11 Microsimulation Model of Personal Tax and Social Security Benefits in the Czech Republic

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11.1 Introduction

Microsimulation modelling is now established in many countries as a valuable tool for the evaluation of taxation and social policy. In the United Kingdom both government departments and independent research organisations—such as the Institute for Fiscal Studies in London, and the Microsimulation Unit at the Department of Applied Economics at Cambridge University—have developed microsimulation models of the UK tax and benefit system. As a result, these models now have a very wide use in public policy debate.

Until recently, such models had not been applied to the tax systems of Central and Eastern European countries. The reason for this does not appear to be lack of suitable data, since a number of countries including the Czech Republic (formerly part of Czechoslovakia) have for many years run household surveys similar to those in Western countries. A more likely reason appears to be the lack of interest in the design of tax policy in the past. Under state planning, it was physical output that was the subject of policy-making. The financing of government policy through taxation, and the impact on economic incentives through wages and prices received little, if any, attention.

With the transition to a market economy this position is rapidly changing. For a market economy to function, it is important that the tax system should be designed to raise revenue effectively while minimising the distortions it causes to wages and prices. The Czech government introduced a reformed tax system in January

1993, and further changes to the benefit system appear likely in the future. The much greater openness of government means that the design of taxes and benefits will become an increasingly important subject of public debate. As a result, there is clearly a need for models which can reliably simulate the effects of policy changes.

A microsimulation model is one which is based on a sample of individual households, which can be used to represent the population of the country being modelled. For some models this sample may be artificially created (Falkingham and Lessof 1992), but it is more usual for the sample to be taken from a survey of actual households. The rules which govern the tax and benefit system are employed to calculate the payments for each household, and the results are then used to forecast payments for the entire population.

Other forms of tax modelling are possible. In particular, the availability of spreadsheet techniques means that macroeconomic data on tax revenue, combined with other information such as GDP, the inflation rate and the distribution of earnings, can be used to forecast the effects of policy changes on tax revenue (see, for instance Chapter 9 in this volume). Such models can produce results very quickly, are easy to use, and require relatively little data in comparison to a microsimulation model.

However microsimulation models have a number of advantages over these types of models. The rules which describe a tax and benefit system can be very complicated. The result is that while with simple tax changes—such as raising the basic rate of income tax—it may be possible to make rough estimates of the revenue consequences using a macroeconomic model by simply extrapolating from the revenue that the system raises already, with more complicated policy changes such an approach is unlikely to be reliable. Furthermore—even with simple changes—since different taxes and benefits interact with each other, the consequences of changing one tax on the payments of other taxes and benefits may not always be easy to predict unless a microsimulation approach is used.

We may also want to know about the distributional impact of policy changes. Some policy changes will make some groups in the population worse off, while others will gain. These effects are often politically sensitive, so that it is important to know what they are.

One way to do this is to use calculations for typical families. The difficulty with this approach is—while it is easy to understand—the results may be seriously misleading, since they are only valid for the chosen examples. Actual households tend to vary very widely in their circumstances, and it is difficult to take sufficient account of these variations with a set of examples since there is always the danger that some groups in the population will be overlooked. A microsimulation model can overcome this difficulty by using a sample that is representative of the actual population.

The purpose of this chapter is to describe CZ, the microsimulation model of the new Czech tax and benefit system developed at the University of Bath, in collaboration with the Institute for Fiscal Studies in London. The first section of this chapter gives a brief overview of the model, what it does and how it works. The second section describes the data, the third section covers the modelling of the individual taxes and benefits, and the fourth section discusses—with some examples—the type of results that it produces.

11.2 The workings of the model

CZ is a computer-based model of the Czech tax and benefit system. It is based upon TAXBEN, a model which has been developed at the Institute for Fiscal Studies in London. This program uses data from the Family Expenditure Survey to model the UK tax and benefit system (Johnson, Stark and Webb 1990). CZ has been adapted from this model so that it uses data on Czech households in order to forecast the impact of changes to the system of direct taxes, cash benefits, and indirect taxes in the Czech Republic.

CZ is written in the Modula-2 language which—as its name suggests—is a modular programming language. This means that a program written in the language consists of a set of inter-connected modules. One module acts as the main program, while other modules perform a variety of specialised tasks. Each module can be separately compiled. This means that it is generally fairly easy to adapt programs that have been written for one particular task to perform similar tasks, since only those modules that are specific to one particular task will need to be rewritten.

A tax benefit model requires three main components:

- a Data Module—to read and transform data;
- a Calculation Module—to perform calculations; and
- a Results Module—to store and present results.

