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**Working Paper — Digitized Version**

## On income tax avoidance: the case of Germany

ZEW Discussion Papers, No. 93-05

**Provided in Cooperation with:**

ZEW - Leibniz Centre for European Economic Research

*Suggested Citation:* Lang, Oliver; Nöhrbaß, Karl-Heinz; Stahl, Konrad O. (1993) : On income tax avoidance: the case of Germany, ZEW Discussion Papers, No. 93-05, Zentrum für Europäische Wirtschaftsforschung (ZEW), Mannheim

This Version is available at:

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# Discussion Paper

Discussion Paper No. 93-05

## **On Income Tax Avoidance: The Case of Germany**

Oliver Lang, Karl-Heinz Nöhrbaß and Konrad Stahl

# ZEW

Zentrum für Europäische  
Wirtschaftsforschung GmbH

Public Finance and  
Corporate Taxation Series

27. MAI 1993 Wirtschaftswissenschaften  
Kiel

W 6.36 (93.05) dft

# **On Income Tax Avoidance: The Case of Germany**

by

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March 1993

## **Abstract**

In this paper, we present a micro estimate determining taxable income as a function of gross income and all major deduction options depending on household and asset categories. It is shown that tax savings strongly increase with increasing income, resulting in a decreasing effective marginal tax rate for the highest income groups. We compute a lower bound on 1983 aggregate income tax losses to the German fiscal authorities of DM 72b, or of 45 % of wage and income taxes paid in 1983. The estimate of tax loss exceeds estimates for other countries by orders of magnitude.

## 1. Introduction

"Two things are unavoidable: taxes and death", tells us a proverb. A contrasting view on tax avoidance is offered by the public finance theorist. Collecting the theoretical evidence, Stiglitz (1985) argues that in a world with perfect capital markets and astute tax payers, income taxes can be completely arbitrated away.

Whilst capital markets apparently are imperfect and tax payers not quite as astute as supposed by neoclassical theory, we still expect to find some degree of tax avoidance, in part via tax arbitrage<sup>1</sup>, in part via outright tax fraud. In this paper, we use micro data for Germany unavailable heretofore to give empirical evidence on this. To an extent unexpected to us, Germans do avoid income tax payments; and this by and large the more, the higher their pretax income. We show this by conducting an analysis of the 1983 wave of the German Income and Consumption Survey that covers all households but about the top two percent of the income distribution.

Our basic Tobit estimate relates taxable income to household gross income. Since in our data set income is recorded in detail by source, and since we have sufficient information on household demographic and wealth status, we are able to control for the better part of tax write offs.

Our estimates suggest that effective marginal income tax rates are not only substantially below the legislated ones in all income brackets covered by our data; but also that the difference between legislated and effective income tax rates increases in gross income, and that for the top quintile of income earners, effective marginal tax rates even decline rather than increase.

More precisely, whilst the 1983 legislated marginal tax rate in Germany increased up to a maximum of 56 percent, the effective marginal tax rate obtained from our micro estimates reaches a maximum of 34 percent at a gross annual income of about DM 80 000.-, and declines thereafter the top 20 percent of income earners to a level close to 30 percent. While the dramatically lower level of effective marginal tax rates must be attributed to tax arbitrage and evasion, the decline in marginal tax rates is due to tax write off opportunities, in particular from real estate that are, or can be exploited only by higher income households. After accounting for all tax write offs and all deductions from taxable income the data allow for, we arrive at a loss in federal income taxes due to both tax arbitrage and tax evasion of about 45 percent of the total 1983 income tax proceeds, or DM 72 billion from the households covered by our data. For several reasons to be explained later, this is likely to be only a lower bound to the true losses in federal income taxes incurred in 1983 by the German fisc.

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<sup>1</sup> For the purposes of this paper, we define by tax arbitrage the exploitation of tax generated price differences through simultaneous purchases and sales.

In addition to this central result, our estimate suggests that real estate ownership is an important contributor to tax shelter and arbitrage; that unreported interest income is heavily contributing to tax fraud; and that (agricultural) self employment status apparently is a contributor to both. The reasons are roughly as follows:

While German owner occupants of housing cannot tax deduct mortgage interest payments as, for instance, in the U.S., they are given rather sizeable tax write offs on the value of their home. By contrast, owners of rental real estate can write off their mortgage interest payments, and in addition are allowed to deduct portions of both, value and investment. Held against the income from real estate, these deductions eventually result in negative income that is tax deductible from employment income.

Interest incomes are taxed in Germany (subject to an allowance). However, taxes were not drawn at the source in 1983. Up to now, bank laws have limited the fiscal authorities' right to check the accurateness of reported interest income. Hence interest income goes largely unreported.

Finally, the self employed are given rather generous tax write off possibilities on inputs into their business activities. Controls by the fiscal authorities on what is declared as inputs into their income generating activities are limited. In addition, the self employed can evade tax payments by transferring income and debt between business and household activities in a way unobserved by the tax authorities.

To the best of our knowledge, we present here the first micro estimate on the extent, and the sources of tax arbitrage and evasion for Germany.<sup>2</sup> Its sheer magnitude invites policy reactions. We will comment on these, and on the relevant literature in the concluding section of this paper. In section 2, we describe our data base. Our principal estimate is presented and interpreted in section 3. We estimate the total tax loss in section 4, and qualify this estimate in detail. We conclude with section 5.

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<sup>2</sup> Roberts (1984) provides an estimate of average German taxes by income on the basis of grouped data from the 1978 German Income and Consumption Survey, without controlling for household specific effects.

## 2. Data and Descriptive Statistics

Our analysis is based on the 1983 wave of the Income and Consumption Survey (EVS) that includes a representative cross section of all West German households with head of German nationality and annual income net of taxes below DM 300 000. Thus the wealthiest, about 2 percent of the West German population are excluded. There remain about 43 000 households in the sample.

In addition to basic demographics, the data contain a detailed account of income by source, wealth by asset categories, and household savings and expenditures. The economic flow data are computed from diaries filed monthly over the entire year by the surveyed households. Recorded expenditures also include all tax payments by category.

