Bracket Creep Revisited: Progressivity and a Solution by Adjusting the Rich Tax in Germany

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Abstract

This paper studies the redistributive and revenue effects of bracket creep in Germany under various inflation scenarios and evaluates the feasibility to charge a rich tax to fight bracket creep for the income distribution in 2009. Using a tax micro-simulation model developed for the newly available PHF data, we document an inverted U-shaped overall redistribution effect of the tax system with respect to the inflation rate, which contrasts Immervoll (2005) who finds that the fiscal drag always enhances the equalizing property. Delaying indexation might not be better off in terms of inequality. A politically in-between approach is proposed to raise the marginal tax rate for the top bracket to compensate the government revenue loss due to indexing the tax schedule in Germany. The rich tax required for fully financing the indexation can be sizable. Under our simulation environment, this rate can reach above 75% with four years' inaction on 4% annual inflation. When this rich tax can be fiscally possible, it can totally offset the decrease of global redistribution effect from indexation. Our results echo the *inequality indexing* proposed by Burman, Shiller, Leiserson, Rohaly and Kennedy (2007) by suggesting institutionalizing a joint adjustment of rich tax and bracket creep / inflation indexing which justifies a pro-growth, risk reducing, revenue-neutral and framing effective policy.

Keywords: Inflation, Fiscal Drag, Rich Tax, Progressivity of Income Tax, Income Distribution, Micro-simulation, Inequality Indexation

JEL-Classification: C81, H24, D31, H23

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[1] Results and opinions expressed in this paper are those of the authors and do not necessarily reflect views of the Deutsche Bundesbank.

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Non-technical summary

Nominal earning growth protecting against inflation does not fully reach the citizen's pocket since they are also pushed to a higher tax bracket. This phenomenon is "bracket creep" (fiscal drag/cold progression). We perform a micro-simulation on the newly available PHF data in order to quantitatively assess the redistributive and revenue effects of bracket creep in Germany when inflation varies and evaluates a policy of taxing the rich to finance the inflation indexing for the German income distribution in 2009. Taxing the rich by raising the top marginal tax rate and indexing the tax schedule is currently on the political agenda of SPD and CDU respectively. Hence, this policy suggestion is politically compromising. As motivated by *inequality indexing* in Burman et al. (2007), our exercise also sheds light on the degree by which our proposal can be inequality-revenue neutral.

The global redistributive effect of a tax system is mainly comprised of the effects that average tax burden increases and how equalized the tax is distributed. Our micro-simulation illustrates an inverted U-shaped redistributive effect of bracket creep as inflation rate increases. In a micro-simulation study using 1998 German income data and under less complete inflation scenarios, Immervoll (2005) documents that bracket creep can always enhance the overall redistributive effect of the tax system. We also document that bracket creep under higher inflation reduces tax progressivity and increases the average tax burden which is consistent with his finding. However, the latter effect does not always dominate under more complete inflation scenarios.

When the inflation is moderate, financing indexing by taxing the rich might not be politically unacceptable. If inflation rate is 4%, we show the top marginal tax rate would have to be 53% in order to finance 3.53 billion Euros loss of tax revenue due to inflation indexing on the income tax function. However, this policy can be in trouble if the government is too patient. For instance, the government would have to raise the top rich tax to be above 75% when the annual inflation rate keeps stable at 4% and there is no indexing for four years. In terms of redistributive effect, the drop of Gini due to taxing the rich can be more than enough to compensate the increase of Gini due to inflation indexing as long as the inflation is not cumulated to push the required top marginal tax rate to exceed 100%.

The inverted U-shaped relationship between redistributive effect and inflation rate implies that the inaction against inflation by the fiscal authority can be justified for a limited duration when inequality concern dominates the growth concern. When the growth concern rises to call for the indexing, our evaluation outcome favours even shorter delay of indexing.

Finally, we discuss a symmetric approach which also lowers the tax burden of the top rich by using the tax revenue gain from bracket creep when indexing is not taken. Following the spirit of the *inequality indexing*, we argue that this symmetric policy can improve the framing effect and political sustainability when the insurance role of the tax system against inequality is emphasized.

1 Introduction

Income tax policy has been long present in the German political agenda as well as the source for many discussions not only among politicians but also in vast parts of the society. At least, there are two irrefutable causes for this effect: First, about one third of all taxes comes from income taxation (Federal Ministry of Finance, 2011); and second, as income taxes affect a large number of taxpayers, income taxation is deemed as the main tool of redistribution.[2]

According to a calculation run by Bach, Haan and Ochmann (2013), the proposal by the SPD's 2013-election-program concerning fiscal policy could have generated up to eight billion Euros in tax revenue per year by raising the tax rates for higher earners (yet adjustments by taxpayers could reduce the volume noticeably). In contrast, the governing parties proposed to adjust the income tax function to inflation, hence offsetting the effect of bracket creep (fiscal drag/cold progression). This measure would have cost around four billion Euros (Bach et al., 2013b).

A possible in-between solution for income taxation could have been fighting bracket creep in the whole income tax schedule, hence adjusting it to inflation, and increasing the top marginal income tax rate together. In doing so, the loss in tax revenue by fighting bracket creep can be offset by the gain from a rich tax (Bach et al., 2013b). On the other hand, a rich tax will improve the equalizing effect of the tax system. Nevertheless, we are uncertain whether the combination with indexation will also achieve inequality neutrality.

To study the equalizing effect of this in-between solution, we have to first investigate the redistributive effect of inflation indexation, or conversely the bracket creep. Immervoll (2005) quantitatively assesses this effect using the EUROMOD, a Euro wide tax-benefit micro-simulation model over Germany, Britain and the Netherlands. The data for Germany refers to 1998. The author finds that fiscal drag will enhance the overall equalizing effect of the tax system. Although inflation deteriorates the tax progressivity, the average tax burdens are widened substantially, which is why the previous effect dominates.

Following this study, we also adopt the approach of micro-simulation using a model developed for the newly available Panel on Household Finance (PHF) data. The reference year is 2009. Similar to Immervoll (2005), we assume a full inflation compensation so that all the income components grows at the same pace with inflation. In addition, we simulate under a much larger array of inflation scenarios ranging between 0 to 100%.

[2] There has been a wide range of literature focusing on the effectiveness and progressivity of income taxation serving to reduce inequality. See e.g. Kakwani (1980) or Atkinson (1970).

Our result implies that the effect of average tax burdens is not playing the pivotal role anymore. Consequently, we observe an inverted U-shaped overall redistributive effect when inflation grows. The reduction of tax progressivity and enlarging average tax burdens are the other facts about bracket creep. They are still consistent with Immervoll (2005). Besides, the regressivity of the social insurance contributions when inflation kicks in counteracts the effect from the income tax, which is the other factor in forming the inverted U-shaped relationship of the overall equalizing effect and inflation rate.

Our findings can play a role in discussing the timing of inflation indexation. In a fiscal leadership regime, the monetary authority is the follower who factors the fiscal policy into the inflation targeting, maintains the stability of inflation but does not include inequality concern in the target function, and then the fiscal authority decides a tax schedule conditional on all of the above.[3] Since frequent inflation indexation is costly, the timing of indexation will then have to be determined appropriately. We argue, based on our result contrasting to Immervoll (2005), that delaying indexation and allowing inflation to cumulate does not enlarge the equalizing effect of the tax system always. If the inequality consideration dominates, a patient fiscal authority is favorable only for a limited duration.