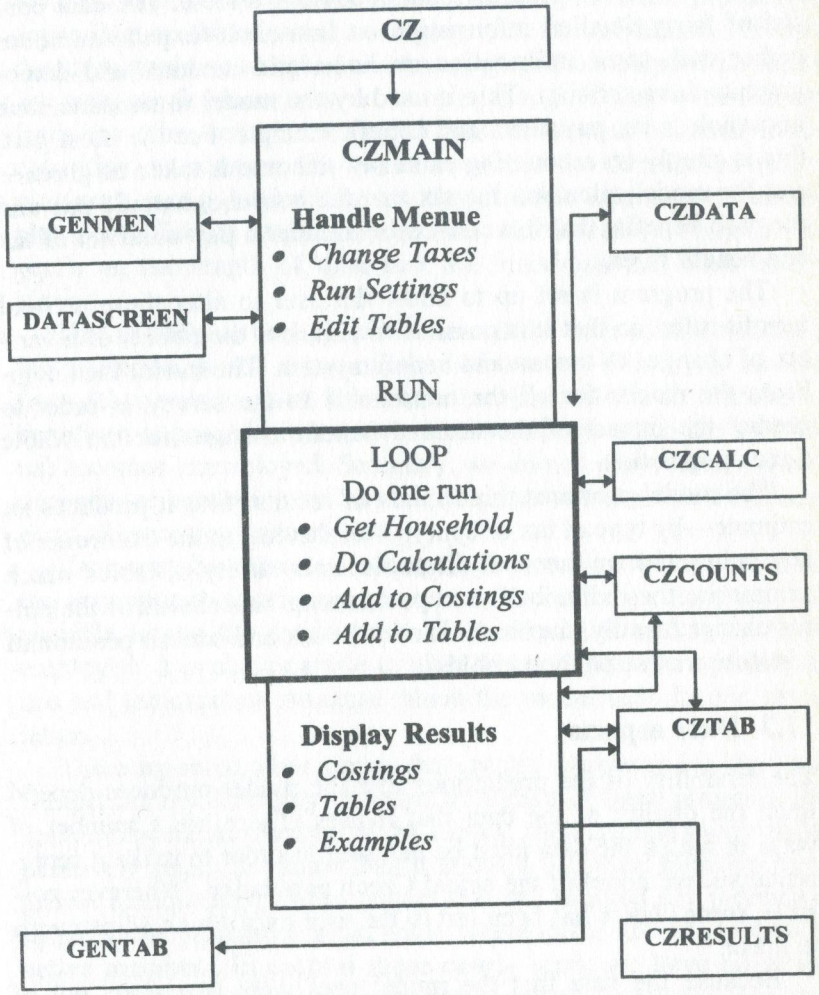
A separate module is also required to function as the main program. The way that each of these modules works will—to some extent—be specific to the particular data-set used and the tax system that is being modelled, although the general structure can be applied to any tax-benefit model.

In addition, for the model to function, a number of modules are needed to perform more general tasks—such as handling menus, data input screens and tables of results. These can be written so as to function independently of the particular tax system being modelled.

This is illustrated in Figure 11.1 which shows the structure of CZ in highly simplified form. A very small module (CZ) calls the module CZMAIN, which contains the procedures that run the model. These in turn call procedures in the modules CZDATA, which read and transform the data in CZCALC—which perform the tax and benefit calculations—and in CZCOUNTS, CZTAB, CZRESULTS which store and process the results. The program also uses a number of other modules—such as GENMEN—which consist of procedures which control the menu system; DATASCREEN—which handles the data input screens; and GENTAB—which handles the tables that the model produces.

The consequence of this structure is that it is unnecessary to rewrite all modules when adapting a tax benefit model written for one country to the tax system of another country. Those modules whose names are prefixed with 'CZ' are specific to this particular model, and had to be specially written when adapting the program from the IFS model TAXBEN. Other modules—such as GENMEN—are not specific and were taken directly from TAXBEN without modification. As a result it was straightforward to adapt the model developed for the UK for use with Czech data.

Figure 11.1: Czech Republic: The structure of CZ



CZ uses data on approximately 4,000 Czech households from the former Czechoslovakian Household Budget Survey. The dataset that the model uses in this chapter is for 1991—though this is continuously updated as the data become available. The data consist of fairly detailed information on household expenditures, together with some information on household incomes and demographic characteristics. This is used by the model to simulate each household's tax payments and benefit receipts. For the most part, this is simply an accounting exercise—income is taken as given—and the model calculates the tax that the household would pay and the cash benefits that it would receive under a particular set of tax and benefit rules.

The program is set up to allow the user to alter these tax and benefit rules, so that it is possible to simulate the effects of a variety of changes to the tax and benefit system. The model then combines the results for all the households in the survey in order to predict the impact of the tax and benefit changes for the whole Czech population.

The model produces three kinds of results: first it produces an estimate—by type of tax or benefit—of the cost to the exchequer of any policy change; secondly it produces a variety of tables which summarise the redistributive impact among households of the policy change; thirdly, the model shows the tax and benefit position of a selection of actual households.

11.3 Data aspects

The reliability of the predictions that the model produces depend upon the quality of the data that it uses. There are a number of ways in which the data must be adjusted in order to make it representative (we hope) of the actual Czech population. Wherever possible, some choice has been left to the user over which adjustments to make.

