

**International Studies Program
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Designing Income Taxes, Payroll
Taxes, and “Simplified” Taxes in
Ukraine**

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How Should Individuals Be Taxed? Designing Income Taxes, Payroll Taxes, and “Simplified” Taxes in Ukraine¹

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I. INTRODUCTION

Individuals in most all countries face a wide range of direct taxes on their income, especially variants of the individual income tax (IIT) and payroll taxes. For the IIT, attempts are often made to reduce the compliance and administrative costs of the tax (among other reasons) by using “presumptive” or “simplified” methods in which the tax liability is determined indirectly from some simple indicators that are more easily measured than the “true” tax base itself.

However, the ways in which these different methods of taxing individuals *interact*, their *combined* effects on revenues, resource allocation, and income distribution, and the appropriate design of a *system* of such direct taxes on individuals remain unresolved issues. This paper examines these issues, focusing on the experience of Ukraine.

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² All results and interpretations are those of the authors.

II. TAXATION IN UKRAINE

A. An Overview of Ukraine Tax System

It is helpful to start with a brief overview of taxation in Ukraine. The level of Ukraine consolidated government tax collections from all sources, including payroll taxes, income taxes, and other sources, is given in Table 1 for the years 1999 to 2005. Table 2 shows the Ukraine tax structure, or specific tax collections as a percent of total consolidated government tax collections. These tables indicate a fairly sustained increase in overall revenues, both in levels and as a percent of GDP. They also indicate that the increased revenues have been driven largely by increases in income tax and payroll tax collections, or more broadly by an increase in the tax burden on labor.

Table 1. Ukraine Tax Collections, 1999-2005

	1999	2000	2001	2002	2003	2004	2005 ^a
In Hrv millions							
Total Revenue	40,191	56,425	67,832	80,714	96,000	120,940	119,198
Tax Revenue	39,443	47,755	56,969	68,427	81,720	100,821	103,476
Individual Income Tax	4,434	6,378	8,775	10,824	13,521	13,213	12,080
Enterprise Profit Tax	6,352	7,698	8,280	9,398	13,237	16,162	15,517
Payroll Taxes	10,349	11,530	14,781	17,932	21,195	29,042	27,134
Property Tax	1,090	1,376	1,619	1,806	2,032	2,293	1,988
VAT	8,409	9,441	10,348	13,471	12,598	14,808	24,664
Gross Collections	n.a.	n.a.	14,228	19,335	22,919	28,701	332,254
Refunds	n.a.	n.a.	3,879	5,864	10,321	13,894	8,590
Other Taxes on Goods and Services	3,074	5,072	7,453	8,805	10,966	14,961	12,875
Taxes on International Trade	1,238	1,561	1,945	2,366	3,795	5,067	5,034
Other Taxes	4,494	4,697	3,769	3,824	4,376	5,276	4,183
Non-tax Revenue	749	8,671	10,863	12,287	14,280	20,119	15,722
As Percent of GDP							
Total Revenue	30.8	33.2	33.2	35.7	35.9	35.0	41.0
Tax Revenue	30.2	28.1	27.9	30.3	30.6	29.1	35.6
Individual Income Tax	3.4	3.8	4.3	4.8	5.1	3.8	4.2
Enterprise Profit Tax	4.9	4.5	4.1	4.2	5.0	4.7	5.3
Payroll Taxes	7.9	6.8	7.2	7.9	7.9	8.4	9.3
Property Tax	0.8	0.8	0.8	0.8	0.8	0.7	0.7
VAT	6.4	5.6	5.1	6.0	4.7	4.3	8.5
Gross Collections	n.a.	n.a.	7.0	8.6	8.6	8.3	11.4
Refunds	n.a.	n.a.	1.9	2.6	3.9	4.0	3.0
Other Taxes on Goods and Services	2.4	3.0	3.6	3.9	4.1	4.3	4.4
Taxes on International Trade	0.9	0.9	1.0	1.0	1.4	1.5	1.7
Other Taxes	3.4	2.8	1.8	1.7	1.6	1.5	1.4
Non-tax Revenue	0.6	5.1	5.3	5.4	5.3	5.8	5.4

^a For 2005, all amounts are for January to September (including GDP).

Source: Ukraine Ministry of Finance.

Table 2. Ukraine Tax Structure, 1999-2005 (as Percent of Total Tax Collections)

	1999	2000	2001	2002	2003	2004	2005 ^a	Average 1999-2004
Consumption Taxes	41.4	40.3	36.9	37.4	34.2	34.8	41.5	36.7
Value Added Tax	21.3	19.8	18.2	19.7	15.4	14.7	23.8	17.5
Excise Taxes	4.5	4.7	4.7	6.0	6.4	6.6	5.6	5.7
Other Taxes ²	15.6	15.8	14.1	11.7	12.3	13.4	12.0	13.5
Labor Taxes	37.5	37.5	41.3	42.0	42.5	41.9	37.9	41.1
Income Taxes	11.2	13.4	15.4	15.8	16.5	13.1	11.7	14.8
Payroll Taxes	26.2	24.1	25.9	26.2	25.9	28.8	26.2	26.2
Capital Taxes	21.1	22.2	21.7	20.6	23.4	23.3	20.6	22.2
Profit Tax	16.1	16.1	14.5	13.7	16.2	16.0	15.0	15.3
Export Taxes	0.0	0.0	0.0	0.0	0.4	0.7	0.4	0.2
Resource Extraction Taxes	0.8	1.2	1.8	1.6	1.6	1.7	2.2	1.6
Property Taxes	2.8	2.9	2.8	2.6	2.5	2.3	1.9	2.6
Other	1.4	2.0	2.6	2.6	2.6	2.6	1.2	2.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

^a For 2005, all amounts are for January to September (including GDP).

Source: Ukraine Ministry of Finance.

For some basis of comparison, Table 3 shows the tax structure for a wide selection of countries for the year 2000. (The results for Ukraine are included, and are somewhat different than the results in Table 2 due to the ways in which taxes are classified in Table 3.) Ukraine tends to rely more heavily on income (individual and corporate) taxes and on payroll taxes than most other countries; indirect taxes for Ukraine are also slightly higher than the international average of countries in Table 3, due largely to the use in Table 3 there of a separate category for taxes on international trade.

Table 3. Ukraine Tax Structure in International Perspective (as Percent of Total Taxes)

Country	Income and Payroll Taxes	Property Taxes	Indirect Taxes	Taxes on International Trade	Other Taxes
Argentina	26.3	8.4	35.0	3.8	0.1
Bahrain	36.3	3.8	16.1	43.8	0.0
Belarus	27.1	3.2	62.3	4.9	0.0
Bhutan	53.4	0.4	42.6	3.6	0.0
Bolivia	10.9	10.5	65.1	6.2	0.1
Bulgaria	31.6	1.5	61.2	3.8	1.8
Canada	57.0	11.7	27.3	0.8	0.0
Chile	22.8	4.1	61.3	7.6	4.2
Congo, Dem. Rep.	12.6	0.0	23.8	24.7	38.8 ^a
Congo, Republic	11.3	0.0	64.5	22.9	1.4

Costa Rica	22.4	0.5	68.7	8.4	0.0
Cote d'Ivoire	29.1	1.7	23.3	45.4	0.5
Croatia	22.1	1.8	66.4	8.7	1.0
Czech Republic	40.1	2.4	53.9	3.1	0.4
Denmark	60.8	3.6	34.6	0.0	1.0
Dominican Republic	20.5	1.1	28.5	48.5	1.4
Estonia	39.2	2.2	58.4	0.2	0.0
Georgia	25.9	9.4	54.6	6.1	0.0
Hungary	36.1	2.6	55.6	4.0	1.7
India	37.3	0.1	37.3	25.1	0.2
Iran Islamic Republic	53.0	2.5	19.9	23.3	1.3
Israel	53.2	7.7	37.3	0.9	0.7
Jamaica	41.9	0.6	40.5	8.9	8.1
Kazakhstan	52.7	6.0	36.3	4.1	0.7
Latvia	36.9	4.9	56.6	1.6	0.0
Lithuania	40.5	2.7	55.3	1.5	0.0
Macao, China	8.9	6.5	82.1	0.0	2.5
Madagascar	15.7	1.0	29.1	53.5	0.6
Maldives	4.6	0.0	29.7	64.4	1.3
Mauritius	14.6	5.8	46.2	33.4	0.1
Mexico	32.6	1.7	59.6	3.9	0.7
Moldova	17.5	6.1	68.9	7.5	0.1
Mongolia	28.4	0.1	56.2	10.1	1.3
Myanmar	34.5	0.0	58.2	7.2	0.0
Nepal	22.4	3.4	41.6	32.6	0.0
Nicaragua	17.1	0.2	73.6	9.4	0.0
Pakistan	28.1	1.2	44.7	16.0	10.1 ^b
Paraguay	17.9	0.0	59.4	18.2	4.4
Peru	26.8	0.0	67.0	12.4	3.2
Poland	35.5	5.2	55.9	3.5	0.0
Puerto Rico	66.8	0	22.0	0	11.2
Romania	34.5	2.7	54.8	6.2	1.1
Russian Federation	33.2	4.5	44.4	13.0	0.1
Seychelles	26.7	0.1	7.8	63.1	2.3
Singapore	50.2	6.5	31.2	2.5	9.6
Slovak Republic	35.9	2.8	54.3	7.0	0.0
Slovenia	36.3	2.5	57.6	3.6	0.0
South Africa	54.0	5.8	34.8	3.1	0.7
Switzerland	58.1	12.3	28.6	1.1	0.0
Tajikistan	16.0	5.6	63.8	12.6	0.0
Thailand	32.2	2.3	53.1	11.9	0.5
Tunisia	28.5	1.9	51.8	15.5	2.2
Turkey	37.4	4.0	52.1	1.7	4.7
Ukraine	42.3	0.0	52.4	5.3	0.0
United States	66.4	13.2	19.5	1.0	0.0
Uruguay	26.2	9.3	57.1	4.7	3.1
Venezuela	42.5	5.5	39.7	11.4	0.9
Mean	32.6	3.6	47.5	13.4	2.0

Sources: International Monetary Fund, *Government Finance Statistics* (2003). Data are for 2000, and exclude social security taxes.