Regarding our proposal of revenue-neutral solution, we can show that we will have to increase the top rich tax to above 75% when the government does not act for four years and inflation is constant at 4% annually. However, for moderately low inflation rate, the increase in rich tax required can be small and politically acceptable. When the cumulated inflation is limited so that top marginal rate required is not pushed above 100%, a rich tax to compensate the revenue loss in indexation will be more than enough to offset the reduction of the equalizing effect from fighting bracket creep. In a joint consideration of political acceptability, revenue balancing and inequality improvement which our proposal aims at, the government should act on this unifying policy earlier than later.

We also discuss a pre-commitment to co-move the rich tax and bracket creep / inflation indexation. The government rebates the top rich when bracket creep is perceived as a progressive redistribution and taxes them when inflation indexation reduces the redistributive effect of the tax system. This policy resembles the *inequality indexing* advocated by Burman et al. (2007). They argue that such a policy will not create excess fiscal burdens on either

[3] Adam and Billi (2014) discuss such a setup. Given the high cost of adjusting fiscal policy such as changing the tax schedule, the fiscal leadership is realistic.

average taxpayers or government, offer an insurance against inequality, be friendly to growth, elevate the framing on inequality and be politically sustainable.

The remainder of this paper is structured as follows: the next section will be dedicated to the concept of bracket creep and the consequences of bracket creep measured for the German case. Section 3 displays the development of the top income distribution as well as the rich tax. Section 4 will shortly present the different approaches to measure progressivity of income tax schedules. Section 5 discusses the data, tax micro-simulation model and the simulation scenarios. Section 6 provides the quantitative assessment on how bracket creep reshapes the equalizing effect of the tax system as well as the redistribution and revenue effects for the proposed rich tax solution. Section 7 considers a symmetric adjustment of rich tax and bracket creep/inflation indexation in a fashion of *inequality indexing*. We conclude in section 8.

2 **Bracket Creep**

Before turning to the empirical exploration, it is necessary to discuss the concept, the solution in reality and the impact of bracket creep.

2.1 Definition of Bracket Creep

There seems to be a consensus among economists on the definition of tax bracket creep as the inflation-induced distortions of a progressive tax function that is defined in nominal terms (see, e.g. Musgrave, Musgrave, and Kullmer (1994); Saez (2003); Immervoll (2005); Gutierrez, Immervoll, and Sutherland (2005); or Heer and Süssmuth (2013)).[4] The German literature describes this effect as "*Kalte Progression*" (see, e.g. Broer, 2011), which literally means "cold progression". The term "cold progression" explicitly covers all of the distortions of the tax function induced by inflation.

Most advanced economies apply income tax schedules with progressive characteristics such that the government raises disproportionately higher income taxes with any increase in nominal income. If wages increase to the same extent as the average price level, the income tax payer will have a lower purchasing power because he or she will be paying more tax in real terms than in the previous period. Hence, a redistribution of income from the households

[4] The German Institute for Economic Research (DIW) differentiates between "bracket creep" in the broad and narrow sense. In the broad sense, this concept refers to the disproportionate increase in income tax revenue along with any nominal income growth (DIW, 2014); while in the narrow sense, it refers to the inflation-induced increase in income tax revenue alone. We will concentrate on the definition in the narrow sense only.

to the government occurs and the tax revenue increases even at zero percent increase in real income (Schaefer, 2013).

To mathematically conceptualize the distortions of the tax function through inflation, Immervoll (2005) uses a general formula for income taxes:

$$t(y) = s(y - a(y)) - c(y),$$

where t(y) represents taxes with respect to the pre-tax income level y, s(.) stands for the tax rate schedule, a(.) includes all the deductions, and finally c(.) stands for tax credits. Immervoll (2005, p.44) argues why it is necessary to apply the micro-simulation approach in order to quantitatively measure the impact as a result of various distortions:

"*…while inflation-induced erosions of tax credits will always reduce liability progressivity, the effect is ambiguous as far as the erosion of deductions and tax bracket limits are concerned. In addition, theoretical conclusions about how inflation might affect progressivity in a nominally defined tax system are more difficult to arrive at once c or a are functions of y (as is, for instance, the case if income dependent SIC are tax deductible). In these cases, the results would depend both on the functional forms of c(y) and a(y) and on whether and how these are distorted by inflation. In any case, if we are ultimately interested in how inflation affects the degree to which income taxes equalize net household incomes then results regarding liability progressivity are not sufficient. In addition one needs to know the size of tax burdens before inflation as well as the pattern of household sharing between tax units with different pre-tax incomes.*"

2.2 Fighting Bracket Creep

If inflation-induced distortions of a tax function are to be avoided, all of its nominally defined parameters and thresholds as well as the related deductions affecting the tax base need to be adjusted for inflation (Gutierrez et al. 2005). We will present the practices Germany has introduced to adjust their tax and benefit systems for inflation.

In Germany there is no automatic indexation, hence, any change in the income tax schedule and in tax allowances needs to be agreed on by the parliament. Notwithstanding, there are some legal criteria from which indexation *suggestions* are actually derived. For example, there is a "pension formula" for calculating adjustments of the contributions as well as the payout level (Gutierrez et al. 2005).

Concerning the income tax schedule itself with its several tax rates, parameters and bracket limits, the reader should not believe that in the absence of an automatic indexation it has not experienced any changes at all. For instance, the adjustment of the basic allowance is not primarily motivated by changes in the CPI, but rather according to the expected development of the minimum income needed to exist, as it can be derived from the "margin of subsistence report" which is presented to the *German Bundestag* by the Federal Government every two years.[5] The last adjustment of the basic tax allowance was enforced on January 1st of the present year. The justification for the last two increases can be read in the draft law to reduce the effect of bracket creep (German Bundestag, 2012). Moreover, within these adjustments further political objectives were implemented, as it is the case for changes in the minimum tax rate. These heterogeneous motivations have led to a total of 13 changes in the income tax schedule since 1990 (Hechtner, Massarrat-Mashhadi, and Sielaff, 2012).

A macroeconomic approach to assess the impact of bracket creep for a given economy is to observe the development of the income tax revenue in relation to GDP (Broer, 2011). As the statistics show, this relation has been rather constant since the mid-1970s, oscillating between 8 and 10%. This means that by regular and major tax reforms, progression-related revenues were returned to income tax payers and hence, the revenue effect of bracket creep has been indirectly phased out (Bach, 2012).

2.3 Micro-evidence of Bracket Creep in Germany

Even though the relation between income tax revenue and GDP has been constant since the mid-1970s, when regarding shorter periods of time, especially those intervals when no major tax reforms occurred, significant bracket creep effects could be observed. "*(...) infrequent inflation adjustments can indeed cause additional tax burdens - even at low rates of inflation*" (Immervoll, 2005, p. 38).In this section, we will present the results of rather recent studies, which have quantified the fiscal consequences of bracket creep in Germany using household micro-data to simulate the revenue generated due to inflation.

Gottfried and Witczack (2008) quantify the overall income tax rate for the years 2010 to 2012 generated through bracket creep by performing a micro-simulation using the official wage and income tax statistics, starting from the year 2001. In order to update and further forecast the wage and income developments, the authors make assumptions about the demographic, economic and price index development. They find that, by assuming an economic growth of 1.97% from 2010 to 2012, the effect of bracket creep leads to additional tax revenue of 9

[5] The ninth "margin of subsistence report" is from the year 2012 and can be found here: http://www.bundesfinanzministerium.de/Content/DE/Pressemitteilungen/Finanzpolitik/2012/11/2012-11-07-PM74-anlage.pdf?__blob=publicationFile&v=2

billion euros. For the years 2011 to 2014, Boss (2011) quantifies the effect of bracket creep to be around 22 billion euros.

