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# Reforming a complicated income tax system: The political economy perspective

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**Abstract**

In this paper we analyze the political economy of revenue-neutral income tax reforms when a government aims at cutting back deduction possibilities in exchange for lower tax rates ("tax-cut-cum-base-broadening"). We show that the individual decision whether to support or reject a reform proposal depends on how strongly the voter is affected by all available exemptions, even if the cut of only one single exemption is at stake. The voting outcome in the society depends on the joint distribution of the deductible characteristics. Due to implicit logrolling there are cases where only symmetrical tax reforms are possible, whereas for other properties of the joint distribution only asymmetric cuts of privileges are politically viable.


## 1. Introduction

Many continental European countries have high income tax rates but extremely complicated rules about how to determine the individual tax base due to many parallel deduction possibilities (Elschner et al., 2003; OECD, 2001). It is frequently argued that this is harmful for the economy because of high information costs for understanding all relevant tax laws (Aaron et al., 1999), and because of problematic distributive effects, as

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typically only the rich hire expensive advisors who know all available legal possibilities to save taxes (Pechman, 1987). Many economists, international organizations and policy commentators therefore prefer a simpler income tax system with fewer exemptions, a wider tax base and lower tax rates (e.g. OECD, 2001). Although some European countries have recently taken steps to implement structural reforms of their income tax systems in this direction, it seems fair to say that there is still a great reluctance to adopt a *tax-cut-cum-base-broadening*. Presumably this is so because of political constraints. In rhetoric there is a broad consensus among policy makers that a simplification of the tax system is desirable but the opposition of voters who are negatively affected by abolition of deduction possibilities is seen as a major obstacle in the reform process.

It is therefore important to analyze the political economy of structural income tax reforms. This is the aim of this paper, which looks at reforms of a "complicated" income tax system, which we define as a system with more than one initial deduction possibility. The government wants to broaden the tax base in exchange for lower tax rates by cutting back or abolishing one, several or all available exemptions. Yet, any specific proposal must win the support of the majority of voters in order to be politically feasible. The main contribution of our analysis is to show how interdependence of tax exemptions influences the voting behavior of individuals and consequently voting outcomes in the society as a whole.

We show that the decision of a single voter whether to support or reject the isolated cut or abolition of *one* tax exemption crucially depends on how strongly he or she is affected by the other deduction possibilities, even though they play no role in the government's reform proposal. To give a concrete example, consider a tax system with two initial deduction possibilities, the deductibility of commuting expenses and of nightwork income. Both are quite common exemptions in European income tax systems. Our analysis implies that the more a voter commutes, the more reluctant he or she is to support the isolated cut of the exemption of nightwork income. This can even lead to the paradoxical situation that some voters reject the cut of a tax exemption from which they nearly do not benefit. That is, voters can reject the abolition of the deductibility of nightwork income in exchange for lower tax rates even though they hardly ever work at night! On the other hand, individuals can also support the abolition of an exemption even though they are affected more than the average voter in the society. This interdependence has an important implication for tax reform. When the government is interested in the political chances of an isolated cut of the nightwork privilege, it is insufficient only to look at how much the voters work at night. To see the full picture, the government also needs to look at how much voters are affected by the other tax exemption, i.e. at how much people commute.

In the paper we will present a simple method for how the government can correctly address the political feasibility of any specific strategy to implement a tax-cut-cum-base-broadening in a system with two initial exemptions. Which reforms are politically feasible depends on the joint distribution of the two tax relevant characteristics across the voting population and implicit logrolling can arise as an important feature that shapes the voting outcome in a "complicated" income tax system. Lastly, the interdependence of the tax exemptions raises the question whether the single exemptions may contribute to their persistence, i.e. whether the existence of one deduction possibility per se lowers the political possibilities to cut back another one. This question is also analyzed below.

There is some related literature, but the political economy of revenue neutral reforms of complicated income tax systems has been neglected so far. One strand studies (tax) reforms in presence of individual uncertainty (Konrad, 2004; Fernandez and Rodrik, 1991). This literature explains the failure of reforms by asymmetric information about whether one belongs to the winners or losers, but it is not concerned with different tax reform strategies. The authors that discuss the various pros and cons of a simple income tax system (e.g. Krause, 2000; Aaron et al., 1999; Hall and Rabushka, 1985) do not address the question why a simple tax system is not implemented if it is desirable from a normative point of view. Another related strand comes from a different field of economics, that of transition from socialism, where researchers have addressed the optimal implementation strategy (*gradualist* or *big bang*) of reforms (see Dewatripont and Roland, 1992a,b; Wei, 1997) and have stressed the different welfare implications of these strategies. Also the argument of Coe and Snower (1997) is related in this respect that fundamental labour market reforms are superior to incremental ones.

In this paper we pursue a different path. Even though the question we ask goes beyond the existing literature, our framework is still simple. Every voter in our model is fully informed about the impact of a tax reform on his or her personal tax payment and makes a rational voting decision. We neglect all *efficiency* effects of a tax reform and we also abstract from all *lobbying* arguments, which are often heard in discussions about the relative political merits of symmetric versus asymmetric, or radical versus small tax reform approaches. For example, it seems to be a prominent prejudice among policy makers that (if at all) only small changes in the status quo are realistic. A drastic abolition of several deduction possibilities is seen as being out of range, since it would "cause a rebellion of all lobby groups in society at once", as the German minister of finance has recently put it. On the other hand, a "pressure group argument" is often used to argue that symmetric reforms are easier to implement than asymmetric ones. If there is an asymmetric cut in privileges, a large group in society might be affected positively. However, this gain might be very small and negligible for the voting behavior of these individuals. On the contrary, some small group will lose heavily and spend a great lobbying effort to defend its tax privilege. According to this argument, tax reforms are realistic only where the burden of foregone tax privileges is split evenly among many groups in society. In our paper, pressure groups and lobbies play no role. We use the most simple one-person-one-vote framework and our analysis thus relies on entirely different mechanisms. This is done in order to highlight the political implications of the interdependence of tax exemptions as clearly as possible.

The rest of the paper is organized as follows. In Section 2 we introduce our basic model structure and in Section 3 we analyse the voting behavior of a single individual on different tax reform scenarios. In Section 4 we look at the society as a whole and in Section 5 we provide a conclusion.

