vs. capital component of various income forms, or the normal vs. supernormal rate of return on capital). The empirical basis for these assumptions is evolving, leading to discrepancies in methods across agencies and over time.

When does our approach capture ultimate tax incidence?. The main criticism of our approach is that it does not capture the full welfare effects of the current tax system. It does so only under the strong assumption of *no household behavioral responses to taxes*. With no household behavioral responses to taxes, labor supply, capital supply, and consumption demand are inelastic and hence not affected by after-tax prices. As a result, production decisions and hence pre-tax prices are also unaffected by prices and the ultimate tax incidence of the taxes is fully on the household consistent with our current-tax distributional approach.[16] The conventional approach in practice also assigns labor, consumption, and capital taxes (except for the corporate tax) to household owners so that the same zero tax elasticities assumptions are generally needed.

Importantly, we still view our distributional analysis as helpful even if it does not capture the ultimate tax incidence. For example, in the canonical Mirrlees (1971) model of optimal nonlinear labor income taxation, our approach assigns taxes $T(wl)$ on a person earning wl. $T(wl)$ represents taxes paid on earnings wl. This is obviously an important statistic for capturing tax progressivity across the labor income distribution even though it is not the ultimate welfare burden of the tax when there are labor supply behavioral responses.

3. Evolution of US tax progressivity

This section applies distributional current-tax analysis to the United States. We construct homogenous series of effective tax rates paid by top income groups including all taxes paid at all levels of government, from 1913 (creation of the federal income tax) to 2021. By construction the series are not affected by changes in how business income is classified for tax purposes, maximizing the comparability of effective tax rates over time. This allows us to address key questions such as: How does the current level of tax progressivity compare to levels seen in the past?

[12] In neoclassical tax incidence theory, all taxes can be partly shifted depending on the relevant elasticities (e.g., labor taxes are partly shifted to capital as long as labor supply is not completely inelastic, and capital taxes other than the corporate tax are partly shifted to labor as long as capital supply is not completely inelastic). The conventional approach generally only shifts the corporate tax because of a presumption that the corporate tax is the one tax for which such incidence effects are most relevant empirically.

[13] See US Congressional Budget Office (2012, 2018); US Treasury (2019); Tax Policy Center (2022); and Nunns (2012), for a detailed description of the methodologies.

[14] US Treasury (2019), US Joint Committee on Taxation (2019), and Tax Policy Center (2022) also treat differently taxes on C- vs. S-corporate profits. In contrast to all these approaches, our series are not affected by changes in businesses' organizational form or income re-classification.

[15] Balkir et al. (2025) use our approach to quantify taxes paid by the top 400 wealthiest Americans linking businesses to owners using administrative tax data. Online appendix A.3 provides an illustration using public data in the case of two of the richest American billionaires Jeff Bezos and Warren Buffett.

[16] In a fully specified model, this also requires assuming the existence of an untaxed numéraire good that absorbs fully any change in disposable income created by taxes.

Did the United States ever impose high effective tax rates on the rich? And if so, what taxes mattered the most?

3.1. Changes in the effective tax rates of top income groups

Methodology and summary statistics. We conduct our analysis using the updated U.S. distributional accounts of Piketty, Saez and Zucman (2018). This work distributes annual national income and household wealth by combining tax data, survey data, and national accounts aggregates. The Piketty et al. (2018) estimates are living series that are regularly updated to incorporate methodological improvements and revisions to the raw input data (such as updated national accounts statistics). All updates are described in online methodological notes.[17] Key methodological revisions are further detailed in Saez and Zucman (2020). The micro-files (for the post-1962 period) and tabulated series (for the pre-1962 period) used in our analysis are taken from the February 2022 release of the PSZ series.

Our main statistic of interest is the effective tax rate, defined as total taxes paid at all levels of government divided by pre-tax income. Following the distributional national accounts literature, pre-tax income is defined as total income derived from labor and capital, after the operation of the pension system and unemployment insurance system.[18] We also include pure realized capital gains (defined as realized capital gains above 3% of national income, the historical average level of corporate retained earnings) in pre-tax income because realized capital gains are taxed, even though realized capital gains due to pure price effects over and above corporate retained earnings are not part of national income.[19] To construct income groups, our unit of observation is the adult individual (age 20 or more) with income equally split between married spouses, and we rank adults by their pre-tax income.

Table 1 reports the distribution of income and taxes by pre-tax income groups in 2021 using this methodology. Taxes include taxes at all levels of government (federal, state, and local). The overall tax system appears mildly progressive, with effective tax rates (all taxes included) ranging from about 26% in the bottom 50% to 34% for the top 0.1%. At the bottom of the distribution payroll taxes and consumption taxes play a key role. At the top, the individual income tax is the by far the largest tax.[20] When using the CBO methodology to allocate the corporate tax, effective tax rates at the top are slightly higher (by about 1 percentage point for the top 0.1%), as detailed in Section 3.2 below.

Effective tax rate of the top 1%. The top panel of Fig. 1 reports the evolution of the effective tax rate of the 1% of adults with the highest pre-tax income back to 1913. A number of findings are worth noting. First, there has been a dramatic inverted-U-shaped evolution of this tax rate, which increased from about 15% in 1913 to a high of nearly 50% during World War II and in the early 1950s, before falling back to 32% in 2021. The tax rate of the top 1% is about the same in 2021 as it was

Table 1
Current tax distribution in the United States, 2021.

	Pretax income		After-tax income		Taxes (all levels)		Tax rate composition					
Income groups	Average	Share	Average	Share	Share	Tax rate	Individual income taxes	Payroll taxes	Consumption taxes	Property taxes (incl. estate tax)	Corporate tax	Memo: Corporate tax, conventional approach
P0-50	$20,889	12.3%	$15,526	13.0%	10.7%	25.7%	2.2%	10.7%	10.5%	1.7%	0.6%	1.1%
P50-90	$80,618	38.1%	$57,498	38.6%	36.9%	28.7%	8.6%	10.3%	5.6%	2.7%	1.4%	1.1%
P90-99	$243,587	25.9%	$170,579	25.8%	26.2%	30.0%	14.7%	6.3%	3.5%	3.5%	2.1%	1.8%
P99-99.9	$1,085,455	11.5%	$741,550	11.2%	12.3%	31.7%	20.8%	2.4%	2.2%	3.8%	2.5%	2.8%
top 0.1%	$10,288,542	12.2%	$6,804,921	11.4%	13.9%	33.9%	22.8%	0.8%	1.8%	5.1%	3.2%	4.1%
All	**$84,672**	**100%**	**$59,593**	**100%**	**100%**	**29.6%**	**12.5%**	**7.3%**	**4.8%**	**3.2%**	**1.8%**	**1.8%**

Notes: Groups are based on pre-tax national income plus pure realized capital gains (defined as realized gains in excess of 3% of national income). The unit is an individual adult (aged 20+) with an equal split of income among couples. Pre-tax income is income before all taxes but after the operation of pension systems (public and private). Taxes include taxes at all levels of government (federal, state, and local). Refundable tax credits are not included as negative tax (as they are treated as transfers, like other cash transfers, in the national accounts). Labor taxes are assigned to the corresponding workers, capital taxes to the corresponding asset owners, and consumption taxes to the corresponding final consumers. In the conventional approach currently used by CBO, the corporate tax is assigned 75% to capital income reported on individual tax returns and 25% to labor income (with no adjustment for corporate profits earned through pension funds). The current tax distribution for federal taxes only (excluding state, local, and foreign taxes) is presented in online appendix Table A.1.

[17] Available online at http://gabriel-zucman.eu/usdina, which also links to current micro-files, computer code, and tabulations of key findings. All vintage releases and corresponding code are also published at the same address.

[18] That is, pre-tax national income is net of Social Security taxes, contributions to pension plans, and contributions to unemployment insurance, and symmetrically includes Social Security benefits, pension distributions, and unemployment insurance benefits.