Our analysis concentrates on households with head of age below 66. The reason for excluding the aged is that inasmuch as they are retired, they contribute only little to income tax proceeds for institutional reasons: only the revenue component of their retirement income is taxable. Thus in 1983, the aged declared on average only 10% of their gross income as taxable, effectively yielding a contribution of a mere DM 7 billion to income tax proceeds totalling DM 142 billion gross of church taxes (drawn by the state on behalf of the churches). Thus, excluding the aged works against our demonstration that the relationship between gross, and taxable income is substantially blurred<sup>3</sup>.

Comparisons of weighed aggregates of the EVS with national accounting data reveal that total income from dependent employment, transfer and pension incomes, and income from agricultural self employment are approximated very well, but that income from non-agricultural self employment is underreported by about 39 percent. Also, depending on asset categories, monetary asset incomes are underreported by 40 to 70 percent.<sup>4</sup> By contrast, comparisons with data collected by the federal tax authorities reveal that tax payments are reported very accurately. We will return to these comparisons in the evaluation of our tax loss estimate at the end of section 4.

Table 1 presents some basic statistics of the sample used for our tax loss estimates.

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3 We have chosen to exclude the aged rather than the retired, in order to avoid an endogeneity bias in our estimate.

4 This figure includes monetary assets incomes of the two percent richest households not included in our sample.

**Table 1****Descriptive Statistics of the Sample Population**

Size	17.422.309
Age of head	
18-34	27,15 %
35-44	24,42 %
45-54	23,25 %
55-65	25,18 %
Average age	43,94
Married	69,57 %
Single	30,43 %
No children living with household	56,63 %
One child	22,82 %
Two children	15,42 %
Three or more children	5,13 %
Monthly gross income below DM 1000	2,98 %
DM 1000 - DM 1999	9,61 %
DM 2000 - DM 2999	13,64 %
DM 3000 - DM 3999	16,90 %
DM 4000 - DM 4999	16,16 %
DM 5000 - DM 9999	36,11 %
DM 10000 +	4,59 %
Average monthly gross income	4.868,41 DM
Dependent employed (without civil servant)	60,90 %
Civil servant	9,44 %
Self employed agricultural	2,17 %
Self employed non-agricultural	6,45 %
Unemployed	2,99 %
Out of labor force	18,06 %
Renters without real property assets	50,89 %
Renters with real property assets	3,15 %
Owners without other real property assets	34,89 %
Owners with other real property assets	11,07 %
No monetary asset income (above allowance)	63,48 %
Monetary asset income (without dividends, above allowance)	36,52 %
Average asset income of monetary asset holders (above allowance)	544,59 DM

Source: EVS 1983, weighed sample.

### 3. An Empirical Model of Tax Evasion in Germany

The estimate central to our analysis involves the relationship between household gross income as the independent, and taxable income as the dependent variable. The latter is computed by inverting the income tax function and inserting the household's income tax payments, while accounting for single vs. joint filing. As tax payments are recorded very accurately, little information is lost with this computation. However, one should keep in mind that current tax payments are reported in the EVS. As all dependent employees' taxes are withheld at the source, these reflect their taxable income of the current year. The taxable income so computed is inflated by the deductions declared when filing the income tax return. In 1983, tax rebates on excess taxes withheld in 1982 amounted to DM 8.3 b net of back claims.

Conversely, the recorded tax payments from self employment typically reflect the previous year's taxable income, if not that of an even earlier year. In 1982 (1983), incomes from self employment and from real assets increased nominally by about 3.8 (10.8) percent. Hence 1983 tax payments are based on a correspondingly lower income. However, the resulting underestimation of taxable income should be held against the underreported 39 percent of gross income from self employment. We have no estimate on the extent to which incomes from real assets were underreported.

First observations on the two income concepts and the relationship between them are contained in Table 2.

Table 2 shows average household gross, and taxable incomes for households ordered by gross income decile. It also gives tax payments over gross, and taxable incomes, and finally the percentage of tax payers in each gross income decile. Not unexpectedly the proportion of taxable to gross income increases monotonically (col.7). However, the coefficient of variation of taxable income (col.6) is substantially larger than that of gross income (col.4), often by an order of magnitude of ten. Given gross income as the order criterion, one must expect a larger coefficient of variation. It is the order of magnitude of the difference that merits a later comment.

At any rate, both coefficients of variation decline monotonically in gross income deciles only until the eighth decile, but then increase. Finally, col.10 (col.11) of Table 2 shows that the average tax rate if computed on the basis of gross income (taxable income) obtains a maximum at only 17.26 (26.5) percent.

Table 3 gives the percentage of households per taxable income decile within a given gross income decile.

The diagonal elements of Table 3 show that with the exception of the top income decile involving an open income interval,<sup>5</sup> the relationship between the two orderings is quite poor. While the lower off diagonal elements are loaded rather heavily, the rest

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<sup>5</sup> It is a statistical regularity due to the openness of the highest income interval that the percentage of households belonging to the highest decile in both income measures turns large again.



**Table 2**  
Households by Gross Income Decile

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Gross Income Decile	Observations	Gross Income (YALL)		Taxable Income (YTAX)			Tax Payments (YTAX)			
		Decile Range [DM]	Coeff. of Var.	mean [DM]	Coeff. of Var.	YTAX/YALL [%]	mean [DM]	Hhlds with TAX>0 [%]	TAX/YALL [%]	TAX/YTAX [%]
1	1857	500- 20.800	0.272	2224.27	1.848	14.25	234.61	25.92	1.44	2.37
2	2281	20.800- 31.200	0.112	9622.20	0.955	35.45	1472.00	59.12	5.37	8.18
3	2699	31.200- 38.800	0.062	18783.54	0.533	53.35	3129.37	84.36	8.88	13.13
4	3293	38.800- 45.900	0.047	24170.64	0.407	56.90	4113.33	92.29	9.68	14.85
5	3789	45.900- 52.900	0.042	28500.57	0.344	57.76	4993.05	95.52	10.11	15.92
6	4129	52.900- 60.500	0.039	33163.00	0.323	58.53	081.53	96.80	10.73	16.96
7	4409	60.500- 69.300	0.039	38945.59	0.304	60.09	7494.87	97.83	11.55	18.09
8	4625	69.300- 80.600	0.043	45494.90	0.276	60.99	9264.37	98.90	12.41	19.41
9	4732	80.600- 98.400	0.058	54663.59	0.278	61.87	12190.44	99.33	13.77	21.33
10	4175	98.400-639.300	0.346	82581.88	0.517	62.26	24181.78	99.35	17.26	26.46

