COVID-19, Fiscal Pressure and Optimal Tax Progressivity*

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Abstract

The COVID-19 pandemic has led to an increase in public debt in most countries. This will increase fiscal pressure in the future. We study how the shape of the optimal nonlinear income tax schedule is affected by this increase in fiscal pressure. We calibrate the workhorse optimal income tax model to 5 European countries: France, Germany, Italy, Spain and the UK. We apply the inverse-optimum approach to the pre-COVID-19 economies. We then ask how the schedule of marginal and average tax rates should be optimally adjusted to the increase in fiscal pressure. For all countries, we find that the increase in fiscal pressure leads to a less progressive optimal tax schedule both in terms of marginal and average tax rates.

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1 Introduction

The COVID-19 pandemic will leave us with a considerable stock of additional government debt. Servicing this debt will limit the fiscal leeway in the future and force governments to spend less or raise more revenue, probably both. The view is widespread that it is important to distribute the burden of servicing the additional debt fairly, suggesting that taxes should become more progressive. For instance, in a recent paper on tax policy after the IMF argues that "countries have multiple options to enhance the effective progressivity of their tax systems"(de Mooij, Fenochietto, Hebous, Leduc, and Osorio-Buitron 2020, p.1) and adds that "options include more progressive personal income tax systems"[1]. However, the paper also reminds policymakers that "the optimal degree of progressivity should strike a balance between equity and efficiency"[2].

So how does the optimal degree of income tax progression change if governments need to raise more revenue? Somewhat surprisingly, this issue has received rather little attention in the literature. In a very recent paper, Heathcote and Tsujiyama (2021) elaborate the role of fiscal pressure for the optimal shape of marginal tax rates.[3] For the U.S. they find that an increase in fiscal pressure – starting from the current level – pushes the optimal tax schedule from a progressive shape of marginal tax rates, first to a flat and then to a U-shaped schedule of optimal marginal tax rates. This analysis helps to reconcile different quantitative findings in the literature. To some extent, they can be explained by different calibrations of exogenous revenue requirements.

In this paper, we also take the workhorse optimal income tax model to ask how optimal tax progressivity changes due to a COVID-19 related increase in fiscal pressure. We study five European countries: France, Germany, Italy, Spain and the UK. For all 5 countries, we find that marginal and average tax rates should increase in particular for lower incomes which implies that the tax schedule should become less progressive. Importantly, we are not relying on a particular social welfare function that may imply very different preferences for redistribution than those of current governments. Instead, we are using an inverse optimum approach (Bourguignon and Spadaro 2012). We calibrate the Pareto weights for which the pre-pandemic tax-transfer systems are optimal (given our assumptions on the utility function and the income distribution). Then we ask, how the optimal tax progressivity should change due to a COVID-19 induced fiscal pressure given these welfare weights. We start the paper with a short refresher about optimal nonlinear income taxation. There, we start with a benchmark where the progressivity of marginal tax rates is not affected by fiscal pressure: a setting without income effects and exogenous marginal social welfare weights. This includes (i) the Rawlsian social welfare

[1] ibid, p.3

[2] ibid, p.4

[3] Lorenz and Sachs (2011), who consider the optimality of the EITC in a model with intensive and extensive margin responses, is an exception.

function, where the goal is to maximize the lump-sum transfer, (ii) a Leviathan government that just tries to maximize tax revenue but also (iii) any set of social marginal welfare weights that only depend on the type but are independent of consumption and hence exogenous. In these cases, an increase in fiscal pressure solely results in a decrease in the lump-sum transfer. While the progressivity of marginal tax rates is unaffected, the schedule of average taxes becomes less progressive.

This 'irrelevance result' for marginal tax rates can be overcome by one normative and one positive feature. The normative feature is to endogenize marginal social welfare weights which can be achieved e.g. by a classical Utilitarian objective and decreasing marginal utility of consumption. This implies that the desire to redistribute between two individuals does not only depend on the difference in their consumption but also on the level. The positive feature is to account for income effects: if the lump-sum transfer gets decreased, this ceteris paribus increases labor supply of individuals under the empirically plausible assumption that leisure is a normal good.

We then calibrate the model to the pre-pandemic situation in five European countries. Importantly, we account not only for the income tax schedule, but consider the whole tax-transfer systems including social insurance contributions, and income transfer payments as well as the phasing out of these transfers (everything based on the micro-simulation model EUROMOD). We calibrate the income distributions based on EU-SILC data augmented by Pareto tails. Then, we calibrate the skill distributions based on country-specific assumptions on labor supply elasticities. This allows us to 'invert' the optimal income tax approach and ask for which Pareto weights, the pre-pandemic tax-transfer systems were optimal.

In a next step, we calibrate the implied fiscal pressure due to COVID-19 debt and consider different repayment scenarios. We then ask how the optimal schedule of marginal and average tax rates changes due to this increase in fiscal pressure. For all countries, we find that the schedule of marginal tax rates is pushed upwards in a U-shaped fashion. Marginal tax rates should particularly increase for low income. For average tax rates, we find that increase in average tax rates is highest for low incomes and then strictly declines in income.