^a Some direct taxes are classified as "other".

^b This includes surcharges on natural gas and petroleum.

B. Payroll Taxation

Ukraine has four separate social insurance programs, each of which has its own separate set of contribution rates and collection machinery. These programs are unemployment insurance, temporary disability insurance, pension insurance, and industrial accident insurance. The tax rates in these four programs are given in Table 4, where the Hrv amounts refer to monthly income.

Table 4. Tax Rates in Social Insurance Programs (as Percent of Employee Wage Income)

Payer of Contributions	Unemployment Insurance	Temporary Disability Insurance	Pension Insurance	Industrial Accident Insurance^a	Total
Employer	1.3	2.9	31.8	1.5	37.5
Employee	0.5	•0.5 for wages up to MSL ^b •1.0 for wages above MSL	•1.0 for wages up to Hrv 150 •2.0 for wages over Hrv 150	□□□□	•2.0 for wages up to Hrv 150 •3.0 for wages over Hrv 150 up to MSL •3.5 for wages above MSL
Total	1.8	•3.4 for wages up to MSL •3.9 for wages above MSL	•33.3 for wages up to Hrv 150 •34.3 for wages over Hrv 150	1.73	•39.5 for wages up to Hrv 150 •40.5 for wages over Hrv 150 up to MSL •41.0 for wages above MSL

^a This represents the average rate of contribution. Actual tax rates range from 0.66 to 13.6 percent, depending on occupational risk.

^b MSL is the “Minimum Subsistence Level”, equal to Hrv 332 from 1 January 2005.

Source: “Mandatory State Social Insurance and Pensions in 2004”, Ministry of Labor and Social Policy of Ukraine/Pension Fund of Ukraine (Kyiv, Ukraine: Ukraine Pension Reform Implementation Project, 2005).

Note that these social insurance contributions are charged only on the first Hrv 4,100 of employment income per month, a ceiling that is set in the annual budget law. In total, the combined tax rate for all programs often exceeds 40 percent and can be as large as 50.6 percent (depending on the risk of industrial accident), the vast bulk of which is the employer’s share. Government officials estimate that the average payroll tax rate for all programs is 38.7 percent.

To put these levels of tax rates into perspective, Table 5 shows the social insurance contribution rates for OECD countries. This table suggests that the payroll tax rates in Ukraine are

comparable to, if somewhat higher than, the levels in OECD countries. In particular, the levels of tax rates for the employer's share of the programs are significantly higher in Ukraine than the employer's share in most other countries. These burdens are largely felt by workers in the formal, or legal, sector of the economy who are subject to employer tax withholding on their wages.

The widespread international use of payroll-based programs of social insurance reflects several considerations. First, a tax (or contribution) on wages has traditionally been seen as a way of financing social insurance programs, going back to Germany in the late 1800s. Second, given the earmarking characteristics of most payroll contribution programs, these programs can provide a clear link between the payment of contributions on wages while working and the receipt of benefits from pensions when retired; however, this linkage is quite weak, if largely nonexistent, in Ukraine, for reasons discussed in more detail below. Third, a contribution base of wages is a readily identified base, which makes administration of a broad-based payroll program relatively straightforward and which allows the government to shift the cost of collection to employers via employer withholding. Fourth, there is substantial evidence, at least from developed countries, that the distorting effects of payroll programs – on labor supply, on savings, on compensation choice, and so on – are often much lower than comparable taxes on other bases. Finally, the programs can be used to ensure that all individuals have a minimally adequate pension upon retirement (e.g., the goal of “social adequacy”) by redistribution from higher-income contributors to lower-income contributors. Of course, these considerations apply mainly to the use of “contributions” based upon payroll, where a “contribution” entitles the individual to some form of benefit whose magnitude is based at least in part on the amount paid by the individual. These considerations do not apply as readily to the use of “taxes” (e.g., a compulsory payment that does not entitle an individual to any benefit) on payrolls. Taxes on payrolls seem motivated largely because such taxes can readily collect large amounts of revenues at low cost to government. International practices largely reflect these considerations. (One might also distinguish in this context an “earmarked tax”, which does

not entitle an individual to benefits linked to individual payments but whose revenues go to a dedicated, or “earmarked”, fund.)

These payments finance a wide range of benefits, although the link between individual contributions and individual benefits in Ukraine is very weak. For example, unemployment insurance finances unemployment benefits to unemployed individuals and their dependents, benefits to unemployed individuals who participate in job training programs, funeral benefits that are paid to survivors in the event of the death of an unemployed individual; payments also finance various job training programs and job placement services. Temporary disability insurance funds benefits for maternity, child birth, child care, and funeral (excluding those for pensioners, the unemployed, or survivors) benefits, in addition to temporary disability benefits. Industrial accident insurance finances a wide range of benefits intended to ameliorate the effects of industrial accidents and occupational diseases, which lead to income losses due to health problems. The main component of the Ukraine social insurance system is pension insurance, which covers all non-working age retirees, invalids, and survivors. These individuals receive pension payments, supplements, compensatory payments, and various additional pension benefits.

Table 5. Tax Rates from Payroll Taxes and Social Security Contributions in OECD Countries

Country	Total Tax Rate (A) = (B)+(C)	Payroll Tax Rate (Other than SSC) (B)	Total Social Security Contribution (SSC) Rates (C) = (D)+(E)	Social Security Charges to Employers (D)	Social Security Charges to Employees (E)
Australia	Up to 7%	Up to 7%	0%	0%	0%
Austria	29.15% – 29.3%	7.5%	21.65% – 21.8%	21.65% – 21.8%	NA
Belgium	32.89% – 48.66%	0%	32.89% – 48.66%	32.89% – 48.66%	NA
Canada	% Rate Varies	1% – 4.5%	% Rate Varies	% Rate Varies	NA
Denmark	0%	0%	0%	0%	0%
Finland	26.4% – 28.4%	0%	26.4% – 28.4%	20.1% – 22.1%	6.3%
France	42.25% – 64.63%	4.25% – 13.60%	38% – 51.03%	38% – 51.03%	NA
Germany	40.8%	0%	40.8%	20.4%	20.4%
Greece	43.86% – 54.36%	0%	43.86% – 54.36%	27.96% – 34.96%	15.90% – 19.40%
Ireland	18%	0%	18%	12%	6%
Italy	36% – 42%	0%	36% – 42%	32% – 36%	4% – 6%
Mexico	42.92% – 44.92%	6% – 8%	36.92%	30.19%	6.73%
Netherlands	25.31%	0%	25.31%	18.66%	6.65%
Norway	26.6%	0%	26.6%	26.6%	NA
Portugal	23.75%	0%	23.75%	23.75%	0%
Spain	37.15% – 37.2%	0%	37.15% – 37.2%	30.8%	6.35% – 6.4%
Sweden	81.34%	48.52%	32.82%	32.82%	0%
Switzerland	13.1%	0%	13.1%	6.55%	6.55%
Turkey	55.5% – 61%	0%	55.5% – 61%	32.5% – 38%	23%
United Kingdom	0% – 23.6%	0%	0% – 23.6%	0% – 11.8%	0% – 11.8%
United States	15.3%	0%	15.3%	7.65%	7.65%

Source: *International Bureau of Fiscal Documentation*, various issues. All contributions are computed as a percentage of the employee's salary.

According to the Ministry of Labor and Social Policy of Ukraine/Pension Fund of Ukraine, the entire social insurance system in 2004 covered 22.8 million insured individuals, including 13.5 million pensioners, with payments of Hrv 46.6 billion (or 13.5 percent of GDP). Projected payments for 2005 are significantly greater, at 71.2 billion (or 16.4 percent of GDP). The largest single component (projected for 2005) is pension insurance at Hrv 61.1 billion; temporary disability insurance is projected at Hrv 5.2 billion (for over 6 million recipients) followed by unemployment insurance (Hrv 2.8 billion and 3 million recipients) and industrial accident insurance (Hrv 2.1 billion and 300,000 recipients).

These payroll taxes are all imposed on largely the same base (e.g., payrolls). However, each program has its own tax rates, each program taxes payrolls in similar but slightly different ways, each is administered by a separate agency, and so each has its own system of registration, enforcement, and remittances. Even aside from any concerns about the relatively large tax burden on labor in the formal sector of the Ukraine economy, the separate administrative machineries are wasteful and duplicative. Many of the same functions are performed by the respective government agencies that administer the separate programs, but there seems to be very little coordination across these agencies.

As for a separate comparison of the relative importance of payroll taxes in overall revenue structures, Table 6 shows the percent of payroll taxes both in total tax revenues and in GDP for OECD countries for the fiscal years 2001 or 2002.

Table 6. Revenues from Payroll Taxes and Social Security Contributions in OECD Countries

Country	Payroll Taxes and Social Security Contributions	
	As Percent of Central Government Total Tax Revenues	As Percent of GDP
Australia	6.2	1.4
Austria	38.7	12.3
Belgium	31.3	10.1
Canada	16.9	5.8
Denmark	4.9	1.9
Finland	26.8	9.0
France	38.5	12.7

Germany	40.5	10.0
Greece	28.4	9.4
Ireland	14.8	3.9
Italy	29.2	10.8
Japan	36.8	7.3
Netherlands	35.9	10.8
New Zealand	0.8	0.2
Norway	20.5	8.7
Portugal	25.7	6.9
Spain	33.6	10.1
Sweden	34.1	13.5
Switzerland	34.5	8.6
United Kingdom	17.0	6.8
United States	23.3	7.4

Source: International Monetary Fund, *Government Finance Statistics*, various issues.