Source: EVS 1983, weighed sample

**Table 3**

Percentage of Households of Taxable Income Decile within Gross Income Decile

Gross Income	Taxable Income										total
	1	2	3	4	5	6	7	8	9	10	
1	48.82	45.27	5.85	0.02	0.04	0.00	0.00	0.00	0.00	0.00	10.00 %
2	27.33	26.65	31.28	14.22	0.46	0.03	0.00	0.04	0.00	0.00	10.00 %
3	10.15	12.06	22.66	29.61	21.60	3.44	0.36	0.14	0.00	0.00	10.00 %
4	5.35	6.03	14.72	22.61	26.55	20.88	3.61	0.19	0.00	0.06	10.00 %
5	2.98	4.06	9.55	14.79	21.83	27.18	17.58	1.95	0.06	0.02	10.00 %
6	2.19	2.76	6.20	8.60	13.96	22.92	28.40	13.81	1.11	0.04	9.94 %
7	1.45	1.66	4.32	5.15	7.97	13.81	24.45	29.90	10.82	0.48	10.00 %
8	0.81	0.78	2.73	2.87	4.64	7.75	16.09	30.75	29.99	3.59	10.00 %
9	0.48	0.42	1.83	1.71	2.30	3.11	7.90	17.35	41.03	23.87	10.00 %
10	0.43	0.33	0.88	0.50	0.73	1.01	1.77	5.94	16.90	71.52	10.06 %
total	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	17422309

Source: EVS 1983, weighed sample

of the upper triangular elements is close to zero. By contrast, the load is much more spread in the lower triangular elements. There is a systematic reason for this; households in low gross income deciles cannot conceivably reside in very high taxable income deciles. However, the substantially larger spread in the load of the lower off diagonal elements also suggests that many households in higher gross income deciles manage to substantially reduce taxable income, thus arriving in very low taxable income deciles.

The information provided so far does not really reveal any tax savings enjoyed by the higher income groups. As Table 3 reflects only an ordering along the two income scales, the higher income earners' relative tax savings could be substantial even if its diagonal elements would be loaded all the way up to 100 percent. Rather, Table 3 together with col.'s (4) and (6) of Table 2 on the coefficients of variation of gross and taxable incomes, respectively, suggests a considerable degree of horizontal inequity in income taxation: households blessed with similar gross incomes may end up in quite different brackets of taxable income.<sup>6</sup> Thus the relationship between the two income concepts is blurred, and increasingly so with increasing income decile. This calls into question the statement made by the German (and other) tax authorities that "taxable incomes ought to reflect the households' (relative) ability to pay".<sup>7</sup>

In order to arrive at a quantification of the relationship between the two income measures and thus the tax savings enjoyed by the different household groups, we specified econometrically household taxable income with household gross income as the main independent variable. As in our sample about 10.6 percent of all households exhibit a computed taxable income of zero, we have chosen to account for this left hand censoring within a Tobit estimate.

We added two important groups of independent variables. One group specifies sources of incomes that are treated differently for tax purposes; and the other one collects indicators of household status that have an impact on the household's tax write off opportunities. Table 4 lists the variables and their definitions.

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<sup>6</sup> This argument is reinforced by the observation not tabulated here that the coefficient of variation of consumption remains about half the level of that of taxable income in the highest gross income deciles.

<sup>7</sup> See e.g. Tipke and Lang (1991, p. 197).

**Table 4**  
Variables entering the Tobit estimate and their definitions

<b>Dependent variable:</b>	
YTAX =	household taxable annual income as computed from reported tax payments, divided by 10000
<b>Independent variables:</b>	
YALL =	total annual household gross income including social security contributions (but the employer component), pensions and public transfers, income from monetary and real assets, excluding revenues from sales of household durables and irregular private transfers, divided by 10000 <sup>1)</sup>
YALL2 =	total gross income squared, divided by 1 000 000
YALL3 =	total gross income cubed, divided by 10 000 000
<b>Specific income sources: Income from employment</b>	
Employment status dummy = 0, if head of household dependent employed, not civil servant	
SELFEMP =	1, if head of household self employed non-agricultural
SELFEMPA =	1, if head of household self employed agricultural
CIVILSERV =	1, if head of household civil servant
UNEMP =	1, if head of household unemployed
NONLAB =	1, if head of household out of labor force
<b>Specific income sources: Income from real and monetary assets</b>	
Income from real assets variables =0 for renters not owning real estate	
REALESTR =	assessed value of rental real estate owned by renters
REALESTON =	assessed value of real estate owned by owner occupiers not owning other real estate
REALESTOO =	assessed value of total real estate owned by owner occupiers owning rental real estate
YINTEREST =	annual capital income net of capital gains, dividends and returns from investment funds (computed from the reported value of monetary assets by multiplication with the average lending interest rate per asset) and net of a tax allowance
<b>Tax relevant household indicators</b>	
CHILD =	number of persons below 18 living within household
CHILD2 =	number of persons below 18 squared
OTHERPERS =	number of persons above 18 in household other than head and partner
Household status dummy = 0, if head of household married	
UNMARRIED =	1, if head of household not married
SEPARATED =	1, if head of household widowed, separated or permanently living separately
SEX =	1, if head of household female
<b>Other control variables</b>	
AGE =	age of head of household
RURAL =	1, if household lives in a community more than 40 km away from next city above 100 000 inhabitants
REGION =	1, if household resides in Southern Germany

- 1) While we did deduct operation costs involved in generating income from real estate, we were not able to deduct depreciation and interest costs because estimates on these would have been too rough. We will later comment on the consequences of this.