Because the data that the model uses were two years out of date—and these have been years of considerable change in the Czech economy—we had attempted to update the data as best we could to reflect these changes. The most important adjustment was

to simulate a sample of unemployed adults. There are no households where the head is unemployed[1] in the 1991 budget survey, and so we had to construct a sample of unemployed. This was done very simply by using a file of random numbers. Each working adult was assigned as either employed or unemployed with a probability depending on the regional unemployment rate of March 1992. If the individual was assigned as unemployed, the income from his or her main employment was set to zero, though if there was income from any other source, the person was assumed to continue to receive this. In addition, the model simulates the duration of unemployment, using information on the duration structure of unemployment. This is important, because entitlement to benefit depends on the length of time that the individual has been unemployed.

This is likely to be a simplification of the state of affairs during the transition period for a number of reasons. Firstly, if income from other sources apart from main earnings affects entitlement to benefit, it is possible that these will also change when the individual becomes unemployed. Secondly, we do not allow for any interdependence between members of the same household of the likelihood of becoming unemployed.

Users may be interested to know how sensitive the results are to the assumptions about unemployment. Therefore we have made it possible to run the model with all workers assumed to be fully employed. It is also possible to alter the unemployment probabilities and the duration structure which the model uses for the simulation.

There are some other groups that are not represented in the 1991 Budget Survey. Probably the most important of these groups is the self-employed. At the time of the survey, their numbers were comparatively small, but since then it appears that their numbers have grown dramatically. Other groups that are omitted are individual farmers and pensioner households where there are economically active members. In each of these cases—since we have no information on the incomes of the omitted groups—we have been unable to adjust the data in order to allow for these omissions. It should be noted, therefore, that the results of the model are only

valid for those sections of the population included: households where the head is in full-time work or unemployed; and pensioner households without any economically active members.

In addition we have had to weight the data in order to make the proportions in each social group representative of their proportions in the population. This is because collective farmers are deliberately over-sampled in the Budget Survey, while pensioners are under-sampled. The process is known as 'grossing up' the sample, and it involves giving a smaller weight to each farming household and a larger weight to each pensioner household compared to other social groups—with the result that the weighted numbers in each social group reflect the actual numbers in the population. However, to do this it is necessary to know the actual numbers. Unfortunately the latest information that we had at the time came from the 1988 Microcensus.

The model can also be run without weighting. This is not generally recommended for the reasons just stated. However, when looking at the impact of tax changes for small groups within the population—such as single parent families—it is often useful to know how many cases the results are based upon, which will give some idea of how reliable they are likely to be.

It is also necessary to make some assumption about inflation. Rather than impose any particular assumption upon the model, we have left this as an option which can be chosen by the user. The income variables used in the model are grossed up to match the information that we have about aggregate incomes in 1992. The user can then choose the amount of inflation assumed to occur since then. The default value assumed by the model is 10 per cent.

In section 4 of this chapter we look at the effects of varying assumptions about inflation. It is important, however, to be clear about which forms of income are assumed to increase in line with inflation. All market incomes are assumed to increase. However for cash benefits this is not necessarily the case. We assume that sick pay—since it is directly linked to wages—increases in line with inflation. Unemployment benefit is automatically linked to wages. Child benefit is not assumed to increase automatically, since the amount paid to a household depends on the rate per child specified in the benefit rules. The user can check the effects of up-rating this benefit by increasing the benefit rates used by the model. We do not model pensions and other benefits, but use the values of these that are recorded in the budget survey, and assume that these rise in line with inflation.

11.4 Taxes and benefits

The taxes that CZ models are the personal income tax, employee's and employer's social insurance contributions, and value added and excise taxes.

CZ also models child benefit, the compensation benefit and unemployment benefit. Pensions, sickness benefit and other benefits are not actually modelled, but the amounts recorded in the budget survey are used in all calculations. The reason for not modelling these benefits is lack of information. In the case of sick pay, we would need information about periods of sickness for each worker in the survey, but all that we have is the total amount received per household. For pensions we would need knowledge of past earnings over many years in order to calculate entitlement. In the case of other benefits, there is no information in the survey as to what these are.

11.4.1 Direct taxes

The direct taxes that CZ models are the personal income tax and employee's and employer's social insurance contributions. The way that it does so is by a straightforward accounting exercise, taking all incomes as fixed. In other words, the model does not allow for any effect of taxes on labour supply. Evidence for Western countries suggests that this assumption is not too far from the truth for adult male workers, since this group generally has a very low elasticity of labour supply. However, other groups such as married women and young workers show a much greater responsiveness to net wages. This may be particularly important for the Czech Republic—given the high proportion of married women who work. It would be possible for the model to allow for labour supply effects, and this is among the options that we hope to include in the future.