C. The Individual Income Tax and the Simplified Tax System

Like nearly all countries, Ukraine imposes an individual income tax (IIT). Also like many countries, Ukraine attempts to simplify the compliance burden on some specific types of taxpayers by the use of a “Simplified Tax System” (STS). The use of a STS for some taxpayers is broadly consistent with the use of presumptive methods of income taxation for these taxpayers, in which “...the ‘desired’ base for taxation (direct or indirect) is not itself measured but is instead inferred from some simple indicators that are more easily measured than the base itself” (Ahmed and Stern 1991). Presumptive methods are used for a variety of reasons: to reduce the compliance costs on taxpayers by making it easier for these taxpayers to compute their tax liabilities, to simplify tax administration by removing some taxpayers (usually those with small tax liabilities) from the tax rolls and be providing more obvious and more direct measures of tax liabilities, to improve tax equity by providing more objective indicators of tax assessment, to reduce corruption by eliminating official discretion in assessing tax liabilities, to encourage taxpayers to keep better accounts in order to provide documentation that may reduce their presumptive tax liabilities, and to improve incentive effects when, say, income above the presumptive level is not subject to taxation.

Individual Income Taxation

Individuals in Ukraine are in principle subject to an individual income tax whose base is their worldwide (or global) income. Income subject to the tax is broadly defined, and includes such standard items as wages and salaries, income from the sale of property, rental income, dividends, interest, royalties, investment income, inheritance, and gifts; benefits in kind are in principle included as well. State pensions, state insurance payments, and state subsidies are legally exempt. Against this taxable income base individuals are allowed various deductions, such as charitable donations, educational expenses, medical expenses, and life and insurance premia; there are also allowances for low income individuals, single mothers, widows and widowers, war veterans, the disabled, and victims of the Chernobyl accident. On this base Ukraine now imposes a flat rate tax rate of 13 percent; previously, there was a progressive rate structure with rates ranging from 10 to 40 percent. Most income tax revenues are collected by employer withholding. According to the Ministry of Finance, there are about 20 million taxpayers, although only about 2 million actually file a tax return because only individuals whose taxable income exceeds some threshold established annually by the government are required to file a return.

Individual income tax systems can be broadly classified into three main types (Goode 1984). A *global* income tax combines incomes from all sources into a single aggregate measure of income, adjusts this aggregate measure for such items as personal exemptions and deductions, and then applies a single rate or a graduated rate structure to determine the tax liability. In a *schedular* income tax, each of the main sources of income is subject to a separate tax; the tax rates across these different income flows can differ, but are not imposed at graduated rates, and personal exemptions and deductions are typically not allowed. There can also be *mixed* systems, which combine elements of both global and schedular income taxes. Ukraine uses a global income tax.

Global systems tend to be found now mainly in developed countries, although in several countries – France and Belgium – global systems have emerged only since the 1950s. The

individual income tax systems in developing countries are often driven mainly by colonial history. Global systems tend to be found in former British colonies (e.g., Jamaica), while schedular systems are more common in Francophone Africa and some Latin American countries.

The advantages often claimed for a global system are that a global tax is thought to be most closely in line with the Ability-to-Pay Principle of equity in taxation; that is, a global tax is better able to achieve equity in the distribution of its tax burdens because it is imposed on a comprehensive definition of income that reflects individual circumstances via deductions and exemptions. Further, a global tax on something close to comprehensive income is seen as a more neutral tax because a broad-based income tax reduces the incentives for income-shifting activities, thereby reducing the efficiency costs of the tax. Finally, a global income tax imposed on a broad-based definition of income has greater revenue potential than one imposed on a narrower base. A schedular tax is often justified more on the basis of lower administrative costs on the tax agency and also lower compliance costs on taxpayers. Withholding at source at the main types of income flows – wages and salaries, interest, dividends, rents, and so on – largely eliminates the necessity of individual returns. This administrative advantage comes at the expense of equity and efficiency considerations.³

Table 7 provides some information on the overall level of income taxation in OECD countries and in a selected sample of developing (and transition) countries for two recent subperiods, 1988–1990 and 1998–2000. As shown there, the overall level of income tax burden, expressed as a share of GDP, is roughly double in the OECD countries than in the developing countries in both subperiods. There is also a tendency for the overall level of taxation to rise over time, but this tendency is small for both groups of countries. This evidence is consistent with the notion that higher levels of economic development are associated with higher levels of taxation (Tanzi 1987; Burgess and Stern 1993).

³ For further discussion of global versus schedular income tax systems, see Plasschaert (1980). For more general discussions of the administrative dimension of taxation, see Goode (1981) and Bird and Casangera de Jantscher (1992).

The individual income tax is of considerably more importance in tax revenues in developed than in developing countries. For OECD countries, the tax averages less than 1/3 of total revenues; for developing countries the fraction is closer to 1/9. More generally, taxes on consumption (e.g., 2 added taxes, sales and excise taxes, taxes on trade) are of much greater relative importance in developing than in developed countries, while taxes on income are more important in the developed world. Even so, the individual income tax has tended to decline in relative importance in OECD countries, at the same time that it has increased slightly in importance for developing countries. Table 8 gives similar information on the share of the individual income tax in total tax revenues for a sample of countries.

Table 7. The Importance of the Individual Income Tax in Tax Revenues (as Percent of GDP)

	1988-1990		1998-2000	
	Total Taxes	Individual Income Taxes	Total Taxes	Individual Income Taxes
OECD Countries	36.8	11.4	38.1	10.9
America	30.9	11.4	32.8	12.6
Pacific	30.8	13.4	31.9	11.7
Europe	38.6	11.5	40.1	11.0
Developing Countries	17.7	1.9	18.4	2.5
Africa (10)	19.4	3.1	20.0	4.0
Asia (10)	16.2	2.0	17.7	2.9
Middle East (8)	16.8	1.2	18.1	1.5

Source: Computed by authors from various issues of International Monetary Fund, *Government Finance Statistics*.

Table 8. Individual Income Taxes in International Perspective

	Individual Income Tax as Percent of Total Taxes
	17.1
Bhutan	11.3
Bulgaria	19.1
Canada	42.7
Congo, Democratic Republic of	8.2
Congo, Republic of	11.3
Costa Rica	1.5
Cote d'Ivoire	13.7
Croatia	16.7
Czech Republic	22.7

Denmark	51.0
Dominican Republic	12.4
Estonia	34.7
Georgia	15.0
Hungary	27.2
India	17.8
Iran, Islamic Republic	19.3
Israel	35.0
Jamaica	19.4
Kazakhstan	11.5
Latvia	28.8
Lithuania	37.2
Macao, China	3.5
Madagascar	5.2
Mauritius	7.4
Myanmar	34.5
Nepal	5.6
Pakistan	4.2
Peru	13.6
Poland	22.2
Puerto Rico	37.9
Romania	20.4
Russian Federation	10.7
Seychelles	0.0
Slovak Republic	16.9
Slovenia	16.1
South Africa	36.4
Switzerland	46.1
Tajikistan	10.9
Thailand	12.0
Tunisia	18.3
Turkey	24.7
Ukraine	17.8
United States	55.3
Uruguay	11.1
Venezuela	1.6
Mean	19.3

Sources: Computed by authors from International Monetary Fund, *Government Finance Statistics*. Data are for 2000, and exclude social security taxes.

In the United States (as in most developed countries), the individual income tax is a major source of revenues for the central government. The tax in the U.S. is imposed on income aggregated over all sources of income (e.g., a global income tax), with the family as the unit of taxation. The vast bulk of the income tax revenues in the U.S. is collected from employer withholding at source on wages. This observation may be somewhat surprising. Even though the U.S. is widely seen as having the most effective tax administration in the world, as recently as the 1980s well over 90 percent of all income tax collections came from source withholding. This

percentage has declined somewhat in the last decade, and has sometimes fallen to roughly 80 percent of individual income tax revenues. Nevertheless, it remains the case that most individual income tax revenues in the U.S. arise from employer withholding on wage and salary income.

Simplified Tax System

Some types of individuals, mainly “entrepreneurs”, may opt to be taxed under a Simplified Tax System, rather than under the individual income tax. The STS was established by Presidential Decree in 1998, and became fully in effect in 2000.

There are different procedures for individuals and for (small) businesses. For example, the *eligibility requirements* for the STS are:

- Individual entrepreneurs (or physical persons) subject to the individual income tax may elect to be taxed under the STS if their “turnover” does not exceed Hrv 500,000 and they do not have more than 10 employees, or if their turnover does not exceed Hrv 119,000 and they do not have more than 5 employees.
- Businesses (or legal entities) may elect to be taxed under the STS if their turnover does not exceed Hrv 1,000,000 and they do not have more than 50 employees. They are also required to keep regular accounts and records.

The *structural features* of the tax also differ for physical persons and for legal entities:

- Physical persons in the STS are taxed at rates that differ by activity and that are established by local councils (and so that may differ across jurisdictions), within the range of Hrv 20 – 200 per month.
- Legal entities in the STS are exempt from the company and the individual income tax and also from the various payroll taxes. If the taxpayer elects to register for the value-added tax (and so pays the VAT), then the legal entity is taxed under the STS at a 6 percent rate on turnover; if the taxpayer elects not to register for the VAT, then the taxpayer is taxed under the STS at a 10 percent rate on turnover.

Recall that the tax rate in the (regular) individual income tax is 13 percent; the tax rate in the company tax is 25 percent. Even aside from the impact of STS election on other taxes, it is immediately apparent that there is a strong incentive to elect to be taxed under the STS. See Table 9 for a summary of the STS.

