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ABSTRACT

The Burden and Disincentive Effects of Hungarian Personal Taxes, 1988–96*

The paper analyses the revenue-raising, distributional and incentive effects of the personal tax system in Hungary from the start of the transitional tax reforms of 1988, and develops methods for estimating marginal indirect taxes. It evaluates the distributional impact of revenue-neutral equivalent indirect tax changes that have occurred since 1988, and shows them to have been regressive.

JEL Classification: H2, H21, P35, P52
Keywords: tax reform, tax burden, efficiency, equity, redistribution, Hungary, transition

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Submitted 24 December 1996

NON-TECHNICAL SUMMARY

What is the best way to describe the system of personal taxation? The redistributive and revenue-raising potential of the tax system can be measured by the average tax rates on individuals, making some assumptions about tax incidence, while the efficiency or disincentive effects are best measured by marginal tax rates. The problem is that individuals are subject to a wide range of taxes on incomes, goods, and savings, some of which depend on their status and income, and some of which are paid on their behalf by employers. With careful tax modelling and the information from a household budget survey, this variety of impacts can be adequately studied, but at the risk of producing too much information. Understanding how this complex set of instruments affects the wide variety of households in an economy requires the careful choice of a suitable method of data compression and representation.

This paper develops a variety of numerical, analytical and graphical techniques directed to this end, and applies them to the study of the transition of Hungary from its former Soviet-style tax system to that appropriate for a market economy, from the first tax reform in 1987 to the 1996 system. The main structural change in the Hungarian tax system came on 1 January 1988 with the introduction of the personal income tax (PIT) and value-added taxes (VAT), the latter replacing the old system of turnover taxes. Social Security payments (for pensions and health care) and unemployment insurance were now partly to be paid out of (and withheld from) wages paid to workers, but mostly paid on wages by employers. Wages paid by enterprises were grossed up and PIT was withheld at source, leaving the same after-tax wage as before, though incomes earned elsewhere were now subject to the marginal PIT rate. In 1989 the enterprise profits tax was reformed and since then the tax rates, tax brackets and allowances or credits for PIT have been revised almost every year, while subsidies and rates of VAT have taken some time to reach a moderately stable state.

Using the Hungarian household budget survey we estimate the average indirect taxes and subsidies paid by quintiles of the active and inactive population for each year from 1987 to 1996 as a percentage of expenditure, correcting for savings which are taxed when consumed at a later date. We find that the original indirect tax system fell considerably more heavily on active households, and was therefore quite progressive, although it became more uniform and burdensome over time. We develop a more sophisticated measure of the redistributive impact of the indirect tax system using individual

expenditure data and the approach of marginal tax reform analysis, and show that the indirect tax reforms were indeed regressive.

Indirect taxes are a small part of the total tax burden, and we compute the total tax burden (direct. and indirect taxes, social security and unemployment insurance – SS & UI payments) as a percentage of gross labour cost (the gross wage paid by employers plus the additional SS & UI paid by the employers). We do this for income deciles of the whole population (to contrast with comparable UK data) and by deciles of non-durable consumption for the active population (our preferred measure) for 1991. The average tax burden varies from just under 40% to nearly 60% of gross labour cost over the deciles in 1991.

We also compute marginal direct taxes from the tax code and income data, and, by estimating consumption functions, compute the marginal indirect tax rates for the 20th and 80th percentiles and the median working family with two children, again for each year, as well as the average tax rates for these three family types. We find that for the median family the average rate rises from just over 40% to nearly 60% (of gross labour cost) between 1988 and 1996, while the marginal rate rises from 60% to 70%. Over this period marginal rates for the different quintiles converge and the tax burden on the 20th percentile rises sharply. The tax system is therefore approaching a simple linear system with a constant marginal rate, similar to those used to compute the optimal tax rate.

The main cause of the high marginal (and average) tax rates is the large share of social security payments. The proposed shift to a three-tier pension system (a minimum guaranteed pension, a defined contribution system, and a voluntary additional element) should reduce the disincentive effects of the present tax system significantly.

The paper therefore presents, in a visually striking way, the tax transition of one of the more heavily taxed transitional economies of Central Europe, and invites other authors to prepare similar descriptions of other economies for comparison.

1. Introduction

What is the best way to describe the system of personal taxation? The redistributive and revenue raising potential of the tax system can be measured by the average tax rates on individuals, making some assumptions about tax incidence, while the efficiency or disincentive effects are best measured by marginal tax rates, which measure the fraction of additional income generated that is transferred to the budget and not returned to the same individual. Under strong assumptions, the optimal tax system will have constant marginal tax rates, and uniform lump-sum transfers (which may depend on demographic status), except perhaps for income taxes. The advantages of non-constant marginal income tax rates should not be exaggerated (Atkinson and Stiglitz, 1980, Newbery, 1997), and the most effective mechanism for redistribution is through transfers rather than taxes.

In Hungary, as in most countries, taxable income is computed from gross income by deducting various allowances, so even with a constant marginal tax rate, the average tax rate increases with income, and the tax system is therefore progressive. This progressivity in the tax system greatly understates the redistributive effect of the tax and transfer system as a whole, as much of the tax revenue is returned as pensions, subsidies, various cash benefits, and services in kind (education and health being the most important). Nevertheless, there is a useful distinction to be made between automatic transfers which are a function of the same variables (current income and expenditure) as tax payments, and conditional transfers that depend on status (whether retired, in education, pregnant, ill or unemployed). Automatic transfers such as subsidies are like tax allowances and tax credits, and best seen as part of the tax side of the budget.

This suggests that a personal tax system is best described by looking at average and marginal tax rates across the income distribution, taking account of tax credits, allowances and subsidies. That will identify the burden of taxation, its progressivity, and its disincentive effects. It is also a useful test of the extent to which the possibly complex tax system can be replaced by a simpler equivalent set of taxes, perhaps closer in form to the simple optimal tax system described. It is useful to think of the simplest tax system equivalent to the actual and more complex reality, in which the only tax is an income tax paid by the employee, who then can purchase untaxed goods. In practice, employers pay employment taxes (social security and unemployment insurance) as a proportion of the gross wage, and with-hold employees' social security contributions and income tax, paying a net wage which is spent on taxed (and subsidised) goods. It should not make any difference who pays the employment taxes, as employers are concerned with the gross labour cost and employees are concerned with the purchasing power of their net income, so it is the total size of the tax wedge between the two that is important. In what follows we shall therefore express taxes as a percentage of gross labour cost, and this will be equivalent to the simple tax system described.

There is one final complication to resolve before reducing the set of taxes to an equivalent income tax, and that relates to the problem of describing taxes and transfers over a lifetime in a static snapshot. Indirect taxes are paid as a function of consumption expenditure, not income, and typically appear regressive, as the savings rate rises with income, but savings are merely deferred consumption, and when spent, will normally attract indirect taxes. If indirect taxes were stable, then the equivalent income tax rate is the ratio of expenditure taxes to expenditure, provided that the equivalent income tax is interpreted as on earned income, not savings. That is, the consumer would make the same

intertemporal decisions and enjoy the same level of real consumption in each period, if all indirect taxes were replaced by equivalent (proportional) income taxes.[1] If indirect taxes rates increase over time, then current indirect taxes as a proportion of expenditure will then understate the true burden. The solution adopted here and discussed below is to assume that savings are taxed at the future, stabilised (post-1994) indirect tax rates. There is no simple way to capture the burden of interest income tax, which has been ignored, thereby somewhat understating the effective tax rate on individuals.

2. The evolution of the Hungarian tax system

The main structural change in the Hungarian tax system came on January 1st, 1988 with the introduction of the personal income tax (PIT) and value added taxes (VAT), the latter replacing the old system of turnover taxes. Social Security payments (for pensions, health, and later for unemployment insurance) were now partly to be paid out of (and withheld from) wages paid to workers, but mostly paid on wages by employers. Wages paid by enterprises were grossed up and PIT was withheld at source, leaving the same after-tax wage as before, though incomes earned elsewhere were now subject to the marginal PIT rate. In 1989 the enterprise profits tax (EPT) was reformed and since then the tax rates, tax brackets and allowances or credits for PIT have been revised almost every year, while subsidies and rates of VAT have taken some time to reach a moderately stable state.

Table 1 gives the income tax rates payable on a single person's taxable income (gross income less allowances) at nominal prices - married couples are taxed as single persons, with the child allowance taken by the higher marginal tax payer. The bottom section of the table gives the allowances for employees and children, and the tax credits that replaced them. In 1994 employees were allowed to deduct their social security and unemployment insurance (together making 11.5% of gross wages) from gross income to give taxable income, but all credits and allowances were abolished in 1995 and handled by the zero tax band. The final two lines gives the consumer price index and the nominal average gross wage, giving a scale to the tax brackets. The gross annual wage of the 20th percentile of full-time earners[2] in the 1991 household budget survey was 135,000 ft., (= £1023 at the 1991 average exchange rate of 132 ft./£, and 58% of the average of 234,000 ft - the median was 197,000 ft.) and this group has certainly been affected by the lowering of tax thresholds as will be shown later.

Table 2 is derived from Table 1 and gives the marginal PIT rates (and, by calculation, would also enable one to compute average PIT payments) on the real wages of a worker with no children (and no other sources of income), whose real gross wage is the given percentage of the 1991 average real gross wage shown in the left and right hand margins of the table. The table is inverted compared to Table 1, with the highest incomes

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[1] Consuming the same real basket of goods each period as before would satisfy the same intertemporal equilibrium conditions for reallocating consumption as before, and the present value of the consumption pattern would bear the same relation to the present value of net income. If τ is the ratio of indirect tax to the tax-inclusive consumer expenditure, this is equivalent to an income tax on gross income at rate τ.

[2] excluding those receiving more than 6% of their income in sickpay and whose annual salaries fell below 91% of the minimum wage, as these are not in full-time employment

Table 1 Rates of Personal Income Tax 1988-96 on nominal income

Taxable income ('000 Ft/year)	1988	1989	1990	1991	1992	1993	1994	1995	1996 wage	1996 other	taxable income (1996 ranges)
0-	0	0	0	0	0	0	0	0	2	20	0-
48-	20										
55-		17	15	12							
70-	25	23									
90-	30		30	18							
100-		29			25	25					
110-							20	20			
120-	35			30							
150-	39	35		32			25	25		25	150-
180-	44								16		185-
200-					35	35					
220-							35	35		35	220-
240-	48	42							32		250-
300-			40	40							
360-	52	49									
380-							40	40	35	40	390-
500-			50	50	40	40					
550-							44	44	44	44	550
600-	56	56									
800-	60										
900-									48	48	900-
Allow. empees	12	12	12	credit	0	credit	.115Y	0	0	0	Allow. empees
Allow. 1-2 /ch	0	0	0	12	15.6	credit	credit	0	0	0	Allow. 1-2 /ch
Allow. 3+ /ch	12	12	12	12	15.6	credit	credit	0	0	0	Allow. 3+ /ch
credit empees				3	0	2.4	0				credit empees
credit 1-2 /ch						3.6	4.8				credit 1-2 /ch
credit 3+ /ch						4.8	7.2				credit 3+ /ch
CPI 1987=100	116	135	175	236	290	355	419	537	661	661	CPI 1987=100
Av. gross wage	108	127	161	215	268	326	400	467	560		Av. gross wage
Av. real wage	219	221	218	215	218	216	225	205	200		

Note: Taxation of income of wages is on a fraction of wages depending on the share of wage to total income, the balance at the higher rate for non-wage income

Allow. empees: Annual allowance per employee in '000 Ft, and where Y is gross wage income, and .115 is the SS+UI contribution of the worker

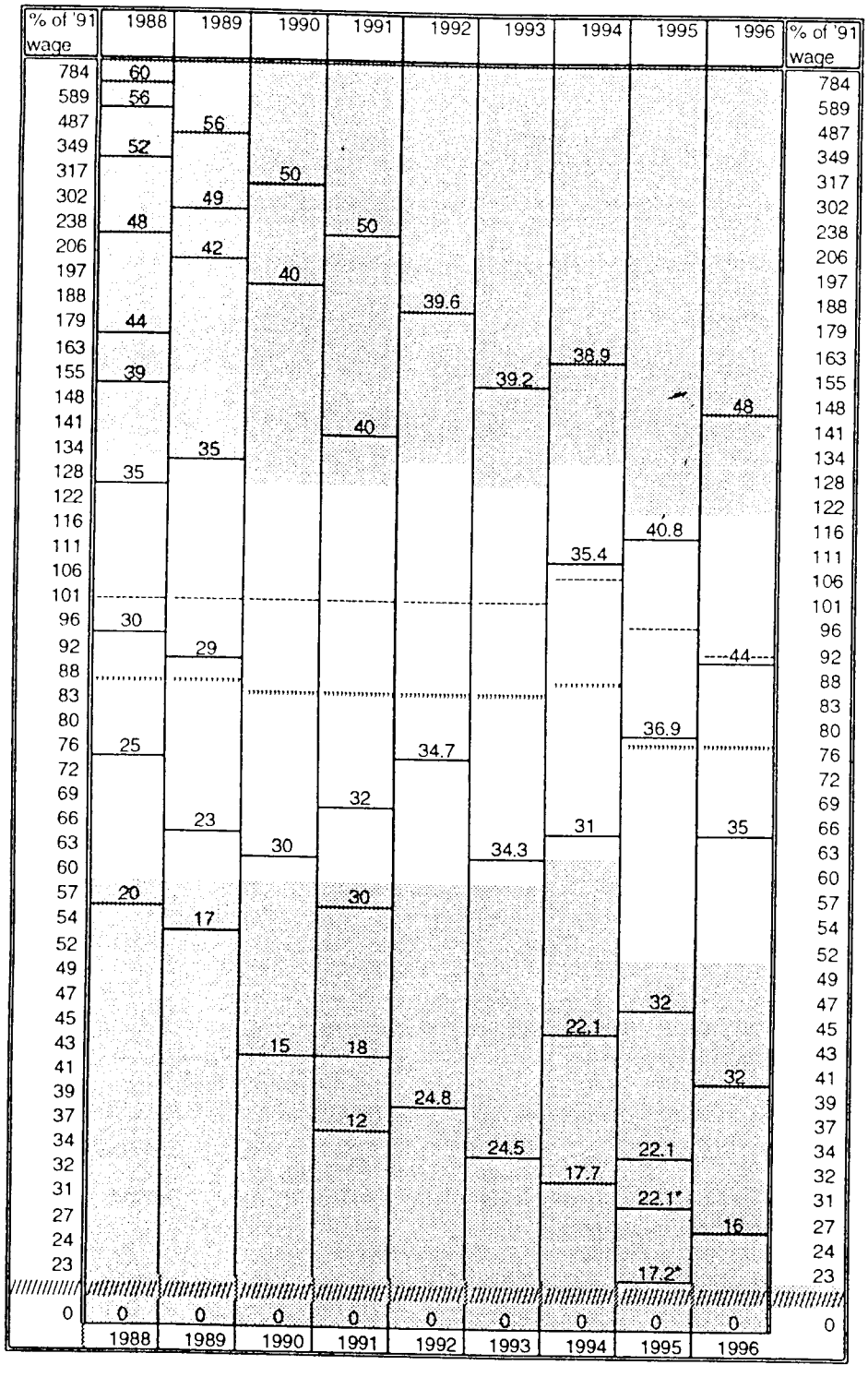
Allow. /ch: annual allowance per child in '000 Ft

credit empees: tax credit in '000 Ft for employees; credit/ch is annual tax credit per child in '000 Ft

Av gross wage is average gross nominal wage+bonuses, '000 Ft/year

Av. real wage is average gross wage at 1991 constant CPI prices

Table 2 P.I.T. marginal rates and bands of gross real wage incomes (1991 average=100)



Note: Scale roughly logarithmic with 5% increments gaps below the 80th percentile
shading indicates bottom and top quintiles, ---- mean; ,,,,,,,,,, median gross real wage
* These rates only apply to incomes above the approximate average
(logarithmic scale, difference of adjacent rows = appx. 5 %) === top 20%, ---- mean, ,,,,,, median, ... bottom 20%

shown highest, and the shaded areas indicate (roughly) the 80th and 20th percentile wages, (ie the top and bottom quintile of workers), with lines indicating the average and median wage in each year.[3]

The table dramatically indicates the steady increase in the marginal (and average) PIT rates facing workers in the bottom quintile. For example, consider a worker with 52% of the average 1991 real wage (below the 20th percentile in 1988 but close to it in 1995 and 1996), who faces a marginal rate of zero in 1988 and 1989, 15% in 1990, 18% in 1991, 24.8% in 1992, which falls slightly in 1993 and 1994 (though with a higher average rate), but then rises to 32% in 1995 and 1996.

