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ABSTRACT

This paper describes the individual income tax microsimulation model developed for the Slovak Ministry of Finance by the U.S. Treasury Department's Office of Technical Assistance. The model is based on a sample of over 50,000 individual income tax returns and gives the Ministry the capacity to estimate the revenue and distributional effects of proposed income tax law changes. The paper discusses the development of data collection and tax analysis capacities to support the use, maintenance, and improvement of such models over time.

Keywords: tax, microsimulation, Slovakia.

JEL Subject Codes: C81, H24

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A MICROSIMULATION MODEL OF THE SLOVAK INDIVIDUAL INCOME TAX

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OVERVIEW

This paper describes the individual income tax microsimulation model developed for the Slovak Ministry of Finance by the U.S. Treasury Department's Office of Technical Assistance. The development of the model had four principal objectives. The first was to establish a capacity within the Ministry of Finance to estimate the revenue and distributional effects of proposed individual income tax law changes. The second was to convince Ministry officials that the potential benefits of such methods of analysis would justify the costs of developing data gathering and tax analysis capacities to support the use, maintenance, and improvement of such methods. The third was to provide a tool for educating analysts about the structure of microsimulation modeling and establish a foundation for developing more sophisticated and flexible models. The fourth was to highlight the dependence of the Ministry on the tax administration (and other agencies) for current, relevant, and accurate data and to emphasize the importance of establishing institutional arrangements for the provision of such data.

The model is based on a sample of 52,764 individual income taxpayers for 1994 and runs in Microsoft Access on a microcomputer. In general, the model allows the analyst to adjust the 1994 data by certain components of nominal GDP to reflect changes that may have occurred in the taxpaying population between 1994 and the year (or years) under analysis. It then calculates the tax liability for each taxpayer in the sample under current- and proposed-law scenarios based on algorithms specified by the analyst. Finally, it grosses-up the sample results to the population and presents estimates of the total tax liability under current and proposed law and the effect of

the change in the law. These estimates are also presented by income class and region of the country.

The model is both transparent and flexible. On the one hand, it is designed so that those with little understanding of microsimulation modeling or computers can adjust important parameters, run the model, and interpret the results. The model can therefore be used as a tool for convincing high-level Ministry officials of the benefits of such methods of analysis and for educating potential users about the nature of microsimulation modeling. On the other hand, those with proficiency in computer programming can modify the calculations with a degree of flexibility that is constrained only by the level of disaggregation of the underlying data. The input and output forms for the model are presented as Attachments 1 and 2.

THE SAMPLE

DataCentrum, a government statistical agency in Slovakia, had collected in electronic form every item from every individual income tax return filed for 1994. The availability in electronic form of detailed data for the entire population of individual income tax filers made it feasible to execute a relatively sophisticated stratified random sample that would be manageable on a microcomputer. The returns were initially stratified into three main groups: 1) Returns reporting only income from wages, 2) Returns claiming a tax base reduction, and 3) All other returns. Each of these groups was sub-stratified into two groups based on the level of income, and the two groups were sampled at different rates. The high-income returns were sampled at a 100 percent rate, and the lower-income returns were sampled at a lower rate.[1] The sampling methodology yielded

[1] For returns reporting only wage income, the sample includes the top 20 percent of returns in terms of income and a 20 percent simple random sample of the remaining returns. For returns claiming a tax base reduction, the sample includes the top 20 percent of returns and a 30 percent simple random sample of the remaining returns. For all other returns, the sample includes the top 5 percent of returns and a 5 percent simple random sample of the remaining returns.

an initial sample of 44,734 tax returns, each of which had a sample weight of 1/p, where p is the sample selection probability (See Table 1).