[19] If we excluded such realized capital gains (as done in the original Piketty et al., 2018 series, taxes at the very top become strongly pro-cyclical due to the surge in taxable realized capital gains during stock market booms. This artificially and in our view misleadingly increases tax progressivity when realized top incomes boom.

[20] Online appendix Table A1 reports the same statistics but focusing on federal taxes only. The federal tax system is more progressive, with effective tax rates rising from 14.5% in the bottom 50% to close to 23% in the top 0.1%. This is due to the fact that more than 80% of consumption taxes—which are regressive, as low-income individuals consume a higher fraction of their income—are levied by state and local governments.

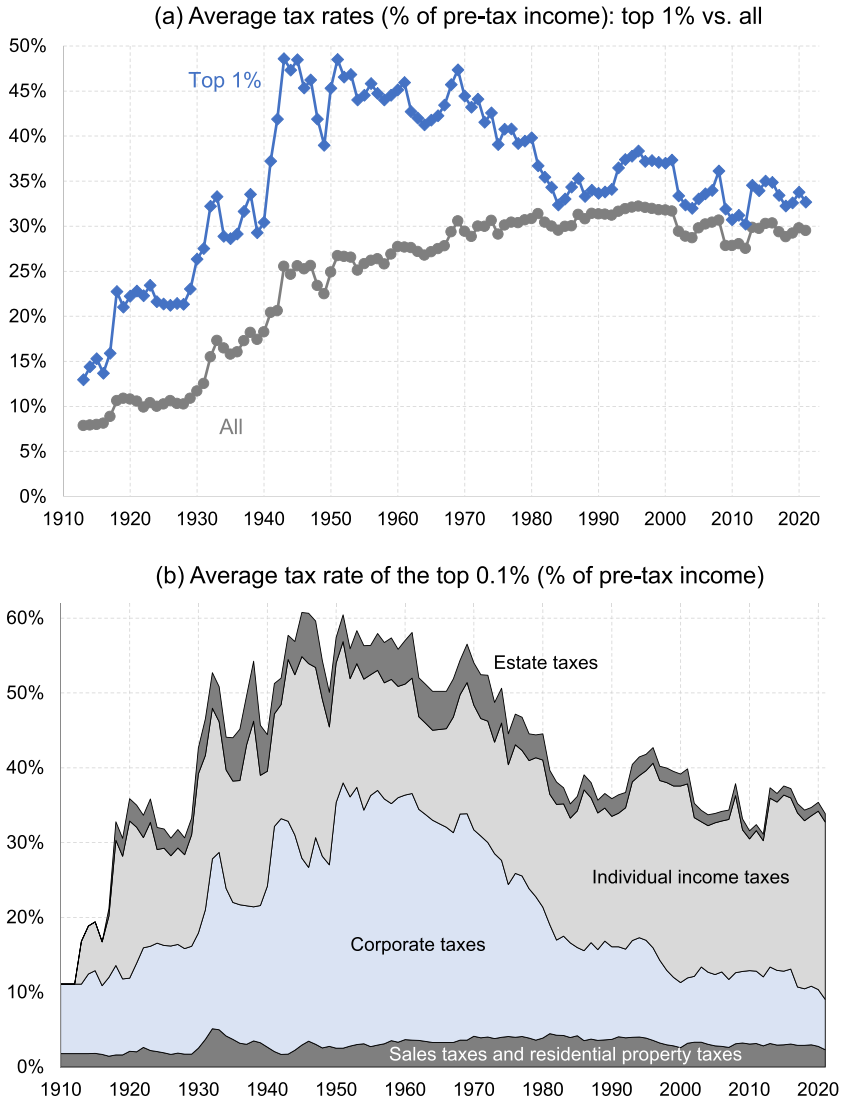

Fig. 1. Changes in tax progressivity in the United States. *Notes:* The top panel reports average effective tax rates for the US population as a whole and for the top 1% of the pre-tax income distribution. To construct income groups, the unit of observation is the adult individual (aged 20 or above), and adults are ranked by their pre-tax national income, with income equally split between married spouses. All taxes at all levels of government are included in the numerator, and all pre-tax national income is included in the denominator. Pure realized capital gains (defined as realized gains in excess of 3% of national income) are included in pre-tax income. The bottom panel shows the effective tax rate of the top 0.1% of the pre-tax income distribution similarly defined, with a decomposition by type of tax. "Corporate taxes" include both federal and state corporate taxes and business property taxes. "Individual income taxes" include both federal and state individual income taxes and payroll taxes.

immediately before the New Deal (32% in 1932). It rose strongly during World War II, remained at a high level of around 45% until the late 1960s, before falling in the 1970s and 1980s. Since the 1990s, it has been on a mild downward trend, with some business cycle volatility—due to relatively strong tax collection at the peak of the cycle—and a clear effect of tax reforms. It increased from about 34% to 37% between 1992 and 1993 (Clinton tax reform) and from about 30% to 34.5% between 2012 and 2013 (Obama tax reform). It fell from 37.5% in 2001 to about 34% in 2002 (Bush II tax reform) and from 35% in 2016 to about 32.5% in 2018 (Trump tax reform).

Second, the effective tax rate of the top 1% is only a little bit higher than the average tax rate today. The tax system, by contrast, was highly progressive in the 1940s, 1950s, and 1960s, when the top 1% rate exceeded the average tax rate by about 20 percentage points. While it is well known that the United States had a nominally highly progressive federal individual income tax (with top marginal tax rates exceeding 90% during and after World War II), it is also well known from publicly available tabulations of income tax returns that few individuals were in the tax brackets subject to these extremely high rates. The actual degree of progressivity of the US tax system in the post-war years is thus an open question. Our series show that—all taxes included—the tax system was progressive not only on paper but in actual fact too. It is also interesting to note that the rise of the fiscal state—the tripling of the macroeconomic tax rate from less than 10% of national income in the early 20th century to 30% in the late 1960s—happened in tandem with an even larger increase in the tax rate of the top 1%, from less than 15% to up to 50%. The expansion of the US government might have been facilitated by the highly progressive nature of its tax system, although a rigorous test of this hypothesis falls beyond the scope of this research.[21]

[21] The top 1% contributed about 30% of total US tax revenues in the middle of the 20th century. For instance in 1950, the top 1% earned 16.5% of total national

The key role of the corporate tax. To better understand the change in tax progressivity, the bottom panel of Fig. 1 shows the evolution of the effective tax rate of the top 0.1% with a decomposition by type of tax. The long-run evolution is even more striking than that for the top 1%. The tax rate of the top 0.1% rose from barely 15% at the beginning of the 20th century to nearly 60% in the middle of the 20th century, before gradually falling back, to about 34% in 2021, the level observed in the 1920s.

When looking at the composition of taxes, a key finding emerges: it is through the corporate tax that the United States achieved a high level of tax progressivity in the middle of the 20th century. More broadly, changes in corporate tax payments drive most of the changes in the effective tax rate of the top 0.1%. Corporate and business property taxes paid by the top 0.1% rose from about 10% of the pre-tax income of the top 0.1% in the early 1900s to a high of 35% in the 1950s, before falling back to about 7% after the Tax Cuts and Jobs Act of 2017.[22] By contrast, the individual income tax has absorbed a broadly constant fraction of the pre-tax income of the top 0.1%—around 20%—since 1930, with no trend and some business cycle volatility. Estate taxes rose from 0% of income before the creation of the federal estate tax in 1916 to about 6% of income in the middle of the 20th century, before falling back to about 1% of income in recent years. If not for the dramatic changes in corporate income taxation (and to some extent estate taxation), the effective tax rate of the top 0.1% would have exhibited little change since 1930.