Related Literature The optimal income tax problem (Mirrlees 1971, Saez 2001) has been extended in many directions, such as to account for different labor supply margins (Kleven and Kreiner 2006, Jacquet, Lehmann, and Van der Linden 2013), taxation of couples (Kleven, Kreiner, and Saez 2009), general equilibrium effects (Rothschild and Scheuer 2013, Sachs, Tsyvinski, and Werquin 2020). Heathcote and Tsujiyama (2021) is the first paper to thoroughly elaborate the role of fiscal pressure in such models.

2 The Workhorse Model of Optimal Income Taxation

We briefly review the optimal income tax formulas in the workhorse model of nonlinear income taxation (Mirrlees 1971, Saez 2001) and discuss how these optimality conditions are affected by fiscal pressure. In Section 2.1 we start with an irrelevance benchmark: without income effects on labor supply and with constant marginal utility, optimal marginal tax rates are independent of fiscal pressure. We then introduce two relaxations: decreasing marginal utility and income effects on labor supply in Sections 2.2 and 2.3.

2.1 Irrelevance Benchmark – No Income Effects and Exogenous Welfare Weights

We first consider iso-elastic preferences of the form: $u(c,l) = c - \frac{l^{1+\frac{1}{\varepsilon}}}{1+\frac{1}{\varepsilon}}$, where c is consumption and l is labor supply. Denote productivity by w and the cumulative distribution function by $F(w)$ and the density by $f(w)$. The welfare function is given by:

$$W = \int_{\underline{w}}^{\overline{w}} u(c(w), l(w))s(w)f(w)dw,$$

where we normalize the weights $s(w)$ such that $\int_{\underline{w}}^{\overline{w}} s(w)f(w)dw = 1$. To obtain a desire for redistribution, we need to have $s'(w) < 0$. The important aspect of this welfare function is that the marginal social welfare weights are independent of consumption due to linear utility.

Government Problem The government chooses a nonlinear tax-transfer system $T(\cdot)$. Formally, the optimization problem of the government reads as:

$$\max_{T(\cdot)} \int_{\underline{w}}^{\overline{w}} u((l(w)w - T(l(w)w), l(w))s(w)f(w)dw$$

subject to individual optimality

$$l(w) = \arg\max_{l} u((l(w)w - T(l(w)w), l(w))$$

and subject to budget feasibility

$$\int_{\underline{w}}^{\overline{w}} T(l(w)w)f(w)dw \geq E,$$

where E is the exogenous revenue requirement.

It is a standard exercise to show that the formula for optimal marginal tax rates reads as:

$$\frac{T'(y(w))}{1-T'(y(w))} = \left(1+\frac{1}{\varepsilon}\right)\frac{\int_w^{\overline{w}}(1-s(x))f(x)dx}{f(w)w}.$$

Note that this expression provides a closed form for the optimal marginal tax rate at a given income level $y(w)$. The respective lump-sum element $T(0)$ then follows from budget feasibility. A change fiscal pressure which is capture by an increase in the revenue requirement E only affects the lump-sum element of the tax schedule $T(0)$ and nothing else. The schedule of optimal marginal tax rates is unaffected by fiscal pressure.

2.2 Endogenous Welfare Weights

We consider the same economy as before, but the utility function reads

$$u(c,l) = U\left(c - \frac{l^{1+\frac{1}{\varepsilon}}}{1+\frac{1}{\varepsilon}}\right)$$

where $U(x) = \frac{x^{1-\gamma}}{1-\gamma}$. Alternative functional forms for U are of course conceivable. This utility function still abstracts from income effects, but one obtains a decreasing marginal utility of consumption. This implies that the marginal social welfare weights are endogenous and will hence change due to changes in fiscal pressure. For ease of notation, we sometimes write $U(w)$ or $U'(w)$ instead of $U\left(c(w) - \frac{l(w)^{1+\frac{1}{\varepsilon}}}{1+\frac{1}{\varepsilon}}\right)$ or $U'\left(c(w) - \frac{l(w)^{1+\frac{1}{\varepsilon}}}{1+\frac{1}{\varepsilon}}\right)$.

It is easy to show that the formula for the optimal marginal income tax rate reads as:

$$\frac{T'(y(w))}{1-T'(y(w))} = \left(1+\frac{1}{\varepsilon}\right)\frac{\int_w^{\overline{w}}\left(1-\frac{U'(x)s(x)}{\int_{\underline{w}}^{\overline{w}}U'(z)s(z)f(z)dz}\right)f(x)dx}{f(w)w}.$$

This formula again does not seem to depend on the exogenous revenue requirement. The elasticity (by assumption) is fixed and therefore takes the same value independently of whether there is an exogenous revenue requirement. The wage distribution is also exogenous.