Table 9. Taxonomy of the Simplified Tax System in Ukraine

Options	Subject of Taxation	Eligibility Criteria	Base	Tax Rate
Unified Tax	Legal entities (firms)	Annual gross (last 12 months) turnover does not exceed UAH 1,000,000; firm does not have more than 50 employees.	Gross Turnover	6%; but not exempt from VAT.
				10%; exempt from VAT.
	Physical persons or “individual entrepreneurs” (individuals)	Annual gross turnover (last 12 months) does not exceed UAH 500,000; entrepreneur does not have more than 10 employees.	Gross Turnover	6%; but not exempt from VAT
				10%; exempt from VAT
Fixed Tax	Physical persons (individuals)	Annual turnover (last 12 months) does not exceed UAH 119,000; do not have more than 5 employees.	□□□□□□□□	Patents vary from UAH 20□200 per month.
Other (Trade patents, fees and permits)	Levied on legal entities and individuals.	Small firms as assessed by local governments (LG)	□□□□□□□□	Various amounts (assessed by LG)

The number of individuals and business opting for the STS has increased dramatically in the last several years. Tables 10 and 11 give some information on the numbers of physical persons and legal entities in the STS, and their tax payments for selected years from 2000 to 2005; see also Figure 1. Note that there are also two other simplified tax systems. Some small traders are eligible to use a “patent”, if their annual gross revenues from entrepreneurial activities does not exceed Hrv 1 million in the 12 months preceding the granting of the patent; this is denoted the “Special Trade Patent” in Table 10. There is also a simplified system for some agricultural activities if sales do not exceed 50 percent of gross revenues; this is denoted the “Fixed Tax” in Table 10.

Table 10. Taxpayers and Tax Payments in the STS

	2002	2003	2004	2005 ^a
Legal Entities				
Number of taxpayers (in thousands)	115.6	133.2	133.2	129.0
Revenues (in Hrv millions)	844.6	1173.4	1362.3	503.5
Physical Persons				
Number of taxpayers (in thousands)	427.0	540.0	602.4	653.4
Revenues (in Hrv millions)	660.0	901.0	1078.0	908.7
Special Trade Patent				
Number of Patents	360,000	382,000	371,000	377,159
Revenues (in Hrv millions)	260.0	246.0	245.0	191.0
Fixed Tax				
Number of taxpayers	210.2	220.6	225.6	229.4
Revenues (in Hrv millions)	322.9	366.4	512.4	497.7

^a Data are for through 1 July 2005.

Source: Ukraine Ministry of Finance.

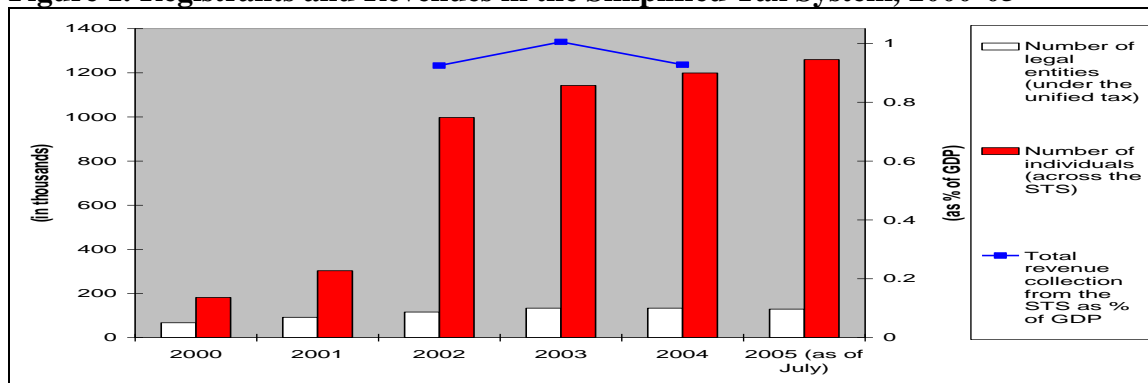
Table 11. Taxpayers and Tax Payments of Physical Persons in the STS

Annual Receipts (in Hrv)	2000	2001	2002	2003	2004	2005 ^a
From 0 to 2,400	88,077	146,351	173,765	162,227	148,541	188,230
From 2,400 to 7,200	26,797	39,950	56,421	72,355	73,369	82,157
From 7,200 to 55,000	44,512	73,356	113,767	163,902	188,158	199,482
From 55,000 to 100,000	8,681	15,472	26,292	41,043	52,297	57,047
From 100,000 to 200,000	7,593	14,065	25,035	40,458	53,046	55,305
From 200,000 to 300,000	2,918	6,110	11,853	20,294	28,227	15,769
From 300,000 to 400,000	1,664	3,524	7,736	13,974	20,456	4,436
From 400,000 to 500,000	1,710	3,707	10,895	23,446	34,506	3,447
Over 500,000	605	741	1,089	2,251	3,800	813
Total	182,557	303,276	426,853	539,950	602,400	606,686

^a Data are for the first 6 months of 2005.

Source: Ukraine Ministry of Finance.

Figure 1. Registrants and Revenues in the Simplified Tax System, 2000-05



Sources: Ukraine State Tax Service and World Bank staff calculators.

Despite the predominance of global income tax systems in developed countries, the U.S. General Accounting Office (1996) provides evidence that thirty-four countries employ variants on simplified income tax systems in which individuals are not required to file end-of-year returns.⁴ Such “no-return” or “final withholding” tax systems vary significantly, but many share some common characteristics. Most all countries use employer withholding on wages and salaries. Also, taxes on interest, dividend, and capital gains incomes are exempt or limited; in many cases interest and dividend income is taxed at a flat rate, with the tax withheld by the financial institution or the company, and even realized capital gains income is often completely exempt. Finally, the unit of taxation in such systems is the individual, so that a spouse who elects final withholding must file as an individual rather than jointly. Put differently, there is much evidence of individual income tax systems that have important schedular components, with the individual as the unit of taxation.

The use of no-return system is motivated in large part by the desire to simplify tax compliance for individual taxpayers. In a related vein, many countries also have introduced some form of simplified or presumptive tax systems for selected agents and activities, typically small businesses and individual entrepreneurs. Some selected country practices are indicated in Table 12,

⁴ According to the General Accounting Office (1996), the countries include: Argentina, Austria, Chile, Colombia, Costa Rica, the Czech Republic, the Dominican Republic, Ecuador, Egypt, Germany, Hungary, Indonesia, Iran, Ireland, Japan, Kenya, the Republic of Korea, Luxembourg, Malawi, Mexico, Morocco, the Netherlands, Nigeria, Panama, Papua New Guinea, Peru, Poland, Romania, the Russian Federation, South Africa, Tanzania, Turkey, Uganda, and the United Kingdom.

which focuses on transition countries and which is not intended to be an exhaustive list of country practices. In addition to a reduction in compliance costs, the introduction of these systems is also driven in part by the desire to create a favorable environment for small-scale activities. Such simplified systems are not limited to transition or developing countries, as suggested by the countries included in Table 12. As noted by Bird and Wallace (2004), there are four general approaches in dealing with hard-to-tax taxpayers, of which introducing a presumptive tax system (including a STS and/or an alternative minimum tax) is only one strategy. Other strategies include greater use of indirect taxation (in the hope that even the hard-to-tax will pay indirect taxes), greater enforcement efforts (in an attempt to reduce the extent of these activities), and legalization of the hard-to-tax activities (in an apparent realization that taxing these activities is simply too difficult).

Issues in Ukraine Individual Income Tax and Simplified Tax System

Incentives. Given the much lower burden of taxation in the STS relative to the regular tax system, there is a very large incentive for individuals and businesses to elect to participate in the STS. For example, consider an individual with a turnover at the threshold of Hrv 119,000. If this represents the annual taxable income, then this individual would pay a regular income tax (at a tax rate of 13 percent) of Hrv 15,470; the maximum tax burden under the STS is Hrv 200 per month, or Hrv 2400. For an individual at the Hrv 500,000 threshold, the incentive to elect the STS is even greater (or Hrv 65,000 versus Hrv 2400).

Of course, one goal of the STS is to reduce the burden on small taxpayers. However, this means that the compliance cost of taxes should be reduced and not necessarily that the overall tax burden must be reduced. Indeed, the overall tax burden under the two alternative regimes should be broadly similar, in order to avoid creating artificial incentives to enter the STS purely to avoid paying one's taxes.

Table 12. Simplified Tax Systems Around the World

Country	Type of System	Comments/Description
Albania	Lumpsum tax or gross turnover tax	A fixed tax for small businesses whose annual turnover is less than 2 million Lek; a 4% gross turnover tax for small business whose gross turnover is 2-8 million Lek
Angola	Lumpsum tax	For small business whose annual turnover is less than 22,000
Armenia	Lumpsum tax	For small-scale activities (e.g., hairdressers, gas stations, commercial fishing, and trading activities conducted in trading areas less than 30 square meters)
Azerbaijan	Gross turnover tax	A 2% gross turnover tax when turnover is less than 300 times the minimum tax-exempt wage
Belarus	Lumpsum tax	For stores that are single owned and that have total trading space less than 25 square meters
Belgium	Flat rate tax	A forfeit scheme that applies for 3 years to small businesses based on profession for income below BF 10,000
Bolivia	Gross turnover tax	For small businesses in two sectors
Bulgaria	Lumpsum tax	For individuals in specific business sectors with an annual turnover less than 75,000 BGN
Cameroon	Lumpsum tax	For small businesses in all industries with gross turnover less than 20,000
Croatia	Lumpsum tax	
Czech Republic	Lumpsum tax	
Georgia	Lumpsum tax	For enterprises with turnover less than GEL 24,000
Ghana	Lumpsum tax	For small businesses and all self-employed, a presumptive tax based on occupation or business activity
Greece	Flat rate tax	Applied to purchases and receipts
Hungary	Lumpsum tax	Small entrepreneurs may choose an itemized presumptive tax in place of the individual income tax and the value-added tax
Israel	Flat rate tax	For retail firms and artisans whose gross turnover is less than 4000
Kazakhstan	Lumpsum tax or gross income tax	A special regime based on a simplified tax return for individuals with no more than 15 employees and T 4.5 million gross income, or for legal persons with no more than 25 employees and T 9 million gross income
Kosovo	Lumpsum tax	For any taxpayer other than an insurance company with gross receipts less than 15,000 DEM
Kyrgyzstan	Gross turnover tax	A 5-10% gross turnover tax for small businesses with total revenue less than 3 millions soms, in lieu of all national taxes; a 4% monthly gross turnover tax for individual entrepreneurs
Lithuania	Presumptive tax	Optional for firms with gross income less than 100,000 LTL
Macedonia	Lumpsum tax	