Why does the corporate tax play such a large role? Fig. 2 shows that there has been dramatic variation in corporate income tax revenues over the last century in the United States. In the middle of the 20th century the corporate tax—which had a statutory rate above 50% and effective rates close to that level—generated about 5% of national income in revenue, and up to 7% during World War II and the early 1950s. By contrast in recent years it has only yielded about 2% of national income. Online appendix Figure A1 contrasts this evolution to that of the individual income tax. In 1950 both generated almost as much. Since then, the individual income tax has been growing (primarily due to a rise in state income taxes), while corporate income tax revenues have collapsed. When the corporate tax was a major source of tax revenue in mid-century, corporate ownership was highly concentrated—this was before the rise of pension funds somewhat equalized equity ownership—leading to high tax rates at the top.[23]

3.2. The role of the corporate tax: comparison of methods

Does it really matter practically how one allocates the corporate tax? To address this question, we construct income and tax distribution series keeping the same principles as those underlying Fig. 1, but allocating the corporate tax following the CBO methodology (25% of the corporate tax is allocated to all workers proportionally to labor income, and 75% to capital owners proportionally to reported taxable dividends, interest, rents, and a measure of normalized realized capital gains).

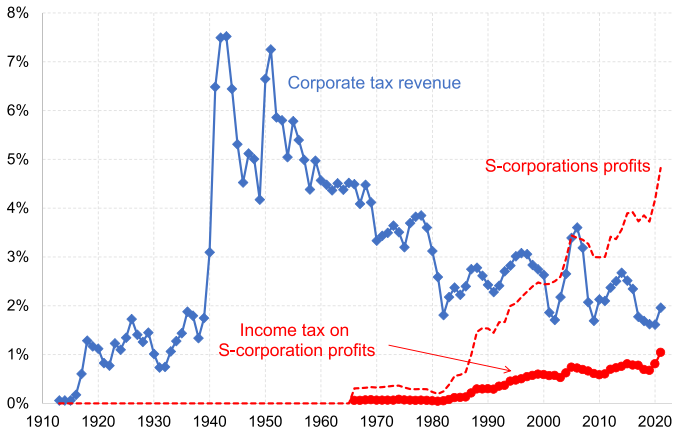

Fig. 2. Corporate tax revenue (% of national income). *Notes:* The figure plots the evolution of (federal plus state) US corporate income tax revenue and of S-corporation profits, both as a fraction of US national income. S-corporation profits are taken from the prototype BEA estimates of S-corporation profits in US national income (Krakower et al., 2021, updated), which cover the years 2012–2018, and are estimated by us using similar methods before 2012 and after 2018. Taxes on S-corporation profits are estimated by applying the effective average income tax rate on ordinary income (i.e., income excluding capital gains) to reported S-corporation profits, separately for the top 1% and the bottom 99% of the fiscal income distribution.

Share of the corporate tax paid by the top 1%. The top panel of Fig. 3 contrasts the fraction of the corporate tax assigned to the top 1% in this approach and ours. Four points arise. First, our current-tax analysis allocates a higher fraction of the corporate tax to the top 1% in the middle of the 20th century: 50–60% in the 1950s–1960s vs. 30%–40% in the CBO methodology. This is because the CBO methodology allocates 25% of the corporate tax to labor, in effectively adding a notional wage tax to workers and reducing the burden for firm owners symmetrically. The gap is even larger earlier in the 20th century, at a time when equity ownership was extremely concentrated. Tabulations of income tax returns show that the top 1% earned up to 80%–90% of all dividend income through to the 1930s; accordingly our method allocates a very high share of the corporate tax to the top 1% back then. In the conventional approach that shifts part of the corporate tax to capital owners other than shareholders based on reported interest and rents—which were not as concentrated as dividends—less corporate tax goes to the top 1%.

Second, in our methodology, the top 1% pays a lower share of the corporate tax today than in the post-World War II decades. This is due to the rise of relatively broadly owned pension funds, which were negligible in the 1950s. The top 1% earns 30%–35% of the profits of companies subject to the corporate tax today—and hence is assigned 30%–35% of corporate tax payments—as opposed to more than 50% in the 1950s. The share of the corporate tax allocated to the top 1% has been stable in our series since the 1980s, as the rise of pension funds since then has been offset by the rising concentration of directly-held corporate equities.

Third and by contrast, in the CBO methodology the fraction of the corporate tax assigned to the top 1% has been on a rising trend since the 1980s. This is due to two issues. Pensions are ignored by CBO: for the 75% of the corporate tax assigned to capital owners, the assignment is proportional to taxable capital income, which excludes tax-exempt capital income earned on retirement accounts. As taxable capital income is increasingly concentrated (Saez and Zucman (2016), so too is the corporate tax. Moreover, as 25% is allocated to labor, the corporate tax becomes more progressive with the rise of *wage* inequality.

Fourth, these biases are reinforced by the rise of S-corporations, depicted in Fig. 2. Until the 1980s, almost all US corporations were subject

income, its effective tax rate was 45%, hence it paid 16.5% × 45% = 7.5% of national income in taxes, which is 30% of the total tax take of 25% of national income.

[22] In the 19th century and early 20th century, state and local governments relied on generalized property taxes—a comprehensive tax on all types of property (real, personal, and financial) that was de facto one of the first wealth taxes (Dray et al., 2023). This explains why effective tax rates at the top are significantly higher than 0 (and higher than the average rate) even before the creation of the federal individual income tax in 1913 and the federal corporate tax in 1909. Generalized property taxes were then gradually phased out and de facto replaced by the income tax.

[23] While our current-tax analysis in this paper focuses on the top of the distribution, it can be implemented to study the effective tax rates for all groups of the population; see Saez and Zucman (2019) for such an analysis and an interpretative synthesis.