Bach (2012) analyzes the effects of bracket creep according to the expectations of the German government, which proposes a tax reform to explicitly fight the cumulated effect of bracket creep for the years 2013 and 2014 (German Bundestag, 2012). According to Bach (2012), in a scenario with 4.4% cumulated inflation for the years 2013 and 2014, as forecasted by the German government, and a full inflation compensation of all incomes, the inflation-induced increase in tax revenue will amount to 6.9 billion euro for both years.

Schaefer (2013) calculates the cumulated inflation-induced income tax increase from 2011 to 2017. In total, the tax burden in the mentioned period amounts to more than 20 billion euros. Similar to what Bach (2012) and Immervoll (2005) document, Schaefer (2013) recognizes that the generated tax burden through bracket creep alone is lower in absolute term for low incomes than for high incomes, yet the ratio between this new tax burden and their remaining income taxes is higher for low incomes than for high incomes.

3 Top Income Taxation

Whenever it comes to political discussions about raising this tax rate, many politicians start to worry about the impact such a measure could have on the migration of the very rich and on economic growth. They fear that with less net income, the very rich will invest less and hence, the GDP growth rate might be in danger. In this section, we will demystify such pessimism by presenting what the literature has shown concerning these issues as well as the development of top rich income and tax liability distributions.

3.1 Migration of Top Income Earners

According to Docquier and Marfouk (2005), in 2000, the highly skilled were 6 times more likely to emigrate than low-skilled workers. Simula and Trannoy (2010) develop a model that depends on the migration costs expressed as a fraction of the utility abroad, the tax rate in the foreign country, and the elasticity of labor supply with respect to a change in taxes in the home country. In their simulation of the French case, they conclude that the top marginal tax rate of 40% can be seen as too high to stop the top 1 percent earners from emigrating to countries like Monaco, Andorra, Liechtenstein and the Channel Islands. Beside the facts that these countries are far smaller than France and it is probably unrealistic to think of the ideal scenario where all the 1% French top earners would find a suitable job in the new country, economists challenge the most unrealistic assumption of the model, namely that the governments provide no public goods (Simula and Trannoy, 2010).

All social barriers, such as language, culture, and mating, among others, are not taken into consideration at all, even though they may very likely increase the migration costs. This is shown by Dahl and Sorenson (2010) in their research paper "The Social Attachment to Place", where they investigate the Danish population and conclude that people do react positively to opportunities with higher wages abroad but that this reaction is in many cases deemed their preference for living near their relatives and friends.

Young and Varner (2011) analyze registered state tax micro-data from New Jersey before and after the increase in the top earners tax in 2004 by 2.6% on income above $500,000, thus reaching 8.97% and becoming one of the highest state tax rates in the United States of America. Although it is easier to move within a country than abroad, New Jersey lost only 5.2 more millionaire households for every thousand households, after the tax increase. In total there is a net out-migration of 14.5 per thousand. The impact was very small and almost insignificant, due to the fact that the millionaire tax revenue increase was positive in every year after the tax increase, with a mean value of 0.9 billion dollars from 2004 to 2006. Furthermore, a causal effect between the millionaire tax increase and the increase in the net-out migration in New Jersey cannot be found because net-out migration rose for both high-income groups - those affected and those not affected by the millionaire tax but still earning between $200,000 and $500,000. One explanation for this common movement could be the boom in New Jersey's housing market, where prices rose from the third quarter of 2003 to the first quarter of 2006 by 47% (Young and Varner, 2011).

3.2 Top Income, Top Income Taxation and Economic Growth: Development in Reunified Germany

As shown in Table 1, from 1992 to 2005 the top percentile, which begins at a yearly income level of about €150,000, has contributed to a more or less constant share of around 25% of the overall income tax liability. During the same period, its effective average tax rate has declined.[6]

Figure 1 shows the pronounced decline of effective average tax rates at the top of the income distribution. This trend started after 1998 and was mainly driven by the 2000 tax reform, which caused the substantial top marginal income tax rate cuts.

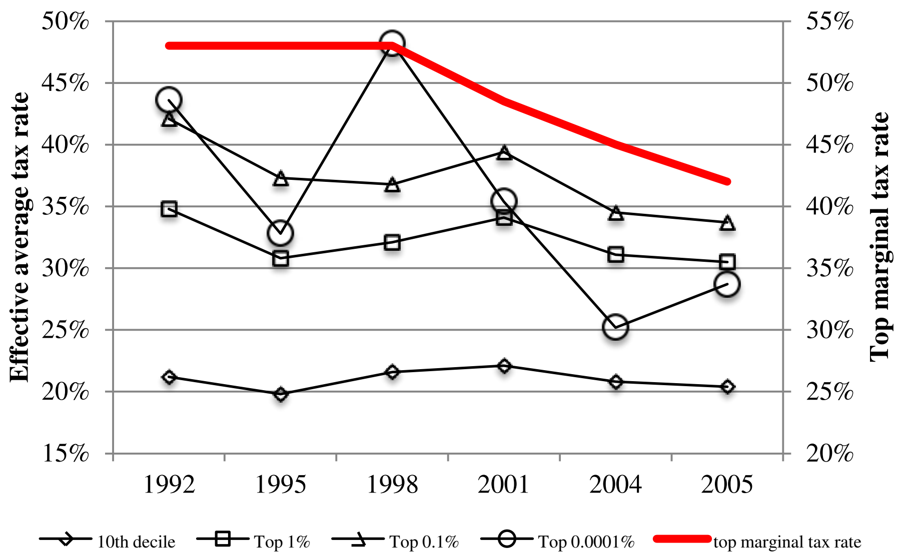
[6] The authors define the effective average tax rate as the ratio of income tax to gross income.

Table 1 Assessed income tax liability (including solidarity surcharge), 1992-2005: in percent of total income tax liability and in percent of gross income (average income tax rates).

Gross income fractiles	Assessed income tax liability (including solidarity surcharge)											
	In percent of total income tax liability						In percent of gross income[a]					
	1992	1995	1998	2001	2004	2005	1992	1995	1998	2001	2004	2005
Top 1%	25.4	21.6	25.7	25.4	23.4	26.8	34.8	30.8	32.1	34.1	31.1	30.5
Top 0.1%	11.8	9.5	12.6	11.2	9.8	12.5	42.1	37.3	36.8	39.4	34.5	33.7
Top 0.01%	4.8	4.1	5.9	4.7	4.2	6.0	43.4	38.5	37.7	39.8	33.4	32.9
Top 0.001%	1.6	1.5	2.4	1.8	1.7	2.8	42.3	37.1	43.1	38.7	30.7	31.0
Top 0.0001%	0.4	0.4	0.7	0.5	0.6	1.2	43.6	32.8	48.2	35.4	25.2	28.7

Note: [a] gross income less deducted losses carried forward/back.
Source: Bach et al. (2013a)

Figure 1 Development of the effective average tax rate and of the top marginal income tax rate from 1992 to 2005.



Source: Own illustration using effective average tax rates from Bach et al. (2013a) and top marginal tax rates from Hechtner et al. (2012).

As it can be noticed in Figure 1, the effective average tax rate of the top decile – and even that of the top percentile – remained rather constant until the end of the observation period. Hence, the 2000 tax reform had only a considerable impact at the very top (Bach et al., 2013a).

