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Recommended Citation

Alm, James, Roy Bahl, and Matthew N. Murray. "Tax Base Erosion in Developing Countries." Economic Development and Cultural Change 39, no. 4 (1991): 849–72. https://doi.org/10.1086/451912.

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Source: *Economic Development and Cultural Change*, Jul., 1991, Vol. 39, No. 4 (Jul., 1991), pp. 849-872

Published by: The University of Chicago Press

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Tax Base Erosion in Developing Countries

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I. Introduction

It is widely believed that the tax base in most developing countries has been severely eroded by legal tax avoidance and illegal tax evasion, brought about largely by poor tax administration.[1] This erosion, it is thought, has had a variety of fiscal effects: tax revenues are lost and the growth of the tax base is dampened, the progressivity implied by the statutory rate structure is not achieved, the costs of tax administration are increased, and horizontal and vertical equity suffer because the effective tax rates faced by individuals depend largely upon their success in playing the tax compliance game. It is not surprising, therefore, that virtually all fiscal reform programs in developing countries start with the promise to improve administration. Better administration is a discretionary government action that at once can lower the tax rate, increase revenues, slow capital flight, and improve the fairness of the system. Yet tax base erosion in developing countries is something about which precious little is known, and, in particular, the empirical evidence about the severity and the nature of the problem is all but nonexistent.[2]

Why do we know so little about the dimensions of the evasion-avoidance problem? One reason is conceptual problems in measuring erosion of the tax base. For example, how does one estimate the substitution of nontaxable for taxable compensation in response to the tax structure, or the extent to which a higher marginal tax rate has induced individuals to report less of their taxable income? Another reason is the problem of comparability across countries. The many legal and

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illegal channels by which individuals can reduce their taxes depend upon the institutions of a country. The comparability problem is further compounded by the importance of cultural factors in defining the line between compliance and noncompliance. Finally, and most important, little of the relevant data to estimate the full tax base are available. Most governments in developing countries find it difficult enough to gather complete data on those who do pay taxes; they make no systematic attempt to collect information on those who do not pay taxes. Further, most of the information that is collected on evasion has come as a result of campaigns to gain a quick revenue fix rather than to estimate the gap between the statutory and the comprehensive tax base. Such information is therefore not comprehensive and often is not reported other than in internal government documents.

The purpose of this article is to demonstrate a set of methods by which micro-level estimates of the amount of income that escapes individual income taxation via both legal and illegal means can be generated and utilized.[3] The country that is examined as a case study is Jamaica, and the estimates presented here were used by the government in its 1986 tax reform program. In fact, it is doubtful that the sweeping reform of the income tax could have occurred in the absence of rigorous statistical analysis of alternative rate and base combinations, which was only made possible by the existence of detailed individual information on the potential tax base. The individual income tax reform of 1986 replaced the existing structure with a simpler, flat-rate tax of 33⅓% on an expanded definition of income. The data discussed in this article were generated as part of our work on the tax reform project for the government of Jamaica and are based on the prereform system.

Estimates of the various types of taxed and untaxed income for 1983 are calculated using several unique sources of information on income recipients in Jamaica. These estimates are used to construct a measure of comprehensive income for each individual, and this expanded measure of income is then used to estimate the incidence of taxes actually paid relative to comprehensive income, as well as the amount and the distribution of taxes that were not collected. To our knowledge, these estimates represent the first time such micro-level measures of erosion have been calculated and analyzed.

The results indicate that there is enormous erosion of the income tax base in Jamaica. Failure to tax comprehensive income has seriously compromised the statutory goals of the tax: it has led to a large reduction in the progressivity of the tax, it has introduced horizontal inequities, and it has cost an amount in revenues equivalent to about 84% of actual collections. Although these results are specific to Jamaica, it is likely that similar conclusions hold for other developing countries.

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Section II describes the Jamaican income tax system. Estimates of base erosion are discussed and derived in Section III. The revenue and distributional effects of base erosion are analyzed in Section IV. Section V compares our micro estimates with those from a simpler, more aggregate method. Section VI summarizes the main results and discusses the implications of these results and the applicability of the measurement methods for other developing countries.

II. Individual Income Taxation in Jamaica

The individual income tax is the largest single revenue source for the government of Jamaica, with revenues in 1983 totaling J$416.3 million.[4] This represents 28.9% of all government revenues and 7.6% of national income. It is also one of its most unpopular taxes. Two types of individuals pay the income tax: those with income only from wages and salaries, and those with income from any source in addition to wages and salaries (interest, rent, dividends, and the like). The first group of taxpayers has taxes withheld by the employer under the Pay-As-You-Earn (PAYE) system, and these individuals are not required to file an income tax return unless some error was made in withholding. Over 90% of income tax revenues are collected by employer withholding under the PAYE system. The second type of income recipient, to whom we refer as the "self-employed," also has PAYE taxes withheld on wage income, if any such income is earned and if the employer is registered. In addition, as long as these individuals have other sources of income, each must file a return upon which taxes on other income are paid.