The inclusion of these variables can be justified as follows. Consider first those indicating **income from employment**. Separating incomes from different kinds of employment is important primarily because of differences in precautionary and other expense allowances. In 1983, the base households receiving income from dependent employment were entitled to a general allowance of about DM 1650 p.a., and in addition itemized precautionary expense allowances up to a volume of DM 3500 plus the difference (if positive) between DM 3000 and the employer contribution to social security (9% of gross income). The civil servants do not contribute to social security. Thus in 1983 they could exploit the full DM 3000 deduction opportunity involved in the latter component.<sup>8</sup>

By contrast, the (non-agricultural) self employed could deduct DM 1200 as a general allowance, and, by the above rule, up to DM 6500 for precautionary expenses. In addition, the self employed could always tax deduct interest payments by (not quite legally) shifting debits to their business activities.

The self employed in the agricultural sector receive preferential tax treatment of two kinds. First, a general deduction of DM 2000 per adult from taxable income, and second, a general deduction of DM 2000 from their taxes payable.

Finally, both unemployment benefits and social security or (other) retirement incomes go untaxed with the exception of their revenue component.

Let us now turn to the variables specifying **incomes from real and monetary assets**. Separating owners of real estate into those owning their dwelling unit and those owning other real estate is motivated by differential tax treatment. Households living in owner occupied dwelling units cannot tax deduct mortgage interest payments. However, in 1983 they were allowed to deduct annually five percent of the value of their unit during the first eight years after purchase, and 2.5 percent thereafter up to a cap of DM 200 000 of the house value for single family homes, and DM 250 000 for duplexes. A linear depreciation rate of two percent applied to all values in excess of these caps.

By contrast, owners of rental real estate are able to deduct all mortgage interest payments, and effective 1983 they could deduct for the first eight years 5 percent of the purchase price for the building proper (not for the lot) and of the improvement investment; 2.5 percent for the next six years thereafter; and 1.25 percent for remaining 36 years.

Also, owner occupiers could deduct investment only in energy saving devices at a ten percent rate over ten years, while owners of rental real estate were able to deduct all maintenance investment over the same period. Most importantly, income earned from real estate can become negative, in view of the interest tax deduction and

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<sup>8</sup> For instance, by engaging in tax saving activities, such as in savings towards owner occupied housing within the German Bausparkassen System. See Börsch-Supan and Stahl (1991).

the depreciation allowances.<sup>9</sup> This negative income can be held against income from other sources. Thus on average, tax savings should increase in the assessed value of real estate owned by the individual household.

Interest income is taxed up to a DM 400 a year allowance per adult. However, as that income is not taxed at the source, a substantial share of it remains unreported. If reported, German tax payers cannot discount this income against interest paid on consumption credit.

We discuss now the **tax relevant household indicators**. Households with children could deduct DM 432 p.a. for each child below age of 18, and DM 1800 p.a. as long as that child was not living with the household while undergoing school, or vocational training. For children between ages 18 and 27, deductions were DM 432, while educational expense allowances were DM 2400 (DM 4200) p.a. for children living (not) at home. The standard allowance for precautionary expenses was DM 900 per child below age 16 (or up to age 27 if undergoing vocational, or school training). Finally, subsidies towards owner occupied housing were available only to households with two or more children. This motivates the inclusion of both CHILD, CHILD2, and OTHERPERS since the latter variable largely captures the children above 18 living with their parents.

The base households, i.e. the married ones receive preferential tax treatment relative to singles, by filing joint tax statements with their spouses. This tax advantage obviously is not available to the UNMARRIED. By contrast, the SEPARATED can deduct payments to children not living in their household. At any rate, the differential application of tax rates is reflected in the function that determinates taxable income from taxes paid.

The variable AGE is included to control for risk aversion, or experience effects in tax evasion.

German tax law allows for a deduction of commuting expenses which on average should be particularly large for households living farther away from the major employment centers. This motivates the inclusion of RURAL.

Finally, REGION should capture the fact that the proportion of assessed to market values of real estate is, on average, 14,7 percent in Northern, and 18 percent in Southern Germany. In both, current assessed values are based on 1964 estimates. The difference arises from a much higher appreciation of real estate values in Southern Germany.

Table 5 and Figure 1 indicate some of the discussed effects by giving figures on incomes and taxes for the relevant household groups.

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<sup>9</sup> In a rather comprehensive accounting study on the tax shelter provided by real estate, Bartholomai (1991) collects DM 10 b (DM 17 b) of tax relevant personal incomes from real estate for 1977 (1986), that were held against an estimated DM 17 b (DM 50 b) of tax relevant losses.

**Table 5**

## Incomes by household groups

	Gross Income		Taxable/ Gross Income (%)	Tax Payments / Gross Income (%)
	Mean (DM)	Coeff. of Var.		
Dependent employed	62.481	0,478	62,94	12,27
Civil Servant	67.766	0,412	65,63	13,40
Self employed non-agricultural	92.924	0,689	50,97	11,89
Self employed agricultural	61.174	0,412	22,62	3,44
Unemployed	30.495	0,707	28,07	4,11
Out of labour force	31.822	0,774	16,68	2,38
Renters without real property assets	44.446	0,551	54,26	10,23
Renters with real property assets	80.908	0,533	57,88	13,07
Owners without other real property assets	68.740	0,486	50,41	9,83
Owners with other real property assets	83.737	0,609	46,30	9,74
No monetary assets income > allowance	51.392	0,571	51,25	9,42
Monetary asset income > allowance	70.640	0,589	53,71	11,35
Without children (& other persons)	45.485	0,702	50,13	9,99
With children	67.682	0,519	53,59	10,23
Urban	58.633	0,622	53,17	10,52
Rural	57.852	0,571	49,41	9,07
Unmarried or separated	35.919	0,731	43,40	9,15
Married	68.265	0,507	55,98	10,55
All households	58.421	0,609	52,15	10,13