But the element of the formula which captures the desire to redistribute is endogenous w.r.t. to the revenue requirement:

$$\int_w^{\overline{w}}\left(1-\frac{U'(x)s(x)}{\int_{\underline{w}}^{\overline{w}}U'(z)s(z)f(z)dz}\right)f(x)dx.$$

Note that this element captures how much the social planner wants to redistribute from those with a wage higher than w to those with a wage lower than w. This depends on the ratios of marginal utilities and is endogenous with respect to the lump-sum transfer. This role of fiscal pressure is discussed in great detail in Heathcote and Tsujiyama (2021) both theoretically and numerically.

2.3 Income Effects

We now introduce income effects. With income effects, even for exogenous marginal social welfare weights, fiscal pressure does influence optimal tax progressivity: as soon as the lump-sum element gets adjusted, labor supply of individuals will adjust due to income effects which then changes the optimality condition for marginal tax rates even for exogenous social marginal welfare weights.

Concretely, we now consider the widely used preferences of the form:

$$\frac{c^{1-\gamma}}{1-\gamma} - \frac{l^{1+\frac{1}{\varepsilon}}}{1+\frac{1}{\varepsilon}},$$

where γ is the constant relative risk aversion and ε captures the Frisch elasticity of labor supply, which is also constant.

It is easy to show that in this case the optimal tax schedule is characterized by:

$$\frac{T'(y(w))}{1-T'(y(w))} = \left(1+\frac{1}{\varepsilon}\right) \frac{\int_w^{\overline{w}} \left(1 - \frac{U'(x)s(x)}{\lambda} + \eta(x)T'(y(x))\right) f(x)dx}{f(w)w}.$$

where $\eta(w) = \frac{\partial y(w)}{\partial T(0)}$ is the income effect parameter which captures the absolute change in income if the lump-sum element of the tax schedule gets increased by one unit. Further, the marginal value of public funds is given by:

$$\lambda = \frac{\int_{\underline{w}}^{\overline{w}} u'(x)s(x)dF(x)}{1+\int_{\underline{w}}^{\overline{w}} T'(y(x))\eta(x)dF(x)}.$$

which follows from the transversality condition (that can also be derived as the first-order condition for the lump-sum element of the tax schedule $T(0)$):

$$\int_{\underline{w}}^{\overline{w}} \left(1 - \frac{U'(x)s(x)}{\lambda} + \eta(x)T'(y(x))\right) f(x)dx = 0.$$

What are the additional implications of income effects for the role of fiscal pressure? If leisure is a normal good, we will find that individuals will ceteris paribus work more due to fiscal pressure. An implication is that marginal tax rates have to be increased by less than in the absence of income effects. Our numerical simulations in the following therefore take income effects into account.

3 Calibration

We calibrate the model to match the income distributions of five European countries. The set of countries includes France, Germany, Italy, Spain and the UK.

Income Distributions To obtain country-specific income distributions we use data on annual incomes from the 2018 cross-sectional European Union Statistics on Income and Living Conditions (EU-SILC). EU-SILC contains annual income data in a harmonized framework which allows for cross-country comparisons. Annual incomes are reported for the previous year of the survey leading to 2017 as the reference year for the income distribution. To calibrate the country-specific income distributions, we apply a standard kernel density estimation to get a smooth distribution. For incomes above 150,000, we append a Pareto distribution where the Pareto parameter decreases linearly between 150,000 and 250,000.[4] The Pareto parameter at the income threshold of 150,000 is chosen such that the ratio $\frac{f(y)*y}{1-F(y)}$ is continuous as in Sachs, Tsyvinski, and Werquin (2020). For incomes above 250,000, we leave the Pareto parameter constant at the country-specific values from Atkinson, Piketty, and Saez (2011). Finally, we smooth the resulting distributions again to ensure differentiability of the hazard ratios at 150,000 and 250,000. We assume that a fixed mass of the population always earns an income of zero. The fixed shares are chosen to match the country-specific shares of recipients of disability benefits as in Mankiw, Weinzierl, and Yagan (2009).[5] Table 1 contains the country-specific values used in the calibration of the income distributions.

Current Tax Systems We approximate the current income tax systems with the tax-benefit microsimulation model EUROMOD and EU-SILC as the underlying input data.[6]

First, we simulate effective marginal tax rates based on the 2017 tax-and-transfer system and calculate average marginal tax rates for income bins with a size of EUR 5,000. The simulated effective marginal tax rates include taxes, means-tested benefits, pension and social insurance contributions.[7] To smooth the average marginal tax rates, we perform a second order local weighted regression (LOESS) with a constant extrapolation for income values outside the

[4]The second threshold of 250,000 is chosen based on the estimation of Pareto parameters in the United Kingdom by Jenkins (2017). His estimation results show that the Pareto parameter of the 2010 income distribution stays constant above an income of approximately 250,000 (see Appendix H-8). Our results regarding fiscal pressure are not sensitive w.r.t to that assumption.