In theory, the Jamaican individual income tax prior to reform was broad based, with only interest income exempt, and the rate structure was high and steeply progressive, rising from a marginal tax rate of 30% on the first J$7,000 of taxable (or "statutory") income to 57.5% on all income above J$14,000.[5] In practice, the base and progressivity of the income tax were reduced by an extensive system of tax credits, a number of loopholes that permitted legal tax avoidance, and widespread tax evasion: (*a*) An individual's tax liability could be reduced to zero by the application of up to 16 tax credits of various amounts, for purposes such as personal and child credits, alimony, medical expenditures, employment of household helpers, and participation in savings and life insurance programs. (*b*) The tax base was narrowed by a firmly entrenched system in which employers provided nontaxable fringe benefits, or "allowances," to their employees. While the Income Tax Act clearly stated that such allowances were taxable, in practice, no taxes were imposed on allowances. There were many different types of allowances—housing, transportation, utilities, and entertainment were among the most popular—and these were paid largely in cash with little verification of the actual individual expenditure. (*c*)

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Income earned from overtime activities received preferential treatment. Overtime income was taxed at the lowest marginal tax rate of 30% even if the individual's total income placed him or her in a higher marginal tax bracket. (*d*) Finally, the tax base was narrowed by evasion. Evasion takes place by underreporting taxable income and by failure to file tax returns. Because of the PAYE withholding system, it is believed that evasion is practiced primarily by the self-employed.

Unfortunately, the government of Jamaica maintains little information on the size of even the actual tax base. It has no information on the magnitude of base erosion via tax credits, allowances, overtime, underreporting, and nonfiling, and therefore cannot estimate the comprehensive income tax base. To make such an estimate we assembled our own data from a variety of primary sources. The next section discusses the methods used.

III. Estimating the Actual and the Potential Tax Base

The first step in measuring base erosion is to develop a profile of those who do pay income taxes, describing the distribution of taxpayers by bracket, the use of tax credits, taxes paid, and the like. To develop such a profile, two random samples were drawn directly from Income Tax Department (ITD) files. One sample is for those self-employed who file tax returns, and the other is for PAYE taxpayers. Evidence on avoidance and evasion was obtained from data in professional registries, business license records, and the telephone yellow pages, from a special compensation survey carried out by the government, and from the audit files of the ITD. Description of these data sets and the results of analysis of each are presented in the following sections.

A. Actual Tax Base

The first sample is a random sample of 4,084 PAYE taxpayers drawn from employer income tax records for 1983. Because the actual number of PAYE taxpayers was unknown, this sample was weighted to represent the population of PAYE taxpayers by forcing income tax collections in the sample to equal actual PAYE income tax revenues for 1983. By this method, the estimated population of PAYE taxpayers was 277,712, a reasonable estimate according to Jamaican government officials. The distribution of taxpayers, regularly taxed income, income claimed as overtime, tax credits, taxes paid, and average tax rate for the PAYE taxpayers is given in table 1.

We also drew a second, stratified random sample of 932 self-employed income tax returns for 1980.[6] These sample returns were first adjusted to represent the known population of 7,625 self-employed taxpayers for that year. The returns were then adjusted to 1983 levels by increasing the number of taxpayers by 6% to approximate the increase in the self-employed labor force over this period—with these

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TABLE 1

Distribution of Income and Taxes for Taxpayers (Amounts in Thousands of Jamaican Dollars)