Source: EVS 1983, weighed sample

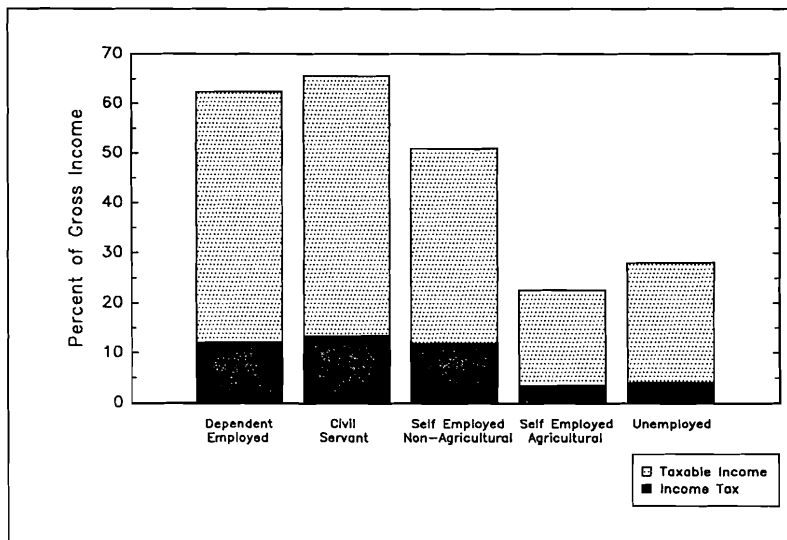
Observe that the non-agricultural self employed's gross income is on average 50 percent higher than that of the dependent employees, but that the spread of their income is considerably higher. By contrast, the share of their taxable income is substantially lower. Amongst the employed, that share is lowest for the agricultural self employed, with about 23 percent. They also enjoy by far the smallest share of tax contributions amongst the employed.

Similarly, the owners without other real property assets have command over 55 percent more gross income than the corresponding renters, yet their share of taxable to gross income, and correspondingly taxes paid to gross income is substantially

lower. This difference becomes extreme when comparing the owners with other real property assets with the renters without these assets.

**Figure 1**

mean tax burden by employment group



Our Tobit estimate based on the variables described in Table 4 is presented in Table 6.



**Table 6**

Determination of taxable income

Parameters	Estimates	t-Statistic	%-change	in response to a change
CONST	-0.221681	-1.732	---	---
YALL	0.890980	21.062	+ 12.8	by 10%
YALL2	-1.359037	-3.702		
YALL3	0.288642	3.829		
SELFEMP	-0.609450	-9.787	- 16.4	from 0 to 1
SELFEMPA	-2.187478	-32.268	- 58.4	from 0 to 1
CIVILSERV	0.035472	2.714	+ 1.0	from 0 to 1
UNEMP	-0.852809	-16.140	- 23.0	from 0 to 1
NONLAB	-1.666366	-48.675	- 42.5	from 0 to 1
REALESTR	-0.053226	-5.076	- 6.8	from 0 to 4.7 <sup>1)</sup>
REALESTON	-0.057766	-16.358	- 6.4	from 0 to 4.2 <sup>1)</sup>
REALESTOO	-0.082764	-10.032	- 15.0	from 0 to 6.8 <sup>1)</sup>
YINTEREST	-0.687544	-5.625	- 2.7	from 0 to 0.15 <sup>2)</sup>
CHILD	-0.260505	-13.926	- 9.5	by one child
CHILD2	-0.033005	-5.279		
OTHERPERS	-0.344768	-28.535	- 9.3	by one person
UNMARRIED	0.061140	2.036	+ 1.7	from 0 to 1
SEPARATED	-0.293122	-9.338	- 7.9	from 0 to 1
SEX	-0.029395	-1.168	- 0.8	from 0 to 1
AGE	-0.006201	-9.035	- 1.7	by 10 years
RURAL	-0.075917	-5.110	- 2.0	from 0 to 1
REGION	-0.036822	-2.916	- 1.0	from 0 to 1
VAR	1.252246	21.744	---	---

Number of cases: 35 989

Likelihood Ratio: 64 548

Dhrymes' Pseudo R<sup>2</sup>: 0.81054

McKelvey-Zavoina's Pseudo R<sup>2</sup>: 0.84076

1) Mean of assessed values (divided by 10.000) of real property owned by the respective households

2) Mean of interest income (divided by 10.000) above allowance of households receiving interest income above allowance

Source: Computed from EVS 1983, unweighed sample

The overall performance measures indicate a very good fit of the estimate.<sup>10</sup> All variables with the exception of the constant and of that controlling for the head of household's sex are significantly different from zero and, as we will argue in the sequel, with the expected sign except that for CIVILSERV. A significant influence of SEX would clearly not correspond to the German tax schedule, nor to expectations about differences in tax evasion.

Quite obviously, gross income is in all terms a highly significant predictor of taxable income. If all variables are evaluated at their means, a ten percent increase in gross income leads to a 12 percent increase in taxable income. However, the significance of both YALL2 and YALL3 suggests that in contrast to the legislated tax allowances, tax shelter is not independent of gross income.

All but one of the dummies characterizing the sources of employment income (SELFEMP, SELFEMPA, UNEMP, and NONLAB), show up with the expected negative sign. The exception is CIVILSERV. Recall that the civil servants do not deduct the employer contributions to social security from taxable income. Therefore, their itemized tax write off opportunities out of the DM 3000 component are larger than those for the other dependent employees. Our estimate indicates that they are not used to the extent possible. Observe also that the dummies reflecting agricultural self employment and non-labor outweigh the others by orders of magnitude. For instance, relative to the dependent employees, the agricultural self employed endowed with the same income are able to reduce their taxable income by 58 percent.

Similarly, the group of variables reflecting incomes from real and monetary assets (REALESTR, REALESTON, REALESTOO), are all negative with the expected relative orders of magnitude. Thus the tax shelter is highest for the owner occupiers owning additional real property: On average, their taxable income is reduced by 15 percent. With an average of 2.7 percent, the reduction in taxable income enjoyed from unreported interest income is comparatively small. However, as discussed above, this is entirely due to underreporting.

In order to appreciate the contribution of reported marginal interest income to taxable income, observe that such a marginal unit does not only increase YINTEREST but also YALL. Therefore, its total impact on taxable income consists of the negative contribution of  $\Delta YINTEREST$  ( $= -.69$ ) and the positive contribution of  $\Delta YALL$  ( $= +.74$ ) (evaluated at DM 70.000 the mean gross income of interest income recipients). It follows that the net contribution of the marginal DM in interest income adds a mere DM .05 to taxable income!

The variables reflecting the number of children in the household do demonstrate the substantive tax shelter allowed for by German tax law. While carrying the significant expected sign, the dummy reflecting the disadvantage of single tax filing is with 1.7 percent surprisingly small, compared to the 7.9 percent reduction in taxable income enjoyed by the separated, due to their tax write off opportunities.