Since wage earners generally are subject to withholding tax by their employers and are not required to file returns, the sample was supplemented with a "simulated" sample of 8,030 tax returns for wage earners. This simulated sample was developed from the relatively small number of wage earners who filed returns because they were required to reconcile wage income from multiple sources for tax purposes at the end of the year.[2] As a result, the simulated sample was based on the sample stratum of wage earners described above, with two adjustments. First, those tax returns carrying over a business loss from previous years were eliminated under the assumption that they were not representative of the population of wage earners. Second, those tax returns reporting wage income in excess of Sk 216,000 (approximately $6,300) were eliminated for the same reason. This threshold was chosen so that the average wage in the overall sample would be consistent with the average wage reported by the Slovak Statistics Office. The weights on the remaining returns were then adjusted so that the sum of the weights was consistent with the number of wage earners subject to the withholding tax (See Table 1).

STRUCTURE OF THE DATABASE

Since all identifying information had been stripped as a condition for obtaining the data, the taxpayers are indexed sequentially from 1 to 52,764. The index allows one to link records across the multiple tables in which the data reside. The data reside in multiple tables (corresponding to the tables on the tax return) in order to keep the size of the database as small as possible. Indeed,

[2] The model implicitly assumes that wage earners with more than one source of income were representative of wage earners with only one source of income. While this assumption may be suspect, it made it possible to develop a comprehensive individual income tax model that included all wage earners.

each table includes only those records that contain non-zero elements. In addition, in order to store adjustments in the 1994 data to reflect changes in the taxpaying population between 1994 and the current- and proposed-law years, there are two additional sets of tables, one for current-law-year data, and one for proposed-law-year data.

Tables 2 to 4 provide examples of the ways in which information from the database can be summarized. Table 2 presents the number of taxpayers, gross income, taxable income, tax liability, and effective tax rate by tax bracket. Table 3 disaggregates the information in Table 2 by type of taxpayer, and Table 4 disaggregates the information in Table 2 by region of the country. This kind of information can provide a useful snapshot of the underlying taxpaying population for tax policy purposes and can be produced as a routine matter by the tax administration.[3] There are two points worth noting from Table 2. First, the effective tax rate for all taxpayers is 10.6 percent and varies from 6.0 percent in the bottom tax bracket to 36.8 percent in the top tax bracket. Second, 77 percent of all individual income taxpayers fall into the lowest income tax bracket, and 93 percent fall into the lowest two brackets. This suggests that the income tax rate structure may be somewhat out of sync with the characteristics of the taxpaying population and that the benefit of a graduated tax rate structure in terms of progressivity may be low relative to the cost of administration.

THE MODEL

The first step in simulating proposed changes in the Slovak individual income tax is to adjust the 1994 tax return data so that they are consistent with data one would expect to obtain from a sample conducted in the year (or years) under analysis. While there are many approaches to adjust-

[3] This function is performed in the United States by the Statistics of Income Division of the Internal Revenue Service.

ing the base-year data, it is important to choose an approach which ensures consistency between the model estimates and the available macroeconomic forecasts. Since the Slovak Ministry of Finance only generated forecasts of nominal GDP (as opposed to, e.g., national income) at the time the model was developed, the approach used was to adjust the 1994 data by the forecasted change in nominal GDP between 1994 and the year (or years) under analysis. In fact, the model enables the analyst to adjust the 1994 data by the following components of nominal GDP: 1) real per taxpayer GDP, 2) the price level, and 3) the number of taxpayers by type. These parameters are incorporated into the model through the input form (See Attachment 1).[4]

The next function the model performs is to calculate the tax liability for each taxpayer in the sample under current and proposed law. The calculation is based on the current- and proposed-law-year databases described above and also on mathematical algorithms that reflect the structure of the individual income tax under current and proposed law. The analyst can adjust certain important elements of these algorithms (i.e., the exemption levels, tax brackets, and tax rates) using the input form (See Attachment 1). By modifying the underlying computer code, however, he/she may adjust the algorithms with a degree of flexibility that is constrained only by the level of disaggregation of the underlying data. The algorithms also make adjustments for obvious data-input errors and resolve certain internal inconsistencies in the data.[5]

The final function the model performs is to gross-up the sample calculations to the entire population to estimate the tax liability for the entire population of individual income taxpayers under current law and proposed law. Using these estimates, it then calculates the change in tax

[4] By clicking on the "Update" buttons, the model creates separate individual income tax return databases for current- and proposed-law years.