## 2. The model

Consider an economy consisting of $n$ individuals, each endowed with an identical gross income $y$. There is a proportional income tax system. Initially the government allows for $m > 1$ deduction possibilities from the tax base that are denoted by $[a_j]$, $j = 1,\ldots,m$. These exemptions matter differently for the single individuals. The individual-specific values of the deductible exemptions of agent $i$ are denoted by $a_j^i$. Her total tax payment $T_{(1)}^i$ in the initial situation, labeled *scenario 1*, is given by

$$T_{(1)}^i = t_{(1)} \left( y - \sum_{j=1}^{m} a_j^i \right), \tag{1}$$

where $t_{(1)}$ is the proportional income tax rate. We assume that every individual makes a strictly positive tax contribution, i.e. $\sum_j a_j^i$ is strictly lower than $y$. The after-tax income is used to purchase a private consumption good for which the price is normalized to unity. Tax revenue is used to finance a public good $g$. In order to abstract from the income effects of a tax reform, utility of agent $i$ is assumed to be quasi-linear,

$$U_{(1)}^i = y - T_{(1)}^i + h(g) = y\left(1 - t_{(1)}\right) + h(g) + t_{(1)} \sum_{j=1}^{m} a_j^i, \tag{2}$$

with $h'(g) > 0$. The (binding) budget constraint of the government in the initial scenario can be written as

$$\sum_{i=1}^{n} T_{(1)}^i = t_{(1)} \left[ ny - \sum_{i=1}^{n} \sum_{j=1}^{m} a_j^i \right] \stackrel{!}{=} v\, g, \tag{3}$$

where $v$ is the relative price of the public good. Using (2) and (3), the optimal supply of the public good $g$ is determined by the usual condition $nh'(g) = v$. The efficient quantity of the public good can be treated as a constant term $g^*$, and the optimal government expenditure level is thus fixed at $vg^*$. The tax rate $t_{(1)}$ necessary to finance this budget can be computed directly from (3).

In this initial scenario, the government wants to implement a revenue neutral tax reform. We make the simplifying assumption that the state is the *agenda setter* and makes only one reform proposal in the time period that we consider. This proposal either gets the support of the public (and is implemented), or the status quo prevails.[1] As reform scenario $x$ we denote the situation, where the government aims to cut back exemption $[a_j]$ by a fraction $0 \leq y_j \leq 1$. The tax payment of individual $i$ in scenario $x$ is

$$T_{(x)}^i = t_{(x)} \left( y - \sum_{j=1}^{m} \left(1 - \gamma_j\right) a_j^i \right), \tag{4}$$

where $t_{(x)} \leq t_{(1)}$ is the post-reform income tax rate that is necessary to finance the unchanged state budget. The post-reform utility of individual $i$ is given by

$$U_{(x)}^i = y - T_{(x)}^i + h(g) = y\left(1 - t_{(x)}\right) + h(g) + t_{(x)} \sum_{j=1}^{m} \left(1 - \gamma_j\right) a_j^i. \tag{5}$$

Voter $i$ supports the tax reform if the utility differential $\hat{U} \equiv U_{(x)}^i - U_{(1)}^i$ is strictly positive. The reform is rejected if $\hat{U} < 0$ and the voter is indifferent between the status

[1] A justification of this assumption is that a government realistically will make only one major tax reform proposal per legislative period, which in case of implementation will be valid at least until the next election.

quo and the government's proposal if $\hat{U}=0$. The utility differential can be computed as

$$\hat{U} = T^i_{(1)} - T^i_{(x)} = \left(t_{(1)} - t_{(x)}\right)\left(y - \sum_{j=1}^{m} a^i_j\right) - t_{(x)} \sum_{j=1}^{m} \left(\gamma_j a^i_j\right). \tag{6}$$

Eq. (6) implies that a voter will support the tax reform if it reduces the personal tax payment. Note that the first term of the right-most expression is positive and denotes the effect of lower tax rates following the implementation of the tax reform, whereas the second term is negative and depicts the effect of the lost tax privileges.

In this analysis we have made two important assumptions. Firstly, we have neglected all *efficiency* effects of a tax reform. The gross income $y$ is exogenous and remains constant after a reform. Secondly, also the $a^i_j$'s were treated as exogenously given parameters that are invariant with respect to the tax system. Recalling the example from above, where one $a_j$ represents the deductibility of commuting expenses, the exogeneity of $a^i_j$ implies that agents do not change their commuting behavior because of a change in tax incentives. Both simplifying assumptions can be criticized. Firstly, welfare gains are an important rationale for revenue neutral tax reforms. Many economists would argue that they lead to higher gross incomes, e.g. because more investment is induced due to the simplified income tax system. In fact, the absence of welfare gains raises the question why the government wants to implement a reform at all. The second assumption is subject to an obvious "Lucas critique". In reality the individual $a^i_j$'s are not exogenously given, but result from an optimization process that is also influenced by tax incentives. Optimizing agents might thus adjust their $a^i_j$'s after a tax reform. We have made these two assumptions in order to focus on a pure political-economy mechanism that neither depends on efficiency gains, nor on induced behavioral responses. But before proceeding with the analysis in the next section, we briefly consider how a relaxation of these assumptions would affect our model.

Firstly, suppose that the tax reform would also lead to a higher gross income. In particular, let the post-reform income be $y_{(x)}=y+\Delta y_{(x)}$, where $\Delta y_{(x)}\geq 0$ denotes the growth effect. Secondly, suppose that the initial $a^i_j$'s result from an underlying optimization process that we do not explicitly model. For example, the commuting distance of individual $i$ is optimally chosen, given such things as housing and commuting costs, and given the initial tax incentives. Let the post-reform value of the deduction possibility, $a_{j,(x)}^i$, be written as $a_{j,(x)}^i= (1-y_j)(a^i_j+\Delta a_{j,(x)}^i)$. Since we do not explicitly consider the (re-)optimization, we can not be certain about the sign of $\Delta a_{j,(x)}^i$. It seems intuitively plausible to expect $\Delta a_{j,(x)}^i<0$, because voters will tend to reduce their commuting distance if the tax incentive for commuting is cut (see e.g. Wrede, 2000). Keeping track of both effects in the post-reform utility level, (5) would change to $U^i_{(x)} = \left(y + \Delta y_{(x)}\right)\left(1 - t_{(x)}\right) + h(g) + t_{(x)} \sum_{j=1}^{m} \left(1 - y_j\right)\left(a^i_j + \Delta a^i_{j,(x)}\right)$, and the utility differential $\hat{U}$ now reads as

$$\begin{aligned}\hat{U} &= \left(t_{(1)} - t_{(x)}\right)\left(y - \sum_{j=1}^{m} a^i_j\right) - t_{(x)} \sum_{j=1}^{m} \gamma_j a^i_j + \left(1 - t_{(x)}\right)\Delta y_{(x)} \\ &\quad + t_{(x)} \sum_{j=1}^{m} \left(1 - \gamma_j\right)\Delta a^i_{j,(x)}. \end{aligned}\tag{7}$$

Compared to (6), expression (7) has two additional terms. The third term is positive and shows that the anticipation of a growing net income $\Delta y_{(x)}>0$ induces voters to accept a tax reform more easily. It is even possible that the growth effect $\Delta y_{(x)}$ is so strong that the third term always dominates $\hat{U}$: If a tax reform would cause a massive income growth, then *any* individual would *always* support this reform. The fourth term is negative with $\Delta a_{j,(x)}^{i}<0$ and positive with $\Delta a_{j,(x)}^{i}>0$. Considering the case with $\Delta a_{j,(x)}^{i}<0$, (7) implies that voters are less willing to support a tax reform proposal with induced behavioral responses. If people reduce their tax relevant characteristics $a_j^i$, they can deduct even less after a tax reform and the broadening of the government's tax base is larger with the negative behavioral responses than without them.[2] With an unchanged state budget, the drop of the tax rate $t_{(x)}$ is thus smaller. This is unattractive for the voters and explains why this makes voters more reluctant to accept a reform.