	Self-employed Taxpayers					PAYE Taxpayers							All Taxpayers				
	Tax Returns	Statutory Income (J$)	Credits (J$)	Taxes Paid (J$)	Average Tax Rate	Tax Returns	Regularly Taxed Income (J$)	Credits (J$)	Taxes Paid on Regular Income (J$)	Overtime Income (J$)	Taxes Paid on Overtime Income (J$)	Average Tax Rate	Tax Returns	Statutory Income (J$)	Credits (J$)	Taxes Paid (J$)	Average Tax Rate
Under J$2,000	1,208	−912.0	266.3	.0	.000	25,432	28,935.0	6,597.0	2,083.5	.0	.0	.069	26,640	28,023.0	6,863.3	2,083.5	.066
2,001–4,000	1,321	4,163.1	1,130.0	118.9	.025	43,044	132,490.0	31,120.5	8,626.5	.0	.0	.063	44,365	136,653.1	32,250.5	8,745.4	.062
4,001–6,000	1,453	7,133.0	1,485.4	681.5	.094	56,644	286,069.4	58,666.5	27,154.3	.0	.0	.094	58,097	293,202.4	60,124.9	27,835.9	.094
6,001–8,000	884	6,122.8	1,033.2	822.2	.133	48,416	331,263.3	59,999.9	40,142.1	1,650.6	495.2	.121	49,300	339,036.7	61,033.1	41,459.5	.122
8,001–10,000	613	5,389.9	707.5	1,019.7	.188	36,856	318,462.2	54,409.1	47,200.5	9,042.5	2,688.8	.152	37,469	332,894.5	55,116.6	50,909.0	.152
10,001–12,000	481	5,242.0	564.7	1,216.7	.232	27,676	291,821.7	44,642.0	53,698.4	10,869.8	3,255.8	.188	28,157	307,933.4	45,206.7	58,170.9	.189
12,001–14,000	350	4,532.5	389.3	1,247.0	.275	15,572	188,701.9	25,293.2	41,665.0	14,114.3	4,186.6	.226	15,922	207,348.7	25,682.5	47,098.6	.227
14,001–16,000	289	4,302.2	327.1	1,323.8	.307	7,684	106,269.8	11,966.1	27,898.5	8,929.2	2,654.6	.265	7,973	119,501.2	12,293.2	31,876.9	.267
16,001–18,000	184	3,089.4	205.4	1,047.4	.339	5,100	76,664.1	7,958.0	22,075.1	9,890.2	2,938.8	.288	5,284	89,643.7	8,163.4	26,061.3	.290
18,001–20,000	263	4,959.3	297.7	1,805.8	.364	4,148	72,929.7	6,226.5	23,965.0	6,122.7	1,836.8	.326	4,411	84,011.8	6,524.2	27,607.6	.328
20,001–25,000	315	7,032.3	420.0	2,725.9	.387	4,420	85,549.0	7,084.5	29,903.5	11,422.2	3,409.7	.343	4,735	104,003.5	7,504.5	36,039.1	.346
25,001–30,000	263	7,240.1	326.8	3,088.1	.426	1,428	35,282.0	1,792.0	14,551.1	3,631.1	1,089.4	.402	1,691	46,153.2	2,118.8	18,728.7	.405
30,001–50,000	359	13,147.5	457.8	6,079.6	.461	884	22,566.5	1,143.1	9,586.9	9,596.4	2,856.9	.388	1,243	45,310.4	1,600.9	18,523.3	.409
Over J$50,000	175	18,390.5	229.4	9,846.4	.522	408	17,510.3	486.9	8,607.5	11,430.8	3,429.2	.400	583	47,331.6	716.3	21,883.1	.437
Total	8,158	89,832.6	7,813.6	31,023.0	.345	277,712	1,994,514.9	317,385.3	357,157.9	96,699.8	28,841.8	.185	285,870	2,181,047.2	325,198.9	417,022.8	.191

Source.—Computed from random samples of self-employed and PAYE tax returns.

added taxpayers distributed across income classes according to the 1980 distribution—and by increasing the income of each taxpayer by 27% to capture the increase in nominal income over this period. The resulting 1983 population of self-employed taxpayers was 8,158. The distribution of taxpayers, income, tax credits, taxes paid, and average tax rate for the self-employed is given in table 1.

Table 1 indicates a substantially skewed distribution of income and taxes, both within and across sectors. Those PAYE taxpayers who earn less than J$10,000 account for over three-fourths of the taxpayers, receive over half of total (regular plus overtime) PAYE income, and pay one-third of total PAYE taxes (overtime income is discussed in more detail below). Only 1.0% of PAYE taxpayers earn more than J$25,000. These taxpayers receive 4.8% of the income and pay 10.4% of the taxes in the PAYE sector. The distribution of income and taxes is even more skewed in the self-employed sector. For this group, 67.2% of the taxpayers earn less than J$10,000; however, they receive only 24.4% of total self-employed income and pay only 8.5% of self-employed taxes. At the other end of the self-employed income distribution, those making more than J$25,000 number only 9.8% of the self-employed, yet they earn 43.2% of the income and pay 61.3% of the taxes.

The combined distribution for both self-employed and PAYE taxpayers is shown in the last four columns of table 1. The self-employed number only 2.9% of all taxpayers. Because of their higher average income (J$11,012 vs. J$7,530), they receive 4.1% of the income and pay 7.4% of the taxes for all taxpayers. Clearly, however, the income tax is dominated by PAYE taxpayers, and the characteristics of all taxpayers are dominated by those of the PAYE taxpayers. Table 1 and figure 1 illustrate the implied progressivity of the income tax on statutory income. For the individual sectors and for the combined distribution of taxpayers, the average tax rate on statutory income rises steadily as income increases, ranging from 0% to 52.2% for the self-employed, from 6.9% to 40.0% for PAYE taxpayers, and from 6.6% to 43.7% for all taxpayers. However, as shown below, avoidance and evasion activities seriously compromise this apparent progressivity.