[5] In cases where the data are internally inconsistent, the algorithms give precedence to more disaggregate information and information that is carried from one table to another.

liability resulting from the proposed change in the law. It summarizes this information by income class in order to assess the effect of the change on the degree of progressivity of the tax system. It also summarizes this information by region of the country in order to assess whether the proposed change may have any redistributional effects across regions.

AN EXAMPLE

The Slovak Ministry of Finance considered a number of changes to the individual income tax law exemption amounts and tax brackets for 1997. In particular, it considered an increase in the personal exemption from Sk 21,000 to Sk 45,000, an increase in the per-child exemption from Sk 9,000 to Sk 12,960, and an elimination of specific exemptions for wage earners and spouses. It also considered widening the lowest tax bracket and increasing the threshold for the second, third, and fourth brackets. Under the proposal, the top two brackets would not change. The proposed changes were explicitly incorporated into the model through the input form (See Attachment 1). Assuming a 27.4 percent increase in the price level, an 18.6 percent increase in real per taxpayer GDP, and no change in the size of the taxpaying population between 1994 and 1997, the model generated the results that are presented in Attachment 2.

According to the model, the proposed changes would lead to a 6.9 percent decrease in income tax liability from Sk 35.5 billion to Sk 33.1 billion. This is not surprising, given the higher exemption amounts and the higher thresholds for the second, third, and fourth income tax brackets. What seems counter-intuitive, however, is that the changes appear to be regressive (i.e., that higher-income individuals would receive a greater proportion of the tax decrease than lower-income individuals). Indeed, the tax liability for the top 20 percent of taxpayers would decrease by Sk 1.5 billion at the same time that the tax liability would increase by Sk 41 million for the bottom 20 percent of taxpayers. The reason for this is that the vast majority of taxpayers are

concentrated in the lowest tax brackets (See Table 2). Indeed, since the top 20 percent of taxpayers for the most part reside in the top five (out of six) tax brackets, increasing the threshold for the second, third, and fourth brackets would reduce the effective tax rate on higher-income individuals.

Although the results of the model seem reasonable, and the exercise provides an interesting insight into the relationship between the tax rate structure and the income distribution, it is important to acknowledge that the model estimates may be less precise than one might hope. Indeed, while the model uses relatively current 1994 data to generate estimates for 1997, the Slovak economy underwent significant structural changes during the period, and it is therefore not clear how representative the 1994 data are for 1997. In addition, while the tax law changes described above may be significant enough to cause a behavioral response on the part of taxpayers, the model assumes that there is no behavioral effect. Finally, even though wages in the sample are calibrated to the national average, there is a substantial discrepancy between tax liability in the model and actual tax collections. This may be due, in part, to the fact that there is a time lag between when tax liabilities accrue and when the collections are realized. Perhaps more importantly, however, the model does not account for tax arrears, which one would expect to be relatively large during a period of economic transition and the early years of independence.

While the model estimates may not be as precise as one might hope, and the model may be more useful for analyzing more incremental tax law changes in periods of greater economic stability, it is important to consider the development of the model in another context. By making microsimulation modeling (and tax analysis) more transparent to those who are responsible for developing tax policy, the model provides a catalyst for the development of data gathering and tax analysis capacities within the Ministry of Finance. Indeed, the model generates information

that is relevant to the debate over proposed legislative changes, it enhances the role of the Ministry of Finance in that debate, and it therefore provides a justification for the expenditure of resources on improving the quality and scope of the data and the skill level of Ministry analysts. As the economy becomes more stable over time, and as the tax law changes become less structural, microsimulation models will become more relevant and more precise methods of analyzing proposed tax law changes.