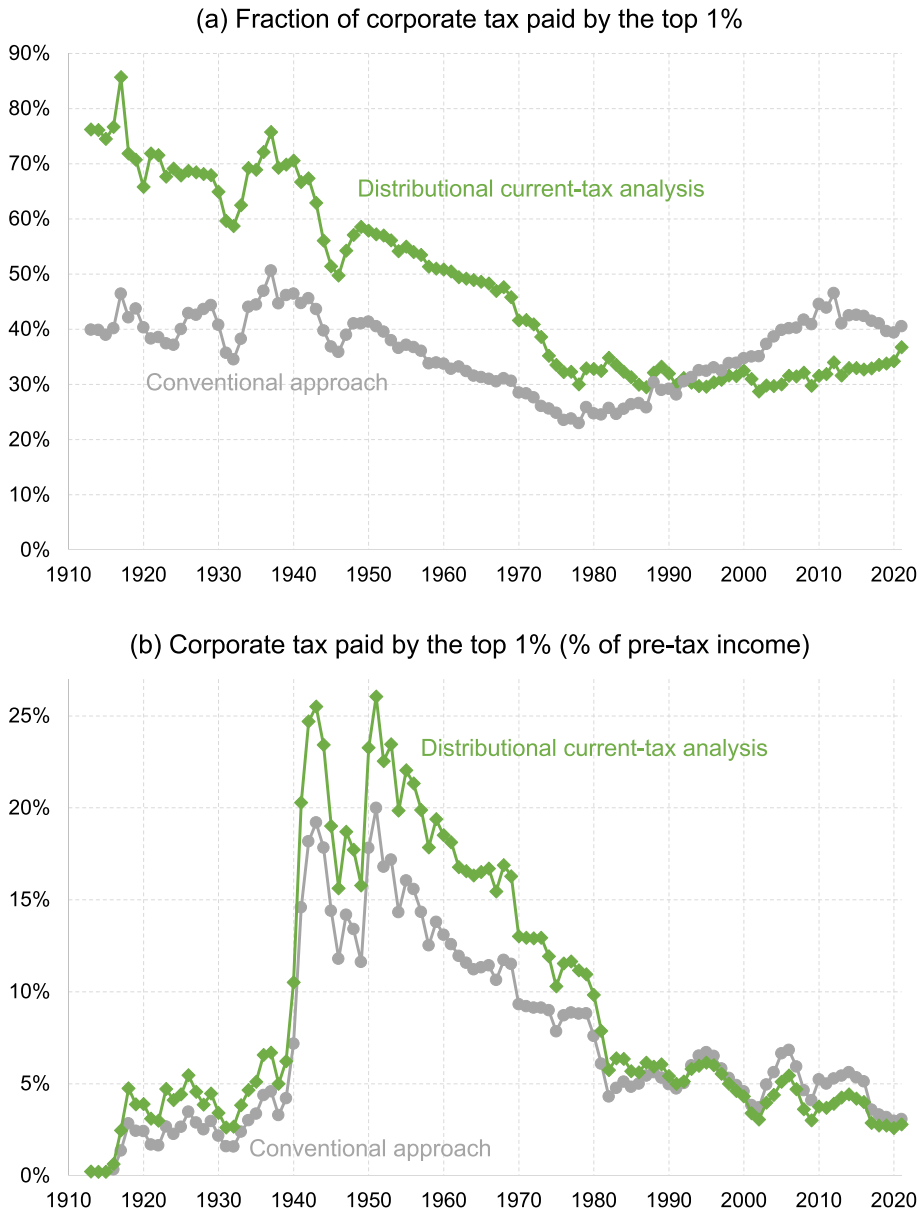

Fig. 3. Allocating the Corporate Tax. *Notes:* The top panel contrasts the share of the US corporate income tax (federal and state) paid by the top 1% of adults with the highest pre-tax national income in our methodology and the CBO methodology. The CBO methodology assigns 75% of the corporate tax to capital owners nationally (proportionally to reported dividends, interest, rents, and a normalized measure of capital gains) and 25% to workers nationally. Our current-tax methodology assigns 100% of the corporate tax to the corresponding shareholders individually. The bottom panel plots the amount of corporate tax paid by the top 1% (as a fraction of top 1% pre-tax income) in the two methodologies. The allocation of the corporate tax does not make a significant difference in the early 20th century and since the 1980s (when the corporate tax overall is small), but it makes a significant difference in the middle of the 20th century (when the corporate tax was high). Both the CBO methodology and our approach distribute only the amount of US corporate tax collected by US governments (i.e., they make the implicit assumption that US residents pay in foreign corporate tax as much as what foreigners pay in US corporate taxes).

to the corporate tax. Today, close to 40% of domestic corporate profits are made by S-corporations, which are free of corporate tax and subject solely to the individual income tax of their owners. These profits generate about 1% of national income in individual income tax revenues. In the CBO methodology, these taxes are fully assigned to the owners of the respective corporations, while taxes paid on C-corporation profits are shifted to workers and capital owners nationally. Taxes on S-corporation profits end up being assigned in a much more progressive manner (70%-80% to the top 1% in the 1980–2021 period with no trend) than taxes on C-corporation profits (25% to the top 1% in 1980, rising to 40% in 2021). As S-corporation profits have risen from 0% to 5% of national income over this period, this creates a large bias in the 1980–2021 evolution of tax progressivity.[24]

[24] Like CBO, the US Treasury, the Joint Committee on Taxation, and the Tax Policy Center all treat C-corporations and S-corporations inconsistently. The US Treasury and the Tax Policy Center assign all of the individual income tax to the corresponding individuals, but about 60% of the corporate tax to shareholders and the remaining 40% split equally between labor income and capital income nationally. The Joint Committee on Taxation assigns the corporate tax like CBO and 95% of individual taxes on passthrough business profits to the corresponding owners vs. 5% to labor income nationally.

Implications for the decline in tax progressivity. Because the conventional approach allocates the corporate tax more equally than our methodology in the middle of the 20th century and corporate income tax revenues were very high then, it delivers significantly lower effective tax rates for the top 1% in those decades (bottom panel of Fig. 3). But since corporate tax revenues are small today, the different allocation of the corporate tax has little impact on top effective tax rates today (cf. Table 1). As a result, while in our approach the effective tax rate of the top 1% falls by nearly 13 percentage points between 1950 and 2021, the decline is only 7 points when applying the CBO methodology. The bias in the conventional approach is larger as one moves up the income distribution, where business profits account for a greater share of income.

Comparison with PSZ. The original Piketty et al. (2018) series, which followed the conventional approach to distributional tax analysis, also suffers from this bias. In these series, corporate taxes were allocated to all owners of non-residential capital (including pensions and non-corporate businesses) and not only to shareholders, building on the tax incidence assumptions of the standard Harberger (1962) model (see below). This led to the issues detailed above: internal inconsistency of shifting taxes while keeping aggregate income constant; non-neutrality with respect to changes in business organizational forms and income classification across tax forms. Online appendix Figure A2 shows that the bias in the original PSZ series is similar to the one in the CBO methodology, and even more pronounced in the middle of the 20th century.[25]

4. Distributional tax-reform analysis in theory

4.1. General Diamond-Mirrlees setting

Diamond-mirrlees model. Let us consider the canonical Diamond and Mirrlees (1971) model of taxation with differentiated linear taxes on a vector of commodities $x = (c,-f)$ that includes both output consumption goods for households (sub-vector c) and input factors of households such as labor and capital (sub-vector f). Inputs f in $x = (c, -f)$ have a minus sign so that they can be treated symmetrically to consumption goods c in the full vector x. Let $p = (p_c,p_f)$ be the pre-tax vector price of commodities relevant for production decisions and $q = (q_c,q_f)$ the after-tax vector price relevant for households' decisions with $t = q - p = (t_c,t_f)$ being the vector of taxes that fund a lump-sum transfer R to all households.[26]

We consider a continuum of households of measure one indexed by i. Individual i maximizes utility $u^i(x)$ subject to $q \cdot x \leq R$ or equivalently $u^i(c,-f)$ subject to $q_c \cdot c \leq q_f \cdot f + R$. This generates an indirect utility function $v^i(q,R)$ and a demand/supply function $x^i(q,R) = (c^i(q,R), -f^i(q,R))$ which satisfies $q \cdot x^i(q,R) = R$.

The production side is competitive with each firm maximizing profits given its production set and taking pre-tax prices p as given. This generates a net aggregate supply of goods $X^s(p) = (C^s(p), -F^s(p))$ which transforms factor inputs demanded by firms $F^s(p)$ into produced consumption goods $C^s(p)$. Pure profits Π, if any, are assumed to be taxed away 100%.

Pre-tax and post-tax incomes. In this model, pre-tax income of individual i is $y_f^i = p_f \cdot f^i + \pi^i$, the sum of factor incomes measured at pre-tax factor prices $p_f \cdot f^i$ plus profits π^i from individual i's firms' ownership. Post-tax income is $y_c^i = p_c \cdot c^i$, i.e., income spent on goods measured at pre-tax production prices. Taxes paid are $T^i = (q - p) \cdot x^i + \pi^i = R - p \cdot x^i + \pi^i = R - p_c \cdot c^i + p_f \cdot f^i + \pi^i = R - y_c^i + y_i^f$. Therefore, post-tax income is pre-tax income minus all taxes plus transfers: $y_c^i = y_f^i - T^i + R$ as in the current distributional analysis we have proposed. In terms of national accounting, both y_c^i and y_f^i sum to national income measured with pre-tax prices, and formally called basic-price national income.[27]

Optimal taxation. We denote by $X(q,R) = (C(q,R), -F(q,R))$ aggregate demand summing across all individuals and by $V(q,R) = \int_i \lambda^i \cdot v^i(q,R)$ the social welfare function where $\lambda^i \geq 0$ is the Pareto weight on person i.