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<sup>10</sup> Dhrymes Pseudo  $R^2$  is the squared correlation coefficient between the observed and the estimated value of the endogenous variable computed only for observation with positive values. McKelvey-Zavoyna's Pseudo  $R^2$  as modified by Veall and Zimmermann (1990) is the measure of goodness-of-fit yielding best prediction for the OLS  $R^2$  of the uncensored sample in the Monte Carlo studies by Veall and Zimmermann.

We attribute the significant negative sign on the age variable to increasing experience in saving tax payments. The RURAL dummy significantly shows the influence of commuting allowances in reducing taxable income. Finally, REGION corrects with the expected sign for the North-South difference in assessed values as predictors of the market value of real property assets.

Figure 2 indicates the aggregate effects of tax shelter and tax evasion differentiated by gross income. The dotted line shows marginal tax rates as a function of gross income under the assumption that taxable income equals gross income minus the standard deductions. While this reflects only the extreme version of the legislated tax rates, it nonetheless can function as a benchmark case. The shaded line gives marginal tax rates if all controls accounting for deductions from taxable income are evaluated at their means. The heavily drawn line finally shows effective marginal tax rates without any controls for tax deduction opportunities.

Figure 2

Legislated and Effective Marginal Tax Rates

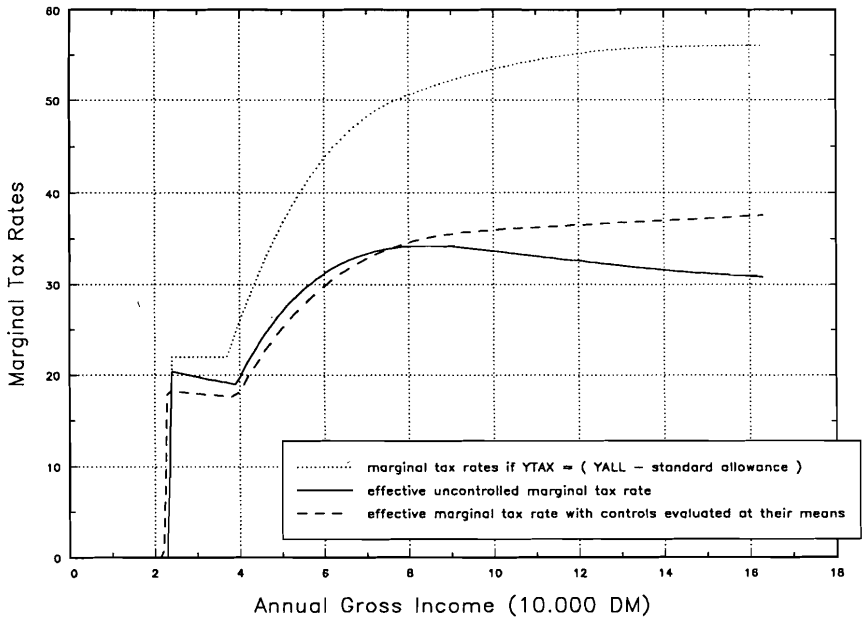


Figure 2 shows quite impressively that both effective marginal tax rates, the one controlled for special allowances and the one uncontrolled for, are located way below the legislated one. Furthermore, the gap between legislated and effective marginal tax

rates increases. Most surprising is the fact that the effective marginal tax rate if uncontrolled for special allowances does not increase monotonically, but decreases from a gross income of about DM 84 000 on! Hence out of every additional income earned, the richest households in the sample (which are not even the richest households in the German economy) pay less taxes than the households earning income just above the sample mean!

Especially in view of this rather striking result, one may question the robustness of our estimate. In order to test for this, we have run several variants of this, especially accounting for its most sensitive components, namely reporting errors in self employment and real asset incomes, and consequently biases in our estimate due to the fact that both the self employed, and the real asset owners are all located in the higher income strata.

In view of the fact that we could not observe **net** income earned from real estate property, we have run an estimate based on gross income **net** of these earnings. There is no qualitative difference to the results presented here except for an upward shift in both controlled and uncontrolled effective marginal tax rate functions by 2.5 and 5 percent, respectively. We also performed an estimate including additional variables interacting both real estate ownership and non-agricultural self employment with income. In the former case, the additional variables turned out to be insignificant. In the latter case, the interaction was weakly significant and positive, but its inclusion did only marginally change the parameters of the original estimate. All of this indicates that the results presented here are quite robust against alternative specifications.

#### **4. Estimating total Tax Losses**

We now use our Tobit estimate of Table 6 to calculate the loss in income taxes incurred in 1983 by the German federal government. Towards this, we assume that the parameters on all controls but the self employment status dummies and the monetary asset variable do indeed reflect the correct use of the legislated tax write off opportunities available to the respective households. We then compute aggregate taxable income and taxes (per household) under the assumption that over and above the deductions controlled for, the households maximally exploit the legal deductions available given their employment status. The relevant computations are summarized in Table 7.

**Table 7**

**Estimation of Income Tax Loss**

	Taxable Income (YTAX)		Tax Proceeds (TAX)	
	Total (DM b)	DM per hhld	Total (DM b)	DM per hhld
(1) Observed values	589.6	33 800	127.6	7 300
(2) Unconditional forecast of latent values	560.9	32 200	123.1	7 100
(3) = (2) with $\beta YALL = 1$ , $\beta YALL2 = \beta YALL3 = 0$	755.8	43 400	190.1	10 900
(4) = (3) with $\beta YINTEREST = 0$	762.4	43 800	192.5	11 050
(5) = (4) with $\beta SELFEMP = 0$	767.5	44 050	194.4	11 150
(6) = (5) with $\beta SELFEMPA = 0$	774.3	44 450	195.3	11 200
(7) = (6)-(2)=Estimated total loss	213.5	12 250	72.2	4 150

Source: Computed from EVS 1983, weighed sample.

Row (2) of Table 7 contains the forecasts of total taxable income and taxes paid on the basis of our estimate, under the assumption that taxable income may also assume negative values. This is obtained by deleting the downward censoring of the dependent variable. The reason for doing so is that we wish to experimentally dismiss different forms of tax shelter. This may have two effects we wish to replicate here. It always increases predicted taxable income; but it may also lead to a change of status from not paying to paying income taxes.