In the remainder of this paper we will impose $\Delta y_{(x)}=$ and $\Delta a_{j,(x)}^{i}=0$ in (7) and focus on the trade-off between lower tax rates and a wider tax base described in (6).

## 3. Individual voting decision on different tax reform scenarios

Consider the voting behavior of a single individual on the tax reform proposal $x$. The voter is indifferent if the individual tax payment remains unchanged before and after the reform. Using (1) and (4), we can write the indifference condition $T_{(x)}^{i}=T_{(1)}^{i}$ in the following form

$$\frac{t_{(x)}}{t_{(1)}}=\frac{y-\sum_{j=1}^{m}a_j^i}{y-\sum_{j=1}^{m}(1-\gamma_j)a_j^i}. \tag{8}$$

From the budget constraint of the state, Eq. (3), with an unchanged expenditure level of the state, we can compute the relative tax rate $(t_{(x)}/t_{(1)})$ as

$$\frac{t_{(x)}}{t_{(1)}}=\frac{y-\sum_{j=1}^{m}\bar{a}_j}{y-\sum_{j=1}^{m}(1-\gamma_j)\bar{a}_j}. \tag{9}$$

$\bar{a}_j$ denotes the average deduction of $[a_j]$ in the voting population in the initial scenario. Substituting (9) in (8) and separating the first exemption $[a_1]$ we have

$$\frac{y-a_1^I-\sum_{j=2}^{m}a_j^i}{y-\bar{a}_1-\sum_{j=2}^{m}\bar{a}_j}=\frac{y-(1-\gamma_1)a_1^i-\sum_{j=2}^{m}(1-\gamma_j)a_j^i}{y-(1-\gamma_1)\bar{a}1-\sum_{j=2}^{m}(1-\gamma_j)\bar{a}_j}.$$

[2] An example might illustrate this: Suppose the commuting distance of all individuals is $d_{(1)}$ kilometers before the tax reform, and the deduction possibility is $c$ cents per kilometer. The tax reform without behavioral responses leads to a deduction of $(1-\gamma)c$ cents per kilometer, applied on an unchanged commuting distance $d_{(1)}$ and thus to a larger tax base in the society. With behavioral responses, there is an additional base broadening, because the individuals reduce their commuting distance to $d_{(x)}<d_{(1)}$, on which the $(1-\gamma)c$ cents per kilometer are applied.

Solving for $a_1^i$ we reach the following general condition that an individual $i$ is indifferent between the tax reform proposal $x$ and the initial scenario

$$a_1^i = \frac{y\left[\gamma_1\bar{a}_1 + \sum_{j=2}^{m}\gamma_j\bar{a}_j\right] - \sum_{j=2}^{m}\left(a_j^i\left[\gamma_j y + (\gamma_1 - \gamma_j)\bar{a}_1\right]\right)}{\gamma_1 y + \sum_{j=2}^{m}(\gamma_j - \gamma_1)\bar{a}_j} \equiv \tilde{a}_{1,(x)}. \tag{10}$$

The voter rejects proposal $x$ if the individual value of $a_1^i$ is greater than $\tilde{a}_{1,(x)}$, and supports the proposal if $a_1^i < \tilde{a}_{1,(x)}$.

The simplest case of a "complicated" income tax system is one with two initial deduction possibilities $[a_1]$ and $[a_2]$ that the governments can cut back with rates $\gamma_1$ and $\gamma_2$, respectively. Since it reduces notation and allows for instructive graphical illustrations, we will set $m=2$ from now on. However, the results on the individual voting behavior that we derive in this paper can be generalized to an environment with more than two exemptions.[3] Setting $m=2$ in (10), the critical level for the support/rejection-decision of tax reform $x$ becomes

$$a_1^i = \frac{y[\gamma_1\bar{a}_1 + \gamma_2\bar{a}_2] - \left(a_2^i\left[\gamma_2 y + (\gamma_1 - \gamma_2)\bar{a}_1\right]\right)}{\gamma_1 y + (\gamma_2 - \gamma_1)\bar{a}_2} \equiv \tilde{a}_{1,(x)}. \tag{11}$$

This function $\tilde{a}_{1,(x)}[a_2^i, \bar{a}_1, \bar{a}_2, \gamma_1, \gamma_2, y]$ can be understood as an "indifference curve" that separates the supporters from the opponents of tax reform $x$ in the $(a_1^i, a_2^i)$-space. We summarise some important properties of this "indifference curve" in the following propositions.

1. The indifference curve (11) is a negatively sloped, linear curve in the $(a_1^i, a_2^i)$-space.
2. The curve must go through the point where $a_1^i = \bar{a}_1$ and $a_2^i = \bar{a}_2$.
3. The curve cuts the vertical axis at some value $a_1^i > \bar{a}_1$ and the horizontal axis at some value $a_1^i > \bar{a}_1$.
4. The slope of the indifference curve is equal to $-1$ if $\gamma_1 = \gamma_2$. It is steeper than $-1$ if $\gamma_1 < \gamma_2$ and flatter than $-1$ if $\gamma_1 > \gamma_2$.

The proof of part ($i$) follows from the fact that derivative of (11) with respect to $a_2^i$ is negative,

$$\frac{\partial\tilde{a}_{1,(x)}}{\partial a_2^i} = -\frac{\gamma_1\bar{a}_1 + \gamma_2(y - \bar{a}\,1)}{\gamma_2\bar{a}\,2 + \gamma_1(y - \bar{a}_2)} < 0 \tag{12}$$

[3] In particular, note that the critical level $\tilde{a}_{1,(x)}$ in (10) depends negatively on the sum of all other available deduction possibilities $\left(\sum_{j=2}^{m} a_j^i\right)$. This readily illustrates that one fundamental insight carries over to the case with $m>2$, namely that a voter is more reluctant to accept a reform the stronger she is affected by other deduction possibilities that are not at stake in the reform proposal of the government. In a different paper (Barbaro and Südekum, 2005) we show that this result also applies in even more general settings with a non-proportional tax system and heterogeneous gross incomes.

and from the fact that the second order derivative is zero. To prove part (*ii*), we show that a voter with an individual value $a_2^i$ equal to the average $\bar{a}_2$, who is located on the indifference curve, must have $a_1^i = \bar{a}_1$. Evaluating (11) at $a_2^i = \bar{a}_2$ one obtains

$$a_1^i = \frac{y[\gamma_1 \bar{a}_1 + \gamma_2 \bar{a}_2] - y\gamma_2 \bar{a}_2 + (\gamma_2 - \gamma_1)\bar{a}_2 \bar{a}_1}{\gamma_1 y + (\gamma_2 - \gamma_1)\bar{a}_2} = \bar{a}_1.$$

To prove part (*iii*), we set $a_2^i = 0$ in (11). The resulting expression $a_1^i = \frac{y[\gamma_1 \bar{a}_1 + \gamma_2 \bar{a}_2]}{\gamma_1 y + (\gamma_2 - \gamma_1)\bar{a}_2}$ can not be smaller than $\bar{a}_1$, as this would imply the contradictory inequality $y < \bar{a}_1(1 - \gamma_1/\gamma_2)$, which can not be true (since $y > \bar{a}_1$). By a similar argument, (11) must cut the vertical axis at a point where $a_2^I > \bar{a}_2$. Finally, considering part (*iv*), Eq. (11) with $0 < \gamma_1 = \gamma_1 \leq 1$ reduces to

$$a_1^i = \bar{a}_1 + \bar{a}_2 - a_2^i, \tag{13}$$

This indifference curve, which obviously has slope $-1$, is associated with *symmetric tax reforms*, where both tax concessions are cut back symmetrically or eliminated entirely. It is illustrated graphically by the thick solid line [2]–[2′] in the following Fig. 1.