To make further progress in examining the distributional consequences of the tax system and changes to the tax rates and brackets, we need a representative sample of households, giving details of their income, tax payments, benefits, and expenditure (needed to compute indirect taxes). Fortunately, we have household surveys for 1987, 1989 and 1991.

3. The Hungarian Household Budget Survey

The Hungarian Central Statistical Office (HCSO) conducts biennial household budget surveys (HBS) of about 12,000 households. In each round, one third of the sample is replaced, so that in the absence of attrition, each household would remain in the survey for three rounds. Details of the surveys, of the construction of the panel, and a discussion of their representativeness, are given in Revesz (1994). For most of the following analysis, we use the 1991 HBS. Jarvis and Pudney (1994) assess the reliability of this 1991 HBS for simulating change in the tax system, and conclude that they are rather more reliable than such surveys as the UK Family Expenditure Survey, which are regularly used to simulate the distributional effects of tax changes. For our purposes we need to be able to estimate the income tax liability of each household from information given on gross earnings and numbers of children. The accuracy of this calculation was checked by attempting to recover an estimate of the tax liability for 1991 and comparing this with the tax recorded as paid in the survey. The correlation between the estimated and recorded payments is 97 percent, increasing confidence in our ability to identify the marginal income tax bracket. It should also be noted that the income tax brackets are quite wide relative to deciles of the income distribution, with most tax payers facing the same marginal tax rate, as will be seen below.

4. Evolution of indirect taxes and subsidies

VAT was introduced in 1988, replacing a variety of indirect turnover taxes, though excise taxes on goods such as alcohol, tobacco, motor fuel were kept, while the subsides on district heating, household fuels, public transport, medicine, and some foodstuffs, were kept but some categories were gradually eliminated. Appendix tables A6 and B1 give the

[3] The location of the quintiles and the median relative to the average is taken from the 1991 HBS for earners in full-time employment. The income distribution becomes slightly less equal in later years, and there are small fluctuations in the locations of these quantiles in other years, but they are small compared to the steps in the scale, and do not have much effect on the fractions of the workforce facing each marginal tax rate. For a recent summary of evidence of (and uncertainties about) the Hungarian income distribution, see Andorka, Ferge and Tóth (1996).

tax and subsidy rates as a fraction of the consumer prices for the years 1987, 1988, 1991, and 1994, after which the VAT rates stabilised.[4] Fig. 1 shows indirect taxes (above the line) and subsidies (below the line) as a percentage of total consumption, for active households (on the left) and inactive households (ie the remainder of the sample) on the right. The taxes are weighted by the 1991 expenditure shares for each group, and the groups are defined by the boundaries of the quintiles of non-durable consumption per equivalent adult of active households.[5] Non-durable consumption per equivalent adult was taken as the best measure of life-time or permanent income, and a better measure of the longer-run distribution of living standards.[6] Fig. 1 therefore shows the evolution of the redistributive impact of the indirect tax and subsidy system with constant weights, and not the actual indirect taxes paid in each year by the decile of that year. The average annual total consumption per equivalent adult in thousands of 1991 forints is shown for each group, and the averages for each sample is shown at right. Note that the average for the inactive sample is substantially lower than the active, as they are concentrated in the lower groups.

Fig. 1 shows that indirect taxes were raised in 1988, and again between 1991 and 1994, when VAT was extended to food and other services in 1993 and 1994. Subsidies were not cut until after 1988, but were then cut sharply between 1988 and 1991, and again between 1991 and 1994. The figure also shows that both taxes and subsidies were progressive across the consumption distribution, and surprisingly different in their impact on the two sub-populations of households. The main reasons for the difference in the average net indirect tax (tax less subsidy) of about 8 per cent of expenditure in the bottom groups in 1987 were the high subsidies on medicines and solid and liquid household fuel, whose consumption shares were considerably higher in inactive households, and the heavier taxes on tobacco and vehicle use, where the active households had larger consumption shares.[7]

The argument for comparing indirect taxes to expenditure, rather than income, as in fig. 1, relates to the question of how to treat savings, bearing in mind that savings

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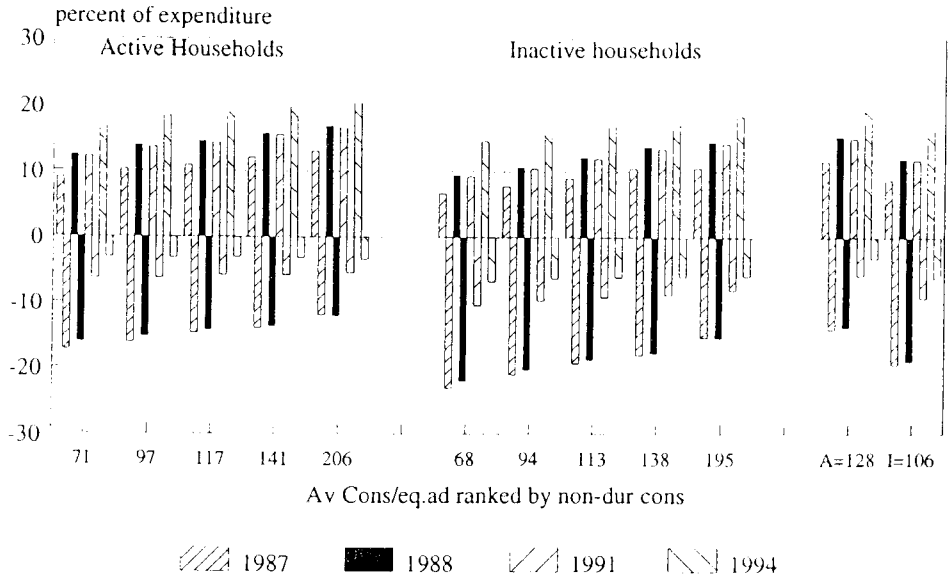
[4] We were not able to obtain details of changes to excises and subsidies in 1995 and 1996, though by 1994 the indirect tax system had eliminated most subsidies. The individual commodity tax rates are given in Table A6.

[5] Using the OECD set of equivalence scales, 1 for the first adult, 0.7 for each subsequent adult, and 0.5 for children. The active households are thus in true quintiles, the inactive household groups have declining average numbers.

[6] The top and bottom deciles of the income distribution contain a disproportionate share of those who are either transitorily rich or poor, or misrepresent their incomes more than usual, and are atypical in other ways (number of children, share of pensioners, savings rates, etc). If households are ranked by equivalised total consumption, then the top decile contains a disproportionate share of those making large occasional durable purchases such as cars. Any ranking system has problems, and the savings rates in the present case are negatively correlated with non-durable consumption, reflecting the lack of correlation between transitory income and consumption.

[7] These four items alone explain all the difference in the bottom group, with the remainder of the 1987 tax system rewarding and penalising active households about equally. The differences are lower in higher groups and later years.

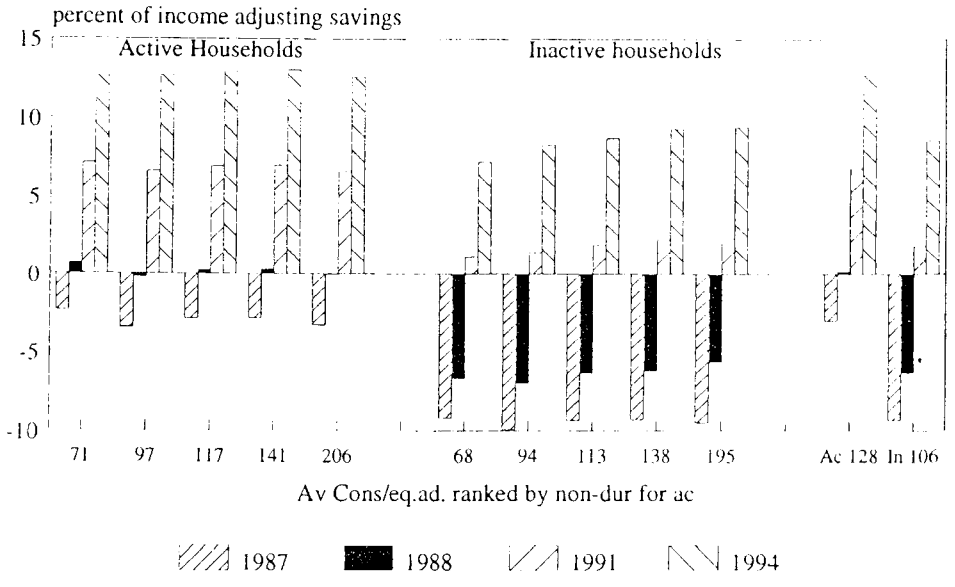
Indirect taxes and subsidies
Hungary 1987-94 Active and Inactive HH



wtcd by 1991 HBS, ITndQbth
group boudaries quintiles of active HH

Fig. 1

Net indirect taxes excl excess veh. tax
Hungary 1987-94 Active and inactive HH



wtcd by 1991 HBS; ITndQbth; ITndQvch

produce a future flow of taxed income, which will be spent on taxed commodities. If the indirect tax and subsidy system remained stable, and if consumers had the same future consumption pattern as at present, then it would be sufficient to compare all taxes and subsidies to current expenditure. If, however, as happened in Hungary, subsidies are gradually phased out and indirect taxes raised, then current consumption expenditure is less heavily taxed than the future consumption out of current savings. One simple adjustment is to estimate the effective indirect tax rate, τ^e, out of (after-tax) household income at date t, Y_t, as

$$\tau_t^e \equiv \frac{T_t^e}{Y_t} = \frac{T_t}{C_t} \cdot \frac{C_t}{Y_t} + \frac{T_{94}}{C_{94}} \cdot \frac{S_t}{Y_t} \qquad (1)$$

where T_t is total indirect taxes less subsidies paid by the household, C_t is consumption, S_t is saving, all at date t, and the tax system is assumed to have stabilised by 1994.

One further correction is required, and that relates to the special tax treatment of cars and motor fuel, some part of which should be treated as a road user charge rather than a tax. The solution adopted is to impute only the standard rate of tax to these items, with all of the balance being treated as a road charge. Fig. 2 graphs the resulting net indirect taxes now shown as a share of income, (with savings taxed at the 1994 tax rates), and only counting the standard rates of tax on cars and motor fuel. As before, active and inactive households are shown separately, and again the indirect tax burden is considerably heavier on the former than the latter in each year (though more so in earlier years).

It is striking that the incidence of net indirect taxes on active households (the left hand panel of fig. 2) is remarkably uniform across the consumption distribution, though this is less true for inactive households in 1994.

5. The combined effect of direct and indirect taxes

In addition to income taxes and indirect taxes and subsidies, workers are also subject to social security (SS) payments made directly, and social security and unemployment insurance (UI) paid by firms on the workers employed. Fig. 3 shows the average tax rates for all households in Hungary. The HBS sample was divided into deciles on the basis of net (after PIT and SS) income per equivalent adult,[8] to enable a comparison with UK data (which was only readily available for income deciles). The taxes distinguished are social security (SS) payments by workers, social security and unemployment insurance (UI) by firms on the workers employed, the net indirect taxes (ie indirect taxes less subsidies), and PIT. The taxes are shown as a percentage of the gross labour cost, defined as the gross wage plus firm contributions to SS and UI. Indirect taxes are corrected as in fig. 2 to tax savings at 1994 tax rates and motor fuel at the standard tax rate only.

The ratio of active earners to numbers of equivalent adults is shown by the

[8] The HBS gives two different measures of earnings, one based on the year-end interview, the other derived from the two-month diary keeping. The HCSO then takes the maximum of the year-end and grossed up (but undeflated) diary records as its measure of earnings (and has similar procedures for taxes and social security contributions). The data presented here is based on year-end interview data, which is systematically lower than the HCSO derived measures.

continuous line in fig.3, showing a sharp drop between the first and second decile for all households. The deciles are marked by the consumption per equivalent adult, as a measure of permanent or lifetime income, and the extreme right-hand column gives the average for the whole population. It will be seen that in Hungary, the lowest decile, selected on income has a higher consumption per equivalent adult than the second decile which is accounted by the higher proportion of active earners per equivalent adult. This may be because the lowest decile contains many temporarily low income earners with high lifetime consumption expectations, and negative savings.

Fig 3. can be compared with its counterpart for a market economy, in this case the UK. Fig. 4 gives the average tax rates as a share of gross labour costs for all UK households in 1991, directly comparable to Fig. 3 (and with the same vertical scale), and taken from CSO (1993). Indirect taxes are computed as a share of expenditure, then grossed up by the ratio of income to expenditure, as indirect taxes are fairly stable in the UK. Note that the range of equivalised income is far larger in the UK than in Hungary[9], that national insurance contributions (NIC, the equivalent of the Hungarian SS + UI) are progressive in the UK, that local property taxes are important and very regressive, and that PIT appears more progressive in the UK than Hungary) but that the range of income is far wider, exaggerating the appearance of greater progressivity. Note also that the overall burden is considerably lower in the UK, largely because of the far smaller levels of SS, and that indirect taxes are relatively and absolutely heavier in the UK.

Showing the tax share for different income deciles of the whole population is standard practice, but gives a misleading view of the progressivity of the tax system, for two reasons. The first is that lower income deciles have a disproportionately large number of inactive households who pay no income tax, and the second is that ranking by income moves those with transiently large and small incomes to the extremes, and gives a misleading idea of the normal burden of taxes on active households. Fig. 5 shows the results for Hungary of considering active households alone and ranking them by equivalised non-durable consumption, as in figs. 1-2. The apparent progressivity is dramatically reduced, though the burden (measured by the average share) increases.[10] Fig. 6 presents the same data in area form, but with the x-axis now numerically scaled, to show the rate at which the average tax burden increases with consumption. The share of PIT now increases smoothly, reflecting the move to a constant rate over a wide range of consumption levels.