[5]We utilize data from the Employment Outlook of the OECD (OECD 2009). The most recent available data refers to the year 2007. Unfortunately, there are no country-specific shares of recipients of disability benefits available for France. Thus, we use the average across OECD countries for France.

[6]For detailed information about the tax-benefit calculator EUROMOD, see (Sutherland and Figari 2013).

[7]For a detailed description of the simulation of effective marginal tax rates in EUROMOD, see Jara and Tumino (2013).

	Germany	UK	Spain	France	Italy
Pareto Threshold Start	150,000	150,000	150,000	150,000	150,000
Pareto Threshold Constant	250,000	250,000	250,000	250,000	250,000
Pareto Parameter Start	2.95	2.34	2.21	2.8	2.56
Pareto Parameter Constant	1.67	1.78	2.11	2.20	2.22
Mass of People with Zero Earnings	4.4%	7.0%	3.8%	5.6%	3.2%
Elasticity	0.54	0.25	0.45	0.20	0.25
Lump-Sum Transfer	20,763	15,037	6,991	13,347	2,540

Table 1: Parameters for Calibration of Income and Skill Distributions

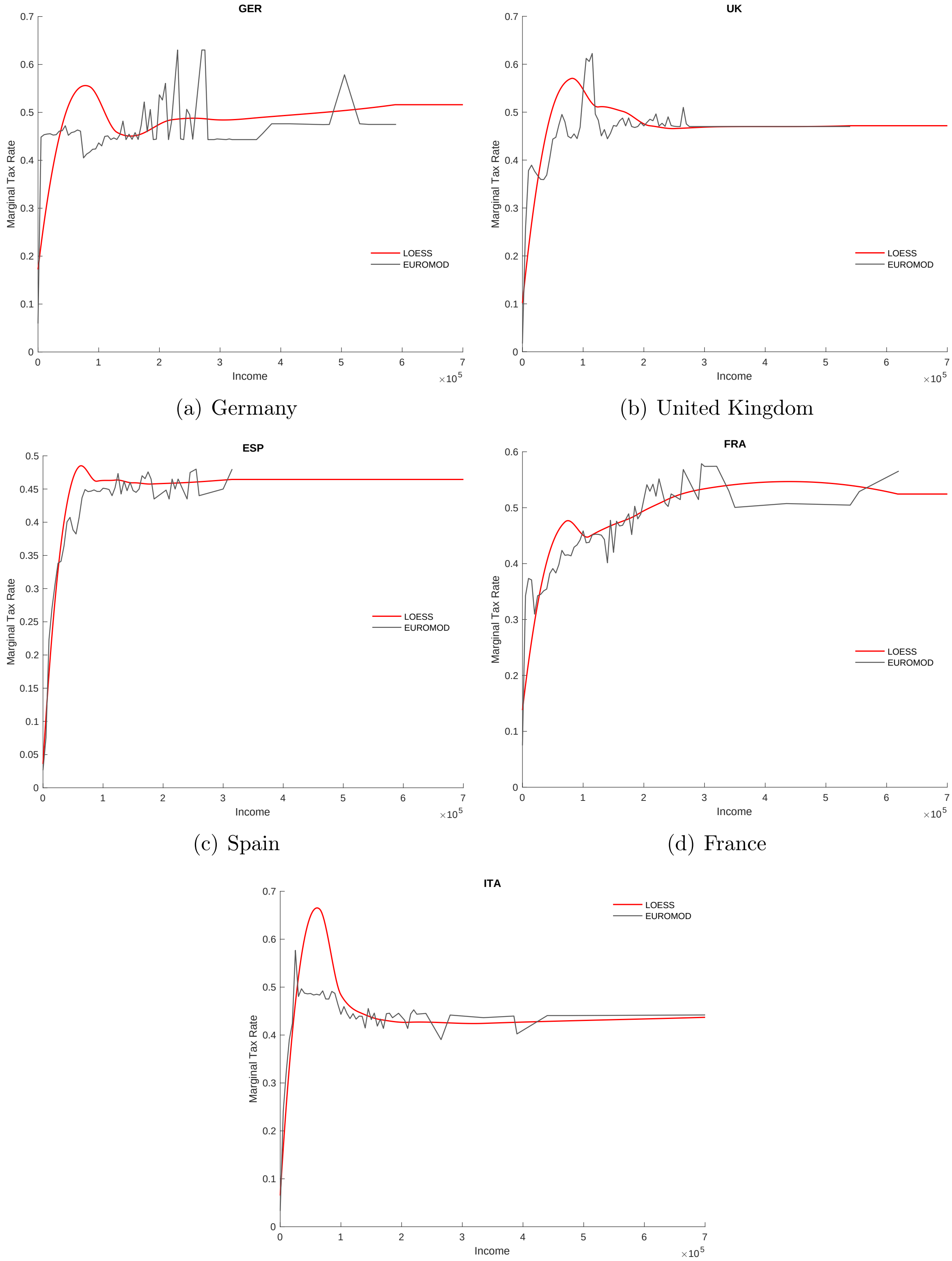
Notes: The constant threshold of 250,000 is chosen based on the estimation of Pareto parameters in the United Kingdom by Jenkins (2017). The starting Pareto parameter at the income threshold of 150,000 is chosen such that the hazard rate $\frac{f(y)*y}{1-F(y)}$ is continuous as in Sachs, Tsyvinski, and Werquin (2020). The values of the constant Pareto parameter are from Atkinson, Piketty, and Saez (2011). The mass of people with zero earnings matches the shares of recipients of disability benefits reported by OECD (2009). For France, we use the average across OECD countries. For the elasticity, we use the estimate of Doerrenberg, Peichl, and Siegloch (2017) for Germany, Brewer, Saez, and Shephard (2010) for the UK, Almunia and Lopez-Rodriguez (2019) for Spain, Lehmann, Marical, and Rioux (2013) for France and the approximate midpoint of estimated elasticities as reported by Saez, Slemrod, and Giertz (2012) for Italy. The values of the lump-sum transfer match the average minimum income protection from 2017 Social Assistance and Minimum Income Protection Interim Dataset and are converted into EUR.