It is important to note that the analytic capacity of the model can be expanded significantly by integrating other microdata into the underlying database. For example, by incorporating population survey data into the model, it may be possible to analyze proposals involving the expansion of the tax base to include those taxpayers who are not currently subject to tax. Similarly, by incorporating consumer finance survey data into the model, it may be possible to derive more precise estimates of the revenue and distributional consequences of capital income tax proposals. In addition, by incorporating consumer expenditure survey data into the model, it may be possible to analyze consumption (e.g., value-added) tax proposals. Since it is highly unlikely that there would be a one-to-one correspondence between records in the core sample of taxpayers and the supplementary samples described above, it will probably be necessary to statistically match actual records from the different samples or impute information based on estimated statistical relationships. It may also be necessary to adjust the matched or imputed data so that they are consistent with aggregate data for the population.[6]

[6] Good sources of information on statistical matching and imputation include Richard S. Barr and J. Scott Turner, "A New, Linear Programming Approach to Microdata File Merging," in *1978 Compendium of Tax Research* (Washington, D.C.: Office of Tax Analysis, 1978), pp. 131-155 and Joseph B. Kadane, "Some Statistical Problems in Merging Data Files," in *1978 Compendium of Tax Research* (Washington, D.C.: Office of Tax Analysis, 1978), pp. 159-179.

CAPACITY BUILDING

The ability of the Ministry of Finance to make valuable contributions over time to the debate over proposed tax policy changes depends critically on the existence of a staff which can run, maintain, and improve the models. It also depends critically on the availability of current, relevant, and accurate data. Since tax returns are the source of much of the data, it is necessary for the Ministry of Finance and the tax administration to cooperate in the production of those data. In Slovakia, there are two principal impediments to that cooperation. First, although the tax administration is organizationally part of the Ministry of Finance, and the head of the tax administration reports to the Minister of Finance, the organizations are quite independent, perhaps because of the physical distance of over 100 kilometers between them. Second, there is a statutory provision which prevents the 107 local tax offices from sharing taxpayer-level information with anyone, including the central and regional tax offices and the Ministry of Finance.

In order to encourage the tax administration to cooperate with the Ministry of Finance in producing data, the model highlights a number of important ways the tax administration may benefit from collecting and analyzing data from individual income tax returns. By identifying internal inconsistencies in the information reported on tax returns, for example, it may be possible to identify additional sources of tax revenue, increase voluntary compliance, and improve the quality of information from tax returns. Indeed, it would be quite easy to develop an algorithm which tested tax return data as they were input into the computer and which generated correspondence to taxpayers identifying errors and requesting more accurate information and payment. Such an algorithm would likely lead to increased revenue, more accurate data,[7] and an

[7] Systematic errors across tax returns might suggest areas where the clarity of the tax returns or instructions could be improved.

increase in voluntary compliance because taxpayers would come to understand that their tax returns are closely scrutinized.

Data from individual income tax returns can also be used to design an audit program which more precisely identifies non-compliant taxpayers and leads to increased revenue and compliance. The simplest approach would be to identify groups of taxpayers according to certain characteristics, estimate statistical norms for each group, and then assign priorities for audit on the basis of the extent to which each taxpayer deviates from the norm for his/her group. Alternatively, if additional data were available on audit results, it would be possible to measure the statistical correlation between the audit results and the information on the tax return in order to develop a model that would predict the result of an audit and therefore the audit priority for any given taxpayer.

If additional information were available on the officials who conducted the audits and the tax offices in which they worked, it would be possible to develop a management information system to monitor the performance of individuals relative to their colleagues and offices relative to other offices. Such a system would assist the tax administration in identifying and correcting performance problems. A similar system could be developed for other tax administration functions.

CONCLUSION

This paper has described the individual income tax microsimulation model developed for the Slovak Ministry of Finance by the U.S. Treasury Department's Office of Technical Assistance. The model provides the Ministry with the capacity to analyze the revenue and distributional effects of proposed individual income tax law changes. While the model is perhaps not as precise as one would have hoped, it did highlight the fact that the vast majority of taxpayers fall into the

lowest tax brackets, which, in turn, raises the question of whether the benefit of a graduated tax rate structure in terms of the progressivity of the tax system is worth the administrative cost. The model is quite transparent and clarifies the benefits of such methods of analysis to those in a position to expend resources on the development of data-gathering and tax analysis capacities to support the methods. It also represents a tool for educating analysts about the structure of microsimulation modeling and therefore establishes a foundation for the development of more sophisticated and flexible models. Finally, it highlights the dependence of the Ministry on the tax administration for accurate, relevant, and current data and emphasizes the importance of establishing institutional arrangements for the provision of such data.