Changing the politically determined reduction rates $\gamma_1$ and $\gamma_1$ leads to a rotation of the indifference curve around the point ($\bar{a}_1$, $\bar{a}_2$). In Fig. 1 we also illustrate the two boundary cases of asymmetric tax reforms. The broken line [*Y*]–[3] depicts the indifference curve

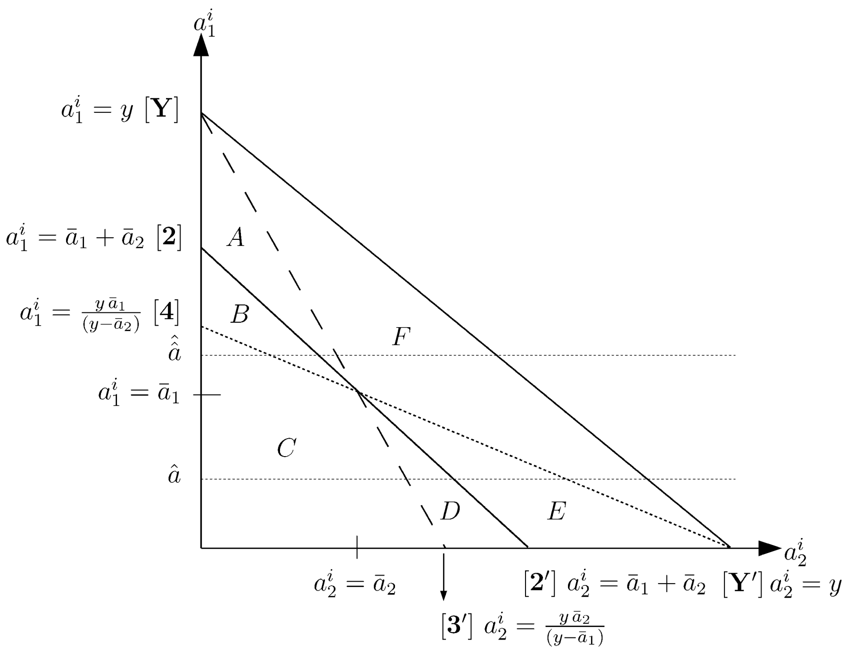


Fig. 1. Support/rejection of the single reform proposal.

for the case that exemption [$a_1$] remains unchanged ($\gamma_1=0$), whereas the other exemption [$a_2$] is cut or eliminated $0<\gamma_2\leq 1$. An individual is indifferent between this and the initial situation if

$$a_1^i = y - \frac{y-\bar{a}_1}{\bar{a}_2} a_1^i. \tag{14}$$

As can be seen, this indifference curve for $0=\gamma_1<\gamma_2=1$ is steeper than [2]–[2′]. Finally, the dotted line [4]–[$Y'$] illustrates the indifference curve for a reform with $\gamma_2=0$ and $0<\gamma_1\leq 1$. This curve, which is flatter than [2]–[2′], is given by

$$a_1^i = \left(\frac{\bar{a}_1}{y-\bar{a}_2}\right)\left(y-a_2^i\right). \tag{15}$$

The indifference curve for a tax reform with $0<\gamma_1\neq\gamma_2<1$ (i.e. where the two exemptions are reduced at a different rate) is steeper than [2]–[2′] and flatter than [$Y$]–[3] if $0<\gamma_1<\gamma_2<1$ and flatter than [2]–[2′] but steeper than [4]–[$Y'$] if $1>\gamma_1>\gamma_2>0$. The thick solid line that runs from point [$Y$] to [$Y'$] separates the relevant parameter constellations where the individual makes a strictly positive tax contribution from those constellations where $a_1^i+a_2^i>y$, a case that we have ruled out by assumption.

The three indifference curves illustrated in Fig. 1 separate six fields (*A–F*). The membership of an individual to one of these fields, which determines her voting behavior on each of the three illustrated reform scenarios, is endogenous and depends on the relation of her individual values $a_1^i$ and $a_2^i$ to the average values $\bar{a}_1$ and $\bar{a}_2$.[4] For example, a voter who ends up in area *B* will vote for symmetric tax reforms and isolated cuts of [$a_2$], because the voter is located below the indifference curves [2]–[2′] and [$Y$]–[3′]. However, the voter will reject a cut of [$a_1$], because the field *B* is to the northeast of the indifference curve [4]–[Y′]. We will return to the exemplifying three reform scenarios in Section 4.

### 3.1. "*Paradoxical*" *voting behavior on asymmetric reforms*

Successively increasing $a_2^i$ will lower the critical level of $a_1^i$ beyond which an individual *i* rejects a tax reform proposal. Hence, even if we consider an *isolated* cut (or abolition) of *one* tax concession, say [$a_1$], it is insufficient only to look at how much a voter benefits from this particular deduction possibility to pin down voting behavior. It also matters how the voter is affected by the other exemption, even though it is not at stake in the reform proposal. A voter is less ready to support the isolated cut of [$a_1$] the stronger the voter is affected by the [$a_1$]-exemption, and vice versa. This insight can also be illustrated graphically. The lower horizontal line in Fig. 1 depicts all voters with a given level $a_1^i=\hat{a}_1$. If such a person has a low value of $a_2^i$ he or she will end up in area *C* and vote for any

[4] Consistency requires that at least one field to the northeast of [2]–[2′] (i.e. *A*, *F*, *E*) and one field to the southwest (i.e. *B*, *C*, *D*) must be non-empty, since it is not possible that the whole voting population benefits above or below average from the combined deduction possibilities.

reform proposal, including the abolition of $[a_1]$. But if a voter with $a_1^i = \hat{a}_1$ has a very high level of $a_2^i$, she will end up in area $F$ and consequently vote against *any* tax reform proposal. Thus, figuratively speaking, the less a voter commutes, the easier she will support an abolition of the deductibility of nightwork income. The reason is the following: If the exemption of $[a_1]$ is reduced, two effects will result. First, a widening of the individual tax base, and second, a drop of tax rates via the budget constraint of the state. A cut of a tax deduction will harm a taxpayer the more, the larger the initially exempted amount. On the other hand, a reduction of tax rates benefits a taxpayer the more, the larger the initial tax base is (i.e. the smaller the initial sum of all deductions). In relative terms, since we have a proportional income tax system in our model, the effect from the tax rate reduction is equally large for all voters. However, the base broadening effect strengthens for individuals with a small initial tax base.