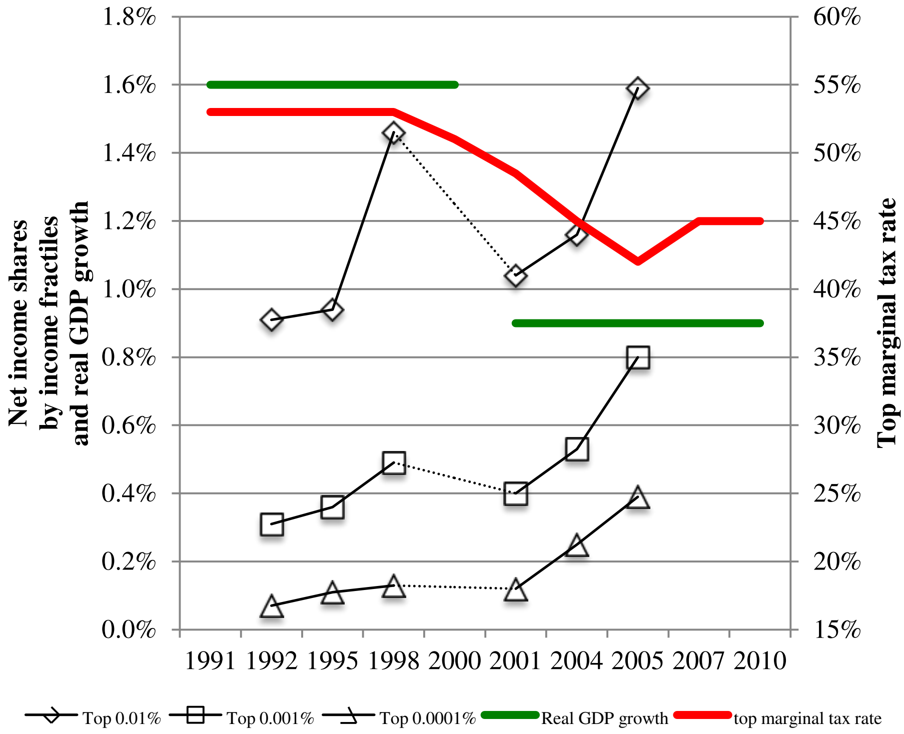
In Table 2, it becomes clear that a sharp relative increase in the concentration of net income for the richest households in Germany has occurred. Further, the richer the households, the stronger this pattern was. Responsible for such a development were the change in tax policy and the increase of top gross incomes (Bach et al., 2013a).

Table 2 Distribution of gross and net income, 1992–2005.

Gross income fractiles	Gross income						Net Income					
	Structure by income fractiles in percent						Structure by income fractiles in percent					
	1992	1995	1998	2001	2004	2005	1992	1995	1998	2001	2004	2005
10th decile	31.26	31.07	32.85	32.36	32.75	33.39	28.07	28.30	29.43	28.75	29.43	29.99
Top 1%	9.05	8.46	10.06	9.17	8.99	10.04	6.78	6.70	7.86	6.95	7.08	7.91
Top 0.1%	3.49	3.14	4.36	3.54	3.41	4.27	2.34	2.29	3.21	2.49	2.57	3.23
Top 0.01%	1.39	1.31	2.01	1.49	1.52	2.09	0.91	0.94	1.46	1.04	1.16	1.59
Top 0.001%	0.46	0.49	0.72	0.56	0.68	1.02	0.31	0.36	0.49	0.40	0.53	0.80
Top 0.0001%	0.11	0.14	0.21	0.17	0.29	0.49	0.07	0.11	0.13	0.12	0.25	0.39

Source: Bach et al. (2013a)

Figure 2 Development of the net income shares by fractiles (1992-2005), of average real GDP growth (1991-2010) and of the top marginal income tax rate (1991-2010).



Notes: Since Bach et al. (2013a) do not present data for the year 2000, we connect the net income shares between 1998 and 2001 by a dotted line. Real GDP growth is presented here as the average yearly real GDP growth rates, first, from 1991 to 2000, and second, from 2001 to 2010.
Source: Own illustration using net income shares from Bach et al. (2013a), real GDP growth from the Federal Statistical Office (2011) and top marginal tax rates from Hechtner et al. (2012).

Diamond and Saez (2012) argue that there is no international evidence among OECD countries supporting the case for lower growth from higher taxes. There is no good evidence from the aggregate data, which supports the thesis that higher tax rates slow growth. It becomes further evident from Figure 2 that the German 2000 tax reform (only) fueled the rising concentration of the very rich.

4 Measuring Progressivity of Income Tax Schedules

The measure Musgrave and Thin (1948) introduced in their seminal paper captures the redistributive effect of a tax schedule by subtracting the post-tax income Gini coefficient from the pre-tax Gini coefficient.

Almost three decades later, Kakwani (1977a and 1977b) demonstrates that the redistributive effect, as presented by Musgrave and Thin (1948), only depicts a change in inequality, while not capturing tax progressivity alone. A couple of years later, Plotnick (1981) recognizes a further complication when comparing the Gini coefficient of the distribution of pre-tax income with that of post-tax income, namely that their respective Lorenz curves do not assure that, for example, the 40% poorest income units in terms of pre-tax income are the same 40% poorest income units in terms of post-tax income. This concept is categorized by Atkinson (1980) and Plotnick (1981) as "reranking", which is likely caused by treating income units with same income differently in the tax system.

The widely accepted Kakwani decomposition of the redistributive effect captures, on the one hand, the progressivity effect through the vertical effect measuring how the inequality of income distribution among income units is reduced or amplified without changing their *ex-ante* relative positions, and on the other, the horizontal effect in terms of reranking, which only captures the change in the relative positions of income units in the income distribution after the application of the income tax schedule.

To summarize, the redistributive effect (RE) of any redistribution policy is

$$RE = G_{pre} - G_{post},$$

where G_{pre} measures the Gini of the pre-policy income distribution and G_{post} represents the Gini of the post-policy income distribution. The Kakwani decomposition states that

$$RE = VE - R = Kakwani\frac{ATR}{1-ATR} - R,$$

where VE is the vertical effect and R is reranking effect. Furthermore, VE is a function of Kakwani index (Kakwani) and average tax rate (ATR). ATR is simply the ratio of aggregate tax revenue and total household pre-policy income. We now extend the discussion on the other components.

Vertical Effect

In order to be able to measure Kakwani's vertical effect (Urban, 2009), or in other words, to calculate the redistributive effect alone not allowing for reranking, Reynolds and Smolensky (1977) propose an index which equals twice the area between the Lorenz curve of taxable income and the concentration curve of net income with respect to gross income (Lambert, 2001).[7] We use this definition of VE throughout the paper.

Reranking Effect

[7] The only difference between concentration and Lorenz curves is the ranking of the population. The former ranks according to the other distribution which is not the one associated with the ordinate. In this case, the concentration curve represents the y% of the net income held by bottom x% of the gross income.

Before giving a suitable mathematical expression for the reranking effect, it is important not to mistake the reranking effect as synonymous with the horizontal effect. The latter is caused by an unequal treatment of equals through the tax system. Yet horizontal inequity does not necessarily need to *rerank* income units after taxation (Aronson, Johnson, and Lambert, 1994). Reranking occurs when income earners change their positions from the income distribution before policy to the one after policy. Hence, we can state that reranking always implies horizontal inequity, while the opposite statement is a misleading one. For the purpose of this paper we will focus only on the reranking effect.

As previously stated, it is Atkinson (1980) and Plotnick (1981) who introduce an index to measure the reranking effect of income taxation as twice the area between the Lorenz curve of net income and the concentration curve of net income with respect to gross income (Lambert, 2001).