The government chooses (q,R) to maximize $V(q,R)$ subject to the government budget constraint (taxes must cover the government lump-sum grant R) and the production resource constraint $X(q,R) \leq X^s(p)$. Diamond and Mirrlees (1971) show that these two constraints are equivalent to a single constraint $P(X(q,R)) \leq 0$ where $P(.)$ denotes the production possibility function.[28] The pre-tax price vector p is equal to the derivative of the function $P(.)$. p measures the marginal costs/value of each input/output. Therefore, denoting by λ the multiplier of the government's single constraint, the Lagrangian for social welfare maximization can be written as:

$$L = \int_i \lambda^i \cdot v^i(q,R) - \lambda \cdot P(X(q,R)).$$

Using the fact that $v^i_{q_k} = -v^i_R \cdot x^i_k$, the first order condition for q_k takes the simple form:

$$-\int_i g^i \cdot x_k^i = \sum_j p_j \frac{\partial X_j}{\partial q_k}, \tag{1}$$

where $g^i = \lambda^i \cdot v^i_R/\lambda$ is the social marginal welfare weight on person i, that is, the social value of giving person i one extra dollar.

The left-hand-side of Eq. (1) measures the social welfare effect across individuals of increasing q_k marginally. The right-hand-side measures the resource cost (at pre-tax price p) on inputs and outputs triggered by the increase in q_k due to household behavioral responses. Individual budgets $q \cdot x^i(q,R) = R$ aggregate to $q \cdot X(q,R) = R$. Differentiating $q \cdot X(q,R) = R$ with respect to q_k, we have $X_k + \sum_j q_j \partial X_j/\partial q_k = 0$. Using $q_k = p_k + t_k$, we can rewrite (1) into its usual form:

$$X_k - \int_i g^i \cdot x_k^i + \sum_j t_j \frac{\partial X_j}{\partial q_k} = 0. \tag{2}$$

Tax reform analysis. Eq. (2) can be derived using a small tax reform approach, from first principles, which we will use for our distributional tax reform analysis. Let us state our main result as a proposition.

Proposition 1. *In the Diamond-Mirrlees model where pure profits are fully taxed away, we consider a* small *tax increase on good k so that q_k increases by dq_k. If taxes on all other goods can be adjusted so that $dq_j = 0$ for $j \neq k$ or are optimal (i.e., satisfy Eq. 2), then the impact of dq_k on money-metric social welfare V is given by:*

$$dV = dq_k \cdot \left[X_k - \int_i g^i \cdot x_k^i + \sum_j t_j \frac{\partial X_j}{\partial q_k} \right]. \tag{3}$$

Importantly, the change dp in pre-tax prices triggered by the small reform does not enter Eq. (3) so that pre-tax price incidence is normatively irrelevant.

[25] The top 1% effective rate in the original PSZ series is significantly too low in mid-20th century (bottom panel of Figure A2) because a large share of the corporate tax is assigned to the owners of non-corporate business assets (e.g., farmers, small retailers, etc.) and other non-residential assets, which prior to the 1980s were more equally distributed than corporate stock—more and more so as one goes back in time (top panel of Figure A2). Updated PSZ series and Saez and Zucman (2019) use the methodology described in this paper.

[26] For an output k, $t_{ck} > 0$ is a positive tax; for an input m, $t_{fm} < 0$ is a positive tax on the input. E.g., $q_k = p_k \cdot (1+\tau_c)$ for a consumption good and $w_{net} = w \cdot (1-\tau_L)$ for wages.

[27] $y_c^i + T_c^i = y^i - T_f^i + R$ (where $T_c^i = t_c \cdot c^i$ and $T_f^i = -t_f \cdot f^i + \pi^i$ are taxes paid on outputs and inputs respectively) sum to traditional national income, also called national income at market-prices, as consumption is measured inclusive of consumption taxes. See online appendix A.2 for more details.

[28] E.g., $P(X) = C - F(K,L)$ in the classic two sector model with $X = (C,K,L)$ described below.

Proof. Consider increasing q_k by dq_k. Let us first assume that we can adjust all the other taxes so that all the other q_j's can be kept constant. dq_k has three effects on money-metric social welfare. First, it mechanically collects $X_k dq_k$ in extra taxes. Technically, the reform also affects pre-tax prices by dp–the classic tax incidence on prices–which in turn changes taxes on goods $(q-p)\cdot X$ by $-dp\cdot X$. However, firms' profits $\Pi = p\cdot X^s(p)$ change by $d\Pi = dp\cdot X + p\cdot dX = dp\cdot X$ as $p\cdot dX = 0$ by profit maximization. $d\Pi = dp\cdot X$ is entirely taxed away and exactly offsets the change in tax revenue on goods $-dp\cdot X$ created by dp. Second, it money-metrically hurts consumer i by $x^i_k dq_k$ which socially aggregates to $-dq_k\cdot\int_i g^i\cdot x^i_k$. Third, it triggers household behavioral responses for inputs and outputs, which change taxes collected by $\sum_j t_j dX_j$ with $dX_j = dq_k\cdot\partial X_j/\partial q_k$. Adding these three terms, we obtain the net money-metric welfare effect of the small reform dq_k stated in Proposition 1.

Second, if instead of assuming that the q_j's can be kept constant by adjusting taxes, we assume that they are optimal, then the reform dq_k may also change each $q_j = p_j + t_j$ by $dq_j = dp_j$ through pre-tax price incidence effects. However, the net first order effect on welfare V generated by each dq_j is zero as each q_j satisfies Eq. (2) and hence the same proof goes through. □

At the optimal q_k, the sum of all three terms in (3) has to be zero which delivers Eq. (2). If the expression in square brackets in (3) is positive, then $dq_k > 0$ is desirable (and conversely).

In our distributional tax reform analysis, any small tax reform can be decomposed into a combination of dq_k's and the corresponding combination of Eq. (3) provides the net welfare effect decomposed into three terms inside the square brackets: (Eq. 1) the aggregate mechanical change in tax revenue absent any behavioral response or price response, (Eq. 2) the distributional welfare effect which simply distributes the mechanical change across income groups and weighs them using the social marginal welfare weights, (Eq. 3) the aggregate change in tax revenue due to behavioral responses of households to the tax change along all tax bases but ignoring pre-tax price effects.

Crucially, Eqs. (2) and (3) do not directly depend on the degree of substitution between factors in the production function, i.e., how pre-tax prices p are affected by tax rates. The effects of taxes on pre-tax prices—effects that are at the heart of classical tax incidence analysis—are normatively irrelevant. What matters for optimal tax and tax reform analysis is the behavioral responses of individuals as consumers, savers, and workers. This is because the government controls all post-tax prices and hence can change one while keeping all the others constant and profits are fully taxed away.

Importantly, this analysis hinges on the key assumption that other taxes can be adjusted to keep other post-tax prices constant. In the Diamond-Mirrlees model, such an adjustment is always possible, which generates a very simple and clear analysis of a pure dq_k tax change.

But what if other taxes are not adjusted and are not optimal? (i.e., the assumptions of Proposition 1 are not met). Then pretax price incidence effects have first order welfare impacts and such effects can overturn the conclusion. For example, taxing one factor (say capital) more may reduce its supply and increase its pre-tax price and therefore decrease the pre-tax price of a substitute (say labor). If labor was over-taxed to start with, this might produce a net welfare loss.[29] But if it is possible to adjust labor taxes to generate a pure capital tax increase, then (3) is the relevant formula for tax reform analysis.

Why has the normative irrelevance of price effects been ignored by the literature on tax incidence? The aim of tax incidence was strictly positive and narrow: to explain all the consequences of a given tax reform that a government is contemplating. The aim of optimal tax is normative and wider: to figure out which goods or factors are overtaxed or undertaxed. Hence, in our view, it is more relevant to guide government policy in the first place. Tax incidence remains useful as a technical tool and in second place to engineer the combination of taxes that generate the pure tax change that normative analysis has identified as desirable.