This interdependence of tax exemptions gives rise to an individual voting behavior on asymmetric tax reforms that might seem quite "paradoxical" at first sight. It is possible that an individual votes against the isolated cut of a tax exemption from which he or she benefits below the average, or even hardly at all. To see this, consider the tax reform where only exemption $[a_1]$ is reduced, whereas $[a_2]$ remains unchanged ($\gamma_1 > 0$, $\gamma_2 = 0$). There always exist constellations ($a_1^i$, $a_2^i$) to the northeast of the associated indifference curve [4]–[4′] such that $a_1^i < \bar{a}_1$. For example, the level $a_1^i = \hat{a}_1$ is below the average $\bar{a}_1$. If voters with $a_1^i = \hat{a}_1$ also have a high value of $a_2^i$ such that they are located in area $F$, they reject the isolated cut of the $[a_1]$-exemption. The opposite is true for voters with a value $a_1^i = \hat{\hat{a}}_1$, which is assumed to be larger than $\bar{a}_1$ but smaller than $\bar{a}_1\, y/(y - \bar{a}_2)$.[5] If their value of $a_2^i$ is so low that they are located in area $C$, these voters support the isolated cut of the $[a_1]$-exemption even though they benefit from it above the average.

An analogous argument can be made for any tax reform with partial, but asymmetric reductions of the two exemptions ($0 < \gamma_1 \neq \gamma_2 < 1$). Recall that any indifference curve must cut an axis above the respective average value $\bar{a}_j$. Hence, it is always possible that a voter with $a_j^i > \bar{a}_j$ is located in the area below the indifference curve and supports a tax reform where privilege $j$ is cut more intensively. A necessary condition for this to occur is that he or she is affected below the average from the other exemption. Similarly, it is also possible that a voter, who is affected from one tax exemption below the average, rejects a reform where this tax privilege is cut more intensively, if she benefits from the other exemption more than the average.

In sum, it is not a meaningful indicator whether a voter benefits below or above average from one tax exemption when it comes to pin down her individual voting behavior. This result *exclusively* applies to asymmetric reforms in "complicated" income tax systems. Suppose that there is only one initial exemption, say $[a_1]$, whereas $a_2^i$ is equal to zero for all individuals (and thus, $\bar{a}_2 = 0$). From (11) it is straightforward to see that a voter will then vote for a cut of the $[a_1]$-exemption if she benefits below the average from this deduction possibility, and she will vote against it if she is affected above the average.[6] For *symmetric* tax reforms in complicated systems we have shown in (13) that all voters who benefit

[5] If $a_1^i \bar{a}_1 y / (y - \bar{a}_2)$ the voter rejects the reform regardless of her level of $a_2^i$.

[6] Graphically, we would then look at the univariate distribution of the $a_1^i$'s along the vertical axis. All voters with $a_1^i < \bar{a}_1$ would vote in favor of a cut, all voters with $a_1^i > \bar{a}_1$ would vote against it.

below the average from the sum of the two tax concessions support the symmetric reform, and vice versa. The insights of this section are summarized in

(i) When the government proposes an asymmetric abolition or cut of one tax exemption (say, $[a_1]$) in a complicated income tax system, the voting decision of an individual is also affected by how much this person benefits from the other deduction possibility that is not at stake in the government's reform proposal (i.e. the $[a_2]$-exemption).
(ii) The stronger a voter with a given level $a_1^i < \bar{a}_1 y/(y - \bar{a}_2)$ is affected by the deduction possibility $[a_2]$, the more reluctant is she to support the asymmetric cut of $[a_1]$.
(iii) A voter can reject the abolition of the $[a_1]$-exemption even though she is affected below the average ($a_1^i < \bar{a}_1$) if she is strongly affected by $[a_2]$. A necessary condition for this rejection is $a_2^i > \bar{a}_2$.
(iv) A voter who is affected by $[a_1]$ above the average ($\bar{a}_1 < a_1^i$ and $a_1^i < \bar{a}_1 y/(y - \bar{a}_2)$) can support the abolition of $[a_1]$ if she is only weakly affected by $[a_2]$. It is necessary that $a_2^i > \bar{a}_2$.

The logic of this proposition also pertains to tax reforms with partial, but asymmetric reductions of both exemptions. We will refer to parts (iii) and (iv) of Proposition 3.1 as "voting paradoxes" that apply to asymmetric reforms in complicated income tax systems. To be sure, this voting behavior is not really "paradoxical", but can be understood intuitively. For the first type of individuals it is due to the fact that these voters have a small initial tax base. They are not predominantly interested in a revenue neutral tax reform, because they are more affected by the base broadening than by the falling tax rates. The intuition for the second paradox is just the opposite. The tax base of these voters is relatively large, because they benefit from $[a_1]$ only moderately above the average and they benefit little (below average) from $[a_2]$. Hence, they have a strong interest in falling tax rates and care relatively less about fewer deduction possibilities.

## 4. Voting results in the society as a whole

The government needs always to take into account how voters are affected by *all* available deduction possibilities to address the political chances of *any* tax reform, even if the aim is to cut back only one single exemption. Whether or not a reform will win the support of the majority of voters in a world with two initial tax exemptions depends on the *joint distribution* of $[a_1]$ and $[a_2]$.

The joint distribution determines the scattering of voters in the relevant part of the ($a_1^i$, $a_2^i$)-space where $a_1^i + a_2^i < y$, i.e. the area below the thick solid line $[Y]$–$[Y']$ in Fig. 1. At the same time, the average values $\bar{a}_1$ and $\bar{a}_2$ are endogenously determined. We have shown above that the indifference condition for any possible tax reform $x$ must cut through the point ($\bar{a}_1$, $\bar{a}_2$), which is the joint support of the distribution. The slope of the indifference curve depends on the politically determined parameters $\gamma_1$ and $\gamma_2$. If the scattering of voters is such that the majority of the population is located in the area below the indifference curve, then the associated tax reform $x$ is politically feasible. Otherwise, if more than half of the population is located above the indifference curve, the reform can not be implemented.