covered income range of EU-SILC data. The simulated average and smoothed marginal tax rates are illustrated in Figure 1.

Skill Distributions We infer the skill distributions from the calibrated income distributions and the simulated effective marginal tax rates by inverting the individual labor supply first-order condition as in Saez (2001). Furthermore, we use empirical evidence to match country-specific labor supply elasticities.[8] For the utility function, we set $\gamma = 1$ for all countries. The first-order condition also depends on the individual's consumption, which is calculated as the difference between income and paid taxes plus a lump-sum transfer. The lump-sum transfers are set to match the average minimum income protection in each country.[9] Table 1 contains details on the used elasticities and values of the transfer in the simulations.

[8] We use the estimate of Doerrenberg, Peichl, and Siegloch (2017) for Germany, Brewer, Saez, and Shephard (2010) for the UK, Almunia and Lopez-Rodriguez (2019) for Spain and Lehmann, Marical, and Rioux (2013) for France. To the best of our knowledge, there exists no empirical evidence on the elasticity of taxable income for Italy. Therefore we use the approximate midpoint of estimated elasticities as reported by Saez, Slemrod, and Giertz (2012).

[9] Specifically, we use the average minimum income protection from the 2017 Social Assistance and Minimum Income Protection Interim Dataset and convert them into EUR. We took a simple average that is based on the minimum income protection of three different categories, namely single, single parents and two-parent families. Our results for the implications of fiscal pressure for tax progressivity are not very sensitive w.r.t. to the calibration of the lump-sum component.



(a) Germany (b) United Kingdom

(c) Spain (d) France

(e) Italy

Figure 1: Simulated Average and Smoothed Marginal Tax Rates with EUROMOD

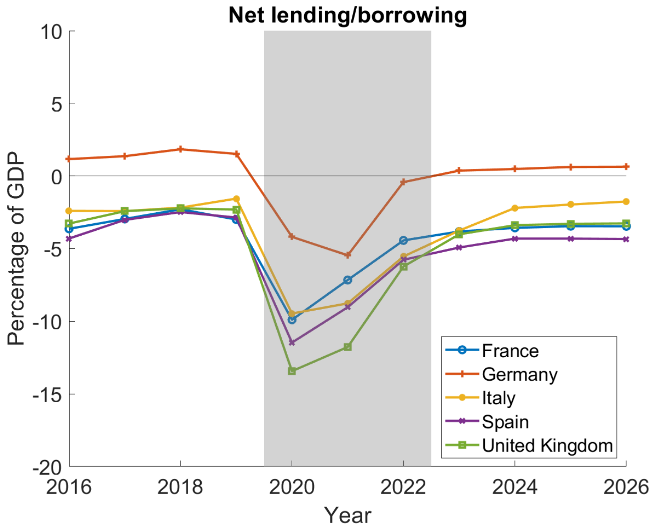


Figure 2: Net Government Lending/Borrowing

Fiscal Pressure Figure 2 shows the net government lending or borrowing from 2016 until 2026. For years until 2020, we use the actual government data from the OECD (OECD 2019). For years from 2021, we use the forecast data from the IMF World Economic Outlook (Fund 2021). The grey area marks the time period we call the pandemic period. It is clear that the governments have had already and are expected to have significantly higher budget deficits during the pandemic period compared to before.

To simulate the fiscal pressure the governments face as a result of COVID-19 pandemic, we use the following approach. First, we compute the total additional debt amount governments accumulated and are expected to accumulate between 2020 and 2022 compared to the average deficit levels before COVID-19. Then, we assume that governments are required to pay back this additional stock of debt accumulated during three years in varying periods, namely five and ten years. One other fiscal pressure measure that we use is the difference between the average spending before and after the pandemic. Hence, we assume that after the pandemic, additional spending is as high as during the pandemic.