In summary, the vertical effect or the pure progressivity effect, calculated by the Reynolds-Smolensky index, measures the total increase in equality aroused by income taxation, while the reranking effect, calculated through the index introduced by Atkinson (1980) and Plotnick (1981), "*(…) measures how much of this equalizing effect is 'undone' by reranking*" (Verbist and Figari, 2014, p. 6).

The Kakwani Index

As mentioned in the previous section, Kakwani (1977a) not only shows that the redistributive effect captures a change in inequality alone, but he further introduces a progressivity measure known in the literature as the Kakwani index . He argues that the progressivity of income taxation should be measured as the departure from proportionality of a certain tax system.[8] Following this logic, Kakwani (1977a) introduces an index to measure the progressivity effect of income taxation as twice the area between the Lorenz curve of gross income and the concentration curve of taxes with respect to gross income (Lambert, 2001).

5 Methodology

We illustrate the data and micro-simulation model adopted and how the simulation scenarios are set up.

[8] A proportional tax system will result in the same Gini coefficient for pre-policy and post-policy income.

5.1 Data and Micro-simulation Model

In our model, all calculations are performed on income data from the Panel on Household Finances (PHF), a national wide panel survey about German household finances and wealth. The PHF is part of the Household Finance and Consumption Survey (HFCS), a joint effort which collects *ex ante* harmonized micro data in the euro area countries (Von Kalckreuth, Eisele, Le Blanc, Schmidt and Zhu, 2012).

Between September 2010 and July 2011, a net sample of 3,565 households were systematically surveyed on their balance sheets, pension claims, savings, incomes and other issues related to their finances. In the first wave of data collection, the households were asked about the information on the year 2009 (von Kalckreuth et al., 2012).

The tax micro-simulation model we use is further developed from a module of the net-gross conversion of income which is imbedded in the imputation process for PHF. This model is similar in many aspects to the Siena Micro-simulation Model (SM2) and EUROMOD.[9]

The main difference between the SM2 and the model we used is that we do not perform the iterative process between imputation and net-gross income conversion when some information required for conversion is missing.[10] In the case of social benefits, we only use the self-reported benefit incomes. We further use all lump-sum tax allowances for all the eligible households. Instead, EUROMOD imputes the social benefits income by assuming full take-up and matches with official tax statistics to enrich the individual-specific allowances. It will be shown below that our gross and net income distribution results match those presented by Gallego Granados and Ochman (2012) in the EUROMOD country report for Germany quite well.

Moreover, the PHF questionnaire allows the respondent to select from a flexible dimension of formats regarding income information: components (e.g. labor, capital, pension, social benefits,…), individual and household levels, time (yearly, monthly, quarterly, other specified duration or months whenever the flows are incomplete throughout the year), gross or net, quantity in brackets and different currencies. By the questionnaire construction, we assume the upfront income is answered. Hence, we first apply the tax rule regarding the upfront tax

[9] The SM2 is a flexible tool for net-gross income conversion and imputation used in some countries' process of EU-SILC (EU Statistics on Income and Living Conditions) data (Betti, Donatiello and Verma, 2011). EUROMOD, a tax-benefit micro-simulation model for the European Union (EU), which assesses the effects of taxes and benefits on household incomes in a comparative manner. For the case of Germany in 2009, it also uses EU-SILC data (Gallego Granados and Ochman, 2012).

[10] The iterative process consists in applying imputation and modelling routines iteratively and in combination (Betti et al. 2011). The iterative process seems to be ideal but rather more resource demanding.

(*Lohnsteuer*) in the beginning to conduct the conversion.[11] An optimization routine is carried out to infer the German specific tax class choice between the married partners (assuming the spouse minimizes the upfront tax). After the imputation, the income tax calculator (*Einkommensteuerrechner*) is used to derive the tax and social insurance contributions. Note the capital income is always separately treated by the flat rate withholding tax (*Abgeltungssteuer*).

Since we will investigate by how much we need to raise the top marginal income tax rate in order to compensate for the overall loss in tax revenue from fighting bracket creep, it is essential that both, the overall income tax revenue as simulated by our model as well as the tax burden shares, are consistent with the official statistics.

Although wealthy households are oversampled in the PHF (Schmidt and Eisele, 2013), the top rich households are still underrepresented in the PHF income distribution, compared to the yearly income taxes statistics (*Jährliche Einkommensteuerstatistik*) for 2009, as presented by the Federal Statistical Office (2013). For the reason stated above, it is necessary to "reweight" the PHF income distribution. In order to do so, we first divide the distribution of total amount of income (*Gesamtbetrag der Einkünfte*) into subsamples according to the same brackets defined by the income tax statistics (see Tabelle 3, Federal Statistical Office, 2013, p.8). Then we multiply the weights of all the income taxpayers in each subsample by one factor so that the aggregate tax paid within subsample matches with the official figure. Notwithstanding, since the PHF gathers no income taxpayers with a yearly gross income of € 2,500,000 or more, we multiply the weights of the richest subsample available in the PHF (those income taxpayers with a yearly income between 1,000,000 and € 2,499,999.99) by a factor high enough so that the weighted aggregate income from the income taxpayers with gross income above € 1,000,000 equal to the corresponding figure in the income tax statistics.

[11] The calculator for the upfront tax (Lohnsteuerrechner) is constructed by strictly following the protocol (PAP 2009) specified by the Federal Ministry of Finance (see *Geänderter Programmablaufplan für die maschinelle Berechnung der vom Arbeitslohn einzubehaltenden Lohnsteuer, des Solidaritätszuschlags und der Maßstabsteuer für die Kirchenlohnsteuer in 2009*: http://www.bundesfinanzministerium.de/Content/DE/Downloads/Steuern/Steuerarten/Lohnsteuer/Programmablaufplan/012_PAP_2009_a.pdf?__blob=publicationFile&v=4)

Table 3 Income Distribution in 2009: Equivalised Disposable Household Income (euros per year)

Decile Mean:	PHF Original	PHF Reweighted	PHF Ratio Reweighted/Original	EUROMOD	EU-SILC	GSOEP
1st	5692	5489	0.964	8316	6985	4014
2nd	10637	10619	0.998	11307	10969	9656
3rd	13222	13510	1.022	13447	13439	12330
4th	15518	16010	1.032	15345	15570	14460
5th	17650	18221	1.032	17138	17664	16573
6th	19937	20605	1.033	19056	19849	18751
7th	22939	23505	1.025	21365	22361	21373
8th	26465	26950	1.018	24516	25680	24720
9th	32202	32579	1.012	29069	30707	30284
10th	54945	61051	1.111	45370	50362	55764
Overall:						
Median	18758	19287	-	18058	18678	18586
Mean	21900	22833	-	20458	21264	21223
Gini	32.05	33.56	-	26.36	29.26	29.10

Notes: The "modified OECD" scale is used for equalizing incomes of households of different structure and size. The respective weights are 1 (first adult), 0.5 (subsequent adults) and 0.3 (children aged below 14).
Source: Own results using PHF data, EUROMOD simulations and EU-SILC micro data for 2009 and GSOEP micro data from the wave 2010 referring to the year 2009 (Gallego Granados and Ochmann, 2012).