Three important assumptions have been made in plotting these average tax rates. The first is to treat all the SS contributions as a tax, rather than allocating some part as a contribution to future pensions. The correct solution would be subtract an estimate of the present value to the worker of benefits derived from additional contributions made by the worker or on his behalf. This will depend on the determination of retirement pensions as

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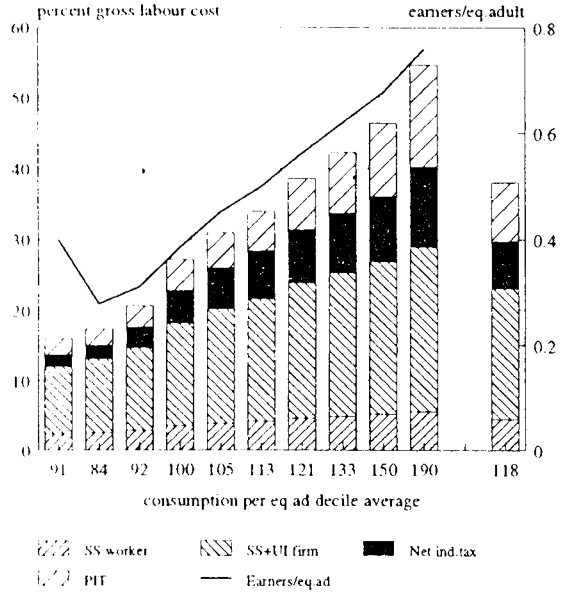
[9] The definition of an equivalent adult used by the CSO is quite different from the OECD measure used in producing the Hungarian estimates but is highly correlated with the OECD measure at this level of aggregation, so the ratio of the top to the bottom will not be affected.

[10] Note that indirect taxes become less progressive as savings are taxed at the higher 1994 tax rates, and savings rates decrease with deciles when ranked by consumption, though they increase when ranked by income.

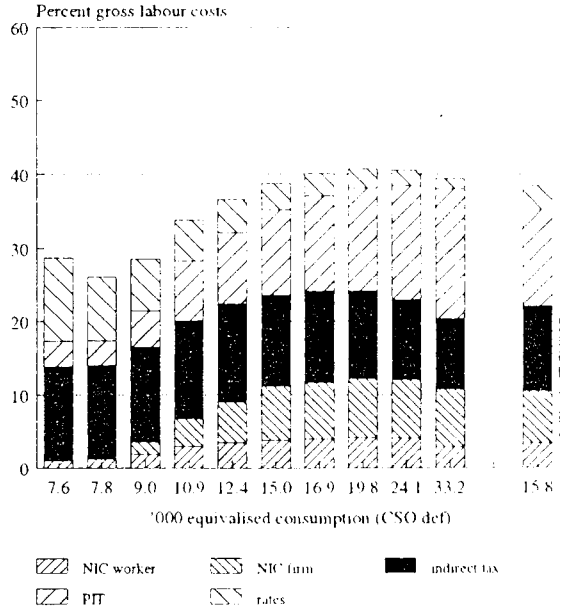
Average Tax Rates, All Households
Hungary 1991, Income deciles (yr end)



TaxDecYF
savings taxed at 1994 tax rates

Fig. 3

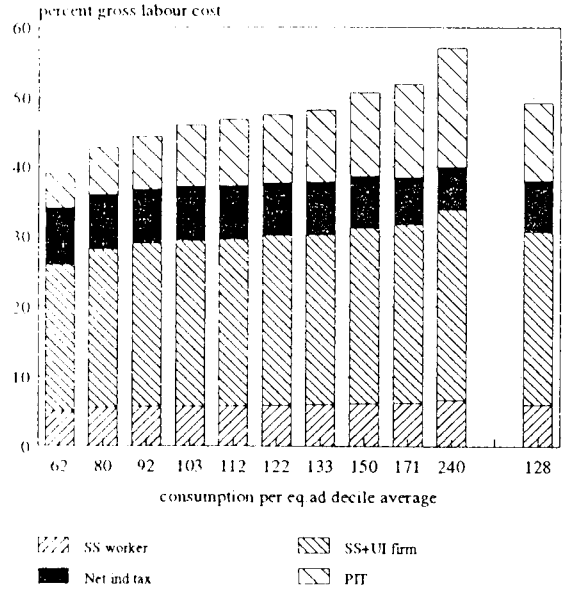
Average tax rates, all households
UK 1991, Income deciles



TaxdecUK

Fig. 4

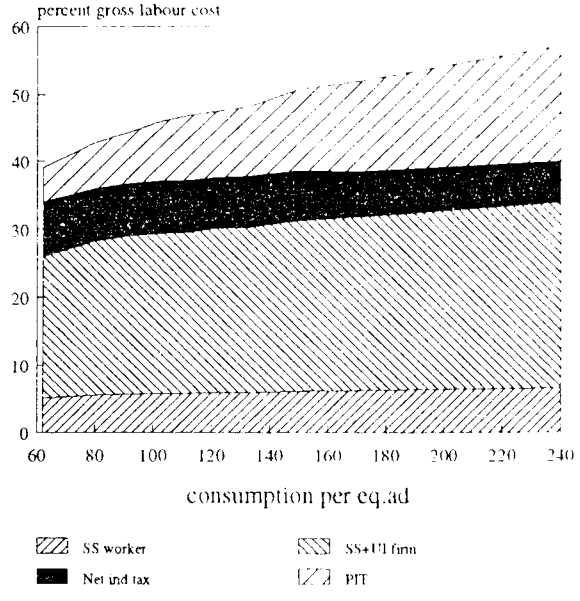
Average tax rates, active households
Hungary 1991, Non-durable Cons. deciles



TaxDecAN
savings taxed at 1994 tax rates

Fig. 5

Average tax rates, active households
Hungary 1991 ranked by non-durable cons.



TaxDecAN; tax91ara
savings taxed at 1994 tax rates

Fig. 6

a function of contributions, the time between the contribution and the pension and the subjected discount rate modified by any uncertainty on the part of the contributor as to the credibility of future pension payment commitments. In Hungary during this period, the only determinants of future pension is the number of years' contribution, not the amount contributed, and the final wage (or best three years' wages over the previous five years). Extra income more than five years before retirement is thus completely taxed through (marginal) SS contributions, while the present value of additional gross income paid shortly before retirement, if it occurs at a period of peak wages, will generate greater benefits than extra tax liabilities. This effect has been ignored.

The conventional wisdom on pension reform, advanced in particular by the World Bank (1994), is a three pillar approach, and it is interesting that the Hungarian Parliament endorsed essentially this approach in 1991 (OECD, 1995, p127). The three pillars are i) a universal flat-rate tier, financed by general revenues; ii) an earnings-related tier with benefits closely linked to contributions; and iii) voluntary supplementary pensions. The situation in late 1996 is that the Hungarian Parliament is still designing the new system, under inducements of further loan support from the World Bank, and at some stage in the near future, some part of SS contributions will directly contribute to future pensions, and at that point would cease to be a tax. But until that happens, it is likely that most agents will treat marginal contributions as a pure tax.

The second has already been mentioned, and relates to the treatment of savings. Net indirect taxes are computed by weighting consumption by the 1991 tax rates and savings by the 1994 tax rates. Finally, no account is taken of taxes on intermediate goods, in contrast to the position taken by the UK CSO in their presentation of tax incidence published annually in *Economic Trends.* VAT on intermediate goods used to produce goods subject to VAT would be rebated in any case, and for other goods the assumption is that producer prices are set on international markets, so intermediate taxes fall on factors not final prices.

The average rates vary considerably over the income distribution of all households, shown in fig.3, as inactive households are concentrated in lower deciles and pay lower average tax rates. In contrast, the variation in average tax rates for active households (fig. 5) varies much less. Appendix figs. A1-A2 distinguish between taxes (above the line) and transfers given through the tax system, (mainly for children, but excluding transfers in kind for e.g. health and education), shown below the line. Subsidies on goods are also shown below the line (so the net indirect tax is the sum of indirect taxes and subsidies). Figs. A1 and A2 reproduce the samples of figs. 3 and 5 (except, to maintain comparability, fig. A2 is partitioned by income deciles of the whole population as in fig. A1) Pension payments can be compared with contributions (all social security contributions, which also include unemployment insurance and some contributions to the health system). As expected, richer families are more likely to be working and making net contributions to the pension fund.

The burden of indirect taxes as a proportion of consumption per equivalent adult is slightly progressive for all households, ranging from a low of 10.7% for the second decile up to 15.9 for the top decile. If taxes on petrol are excluded the degree of progressivity decreases considerably, reflecting the concentration of car ownership and use in the higher deciles. Elsewhere we have counted the tax on vehicles an fuel at the standard rate, but here they are shown in full.

Subsidies as a percentage of consumption per equivalent adult are also progressive across deciles (see fig. A2, which distinguishes subsidies from other transfers - there are no pension payments by sample definition), and the net indirect tax (taxes less subsidies) then appear very progressive across all households (see fig. 3).

6. . Calculating marginal tax rates

Marginal income taxes for wage earners at different points in the income distribution have already been presented in Table 2, and three representative families have been chosen to illustrate the evolution of the marginal and average tax rates over time. The poorest such family is assumed to have a single wage earner (with no other income) at the 20th percentile of the earnings distribution, married with two children.[11] The middle family also has a single wage earner (with no other income) and two children, at the median wage. The richest family has no children, and a single wage earner (with no other income) at the 80th percentile of the earnings distribution. Families with other income will typically face higher average and possibly also higher marginal tax rates, and would require more complex modelling to compute these rates. Fortunately, all other direct taxes and contributions are proportional and thus have constant marginal rates. The average and marginal direct tax rates on these three families are given in the top part of Table 3.

In addition to PIT, the employee pays social security contributions and unemployment insurance (SS, UI), as does the firm, on the gross wage at the uniform proportional rates shown. The gross labour cost to the firm is the sum of the gross wage and the SS + UI contributions paid by the firm, and is shown in the table. The average and marginal direct tax wedges as a percent of the gross labour cost can then be computed once the relevant taxes have been identified and are shown in the centre of the table. The system of pension contributions is in the process of reform towards a defined contribution system (though it is not yet clear how rapidly it will be phased in for different age groups), and when this reform is in place, some part of the current SS tax-like charges will become compulsory savings with a higher current value. The last column of table 3 gives the effect of reducing the personal tax element for pensions from 6% to 3% (the balance being health insurance and UI), and the firm contribution by one-third of 42.5%. Of course, the effect on incentives will only operate to the extent that workers appreciate that higher firm payments translate into higher future pensions at the margin, but in other market economies firms often bargain with workers over the entire package of benefits and pensions, so this may eventually become part of the culture.

6.1 Marginal indirect taxes

The marginal indirect tax rate is defined as the extra indirect tax (net of subsidies) paid

[11] In Newbery and Revesz (1995) we considered a family with 3 children, which dramatically affects the average and marginal rates in the first few years, as Table 1 shows. Table 3 therefore also gives the average and marginal PIT rates for a family of one earner at the 20th percentile with three children, though it should be noted that this would be a rare occurrence, and the family would be in desperate poverty.

Table 3 Evolution of Average and Marginal Tax Rates in Hungary

percentages

	1988	1989	1990	1991	1992	1993	1994	1995	1996	pension reform**
AVERAGE tax rates on gross wage										
PIT bot quintile = 3 ch.*	0	0	0	0.4	0.3	1.6	0.0	9.5	11.0	11.0
PIT bot.quintile + 2 ch.	0.1	1.0	3.9	3.7	2.9	5.6	4.7	9.5	11.0	11.0
PIT median wage + 2 ch.	7.2	7.7	11.3	11.9	10.2	14.4	12.8	17.1	18.5	18.5
PIT top quintile	15.1	15.1	17.9	19.0	18.6	21.4	20.0	25.6	26.5	26.5
MARGINAL tax rates on gross wage										
PIT bot quintile = 3 ch.*	0	0	0	12.0	24.8	24.5	0.0	32.0	32.0	32.0
PIT bot.quintile + 2 ch.	20.0	17.0	15.0	18.0	24.8	24.5	22.1	32.0	32.0	32.0
PIT median wage + 2 ch.	25.0	23.0	30.0	31.9	24.8	34.3	31.0	36.9	35.0	35.0
PIT top quintile	35.0	35.0	30.0	31.9	34.6	34.3	35.4	40.8	44.0	44.0
PROPORTIONAL taxes on gross wage										
SSC+UI	10.0	10.0	10.0	10.3	11.0	12.0	11.5	11.5	11.5	8.5
SSC+UI firm	43.0	43.0	43.0	44.5	49.0	51.0	49.5	49.0	47.5	33.3
Gross labour cost/gross wage	143.0	143.0	143.0	144.5	149.0	151.0	149.5	149.0	147.5	133.3
AVERAGE direct tax wedges on gross labour cost										
bot. quin.+2ch	37.1	37.7	39.8	40.5	42.2	45.4	43.9	47.0	47.5	39.6
median wage+2ch	42.1	42.4	45.0	46.1	47.1	51.2	49.3	52.1	52.5	45.3
top quintile	47.6	47.7	49.6	51.0	52.7	55.9	54.2	57.8	58.0	51.3
MARGINAL direct tax wedges on gross labour cost										
bot. quin.+2ch	51.0	49.0	47.6	50.3	56.9	57.9	55.6	62.1	61.7	55.4
median wage+2ch	54.5	53.1	58.0	60.0	56.9	64.4	61.5	65.4	63.7	57.6
top quintile	61.5	61.5	58.0	60.0	63.5	64.4	64.5	68.0	69.8	64.4
Indirect tax rate (as % of after tax income correcting for savings)										
AVERAGE indirect tax										
bot. quintile	0.2	2.4	4.6	6.9	8.8	10.7	12.7	12.7	12.7	12.7
median wage	0.2	2.4	4.6	6.9	8.9	10.9	12.9	12.9	12.9	12.9
top quintile	0.2	2.4	4.6	6.8	8.8	10.8	12.8	12.8	12.8	12.8
MARGINAL indirect tax (as % of after tax income correcting for savings)										
bot. quintile	12.9	13.2	13.5	13.9	14.6	15.1	15.6	15.6	15.6	15.6
median wage	14.0	14.1	14.2	14.4	14.8	15.3	15.8	15.8	15.8	15.8
top quintile	14.8	14.7	14.6	14.5	14.8	15.1	15.4	15.4	15.4	15.4
TOTAL AVERAGE TAX as % of gross labour cost										
bot. quin.+2ch	37	39	43	45	47	51	51	54	54	47
median wage+2ch	42	44	47	50	52	57	56	58	59	52
top quintile	48	49	52	54	57	61	60	63	63	58
TOTAL MARGINAL TAX as % of gross labour cost										
bot. quin.+2ch	57	56	55	57	63	64	63	68	68	62
median wage+2ch	61	60	64	66	63	70	68	71	69	64
top quintile	67	67	64	66	69	70	70	73	74	70

Note: Bottom quintile is 20th percentile, top is 80th percentile, all of the current year's distribution
Indirect tax rates for 1989-90, 1992-3, and 1995-6 interpolated
* average and marginal PIT rates for a family with earner at 20th percentile with 3 children (in acute poverty) - other components of the table can then be computed as for family of 2 ch.
** reducing tax element of SS relative to 1998 by amounts shown

Subsidies as a percentage of consumption per equivalent adult are also progressive across deciles (see fig. A2, which distinguishes subsidies from other transfers - there are no pension payments by sample definition), and the net indirect tax (taxes less subsidies) then appear very progressive across all households (see fig. 3).

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Marginal income taxes for wage earners at different points in the income distribution have already been presented in Table 2, and three representative families have been chosen to illustrate the evolution of the marginal and average tax rates over time. The poorest such family is assumed to have a single wage earner (with no other income) at the 20th percentile of the earnings distribution, married with two children.[11] The middle family also has a single wage earner (with no other income) and two children, at the median wage. The richest family has no children, and a single wage earner (with no other income) at the 80th percentile of the earnings distribution. Families with other income will typically face higher average and possibly also higher marginal tax rates, and would require more complex modelling to compute these rates. Fortunately, all other direct taxes and contributions are proportional and thus have constant marginal rates. The average and marginal direct tax rates on these three families are given in the top part of Table 3.