Table 1

Population Size, Sample Size, and Weight by Sample Stratum

Stratum	Number of Returns		Weight
	Population	Sample	
Article 6 Income Only	26,931	9,683	
High Income (Top 20%)	5,386	5,386	1.0
Other Returns	21,545	4,297	5.0
Tax Base Reduction	17,214	7,578	
High Income (Top 20%)	3,443	3,443	1.0
Other Returns	13,771	4,135	3.3
All Other Returns	281,761	27,473	
High Income (Top 5%)	14,088	14,088	1.0
Other Returns	267,673	13,385	20.0
Simulated Sample	1,900,000	8,030	
High Income	296,604	3,864	76.8
Other Returns	1,603,396	4,166	384.9
Total	2,225,906	52,764	

Table 2

Summary Information on Individual Income Taxpayers in the Slovak Republic, 1994

Tax Bracket (Sk 000)	Number of Taxpayers	Percent	Gross Income (Sk Millions)	Percent	Taxable Income (Sk Millions)	Percent	Tax Liability (Sk Millions)	Percent	Effective Tax Rate
1,080 +	1,250	0.1%	3,223	2.0%	3,152	3.4%	1,186	7.0%	36.8%
540 - 1,080	2,857	0.1%	2,183	1.4%	2,081	2.2%	631	3.7%	28.9%
180 - 540	46,958	2.1%	12,435	7.8%	10,966	11.7%	2,465	14.6%	19.8%
120 - 180	106,013	4.8%	18,858	11.8%	15,372	16.4%	2,881	17.1%	15.3%
60 - 120	355,259	16.0%	41,153	25.9%	29,589	31.6%	4,839	28.7%	11.8%
0 - 60	1,713,582	77.0%	81,338	51.1%	32,454	34.7%	4,863	28.8%	6.0%
Total	2,225,919	100.0%	159,190	100.0%	93,613	100.0%	16,864	100.0%	10.6%

Table 3

Summary Information on Individual Income Taxpayers in the Slovak Republic By Type of Taxpayer, 1994

Tax Bracket (Sk 000)	Number of Taxpayers	Percent	Gross Income (Sk Millions)	Percent	Taxable Income (Sk Millions)	Percent	Tax Liability (Sk Millions)	Percent	Effective Tax Rate
1. Taxpayers Filing Returns With Only Paragraph 6 Income									
1,080 +	68	0.3%	127	5.4%	125	7.9%	44	14.7%	34.7%
540 – 1,080	175	0.6%	134	5.7%	129	8.1%	35	11.7%	26.3%
180 – 540	1,240	4.6%	403	17.2%	365	22.8%	75	25.0%	18.6%
120 – 180	1,296	4.8%	227	9.7%	188	11.8%	32	10.7%	14.2%
60 – 120	4,539	16.9%	512	21.8%	378	23.7%	55	18.4%	10.8%
0 – 60	19,613	72.8%	943	40.2%	413	25.8%	58	19.5%	6.2%
Total	26,931	100.0%	2,346	100.0%	1,598	100.0%	300	100.0%	12.8%
2. Taxpayers Filing Tax Base Reduction Returns									
1,080 +	134	0.8%	311	13.2%	304	16.5%	116	26.1%	37.3%
540 – 1,080	298	1.7%	226	9.6%	215	11.7%	67	15.0%	29.5%
180 – 540	1,832	10.6%	592	25.1%	532	28.9%	130	29.2%	22.0%
120 – 180	1,584	9.2%	280	11.9%	230	12.5%	43	9.7%	15.4%
60 – 120	3,919	22.8%	449	19.0%	333	18.1%	55	12.3%	12.2%
0 – 60	9,447	54.9%	500	21.2%	230	12.5%	35	7.8%	6.9%
Total	17,214	100.0%	2,357	100.0%	1,845	100.0%	445	100.0%	18.9%
3. All Other Taxpayers Filing Returns									
1,080 +	1,048	0.4%	2,785	11.6%	2,723	15.3%	1,026	25.2%	36.8%
540 – 1,080	2,384	0.8%	1,823	7.6%	1,737	9.7%	529	13.0%	29.0%
180 – 540	15,427	5.5%	4,831	20.1%	4,364	24.5%	1,049	25.7%	21.7%
120 – 180	15,032	5.3%	2,635	10.9%	2,201	12.4%	411	10.1%	15.6%
60 – 120	42,071	14.9%	4,731	19.6%	3,537	19.9%	575	14.1%	12.2%
0 – 60	205,799	73.0%	7,271	30.2%	3,258	18.3%	487	11.9%	6.7%
Total	281,761	100.0%	24,077	100.0%	17,820	100.0%	4,077	100.0%	16.9%
4. Simulated Returns for Wage Earners									
180 – 540	28,459	1.5%	6,609	5.1%	5,705	7.9%	1,211	10.1%	18.3%
120 – 180	88,101	4.6%	15,716	12.1%	12,753	17.6%	2,395	19.9%	15.2%
60 – 120	304,731	16.0%	35,461	27.2%	25,340	35.0%	4,154	34.5%	11.7%
0 – 60	1,478,723	77.8%	72,623	55.7%	28,553	39.5%	4,283	35.6%	5.9%
Total	1,900,013	100.0%	130,410	100.0%	72,350	100.0%	12,043	100.0%	9.2%