Mexico	Tachiv	For small businesses and professionals, with no threshold
Moldova	Lumpsum tax	A monthly fee for some individual entrepreneurs
Morocco	Gross turnover tax	A flat rate tax for small business in the service sector
Poland	Lumpsum tax	
Romania	Gross income tax	For small enterprises with no more than 10 employees and Euro 100,000 annual turnover
Russian Federation	Uniform (unified) tax	A uniform 15% imputed income tax for entrepreneurs and companies in selected industries (e.g., retail trade, public catering, car maintenance, transportation services, personal and veterinarian services) A single 6% gross turnover tax, or a 15% gross turnover less expenses tax, for entrepreneurs and companies with no more than 100 employees and 11 million RUR turnover; both taxes replace the profits tax, the individual income tax, the property tax, the sales tax, and a single social security tax, exempt firms and entrepreneurs from the value-added tax, and provide a tax credit for pension contributions
Serbia	Gross turnover tax; lumpsum tax	A 2% tax on gross receipts for enterprises with no more than 50 employees, 8,000 average monthly gross wages, and average value of assets no more than 6,000 average monthly gross wages; a lumpsum tax for entrepreneurs
Slovak Republic	Lumpsum tax	
Spain	Forfait scheme for 28 enterprises; flat rate tax for other small businesses	Imposed on sales less limited expenses
Uganda	Flat rate tax	A flat rate tax on turnover for small businesses with annual turnover less than (approximately) US\$38,000
Uruguay	Flat rate tax	A flat rate tax on turnover, for small businesses and professionals
Uzbekistan	Gross turnover tax; lumpsum tax	A 3-5% tax (depending on location) on turnover, for wholesale trade firms, and a 7-10% tax (depending on location) on turnover, for public catering firms; a lumpsum tax for individual entrepreneurs with no legal entity

Sources: Engleschalk (2004) and Bird and Wallace (2004). See also the other papers in Alm, Martinez-Vazquez, and Schneider (2004).

Aside from the strong incentive to opt for the STS (whether legally justified or not), the STS further distorts incentives facing taxpayers in several significant ways. First, individuals and firms at the threshold have an incentive to fragment their operations in order to meet the requirements. Such purely tax-driven fragmentation is economically efficient.

Second, there is a major “notch” problem facing taxpayers. Consider a legal entity with turnover of exactly Hrv 1 million or exactly 50 employees. An increase of 1 unit in either turnover or employees would generate an enormous increase in tax liability, as the taxpayer must legally move into the regular tax system, thereby paying the regular income tax as well as the value-added tax and all of the payroll taxes. These disincentives for growth in turnover or in employment are also economically inefficient.

One feature of the STS that may have some positive incentive effects is the lumpsum aspect of the tax on physical persons. Individuals face a fixed payment that ranges from Hrv 20 – 200 per month. This tax burden does not change with the level of economic activity, so that it does not create any disincentive for individuals to expand their activities.

Thresholds. Like most presumptive tax systems, the Ukraine STS has thresholds based upon turnover and upon employee size. Only individuals and legal entities that do not exceed these thresholds are eligible for STS status.

The establishment of appropriate levels for these thresholds is a crucial design feature. A threshold that is set too high will undermine the regular tax system because too many agents will opt for the reduced rate of taxation in the STS; a threshold that is set too low will fail to achieve the goal of simplification for many small taxpayers, thereby imposing compliance costs on many for whom the intent was to make their tax calculations much less burdensome.

In Ukraine, it is widely believed by government officials that the thresholds have in fact been set far too high. For example, recall that for individuals (or physical persons) the number of employees can be as high as 10 (if their turnover does not exceed Hrv 500,000) or as high as 5 (if

their turnover does not exceed Hrv 119,000; legal entities may have as many as 50 employees (if their turnover does not exceed Hrv 1,000,000). The turnover limits are also quite high, especially the Hrv 500,000 threshold for individuals, an amount roughly 20 times the average wage level of Hrv 25,000 in Ukraine. These are extremely high thresholds, especially for legal entities, and likely include viable and ongoing enterprises that are fully capable of being taxed under the regular tax regimes. There is little question that many entrepreneurs and, especially, legal entities are in the STS even though they likely keep detailed financial records and are fully capable of paying the regular income tax.

A related issue is that there is no apparent mechanism by which taxpayers “graduate” to the regular tax system, except when they exceed the thresholds. In many countries, there is a limit on the number of years that a taxpayer can participate in a STS, even taxpayers that meet the formal eligibility requirements. However, there do not seem to be such graduation provisions in Ukraine.

Finally, any threshold must be revised periodically in light of changed economic circumstances (e.g., inflation, economic growth). However, the Ukraine thresholds have apparently not been adjusted since their enactment.

Complexity. Despite its name, the simplified tax system is in fact fairly complex, given the wide range of options that are presented to entrepreneurs and businesses. Recall that there are four components to the STS: the tax on physical persons, the tax on legal entities, the special trade patent, and the agriculture (of fixed) tax. Recall also that the tax on individuals is set by local councils, and varies by occupation and by location. Recall finally that legal entities that elect to register for the value-added tax face the standard compliance burdens associated with the VAT. Such complexity defeats the main purpose of any STS: to reduce the compliance costs on small scale taxpayers.

Income Tax Collections. It is not possible to determine whether income tax revenues actually collected under the STS represent additional revenues (e.g., revenues that would not have

been collected in the absence of the STS) or revenues that merely displace income taxes that would have been collected under the regular income tax regime. If the existence of the STS leads agents who would otherwise participate in the shadow economy (and so who would otherwise have not paid any income taxes) to opt for the STS, then their tax payments represent new, additional income tax revenues. Indeed, this possibility is one of the arguments in favor of a simplified system. However, if agents merely switch from the regular to the simplified tax system, then total income tax collections decline, even though revenues for the STS will be positive. It is not possible to know which of these effects is more important, although it seems more likely that the net impact of the STS on income tax revenues is negative.

Relation to Other Taxes. Even so, the impact of the STS on the revenues of other taxes is almost certainly negative. As noted earlier, legal entities under the STS are not liable for any of the payroll taxes, so that the STS has a significant negative impact on payroll tax collections. If legal entities opt not to register for the value-added tax – as most all firms choose to do – then VAT revenues will also be negatively affected by the STS. Even aside from this latter revenue impact, firms that opt out of the value-added tax break the chain of transactions in the VAT, thereby destroying for many enterprises the paper trail of invoices that is central to VAT enforcement.

Legal Eligibility for the STS and its Enforcement. As noted earlier, there are significant incentives for taxpayers to elect the STS rather than the regular tax system, even if they do not meet the legal qualifications. However, according to government officials, there is no verification that those taxpayers who elect to be taxed under the STS are in fact legally eligible for such participation. This suggests that the enormous increase in the number of STS participants has been generated by the illegal migration of taxpayers to the lower cost tax system. Government officials believe that perhaps as many as 50 percent of all participants (individuals and firms) are fraudulently in the STS.

There are also apparently legal, though largely artificial, methods by which individuals can become eligible for STS participation. These tax avoidance schemes involve individuals changing their status from an “employee” (who is subject to income tax withholding by the employer) to an individual entrepreneur (who is taxed at the far lower rates under the STS). Relatedly, a business may pay fees for services to an individual who may be an employee of the firm but who changes his or status so as to register under the STS.

Fairness. There is little doubt that the STS contributes to horizontal and vertical inequities in the tax system. Individuals and firms with equal “true” income are taxed very differently if one is subject to the regular tax system and the other is in the STS. Similarly, a high income individual in the STS may pay significantly lower taxes than someone with a much lower “true” income if the latter individual faces the full force of the regular income tax system. Employees subject to income tax withholding by their employer seem particularly likely to be treated unfairly relative to those in the STS because wage earners have little recourse other than to pay the regular individual income tax.

III. SOME EFFECTS OF THE “SYSTEM” OF LABOR TAXES

The interaction of the individual income tax, the payroll taxes, and the simplified tax system has significant effects on incentives and, through these incentive effects, on a wide range of economic variables. To examine fully these economic effects requires a general equilibrium model, and even a simple general equilibrium model can generate a wide range of results. For example, consider a highly stylized economy in which there are three sectors, a sector in which labor (as well as capital) is subject to the full rates of payroll and income taxes, a sector that is for the most part legally exempt from taxation due either to explicit exemption from taxation or to the low effective rates of taxation under a STS, and a sector that is legally subject to full taxation but that illegally escapes all taxes because activities there are hard to tax (e.g., the shadow economy or an informal

sector). If labor is mobile between these three sectors, then the imposition of payroll and income taxes in the taxed sector will cause labor to respond by moving to the untaxed sectors. This movement will affect the wage of labor, the return to other factors of production, and the prices of consumer products. It will also influence the allocative effects of the taxes and the revenues that are collected.

To be more precise, let a stylized economy be divided into three sectors: a fully taxed sector that produces output (denoted X), a sector (Y) that is legally exempt from (most) taxation, and a sector (Z) that is legally subject to taxation but that illegally escapes taxation; for simplicity, assume that sector Y is legally exempt from all taxes. Demand for each output is a function of relative prices, and all agents (including government) are assumed for simplicity to have the same average and marginal propensity to consume each commodity. Each good is produced under competitive conditions with a linearly homogeneous production function that depends upon the amount of capital (K) and labor (L). Capital and labor are assumed to be fixed in supply to the entire economy; they are also assumed to be perfectly mobile among the three sectors. Because of perfect mobility, net factor returns must be equalized across sectors, where factor returns are assumed to be adjusted for the presence of any risk premia that may exist in the untaxed sectors. Since capital and labor in sectors Y and Z are assumed to be untaxed due either to legal avoidance or illegal evasion, there are only two taxes: a tax on capital (T_K) and a tax on labor (T_L) in the taxed sector X ; the only other tax that might be imposed is a tax on consumption of \square , a tax that is equivalent to an equal-rate tax on capital and labor in \square . As discussed above, the taxation of labor (and capital) in only some of its uses creates an incentive for resources to flow from the taxed sector (X) to the untaxed sectors (Y and Z).