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on additional goods purchased when income (or expenditure) increases by one unit.[12] Suppose that preferences can be described by the Linear Expenditure System (LES):

$$p_i q_i^h = p_i \gamma_i^d + \beta_i (y^h - p'\gamma^d) \tag{2}$$

where p_i is the price of good i, q_i^h is consumption of good i by household h (defined as consumption per equivalent adult), γ_i^d is the minimum consumption of demographic group d to which h belongs (defined by number of adults, children, active/inactive, location, etc listed in Appendix B), y^h is income (or, more usually, total expenditure) of household h (again, expressed per equivalent adult),[13] and β_i is the marginal expenditure share on good i. If τ_i is the indirect tax rate on good i (as a fraction of the tax-inclusive price), then $\Sigma\beta_i^d\tau_i$ is the marginal indirect tax rate. These will be constant across the income distribution for the LES.

If we wish to explore any non-linearities in the Engel curves, then the simplest alternative is the Working-Leser model:

$$\omega_i^h = \alpha_i^d + \delta_i \log y^h, \tag{3}$$

where ω_i^h is the share of expenditure by h on good i. To find the marginal tax rates, (3) can be rewritten as

$$p_i q_i = \alpha_i^d y + \delta_i y \log y, \tag{4}$$

so that

$$p_i \frac{dq_i}{dy} = \alpha_i^d + \delta_i \log y + \delta_i = \omega_i + \delta_i. \tag{5}$$

The marginal indirect tax rate will then be $\Sigma(\omega_i+\delta_i)\tau_i$, which will vary across the income distribution as the budget shares ω_i vary.

The practical question is how best to estimate the values of the marginal expenditure shares β_i and $\omega_i+\delta_i$. With only cross-section data, there is little choice but to estimate equations (2) and (3) across households, controlling for demographic and other status characteristics. The results of this estimation using the 1991 HBS are given in appendix table B1, together with the average shares for each commodity, ω_i. Of the two models, the Working-Leser model had the better fit, judging by the residual errors, and will be the version used in the calculations. It gave considerably higher marginal tax rates than the LES, as shown in table B1. The main sources of divergence between the two estimates relate to subsidized goods, motor fuel and non-durable consumption (itself a very large share), tobacco, and medicine. In each case there is considerable evident

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[12] As argued, it is more logical to express indirect tax rates on their tax base of consumption, and to adjust for savings as in equation (1).

[13] Non-durable consumption was taken as the base as a better measure of life-time income, and the parameters scaled up to reflect the share of non-durable consumption in total expenditure.

non-linearity in the Engel curves, and the Working-Leser estimates appear to capture the marginal shares rather better.

Appendix A also discusses attempts to use the panel element of the 1989-91 surveys, and the full cross-sections for several years, though these proved to be unsatisfactory, perhaps because of the substantial decline in real income and expenditure over this period, coupled with liberalisation of the durable goods market in particular. The pooled cross-section sample gave estimates that were reasonably close to the single 1991 cross-section used here, except for implausible figures for marginal expenditure shares on durables and especially cars. The treatment of durable goods is further discussed in appendix B.

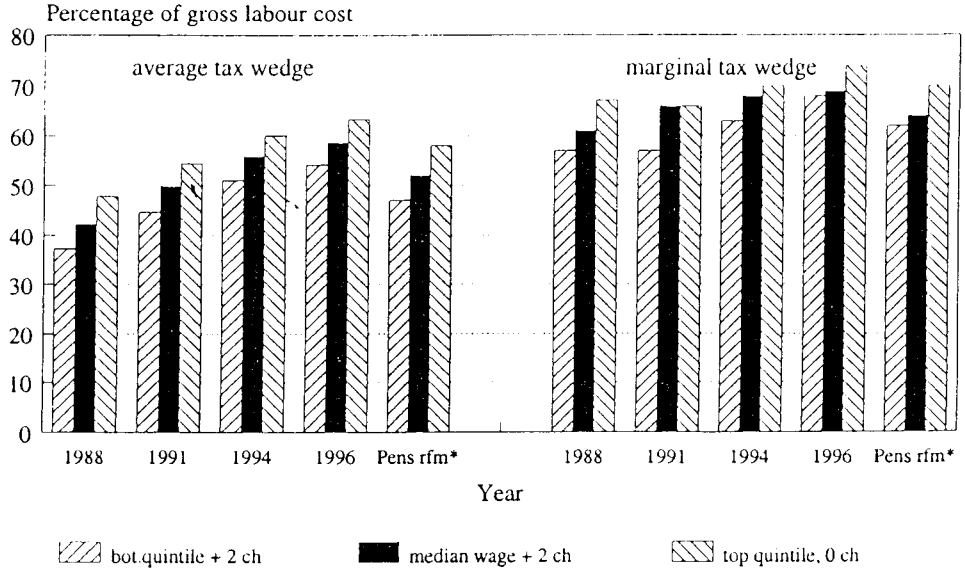
Table 3 gives the average and marginal indirect tax rates estimated for the years 1988, 1991, and 1994, (when it stabilised) with the figures for intervening years linearly interpolated. Both are adjusted for savings, and only count the standard rates of tax on vehicles and fuel, and are derived from the estimates of active households.

The last six lines of the table show the total average and marginal tax wedges on employees as a percentage of gross labour cost, measuring the tax wedge between the cost of employment and the purchasing power of the employee. The same information for selected years is graphed in fig. 7, including the final column of table 3 showing the possible effects of pension contribution reform. Note that the average tax rates increase across the income distribution in each year and from year to year, as do (slightly less regularly) the marginal tax rates, which show some tendency to converge to a constant rate of about 70 per cent. This process has happened despite the fall in real income of the whole population, and with it that of the bottom quintile. (The average real gross wage, given in Table 1, fell about 10% between 1987 and 1996, with considerable fluctuations.) Almost half of the marginal tax rate is borne by firms in social security and unemployment insurance (32.2% of the gross labour cost), which exceed all direct taxes and contributions made by workers even in the top quintile, and which are proportional, not progressive like PIT. Quite small proportionate changes in this element can have large effects on the tax rates, as the last column in each group shows. Indirect taxes are a relatively small component of the total marginal tax burden (less than 10% of gross labour cost for all marginal rates, and less for average rates).

7. Assessing the distributional impact of indirect tax changes

The indirect tax and subsidy system has clearly changed considerably since 1987, increasing its relative burden and reducing its apparent progressivity over the income distribution. Ideally, we would like to judge whether the set of all tax reforms since 1988 had improved the tax system, in terms of providing the chosen degree of redistribution at least deadweight loss. Techniques exist to judge whether small tax reforms have improved the efficiency of the tax system, and Newbery and Stern (1987) provide a recent summary of such techniques. Unfortunately, they require detailed behavioral information about the responses of agents to changes in tax rates, which Deaton (1987) suggests will be hard to identify. Instead, we settle for the less ambitions task of judging whether the changes to indirect taxes and subsidies have reduced their progressivity in the sense that they have adversely affected the distribution of well-being, using individual household data to look behind the relatively crude grouped data presented in Figs. 1 - 2. This is only a partial question, as it may improve the efficiency of the overall system to reduce the

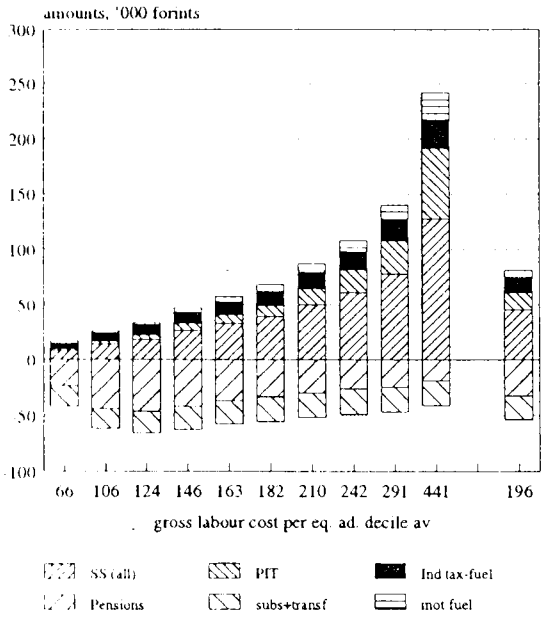
Average and Marginal Tax Wedges on workers in Hungary 1988-96



Taxsys; AMT8896
* pension reform: 1/3 SS is contrib.

Fig. 7

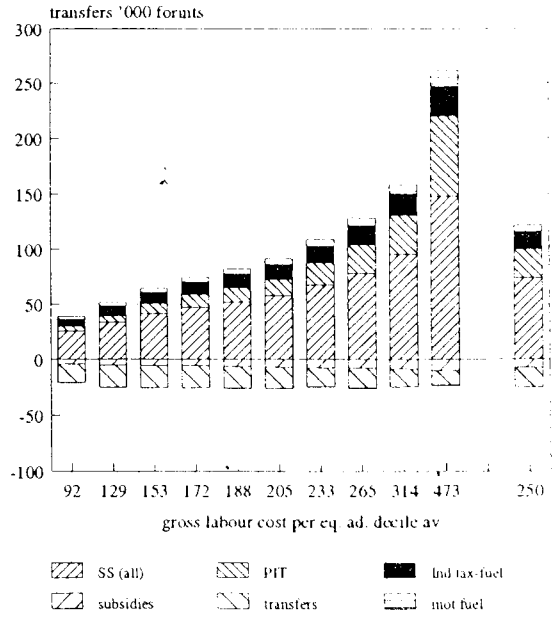
Average transfer amount, All Households Hungary 1991, Income deciles (yr end)



TaxDecYE; taxdcyet

Fig. A1

Average transfer amount, Active Earners Hungary 1991, Income deciles (yr end)



TaxDecAY; taxdcayt

Fig. A2

progressivity of one part of the tax system (such as indirect taxes) while making other parts more progressive (for example, PIT). The techniques described below may also be extended to examine the impact of the whole set of tax changes, though there are obvious problems in modelling the impact of the direct tax system, which affects both enterprises and employees.

There are several different ways of examining the distributional impact of the indirect tax reforms. Clearly if, as happened, indirect tax revenue increased, most households would probably be made worse off, but this tells us little about the impact of changes in the pattern of indirect taxes as such, as this affect would be confused with the general increase in tax revenue. The obvious solution is to calculate the distributional impact of a revenue-neutral set of indirect tax changes that result in the same set of final *relative* consumer prices in each year.

First, however, we need to develop a method for analyzing the impacts of tax changes on income distribution. The approach followed is adapted from the theory of marginal tax reform developed by Feldstein (1972), summarised in Newbery and Stern (1987), and applied to the study of relative price changes in Hungary in Newbery (1995). Suppose that the government ranks distributional outcomes according to a Utilitarian social welfare function $W(V^1,...,V^h,...,V^H)$, where agent h enjoys utility $V^h = V^h(y^h+g, \mathbf{p})$ that depends on net income y^h, plus any transfers, g, and the vector of consumer prices, p.[14] Consider the impact on social welfare of a change in consumer price p_i, caused, for example, by a change in taxes or subsidies:

$$\frac{\partial W}{\partial p_i} = \sum_h \frac{\partial W}{\partial V^h} \cdot \frac{\partial V^h}{\partial p_i} = -\sum_h \beta^h q_i^h, \tag{6}$$

where

$$\beta^h \equiv \frac{\partial W}{\partial V^h} \cdot \frac{\partial V^h}{\partial g} \tag{7}$$

is the social marginal utility of transferring £1 (or 1 forint) to agent h, q_i^h is consumption of good i by agent h, and the last equality in equation (3) makes use of Roy's identity. The impact of the price change will thus depend on both the level of consumption and its distribution amongst the population. It is convenient to isolate these two effects by defining d_i, the *distributional characteristic* of good i:

[14] The force of utilitarianism is that it is *individualistic*, that is, it respects individual wellbeing as measured by the individual utility function, and it is *consequentialist*, in confining attention to outcomes, rather than processes or rights (though these can be included by restrictions on either information or policy variables). When it comes to numerical quantification, individuals are weighted by the OECD equivalence scale used earlier, with the first adult in a household counting as 1.0, additional adults as 0.7, and children under 14 as 0.5. An *agent* is then defined as one equivalent adult, who is assumed to receive the equivalent share of total household expenditure.

$$d_i \equiv \frac{\sum_h \beta^h q_i^h}{\bar{\beta} Q_i}, \qquad Q_i \equiv \sum_h q_i^h, \qquad \bar{\beta} \equiv \frac{1}{H}\sum_h \beta^h. \tag{8}$$

where Q_i is aggregate consumption of i, $\bar{\beta}$ is the average over the H agents of β^h, so that d_i is a measure of how concentrated the consumption of good i is on the socially deserving (those with high social marginal values of consumption, β^h). The social welfare impact of a price change is then

$$\frac{\partial W}{\partial p_i} = -\bar{\beta} d_i Q_i. \tag{9}$$

In order to make this approach operational one needs a method for calculating the social weights, β^h. The simplest and most easily parameterised such measure is given by the iso-elastic utility function defined over real consumption per equivalent adult, $u^h = (c^h)^{1-\nu}/(1-\nu)$, $(\nu \neq 1)$, $u^h = \log c^h$, $(\nu = 1)$, where ν is Atkinson's (1970) coefficient of inequality aversion. Then for an additive (utilitarian) social welfare function, $W = \Sigma u^h/H$, $\beta^h = (c^h)^{-\nu}$. (Total utility is divided by the number of equivalent adults, H, to give average welfare per equivalent adult as we do not wish to count improvements or losses in social welfare arising from changes in the population over time.) Thus, if $\nu = 1$, transferring £1 to someone at double the living standard of another has a social value of only one-half that of the reference person. If $\nu = 2$, the transfer would only count one-quarter as much, while if $\nu = \frac{1}{2}$, it would count for 70 per cent as much.

8. The impact of a revenue-neutral indirect tax reform

Define τ_i to be the tax share in the *consumer* price (normally VAT rates are given as a percentage of the pre-tax or producer price). The initial ratio of revenue to consumer expenditure is $\Sigma\omega_i\tau_i$, where ω_i is the budget share of good i, and the producer price is $(1-\tau_i)p_i$. If the only reason that prices change is because indirect taxes change to τ'_i, then the new set of consumer prices will be

$$p_i' = \left(\frac{1-\tau_i}{1-\tau_i'}\right) p_i \tag{10}$$

Total tax revenue would be $\Sigma p'_i \tau'_i Q_i$ if consumers continued to purchase their original quantities of goods despite the new set of prices. Suppose now that all consumer prices are scaled up by a factor θ by adjusting taxes and subsidies, leaving the producer prices unchanged, so that the tax revenue collected in total is the same as before when consumers spend the same money income as in the initial case. Total producer receipts will equal total consumer expenditure less total (and constant) tax revenue, and will hence be unchanged. These adjusted consumer prices, π_i, will capture the effect of a revenue-

neutral indirect tax reform that adjusts relative prices, and the consequential price changes for good i will be defined as $\Delta\pi_i = \pi_i - p_i$. Since $\Sigma\pi_i Q_i = Y \equiv \Sigma y^h$ will equal the original total expenditure on goods, it follows that $\Sigma\omega_i p_i = \Sigma\omega_i \pi_i$, so the price index of goods facing households will not have changed, and in that sense assuming no change in net money income, deflated incomes will also have remained unchanged. However, the deflator is that for the whole economy, and individual households who experience a relative increase in taxes on goods that are relatively more important will be worse off. It is this effect that we are attempting to measure.