Table 3 provides a comparison of equivalised disposable household income from different sources. By taking a closer look at the ratios from the reweighted to the original PHF decile means of net income, we observe PHF income data match rather well with the income tax statistics (Federal Statistical Office, 2013). Actually, the weighted proportions of total amount of income (*Gesamtbetrag der Einkünfte*) constructed from our original data according to the fine brackets in the income tax statistics agree with the reported ones satisfactorily (Tabelle 3, Federal Statistical Office, 2013, p.8).[12] Moreover, our results are rather close to the other three sources. In particular, our decile means are almost always inside the interval between EU-SILC and GSOEP. Mean and Median are also close.

5.2 Simulated Scenarios

In this section, we describe which steps we follow in the production of the empirical findings. For each inflation scenario, we proceed in the same manner as Immervoll (2005). We prorate all the income according to the inflation rate specified.[13] Micro-simulation is then performed

[12] This benchmark can be delivered upon request.
[13] Our study also partly relies on the assumption about zero real growth in income. Brenke and Grabka (2011) argue that real gross hourly wages in Germany have stagnated on average during the last decade.

based on the tax schedule without indexation, with indexation and with both indexation and rich tax. The net income data under each regime are all saved for analyzing the redistributive and revenue effects.

We fight the effect of bracket creep by inflation indexation which adjusts all nominally defined edges, slope coefficients, deductions and credits of the income tax schedule so that the average tax curve is unchanged.[14] The higher top marginal tax rate is simply solved via a root-finding process for one parameter (i.e. the flat rate for the highest income bracket, which is 45% under the tax rule in 2009) to keep revenue neutral between the last two regimes.

In this exercise, we profit from the strength of the micro-simulation approach, which "*(…) lies precisely in its ability to analyze one type of change at a time while holding 'everything else' constant*" (Immervoll, 2005, p. 44).

Furthermore, we recognize that the accuracy of our empirical findings might be enhanced by taking into account potential behavioral reactions from the very rich after an increase in the top marginal income tax rates given the empirical evidence (Schmidt and Müller, 2012). A potential method to count for these reactions would be to introduce a mid-range estimate from the empirical literature of the elasticity of taxable income for the affected group of households. Notwithstanding, we decided to keep this issue in mind for future development and to concentrate on the first order effects in the current paper.

6 Empirical findings

This section provides the quantitative answers on how bracket creep changes the equalizing effect of the tax system as well as the policy evaluation on the proposal of fighting bracket creep using rich tax.

6.1 Inverted U-shaped relationship of RE and inflation rate

We first contemplate how differently German households along the net income distribution would benefit from an adjustment of the income tax schedule to inflation, hence from fighting the effect of bracket creep, under different inflation scenarios. Since it is the mirror image of the distribution of bracket creep, the reversal figures provide the assessment of the impact from inflation.

[14] Note it is not a complete indexation since we leave alone the bracket creep from the social insurance contributions. It is realistic since Germany always enforces the indexation of income tax and social insurance contributions separately in the history. Our study focuses on the former which is currently in the limelight.

Table 4 Relief of the households' net incomes after fighting bracket creep under different inflation scenarios as a percentage of taxable income

Inflation rate	Deciles									
%	1	2	3	4	5	6	7	8	9	10
1	0.001	0.029	0.072	0.115	0.126	***0.135***	0.133	0.122	0.115	0.107
2	0.002	0.059	0.148	0.230	0.254	***0.268***	0.264	0.243	0.229	0.213
4	0.004	0.136	0.298	0.469	0.504	***0.528***	0.523	0.482	0.452	0.420
5	0.005	0.182	0.374	0.590	0.623	***0.662***	0.648	0.601	0.560	0.521
10	0.011	0.423	0.804	1.184	1.233	***1.302***	1.250	1.174	1.088	1.010
15	0.045	0.648	1.280	1.760	1.848	***1.907***	1.823	1.718	1.580	1.461
20	0.080	0.939	1.727	2.312	***2.461***	2.457	2.366	2.231	2.043	1.885
25	0.127	1.218	2.228	2.838	***3.039***	2.981	2.883	2.720	2.480	2.269
30	0.166	1.571	2.746	3.328	***3.595***	3.481	3.376	3.185	2.891	2.631
40	0.259	2.304	3.793	4.303	***4.596***	4.439	4.297	4.054	3.676	3.264
50	0.358	3.119	4.848	5.172	***5.483***	5.312	5.142	4.841	4.340	3.809
60	0.652	3.798	5.848	5.927	***6.378***	6.040	5.929	5.558	4.922	4.266
70	0.806	4.617	6.697	6.785	***7.091***	6.768	6.654	6.218	5.388	4.692
80	1.143	5.241	7.515	***7.770***	7.590	7.419	7.334	6.809	5.787	5.031
90	1.400	6.011	8.262	***8.498***	8.391	7.935	7.945	7.352	6.116	5.323

Notes: Decile groupings are determined by the distribution of the equivalised household disposable income (EHDI) in the regime without indexation. The "modified OECD" scale is used for equivalising incomes of households of different structure and size. The respective weights are 1 (first adult), 0.5 (subsequent adults) and 0.3 (children aged below 14). Individual relief is calculated as the difference of EHDI before and after indexation. Each cell contains the decile mean of the individual ratio of the relief and the equivalised taxable income.
The rank of the figures under each inflation scenario is represented by the extent of shading in the background. The heaviest represents the top and the lightest denotes the bottom. We also highlight the largest number in bold and italic font.
Source: Tax micro-simulation model using PHF.

Table 4 reveals such an evaluation. Every column depicts the mean percentage relief of German household's net income with respect to taxable income in every decile of the distribution. Independently of the decile observed, the higher the inflation rate to which the income tax schedule was indexed, the higher the relief of all household incomes. Notwithstanding, by regarding the reliefs in household income distribution, an up-and-down development becomes clear. The poorest as well as the richest households will not benefit as much in relative terms from an indexation of the income tax schedule as those households in the middle of the income distribution. This pattern is strongly related to the varying progression along the income tax schedule. A large number of household incomes will remain below the basic tax allowance even if their nominal incomes increase by 4%, while, on the opposite of the income distribution, the top two richest deciles face the flat marginal income tax rates. At the same time, all those household incomes that are in the linear progressive part of the income tax function will thus experience a higher relative income tax load for every additional Euro they earn. Bach et al. (2013b) gather similar results when analyzing the relief effect for households after applying the different income tax reform proposals presented by the most powerful political parties.

In addition, the rank of relative relief is not constant under different inflation scenarios. As inflation grows, the poorer receives more relative relief than the richer. The largest winner gradually shifts from the rich middle class (6th decile) to the poor middle class (4th decile; see the column highlighted in bold font).

To investigate the underlying mechanism, we turn to the Kakwani decomposition of RE introduced in the section 4. Table 5 contains this result for the selected inflation scenarios when indexation is not introduced.

Table 5 Redistributive effect (RE) of the tax system in Germany (2009) under different inflation scenarios (without indexation)

Inflation rate %	G_{pre}	G_{post}	RE	ATR	Kakwani	VE	R
0	0.40766	0.33559	0.07206	0.26269	***0.21689***	0.07727	0.00521
1	0.40766	0.33557	0.07209	0.26384	0.21570	0.07731	0.00522
4	0.40766	0.33540	0.07226	0.26693	0.21289	0.07752	0.00526
10	0.40766	0.33520	0.07245	0.27282	0.20735	0.07779	0.00534
20	0.40766	0.33517	***0.07248***	0.28183	0.19853	***0.07791***	0.00543
30	0.40766	0.33534	0.07232	0.28997	0.19050	0.07780	0.00548
60	0.40766	0.33640	0.07126	0.30984	0.17093	0.07674	***0.00548***
90	0.40766	***0.33769***	0.06996	***0.32496***	0.15647	0.07533	0.00536

Notes: G_{pre} represents the Gini of gross income and G_{post} is the Gini of EHDI after inflation. RE represents the redistributive effect, VE represents the vertical effect, Kakwani shows the Kakwani Index and ATR represents the average tax rate.
The rank of the figures in each column is represented by the extent of shading in the background. The heaviest goes to the top and the lightest denotes the bottom. We also highlight the largest number in bold and italic font.
Source: Tax micro-simulation model using PHF.