The full set of equations for this stylized economy is in Appendix A. These equations can be calibrated with data that capture the main characteristics of the Ukraine economy, and its numerical solution can then be used to examine the economic impacts of changes in tax rates. It is

this simple general equilibrium model that forms the basis for much of the following analysis of the economic effects of the income, payroll, and simplified taxes.

Tax Base Erosion. It is widely suspected that the existence and structure of the income and payroll taxes (in combination with the STS) gives both an incentive and an opportunity for individuals to escape the payment of taxes. There are several avenues that are available to individuals. One avenue is to move from the formal sector to the untaxed informal sector of the Ukraine economy.⁵ Another avenue is outright evasion of the legally due tax liability; indeed, there is a widespread perception that compliance with the income and payroll taxes, especially by the self-employed, is very low. Still another, and legal, method of avoidance is for individuals to elect to be taxed under the STS. As discussed earlier, taxpayers who elect to be taxed under the STS are not required to pay the social insurance taxes.

Measuring the extent of this erosion via avoidance and evasion, and the associated revenue loss, is obviously quite difficult. There is little if any systematic information for Ukraine by which this notion can be tested. Ukraine government officials have suggested that the revenue loss due to evasion of the payroll programs themselves may be at least one-half of the actual collections from the programs, but this seems largely a guess, even if an informed one; officials make a similar estimate for the loss of IIT revenues. Econometric estimates of the revenue loss from evasion of all tax sources suggests that the revenue loss from both income and payroll taxation may be slightly more than one-third of potential revenues, an estimate that is still quite large but that is somewhat less than that suggested by Ukraine officials (Alm, Martinez-Vazquez, and Schneider 2004).

These massive amounts of legal and illegal erosion compromise many dimensions of the fiscal system of Ukraine. Most obviously, base erosion leads to a loss in revenues, thereby affecting taxes that compliant taxpayers face and public services that citizens receive. Erosion creates misallocations in resource use when individuals and firms alter their behavior to evade or

⁵ See Bird (1992) for an analysis of the impact of labor taxes on employment in the formal and informal sectors.

avoid their taxes and contributions. Its presence requires that government expend resources to deter noncompliance, to detect its magnitude, and to penalize its practitioners, even though these government enforcement activities seem infrequent and ineffective in Ukraine. Erosion alters the vertical and horizontal equity of taxation in unpredictable ways. Individuals with the same “true” level of income may pay very different amounts in taxes if some avoid/evade and others do not; individuals with different levels of “true” income may pay similar amounts of taxes even though their abilities to pay may differ greatly; and unless tax evaders are caught, evaders pay fewer taxes than honest taxpayers. Tax base erosion may contribute to feelings of unfair treatment and disrespect for the law, creating a self-generating cycle that feeds upon itself and leads to even more evasion. All of these results represent costs to the fiscal system of Ukraine.

Tax Incidence. In their entirety, the income and payroll taxes generate substantial revenues. Because these revenues must ultimately be paid by someone, they have a significant impact on the distribution of income. This subsection analyzes the “incidence”, or the distributional effects, of the taxes, and attempts to answer the basic question: “Who bears the burden of the taxes?” It should be emphasized that it is only the incidence of taxes that is considered. Any payroll benefits that may be received by individuals are ignored, in large part because of the absence of information on benefits.

Economists have devoted much attention to the question of tax incidence.⁶ Although there is wide agreement about the incidence of some taxes, such as excise or individual income taxes, the incidence of other taxes remains controversial. So who bears the burden of income and payroll taxes?

There are two main issues here. The first is whether the incidence of a tax depends upon where it is imposed, whether on the employer or the employee, an issue that is relevant to the current discussion in Ukraine about whether to reduce the (high) employer share of the total payroll

⁶ For example, see Kotlikoff and Summers (1987) and Fullerton and Metcalf (2002).

tax rate and to increase the (low) employee tax rate. It is widely accepted in economics that in competitive markets the incidence of a tax does not depend upon where the tax is statutorily levied; that is, a tax collected from an employer has the same economic effects as the same rate tax collected from an employee. However, when markets are not competitive, this equivalence may fail.

The second issue is the incidence of the combined employee plus employer tax. The dominant school of thought asserts that labor bears the full burden of income and payroll taxes, so that its net-of-tax income falls by the full amount of the taxes. Another school holds that labor is able to shift at least some of the tax elsewhere. If the imposition of the taxes causes workers as a group to reduce the supply of labor, then the gross-of-tax wage will rise, and this increase in the gross-of-tax wage will in turn shift some of the burden of the taxes elsewhere: to employers in the form of a higher cost of labor than would exist in the absence of the taxes, to consumers in the form of higher product prices, to capital in the form of reduced rates of return on capital, or to other input suppliers in the form of lower input prices.⁷

The crucial variable on payroll tax incidence is the degree of responsiveness of labor to a change in its wage, or its elasticity of labor supply. If labor is fixed in supply to the taxable sector – or if its supply elasticity is zero – then labor will be unable to avoid bearing the full burden of the programs. Conversely, the more responsive is labor to a wage change, the more will the tax burden be shifted elsewhere.

Much, though not all, of the empirical work in developed countries concludes that labor supply is almost completely inelastic, so the standard conclusion in nearly all applied incidence studies is that labor bears the full burden of any payroll tax. However, estimates of the labor supply

⁷ For example, suppose that an average worker has annual wages of Hrv 100,000. If there is a tax of, say, 20 percent and if workers bear the full burden of the tax, then the average worker's net-of-tax wage income falls to Hrv 80,000. However, suppose that the presence of the 20 percent tax causes workers to reduce their supply of labor to the taxed sector, perhaps by working fewer hours in total or by working fewer hours in the taxed sector and more in the untaxed, informal sector. If the average wage rises to, say, Hrv 110,000, then labor has been able to shift part of the 20 percent tax to employers via a higher gross-of-tax wage; employers may in turn shift some of their burden to consumers via higher product prices or to other input suppliers via lower input prices.

elasticity in transition and developing countries suggest that labor supply is not completely inelastic.⁸ One possible channel of labor supply response is migration. Of greater importance in Ukraine is the fact that only labor in certain sectors of the economy is taxed: labor can largely escape the burden by moving to the untaxed or uncovered sectors, such as the informal sector or the self-employed sector. An important avenue of escape here is electing to be taxed under the tax system, since taxpayers in the STS do not have to pay the payroll taxes. These avenues of escape suggest that labor may be able to shift some of the payroll burden to other groups, even though the precise magnitude of the shifting is unknown.

Note that this discussion relates only to the incidence of the tax component of the payroll programs. If a program has benefits that are equal to the amount of taxes paid, then the individual essentially “breaks even” on the program. In the absence of any actuarial studies of these programs, and, especially, in the absence of a close linkage between contributions and benefits, it is not possible to evaluate their actuarial fairness. Anecdotal evidence suggests that it is highly unlikely that benefits equal contributions because the linkage between taxes and benefits is not present.

The general equilibrium model can be used to examine the incidence of the taxes. Various numerical simulations of the model indicate that an increase in the tax rate on labor is shifted in part to capital (given that the taxed sector is assumed to be capital intensive) and in part to consumers of the taxed product (given that the labor tax increases the relative price of the taxed good). Even so, the main burden of any tax on labor is borne largely by labor in the form of a lower net-of-tax wage, which likely makes the overall burden of taxation regressive.

Allocative Effects. The income and payroll taxes also affect the efficiency of resource use, or the excess burden of taxation. Measuring the excess burden requires knowledge of the responses of resources to the various taxes. This information can be generated from the general equilibrium

⁸ For example, see Kugler and Kugler (2001) for the case of Colombia, Gruber (1997) for Chile, Angrist (1996) for Palestinian labor, and Marrufo (2001) for Mexico.

model. To illustrate, consider the tax on labor (L_X) in sector X , or T_L . In the absence of the tax, factor mobility will assure that the equilibrium price of labor will be the same in all sectors. In the presence of the tax, however, labor will move from sector X until the gross-of-tax price of labor in X exceeds the price of labor in Y and in Z by the amount of the tax. Labor thus moves from higher productivity uses in the formal sector to lower valued uses in the other two sectors. The excess burden of this single tax on labor in sector X is measured by the usual welfare “triangle” of $(-1/2 T_L \Delta L_X)$. When there are also taxes on capital in X (or K_X), the combined excess burden becomes $(-1/2 T_K \Delta K_X - 1/2 T_L \Delta L_X)$. Here, ΔK_X and ΔL_X represent the changes in factors that result from both taxes simultaneously.

Estimation of the excess burden therefore requires knowledge of these total factor responses. Assuming that the relevant derivatives are constant, it is straightforward to show that the excess burden EB is measured by:

$$EB = -1/2 T_K [(\partial K_X / \partial T_K) T_K + (\partial K_X / \partial T_L) T_L] - 1/2 T_L [(\partial L_X / \partial T_K) T_K + (\partial L_X / \partial T_L) T_L],$$

where, for example, $\partial L_X / \partial T_L$ is the partial derivative of L_X with respect to T_L . These partial derivatives allow for all general equilibrium adjustments in production and in demand, and so may be viewed as “reduced form” coefficients that show the equilibrium responses of capital and labor in the taxed sector to changes in the taxes. As in the case of the incidence of the payroll taxes, the solution of the system of equations allows these partial derivatives to be calculated directly, as functions of the amounts and the shares of capital and labor in the three sectors, the taxes on the factors in the taxed sector, and the various elasticities of demand and of substitution.

In all cases, the existence of a hard-to-tax sector (e.g., the informal sector Z), in combination with a legally untaxed sector (e.g., sector Y , due to the STS), generates a large excess burden, somewhere between 11 and 27 percent of taxes and between 3 and 7 percent of formal sector output. These estimates are especially sensitive to the compensated elasticity of demand for the

taxed good. They are also somewhat sensitive to the various elasticities of substitution in production. It should also be remembered that there are many other sources of inefficiencies.