Appendix Table A6 gives the indirect tax rates for 1987, 1988, 1991, and 1994, and the derived set of taxes that would give the same revenue at 1991 budget shares as the 1994 set of taxes, and which have the same relative consumer prices as those prevailing in the relevant years. The (weighted) coefficient of variation of tax rates of these equivalent tax systems increases from 1.64 to 1.92 from 1987-8, and then falls to about 1.25 in 1991, suggesting an initial increase in the dispersion of tax rates and then a reduction, though the variability of rates suggests that the indirect tax system is still not yet neutral.

Agent h has utility $V^h(p_i, m^h)$ initially, where net money income is m^h, and utility $V^h(\pi_i, m^h)$ after the tax reform. Consider now the change is social welfare caused by changes in consumer prices. For small changes in prices this can be found by expanding about the initial position:

$$\Delta W \approx \sum_{i,h} \frac{\partial W}{\partial V^h}\frac{\partial V^h}{\partial p_i}\Delta\pi_i = -\sum_{i,h}\beta^h q_i{}^h \Delta\pi_i = -\bar{\beta}\sum_i d_i Q_i \Delta\pi_i, \qquad (11)$$

from (6). It can be shown that if consumer prices in the base year are normalised to unity, then the prices π_i in the final year can be equivalently found by deflating the consumer prices in that year by a base-weighted price index, $P = \Sigma\omega_i p'_i$, so that $\pi_i = p'_i/P$. There is thus an exact equivalent between the method of computing the impact of a revenue-neutral indirect tax change and the method used by Newbery (1995) to compute the impact of changes in real relative prices, leaving (deflated) income unchanged. The proportional change in social welfare is then

$$\frac{\Delta W}{W} \approx \frac{-\bar{\beta}\sum_i d_i\omega_i(\sum_j \pi_j Q_j)\Delta\pi_i}{\sum_h \beta^h \sum_i \pi_i q_i{}^h} = -\frac{\sum_i d_i\omega_i\Delta\pi_i}{\sum_i d_i\omega_i}, \qquad (12)$$

where social welfare W is the socially weighted sum of expenditure per equivalent adult.[15] Thus the impact of relative price changes is given by weighting the price

[15] The value of (9) is a measure of the proportionate increase in expenditure that could be given to everyone which would be equivalent in social welfare terms to the effect of the relative price change. Let $\Delta c^h = \mu c^h$, and compute ΔW, where $W = \Sigma u^h = \Sigma(c^h)^{1-v}/(1-v)$. $\Delta W = \Sigma(c^h)^{-v}\Delta c^h = \mu\Sigma(c^h)^{1-v} = \mu\Sigma\beta^h c^h = \mu\Sigma\beta^h\Sigma\pi_i q_i^h$.

changes by the distributional weights (correcting for the commodity share), and normalising by the weighted average distributional weight. Note that the weighted relative price change is zero by construction, for $\Sigma\omega_i\pi_i = 1$, so $\Sigma\omega_i\Delta\pi_i = 0$, and if all the $d_i = 1$, then $\Delta W = 0$, which is equivalent to the claim that redistributions of purchasing power between households caused by relative price changes would cancel out with a distributionally insensitive social welfare function.

Equation (12) gives the impact of relative price changes caused by the revenue-neutral tax changes, holding real incomes constant. The full impact of price and income changes caused by non-revenue neutral tax changes can be decomposed into real income and price changes as follows:

$$\Delta W = \Delta_Y W + \Delta_\pi W = \left(W(Y_1, \pi_1) - W(Y_0, \pi_1)\right) + \left(W(Y_0, \pi_1) - W(Y_0, \pi_0)\right), \tag{13}$$

where Y_t is the vector of real incomes in year t. Most studies of changes in inequality confine attention to the change in real incomes (the first term), whereas here we are studying the importance of the second term. A non-revenue neutral tax reform can similarly be decomposed into an impact on real after-tax income (or expenditure) and an impact on relative prices, holding deflated income constant.

Equation (12) was computed for the three chosen values of v and for successive tax changes from 1987 to 1994, as shown in Table 4. The distributional impacts in each sub-period were computed using the expenditure patterns of the panel of households who remained in the sample from 1987 to 1991 for the nearest base-year, 1987 for the taxes introduced on 1 January 1988, 1989 for those introduced between 1988 and 1991, and 1991 for those introduced between 1991 and 1994.

Table 4 Welfare impacts of revenue-neutral indirect tax reforms in Hungary

percentages

Period	*panel year*	*Inequality aversion* v 0.5	1	2	R^2	*t-value*
1987-88	1987	-0.1	-0.2	-0.3	0.02	1.42
1988-91	1989	-0.3	-0.5	-1.0	0.02	1.35
1991-94	1991	-0.1	-0.3	-0.6	0.05	2.33
1987-94	chained	-0.4	-0.7	-1.5		
1987-94	1987	-0.4	-0.8	-1.3	0.04	1.98
1987-94	1989	-0.6	-1.1	-2.1	0.10	3.24
1987-94	1991	-0.4	-0.8	-1.6	0.05	2.33

Notes: Computed from the 1987-91 constructed HBS panel (Revesz, 1994)

Whether the welfare changes are statistically significant from zero can be derived

from equation (12), which can be interpreted as a measure of correlation of $d_i\omega_i$ on $\Delta\pi_i$.[16] The values of d_i for the three years for $\nu = 1$ were regressed on $\omega_i\Delta\pi_i$ for each sub-period, and the resulting values of R^2 and the t-value on the slope coefficient are presented in Table 5. The distributional impacts are not significantly different from zero for the first two sub-periods, though they are for the third. They are all significantly different from zero for the whole period whichever set of weights are taken. There is also an agreeable consistency of estimated impacts whichever set of weights are taken for the whole period, and the preferred measure would be the chained index, computed as the sum of the sub-period impacts.

If one takes an inequality aversion of unity, then the change in relative prices caused by the indirect tax reforms is equivalent to a uniform drop in disposable income of 0.7 of 1%, leaving the original set of relative prices unchanged. Compared to the level of indirect taxes, this is quite large (though we have not quantified any efficiency gains that might result from a more uniform tax system, and these could be appreciable, judging from the estimates given in Newbery, 1997).

9. Conclusions

The tax reforms introduced in Hungary in 1988 and subsequently reformed periodically since then have had the effect of moving an exceptionally progressive tax system with increasing marginal tax rates to one in which marginal tax rates are fairly uniform over the income distribution, with most of the redistribution taking place through transfers and the provision of such services as education, health and the like. As such, the reforms have moved the structure of taxation towards that found in many market economies, though the marginal tax wedge of 70% of the gross labour cost is very high by international standards.

The paper analyzed the distributional impact of revenue-neutral indirect tax changes, and found that the reforms did indeed have a distributionally adverse impact, as would be expected from the reduction in progressivity over the period. Indirect taxes account for a relatively small part of the total tax wedge, and there are good reasons for restricting progressivity to the income tax and achieving most distribution by transfers.

One of the major reasons for the high marginal tax rates is the large tax-like element of social security contributions by firms and employees. The Government plans to introduce a reformed system of pension contributions from January 1, 1998, and for some group of younger workers, a part of their contributions will then directly affect their future pension receipts, as the system moves at least in part to a defined contribution system. The consequences of a relative modest shift towards a defined contribution element (3% of the worker's gross wage, and 14.2% of the employer's contribution out the gross wage) were shown in table 3 and fig. 7, and reduce the final marginal tax wedge

[16] $\Sigma(d_i - \bar{d})(\omega_i\Delta\pi_i - \Sigma\omega_i\Delta\pi_i) = \Sigma d_i\omega_i\Delta\pi_i = r\sigma_d\sigma_p$, where r is the correlation coefficient, and the σ's are the SDs of d_i and $\omega_i\Delta\pi_i$. This is insignificantly different from zero if r is.

from 69% to 64% of the gross labour cost for the median worker. As a very rough rule of thumb, the distortionary costs rise as the *square* of the tax rate, so the distortionary cost would fall would fall by about 14% of its previous level for a 3% fall in the tax wedge. Tax evasion further strengthens the case for linking contributions to benefits, providing better incentives to support the social contract that taxes reflect. Clearly, pension reform is the next key step to take to complete the reform of the personal tax system from its previous soviet-type form to that of a market economy.

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APPENDIX A. Calculating marginal consumption shares - earlier experiments

1. Cross section estimates

We experimented with various formulation of consumers' demand. First we estimated the marginal expenditure shares using the cross-sectional data of the 12,000 households of the 1991 HBS for the Linear Expenditure System of equation (2). We regressed equivalised household consumption of the individual goods on the total equivalised consumption of the household and the constant term (intercept). Note that the price impact cannot be distinguished from the constant term. In the regression the observations were weighted by the number of equivalent adults (i.e. the compounded weight was the product of these and the inverse sampling rates). From the resulting marginal consumption shares the marginal elasticities were computed by dividing the marginal shares by the average shares (see Table A1). At the aggregate level (i.e. without distinguishing between various socio-economic groups), most elasticities seemed quite plausible even at the 101 commodity break-down. For example, basic foods and household fuels showed very low marginal elasticities (the two lowest elasticities were that of the flour and the solid and liquid household fuels: -0.1 and 0.02 respectively), while durables, motoring and recreational goods showed elasticities well over the unity (see Table A1). However, car purchases (good 60) showed a questionably high marginal elasticity (7.69).

We also analyzed the cross-sectional data by consumption deciles, calculating the population deciles of the equivalised consumption and their average consumption patterns. The resulting average shares by deciles can be used for kernel-regression which aims to filter out most of the noise in the individual data. These consumption patterns, shown in table A2, were interesting, and reveal the peculiarity of car purchases, which rises from 0.03% in the two bottom deciles to 5.44% in the top decile. This 200-fold difference is partly explained by ranking households by total consumption, which includes the atypically large car expenditures. In consequence we decided to rank deciles by non-durable consumption and run cross-section data on that, as described in Appendix B.

2. Panel calculations

As we have a panel of households who were surveyed in both 1989 and 1991, it is also possible to estimate the marginal responses to changes in income, by first differencing equation (2) to give:

$$\Delta(p_i q_i{}^h) = \gamma_i^d \Delta p_i + \beta_i^d \Delta y^h - \beta_i^d \gamma^d . \Delta p$$

This equation was rewritten as

$$\Delta c_i{}^h = \alpha_i' z^h + \beta_i \Delta C^h + \gamma_i' d^h \Delta C^h \qquad \text{(A1)}$$

and estimated, where Δc_i is the change in the real expenditure on good i, ΔC^h is the change in total real expenditure, z^h and d^h are vectors of household characteristics (in many cases converted to dummies), and the greek letters represent the corresponding vectors of parameter values.

To estimate (A1) we used the 1989-91 panel of almost 6,000 households. We regressed changes in the real consumptions of the individual goods on the constant term, the change in total household real expenditure, demographic and status variables and their changes, and by their (values' or dummies') cross-product with the change in the total consumption. These cross-products modify the slope of the regressor. When estimating changes one can interpret the levels of the status variables mainly as proxies for other changes (if they were the determinants of the level of the consumption then there would not be any change if they did not change). Then from

the regression coefficients we calculated the average compounded effects of the change in the total consumption by deciles of equivalised consumption and income by adding the parameter values of the change in total consumption and the sum of the products of the parameter values of the individual cross-products and the ratio of the mean of the given cross-product to the mean of the change in total consumption of the given decile according to (A1). Note that $\boldsymbol{d}^h \Delta y^h$ represents the vector of cross-products. Thus the compounded coefficient of the change in consumption is the sum of the direct (or pure) effect and the decile effect (determined as the ratio of the total change to the change in the given decile's total consumption).

The main results can be seen in tables A3 and A4. For the top consumption decile the results were not satisfactory. The marginal consumption pattern of this decile seemed to be implausibly different from the others. It turned out that this was the only group where consumption increased between 1989 and 1991 mainly because the consumption deciles were determined according to the 1991 level of consumption. For the income deciles the problem was less pronounced because of the weak correlation of reported income and consumption. There is the additional problem that consumption includes durable expenditures which are poorly explained, as discussed above.

The estimates of the β_i's, controlling for demographic variables (and car ownership), provide short-run estimates of the likely indirect tax revenue consequences of changes in income that lead to changes in expenditure (the variable used in the regressions). As such, they may not reflect the long-run adjustments as changes in permanent income give rise to changes in durable ownership (and possibly even housing), giving rise to different patterns of purchases and taxes paid.

3. Pooled estimates

Given the problems of using the panel data during such a turbulent period, we tried a third approach. Again we used our panel dataset but instead of trying to match the apparently identical households we simply used it as a pool of households observed at different times and places. The estimated equation was:

$$r_i^h = (\alpha_i' z_1^h + \beta_i) U^h + \gamma_i p_i + \delta_i' z_2^h \qquad \text{(A2)}$$

where r_i^h is the real value of the expenditure on the i-th good (in 1989's purchasing power), p_i is the price index of the i-th good (1989=1), U^h is the total real consumption (deflated back to 1989), z_1^h is the vector of variables used to make cross-products (with U^h) and z_2^h is the vector of other variables (in many cases the same as were used in the cross-products). Greek letters are the coefficients to be estimated. Naturally changes were not represented among the variables but z_2^h included the constant term. Note that as the price index variables had only two values, it picks up any trend changes as well as price effects.

The main results for marginal consumption shares are shown in table A5. As with the panel estimates we formed income deciles (based on the borders of equivalised income deciles the 1991 full sample) and calculated the compounded coefficients of the changes in the total consumption for each goods and decile. The results seem to be quite acceptable and the calculations of Newbery and Revesz (1995) were based on them. These data plus the tax rates (shown in table A6) can then be used to compute the marginal tax rates. Table A7 shows the results by deciles for 1991, and the resulting figures, but only counting half of the apparent marginal tax cost on cars, to roughly compensate for the over-estimate of its expenditure elasticity, were used in the earlier paper.