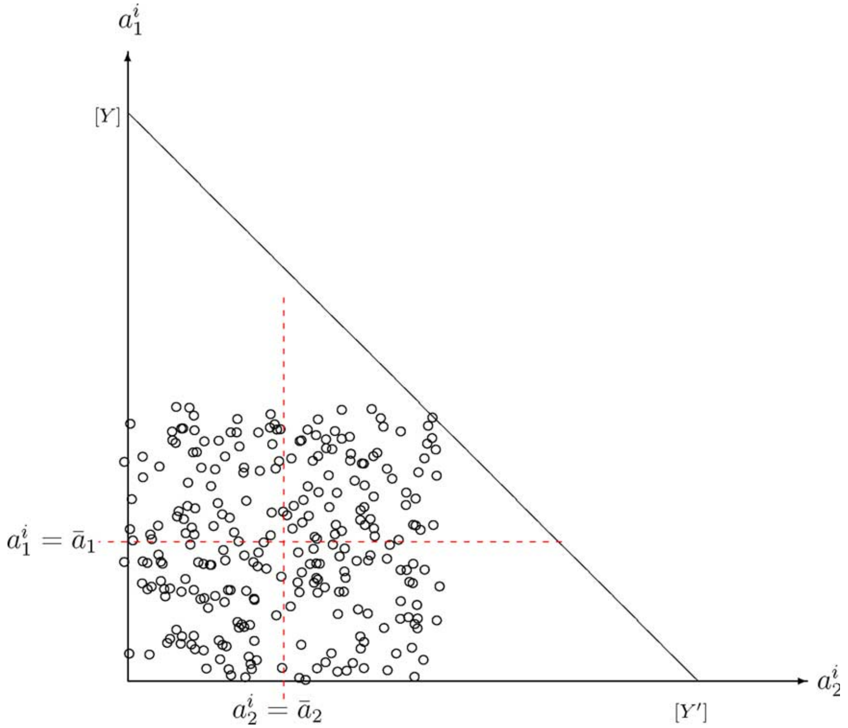


Fig. 2. Uniform distribution.

To illustrate how the joint distribution of the tax exemptions determines the voting outcome in the society, we first consider some examples of continuous distributions. However, $[a_1]$ and $[a_2]$ by no means have to follow simple distribution functions. That is to say, the $n$ voters can be scattered in any possible way in the relevant part of the $(a_1^i, a_2^i)$-space. These more general cases are then analyzed afterwards.

Consider the following benchmark scenario: $[a_1]$ and $[a_1]$ are uncorrelated and both exemptions $[a_j]$, $j=1,2$, are distributed uniformly in the range $[0; b_j]$. Since every individual has a strictly positive tax base, it must be true that the exogenous parameter $b_j$ is smaller than gross income $y$. In the $(a_1^i, a_2^i)$-space, voters are scattered evenly in a box with side length $b_1$ and $b_2$, respectively. This case is shown in Fig. 2. The joint support $(\bar{a}_1=b_1/2, \bar{a}_2=b_2/2)$ is located directly in the middle of this box. Due to the even scattering of voters inside the box, there is always (approximately) one-half of the voting population located below, and the other half located above any possible indifference curve.[7] The political outcome on any tax reform proposal in a direct democratic vote is thus undetermined if the two exemptions and uncorrelated and uniformly distributed.

[7] This follows from the geometrical property that any line drawn through the point in the middle of a box cuts the box into two equal parts. Strictly speaking, the voting outcome is random if $n$ is finite, as there can be a close majority for or against the reform proposal, e.g. if $n$ is an odd number. We will not deal with these issues in this paper and simply state that the political outcome is “undetermined” in these cases.

This political indeterminacy also follows for other cases of continuous distributions. For example, suppose that $[a_1]$ and $[a_2]$ are uncorrelated and follow the same normal distribution with $\bar{a}_1=\bar{a}_2$ and the same variance. In graphical terms, there is no longer an even scattering as in Fig. 2, but a clustering of voters around $(\bar{a}_1, \bar{a}_2)$ that becomes more dense the closer one moves to the joint support. Since the clustering is entirely symmetric if both exemptions follow the same normal distribution, there will again be half of the population located below, and half of the population located above any indifference curve. Political indeterminacy also results if instead of a zero correlation, $[a_1]$ and $[a_2]$ are *perfectly* correlated. All voters are scattered along a linear ray out of the origin and through $(\bar{a}_1, \bar{a}_2)$. With a uniform distribution voters are scattered evenly along this ray. With a normal distribution there is a clustering in the middle range. Still, in both cases the voting population will always be divided evenly by any indifference curve.

Now suppose that the joint distribution of $[a_1]$ and $[a_2]$ becomes more complex. For example, the two exemptions might follow different distributions, the distributions might be skewed, not single peaked, or entirely “irregular”. The two exemptions might also be imperfectly correlated with each other. In these cases voters are scattered unevenly in the $(a_1^i, a_2^i)$-space and the political outcome depends on the slope of the indifference curve. In Fig. 3 we illustrate such a case where the distribution of $[a_1]$ is

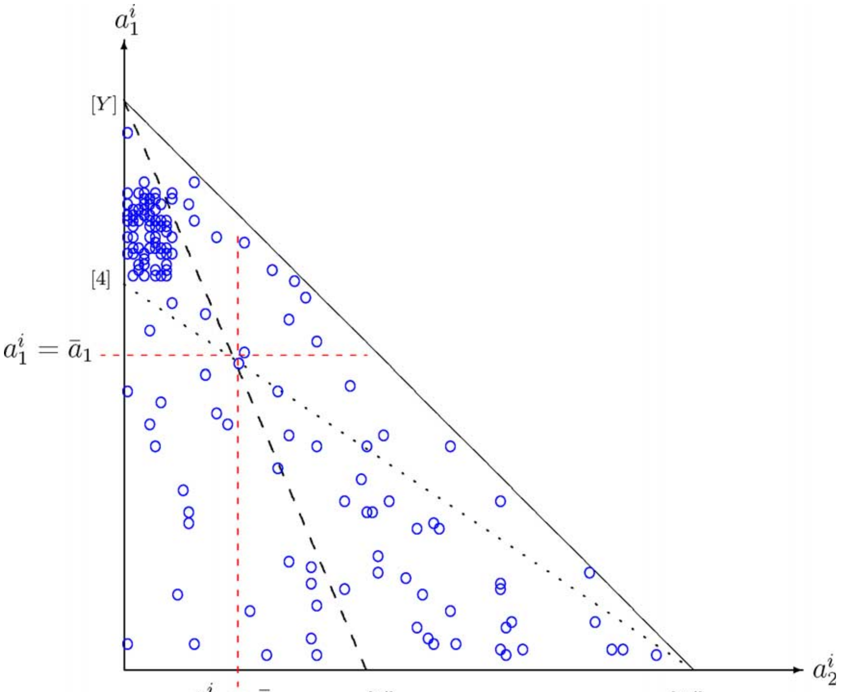


Fig. 3. Uneven scattering.