To flesh out this theory, we apply it to two widely used models: the 2-sector labor and capital model and the Harberger model of corporate taxation.

4.2. Two-sector labor and capital model

On the production side, the model is competitive with an aggregate production function $Y = F(K,L)$ with constant returns to scale, where K is capital and L is labor. We denote by w the economy-wide pre-tax wage rate and by r the pre-tax rate of return on capital. Profit maximization leads to the standard conditions: $w = F_L$ and $r = F_K$. Because of constant returns to scale, there are no pure profits and $F(K,L) = rK + wL$ in equilibrium, so that output Y can be divided into capital income rK and labor income wL.

On the supply side, we consider a simple two-class economy with workers and capitalists. Workers have, for simplicity, linear utility in consumption with inelastic labor supply so that L is fixed and equal to the number of workers. Labor income is taxed at rate τ_L so that $c = w\cdot(1-\tau_L)$ for workers. Capital income is taxed at rate τ_K so that $\bar{r} = r\cdot(1-\tau_K)$ is the net-of-tax rate of return. Capitalists have a (reduced-form) utility function of the form $u^K(c,k)$ increasing in consumption $c = \bar{r}k$ and declining in k, reflecting the opportunity cost of supplying capital to domestic production. If the net-of-tax return increases, capitalists are willing to supply more capital, either by saving more or by bringing capital from another sector—e.g, capital owned abroad—into the domestic production sector.[30] Therefore, domestic capital K depends on the net-of-tax return $\bar{r} = r\cdot(1-\tau_K)$ where τ_K is the tax rate on capital income.

Suppose the social marginal welfare weight on capitalists is zero so that τ_K is set to maximize workers' income $wL+(r-\bar{r})K = F(K(\bar{r}),L)-\bar{r}K$. The first-order condition in $\bar{r}$ is such that:

$$0 = (r-\bar{r})dK - Kd\bar{r} = -Kd\bar{r}\left[1-\frac{r-\bar{r}}{\bar{r}}\frac{\bar{r}}{k}\frac{dk}{d\bar{r}}\right] = -Kd\bar{r}\left[1-\frac{\tau_K}{1-\tau_K}e_K\right], \tag{4}$$

where $e_K = (\bar{r}/K)dK/d\bar{r}$ is the supply elasticity of capital with respect to the net-of-tax rate of return. This leads to the usual inverse-elasticity rule optimal tax rate $\tau^*_K = 1/(1+e_K)$.

The key insight is that the optimal tax rate only depends on the supply elasticity e_K, not on whether the tax on capital is shifted to workers. In other words, the supply elasticity is a sufficient statistics for the optimal tax rate (and the elasticity of substitution between K and L in production is irrelevant). Intuitively, setting τ_K is equivalent to setting $\bar{r}$ so that the implicit changes in r triggered by τ_K can be neutralized.

How can this result be squared with the common intuition that if the tax on capital hurts wages, it makes the tax less desirable to workers? The reasoning is the following. If the tax on capital hurts wages, it also means that it increases the rate of return for capitalists, and therefore tax revenue that can be raised from capitalists to benefit workers. In

[29] We provide a complete formal description of such a model of labor and capital in online appendix A.4.

[30] This utility form can arise from two models. First, suppose capitalists have a fixed capital k_0 and decide how much to invest domestically k and how much to invest abroad $k_0 - k$. Suppose capital abroad earns a rate of return r_0 but that capitalists value investing k at home by $a(k)$ with $a(.) \geq 0$ increasing and concave reflecting home bias. In this case, money metric utility takes the form $u^K(c,k) = c + a(k)$ with $c = \bar{r}k + r_0(k_0 - k)$, leading to a first order condition $a'(k) = r_0 - \bar{r}$ which defines an upward sloping supply of domestic capital $k(\bar{r})$. With no home bias, the supply is infinitely elastic as $\bar{r} = r_0$. Second, as in Saez and Stantcheva (2018), intertemporal maximizers have instantaneous utility $c + a(k)$ for consumption and wealth, discount rate δ, and start with wealth k_0. In this case, intertemporal utility takes the simple form $c + a(k) + \delta(k_0 - k)$ with $c = \bar{r}k$ which leads to $a'(k) = \delta - \bar{r}$ (the wealth of the individual jumps immediately from k_0 to k at time zero). Without utility for wealth, the supply is also infinitely elastic as $\bar{r} = \delta$.

net, this is a wash. Put another way, if the tax on capital is shifted partly to workers, it is indirect evidence that the supply of capital is elastic and hence should not be taxed too much. However, the key sufficient statistic is the supply elasticity e_K and not the extent to which the tax τ_K is shifted onto wages.

4.3. The Harberger corporate tax model

The Harberger (1962) model of corporate tax incidence is a special case of a Diamond and Mirrlees (1971) model with two competitive production sectors using the same labor and capital inputs: (Eq. 1) a corporate sector producing a corporate good $C_1 = F^1(K_1,L_1)$ and (Eq. 2) a non-corporate sector producing a non-corporate good $C_2 = F^2(K_2,L_2)$. Individuals supply labor L and capital K so that $L = L_1 + L_2$ and $K = K_1 + K_2$. Individuals supply labor L and capital K inelastically with no preferences across sectors. Labor and capital must therefore have the same net-of-tax returns in the two sectors.

The corporate tax is a tax on the return to K_1 (but not K_2) which therefore violates the production efficiency theorem of Diamond and Mirrlees (1971) as the same input K supplied by households is taxed differently in two production sectors. As a result, the corporate tax is second-best Pareto inefficient: replacing the corporate tax with a lower tax on *all* uses of capital can generate a Pareto improvement, because it would allow for more production in both the non-corporate and corporate sectors.

Alternatively, considering K_1 and K_2 as distinct goods, perfect mobility of capital across sectors implies that the household supply elasticity of K_1 is infinite. If individuals had instead different preferences for supplying K_1 vs. K_2 (e.g., specific costs or benefits for managing capital in each sector), then the household supply elasticity of K_1 would be finite, and the corporate tax would not necessarily be inefficient.

This point does not seem to have been noted in the literature, perhaps because of the gap between tax incidence analysis and theoretical optimal tax analysis. To see this point within the context of our distributional tax-reform approach, consider a small increase in the corporate tax rate. The distributional part of the analysis assigns the extra tax to the owners of corporations, ignoring behavioral responses and price effects. The efficiency part of the analysis considers the supply-side response ignoring price effects. Because the supply elasticity is infinite, the loss in tax revenue due to the behavioral response swamps any distributional gain. As long as capital in the corporate sector is taxed more than capital outside the corporate sector, it is always desirable to lower the corporate tax rate.

Conventional tax incidence, starting with the pioneering work of Harberger (1962) fails to note this important point because pre-tax price effects muddy this clean conclusion. In our view, this is a decisive advantage of optimal tax theory pioneered by Diamond and Mirrlees (1971) over conventional tax incidence following Harberger (1962).[31] Because an infinite elasticity for corporate capital supply is an extreme assumption and not realistic empirically, the basic Harberger (1962) model is not well suited for welfare analysis of the corporate tax. As discussed above, it is, however, easy to amend the model to make the corporate capital supply elasticity finite, leading to non-degenerate tax reform and optimal tax analysis as we shall see below.

5. Distributional tax-reform analysis in practice

Distributional tax-reform analysis involves estimating how a tax reform would affect pre-tax income, post-tax income, taxes paid, and money-metric welfare for each income group. As shown in Section 4, in neoclassical models a comprehensive distributional tax reform table only needs to report (i) the mechanical change in tax liability by income groups assuming no behavioral responses and no price effects, and (ii) the aggregate revenue effect due to household side responses ignoring price effects. Along with social marginal welfare weights for each group of the population, these are sufficient statistics to evaluate the value or cost of the reform. As we discussed in detail, pre-tax price effects can be ignored because they can be neutralized by adjusting other taxes at zero budget cost. Without such neutralization, pre-tax price effects are welfare relevant if other taxes are not set optimally. This is why having the full suite of distributional tax reform for each type of tax is actually useful.