Figure 3 shows the fiscal pressure that the governments face. As expected, paying back the additional debt in 5 years puts a significant strain on governments expenditure. It ranges from 2 percent of GDP for France to 5 percent of GDP for Spain. Paying back the debt in 10 years scales down the fiscal pressure by a factor of 2. Lastly, the expenditure forecast in 2023 shows that the expenditure numbers will be similar to the two hypothetical fiscal pressure specifications, except for France and the UK.

In a low interest rate environment – such as the one we are experiencing right now – additional stock of debt does not really hurt the balance between expenditures and revenue in governments'

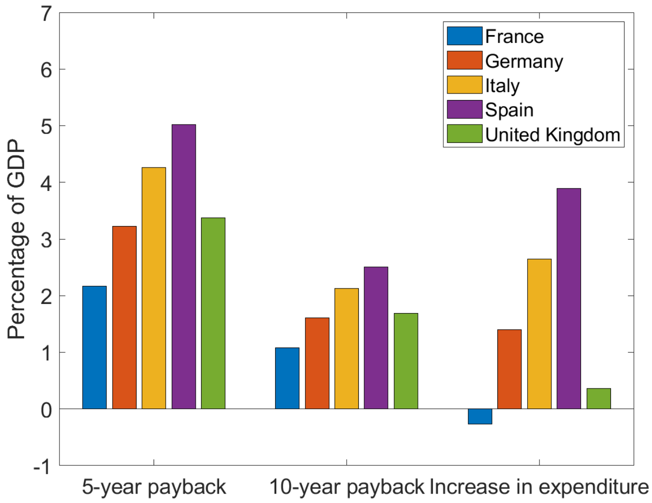


Figure 3: Different Measures of Fiscal Pressure

budget. However, it is not for certain that the interest rates continue being low in the long run. Therefore, we believe that our calculations for the fiscal pressure are an interesting benchmark.

4 Quantitative Results

After establishing the theory and calibrating the income distributions as well as tax-transfer systems of five European economies, we present our results from the numerical simulations in this section. The simulations compute the welfare maximizing tax marginal tax rates as well as the lump-sum transfer levels for different levels of fiscal pressure. Maximizing welfare requires setting the welfare weights for different skills, which is a normative question. We refrain from answering that normative question and employ an inverse optimum approach instead (Bourguignon and Spadaro 2012, Lockwood and Weinzierl 2016, Lorenz and Sachs 2016, Jacobs, Jongen, and Zoutman 2017).

Increased spending requirements mechanically crowd out

blueich würde das weglassen und nur lump-sum transfer schreiben lump-sum transfers. Figure 4 shows how much the lump-sum transfer should change as a result of fiscal pressure. The first thing to notice is the higher the fiscal pressure, the larger the decrease in the lump-sum payment. For example, 5-year payback results in a larger decrease in lump-sum transfers for all countries compared to 10-year payback. We can also see that this crowding-out effect is not one-to-one. The fact that the governments have different abilities to raise additional tax revenue also results in different exposure to fiscal pressure in terms of the change in the lump-sum transfers. For example, we see that 5-year payback puts around 20% more fiscal pressure to Spain compared to Italy. However, the decrease in their lump-sum payment is virtually identical.

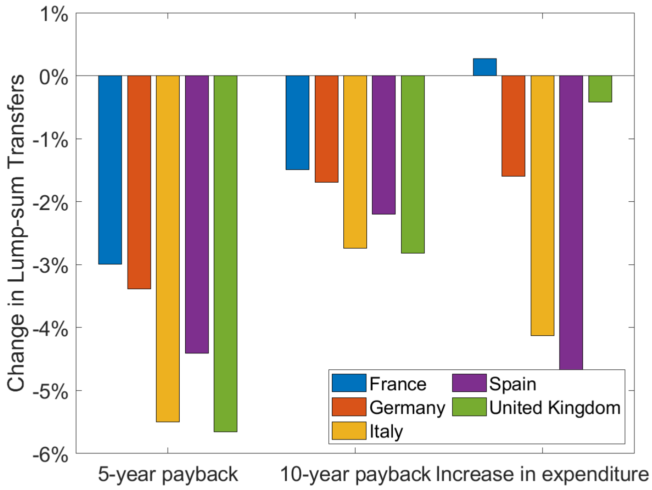


Figure 4: Decrease in Lump-Sum Payments for Different Measures of Fiscal Pressure

Optimality of marginal tax rates is guaranteed by the balance between the gains from redistribution and the efficiency costs. Increasing marginal tax rates is costly for governments because it results in a lower labor supply. The effect of this decrease in labor supply should be equal to the welfare increase resulting from the redistribution. When lump-sum payments decrease as a result of fiscal pressure, the balance between the gains and costs is disrupted. Lower lump-sum payments make the gains from redistribution higher compared to efficiency costs. This is because lower lump-sum payments mean lower disposable income for individuals. As the marginal utility increases when consumption is lower, the possible gain of additional redistribution is also higher.