Table 4

Summary Information on Individual Income Taxpayers in the Slovak Republic By Geographic Region, 1994

Tax Bracket (Sk 000)	Number of Taxpayers	Percent	Gross Income (Sk Millions)	Percent	Taxable Income (Sk Millions)	Percent	Tax Liability (Sk Millions)	Percent	Effective Tax Rate
Bratislava	336,351	15.1%	32,275	20.3%	22,575	24.1%	4,367	25.9%	13.5%
Nitra	319,991	14.4%	20,039	12.6%	11,059	11.8%	1,920	11.4%	9.6%
Trnava	323,384	14.5%	22,801	14.3%	13,268	14.2%	2,407	14.3%	10.6%
Banska Bystrica	296,022	13.3%	19,481	12.2%	10,943	11.7%	1,907	11.3%	9.8%
Zilina	366,144	16.4%	24,926	15.7%	13,741	14.7%	2,384	14.1%	9.6%
Kosice	308,079	13.8%	22,269	14.0%	12,864	13.7%	2,295	13.6%	10.3%
Presov	275,948	12.4%	17,398	10.9%	9,163	9.8%	1,585	9.4%	9.1%
Total	2,225,919	100.0%	159,190	100.0%	93,613	100.0%	16,864	100.0%	10.6%

Attachment 1

Microsimulation Model of the Slovak Individual Income Tax

Assumptions

	1994	Current Law	Proposed Law
Price Level	1,000	1,274	1,274
Real Per Taxpayer GDP	1,000	1,186	1,186
No. of Para. 6 Only Filers	26,931	26,931	26,931
No. of Tax Base Red'n Filers	17,214	17,214	17,214
No. of All Other Filers	281,761	281,761	281,761
No. of Wage Earners	1,900,000	1,900,000	1,900,000
		Update	Update

Exemptions

	1994	Current Law	Proposed Law
Taxpayer	21,000	21,000	45,000
Wage Earners	3,600	3,600	0
Child	9,000	9,000	12,960
Spouse	12,000	12,000	0
Partial Disability	6,000	6,000	6,000
Full Disability	12,000	12,000	12,000
Extreme Disability	36,000	36,000	36,000

Tax Brackets and Rates

Current Law		
From	To	Tax Rate
0	60,000	15%
60,000	120,000	20%
120,000	180,000	25%
180,000	540,000	32%
540,000	1,080,000	40%
1,080,000	and over	42%

Proposed Law		
From	To	Tax Rate
0	90,000	15%
90,000	144,000	20%
144,000	192,000	25%
192,000	540,000	32%
540,000	1,080,000	40%
1,080,000	and over	42%