Table 1
Eight numerical examples: any political outcome is possible

| | Ex1 | Ex2 | Ex3 | Ex4 | Ex5 | Ex6 | Ex7 | Ex8 |
|---|---|---|---|---|---|---|---|---|
| $\mu_A$ | 0.00 | 0.00 | 0.51 | 0.00 | 0.00 | 0.00 | 0.00 | 0.33 |
| $\mu_B$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.33 | 0.00 |
| $\mu_C$ | 0.51 | 0.49 | 0.49 | 0.49 | 0.26 | 0.26 | 0.00 | 0.34 |
| $\mu_D$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.33 | 0.00 |
| $\mu_E$ | 0.00 | 0.00 | 0.00 | 0.51 | 0.00 | 0.00 | 0.00 | 0.33 |
| $\mu_F$ | 0.49 | 0.51 | 0.00 | 0.00 | 0.49 | 0.49 | 0.34 | 0.00 |
| Reform 2 | + | − | − | − | + | + | + | − |
| Reform 3 | + | − | + | − | + | − | − | + |
| Reform 4 | + | − | − | + | − | + | − | + |

strongly skewed to the right and the distribution of $[a_2]$ is skewed to the left, yet retaining the assumption of zero correlation. Voters are clustered at the top left part of the relevant range, since the population benefits more from $[a_1]$ than from $[a_2]$. If the tax reform targets $[a_1]$, the associated indifference curve is flat and the majority of the population will reject the tax reform. Yet, if the government proposes a tax reform that aims at cutting back $[a_2]$, the associated indifference curve is steep and the population will vote in favor of this proposal.

### *4.1. Logrolling and the political chances for symmetric and asymmetric reforms*

With an uneven scattering of voters, it is generally the case that some tax reform scenarios will be supported by the public, whereas others will not. But even at the level of the society as a whole, there are some further interesting interactions between the two tax exemptions that can lead to some surprising voting results on "symmetric" versus "asymmetric" tax reforms. To illustrate this, we return to the three exemplifying tax reforms that were graphically depicted in Fig. 1: symmetric cuts of both concessions (labelled *reform 2* since depicted by the indifference curve [2]–[2′]), an isolated cut of $[a_2]$ (*reform 3*), and an isolated cut of $[a_2]$ (*reform 4*).

Depending on the joint distribution, the voters are scattered in some way across the six fields *A–F*. Let us denote with $\mu_k$ ($k=A,\ldots,F$) the voters in the respective area $k$ in Fig. 1 as a (non-negative) share of the total voting population, with $\sum_k \mu_k = 1$ and $\mu_B+\mu_C+\mu_D>0$, $\mu_A+\mu_B+\mu_F>0$ for consistency (cf. footnote 4). With the three different reform scenarios, there are in total eight possible constellations with zero up to three viable reforms. We denote the case that reform scenario 2 would win the support of the majority of voters by 2+, the case that reform 3 would be rejected by 3−, and so on. The eight possible constellations are then: (2+, 3+, 4+), (2−, 3−, 4−), (2−, 3+, 4−), (2−, 3−, 4+), (2+, 3+, 4−), (2+, 3−, 4+), (2+, 3−, 4−), and (2−, 3+, 4+). It is possible to find consistent examples for *each* of these eight constellations, presented in Table 1. Hence, depending on the distribution of voters across the six fields *A–F*, any political outcome is possible.[8]

[8] In the following, we provide examples where one or more fields *A–F* are empty. This is done only to keep the examples as simple as possible. One could also provide examples for each of the eight possible cases with all six fields *A–F* non-empty.

This includes the two presumably most interesting cases, illustrated by the numerical examples 7 and 8. In example 7, only symmetric reforms are possible, but no asymmetric reform. That is, a change in the status quo is only possible if the government aims to cut back both exemptions symmetrically, whereas the cut of a single exemption is not viable. Just the opposite is true in example 8. Here we have the case that asymmetric reforms can be implemented, but not a symmetric reform. That is, both $[a_1]$ and $[a_2]$ can be abolished in isolation, but not together!

Before discussing these two cases in detail, we briefly consider the intuition for the other six examples. In the examples 1 and 2, only the fields $C$ and $F$ are non-empty. If an absolute majority of voters is located in area $C$, all reform proposals will pass, because voters in this area support *any* tax reform. If an absolute majority of voters is located in area $F$, no reform will be possible. In example 3, only a cut of $[a_2]$ is possible, whereas symmetric reforms and cuts of $[a_1]$ are rejected. A majority of the population is located in area $A$, who benefit from $[a_2]$ so much that they would never support a cut of this tax privilege, neither in isolation, nor in combination with a cut of $[a_2]$. Example 4 is the analogous case, where only an isolated cut of $[a_1]$ is possible, since the majority of the population is located in area $E$. In example 5, symmetric reforms and isolated cuts of $[a_2]$ are possible, but no isolated cuts of $[a_1]$. This is so, because a majority is formed if the groups $B$ and $C$ build a coalition against the unconditional reform opponents in $F$. This occurs if the government proposes either reform 2 or 3. The group $B$ is not interested in an isolated cut of $[a_1]$, however, and the individuals in this area would vote together with group $F$ if the government proposes reform 4. Example 6 is the analogous case, where only reform 3 is not feasible.

Let us look now look at the intuition for example 7, where only symmetric reforms are viable. Voters in $B$ benefit relatively strongly from the deduction possibility $[a_1]$, but relatively little from $[a_2]$. They would not vote for an isolated cut of $[a_1]$. For the same reason, voters in $D$ would not vote for an isolated cut of $[a_2]$. But if both tax exemptions are reduced *simultaneously*, then the effect of the general tax rate reduction over-compensates the effect of the foregone tax privilege. The two groups will only vote together in favor of a change in the status quo if reform 2 is proposed by the government. Otherwise, one group builds a coalition with the strict reform opponents in area $F$. We thus have an exclusive feasibility of symmetric tax reforms, because an *implicit logrolling* between the groups $B$ and $D$ is possible and successful. Through the combination of two issues, the abolition of $[a_1]$ and $[a_2]$, the government can achieve that the majority of the population accepts the reform agenda. This logrolling arises if the following three conditions are simultaneously satisfied: $(\mu_D+\mu_E+\mu_F)>0.5$ $(\mu_A+\mu_B+\mu_F)>0.5$ and $(\mu_B+\mu_C+\mu_D)>0.5$. The first two conditions state that no asymmetric reform can be implemented, whereas the third condition says that a symmetric reform is possible. Since these inequalities logically imply $(\mu_A+\mu_B+\mu_C)<0.5$ $(\mu_C+\mu_D+\mu_E)<0.5$ and $(\mu_A+\mu_E+\mu_F)<0.5$, it is straightforward to simplify the sufficient conditions for an *exclusive feasibility* of symmetric tax reforms: $\mu_F>\mu_C$, $\mu_B>\mu_E$ and $\mu_D>\mu_A$. Each logrolling group must be larger than the complementary non-logrolling group with opposite preferences, and the group of unconditional reform opponents ($F$) must be larger than the group $C$, who votes for any change in the status quo.[9]

Finally, the intuition for example 8, where both asymmetric reforms are possible although a symmetric reform is not, is quite similar. Symmetric cuts (reform 2) are impossible, since the groups $A$ and $E$ form the majority. Group $A$ is against the cut of the exemption [$a_1$] under all circumstances. The same is true for group $E$ and the exemption [$a_2$]. However, if the government proposes an asymmetric reform, then either group $A$ or group $E$ (depending on whether a cut of [$a_2$] or [$a_1$] is at stake) builds a coalition with group $C$. An implicit logrolling between groups $A$ and $E$ prevents symmetric tax reforms in example 8. The general sufficient conditions for an exclusive possibility of either asymmetric reform are just the inverse of the conditions for an exclusive feasibility of symmetric reforms, namely $\mu_F < \mu_C$, $\mu_B < \mu_E$ and $\mu_D < \mu_A$.