The user is able to change a large number of parameters that affect the way that income taxes are calculated. These include the tax rates and the income levels to which they apply, the single person allowance, the married allowance, the child allowance and the travel allowance. Furthermore they include the wife's earnings' limit, and the rate at which the married allowance is withdrawn above that limit, as well as the income limit above which all allowances are withdrawn, and the rate at which these are withdrawn. It is also possible to switch to joint taxation of husband and wife, and to change the definition of taxable income. For insurance contributions, the rate of contribution for social, health and employment contributions can be changed, as well as the definition of income on which contributions are paid.

11.4.2 Indirect taxes

Indirect taxes are more difficult to model than direct taxes, because in order to do so we have to make some assumption about how household behaviour changes in response to tax changes. The amount of indirect tax paid depends on household expenditure on the taxed goods. In general we would expect this to depend upon both relative retail prices and on disposable income, and both of these are themselves affected by the tax system. Therefore we need to model the response of household spending to prices and income.

One way to do this is to estimate a household demand system. Unfortunately the data that we have for the Czech Republic do not allow us to do this, and so we have used a much simpler approach. This is to assume that the shares of expenditure on each good are a constant proportion of household income, hence are independent of prices. This corresponds to the assumption that the household utility function has the Cobb-Douglas form. This makes modelling much easier, because it means that expenditure is only affected by changes in disposable income (market income plus cash benefits minus direct taxation). The calculation involved is then very simple, since we can obtain the expenditure shares for each household directly from the Budget Survey. It is worth noting also that though this is a restrictive assumption in some ways, in one important respect it is not, because we do not assume that households have the same expenditure shares. This means in particular that the model

does allow for the fact that richer households are likely to have different expenditure and saving patterns from poorer ones.

Once expenditure shares are known, expenditure is calculated as the product of these shares and disposable income. Value-added tax payments are then calculated in a straightforward manner. However excise tax payments depend on the amount of the good bought, and so we have had to use estimates of current prices of the goods, combined with the expenditure information in the Budget Survey to estimate the amount bought.

11.4.3 Benefits

As it has already been indicated, the cash benefits that we model are child benefit, compensation benefit and unemployment benefit.

Unemployment benefit is modelled very simply—it is assumed to be a percentage (which can be specified by the user) of the wage when in work. This percentage depends on the duration of unemployment, and the total amount of the payment is also cash limited. After six months entitlement to unemployment, benefit ceases. The unemployed person may then be entitled to a safety-net payment if the family income is sufficiently low.

The model uses the old system of child benefits. However it is possible to change the benefit in several ways. The benefit rates can be dependent on either the number of children, or their ages, or both. In addition the benefit can be made dependent on income. The income threshold at which benefit is withdrawn can be chosen (and can depend on family composition), as can the rate of withdrawal.

Compensation benefit is payable to pensioners and families with children, subject to an income threshold. The user is able to change the amounts payable and the income threshold.

11.5 Some applications and empirical results

In this section we use CZ to explore two important issues: the revenue and distribution consequences of the new Czech tax system, in comparison to the immediately preceding interim system,

and the marginal revenue elasticity and tax incidence of changes in the new system.

The Czech Republic has had three different household tax systems since the beginning of 1989; the pre-revolutionary system—which incorporated a complex opaque individual income tax and a completely obscure highly differentiated turnover tax (Kameníckoá 1990); an interim system with a much simplified transparent turnover tax (Heady *et al* 1992), and a reformed system from January 1993, with a considerably simplified income tax, and a value added tax replacing the turnover tax (Coulter *et al* 1992a),

The results reported here continue the analysis of this evolving system, an analysis which was begun in Coulter *et al* (1992a) and continued in Coulter *et al* (1992b and 1992c). In the first of these papers we used regression analysis to show that the pre-1990 individual tax-benefit system implicitly provided very generous tax treatment for children, and that its revenue raising and distributional effects could be closely approximated by a simple linear tax system with personal child tax allowances. We also argued that the post-1993 system would be more progressive than the previous system.

In the second and third papers we used an earlier version of CZ to examine the revenue and distribution consequences of the 1993 proposal to raise the child tax allowance from 6,000 to 9,000 crowns per year. By separating the household budget survey statistics into Czech and Slovak data sets we were able to analyse the impact of the proposals on the two different republics before their formal separation in January 1993. In both cases we showed that although the revenue consequences were rather straightforward, the distributional consequences were complex.

After producing these papers our subsequent development of the model concentrated on the Czech Republic, as does this chapter. So although the Slovak tax and benefit system in 1993 was still very close to the Czech system, and our current results would almost certainly carry over to Slovakia, strictly speaking this is just conjecture.

11.5.1 Comparing the old and new systems

CZ as described in this chapter has the 1993 tax scheme built into it. An outline of the scheme is given in the Appendix. Before using CZ to explore some of the characteristics of the new scheme, it is worth looking quickly at the broad changes in emphasis in taxation which the new scheme implies.