Thus, row (3) predicts taxable income and tax proceeds under the assumption that after exploiting all standard tax write off opportunities reflected in the controls, all additional gross income contributes one for one to taxable income. This would increase taxable income by DM 195 b, and tax proceeds by DM 67 b.

Row (4) adds to this the assumption that all interest income beyond the first tax free DM 400 per adult is contributing in full to taxable income. This leads to a further increase in taxable income of DM 6.6 b, and of tax proceeds by DM 2.4 b. Similarly, removing tax shelter from the non-agricultural self employed beyond the legislated allowances (row (5)) would increase taxable income by DM 5.1 b and tax proceeds by DM 1.9 b. A similar move on the agricultural self employed would increase taxable income by DM 6.8 billion and tax proceeds by DM .9 billion.

The last row of Table 7 reflects the sum of all losses in taxable income and tax proceeds. In particular, after correcting for all tax write offs that are identifiable within the context provided by our data, we estimate a total tax loss of DM 72.2 b.

Per head of the households considered in our sample, this amounts to DM 4 150 in taxes underpaid in 1983.

Table 8 disaggregates this tax loss by household gross income deciles. Not unsurprisingly, the tax losses increase strongly with increasing decile, and peak at DM 15 713, or almost 12 percent of gross income lost per annum from the income earners in the highest decile.

**Table 8**

Tax Loss per Household and Gross Income Decile

Gross Income Decile	Average Tax Loss	Tax Loss in % of Gross Income
1	75	0,53
2	522	1,98
3	1275	3,63
4	1833	4,32
5	2301	4,66
6	2996	5,29
7	3917	6,04
8	5263	7,05
9	7463	8,45
10	15713	11,92

Source: Computed from EVS 1983, weighed sample

The remainder of this section serves to qualify our Tobit estimate as the basis for calculating aggregate income tax losses, and to evaluate our quantification of these. Towards the former, we computed the sumtotal of standard allowances available according to the 1983 German wage and income statistics to the (agriculturally) self employed, and compared this to forecasts on the basis of our Tobit estimate without, and with correction for these allowances. We arrived at a nearly perfect fit between computed and forecasted volume of allowances for the agriculturally self employed. A similar calculation for the non-farm self employed led to an excess of 0.9 billion of forecasted over the computed sumtotal of allowances for the self employed non-agricultural. That difference is easily explained by the fact that our Tobit based forecast includes all households with positive income from self employment, whereas the value computed from the wage and income statistics is restricted to households with self employment as the major income source.

We finally discuss the question whether our figure of DM 72.2 billion over- or underestimates the true tax losses the German government suffered in 1983.

As to factors contributing to **overestimation**: We cannot control for (borderline) legal tax arbitrage opportunities involving monetary assets, of the type suggested by Raab (1992). However, as in 1983, income from monetary assets went uncontrolled by the fiscal authorities, there was little incentive to exploit these. We are also not able to control for itemized special deductions. However, many of these are at the legal borderline. At any rate, they should be more than compensated on average by our assumption that the limits for itemized standard deductions are fully exploited.

The weakest component of our estimate is clearly the tax loss from the self employed's income. It is inflated due to the fact that their tax payments reflect earlier years' lower incomes, and that we were unable to account for backward or forward roll overs from preceding or consecutive years in case these years' tax returns had involved negative taxable income.<sup>11</sup>

In evaluating this, recall that this group's income is underreported by 39 percent relative to the national income accounts. By contrast, tax payments are reported accurately, relative to the wage and income tax statistics. In our view, underreported income alone should more than compensate for the overestimation involved in basing our measure of taxable income on taxes paid on earlier years' incomes. After all, the tax loss we attribute to income from agricultural and non-agricultural employment amounts to merely DM 2.8 b or less than 4 percent of the computed total tax loss.

At any rate, these should be the only important components contributing towards overestimating the tax loss. Quantitatively much more important are aspects contributing to its **underestimation**. A first one is that we were unable to include tax rebates in our estimate. In 1983, tax rebates net of back claims amounted to DM 8.3b. While these are added to our households' gross incomes, they are also not deducted from the taxes paid. Therefore, taxable incomes as computed from tax payments are inflated by more than the household gross incomes are.

Second, we have incorrectly assumed in our calculation that counterfactually the self employed households would maximally exploit of itemized standard deductions up to the limits applicable to them, and for this reason would pay less taxes than we observe them to do. Third, by controlling our estimate for real estate assets, we have implicitly considered legal all tax savings resulting from those assets.

Fourth, recall that interest income is underreported in our survey on average by more than 50 percent relative to the national accounts, and that virtually all of this income illegally goes untaxed. Further on this, the national account figures do not include the incomes from monetary assets deposited by Germans in other countries; in particular in Luxembourg and Switzerland.

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<sup>11</sup> A similar argument could be made with respect to tax losses incurred from owners of rental real estate. However, our real estate variables should fully control for their deduction possibilities, and we did not call these into question within our simulation.

Fifth, the national account figures do not include incomes generated from black market activities. Kirchgässner (1983) estimates a size of the German shadow economy for 1980 of 10.3 percent of GNP, implying DM 155 000 b that went untaxed.

Last but not least, the two percent richest households are not included in our calculation of tax losses. However, by sweeping generalization from our Tobit estimate, these should be the strongest tax savers. In conclusion, we are most certain that our tax loss figure is an extremely conservative estimate of the true loss in income tax payments suffered in 1983 by the German fisc.

## 5. Concluding Remarks

Since the incipient paper by Allingham and Sandmo (1972), the theoretical literature suggests that rational individuals attempt to avoid tax payments; and this the more, the higher their income. This can be done by exploiting sometimes elaborate tax arbitrage opportunities (Stiglitz (1988), ch. 24) and/or by outright tax fraud (Cowell (1990)). In the current tax legislation at least of Germany, the borderline between the two is not clear cut.<sup>12</sup>

Rather than trying to fix this borderline, we have provided an empirical estimate of the magnitude and the distribution of both income tax arbitrage and evasion in Germany. We have based our estimate on evidence from the 1983 Income and Consumption Survey, by computing taxable household income from tax payments and comparing it to reported household gross income, while accounting for household and asset specific tax write off opportunities. To the best of our knowledge, the indirect approach we have chosen here to estimate tax losses is novel in the literature.