Sectoral, Occupational, and Employment Effects. Closely related to the incidence and the allocative effects of the income and payroll taxes are their sectoral, occupational, and employment effects. The assumption that it is mainly workers in the formal sector of the Ukraine economy who bear the burden of the taxes does not allow for any shifting of the burden of taxes via adjustments in wages and other prices. As noted earlier, the existence of sectors to which resources may move to avoid the taxes means that these taxes drive a wedge between the returns to factors of production in the different sectors. If labor is mobile, then labor will respond to an increased tax in the formal sector by moving between the sectors until the net-of-tax return across the three sectors is equalized. This movement will affect the wages of labor in the three sectors, raising wages in the formal sector as labor flows from this sector and reducing wages in other two sectors as labor moves into these sectors. There will also be an impact on the returns to other factors and on product prices, as well as an impact on the overall unemployment rate in the economy.

Fully identifying these impacts requires a more detailed general equilibrium model of the economy than the one outlined earlier, one that allows for unemployment and that distinguishes labor types. However, there is some related work for other countries. For example, Alm and Lopez-Castano (2005) use a general equilibrium model of Colombia, in which the economy is divided into four sectors (farming, urban/informal, urban/unskilled, and urban/skilled) and which is calibrated with data from the 1999 social accounting matrix for Colombia. They find that the high rates of labor taxation lead to an overall increase in the number of unemployed workers, but also to an increase in employment in the informal sector. They also find that maintaining the level of expenditures of the programs financed by the taxes but changing the method of their finance to alternative revenues sources (e.g., deficit finance, company taxation) increases overall employment and formal sector employment.

The Revenue Effects of Payroll Rate Reductions. Of central issue in current discussions of Ukraine payroll programs is the potential effect of payroll tax rate reductions on tax revenues. There are several ways of examining this issue. The simplest approach makes use of a simple accounting identity, in which tax revenues R are equal to the product of the tax rate t , the number of individuals subject to the payroll taxes $N(t)$, and the value of the associated wage base $W(t)$:

$$R = t \cdot N(t) \cdot W(t).$$

Both $N(t)$ and $W(t)$ are assumed to be functions of (among other things) the tax rate, to reflect the likelihood that changes in the tax rate affect the payroll tax base. The proportional change in revenues is then simply

$$\Delta R/R = \Delta t/t + \Delta N/N + \Delta W/W,$$

so that the proportional change in revenues equals the sum of the proportional changes in the individual components. Recognizing that the number of individuals and the value of the wage base each depends upon the tax rate, the proportional change in revenues can also be written as

$$\Delta R/R = \Delta t/t (1 + \varepsilon_{N,t} + \varepsilon_{W,t}),$$

where $\varepsilon_{N,t}$ is the elasticity of the number of taxpayers with respect to the duty rate and $\varepsilon_{W,t}$ is the elasticity of the wage base with respect to the rate. Both elasticities will be negative in value because a reduction in tax rates will increase both N and W .

Now suppose that the payroll tax rates are reduced by, say, 50 percent. In the absence of any change in the tax base, payroll tax revenues would fall, also by 50 percent. However, conversations with numerous government officials suggest that both $N(t)$ and $W(t)$ will respond to the rate reductions. For example, if each variable increased by, say, 25 percent (or an elasticity in each case of $\square/2$), then overall revenues would be unchanged by the rate reduction. If the elasticities are greater than $\square/2$ (in absolute value), then revenues would actually increase. More generally, if the sum of the two elasticities exceeds \square , then a rate reduction would increase tax revenues.

The relevant issue then becomes the magnitude of the elasticities. There is no information on these elasticities. However, evidence for other types of responses in other countries suggests that elasticities in excess of 1/2 are extremely unlikely.

A slightly more complicated framework generates the same conclusion. Suppose that the equilibrium level of some tax base (e.g., the wages of workers subject to the labor taxes) depends upon the supply and the demand of this tax base. Then it is straightforward to show that the tax rate that maximizes the tax revenues collected from this tax base is:

$$t_{RMaximum} = (\varepsilon_S - \varepsilon_D) / (\varepsilon_D (1 - \varepsilon_S))$$

where $t_{RMaximum}$ is the revenue-maximizing tax rate, ε_S is the elasticity of supply of the tax base, and ε_D is the elasticity of demand, where both elasticities are assumed to be constant, and where $\varepsilon_S \geq 0$ and $\varepsilon_D \leq 0$. Again, the crucial issue for the impact of any tax rate reduction is the magnitude of the elasticities. It is only when the elasticity of demand for the tax base exceeds 1 (in absolute value) that there is any chance that a reduction in tax rates will increase revenues.

The general equilibrium model discussed earlier also gives the same conclusion. For reasonable values of the various elasticities, values that approximate estimates derived from empirical work on these behavioral responses, it is never the case that a decrease in the tax rate on labor increases tax revenues. The typical result is that a reduction in the labor tax rate generates some increase labor in the taxed sector, but that this increase in labor (and the corresponding increase in labor tax revenues) is not nearly sufficient to offset the loss in revenues from the rate reduction. Indeed, for plausible values of the parameters, a reduction of, say, 10 percent in the labor tax rate reduces tax revenues in most scenarios by 5 to 9 percent. It is only when these elasticities (especially the elasticities of substitution between labor and capital in the various sectors and elasticities of demand) are extraordinarily high – and in excess of most elasticities estimated from empirical work – that revenue simulations give the result that a reduction in the labor tax rate increases labor tax revenues. Recall also that the stylized model assumes that labor (as well as

capital) is perfectly mobile across the taxed sector, the legally untaxed sector, and the evasion sector. When factor mobility becomes less than perfect, the possibility that a reduction in the tax rate increases tax revenues becomes even less likely.

The results from many other general equilibrium analyses generate similar conclusions. For example, Fullerton (1982) constructs a general equilibrium model of the United States economy calibrated for 1973 data, with 19 producer types, 15 consumption products, and 12 consumer groups. He finds that a reduction in the tax rate increases tax revenues only when the elasticity of supply of labor exceeds roughly 2.0. Upper bounds from empirical studies of labor supply usually place the labor supply elasticity in the range 0.1 to 0.3; in this range, Fullerton (1982) finds that tax revenues always increase with an increase in the tax rate.

In a similar analysis for Colombia, Alm and Lopez-Castano (2005) utilize a general equilibrium model of the Colombian economy. They assume that the payroll taxes do not have a direct impact on either the informal sector (29 percent of the labor force in 1999) or the farming sector (22 percent of the labor force); rather the taxes affect only non-farming wage earners (skilled and unskilled), or the remaining 49 percent of the Colombian labor force. They examine several scenarios, including one in which there is an increase of 2 percentage points in the payroll tax rate, and one in which there is the abolition of several of the payroll tax programs (of 9 percentage points in total) with revenue reductions financed by an increase in the fiscal deficit. They find that payroll tax rate reductions can increase employment by relatively large amounts, but that in instances do the rate reductions come close to paying for themselves.

IV. CONCLUSIONS: PROBLEMS AND REFORM OPTIONS

The current system of payroll taxes in Ukraine has some severe weaknesses:

- The tax rates of the payroll-based programs are somewhat high by international standards, especially the share of the total tax rate borne (statutorily) by the employer.

- There is much in the separate administration of the programs that is wasteful and duplicative. Many of the same functions are performed by the respective government agencies or ministries that administer the programs, but there seems to be virtually no coordination among these institutions.
- From the perspective of employers, there is also much that is costly and cumbersome to comply with in the payment of the taxes and contributions, due to the complexity of the separate programs, the duplicative nature of their administrations, and the burden on employers to collect nearly all revenues via employer source withholding.
- The programs create economic distortions, as individuals adjust their behavior to avoid or evade paying the taxes and contributions. An especially significant inefficiency arises from the intersectoral distortion.
- The bases of the programs have been substantially reduced by evasion. This has led to large, but largely unknown, revenue losses, perhaps as much as one-third to one-half of the revenues actually collected.
- The programs introduce substantial horizontal inequities, between individuals who work in the formal taxed sector and those who work in the untaxed sector, between taxpayers who are able to elect to be taxed under the simplified tax system (and so who are not subject to the payroll taxes), and between those who evade and those who do not.
- The programs introduce vertical inequities due to the somewhat regressive distribution of tax and contribution burdens.

Similarly, the individual income tax, together with the simplified tax system, also has some serious limitations:

- The STS creates huge incentives for individuals to be taxed under the STS, even if they are not legally eligible for this tax treatment.
- The STS also distorts taxpayer decisions by giving them an incentive to fragment their operations in order to fall below the thresholds, and by discouraging taxpayers right at the thresholds from increasing either turnover or employment.
- The turnover and employee thresholds are extremely high, and the thresholds have not been adjusted to reflect the changing economic environment.
- The STS is not in fact all that simple. Its compliance burden on truly “small” taxpayers can be quite significant.
- The STS most likely has led to a loss in income tax revenues. It has also reduced collections from the payroll taxes and from the value-added tax, and it has reduced the self-enforcing capability of the VAT.
- There is apparently no government verification that individuals and businesses that participate in the STS actually meet the legal requirements.

- The STS introduces substantial horizontal and vertical inequities. Individuals who must pay the regular income tax via employer withholding seem especially likely to face a heavy tax burden.