Table 11.1: Czech Republic: The changing pattern of tax revenue 1989–93[1]

TAX	1989	1990	1991	1992	1993
Profit	23.5	24.2	29.4	26.7	22.7
Income	14.8	13.2	12.4	13.6	5.0
Payroll	27.0	23.7	25.9	25.9	34.6
Property	1.4	1.7	0.6	0.5	1.0
Commodity[2]	24.2	27.3	29.8	30.2	33.4
Foreign Trade	3.9	6.2	1.9	3.0	2.0
Other[3]	5.2	3.8	0.0	0.0	1.3
TOTAL	100.0	100.1	100.0	99.9	100.0

[1] 1989 and 1990 data were tax revenues, while 1991, 1992 and 1993 data were budget estimates, 1989–92 data were for Czechoslovakia; 1993 was for the Czech Republic.— [2] Net of subsidies in 1989 and 1990. Negative rates of turnover tax ceased in 1991.— [3] This residual category reconciles total revenue with data on individual taxes in 1989 and 1990. In 1993 it includes Road Tax revenues.

Source: Federal and Czech Ministries of Finance.

Table 11.1 shows the changing pattern of taxation under three different schemes—the old regime (1989–90), an interim regime (1991–92), and the new scheme. During this period total revenue as a percentage of GDP fell from 61.7 in 1989 to roughly 47 per cent in 1992. At the same time there was a rapid phasing out of subsidies on commodities. Under the old regime these subsidies had been substantial, accounting for 7.5 per cent of GDP in 1989.

The changes in revenue sources are crystal clear. In comparison with the old and interim tax regimes the new system involves

- *a similar role for direct taxes*. A major reduction in personal income tax is balanced by the introduction of taxes for social, health and employment insurance; and
- *a significant increase in indirect taxation*, and therefore a substantial shift in the balance of taxation of individuals towards indirect taxation.

Table 11.2: Czech Republic: Taxes and benefits under the 1993 system: Impact of raising income tax by one per cent

ITEM	1993 System[1] (million crowns)	Impact of tax (change)
Income tax	19,221	1,091
Social Insurance		
Employee	23,718	
Employer	68,519	
Total	92,237	
Health Fund		
Employee	11,859	
Employer	26,353	
Total	38,212	
Benefits		
Pensions	69,649	
Child Benefit	12,606	
Sickness Benefit	6,994	
Unemployment Benefit	2,502	
Compensation Benefit	12,128	
Other Benefits	5,716	
Total	109,595	
Indirect taxes		
VAT	44,742	-126
Excise Tax	20,061	- 59
Total	64,803	-185
Net revenue (Taxes-Benefits)	104,878	905

[1] The calculation uses 1991 household budget data and assumes 10 per cent inflation 1992-93.

Table 11.3: Czech Republic: Impact of one per cent basic income tax rate increase by income class

(1) Monthly net income range (Crowns)	(2) Per cent of households in range	(3) Average monthly change in household income (Crowns)	(4) (3) as per cent of average total income in net range	(5) Per cent of total income in range
2,000–3,000	7.17	-2.72	0.11	2.53
3,000–3,999	10.24	-5.65	0.16	4.87
4,000–4,999	7.89	-9.09	0.20	4.88
5,000–5,999	10.82	-10.22	0.18	8.24
6,000–6,999	14.30	-14.62	0.22	12.80
7,000–7,999	14.86	-22.57	0.30	15.28
8,000–8,999	11.20	-28.54	0.34	13.09
9,000–9,999	7.80	-32.59	0.34	10.17
10,000–10,999	5.48	-41.05	0.39	7.90
11,000–11,999	3.57	-41.57	0.36	5.62
12,000–14,999	4.14	-41.77	0.32	7.51
15,000 & over	2.56	-49.40	0.24	7.13
Total	100.03	-20.51	0.28	100.00

Source: Authors' calculations.

11.5.2 Tax incidence and revenue elasticity

CZ can be used to estimate revenue yields under a wide range of different types of parameter changes, including tax rates, tax allowances and inflation assumptions. Apart from the level of revenue, the most important aspects of the recent reforms—for fiscal and social policy reasons—are their revenue elasticity and distributional impacts. Tables 11.2 to 11.9 report the results of some experimental simulations on these issues.

Table 11.2 shows the model's estimates of the 1993 tax yields and benefit payments. Of the total tax yield we estimate that 9.0 per cent would come from income tax, 60.8 per cent from social insurance, and 30.2 per cent from indirect taxes. Note that we did not estimate corporation tax and some less significant revenue sources which are included in Table 11.1.Table 11.2 also shows the interaction of the direct and indirect tax systems. A one per cent increase in the basic rate of income tax leads to a rise in income tax revenue, but because disposable income and hence consumption fall, so does indirect tax. So although the consequence of the rise in income tax is a 5.7 per cent increase in the gross yield from that tax, the net yield, allowing for interaction effects, only rises by 4.7 per cent.