B. Tax Credits

These data allow us to estimate directly the extent to which the tax base is reduced by the use of tax credits. For all taxpayers, credits significantly erode revenues, reducing collections by J$325.2 million, an amount equivalent to nearly 80% of revenues actually collected. However, credits also increase the progressivity of the income tax. The presence of credits decreases tax burdens across all income brackets but lowers them by greater proportionate amounts in lower brackets.

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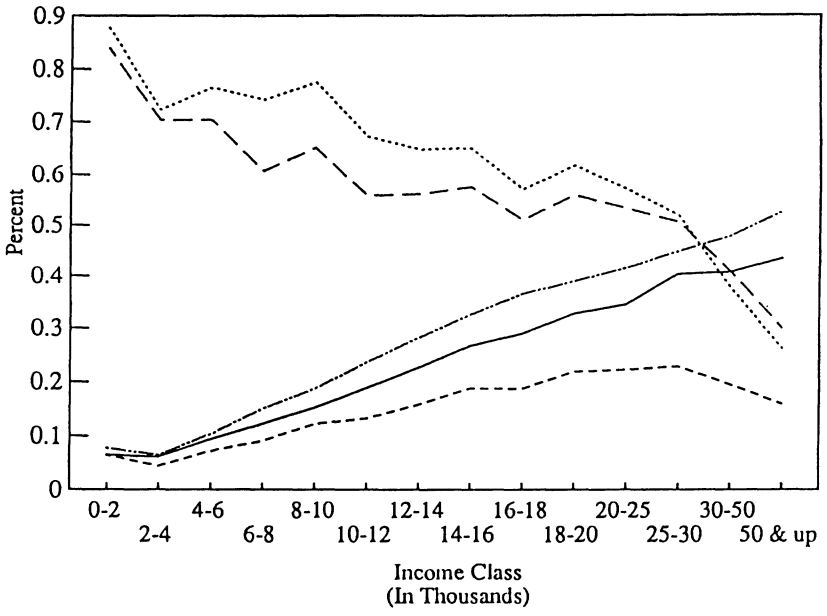

FIG. 1.—Income class (in thousands).———Taxes paid as proportion of statutory income;- - - - - - - - - -taxes paid as proportion of comprehensive income;····· statutory income as proportion of comprehensive income;— — — — —taxes paid as proportion of taxes on comprehensive income; and—·—·—·— taxes on comprehensive income as proportion of comprehensive income.

C. PAYE Overtime Income

In 1983 the government introduced preferential treatment of income earned from overtime activities, in which all overtime income is subject to a 30% tax rate. Although overtime income is not reported by the employer (or the employee), we were able to calculate the amount of overtime using the sample of 4,084 PAYE taxpayers.

For 29% of the taxpayers in the PAYE sample, there was a discrepancy between the tax liability implied by income and credits, and the tax actually paid; in nearly all cases the tax paid was less than the implied liability. We calculated for these taxpayers the amount of overtime income necessary to result in the reported tax liability.[7] The resulting amounts of overtime income are shown in table 1. Total overtime income is J$96.7 million, or nearly 5% of total income for all PAYE taxpayers; for those individuals receiving overtime income, overtime is over 10% of total income.[8]

D. Undeclared Income by Nonfiling Self-employed Taxpayers

One is struck by the extent to which the income tax is a withholding levy in most developing countries. Jamaica is no exception. Only 2.9%

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of all tax returns are from the self-employed, and the self-employed receive only 4.1% of total statutory income and pay only 9.5% of all taxes. These numbers suggest that evasion in the form of nonfiling is a widespread problem among this group. Estimation of the number of self-employed individuals who do not file any tax return, and the amount of income that escapes taxation as a result, requires a different approach from those described above.

A master population list of names was assembled from various third-party sources of information, including telephone directories, trade association lists, the Small Business Association of Jamaica, and the Ministry of Health. Nine occupations were examined, chosen largely on the basis of advice from Jamaican tax experts on what occupations were important to and representative of the Jamaican economy. These occupations were service stations, customs brokerages, auto repair, auto parts, hair care, real estate, contractors, transport operators, and beverage and spirits outlets.[9] In total, the master lists contained 29,838 entries for the period 1982–84. From this list a random sample of approximately 40%, or 12,336 names, was drawn. These names were taken to the ITD, and, with the assistance of their personnel, an examination was made to determine whether these individuals had paid any income taxes, either by filing a tax return or by having tax withheld. The search procedures were quite exhaustive and thorough. We refer to this as the "self-employed sample of nonfilers."