In this section we apply this methodology to two frequently discussed policies: a change in the federal corporate income tax rate, and an increase in federal individual income taxes for the top 1%. We contrast our approach with the conventional approach influenced by models where the relevant elasticities are sometimes infinite by assumption. Lastly, as an illustration of the value of our approach, we also consider introducing a small tax on currently tax exempt interest from municipal bonds.

5.1. Corporate income tax reform

Consider first a 10% increase in the US federal corporate income tax rate which would increase from 21% to 23.1%. This is a 2.1 percentage point increase, which is quantitatively modest and hence where our prior small reform analysis can be applied. In neoclassical models, what matters for the equity side of the tradeoff involved in this tax change is the mechanical change in corporate tax payments (which follow directly from the current-tax table showing how much corporate tax is paid by the different income groups, cf. Table 1) and social marginal welfare weights. We assume a simple pattern of social welfare weights declining geometrically as one moves up the income distribution: the weight on the top 0.1% is half the weight on the next 0.9%, which is half the weight on the next 9%, etc. For the efficiency part of the tradeoff, what matters is the elasticity of corporate profits with respect to the net-of-corporate-tax rate keeping pre-tax factor prices constant. This elasticity governs the loss of tax revenue due to supply responses of corporate capital (such as movements of capital abroad or to the non-corporate business sector). The key point is that there is no need to assess how pre-tax incomes are going to change in response to the tax increase (e.g., if wages are going to increase), greatly simplifying the analysis relative to conventional practice.

A specificity of the corporate tax is that a significant fraction of it is paid by non-resident owners of US corporations. Vice-versa, US individuals pay corporate taxes to foreign governments via their ownership of foreign stock. We estimate that 39% of the US federal corporate tax was paid by non-residents in 2021 (consistent with Rosenthal and Burke, 2020); the amount of corporate tax paid by US residents to foreign governments is similarly large (see Zucman, 2023, for complete details). In recent years, *net* cross-border corporate income tax payments are small and can be neglected in distributional current-tax analysis.[32] But because the gross flows are large, taking into account foreign ownership of US corporations matters for distributional tax-reform analysis.[33] We assume a zero marginal social welfare weight on non US-residents, but other choices are possible.

[31] Conventional distributional analysis carried out by US agencies and inspired by the Harberger (1962) model further muddies the waters because it is not conceptually fully consistent with the Harberger model, particularly due to its assumption that taxes cannot change aggregate output and its composition.

[32] I.e., the total amount of corporate tax revenue collected by US governments is similar to the total amount of corporate tax paid by US households to US and foreign governments, so that allocating one aggregate or the other makes little difference to effective tax rates by income groups.

[33] The US Joint Committee on Taxation, 2013 assumes that 10.8 percent of the 75% of corporate income taxes not shifted to labor are borne by foreigners, i.e., about 8% of total federal corporate income taxes, much lower than the 39% in our analysis. The JCT allowance for non-resident ownership is insufficient because it only factors in portfolio investments into US stock (ignoring direct investment) and it is based on data from the 2005–2012 period (while foreign investments in US equities have been on a rising trend since then).

Table 2
Distributional Tax-Reform Analysis: Applications.

A. Reform of the US federal corporate income tax

	Current income and taxes (2021)				Tax reform analysis			
	Pretax income	All corporate taxes	Federal corporate tax		Consider a 10% increase in the federal corporate income tax rate, from 21% to 23.1%			
Income groups	Share	Share	Share	Taxes. ($ billion)	Mechanical tax increase ($ billion)	Tax loss supply side ($ billion)	Social welfare weights	Social welfare cost ($ billion) = -(5) x (7)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
P0-50	12%	4%	3%	$7	$0.7	-$0.1	1.38	-$1.0
P50-90	38%	29%	18%	$50	$5.0	-$0.7	0.69	-$3.4
P90-99	26%	30%	18%	$50	$5.0	-$0.7	0.35	-$1.7
P99-99.9	12%	16%	9%	$26	$2.6	-$0.4	0.17	-$0.5
top 0.1%	12%	21%	13%	$36	$3.6	-$0.5	0.09	-$0.3
Non-US residents	0%	0%	39%	$109	$10.9	-$1.5	0	$0.0
All	**100%**	**100%**	**100%**	**$279**	**$27.9**	**-$3.7**	**1.00**	**-$6.9**
					Net revenue:		**$24.1**	**billion**
					Net value of reform:		**$17.2**	**billion**

B. Reform of the US federal individual income tax

	Current income and taxes (2021)					Tax reform analysis			
	Pretax income	Fiscal income	Federal individual income tax			Consider a 10% increase in the Federal individual income tax for the top 1% only			
Income groups	Share of total pretax income	as % of pretax income	Share of total individual income tax	Tax rate = Taxes / Pretax income	Taxes ($ billion)	Mechanical tax increase ($ billion)	Tax loss supply side ($ billion)	Social welfare weights	Social welfare cost ($ billion) = -(6) x (8)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
P0-50	12%	53%	2%	1.7%	$46	$0.0	$0.0	1.38	$0.0
P50-90	38%	67%	26%	6.8%	$552	$0.0	$0.0	0.69	$0.0
P90-99	26%	68%	30%	11.6%	$639	$0.0	$0.0	0.35	$0.0
P99-99.9	12%	72%	19%	16.5%	$404	$40.4	-$5.7	0.17	-$7.0
top 0.1%	12%	74%	22%	18.1%	$467	$46.7	-$6.3	0.09	-$4.0
All	**100%**	**67%**	**100%**	**9.9%**	**$2,108**	**$87.1**	**-$12.0**	**1.00**	**-$11.0**
						Net revenue:		**$75.1**	**billion**
						Net value of reform:		**$64.1**	**billion**

Notes: Groups are based on pre-tax national income including pure realized capital gains. The unit is an individual adult (aged 20+) with an equal split of income among couples. The top panel considers 10% increase in the federal corporate income tax while the bottom panel considers a 10% increase in the federal individual income tax for the top 1% in reference year 2021. In the top panel, column (2) includes all corporate taxes (U.S., state, and foreign) paid by U.S. residents on their corporate ownership (in the U.S. and abroad). Column (3) includes only the federal corporate tax, close to 40% of which is paid by non-resident owners of U.S. corporations. For the reform analysis, the tax loss due to supply side responses is computed assuming an elasticity of corporate profits of 0.5 in the top panel and a top 1% reported income elasticity of 0.25 in the bottom panel. We use a marginal tax rate of 30% for top 1% individuals in the current federal individual income tax (as top 1% fiscal incomes include ordinary income and tax preferred business income, dividends, and capital gains). In both cases, we assume a simple pattern of social marginal welfare weights declining geometrically as one moves up the income distribution: the weight on the top 0.1% is half the weight on the next 0.9%, which is half the weight on the next 9%, etc. The bottom of each table shows the aggregate net revenue gain (mechanical tax increase minus tax loss due to behavioral responses) and the net value of the reform (net revenue minus the social welfare cost which is the mechanical tax increase weighted by the social welfare weights). A positive net value implies that the reform is desirable. The corporate tax increase remains desirable up to an elasticity of 2.9 (and raises net revenue up to an elasticity of 3.9). The individual tax increase remains desirable up to an elasticity of 1.6 (and raises net revenue up to an elasticity of 1.9). A companion Excel file allows changes to the elasticity parameters. As discussed in the main text, we ignore pre-tax price effects because such effects are normatively irrelevant (i.e., they can be neutralized at zero fiscal cost by adjusting labor and capital taxes).