It becomes evident that there is an inverted U-shaped RE when inflation increases. This simply echoes the evidence found above about the relative relief. The highest RE is associated with about 20% of inflation. In the other exercise where all the social benefit incomes totally lag in nominal compensation (which does happen in reality), the peak arrives under only about 4% of inflation.[15] This fact is in contrast with Immervoll (2005) which shows that fiscal

[15] We can deliver this result upon request.

drag always intensifies the RE and this effect is monotonic with inflation. Similar to his study, bracket creep worsens the progressivity of the tax system as the Kakwani index drops when inflation grows but the ever increasing average tax counteract with the progressivity effect. We show the effect of average tax does not dominate as claimed by Immervoll (2005) any more. VE also bears the pattern of inverted U-shaped development which is the function of Kakwani index and ATR.

To explore the causes of the inverted U-shaped development, we further decompose the RE purely introduced by bracket creep into the contributions by income tax (IT) and social insurance contribution (SIC). The part belonging to SIC is the RE between the net income distribution when there is no inflation and that when there is inflation as well as indexation. The part owning to income tax is the RE between the net income distribution when there is inflation as well as indexation and the one when there is inflation but without indexation. By doing so, we isolate the RE due to bracket creep from the part inherent in the tax system itself. Table 6 presents this result.

Table 6 Extra redistributive effect (RE) owning to the bracket creep effect on income tax and social insurance contributions (SIC) in Germany (2009) under different inflation scenarios

Inflation rate	Income Tax							SIC
%	G_{pre}	G_{post}	RE	ATR	Kakwani	VE	R	RE
1	0.3357	0.3356	0.0001	0.0011	***0.1189***	0.0001	***0.0000***	***-0.0001***
4	0.3359	0.3354	0.0005	0.0045	0.1127	0.0005	0.0000	-0.0003
10	0.3363	0.3352	0.0011	0.0112	0.1018	0.0011	0.0000	-0.0007
20	0.3370	0.3352	0.0019	0.0218	0.0859	0.0018	0.0000	-0.0014
30	0.3376	0.3353	***0.0023***	0.0319	0.0715	***0.0022***	-0.0001	-0.0020
60	0.3385	0.3364	0.0021	0.0584	0.0355	0.0020	-0.0002	-0.0029
90	0.3384	***0.3377***	0.0007	***0.0798***	0.0056	0.0004	-0.0003	-0.0028

Notes: For measuring the income tax, G_{pre} represents the Gini of EHDI after indexation and G_{post} is the Gini of EHDI after inflation but without indexation. For measuring SIC, G_{pre} represents the Gini of EHDI when inflation is nil and G_{post} is the Gini of EHDI after indexation. RE represents the redistributive effect, VE represents the vertical effect, Kakwani shows the Kakwani Index and ATR represents the average tax rate. To save the space, we only demonstrate the RE for SIC.
The rank of the figures in each column is represented by the extent of shading in the background. The heaviest goes to the top and the lightest denotes the bottom. We also highlight the largest number in bold and italic font.
Source: Tax micro-simulation model using PHF.

The overall equalizing effect measured by RE from the income tax again bears an inverted U-shaped relationship with inflation rate. This should be explained again by the interaction of progressivity (Kakwani index) and average tax rate.[16] The overall RE from SIC shows ever increasing regressivity. This is due to the ceiling stipulated in the SIC schedule. Therefore, we can infer that the opposite progressivity relationships with inflation rate between IT and SIC introduces the other channel inducing the inverted U-shaped relationship in the overall tax system, besides the interaction between progressivity of tax schedule and ever increasing tax burden.

6.2 Fighting bracket creep by the rich tax

We then turn to the evaluation of the redistributive and revenue effect of the proposal to raise the rich tax to fund the indexation.

Table 7 Redistributive effect (RE) explained by indexing the income tax schedule and by raising the top marginal income tax rate in Germany (2009) under different inflation scenarios

Inflation rate %		G_{post}	RE	ATR	Kakwani	VE
1	Indexation	0.3357	-0.0001	-0.0011	0.1189	-0.0001
	Rich tax	0.3350	0.0007	0.0011	0.6625	0.0007
4	Indexation	0.3359	-0.0005	-0.0045	0.1127	-0.0005
	Rich tax	0.3331	0.0028	0.0042	0.6622	0.0028
10	Indexation	0.3363	-0.0011	-0.0112	0.1018	-0.0011
	Rich tax	0.3293	0.0070	0.0105	0.6618	0.0070
20	Indexation	0.3370	-0.0019	-0.0218	0.0859	-0.0018
	Rich tax	0.3238	0.0132	0.0197	0.6611	0.0133

Notes: Two scenarios are presented for each case of inflation rate. The Indexation row shows the pure effect from indexation: G_{pre} represents the Gini of EHDI after inflation but without indexation and G_{post} is the Gini of EHDI after indexation. The Rich tax row displays the pure effect from rich tax: G_{pre} represents the Gini of EHDI after indexation and G_{post} is the Gini after both indexation and rich tax. G_{pre} is not shown to save the space. RE represents the redistributive effect, VE represents the vertical effect, Kakwani shows the Kakwani Index and ATR represents the average tax rate.
Source: Tax micro-simulation model using PHF.

Table 7 shows the change in different progressivity measures (as well as in the average tax rate) that would arise, first, from solely indexing the income tax schedule, and second, from

[16] As documented in Immervoll (2005), there are mass points of the income distribution in front of the kink points of tax schedule where marginal tax rate jumps. This results from the behavioral response predicted from the standard labor supply model (see the analysis and empirical evidence discussed by Saez (2010)). Similar to other countries, the main spike occurs before the first tax band so that a large portion of population is exempt from the tax system. Bracket creep will push many of them to start paying tax. This evidence can be the main driver to lower the progressivity. On the other hand, given the fact that many households have the taxable income subject to the linear progressive part of tax schedule, there is significant increase of relative tax burden. Since this growing load happens at the most progressive part of the tax schedule, the increasing progressivity could have been achieved even if their marginal tax rate did not change. The importance of this latter aspect explains the dominance of the effect from the average tax rate.

raising the top marginal income tax rate to balance the tax revenue once the income tax schedule has been indexed. We only focus on the range of inflation where using rich tax is fiscally sustainable (it might be politically infeasible) so that the rich tax required for compensation is below 100%.[17] As discussed above, in this area, indexation increases the inequality (RE is negative) because the bracket creep is progressive. By raising the rich tax, the drop of inequality introduced can more than compensate for the loss from indexation (RE is positive and larger than the one from indexation only in the absolute term). This equalizing effect is so strong so that the Ginis of the final net income distribution are even lower than 0.3356, the Gini of the initial net income distribution when there is no inflation.[18] The high inflation can even intensify this effect.