The results are dramatic and indicate an enormous amount of evasion among the self-employed. As shown in table 2, only 10.9% of individuals in the self-employed sample file a tax return; in no occupation does the filing rate exceed 13.3%.[10] For those self-employed who file tax returns, the average income is J$7,953, approximately the same as for all taxpayers; average credits and taxes paid for the filers are J$944 and J$2,019, respectively. The sample results on those who filed returns were then used to estimate the total number of self-employed individuals who do not file an income tax return, and the total income and taxes that thereby escape the tax net. In the absence of additional information on the characteristics of nonfilers, we assumed that the filing rate and characteristics of those in the sample and in the population of self-employed are the same. For 1983, the number of filers is 445 from a sample of 4,113, for a filing rate of 10.8%.[11] The total number of self-employed individuals in 1983 is determined by dividing the number of self-employed tax returns in 1983 (or 8,158) by the filing rate (or 10.8%). This procedure yields 75,402 self-employed individuals in 1983, with 8,158 filers and 67,244 nonfilers. The income, credits, and taxes of the 67,224 nonfilers are estimated from the characteristics of those in the self-employed sample who filed tax returns. The amount of undeclared income from this sample is estimated at nearly J$600 million. Clearly, the extent of evasion via nonfiling is enormous.

The results from the self-employed sample should be viewed with

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TABLE 2

RESULTS FROM THE SELF-EMPLOYED SAMPLE

SAMPLE	POPULATION	SAMPLE SIZE	FILERS	
			N	%
Occupational sample:				
Service stations	630	252	14	5.6
Customs brokerages	366	147	4	2.7
Auto repair	888	318	31	9.7
Auto parts	402	158	13	8.2
Hair care	2,280	919	53	5.8
Real estate	105	79	8	10.1
Contractors	297	132	7	5.3
Transport	13,485	5,857	781	13.3
Beverage and spirits	11,385	4,474	430	9.6
Total	29,838	12,336	1,341	10.9
Professional sample:				
Accountants	384	176	45	25.6
Architects	75	25	5	20.0
Attorneys	373	100	22	22.0
Medical doctors	1,146	225	43	19.1
Optometrists	9	9	4	44.4
Veterinarians	37	37	10	27.0
Total	2,024	572	129	22.6

SOURCE.—Computed from the self-employed and professional samples of nonfilers.

some caution. However, a smaller sample of higher-income professionals gave a similar, and slightly larger, picture of the amount of undeclared income. This sample is called the "professional sample" and it used the same basic procedures as the self-employed sample. A master population list of 2,024 names was gathered for accountants, architects, attorneys, medical doctors, optometrists, and veterinarians. From this list a random sample of 572 names was selected, and the names were taken to the ITD to determine whether these individuals had paid any income taxes. We found that only 23% of these professionals paid any income taxes (see table 2); the implied base erosion for the population of self-employed exceeds J$700 million.

In order to provide a lower boundary on the amount of evasion via nonfiling, only the results from the self-employed sample are reported. These estimates are given by income class in table 5, and the potential revenues from taxation of the income—J$162 million—are reported in table 6.

E. Underreported Income of Self-employed Taxpayers

Another form of tax evasion is the underreporting of income on the tax returns of those individuals who file a tax return. Data limitations

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here are obviously quite severe. Nevertheless, there is enough information on underreporting to allow estimation of the determinants of this underreporting. The approach we took here required two steps. First, we used data from audited returns to estimate the determinants of underreporting. Second, we used a structural equation to impute a total amount of underreporting to all self-employed taxpayers.

In the process of collecting the self-employed sample of nonfilers, we discovered that many of those in the sample had been subjected to an audit or an examination, which then led to a change in tax liability. Therefore, for these audited taxpayers, there is information both on reported return items and on postaudit, or "true," return items. The self-employed sample includes 440 audited tax returns for the period 1982–84; 121 are for 1982, 187 are for 1983, and 132 are for 1984. This information on audited taxpayers is not without weaknesses: it is unlikely that auditors have detected all forms of underreported income (or overclaimed tax credits), the sample provides no information on those who do not file a tax return, underreporting may not always be intentional, and there is no information on the probability of detection. Still, these weaknesses are common with compliance data.[12]

It is possible to use this unique information to estimate the determinants of self-employed underreporting at the individual level. The empirical specification is based on the extremely limited empirical literature on tax compliance.[13] Two alternative measures of noncompliance are used. The first is the log of the difference between the taxpayer's reported income and the postaudit, or "true," level of income. The second measure is the log of the difference between the taxpayer's reported tax liability and the postaudit tax liability. For both measures, the log transformation applies only to the nonzero cases.