As a result of the mechanism described above, lower lump-sum payments drive governments to increase marginal tax rates. However, governments do not increase them uniformly. This is because the marginal tax rates for high incomes are already very close to revenue maximizing tax rates. Therefore, governments increase the marginal rates for lower incomes more compared to higher incomes. Figure 5 shows how the optimal marginal tax rates should change as a result of the fiscal pressure face. We see that the marginal tax rates should increase almost for all income levels. The increase is U-shaped and higher for lower incomes as we expect.

Combining these two changes in the lump-sum transfers and the marginal tax rates, we can also calculate the implied change in average tax rates. Figure 6 shows the implied change in the average marginal tax rates. The decrease in the lump-sum transfers increases the average tax rates, especially for low incomes. The overall result is a regressive update in the tax-transfer schedules. The increase in average tax rates is substantial for incomes lower than EUR 50,000 and ranges between 5% and up to 25%.

To sum up, an increase fiscal pressure decreases lump-sum transfers. This decrease makes increasing tax rates more beneficial. However, governments levy marginal tax rates that are

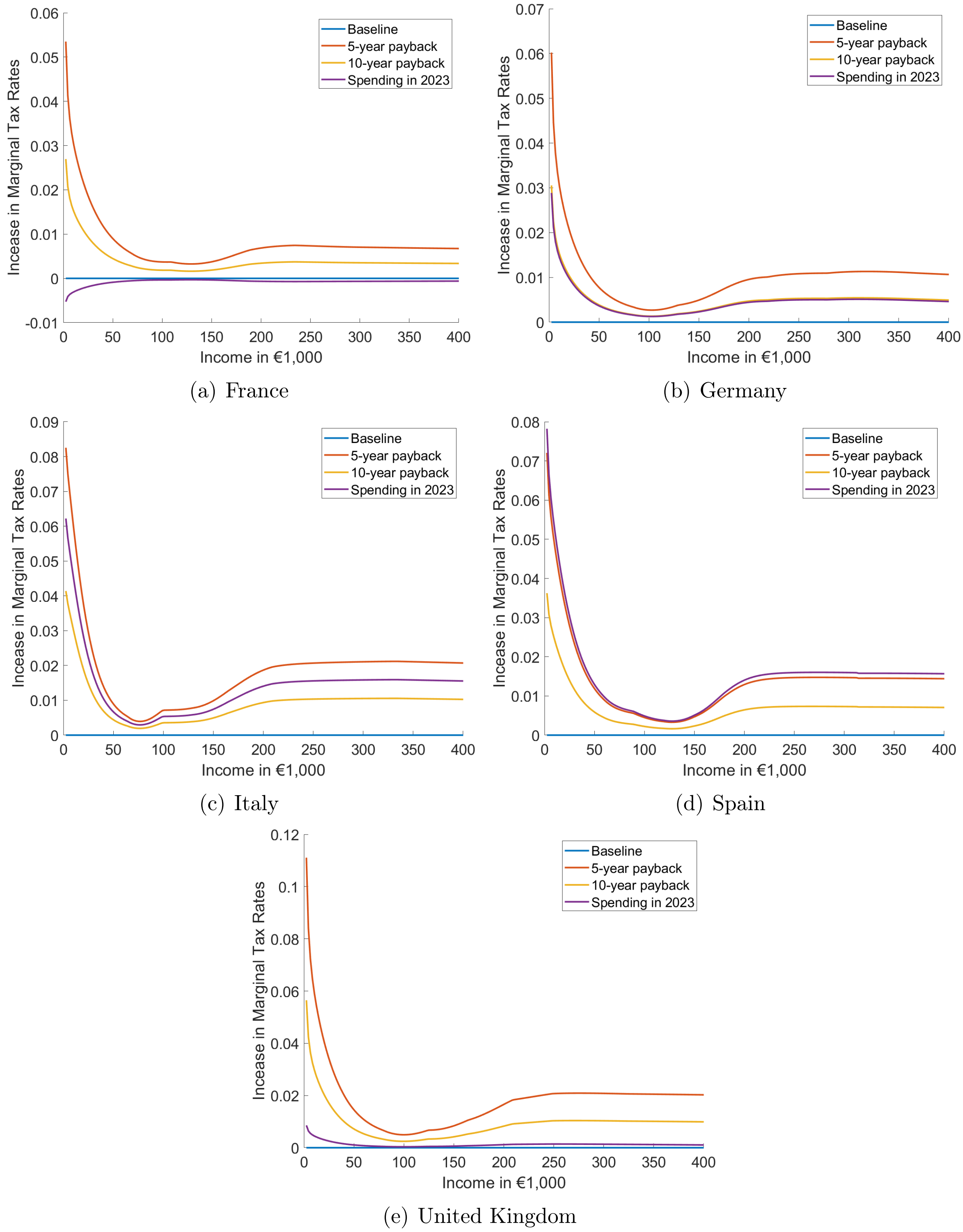
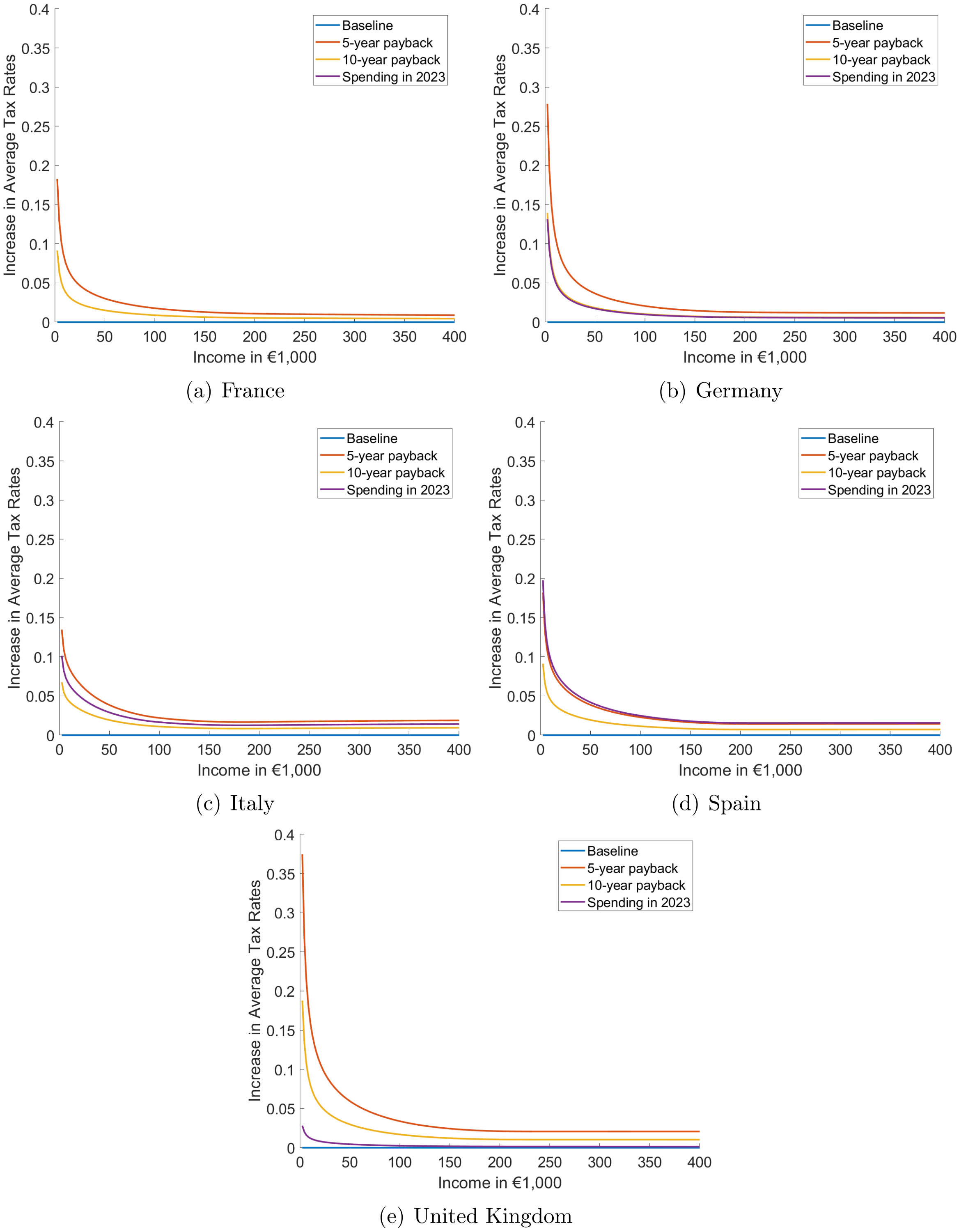


Figure 5: Increase in marginal tax rates for different measures of fiscal pressure

almost as high as revenue maximizing tax rates for high incomes. Therefore, they increase the marginal tax rates for low incomes in an effort to raise more tax revenue. In other words, an exogenous pressure to raise more revenue decreases the redistributive power of governments.



(a) France (b) Germany (c) Italy (d) Spain (e) United Kingdom

Figure 6: Increase in average tax rates for different measures of fiscal pressure

5 Conclusions

This paper investigates how an increase in the tax revenue requirement due to COVID-19 affects the optimal progressivity of the income tax system. It turns out that, for a wide range of assumptions regarding the social planner's objective function, optimal progressivity declines.

There is a tradeoff between the objectives of raising revenue and redistributing through the tax system by making it more progressive. This suggests that governments may face difficult choices when it comes to financing the burden of the additional debt incurred as a result of the COVID-19 pandemic. Of course, our analysis has focused on the income tax only. In the debate on who bears the cost of the crisis, other taxes also play a role, in particular wealth taxes. Whether it is optimal to increase wealth taxes or make them more progressive is beyond the analysis in this paper.

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