Given these findings, there are several obvious avenues of reform, which mainly involve steps to rationalize this now disjoint “system” of taxes, to integrate each payroll tax with the others (and with the individual income tax), to increase the collection efficiency and to decrease the administrative costs of the programs, to lessen the distorting effects of the high marginal tax rates, and to improve the horizontal and vertical equity of the entire system of labor taxation:

- **Substitute a single unified payroll tax system for the four separate programs that currently exist.** This reform should involve two components: a single unified tax rate and a single collection agency. There are separate tax rates and four separate collection machineries, including compliance procedures, for each of the payroll programs (as well as for the individual income tax). However, these systems are largely independent of one another and also largely independent of the income tax. All of this occurs despite a common method of collection of the vast bulk the revenues that are generated, or employer withholding on wage incomes. The collection procedures of all payroll programs could be consolidated by merging the administration of the payroll programs into a single agency, by imposing a single tax rate, and also by imposing the tax rate on a common tax base. A single form should be used to collect all payroll taxes and contributions, including the individual income tax. This form would have for each employee a separate entry for the individual income tax and for any other payroll tax or contribution withheld. Payments would be deposited with a single receiver in accounts earmarked for each program. The use of a single form would be facilitated by a common tax base, the use of proportional tax rates, and (perhaps) the elimination of the wage ceiling linked to the minimum subsistence level of income. A single agency should also be given the responsibility for enforcement and compliance. One candidate for this agency is the State Tax Administration, especially given its sole responsibility for collecting the individual income tax via wage withholding. Another candidate is the Ministry of Labor and Social Policy, a choice that might have a stronger justification if the linkage between taxes paid and benefits received became much closer than in the current system.
- **Expand the tax bases of the payroll taxes.** There is much evidence, even if this evidence is not firm, that substantial amounts of payroll program revenues are not collected, due to illegal evasion of tax and contribution liabilities and legal avoidance of these liabilities. Accordingly, consideration should be given to broadening the bases of the payroll programs by forcing those individuals already in the individual income tax net to pay the full legally due amount of each tax and contribution, by forcing firms to do the same, by instituting a compliance program that reduces evasion, and (as discussed later) by restricting the ability of individuals to elect to be taxed under the simplified tax system. To the extent that a stronger linkage between contributions and benefits is actually established, then any expansion in the base of a contributory scheme should be accompanied by a change in the scheme’s benefit formula, in order to ensure actuarial fairness.

- **With any base expansion, consider a corresponding reduction in tax and contribution rates.** Any expansion in bases should be accompanied by a corresponding reduction in tax and contribution rates. Such a rate reduction would lessen the distorting effects of the system of payroll programs. In the absence of any significant base expansion, any tax rate reduction will lead to tax revenue reductions. In this regard also, any change in the relative employer–employee tax rate shares is unlikely to have any substantive or significant economic impact, given the economic equivalence between a tax on employees and a tax on employers.
- **Reevaluate the flat rate tax imposed on individuals (or physical persons), so as to ensure that the tax burdens under the STS and under the regular tax system are comparable.**
- **Reevaluate turnover and employee thresholds, so as to ensure that only “small” taxpayers are eligible for the STS.** The current thresholds are very high, and allow some individuals and firms that are fully capable of paying the regular income tax to elect the STS. In addition, the threshold for legal entities should be linked directly to the VAT threshold (or Hrv 300,000).
- **Adjust the thresholds for inflation and other changing economic circumstances.**
- **Apply the STS only to physical persons, and exclude all legal entities from the STS.** Most legal entities have the ability and the means (e.g., formal accounting methods and records) to the regular income tax.
- **If legal entities are allowed to continue in the STS, remove the current payroll tax and VAT exemption.** A firm that employs as many as 50 employees should be capable of withholding payroll contributions and of handling VAT paperwork.
- **Improve enforcement of the STS.** There must be some official verification that individuals and firms who participate in the STS are in fact eligible for participation. There must also be attempt to reduce purely artificial accounting schemes that allow STS participation.

More broadly, appropriate reforms require that the many ways in which these different methods of taxing individuals interact as a single system must be considered. In this regard, we believe that it is likely that many countries will have increasing difficulties imposing a broad-based, global income tax. Instead, the most suitable form of taxation is likely to be one characterized by a schedular approach to taxation of each separate member of the family unit, in which each of their main types of income flows (e.g., wages and salaries, dividends, interest, rent) is subject to separate rate schedules that may be but are not highly graduated. Such a less ambitious scope for taxation of individuals seems better able to achieve the goals of equity, efficiency, and adequacy.

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Appendix A. Equations of a General Equilibrium Model

The full set of equations for the stylized economy can be represented as follows (where $\hat{\square}$ denotes the percentage change in the relevant variable):

$$\begin{aligned}
 (1) \quad & \hat{X} = E_{XX}(\hat{P}_X - \hat{P}_Z) + E_{XY}(\hat{P}_Y - \hat{P}_Z) \\
 (2) \quad & \hat{Y} = E_{YX}(\hat{P}_X - \hat{P}_Z) + E_{YY}(\hat{P}_Y - \hat{P}_Z) \\
 (3) \quad & \hat{X} = f_K \hat{K}_X + f_L \hat{L}_X \\
 (4) \quad & \hat{Y} = g_K \hat{K}_Y + g_L \hat{L}_Y \\
 (5) \quad & \hat{K}_X - \hat{L}_X = s_X(\hat{r} + T_K - \hat{w} - T_L) \\
 (6) \quad & \hat{K}_Y - \hat{L}_Y = s_Y(\hat{w} - \hat{r}) \\
 (7) \quad & \hat{K}_Z - \hat{L}_Z = s_Z(\hat{w} - \hat{r}) \\
 (8) \quad & \hat{K}_X K_X + \hat{K}_Y K_Y + \hat{K}_Z K_Z = 0 \\
 (9) \quad & \hat{L}_X L_X + \hat{L}_Y L_Y + \hat{L}_Z L_Z = 0 \\
 (10) \quad & \hat{P}_X = f_K(\hat{r} + T_K) + f_L(\hat{w} + T_L) \\
 (11) \quad & \hat{P}_Y = g_K \hat{r} + g_L \hat{w} \\
 (12) \quad & \hat{P}_Z = h_K \hat{r} + h_L \hat{w} \\
 (13) \quad & \hat{P}_Z = 0
 \end{aligned}$$

where E_{ij} is the compensated elasticity of demand for i with respect to a change in the price of good j , defined to be nonpositive ($i, j = X, Y$); P_i is the price of good i ($i = X, Y, Z$); r is the price of capital; w is the price of labor; f_j is the initial share of factor j in sector X ($j=K, L$); g_j is the initial share of factor j in sector Y ($j=K, L$); h_j is the initial share of factor j in sector Z ($j=K, L$); s_i is the elasticity of substitution between capital and labor in sector i , defined to be nonpositive ($i=X, Y, Z$); and T_j is the tax on factor j in sector X ($j=K, L$).

Equations (1) and (2) express the percentage change in compensated demand as a function of the percentage change in the relative product prices of X and Y , respectively. Equations (3) and (4) describe the change in output of X that results from changes in factor usage in the sector. Equations (5), (6), and (7) relate the change in factor proportions in the sectors to changes in relative factor prices via the elasticity of substitution in production. Equations (8) and (9) follow from the assumption of fixed factor supplies of capital and labor. Equations (10), (11), and (12) show the relationships between changes in factor prices (including taxes where appropriate) and the resulting changes in product prices. Equation (13) defines the price of good Z as the numeraire. All physical units are chosen such that initial prices are unity.

These equations constitute a thirteen-equation, thirteen-unknown system, where the unknowns are the percentage changes in output in X and Y , in labor and capital in each of the sectors, and in product and factor prices, or ΔY , ΔK_X , ΔK_Y , ΔL_X , ΔL_Y , ΔP_X , ΔP_Y , ΔP_K , ΔP_L , Δr , and Δw . This system can be reduced by substitution and then solved for the remaining unknowns by Cramer's Rule.

Using dollars as the unit of currency for purposes of discussion, the size of sector X is assumed to equal 75, and this also equals the sum of the gross-of-tax income of capital and labor in the sector. Similarly, the legally untaxed sector Y is assumed to equal 25; sector Y is therefore 1/3 the size of the taxed sector. The amounts paid gross-of-tax to K and L in the taxed sector are assumed to equal 20 and 55, respectively, so that the shares of capital and labor in sector X (denoted f_K and f_L) are assumed to equal $f_K=0.2667$ and $f_L=0.7333$. The amounts paid to K and L in sector Y are assumed to equal 5 and 20, respectively. The factor shares in sector Y (g_K , g_L) are therefore $g_K=0.2$ and $g_L=0.8$.

Recall that units are chosen so that one unit of a factor is the amount that earns 1 net of taxes. Because capital and labor in sector Y are not taxed, there are 5 units of capital and 20 units of labor in the sector. For sector X , the number of units depends on the burden of taxation. We assume that total taxes equal 25 percent of output in sectors X and Y , with 8 of taxes coming from capital in sector X and 17 coming from labor in X . Because units of capital and labor are chosen so that one unit of a factor is the amount that earns 1 unit net of all taxes, there are 12 (=20/8) units of capital in X and 38 (=55/17) units of labor. This procedure also generates estimates of the tax rate on capital and labor. The tax rate is calculated by dividing the total taxes borne by the factor by its net-of-tax income. The tax rate on capital in sector X is 0.6667 (=8/(12)), while the tax rate on labor is 0.4474 (=17/38). Capital and labor in sector Y are untaxed. See Harberger (1962), Alm (1986), or Alm and Buckley (1998) for more discussion of this procedure.

As for the informal or hard-to-tax sector Z , we make two alternative assumptions about its size. We assume that sector Z equals either 25 percent of formal sector ($X+Y$) output, or 25, or that it equals 50 percent (50) of formal sector output. In either case, we assume that this sector is highly labor-intensive, with factor shares for labor (h_L) and capital (h_K) of $h_L=0.9$ and $h_K=0.1$, respectively; the amounts of labor and capital therefore equal (22.5, 2.5) and (45, 5) in the two alternative scenarios. Sensitivity analysis indicates that the various estimates do not vary substantially with variations in the size of the sector.

We assume various combinations of the elasticities of substitution between capital and labor (or s_i , $i=X,Y,Z$), from 0 to 1/2 to 1. As for the compensated elasticities of demand, we assume that the own-elasticities (E_{XX} , E_{YY} , E_{ZZ}) are equal to each other, and that the cross-elasticities of demand of Y and Z with respect to the price of the taxed good X are equal to one another. Together with the requirement of symmetry in compensated responses, these assumptions imply

that choosing a value for E_{XX} determines the values of the other elasticities. We assume that E_{XX} equals $1/2$ or 1 . Variations in the elasticities of demand and of substitution have a more significant impact on the estimates.