Several explanatory variables are used. The first variable is the marginal tax rate (MTR), measured to include both the income tax and the numerous payroll taxes that are also imposed on statutory income. In specifying MTR, postaudit income is used to determine the taxpayer's tax bracket. Since postaudit income is independent of the taxpayer's reporting decision, this approach makes the marginal tax rate exogenous. One would expect that an increase in MTR would lead to greater evasion because the reward for successful evasion is greater. However, unless one imposes restrictions on the degree of individual risk aversion, the impact of MTR is ambiguous.

A second explanatory variable is income (INCOME), measured as net-of-tax income. Income and taxes are calculated using their postaudit values, in order to ensure their exogeneity. As with MTR, the expected impact of INCOME is ambiguous and depends on the individual's attitude toward risk. However, if evasion opportunities vary systematically and positively by income class, a positive income effect will occur.

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TABLE 3

ESTIMATION RESULTS: DETERMINANTS OF UNDERREPORTED INCOME AND TAXES

	DEPENDENT VARIABLE	
INDEPENDENT VARIABLE	Underreported Income	Underreported Taxes
MTR	2.05**	3.64**
	(3.60)	(5.70)
INCOME	2.90×10^{-5}**	4.7×10^{-5}**
	(3.70)	(5.40)
FAMILY	−.31	−.21
	(1.50)	(.92)
CREDIT	-3.30×10^{-4}	-1.00×10^{-3}
	(.62)	(1.70)
CREDITSQ	2.10×10^{-7}	2.60×10^{-7}
	(1.40)	(1.50)
DMALE	.08	−.02
	(.90)	(.16)
DTRANSPORT	.18**	.24**
	(2.70)	(3.20)
DOTHER	.23*	.19
	(1.90)	(1.40)

SOURCE.—Computed from the self-employed sample of nonfilers.
NOTE.—Coefficient estimates with *t*-statistics in parentheses.
* Significant at .10 level.
** Significant at .01 level.

A family size variable is included (FAMILY), constructed from tax credit information, that serves to control for unobserved differences in taxpayer heterogeneity. A dummy variable for sex (DMALE) is also included to control further for heterogeneity. Two variables are entered to reflect credit usage: the amount of credits (CREDIT) and, to control for nonlinearities, the square of credits (CREDITSQ). Finally, two dummy variables are included for the sector of occupation. The reference sector is beverage and spirits. DTRANSPORT represents those who work in the transport sector, and DOTHER represents those in all other sectors. Since there are a large number of limiting values for both measures of noncompliance, the appropriate estimation technique is the Tobit maximum likelihood procedure.

Estimation results are reported in table 3.[14] Of most importance are the coefficients on MTR and INCOME. In both specifications, the marginal tax rate has a positive and highly statistically significant impact on evasion. Similarly, the coefficient on income is always positive and statistically significant at the .01 level. The responses of evasion to changes in these variables are nonetheless small, and the elasticities (evaluated at the means) are generally less than unity.

The results for the other variables are mixed. The dummy variables for sector of employment suggest that those who work in the transport and other sectors evade more than those in the beverage and

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spirits sector. The coefficients on CREDIT, CREDITSQ, and DMALE are never statistically significant.

These estimation results are used to predict the expected amount of underreported income for the 8,158 self-employed taxpayers in 1983. The predicted amount of underreported income equals J$112 million in 1983, as shown in table 5, and the implied tax loss exceeds J$50 million (about 15% of actual collections), as shown in table 6. Again, these results should be taken as rough orders of magnitude. However, estimation from a second sample of data gave similar estimates.[15]

F. Allowances of PAYE Taxpayers

PAYE employees receive compensation in two basic forms: taxable wages/salaries, and allowances, which are in principle subject to taxation but which in practice are not taxed. Allowances are cash supplements that may be given for a variety of purposes: housing, travel, car, entertainment, bonus and profit sharing, utilities, meals, commissions, education, laundry, and uniforms. Because allowances are not taxed and monitoring is minimal, employees have a strong incentive to substitute allowances for wages. Employers are not required to report employee allowances to the ITD. Fortunately, we had access to information on these fringe benefits, drawn expressly for the tax reform project.

In 1984 the Revenue Board of the government of Jamaica requested that all public and private sector employers provide detailed information on taxable and nontaxable compensation paid to their employees. In total, 1,345 firms with 70,155 employees responded; roughly half of the workers were in the public sector. Although the Revenue Board survey is not a random sample, the survey covers approximately 25% of the formal PAYE labor force in Jamaica, and the distribution of taxpayers and their characteristics are similar to that produced by the random samples reported in table 1.