The distributional consequences of the change are shown in Table 11.3. Given the tax allowance system (see Appendix) and the rate structure, the progressivity of the results was obviously expected. The rate change increases the household direct tax bill by 0.18 per cent of average net income in the 5,000–5,999 crowns range, and by 0.39 per cent in the range of 10,000 to 10,999 crowns. But note that we are considering households—not individual recipients. The composition of households as well as their sources of income may change between income ranges. So we should not expect necessarily to see a steady increase in the proportionate tax bill across all income ranges. In addition there are significant non-linearities in the tax structure caused by the fact that the married man's allowance disappears in its entirety once the wife's earnings exceed 1,800 crowns per month. This regulation is the most likely reason for the observed fall in the tax impact between the 4,000–4,999 and the 5,000–5,999 crowns ranges.

The regressivity of the income tax system which sets in at incomes above 10,999 crowns is due to the fact that high income earners in the budget survey report a relatively high proportion of their income not directly as income from employment, but in the category 'other cash income'. This category we have assumed is not taxed. However this is a convenient provisional assumption, made to better reconcile the model's tax predictions with the payments reported in the survey by the interviewees. A more sophisticated modelling of this income category may reduce or remove the regressivity.

Table 11.4 shows the revenue impacts of a one per cent rise in the employee's social insurance contribution rate. Here the rise in insurance revenues is partly counterbalanced by the effects of a smaller income tax base, and the indirect tax consequences of lower disposable income. The result is to reduce the 7.4 per cent increase in the gross yield from the tax increase, to a net 5.2 per cent rise.

Table 11.4: Czech Republic: Impact of a one per cent rise in the employee's social insurance contribution rate by type of tax

Item	Impact of Change
Income Tax	-396
Employee Insurance	+2,635
VAT	-256
Excise Tax	-122
Net Revenue	+1,859

Source: Authors' calculations.

The distributional consequences of this tax change are shown in Table 11.5. They should be compared to those for the change in income tax (Table 11.3) and to the distributional consequences of a one per cent change in the main VAT rate (Table 11.6). From a revenue raising viewpoint, a one per cent rise in the standard VAT rate raises a little more revenue than a similar change in the income tax schedule, while substantially more is generated by the social insurance changes. This is because the very significant exemptions and allowances in the personal tax system have led to important reductions in that tax's base.

Table 11.5: Czech Republic: Impact of a one per cent rise in the employee's social insurance contribution rate by income class

(1) Monthly net income range (Crowns)	(2) Per cent of households in range	(3) Average monthly change in household income (Crowns)	(4) (3) as per cent of average total income in net range	(5) Per cent of total income in range
2,000–3,000	7.17	-6.20	0.24	2.53
3,000–3,999	10.24	-10.98	0.32	4.87
4,000–4,999	7.89	-20.81	0.46	4.88
5,000–5,999	10.82	-27.81	0.50	8.24
6,000–6,999	14.30	-37.48	0.58	12.80
7,000–7,999	14.86	-50.35	0.67	15.28
8,000–8,999	11.20	-60.07	0.71	13.09
9,000–9,999	7.80	-63.78	0.67	10.17
10,000–10,999	5.48	-71.27	0.68	7.90
11,000–11,999	3.57	-73.52	0.64	5.62
12,000–14,999	4.14	-70.87	0.53	7.51
15,000 & over	2.56	-73.31	0.36	7.13
Total	100.03	-42.10	0.58	100.00

Source: Authors' calculations.

Table 11.6: Czech Republic: Impact of a one per cent rise in the standard rate of VAT

(1) Monthly net income range (Crowns)	(2) Per cent of households in range	(3) Average monthly change in household income (Crowns)	(4) (3) as per cent of average total income in net range	(5) Per cent of total income in range
2,000–3,000	7.17	-11.68	0.46	2.53
3,000–3,999	10.24	-14.91	0.43	4.87
4,000–4,999	7.89	-19.01	0.42	4.88
5,000–5,999	10.82	-23.89	0.43	8.24
6,000–6,999	14.30	-27.79	0.43	12.80
7,000–7,999	14.86	-31.84	0.43	15.28
8,000–8,999	11.20	-35.36	0.42	13.09
9,000–9,999	7.80	-37.74	0.40	10.17
10,000–10,999	5.48	-43.62	0.42	7.90
11,000–11,999	3.57	-48.08	0.42	5.62
12,000–14,999	4.14	-54.01	0.41	7.51
15,000 & over	2.56	-91.19	0.45	7.13
Total	100.03	-30.73	0.42	100.0

Source: Authors' calculations.

However the important differences are distributional. Table 11.7 has been constructed to highlight the comparisons. It indicates that the income tax change is progressive for most of the bottom 90 per cent of households, while the social insurance rate increase is progressive for most of the bottom three quarters. On the other hand VAT is broadly proportional in its impact.