Analyze

Attachment 2

Microsimulation Model of the Slovak Inidividual Income Tax

	Current Law					Proposed Law					Change	
	Number of Taxpayers	Taxable Base (Line 1) Sk Millions	Tax Liability (Line 19) Sk Millions	Percent Distribution of Tax Liability	Effective Tax Rate	Number of Taxpayers	Taxable Base (Line 1) Sk Millions	Tax Liability (Line 19) Sk Millions	Percent Distribution of Tax Liability	Effective Tax Rate	Tax Liability (Line 19) Sk Millions	Percent Distribution of Tax Liability
Total												
	2, 225, 906	221,795	35,521	100.0	16.0	2,225,906	233,734	33,067	100.0	14.1	-2,454	100.0
By Income Quintile												
Top	445,352	99,959	20,335	57.2	20.3	445,352	101,212	18,833	57.0	18.6	-1,502	61.2
Second	445,058	53,296	7,528	21.2	14.1	445,058	53,907	6,734	20.4	12.5	-794	32.4
Middle	445,458	38,026	4,472	12.6	11.8	445,458	38,837	4,231	12.8	10.9	-241	9.8
Fourth	445,228	23,307	2,186	6.2	9.4	445,228	25,048	2,228	6.7	8.9	42	-1.7
Bottom	444,810	7,208	999	2.8	13.9	444,810	14,731	1,041	3.1	7.1	41	-1.7
By Region												
Bratislava	330,910	43,119	7,956	22.4	18.5	330,910	45,928	7,628	23.1	16.6	-328	13.4
Nitra	321,787	27,781	4,250	12.0	15.3	321,787	29,944	3,930	11.9	13.1	-320	13.0
Trnava	322,672	31,337	5,001	14.1	16.0	322,672	33,225	4,629	14.0	13.9	-372	15.1
B. Bystrica	297,096	27,500	4,239	11.9	15.4	297,096	28,895	3,911	11.8	13.5	-328	13.4
Zilina	366,258	35,239	5,251	14.8	14.9	366,258	36,527	4,836	14.6	13.2	-415	16.9
Kosice	309,181	31,646	5,076	14.3	16.0	309,181	33,089	4,705	14.2	14.2	-371	15.1
Presov	278,001	25,173	3,748	10.6	14.9	278,001	26,127	3,428	10.4	13.1	-320	13.0

REFERENCES

Barr, Richard S. and J. Scott Turner, "A New, Linear Programming Approach to Microdata File Merging," in *1978 Compendium of Tax Research* (Washington, D.C.: Office of Tax Analysis, 1978), pp. 131-155.

Bristol, Ralph B., Jr., "Tax Modelling and the Policy Environment of the 1990's," Multi-National Tax Modelling Symposium Proceedings, September 17-19, 1985, pp. II-11-17.

Cilke, James, *The Treasury Individual Income Tax Simulation Model*, Office of Tax Analysis, April 1994.

_____ and Roy A. Wyscarver, "The Treasury Individual Income Tax Simulation Model," in *Compendium of Tax Research 1987* (Washington, D.C.: Office of Tax Analysis, 1987), pp. 43-75.

Kadane, Joseph B., "Some Statistical Problems in Merging Data Files," in *1978 Compendium of Tax Research* (Washington, D.C.: Office of Tax Analysis, 1978), pp. 159-179.

National Research Council, *Improving Information for Social Policy Decisions*: *The Uses of Microsimulation Modeling, Review and Recommendations* (Washington, D.C.: National Academy Press, 1991).

_____, *Improving Information for Social Policy Decisions*: *The Uses of Microsimulation Modeling, Technical Papers* (Washington, D.C.: National Academy Press, 1991).

Nunns, James R., "Tabulations from the Treasury Tax Reform Data Base," in *Compendium of Tax Research 1987* (Washington, D.C.: Office of Tax Analysis, 1987), pp. 101-129.

Trautman, William B. and Jonathan F. Kuniholm, "Developing Statistical Tools for Tax Policy and Tax Administration in Slovakia," in *Turning Administrative Systems into Information Systems* (Washington, D.C.: Statistics of Income Division, IRS, 1995), pp. 115-123.