Average cash compensation of employees in the Revenue Board survey is J$8,132, and average allowance compensation is J$1,170. The proportion of allowances in total (cash plus allowance) compensation is .126. The most commonly used allowances are for housing, travel, and entertainment. There is considerable variation in the use of allowances, both within and across income classes. Individuals in the lowest income class receive on average only J$74 in allowances; those in the top class receive J$17,273 in allowances. However, there is a tendency for allowances to fall as a percentage of income as income rises above J$20,000.

Data for the Revenue Board survey can be used to estimate the determinants of the share of allowances in total compensation.[16] The dependent variable is the share of total net-of-tax compensation received in allowances. Several independent variables are used. The

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TABLE 4

ESTIMATION RESULTS: DETERMINANTS OF ALLOWANCE SHARE

Independent Variable	Dependent Variable: Allowance Share
[1-MTR]	−.16*
	(43.22)
INCOME	-2.00×10^{-3}*
	(15.06)
DPRIVATE	.09*
	(178.83)
[MTR*DPRIVATE]	−.07*
	(43.40)
R^2	.18

SOURCE.—Computed from the Revenue Board survey of allowances.
NOTE.—Coefficient estimates with t-statistics in parentheses.
* Significant at .01 level.

marginal tax rate (MTR) is included to capture the incentive to substitute allowances for wages: a higher tax rate increases the payoff to nontaxable compensation. The marginal tax rate is entered as (1 − MTR) because this is the price of allowances relative to taxable wages. Net-of-tax compensation (INCOME) is also included as an independent variable. Income, taxes, and the marginal tax rate are calculated using total (cash plus allowance) compensation in order to ensure exogeneity. A dummy variable equal to one if the firm is in the private sector and zero otherwise (DPRIVATE) is included, since private sector companies may be more generous with their allowance package than public sector companies. An interaction term (MTR*DPRIVATE) is also included. Estimation is by ordinary least squares.

The estimation results are reported in table 4.[17] The coefficient on the price of allowances (1 − MTR) is negative and highly statistically significant. A higher marginal tax rate therefore leads to greater allowance compensation. INCOME is significant, although its sign is negative. Workers in private sector companies receive greater allowance shares than comparable public sector workers.

These estimation results are used to predict the amount of allowances for each of the 277,713 PAYE employees in 1983. The amounts of allowances by income class are reported in table 5, and the potential tax revenues from full taxation of allowance income are given in table 6. In total, allowances reduce the tax base by J$246.6 million, or by 11.3%; they reduce taxes by J$116.9 million, or by 28.0% of taxes collected. These results also have been replicated in another sample.[18]

IV. Effects of Base Erosion

Estimates of the actual and the potential tax base are summarized in table 5; actual and potential tax revenues are in table 6. Consider first

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TABLE 5

ACTUAL AND POTENTIAL TAX BASE
(Amounts in Thousands of Jamaican Dollars) (J$)

	Fully Taxed Income of Self-employed and PAYE Taxpayers*	Overtime Income of PAYE Taxpayers	Undeclared Income of Nonfiling Self-employed Individuals	Underreported Income of Self-employed Taxpayers	Allowances of PAYE Taxpayers	Total: Comprehensive Income
Under 2,000	28,023.0	.0	2,585.3	.0	1,340.8	31,949.1
2,001–4,000	136,653.1	.0	45,508.2	.0	6,922.9	189,084.2
4,001–6,000	293,202.4	.0	70,744.2	1,775.3	17,100.9	382,821.9
6,001–8,000	337,386.1	1,650.6	79,868.3	10,538.3	25,099.6	454,543.3
8,001–10,000	323.852.0	9,042.5	44,065.4	10,338.0	30,116.4	417,413.9
10,001–12,000	297,063.6	10,869.8	82,593.8	18,790.6	32,181.9	441,499.8
12,001–14,000	193,234.4	14,114.3	48,940.6	13,463.5	27,452.2	297,204.8
14,001–16,000	110,572.0	8,929.2	22,697.5	7,580.4	19,896.4	169,675.1
16,001–18,000	79,753.5	9,890.2	26,270.4	5,405.2	18,051.4	139,370.3
18,001–20,000	77,889.1	6,122.7	20,572.8	3,926.6	17,370.1	125,881.2
20,001–25,000	92,581.3	11,422.2	24,007.6	7,149.7	26,525.6	161,686.8
25,001–30,000	42,522.1	3,631.1	21,530.8	4,715.4	9,266.2	81,665.4
30,001–50,000	35,713.9	9,596.4	29,436.4	10,942.6	8,056.3	93,745.3
Over 50,000	35,900.9	11,430.8	64,941.8	17,696.0	7,210.0	137,179.5
Total	2,084,347.4	96,699.8	583,763.2	112,321.6	246,590.2	3,123,720.6

SOURCE.—Computed from the random samples of self-employed and PAYE tax returns, the self-employed sample of nonfilers, and the Revenue Board Survey of allowances.