ABLE A1 . Regression results for marginal cons. shares:

TABLE A2. Average cons. shares by deciles total population by equivalised consumption percentages

o.	Good	Marg. coeff.	% avg. shares	Expen elastic	D 1	E 2	C 3	I 4	L 5	E 6	S 7	8	9	10
1	Raw meat & edible offals	2.39	4.87	0.49	6.07	6.12	5.79	5.53	5.45	5.33	4.97	4.68	4.26	3.59
2	Meat products	2.24	3.99	0.56	4.41	4.57	4.75	4.39	4.34	4.25	4.10	4.00	3.85	3.02
3	Poultry	0.59	2.41	0.25	3.62	3.48	3.16	3.01	2.85	2.64	2.24	2.16	1.95	1.50
4	Eggs	0.24	1.10	0.22	1.72	1.50	1.44	1.34	1.30	1.22	1.10	1.00	0.91	0.65
5	Fish & fish products	0.20	0.23	0.87	0.17	0.22	0.21	0.23	0.24	0.25	0.24	0.26	0.26	0.21
6	Milk	0.21	1.98	0.10	3.38	2.94	2.80	2.53	2.31	2.11	1.98	1.72	1.54	1.07
7	Other dairy products	1.04	1.68	0.62	1.98	1.87	1.86	1.85	1.86	1.70	1.74	1.66	1.58	1.35
8	Butter, margarine, oil	0.43	1.04	0.41	1.35	1.36	1.22	1.21	1.16	1.11	1.05	1.02	0.92	0.72
9	Fat, lard & bacon	0.07	0.80	0.08	1.42	1.18	1.15	1.04	0.90	0.86	0.76	0.72	0.62	0.44
10	Flour	-0.05	0.51	-0.10	1.02	0.83	0.73	0.68	0.62	0.54	0.47	0.45	0.34	0.23
11	Rice	0.05	0.27	0.17	0.46	0.39	0.35	0.34	0.33	0.30	0.29	0.24	0.22	0.15
12	Bakery products	0.16	3.02	0.05	5.73	4.65	4.19	3.77	3.50	3.23	2.93	2.66	2.27	1.58
13	Sugar	0.12	1.01	0.12	1.68	1.44	1.34	1.28	1.16	1.12	1.05	0.93	0.78	0.53
14	Other cereals	0.25	0.57	0.44	0.77	0.73	0.71	0.64	0.64	0.58	0.57	0.55	0.51	0.41
15	Sweets, cocoa, honey	1.40	1.42	0.99	1.17	1.28	1.31	1.39	1.50	1.43	1.51	1.55	1.48	1.38
16	Potato,fresh vegetable &fruit	2.43	5.00	0.49	5.98	5.96	5.84	5.85	5.38	5.35	5.08	4.88	4.82	3.62
17	Vegetable & fruit products	1.25	1.73	0.72	1.78	1.89	1.80	1.91	1.86	1.75	1.86	1.75	1.62	1.50
18	Spices and other foods	0.67	1.57	0.42	2.10	1.93	1.87	1.83	1.80	1.65	1.58	1.57	1.40	1.07
19	Meals taken out of home	3.36	2.81	1.20	3.06	2.36	2.68	2.66	2.66	2.79	2.98	2.80	2.91	2.92
20	Wine	0.91	0.97	0.93	0.91	0.89	0.91	1.03	1.11	1.03	0.98	1.03	0.94	0.89
21	Beer	1.13	1.08	1.04	0.92	0.93	1.11	1.01	1.07	1.12	1.14	1.18	1.08	1.10
22	Spirits	0.90	0.98	0.92	0.86	0.92	1.04	0.99	0.96	1.01	1.01	1.09	0.93	0.93
23	Soft drinks	0.80	0.70	1.14	0.65	0.63	0.64	0.64	0.69	0.65	0.70	0.79	0.73	0.73
24	Coffee and tea	0.51	1.26	0.41	1.85	1.66	1.53	1.43	1.35	1.34	1.29	1.22	1.06	0.87
25	Tobacco	0.69	2.21	0.31	3.13	2.89	2.83	2.60	2.33	2.50	2.33	2.23	1.82	1.39
26	Dress materials	0.23	0.18	1.28	0.08	0.10	0.13	0.15	0.18	0.18	0.19	0.19	0.21	0.22
27	Men's coat	0.60	0.38	1.61	0.22	0.25	0.29	0.23	0.29	0.34	0.37	0.40	0.45	0.54
28	Men's suits	0.49	0.30	1.65	0.14	0.18	0.24	0.25	0.23	0.26	0.28	0.31	0.39	0.40
29	Men's trousers, jacket, work clot	0.66	0.52	1.26	0.25	0.42	0.45	0.50	0.43	0.51	0.55	0.64	0.62	0.56
30	Men's pull-over, cardigan, track s	0.35	0.25	1.40	0.07	0.18	0.18	0.21	0.22	0.22	0.28	0.30	0.28	0.30
31	Men's footwear	0.74	0.81	0.92	0.66	0.85	0.85	0.75	0.84	0.83	0.82	0.83	0.80	0.79
32	Men's shirt, underwear	0.71	0.54	1.30	0.30	0.45	0.38	0.45	0.51	0.53	0.54	0.62	0.60	0.67
33	Men's stockings, socks	0.12	0.13	0.91	0.12	0.11	0.12	0.14	0.14	0.14	0.14	0.15	0.13	0.13
34	Men's complementary clothing a	0.21	0.12	1.78	0.07	0.07	0.08	0.11	0.09	0.12	0.10	0.15	0.14	0.16
35	Woman's coat	0.80	0.49	1.63	0.27	0.39	0.42	0.32	0.45	0.42	0.47	0.49	0.56	0.68
36	Woman's dress	0.79	0.65	1.22	0.51	0.59	0.55	0.57	0.57	0.61	0.65	0.64	0.78	0.74
37	Woman's skirts, blouse, work clo	0.89	0.67	1.34	0.40	0.55	0.49	0.55	0.69	0.58	0.67	0.77	0.77	0.77
38	Woman's pull-over, cardigan, tra	0.46	0.27	1.74	0.14	0.20	0.20	0.20	0.24	0.19	0.24	0.31	0.30	0.37
39	Woman's footwear	0.80	0.95	0.85	0.94	1.01	0.99	0.96	1.02	0.95	0.96	0.90	0.96	0.88
40	Woman's underwear	0.43	0.29	1.47	0.16	0.21	0.20	0.28	0.29	0.27	0.27	0.31	0.35	0.36
41	Woman's stockings, socks	0.21	0.24	0.86	0.18	0.22	0.25	0.25	0.26	0.25	0.25	0.26	0.25	0.22
42	Woman's complementary clothin	0.35	0.20	1.76	0.10	0.14	0.13	0.15	0.15	0.18	0.18	0.21	0.25	0.29
43	Child coat	0.20	0.33	0.61	0.29	0.34	0.41	0.40	0.38	0.37	0.36	0.32	0.32	0.25
44	Child suits, dresses	0.55	0.66	0.82	0.54	0.62	0.62	0.69	0.66	0.70	0.72	0.78	0.75	0.53
45	Child pull-over, cardigan, track s	0.18	0.18	1.01	0.11	0.14	0.15	0.17	0.15	0.19	0.22	0.15	0.23	0.17
46	Child footwear	0.31	0.51	0.60	0.50	0.51	0.57	0.60	0.53	0.53	0.56	0.54	0.51	0.38
47	Child underwear	0.17	0.21	0.82	0.15	0.18	0.24	0.19	0.28	0.24	0.23	0.22	0.22	0.16
48	Child stockings, socks	0.05	0.07	0.69	0.06	0.06	0.08	0.08	0.07	0.08	0.09	0.07	0.09	0.05
49	Child complementary clothing ar	0.11	0.08	1.34	0.03	0.05	0.06	0.06	0.08	0.09	0.08	0.09	0.09	0.09

TABLE A6 Evolution of tax rates

	Original Tax/consumer price 1987	1988	1991	1994	Revenue-equivalent Tax/consumer price 1987	1988	1991	1994
1	0.00	0.00	0.00	0.09	0.19	0.15	0.08	0.09
2	0.00	0.00	0.00	0.09	0.19	0.15	0.08	0.09
3	0.00	0.00	0.00	0.09	0.19	0.15	0.08	0.09
4	0.00	0.00	0.00	0.09	0.19	0.15	0.08	0.09
5	0.00	0.00	0.00	0.09	0.19	0.15	0.08	0.09
6	*-0.36*	*-0.47*	-0.12	0.09	-0.11	-0.24	-0.03	0.09
7	*-0.36*	*-0.47*	-0.03	0.09	-0.11	-0.24	0.05	0.09
8	*-0.36*	*-0.47*	-0.06	0.09	-0.11	-0.24	0.02	0.09
9	*-0.29*	0.00	0.00	0.09	-0.05	0.15	0.08	0.09
10	*-0.29*	0.00	0.00	0.09	-0.05	0.15	0.08	0.09
11	*-0.29*	0.00	0.00	0.09	-0.05	0.15	0.08	0.09
12	*-0.29*	0.06	0.06	0.09	-0.05	0.20	0.13	0.09
13	*-0.29*	0.00	0.00	0.09	-0.05	0.15	0.08	0.09
14	0.00	0.00	0.00	0.09	0.19	0.15	0.08	0.09
15	*0.11*	0.23	0.23	0.20	0.28	0.35	0.29	0.20
16	0.00	0.04	0.04	0.09	0.19	0.19	0.12	0.09
17	0.00	0.00	0.00	0.09	0.19	0.15	0.08	0.09
18	*0.11*	0.20	0.20	0.20	0.28	0.32	0.26	0.20
19	*0.00*	0.08	0.08	0.20	0.19	0.22	0.16	0.20
20	*0.26*	0.31	0.31	0.31	0.40	0.41	0.36	0.31
21	*0.47*	0.52	0.44	0.44	0.56	0.60	0.48	0.44
22	*0.77*	0.83	0.73	0.73	0.81	0.86	0.75	0.73
23	*0.00*	0.20	0.20	0.20	0.19	0.32	0.26	0.20
24	*0.12*	0.14	*0.13*	0.20	0.28	0.27	0.20	0.20
25	*0.68*	0.73	0.73	0.73	0.74	0.77	0.75	0.73
26	*0.24*	0.20	0.20	0.20	0.38	0.32	0.26	0.20
27	*0.24*	0.20	0.20	0.20	0.38	0.32	0.26	0.20
28	*0.24*	0.20	0.20	0.20	0.38	0.32	0.26	0.20
29	*0.24*	0.20	0.20	0.20	0.38	0.32	0.26	0.20
30	*0.24*	0.20	0.20	0.20	0.38	0.32	0.26	0.20
31	*0.24*	0.20	0.20	0.20	0.38	0.32	0.26	0.20
32	*0.24*	0.20	0.20	0.20	0.38	0.32	0.26	0.20
33	*0.24*	0.20	0.20	0.20	0.38	0.32	0.26	0.20
34	*0.24*	0.20	0.20	0.20	0.38	0.32	0.26	0.20
35	*0.24*	0.20	0.20	0.20	0.38	0.32	0.26	0.20
36	*0.24*	0.20	0.20	0.20	0.38	0.32	0.26	0.20
37	*0.24*	0.20	0.20	0.20	0.38	0.32	0.26	0.20
38	*0.24*	0.20	0.20	0.20	0.38	0.32	0.26	0.20
39	*0.24*	0.20	0.20	0.20	0.38	0.32	0.26	0.20
40	*0.24*	0.20	0.20	0.20	0.38	0.32	0.26	0.20
41	*0.24*	0.20	0.20	0.20	0.38	0.32	0.26	0.20
42	*0.24*	0.20	0.20	0.20	0.38	0.32	0.26	0.20
43	*-0.17*	0.20	0.20	0.20	0.05	0.32	0.26	0.20
44	*-0.17*	0.20	0.20	0.20	0.05	0.32	0.26	0.20
45	*-0.17*	0.20	0.20	0.20	0.05	0.32	0.26	0.20
46	*-0.17*	0.20	0.20	0.20	0.05	0.32	0.26	0.20
47	*-0.17*	0.20	0.20	0.20	0.05	0.32	0.26	0.20
48	*-0.17*	0.20	0.20	0.20	0.05	0.32	0.26	0.20
49	0.00	0.20	0.20	0.20	0.19	0.32	0.26	0.20