Table 11.7: Czech Republic: Comparative progressivity of one per cent rises in income tax, social insurance and VAT rates

(1) Monthly net income range (Crowns)	(2) Income tax PI*	(3) Social Security PI*	(4) VAT PI[1]	(5) 'Inflation tax' PI*	(6) Cumulative per cent of people in income range
2,000–3,000	1.00	1.00	1.00	1.00	7.17
3,000–3,999	1.45	1.33	0.93	0.78	17.41
4,000–4,999	1.82	1.92	0.91	1.15	25.30
5,000–5,999	1.64	2.08	0.93	1.30	36.12
6,000–6,999	2.00	2.42	0.93	1.46	50.42
7,000–7,999	2.73	2.79	0.93	1.56	65.28
8,000–8,999	3.09	2.96	0.91	1.71	76,48
9,000–9,999	3.09	2.79	0.87	1.73	84.28
10,000–10,999	3.55	2.83	0.91	2.21	89.76
11,000–11,999	3.27	2.67	0.91	2.33	93.33
12,000–14,999	2.91	2.21	0.89	1.43	97.47
15,000 & over	2.18	1.50	0.98	1.20	100.03
Total	2.55	2.42	0.91	1.55	—

[1] PI = Progressivity Index. It is calculated as the average monthly change in household income as a percentage of average household income in that range—columns (4) in Tables 11.3, 11.4 and 11.5—taken as a proportion of that figure for the lowest income range. A sequence of values increasing away from 1.00 indicates a fully progressive tax.

Source: Authors' calculations.

The results in Table 11.7 show the distributional consequences of a varied tax structure on a population formed into a wide variety of households and drawing its income from a range of income sources subject to different tax treatments. We have already discussed the progressivity of income tax. The results in column (3) for social insurance are equally interesting. If all income were wage income, we would expect the impact to be proportional. But the results reflect the fact that the proportion of wage income in

total income increases, at least for the first three quarters of the income distribution.

Table 11.8: Czech Republic: Taxes and benefits under the 1993 system, assuming a 20 per cent inflation rate

ITEM	1993 system	Changes from 1993 system
	(Million Crowns)	(10 % Inflation)
Income tax	23,043	+3,822
Social Insurance		
Employee	25,874	+2,156
Employer	74,748	+6,229
Total	100,622	+8,385
Health Fund		
Employee	12,937	+1,078
Employer	28,749	+2,396
Total	41,686	+3,474
Benefits		
Pensions	75,981[1]	+6,332
Child Benefit	12,606	0
Sickness Benefit	7,630[1]	+636
Unemployment Benefit	2,604	+102
Compensation Benefit	11,667	-461
Other Benefits	6,235[1]	+519
Total	116,723	+7,128
Indirect taxes		
VAT	48,244	+3,502
Excise Tax	21,624	+1,563
Total	69,868	+5,065
Net revenue (Taxes-Benefits)	118,495	+13,617

[1] Presupposed to increase in line with the assumed inflation rate.

Source: Author' calculations.

The VAT results are also less obvious and predictable than might be thought. The broad proportionality distribution result occurs despite the multi-rate nature of the tax. Very broadly speaking this is likely to be because the negative impact of higher savings by wealthier groups on VAT receipts is counterbalanced by the low VAT rate on food.

A useful option of CZ is that the policy maker or researcher can select different rates of wage inflation—which amongst other effects—obviously have revenue implications for the Ministry of Finance. As we have noted, the micro database used to generate Tables 11.2 to 11.9 was collected in 1991, but in the simulations reported here we wanted a forecast for 1993. Therefore we needed to adjust the data for money wage increases which occurred in 1992 and would occur in 1993. In column (5) we report the distributional consequences of money wage inflation.

The base calculations throughout this chapter assume a 10 per cent money wage inflation rate for 1992–93. This was increased to 20 per cent. We then compared mean net income in the various ranges—with the 20 per cent inflation assumption—to what it would have been if net incomes had been increased by 20 per cent, but no extra tax had been collected above the base assumption. This extra or 'inflation tax' is, of course, the result of imperfect indexation. The impact of the inflation tax is progressive except at the very top and the very bottom of the income ranges. Table 11.2 gives the results on revenue of assuming 10 per cent inflation, and Table 11.8 depicts the consequences of 20 per cent inflation over this period. Note that while we have modelled the impact on unemployment and compensation benefits to correspond with our knowledge of Czech practice, we have had to make simpler assumptions for other types of benefits. But while some further improvements in modelling may be possible in these cases, we should stress that both the direct and indirect tax systems are now fully modelled and integrated.

Finally Table 11.9 shows the elasticities of revenue and of some benefit payments with respect to changes in money wages. The buoyancy of income tax receipts is particularly marked, as is the far more limited buoyancy of state insurance revenue and indirect tax receipts. Note that the low indirect tax elasticity is a direct consequence of the high elasticity of income tax with respect to money wages. Looked at from the viewpoint of automatic stabilisation, the results of Table 11.9 suggest that the effect of the policy switch towards state insurance and indirect tax in the 1993 system will be to reduce considerably the automatic feedback characteristics of the fiscal system. While this was presumably an unintended consequence of the reforms, its importance should not be exaggerated, for the elasticity of net revenue with respect to money wages of 1.43 indicates the continued existence of significant fiscal drag.