In sum, it is not possible to claim in general (as it is sometimes done in public discussions) that symmetric reforms are easier to implement than asymmetric ones, nor is it possible to claim the opposite. Depending on the joint distribution of the two tax deductions, all political outcomes are conceivable. Note that this result does not depend on the usual pressure group arguments outlined in the Introduction, but it is entirely due to the mechanics of the government's budget constraint in combination with completely rational individual voting behavior.

### *4.2. The mutual persistence of income tax exemptions*

The last issue we analyze in this paper is whether the presence of one tax exemption per se eases or complicates the political feasibility of a tax reform that aims at cutting back another exemption. That is, we ask if tax deduction possibilities may lead to their mutual persistence. For matters of comparison, let us consider a situation in which there is only the [$a_1$]-exemption, but not the [$a_2$]-exemption. As argued above, it is easy to determine who is going to vote for an abolition of the [$a_1$]-exemption in this situation: All voters with an individual value $a_1^i$ greater than the average level $\bar{a}_1$ will reject this tax reform, all voters with $a_1^i < \bar{a}_1$ will support it. If now the [$a_2$]-characteristic also becomes tax relevant, i.e. if we move from a "simple" to a "complicated" income tax system, this easy relation no longer holds. Now all individuals to the southwest of the line [4]–[$Y$] vote for tax reform 4 that aims at abolishing the [$a_1$]-exemption.

When comparing the same tax reform proposal in the two environments ("simple" and "complicated"), we find that some voters would have supported the reform agenda in the simple income tax system, but they reject the same reform in a complicated one. These are the voters located in area $X$ in Fig. 4. On the other hand, there is a second group of voters who would have rejected the reform in a simple tax system, but they support it in a complicated system. These are the voters located in area $Y$. It is readily verified that the

[9] Note that this logrolling equilibrium is not a Condorcet winning scenario. After the radical reform has been implemented, there would again be a majority who votes for the reintroduction of the tax concessions. After the reintroduction, there is again a majority for a radical abolishment, and so on. This represents the insight put forward by Bernholz (1973) that under implicit logrolling there are cyclical majorities. An analysis of these long-run aspects of tax reforms, however, is left aside in the present paper.

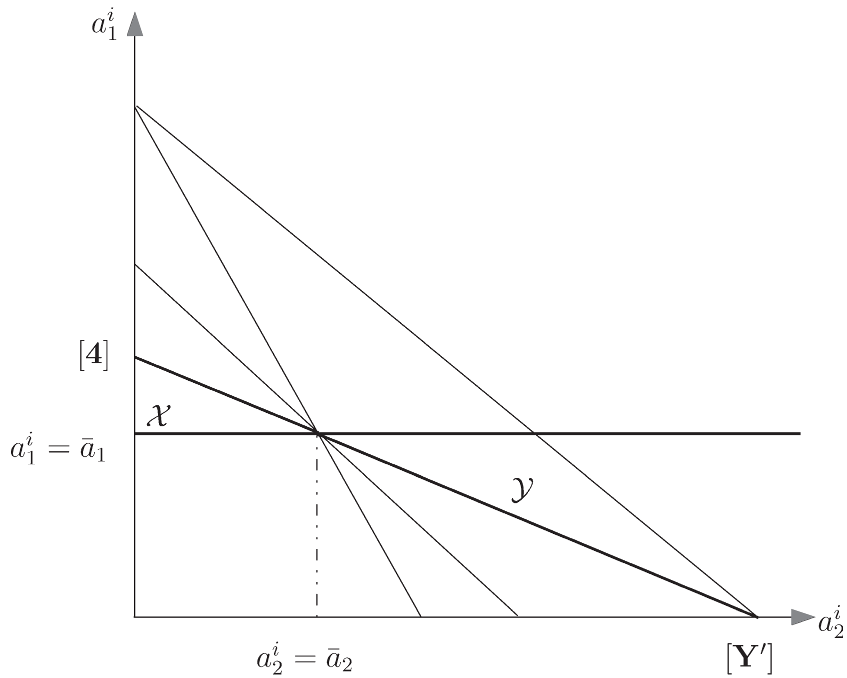


Fig. 4. The mutual persistence of tax exemptions.

individuals in $X$ are those who vote against an abolition of $[a_1]$ in a complicated income tax system, although they are affected below the average from this deduction possibility (i.e. those subject to the "voting paradox" described in Proposition 3.1, part (iii)). The group $Y$ consists of those who vote for an abolition of $[a_1]$ although $a_1^i > \bar{a}_1$, i.e. the individuals subject to the other "voting paradox" described in Proposition 3.1, part (iv). Depending on the number of voters located in either area we reach a different answer for the question whether the existence of one exemption eases or complicates the possibility to abolish another exemption.

(i) The two income tax exemptions contribute to their mutual persistence if more voters are located in area $X$ than in area $Y$.
(ii) If more voters are located in $Y$ than in $X$, then the $[a_1]$-exemption can easier be abolished in a complicated than in a simple income tax system.

If more voters are located in $X$ than in $Y$, then the existence of the $[a_2]$-exemptions per se reduces the share of voters in the society who supports the abolition of the $[a_1]$-exemption. Hence, the existence of $[a_2]$ contributes to the persistence of $[a_1]$. The opposite is true if more voters are located in $Y$ than in $X$. The intuition for this case can be grasped by observing that the tax rate necessary to finance the fixed budget is higher in the complicated system when individuals can also deduct their $a_2^{i\prime}$s. When the $[a_1]$-exemption is abolished, the drop in tax rates is thus relatively stronger in the complicated than in the simple tax system, and this is attractive and decisive for the voting decision of the individuals in area *Y*, who have a large individual tax base.

## 5. Concluding remarks

In this paper we have studied the political economy of revenue neutral reforms in a complicated income tax system. Compared to a simple system with only one exemption, some additional issues arise. The voting decision of an individual with respect to an asymmetric reform does not only depend on how much a person benefits from this particular deduction possibility. The decision always depends on all available deduction possibilities, since they determine the voter's tax base on which the post-reform tax rate is applied. A government that aims at a tax reform must therefore always take into account how the voting population is affected by all available deduction possibilities, even if it aims at cutting back only one single exemption. Many policy makers in reality do not seem to be aware of this, as the political chances of such a tax reform are usually assessed only by looking at how much the voters are affected from this particular tax privilege.

Our model, which completely abstracts from lobbying or pressure group arguments, can neither be used to argue that symmetric reforms are always easier to implement than asymmetric ones, nor does it imply the opposite. Which reform strategies are politically viable depends on the joint distribution of the tax relevant characteristics across the voting population.

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