50	Solid & liquid household fuels	0.08	3.46	0.02	6.50	5.13	4.94	4.47	4.15	3.72	3.30	2.93	2.69	1.74	*-1.10*	-1.00	-0.37	0.09	-0.71	-0.69	-0.26	0.09
51	District heat, hot water	1.04	1.33	0.78	0.89	1.12	1.46	1.54	1.30	1.41	1.47	1.57	1.36	1.11	*-1.79*	*-1.78*	*-0.85*	0.09	-1.28	-1.35	-0.70	0.09
52	Electricity	1.16	2.84	0.41	4.01	3.70	3.44	3.29	3.08	3.24	2.87	2.66	2.36	2.01	0.00	*0.00*	*0.00*	0.00	0.19	0.15	0.08	0.00
53	Gas	0.86	2.00	0.43	2.89	2.73	2.37	2.39	2.21	2.11	1.92	1.78	1.73	1.47	0.00	0.00	0.00	0.09	0.19	0.15	0.08	0.09
54	Water	0.05	0.18	0.31	0.25	0.24	0.21	0.22	0.20	0.20	0.18	0.17	0.15	0.11	*-3.20*	*-4.00*	*-0.25*	*-0.25*	-2.42	-3.23	-0.15	-0.25
55	Furniture	1.99	1.00	1.99	0.34	0.43	0.66	0.74	0.61	0.92	0.95	0.93	1.36	1.61	*0.09*	0.20	0.20	0.20	0.26	0.32	0.26	0.20
56	Electric refrigerator	0.83	0.67	1.24	0.33	0.37	0.37	0.68	0.59	0.60	0.70	0.85	0.86	0.75	*0.10*	0.20	0.20	0.20	0.27	0.32	0.26	0.20
57	Washing machines, spindriers	0.36	0.19	1.89	0.08	0.12	0.10	0.15	0.13	0.10	0.20	0.19	0.29	0.28	*0.10*	0.20	0.20	0.20	0.27	0.32	0.26	0.20
58	Cooking & heating equipments	0.85	0.44	1.92	0.18	0.27	0.19	0.28	0.37	0.46	0.49	0.37	0.59	0.65	*0.10*	0.20	0.20	0.20	0.27	0.32	0.26	0.20
59	Other household machines	0.42	0.18	2.38	0.04	0.05	0.12	0.12	0.15	0.12	0.17	0.16	0.20	0.33	*0.10*	0.20	0.20	0.20	0.27	0.32	0.26	0.20
60	Cars	10.45	1.36	7.69	0.03	0.03	0.10	0.10	0.23	0.17	0.27	0.61	0.94	5.44	*0.38*	*0.41*	*0.37*	*0.37*	0.49	0.50	0.42	0.37
61	Motor- & bycicles	0.20	0.16	1.31	0.05	0.10	0.13	0.11	0.16	0.15	0.15	0.18	0.22	0.17	*0.38*	0.20	0.20	0.20	0.49	0.32	0.26	0.20
62	TV sets	1.12	0.74	1.52	0.31	0.27	0.52	0.68	0.66	0.75	0.81	0.68	0.91	1.00	*0.10*	0.20	0.20	0.20	0.27	0.32	0.26	0.20
63	Radio sets	0.04	0.04	1.20	0.04	0.02	0.04	0.03	0.04	0.03	0.05	0.04	0.03	0.04	*0.10*	0.20	0.20	0.20	0.27	0.32	0.26	0.20
64	Tape recorders, record players	0.97	0.52	1.87	0.11	0.18	0.25	0.25	0.36	0.47	0.60	0.56	0.80	0.77	*0.10*	0.20	0.20	0.20	0.27	0.32	0.26	0.20
65	Other durable cultural goods	1.05	0.37	2.85	0.04	0.08	0.16	0.14	0.16	0.29	0.26	0.29	0.54	0.81	*0.10*	0.20	0.20	0.20	0.27	0.32	0.26	0.20
66	Household textiles	0.93	0.62	1.51	0.37	0.41	0.54	0.42	0.57	0.53	0.62	0.73	0.81	0.71	*0.10*	0.20	0.20	0.20	0.27	0.32	0.26	0.20
67	Table-ware&other househ.equip.	1.62	0.77	2.12	0.36	0.48	0.64	0.50	0.57	0.65	0.72	0.74	0.87	1.22	*0.10*	0.20	0.20	0.20	0.27	0.32	0.26	0.20
68	Other household products	0.65	0.64	1.01	0.60	0.61	0.55	0.62	0.65	0.60	0.67	0.69	0.70	0.65	*0.12*	0.20	0.20	0.20	0.29	0.32	0.26	0.20
69	Detergents	0.92	1.61	0.57	1.96	1.95	1.81	1.75	1.81	1.67	1.60	1.62	1.50	1.24	*0.12*	0.20	0.20	0.20	0.29	0.32	0.26	0.20
70	Toilet articles	1.49	1.60	0.94	1.30	1.49	1.54	1.58	1.67	1.59	1.71	1.70	1.66	1.54	*0.12*	0.20	0.20	0.20	0.29	0.32	0.26	0.20
71	Medical articles, medicines	0.55	0.94	0.59	1.35	1.20	0.97	1.12	1.02	0.97	0.87	0.92	0.75	0.80	*-3.55*	*-3.61*	*-3.31*	*-3.31*	-2.70	-2.90	-2.96	-3.31
72	Car parts and accessories	1.63	0.92	1.77	0.17	0.26	0.44	0.48	0.75	0.93	0.95	1.06	1.32	1.36	*0.10*	0.20	0.20	0.20	0.27	0.32	0.26	0.20
73	Motor fuels and oils	9.38	4.90	1.91	1.02	2.02	2.27	2.84	3.57	4.56	5.27	5.85	6.76	7.25	*0.70*	0.70	0.71	0.71	0.75	0.75	0.73	0.71
74	Newspapers, magazines	0.66	0.89	0.74	0.96	0.97	0.90	0.94	0.94	0.94	0.92	0.94	0.88	0.76	*0.10*	0.00	0.00	0.09	0.27	0.15	0.08	0.09
75	Books	0.97	0.48	2.02	0.10	0.21	0.28	0.27	0.35	0.40	0.51	0.54	0.61	0.77	0.00	0.00	0.00	0.09	0.19	0.15	0.08	0.09
76	Stationery goods	0.29	0.34	0.85	0.20	0.31	0.42	0.38	0.35	0.39	0.33	0.37	0.35	0.30	*0.10*	0.20	0.20	0.20	0.27	0.32	0.26	0.20
77	Sport goods & toys	0.64	0.38	1.67	0.08	0.18	0.18	0.32	0.39	0.33	0.40	0.45	0.42	0.56	*0.10*	0.11	0.11	0.20	0.27	0.25	0.18	0.20
78	Other cultural goods, instrum.	0.60	0.29	2.06	0.08	0.09	0.17	0.25	0.17	0.24	0.34	0.30	0.37	0.46	*0.10*	0.20	0.20	0.20	0.27	0.32	0.26	0.20
79	Other consumer products	2.51	1.63	1.54	0.99	1.28	1.32	1.33	1.49	1.52	1.66	1.76	1.74	2.07	0.00	0.20	0.20	0.20	0.19	0.32	0.26	0.20
80	Clothing services	0.25	0.18	1.37	0.07	0.14	0.17	0.17	0.19	0.15	0.20	0.21	0.19	0.22	0.00	0.20	0.20	0.20	0.19	0.32	0.26	0.20
81	Rent	0.67	1.01	0.66	1.23	1.24	1.14	1.10	1.14	1.00	1.04	0.99	0.87	0.82	*-0.54*	*-1.56*	*0.00*	*0.00*	-0.26	-1.17	0.08	0.00
82	Maintenance of dwellings	2.77	3.56	0.78	3.44	3.61	3.65	3.91	3.68	3.77	3.64	3.75	3.53	3.14	0.00	0.00	0.00	0.20	0.19	0.15	0.08	0.20
83	Other dwelling services	0.06	0.09	0.66	0.11	0.11	0.10	0.10	0.10	0.09	0.09	0.09	0.08	0.07	0.00	0.20	0.20	0.20	0.19	0.32	0.26	0.20
84	Sewage	0.03	0.07	0.44	0.10	0.09	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.05	*-4.92*	*-1.70*	*-0.30*	*-0.30*	-3.82	-1.29	-0.19	-0.30
87	Repair of household equipments	0.51	0.32	1.58	0.17	0.26	0.22	0.31	0.30	0.30	0.27	0.29	0.38	0.43	0.00	0.13	0.13	0.20	0.19	0.26	0.20	0.20
88	Household services (Laun+dom.)	0.15	0.08	1.95	0.08	0.06	0.04	0.09	0.10	0.05	0.04	0.08	0.07	0.13	0.00	0.00	0.00	0.20	0.19	0.15	0.08	0.20
89	Hair-dresser & beauty services	0.50	0.45	1.11	0.31	0.36	0.38	0.41	0.47	0.42	0.47	0.52	0.49	0.47	0.00	0.13	0.13	0.09	0.19	0.26	0.20	0.09
90	Purchased health services	1.36	0.66	2.06	0.55	0.54	0.48	0.59	0.59	0.50	0.53	0.63	0.63	1.03	0.00	0.00	0.00	0.00	0.19	0.15	0.08	0.00
92	Repair of vehicles	2.56	1.40	1.83	0.35	0.54	0.73	0.79	1.23	1.37	1.46	1.60	1.78	2.09	0.00	0.13	0.13	0.20	0.19	0.26	0.20	0.20
93	Transport services	1.86	2.19	0.85	2.13	2.28	2.32	2.35	2.24	2.14	2.30	2.19	2.18	2.00	*-0.75*	*-0.92*	*-0.59*	*-0.59*	-0.43	-0.63	-0.47	-0.59
94	Postal & telephone services	1.86	0.96	1.94	0.32	0.57	0.51	0.67	0.71	0.97	0.89	1.02	1.16	1.48	0.00	0.00	0.00	0.09	0.19	0.15	0.08	0.09
95	Radio and TV licence	0.21	0.76	0.27	1.13	1.10	0.96	0.95	0.88	0.81	0.76	0.70	0.61	0.47	0.00	0.00	0.00	0.09	0.19	0.15	0.08	0.09
96	Recreational articles' repair	0.17	0.17	0.98	0.16	0.16	0.18	0.16	0.15	0.16	0.20	0.20	0.14	0.19	0.00	0.13	0.13	0.20	0.19	0.26	0.20	0.20
97	Purchased educ. services	1.15	0.47	2.48	0.07	0.08	0.27	0.23	0.26	0.37	0.38	0.48	0.66	0.89	0.00	0.00	0.00	0.00	0.19	0.15	0.08	0.00
99	Theatre, concert	0.15	0.06	2.43	0.02	0.02	0.03	0.02	0.05	0.03	0.06	0.06	0.10	0.12	0.00	0.00	0.00	0.09	0.19	0.15	0.08	0.09
100	Cinema	0.07	0.08	0.88	0.07	0.07	0.08	0.08	0.07	0.08	0.10	0.07	0.10	0.07	0.00	0.00	0.00	0.09	0.19	0.15	0.08	0.09
101	Other purchased recr. services	0.64	0.37	1.71	0.24	0.21	0.31	0.36	0.36	0.28	0.36	0.40	0.42	0.49	0.00	0.20	0.20	0.20	0.19	0.32	0.26	0.20
104	Gambling services	0.41	0.48	0.85	0.30	0.43	0.42	0.46	0.57	0.52	0.52	0.49	0.54	0.43	0.00	0.20	0.20	0.20	0.19	0.32	0.26	0.20
105	Subscription fees, donations	0.59	0.52	1.12	0.37	0.45	0.46	0.46	0.49	0.54	0.57	0.59	0.55	0.55	0.00	0.00	0.00	0.00	0.19	0.15	0.08	0.00
106	Holiday expenditures	4.52	1.57	2.88	0.32	0.43	0.56	0.61	0.90	1.12	1.40	1.48	1.98	3.35	0.00	0.00	0.00	0.00	0.19	0.15	0.08	0.00
108	Other services	2.81	0.88	3.19	0.34	0.45	0.46	0.68	0.63	0.58	0.53	0.65	0.85	1.97	0.00	0.20	0.20	0.20	0.19	0.32	0.26	0.20
	TOTAL	100	100		100	100	100	100	100	100	100	100	100	100	-0.06	-0.02	0.06	0.14	0.14	0.14	0.14	0.14
																			1.64	1.92	1.22	1.27	CV

PANEL CALCULATIONS (1989-91 HBS Panel)

TABLE A3. Marginal consumption shares by tax rates and consumption deciles

CONS DECILES	Gp0	Gp15	Gp25	Spec.t	Subsid	Total
All households:	0.174	0.019	0.676	0.090	0.041	1.00
Decile 1	0.176	0.021	0.654	0.096	0.053	1.00
Decile 2	0.178	0.021	0.657	0.095	0.049	1.00
Decile 3	0.179	0.019	0.666	0.092	0.044	1.00
Decile 4:	0.171	0.019	0.678	0.091	0.041	1.00
Decile 5:	0.174	0.020	0.674	0.092	0.040	1.00
Decile 6:	0.160	0.019	0.695	0.089	0.037	1.00
Decile 7:	0.168	0.020	0.685	0.091	0.037	1.00
Decile 8:	0.176	0.021	0.676	0.092	0.035	1.00
Decile 9:	0.169	0.016	0.704	0.080	0.031	1.00
Decile 10	0.090	0.031	0.665	0.168	0.046	1.00

Note: groupings differ from text tables

TABLE A4. Marginal consumption shares by tax rates and income

INCOME	Gp0	Gp15	Gp25	Spec.t	Subsid	Total
All househ	0.174	0.019	0.676	0.090	0.041	1.00
Decile 1	0.171	0.019	0.662	0.098	0.051	1.00
Decile 2	0.178	0.021	0.658	0.095	0.048	1.00
Decile 3	0.193	0.021	0.645	0.095	0.046	1.00
Decile 4:	0.173	0.021	0.681	0.084	0.042	1.00
Decile 5:	0.166	0.020	0.677	0.093	0.044	1.00
Decile 6:	0.160	0.019	0.689	0.090	0.042	1.00
Decile 7:	0.166	0.019	0.694	0.085	0.036	1.00
Decile 8:	0.164	0.017	0.696	0.088	0.036	1.00
Decile 9:	0.183	0.020	0.673	0.089	0.034	1.00
Decile 10	0.187	0.016	0.682	0.080	0.035	1.00

Note: groupings differ from text tables

POOL ESTIMATES:

TABLE A5. Marginal consumption shares by income deciles and tax rates (1989-91 HBS pooled panel samples):

		All h.hol	1	2	3	4	5	6	7	8	9	10	unadj*
0%	GROUP0	0.21	0.22	0.23	0.22	0.22	0.22	0.21	0.21	0.21	0.21	0.21	0.23
15%	GROUP15	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
25%	GROUP25	0.37	0.37	0.37	0.38	0.38	0.38	0.38	0.37	0.37	0.36	0.35	0.38
60	CAR (60.)	0.23	0.24	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.24	0.25	0.16
	SPECTAX	0.11	0.10	0.10	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.12	0.13
	SUBSIDY	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.07
6	Milk	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	Other dairy products	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
8	Butter, margarine, oil	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00
12	Bakery products	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
15	Sweets, cocoa, honey	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
16	Potato, fresh vegetable	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.03
19	Meals taken out of home	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
20	Wine	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
21	Beer	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
22	Spirits	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
25	Tobacco	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	Solid & liquid hh. fuel	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
51	District heat, hot water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
54	Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
71	Medical articles	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01
73	Motor fuels and oils	0.03	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.02
77	Sport goods and toys	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00
84	Sewage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
93	Transport services	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.03

* parameter values on consumption without cross-product terms

Table A7 Marginal taxes per 100 HUF additional expenditure at consumer prices 1991 rates

All h.hold	Decile 1	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Decile 10	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Commods taxed at 0%
0.29	0.29	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.29	0.31	Commods taxed at 15%
11.99	12.05	11.91	11.87	11.93	12.01	12.07	12.03	12.03	12.03	11.96	Commods taxed at 25%
-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	Other dairy products
-0.03	-0.04	-0.04	-0.04	-0.04	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	Butter, margarine, oil
-0.04	-0.05	-0.05	-0.05	-0.05	-0.05	-0.04	-0.04	-0.04	-0.04	-0.04	Milk
-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	Water
-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	Sewage
-0.39	-0.52	-0.50	-0.46	-0.45	-0.45	-0.42	-0.37	-0.36	-0.35	-0.32	Solid & liquid household fuels
-0.90	-0.89	-0.95	-0.98	-0.97	-0.95	-0.91	-0.89	-0.88	-0.86	-0.85	Transport services
-0.09	-0.02	-0.04	-0.06	-0.05	-0.06	-0.07	-0.07	-0.10	-0.13	-0.15	District heat, hot water
-1.71	-2.02	-2.08	-1.93	-1.83	-1.80	-1.64	-1.62	-1.58	-1.60	-1.63	Medical articles, medicines
0.98	1.05	1.06	1.05	1.05	1.05	1.02	0.97	0.96	0.94	0.90	Spirits
0.06	0.12	0.11	0.10	0.10	0.09	0.08	0.07	0.06	0.04	0.02	Tobacco
1.80	0.84	0.77	0.99	1.20	1.36	1.64	1.89	1.97	2.20	2.53	Motor fuels and oils
0.51	0.53	0.53	0.54	0.55	0.55	0.54	0.53	0.52	0.50	0.46	Beer
0.22	0.21	0.22	0.22	0.22	0.21	0.21	0.21	0.21	0.21	0.23	Wine
0.32	0.30	0.31	0.32	0.33	0.33	0.33	0.33	0.33	0.32	0.31	Sweets, cocoa, honey
0.06	0.03	0.04	0.05	0.06	0.06	0.06	0.07	0.07	0.06	0.06	Sport goods & toys
0.14	0.10	0.12	0.13	0.13	0.14	0.14	0.14	0.15	0.16	0.16	Meals taken out of home
0.02	0.04	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	Bakery products
0.06	0.06	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05	Potato,fresh vegetable &fruit
3.89	3.94	3.73	3.60	3.64	3.69	3.78	3.84	3.83	3.95	4.20	Extra excise tax on cars
17.1	16.0	15.5	15.7	16.1	16.5	17.1	17.4	17.4	17.7	18.1	total marg tax, full car effect
13.2	12.0	11.7	12.1	12.5	12.8	13.3	13.5	13.6	13.8	13.9	total marg tax with .5*car effect
11.4	11.2	11.0	11.1	11.3	11.4	11.6	11.6	11.6	11.6	11.4	excl mofuels and only .5*car effect
16.5	15.6	15.5	15.7	15.9	16.2	16.5	16.6	16.7	16.8	17.0	marg rate on tax gds (.5*car effect)
-3.2	-3.6	-3.7	-3.6	-3.4	-3.4	-3.2	-3.1	-3.0	-3.1	-3.1	marginal rate on subsidised goods

Note: estimated holding car ownership constant from pooled 1989-91 panel

APPENDIX B. Calculating marginal consumption shares

1. Cross section estimates

The preferred method for estimating the marginal consumption shares was to estimate equations (2) and (3) for commodities grouped by tax rates (but distinguishing durable and non-durable goods) on the cross-sectional data of the active households of the 1991 HBS. For each household we calculated the equivalised non-durable consumption as the main explanatory variable, with constant dummies for number of equivalent adults, active earners, number of children, age ranges of household members, number of unemployed, urban, Budapest, ownership of holiday home, main dwelling owned or rented, whether a smoker, form of heating, telephone, value of own produce, and whether below the poverty line. Two different goods classifications were used and are shown in the top and bottom panels of table B1. The first, shown in the top panel, aggregates goods into 8 groups (zero, 15 and 25% VAT, the latter split into durable and non-durable, vehicles, other motoring expenses, excise goods and subsidised goods), the second, shown in the lower panel, distinguishes the 21 goods with non-standard tax rates (replacing the last three sub-groups). For the groups, the average share-weighted tax rates were used to compute the total marginal tax rates for the four points on the consumption distribution - the 20th percentile (average of deciles 2 and 3), the median (average of deciles 5 and 6), 80th percentile (average of deciles 7 and 8) and the average, each computed for the sample of active households of the 1991 HBS. As the independent variable was non-durable rather than total consumption, the estimates had to be grossed up by the ratio of total to non-durable consumption, so that the estimated shares summed to unity. For the Working-Leser model, the shares ω_i were derived for each of the four points on the distribution as described above, to give the required marginal rates.