The top panel of Table 2 reports the results. The left panel shows the distribution of current (as of 2021) incomes and corporate tax payments by income groups. The right panel shows the effect of the reform considered. Federal corporate tax revenues would mechanically increase by 10%, a gain of $27.9 billion. Corporate profits would shrink, leading to a loss of $3.7 billion in aggregate tax revenue. The net tax revenue raised by the reform is $27.9 – $3.7 = $24.1 billion. The MVPF (Hendren and Sprung-Keyser, 2020) of the policy is 27.9/24.1 = 1.16 (cost of the policy to tax payers divided by the net revenue raised). Using social welfare weights, the reform would entail social welfare costs for all domestic income groups, adding up to $6.9 billion in total. The net value of the reform—i.e., after subtracting social welfare costs—is $17.2 billion, making the reform desirable.

Three remarks are in order. First, in contrast to the conventional approach, we do not shift any of the corporate tax increase onto labor. If such a shift took place, our method implicitly assumes that it is

undone by readjusting labor and corporate taxes at zero budget cost. As we discussed in Section 4, this is theoretically possible in the neoclassical model underlying such incidence effects. It is also important to note that neoclassical pre-tax price effects assumed in the conventional model are hard to identify compellingly empirically. Therefore such price effects are much more assumption than established fact (see online appendix A.5). Second, there is uncertainty about the corporate profits elasticity. With our social welfare weights, the reform is desirable for a value of the elasticity up to 2.9 (and it raises net revenues for an elasticity up to 3.9).[34] Note that in the formal Harberger (1962) model, this elasticity is by definition infinite making a corporate tax rate decrease always desirable (as long as corporate capital is taxed more than non-corporate capital). Third, the fact that about 40% of the US corporate tax is paid by foreigners (with zero welfare weight in our analysis) makes the corporate tax reform desirable even if the government has no redistributive tastes within US residents. With equal social marginal welfare weights across all income groups and an elasticity of 0.5, the net value of the reform is $7.2 billion.

5.2. Top 1% individual income tax reform

The bottom panel of Table 2 considers a 10% increase in the US federal individual income tax for taxpayers in the top 1% of the pre-tax income distribution, another commonly discussed tax reform. Again, this is a 10% increase not a 10 percentage point increase so that the reform can be considered small. We use the same social welfare weights and assume an elasticity of reported individual income with respect to the net-of-tax rate of 0.25, consistent with the large body of work estimating behavioral responses to individual income tax changes (see Saez et al., 2012; Scheuer and Slemrod, 2020, for reviews). Under these assumptions the net revenue gain is $75 billion, or 86% of the $87 billion revenue gain absent any behavioral response. The MVPF (Hendren and Sprung-Keyser, 2020) of the policy is 87/75 = 1.16 (cost of the policy to taxpayers divided by the net revenue raised). The net value of the reform is $64 billion as the reform targets the top 1% only and hence has a low welfare cost of $11 billion. The reform remains desirable for top income elasticities of up to 1.6 (and it raises net revenues for an elasticity up to 1.9).[35]

5.3. A litmus test: tax exempt municipal bonds

Sometimes very large elasticities exist. This is the case for municipal bonds (munis) whose interest payments are currently exempt from federal individual income tax. It is enlightening to consider a reform of the taxation of munis, a litmus test for our approach.

In our current-tax analysis, the owners of munis pay no federal income tax on the corresponding interest income and are assigned relatively low tax rates. Due to their tax-exempt status, however, munis have lower pre-tax returns than taxable bonds, as there is an active market of professional bond traders that arbitrages the net-of-tax returns between munis and taxable bonds. This is a key difference with the corporate tax, as it is much harder to arbitrage corporate stock with other capital assets (e.g., given the price volatility of stocks). Our current-tax methodology captures that the pre-tax incomes of the owners of munis are depressed, although it does not single out taxes as the culprit.[36]

Consider now introducing a (small) tax on muni interest. Current owners of munis would pay the extra tax mechanically. However, the behavioral response would likely be large. Investors would shift away from munis into taxable bonds (as our method keeps pre-tax returns constant), effectively indicating a very large elasticity. This behavioral response would create a large revenue gain for the government, as taxable bonds generate more tax revenue than munis. With a very large elasticity, this revenue gain swamps any distributive considerations. In a standard model, our method indicates that it is unambiguously welfare improving to increase the tax rate on munis as long as munis are tax-favored, up to the point where the tax rates are aligned.[37] Indeed, in the Diamond and Mirrlees (1971) model, exempting munis but not other bonds creates a production inefficiency. Too much capital flows to the local government sector at the expense of the other sectors. A tax on munis can make a Pareto improvement. Any tax optimum should align the tax treatment of munis and other bonds.

Justifying the munis tax exemption requires a departure from the standard model. The simplest approach is to assume that investors derive utility from owning specific assets (such as munis), in which case different tax rates on different assets can be optimal. More radically, if top wealth generates excessive power in the form of concentrated business ownership, the munis tax exemption could be a desirable tool to induce top wealth holders to divest from their businesses and invest more in local government projects.

6. Conclusion

Two main lessons emerge from our work.

First, it is possible to conduct conceptually consistent and practically relevant current-tax analysis that does not merely follow statutory incidence but rather adheres to economic reasoning and yet does not require specifying behavioral responses. This analysis assigns taxes to individuals simply—labor taxes to the corresponding workers, capital taxes to the corresponding owners, consumption taxes to consumers—as one writes a model of optimal taxation. The tax rates are the wedges between pre-tax prices (relevant for production) and after-tax prices (relevant for work, savings, and consumption decisions of households). This method maximizes the comparability of tax progressivity over time and across countries, regardless of differences in the legal tax structure and the form of business organization. Classical tax incidence analysis is not required to study the distribution of current taxes.

Practically and relative to current practice by government agencies, the main difference is that we assign corporate taxes to shareholders only instead of shifting them to labor and capital in general. We think that this captures best and most coherently the progressivity of the actual tax system.

Second, classical incidence analysis also turns out to be largely irrelevant for the distributional analysis of tax reforms. This is because the effect of taxes on pretax prices at the heart of classical tax incidence is normatively irrelevant in neo-classical optimal tax models following Diamond and Mirrlees (1971). To analyze the distributional effects of *tax reforms*, mechanical changes in tax liability by income groups and aggregate revenue effects due to household (but not firms') behavioral responses are sufficient statistics.

Last, a recent applied literature on behavioral responses to taxes has uncovered effects that are very different from those captured by classical incidence (see Benzarti, 2025 for a recent survey). In particular, asymmetries (tax cuts having different effects than tax increases), intra-firm bargaining effects, and wage rigidities appear to be key for the incidence of tax changes. We summarize the lessons from this new literature in online appendix A.5 and discuss how to pragmatically carry out tax

[34] The companion Excel file allows readers to choose any elasticity.

[35] This analysis is consistent with the optimal income tax theory of Mirrlees (1971) and in particular the optimal top tax rate formula $\tau = (1-g)/(1-g+a\cdot e)$ developed in Diamond (1998) and Saez (2001) with the elasticity e, $a \simeq 1.5$ the Pareto parameter on the tail of the income distribution, and g the social marginal welfare weight assigned to top earners.

[36] A tax incidence approach, by contrast, should logically assign muni investors a higher counterfactual pre-tax income (based on applying a normal rate of return to their holdings), and then fictitious taxes they do not pay, following the same logic as the one used for the corporate tax and workers. To the best of our knowledge, however, in practice US agencies and think-tanks follow our methodology and do not gross up muni interest income by fictitious taxes.

[37] Once the tax rates are aligned, portfolio rebalancing responses no longer generate revenue effects as tax rates are the same.

reform analysis in such situations. However, additional work needs to be conducted to understand the nature of these non-standard effects and additional theories will need to be developed to properly and coherently measure welfare effects of tax changes in such settings.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at doi:10.1016/j.jpubeco.2026.105675.

Data availability

Data will be made available on request.

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