The exceeding equalizing effect from charging rich tax is mainly driven by the rising progressivity. The reason for the strong increase in the Kakwani index once the top income tax rate has been raised is the strong increase in the concentration of the tax burden for the richest households while the rest of the population are not affected. On the other hand, as expected, the average tax rates almost offset each other between these two scenarios.[19]

Table 8 Income tax revenue loss after fighting bracket creep and the corresponding top income tax rates to balance the budget under different inflation scenarios

Inflation rate %	Income tax revenue loss (in billion euros)	Top marginal tax rate required
1	0.92	47.06%
4	3.53	53.12%
10	8.24	65.24%
20	14.81	82.81%
25	17.62	92.82%

Source: Tax micro-simulation model using PHF.

Finally, Table 8 demonstrates the tax revenue loss after fighting bracket creep under 5 different inflation scenarios and their adjusted top marginal income tax rates needed to fully compensate for the loss. For instance, if inflation as well as nominal incomes had increased by 4%, the government would have raised around €3.53bn more in real income taxes, even

[17] It will reach 100% when inflation rate is between 25-30%.

[18] Note the gini after indexation only does not return to 0.3356, the initial state. The reason is that we leave SIC unindexed.

[19] They are not perfectly compensated because we apply an iterative root-finding process to solve the rich tax required whose stopping rule is finally hinged by the accuracy demanded for the tax rate.

though real incomes experienced no change at all. This €3.53bn represents a redistribution of wealth from the households to the government which is to be fully attributed to the effect of bracket creep. If the government were to index the income tax schedule to inflation to give this extra amount of tax revenue back to the households, and at the same time were willing to raise this amount from taxing the rich more, they would have to increase the top marginal income tax rate from the current 45% up to 53.12%.

In a country like Germany where there is no automatic indexation, it is not unrealistic to build up relatively high inflation which requires a very high rich tax. We can show that we will have to increase the top rich tax to above 75% when the government does not act for four years and inflation is constant at 4% annually.[20] The additional two more years of inertia (with cumulated inflation being about 26.5%) will cost the government to charge a more than 100% rich tax. This can be just unsustainable. Our results would suggest a quick action if we prefer a revenue-neutral and inequality favorable solution such as what we propose. For 1% inflation rate, the rich tax required is about 47% which is not much different from now. And there is almost no exaggeration in terms of inequality reduction (Table 7 shows the Gini returns to 0.3350 which is almost same as the initial 0.3356 compared to much higher inflation scenarios).

7 Symmetric adjustment

So far our proposal might not convince the richest voters to support it who will mainly suffer from the rich tax while they may indirectly benefit through a long-run growth due to inflation indexation. The remedy can be a rule to guarantee a downward modification of top marginal tax rate when the bracket creep induces a revenue surplus for the government. This simply mirrors the upward movement of rich tax and inflation indexing so that it can be inequality and revenue neutral too. By doing so, we achieve many features shared by the *inequality indexing* proposed by Burman et al. (2007).

The tax system can be perceived as a risk management tool. Since people is uncertain on their future position in the income distribution and risk-avert, there will be willingness to pool risk across income strata such that any progressive redistribution (e.g. inflation indexing) should be accompanied by a regressive action (e.g. rich tax) (Shiller, 2003). On the other hand, the symmetric commitment provides the other layer of insurance for those less uncertain on their

[20] The cumulated inflation is 17% ($\approx 1.04^4 - 1$).

rank given the cyclical nature between bracket creep and inflation indexing. Additionally, the fluctuation of post-policy income distribution is lower than the pre-policy one.

Bracket creep or inflation indexation is often deemed as either the by-product or direct measure of the pro-growth policies. Maintaining a stable relative gain across the income strata and both policy regimes will stimulate much broader political support for pro-growth policies.

Targeting such a system of symmetric adjustment forehand towards enhancing the equalizing power can effectively frame the inequality concern into the tax system. The individual tends to pay more attention to abstract values if they are bundled with a future decision than a recent one. Explicit exposure to the notion of balancing the redistributive effect can psychologically ignite the audience to credit the proposed policy with inequality-reducing nature and further convince them to take supportive action.

Much opposition to inflation indexation is driven by the concern on the loss of tax revenue. Our proposal wipes out this concern by redistributing within the taxpayers instead of between government and taxpayers.

Besides a solution to the fiscal sustainability, our proposal also contributes to the political sustainability. Because it is essentially symmetric, the status of winner/loser is interchangeable between the inflation and indexing scenarios. This system can be interpreted to be fair *ex ante* which also improves the framing effect.

8 Conclusions

From the current legislation period onwards, the German government plans to assess the effects of bracket creep every two years. The question remains unanswered whether the government will fully index the income tax schedule or further enforce discretionary adjustments to fight the effect of bracket creep. The main resistance to act against bracket creep is the insistence on restraining from any new structural debt by 2020. However, the inequality consideration has not yet been put on the same table with this revenue defense.

Our study supplies such an answer by investigating the redistributive effect of bracket creep and evaluating a proposal to finance the inflation indexation by a rich tax to raise the top marginal tax rate. This is currently a political in-between solution either part of which is supported by the left and right parties.

In our analysis, we use a tax micro-simulation model developed for the 2009 income distribution from the newly available PHF data. The simulation reveals that the required top rich tax has to be above 75% if no action has been taken against bracket creep for four years under a 4% yearly inflation. When the cumulated inflation is not high enough to induce above 100% rich tax in our policy proposal, indexing funded by a rich tax can be more than inequality neutral such that Gini of post-policy income is even lower than the one with zero inflation. These results would suggest a government impatient towards bracket creep is favorable.

By simulating under a more complete list of inflation rates compared to Immervoll (2005), we produce an inverted U-shaped overall redistributive effect from the tax system when inflation grows. The reduction of tax progressivity and enlarging average tax burdens are still consistent with the findings from Immervoll (2005). Besides, we also argue that the regressivity of the social insurance contributions observed offsets the effect from the income tax, which also contributes to the inverted U-shaped relationship of the overall equalizing effect and inflation rate. On the other hand, the general study of the relationship between redistributive effect and inflation rate should be an arena to discuss the interaction of monetary and fiscal policies.

Using this finding under a fiscal leadership regime, we claim that delaying indexation does not enhance the equalizing effect of the tax system always. To postpone the action against bracket creep is not always supported when the inequality becomes the major concern.

Furthermore, we put forward a symmetric adjustment which complements the current proposal by guaranteeing a reduction of the top marginal tax rate when bracket creep leads to revenue surplus. Similar to the *inequality indexing* raised by Burman et al. (2007), we also argue that our proposal can serve as a pro-growth, risk reducing, revenue-neutral and framing effective policy.

On the other hand, we should also bear in mind that there is a distance between our simulation environment and the reality. Similar to the drawbacks in the EUROMOD summarized by Immervoll (2005), in spite of the precise match with the income tax statistics and other sources, we also have the differences in definitions of what is counted in a given tax category, tax evasion, less than perfect representation of tax rules in model algorithms and, importantly, shortcomings in the underlying micro-data such as underrepresentation of high income groups or missing information about tax deductible expenses.

While our reweighting on the top rich should have pulled the revenue effect studied through the paper in line with the income tax statistics, we do not recover the distribution perfectly accurately. The real income distribution should be more concentrated because we retrieve the missing income from the top rich by inflating the population of less richer subgroup instead of imputing this small group in the very end of the income distribution. We can then infer that our result is simply a conservative estimate because this small group of top rich taxpayers has their individual taxable income much higher than the edge of the last bracket in the tax schedule so that they will always be subject to the rich tax levied from our proposal and receive no gain from indexation. This line of argument should also work in the same direction for our ignorance of the distortionary property of the rich tax.

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