A central result is that in 1983 effective marginal tax rates do not increase monotonically in gross income, but decrease in the upper two income deciles of our sample households. In addition, the gap between legislated and effective marginal tax rates widens in gross income. The distributional consequences of this are obvious: At least around 1983, income taxation did not work as intended by the fiscal authorities, but was grossly inequitable.

We also have shown that interest income goes largely unreported, and if reported, contributes only marginally to taxable income. This together with negative income from real assets is largely responsible for the decrease in marginal tax rates. Based on our estimate we computed DM 72.2 b as a lower bound of the sum total of tax losses suffered by the German fisc in 1983.

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<sup>12</sup> What is deemed illegal is decided by the courts on particular cases, and is then adopted in a case law mode.



Unquestionably, our estimate of taxes lost, as any on this difficult subject, is loaded with difficulties. Major ones are that not all income is reported in our survey; that we cannot perfectly relate tax payments to income of the same year; and that we cannot exhaustively account for all legal tax write off opportunities.

However, Cowell (1990) and most recently Webley et al.(1991) compare other methods of estimating the magnitude of tax evasion, and convincingly conclude that each one of them poses problems on the correct inference of tax evasion that are at least as serious as the ones arising from our estimate. The evaluation of our estimate at the end of section 4 suggests that the ballpark figures presented by us are rather robust, and definitely at the low end of the expected volume of taxes lost by the German government in 1983.

How does our estimate compare to those of the literature? The ones closest in spirit are based on data provided by the U.S. American Internal Revenue Service. We look first at estimates of total taxes lost, and then at micro details. Slemrod (1990) reports on estimates by the Internal Revenue Service (1988), according to which in 1987 noncompliance with the individual and corporation income tax cost the Treasury over 20 percent of tax liability. Our estimate of taxes lost for Germany is substantially higher, we estimate losses only on individual income tax proceeds and obtain a tax loss of 45 percent of tax liability. The reasons for this large difference are unclear at present. It may be that the American tax auditors are only able to observe smaller portions of (untaxed) gross income than is reported in our anonymous survey. There may also be cross national differences in tax compliance. Finally, the incentives in two tax systems may differ.

There are many micro studies analyzing IRS data, mostly emphasizing the effects of alternative auditing rules on tax compliance<sup>13</sup>. Our objective was much more moderate: We simply intended to describe the incidence and the magnitude of tax arbitrage and evasion. Yet some of the results are comparable. Closest in spirit is Clotfelder (1983). He shows that the marginal tax rate has a significant effect on underreporting, an effect that is at least not refuted by our estimate. A similar result is reported by Slemrod (1985). By contrast, both Clotfelder's and Slemrod's estimates suggest increasing tax compliance with increasing age, whereas tax compliance decreases with age in our estimate. Also in contrast to our result, the existence of interest and dividend incomes (together with that of wages) is associated with better compliance in Clotfelder's estimate. This should be of little surprise, as in contrast to Germany, taxes on interest and dividends are withheld at the source in the U.S.

It remains to discuss some policy implications of our results. When comparing the results for Germany and the U.S., the clear difference in the impact of interest and dividend income on tax compliance suggests taxation at the source also in Germany. Adopting such a measure would be short sighted, however. Figure 3 shows that in 1983, net purchases by Germans of foreign investment certificates were close to zero, and purchases of foreign fixed interest securities amounted to merely DM 6 b , but that in 1988 and 1992 purchases reacted dramatically to different modes of withholding taxes on incomes from monetary assets, the first one of which was

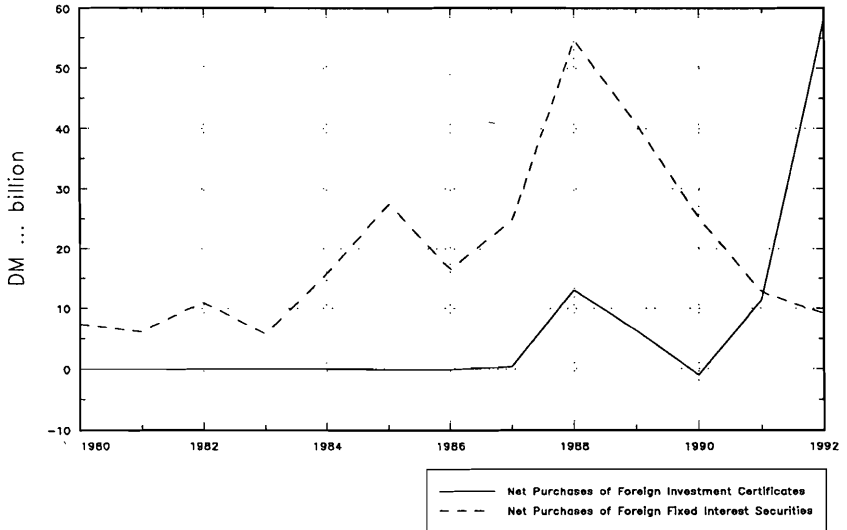
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<sup>13</sup> e.g. Clotfelder (1983), Crane and Nourzad (1986), Dubin et al.(1987, 1990), Slemrod (1985), or Witte and Woodbury (1985)

revoked three months after its inception (Nöhrbaß & Raab (1990)). Thus the 1988 and 1992 attempts to modify the modes of drawing taxes from this income resulted in a massive export of monetary assets. Such exports can never be kept under control in a geographically integrated country such as Germany.

**Figure 3**

German Purchases of Foreign Securities



Source: Deutsche Bundesbank

However, our estimate together with Figure 2 suggests that there were (and still are) severe distributional consequences involved in the mode of taxing income. In particular, we show that the marginal tax rate is regressive in the highest income classes. Apparently the negative redistributive impacts are the result of a large number of partial tax write off measures that may even be rational if working in isolation, together with the fundamental problem that incomes from different sources are easy to conceal. Therefore income is not an ideal tax base. In sum, our results hint towards fundamental reform that eventually leads away from income towards consumption as the more appropriate tax base.

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