Not surprisingly, car purchases are poorly explained by non-durable consumption, as purchase decisions are investment (or replacement) decisions. The same is true to a lesser extent with durable goods,[17] though their shares are reasonably stable across the consumption distribution. Faced with a choice between estimating car consumption from fuel consumption, or just taking the standard rate of tax on the car and fuel expenditures, we chose the latter as very close to the former (when adjusting for tax rates). Earlier experiments controlling the slopes as well as intercepts with the same set of dummies are reported in Appendix A.

Table B1 indicates with shading the sources of the main differences in estimating the marginal tax rates between the Working-Leser (W-L) model (estimated at the average for the whole population) and the LES for 1991. The main differences are motoring costs, which W-L identifies as having a higher elasticity, and tobacco and medical articles, where W-L plausibly picks these up as having a low elasticity.

The tables below B1 give the computed marginal tax rates as percentages for the LES model and the four expenditure patterns of the W-L model, each derived using the finer 21 good classification. Note that the main differences between the two models occur in the earlier years when tax rates are more diverse, and they increasingly converge.

[17] See the standard errors on the parameters δ_i for durables and cars in table B1.

Table B1 **Estimates of slope parameters from 1991 HBS Active households**

	budget	W-L	marg. cons share		standard errors		Tax rates (fraction of expend.)				91 tax build up	
Tax group	share wi	delta i	wi+di	LES Bi	W-L SE	LES SE	1987	1988	1991	1994	W-L	LES
GROUP0	0.32	-0.20	0.13	0.29	0.009	0.004	-0.03	-0.05	0.00	0.08	0.00	0.00
GROUP15	0.13	-0.09	0.05	0.10	0.006	0.003	-0.05	0.07	0.07	0.14	0.00	0.01
GROUP25D	0.05	0.01	0.05	0.06	0.010	0.004	0.11	0.20	0.20	0.20	0.01	0.01
GROUP25N	0.22	0.22	0.41	0.34	0.009	0.004	0.10	0.20	0.20	0.20	0.08	0.06
CAREXP	0.02	0.04	0.05	0.04	0.014	0.006	0.38	0.41	0.37	0.37	0.01	0.01
MOTORING	0.09	0.20	0.26	0.16	0.010	0.005	0.49	0.53	0.53	0.55	0.05	0.03
SPECTAX	0.07	-0.03	0.04	0.06	0.004	0.002	0.48	0.54	0.52	0.51	0.02	0.03
SUBSIDY	0.12	-0.10	0.02	0.06	0.006	0.003	-1.01	-1.06	-0.50	-0.21	-0.01	-0.03
SUBTOTAL	1.00	0.05	1.00	1.09							0.17	0.11
Milk	0.02	-0.03	-0.01	0.00	0.00	0.00	-0.36	-0.47	-0.12	0.09	0.00	-0.00
Other dairy produ	0.02	-0.00	0.01	0.01	0.00	0.00	-0.36	-0.47	-0.03	0.09	-0.00	-0.00
Butter, margarine	0.01	-0.01	0.00	0.00	0.00	0.00	-0.36	-0.47	-0.06	0.09	-0.00	-0.00
Bakery products	0.03	-0.06	-0.03	0.00	0.00	0.00	-0.29	0.06	0.06	0.09	-0.00	0.00
Sweets, cocoa, h	0.02	0.01	0.03	0.02	0.00	0.00	0.11	0.23	0.23	0.20	0.01	0.00
Potato,fresh vege	0.04	-0.04	0.01	0.02	0.00	0.00	0.00	0.04	0.04	0.09	0.00	0.00
Meals taken out o	0.04	0.01	0.04	0.06	0.00	0.00	0.00	0.08	0.08	0.20	0.00	0.00
Wine	0.01	-0.00	0.01	0.01	0.00	0.00	0.26	0.31	0.31	0.31	0.00	0.00
Beer	0.01	0.01	0.02	0.01	0.00	0.00	0.47	0.52	0.44	0.44	0.01	0.01
Spirits	0.01	0.01	0.02	0.01	0.00	0.00	0.77	0.83	0.73	0.73	0.01	0.01
Tobacco	0.02	-0.05	-0.03	0.00	0.00	0.00	0.68	0.73	0.73	0.73	-0.02	0.00
Solid & liquid hou	0.03	-0.02	0.02	0.01	0.00	0.00	-1.10	-1.00	-0.37	0.09	-0.01	-0.00
District heat, hot	0.01	-0.03	-0.02	0.00	0.00	0.00	-1.79	-1.78	-0.85	0.09	0.01	-0.00
Water	0.00	-0.00	-0.00	0.00	0.00	0.00	-3.20	-4.00	-0.25	-0.25	0.00	-0.00
Medical articles,	0.00	0.00	0.01	0.01	0.00	0.00	-3.55	-3.61	-3.31	-3.31	-0.03	-0.02
Car parts and acc	0.01	0.03	0.04	0.02	0.00	0.00	0.10	0.20	0.20	0.20	0.01	0.00
Motor fuels and o	0.05	0.14	0.19	0.12	0.01	0.00	0.70	0.70	0.71	0.71	0.13	0.07
Sport goods & toy	0.01	0.02	0.02	0.01	0.00	0.00	0.10	0.11	0.11	0.20	0.00	0.00
Sewage	0.00	-0.00	-0.00	0.00	0.00	0.00	-4.92	-1.70	-0.30	-0.30	0.00	-0.00
Repair of vehicles	0.01	0.03	0.05	0.03	0.00	0.00	0.00	0.13	0.13	0.20	0.01	0.00
Transport service	0.02	-0.01	0.01	0.02	0.00	0.00	-0.75	-0.92	-0.59	-0.59	-0.01	-0.01
subtotal indiv gds	0.38		0.37	0.36							0.136	0.074

Notes: W-L: Working-Leser estimates, LES: Linear expenditure system, both estimated on non-durable consumption
SE = standard errors of W-L estimates
91 tax build up is contribution of each category or commodity to total marginal tax share,
shading shows main differences between W-L and LES

MTR with vehicles at std rate*

	1987	1988	1991	1994
LES	2.9	7.3	11.2	15.7
all	9.9	14.3	14.3	15.6
bottom	6.6	11.9	13.3	15.6
middle	8.9	13.6	14.1	15.8
top	10.7	14.8	14.4	15.4

* indiv commods

MTR, veh at std rate, savings adjusted*

	1987	1988	1991	1994	S/Y
LES	4.6	8.4	11.8	15.7	13.3
all	10.6	14.4	14.5	15.6	13.3
bottom	9.0	12.9	13.9	15.6	26.7
middle	10.2	14.0	14.4	15.8	18.1
top	11.1	14.8	14.5	15.4	7.4

* indiv commods

MTR with vehicles at full rate*

	1987	1988	1991	1994
LES	8.0	13.2	17.0	21.5
all	18.7	24.4	24.2	25.5
bottom	14.3	20.6	21.9	24.2
middle	17.4	23.3	23.6	25.3
top	20.1	25.4	24.9	25.9

* indiv commods

MTR, veh at full rate, savings adjusted*

	1987	1988	1991	1994	S/Y
LES	9.8	14.3	17.6	21.5	13.3
all	19.7	24.5	24.4	25.5	13.3
bottom	16.9	21.6	22.5	24.2	26.7
middle	18.8	23.6	23.9	25.3	18.1
top	20.5	25.5	25.0	25.9	7.4

* indiv commods

APPENDIX C The compilation of indirect tax and subsidy rates

Sources:

[1] Various issues of *Magyar Közlöny*, the official collection of the text of laws.

[2] A MoF worksheet provided by Mr. Lajos Nagy containing the time series of the excise tax rates for 1988-94.

[3] The time series of the consumption transformation matrices compiled by Mr. Ferenc Gáspár (MoF) which contain the tax/subsidy content of the consumers' expenditure on roughly 13 main consumption categories for the period 1986-92.

[4] Various tables of the Government Budget Reports and Plans

[5] Background calculation of the Government's Economic Programme 1992-1993 (MoF)

[6] *Consumer price indices 1992* - HCSO (contains time series and unit prices)

[7] Consumption time series - publication (1970-1990) and worksheet of the HCSO (for the years 1988-91)

The main problems which had to be resolved in the calculations were the following:

1. Budget data do not separate out the taxes/subsidies on personal consumption from total revenues/expenditures which include intermediate consumption.
2. Budget data usually do not present the taxes/subsidies collected/paid by the extrabudgetary funds and local governments (e.g. the part of the petrol-tax collected by the Road Fund, the medicine subsidy paid by the social security fund, the cities' subsidisation of the public transport, or the car-tax collected by the local governments).
3. Data are not sufficiently detailed for our 101 purchased goods level analysis.
4. The traditional distinction between producer price subsidies and consumer price subsidies makes it very difficult to calculate the true consumer price modifying subsidies. This problem also faces MoF and HCSO staff in compiling the national accounts.
5. Our data do not show the significant hidden or cross-subsidies (e.g. rent, electricity, gas, rail, post).
6. Sometimes it was not clear which types of taxes were applied for a particular product and in what order they were used (e.g. coffee, cars, gambling, etc.).
7. The HBS does not distinguish between new and second-hand goods, although the taxes apply only to the new products. This was a significant problem in the case of the car purchases.
8. The HBS does not separate out children's furniture (eg cots, which were heavily subsidised) and school-books from the furniture and book purchases, although they were treated differently in the tax/subsidy system. Many HBS consumption categories contain goods taxed at different rates (e.g. sweets-cocoa-honey, other foods, meals taken out of home, transport services, sporting goods and toys, toilet articles, medicines).
9. Products obtained in-kind (own-produced, received gifts, fringe benefits from employers, etc.) usually do not involve tax/subsidy payments. It was sometimes too difficult or impossible to separate out these products, though quantitatively these items are not very important.
10. Data derived from the actual payments show the effective tax rates, while for other commodities the legal rates were applied.
11. There are some subsidies which are paid only to certain groups. These are treated by the SNA as transfers but before 1992 in the Hungarian national accounts most of them were included in the price subsidies.
12. We did not attempt to include import duties in the taxes. Not only were the import duty

not available in the desired detail, but it is not known which goods were domestic and which were imported (e.g. in the case of the cars). Logically, import tariffs which protect identical domestic goods which also face competition from these imports should be treated as consumer taxes (with associated production subsidies), but the task of estimating this 'shadow' tax system are too great.

13. In some cases there are significant regional differences in the subsidy rates (water, public transport, gas, rent; etc.) but data availability was insufficient to address such issues.

The special problems in estimating the tax rates for individual years were the following:

1987 Before 1988 many goods were subsidised and there were many different turnover tax rates, many of which were set simply by circulars of the authorised ministries and were not published in [1]. Instead we calculated the ratios of the government's tax revenues/expenditures on subsidies and the value of the consumption by main categories. Since these value data were not too disagregated sometimes it was difficult to estimate the differences within the individual categories (e.g. within dairy products).

1988 The average tax rate for excise goods (alcohol, tobacco) seemed to have been lowered in 1988 but we did not have any information about which particular goods were the beneficiaries of these cuts. The cuts were allocated proportionally to the affected commodities. 1988 was selected not only because it was the first year of the new tax system but also because for 1989 the fundamental source of [3] is missing, in that single year different break-down was used. However, in 1988 the HBS was not conducted and we had to use the 1989 HBS budget shares with the 1988 tax rates.

1991 The open rent subsidy had almost completely disappeared by 1991 but we did not have data on how much the local governments spent on maintenance of the rental stock.

1994 Data on subsidies were incomplete, so we had to rely on [1] but without the legal rates for the remaining subsidies. Similarly in the case of the amount/physical unit type taxes we could not calculate (ad valorem) tax rates since we did not know the consumer prices. Nevertheless, we still could take into account the bulk of the changes in the tax system in 1994, since the VAT system changed in that year fundamentally (the 15 % rate was abolished and the VAT was extended to food, household fuel, many services, etc.) and many subsidies had ceased altogether by then.

Note on the comparison of the legal and effective tax rates

For some of the 101 commodity groups of the Hungarian consumption statistics it was possible to estimate both the legal and the effective tax rates. To illustrate the method consider two important products, one which is subject to excise tax and an other which is subject to VAT. The reference year was 1991.

Petrol:
Legal rate: The average consumer price was 54.1 forints/litre of which 38.2 were the excise tax (33.2) and the road fund contribution (5). Therefore the producer price can be estimated as 15.9. Consequently the tax rate was 54.1/15.9 -1 = 2.4
Effective rate: According to [3] the personal consumption of petrol was 22.5 billion forints at producer prices after which 44.5 tax was levied. Hence the effective tax rate was 44.5/22.5 = 2.

Clothing:
Legal rate: Since 1988 all clothing articles are subject to 25 % VAT.
Effective rate: According to [3] the personal consumption of clothes was 84.3 billion forints at producer prices after which 17 billion tax was levied. Hence the effective tax rate was 17/84.3 = 20 %.

In both cases the legal and the effective tax rates are not very different. However, if the consumption statistics classified the bleached petrol (in which the incriminating colour has been illegally removed) as heating-oil then it would not be possible to estimate the effective rate from our data. Note that since 1993 the problem has become more serious: foodstuffs are subject to a steadily increasing VAT (beginning with 6%, which was increased to 10 and 12% by 1995) but a considerable part of the food-sales remain unregistered.

In Table A6 effective tax rates are indicated by italics. For 1987 only the effective rates were normally available. After the introduction of the VAT in 1988 the estimates are mostly based on the legal rates. However, in the case of the subsidies the rates either were not available or were too detailed (e.g. regional differences in the case of the water-sewage, transportation, district heat, gas and a large number of medicines each with different subsidies) and the weights needed for their aggregation were not available and for these the effective subsidy rates are given. For 1994 the data needed for the estimate of the effective excise tax and subsidy rates were not available and the 1991 effective rates were used. Subsequently, we managed to obtain some of the corresponding data for 1993 which is presumably nearer to the 1994 situation than the 1991 rates. Based on them for example for the medicines the following effective subsidy rates can be calculated for 1993 (and used in the 1994 calculations):

(data in billion forints)	Cons.price	Tax (+) or subsidy (-)	Effective tax/cons.price
medicines	24.0	-54.2	-2.26

Unfortunately, we are still waiting for more details which are needed for the reasonable estimate of other rates (e.g. local government subsidies for the urban public transport, share of personal consumption of the total petrol consumption).

Comparison of the estimated and the effective (macrostatistical) total net indirect taxes

According to [3] the total net indirect tax burden of the personal consumption was 20, 53.6 and 112.2 billion forints for 1987, 1988 and 1991 respectively. Using our estimated tax rates and the consumption statistics data this burden can be estimated at 19.9, 55.6 and 145.7 billion forints for the same years. The difference between the two sequences is not too high but increasing over time. However, this is mainly due to the fact that for later years our rates were based more and more on the legal rates. In any case, the comparison of the legal and effective tax rates or the tax avoidance and its accounting in the macrostatistics deserves a separate study.