Table 11.9: Czech Republic: Elasticities of taxes, benefits and income with respect to money wages

Item	Elasticity
Income tax	2.19
Social insurance	1.00
Indirect tax	0.86
Sickness benefit	1.00
Unemployment benefit	0.45
Net revenue	1.43

Source: Authors' calculations.

11.6 Conclusions

In this chapter we have described a model of the Czech personal tax and benefit system, CZ, and have illustrated part of its repertoire by using it to examine the revenue and distribution consequences of the 1993 reforms and to explore the tax incidence and marginal revenue elasticities of changes in the new system. Although further refinements to the modelling of the benefit side of the model are possible, and will be undertaken as information becomes available, CZ in the presented form is a fully articulated policy and research tool.

The results show:

- that the 1993 reforms would lead to an unchanged role for direct taxes. A major reduction in personal income tax was balanced by the introduction of taxes for social, health and employment insurance;
- that there would be a very significant increase in indirect taxation which—taken in conjunction with the previous effect—implied a major shift in the balance of taxation of individuals towards indirect taxes;
- that the interaction of the direct and indirect tax systems would reduce the yield of a marginal increase in income tax by 18 per cent. It reduced the yield of a marginal increase in employee social insurance rates by 30 per cent;
- that the income tax change was progressive for most of the bottom 90 per cent of households, while the social insurance rate increase was progressive for most of the bottom three quarters. A VAT increase was broadly proportionate; and
- that income tax revenue was much more responsive to wage inflation than were state insurance or indirect tax revenues. Given this, the second effect mentioned above is to reduce the automatic stabilising effect of the fiscal system.

Finally we should stress three points. The calculations in this chapter should be treated as provisional and with caution, in two senses. First, the accuracy of the estimates can always be improved when new household budget data become available. Second, our calculations assume that there would be no start-up problems in the collection of VAT, or any other of the new taxes.

However, the focus of this book is on methodology rather than on a historic analysis of the transition process in the Czech Republic and its impact on taxation. The data presented here should therefore be taken as an illustration of the power of microsimulation models and their application within the framework of an economy in transition—with all its specific problems compared to more established market economies. However, the results shown here represent only a small part of the revenue prediction and incidence analysis capacities of the model. Some further aspects of its versatility are shown in Coulter *et al* (1992b and 1992c).

Note

1 There are some households where members have experienced unemployment in the past. However the numbers are very small and these households may not be representative of the unemployed during the phase of transition. It was therefore considered better to simulate the unemployed sample.

APPENDIX
DESCRIPTION OF DATA

The base line simulations used the following assumptions:

Social insurance contributions (as percentage of wages)

State Insurance	Employee	Employer
Social Insurance	6.5 per cent	23.5 per cent
Health Insurance	4.5 per cent	10.0 per cent
Employment Insurance	2.5 per cent	2.5 per cent

Income tax

Allowances	Crowns
Single Allowance	20,400
Married Allowance	12,000
Wife's Employment Limit	20,400
Child Allowance	9,000
Travel Allowance	2,400

Income tax

Rates (in per cent of taxable income)	Bands (taxable income per annum)
15	up to 60,000
20	up to 120,000
25	up to 180,000
32	up to 540,000
39	up to 1,080,000
47	above 1,080,000

Value Added Tax Rates

Basic food	0.05	Other food	0.23
Alcohol	0.23	Medicines	0.05
Children's clothes	0.23	Adult's clothes	0.23
Cars	0.23	Petrol	0.23
Solid fuel	0.23	Books	0.05
Other goods	0.23	Renting	0.23
Transport	0.23	Repairs	0.05
Services	0.23	Tourism	0.05
Entertainment	0.23		

Wage Inflation

1992–93: 10 per cent

Excise Taxes

Beer	1.54 crowns per litre
Wine	16.3 crowns per litre
Spirits	180.0 crowns per litre
Fuels	8.25 crowns per litre
Leaded Petrol	10.8 crowns per litre
Unleaded Petrol	9.39 crowns per litre
Tobacco	0.46 crowns per cigarette

Benefits

Child Benefits

First child	200 crowns per month
Second child	450 crowns per month
Third child	560 crowns per month
Fourth child	510 crowns per month
Fifth child & subsequent	350 crowns per month

(There are no income limits to the payment of child benefit.)

Unemployment Benefits

First 3 months	60 per cent of last wage
3–6 months	50 per cent of last wage

After six months unemployment benefit runs out: there then comes into operation a social safety net for the unemployed. This is 1,600 crowns per month. We assume that it is paid if family income is less than 2,400 crowns per month.

Note: Lacking precise information we made this as an assumption.

Compensation Benefits

Per child 220 crowns per month
Per pensioner 220 crowns per month