* Fully taxed income equals the sum of self-employed statutory income and PAYE regularly taxed income; see table 1.

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TABLE 6

ACTUAL AND POTENTIAL TAX REVENUES
(Amounts in Thousands of Jamaican Dollars) (J$)

	Taxes Paid by Self-employed and PAYE Taxpayers	Added Taxes from Full Taxation of PAYE Overtime Income	Taxes on Undeclared Income of Nonfiling Self-employed Individuals	Taxes on Underreported Income: Self-employed Taxpayers	Taxes on Allowances of PAYE Taxpayers	Total of Taxes on Comprehensive Income
Under 2,000	2,083.5	.0	.0	.0	402.2	2,485.7
2,001–4,000	8,745.4	.0	1,597.5	.0	2,076.9	12,419.8
4,001–6,000	27,835.9	.0	5,921.1	646.0	5,130.1	39,533.1
6,001–8,000	41,459.5	165.0	14,271.4	3,191.9	9,098.7	68,186.5
8,001–10,000	50,909.0	904.3	10,193.0	3,703.1	12,270.1	77,979.5
10,001–12,000	58,170.9	1,403.7	22,240.2	7,608.4	14,631.4	104,054.6
12,001–14,000	47,098.6	2,233.7	14,872.0	5,646.1	13,979.0	83,829.4
14,001–16,000	31,876.9	1,820.8	7,715.1	2,876.4	10,986.6	55,275.8
16,001–18,000	26,061.3	2,261.7	9,659.4	2,992.0	10,032.7	51,007.1
18,001–20,000	27,607.6	1,605.1	7,709.2	2,410.5	9,919.4	49,251.8
20,001–25,000	36,039.1	2,763.8	10,034.8	3,716.9	14,875.9	67,430.5
25,001–30,000	18,728.7	872.7	9,476.1	2,519.8	5,202.3	36,799.6
30,001–50,000	18,523.3	2,387.4	14,080.3	5,747.9	4,380.8	45,119.7
Over 50,000	21,883.1	2,954.8	34,168.9	9,630.2	3,957.1	72,594.1
Total	417,022.8	19,373.0	161,938.9	50,689.2	116,943.2	765,967.2

SOURCE.—Computed from the random samples of self-employed and PAYE tax returns, the self-employed sample of nonfilers, and the Revenue Board Survey of allowances.

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the amount of income that escapes the income tax net. As shown in table 5, this amount is enormous. Fully taxed income of self-employed and PAYE taxpayers in 1983 is J$2,084.3 million; total comprehensive income is more than J$1 billion greater, or J$3,123.7 million. The actual tax base is only two-thirds of its potential. Even this figure, however, understates the extent of base erosion because it does not count base reduction due to tax credits.

The major source of base erosion is the failure of many self-employed individuals to file any tax return. Nonfiling shrinks the tax base by J$583.8 million, or by 56.2% of the total reduction of J$1,039.4 million. Also of considerable importance is the receipt of allowances in lieu of cash compensation; this practice reduces the base of J$246.6 million, or by 23.7% of the total reduction. Underreported income and overtime income in total reduce the potential tax base by J$209.0 million (20.1% of the total reduction).

The distribution of base erosion across income classes is quite varied. Fully taxed income as a proportion of comprehensive income falls somewhat steadily as income rises (see fig. 1). For those whose income is less than J$10,000, this ratio is roughly three-quarters. However, for those in higher-income classes, this ratio is considerably less and reaches .262 for those whose income is more than J$50,000. The major erosion in the tax base is due to tax evasion, a practice that is more common and more accessible to those who are self-employed.

Hidden in the estimates of comprehensive income is substantial variation within income classes in the proportion of income that is fully taxed. For individuals in the PAYE sector, the bulk of their income is fully taxed; however, individuals with equal comprehensive income who are self-employed are better able to pursue evasion via nonfiling and underreporting. Noncompliance therefore introduces horizontal inequities into the tax system, inequities that may further discourage voluntary compliance.

Failure to tax comprehensive income reduces tax collections by a substantial amount. As shown in table 6, potential taxes—those that might be collected on a comprehensive income base—are J$766.0 million; taxes actually collected are J$417.0 million, or only 54.4% of potential revenues. Failure to tax comprehensive income therefore leads to a revenue loss of J$349.0 million, or 83.7% of the taxes actually generated in 1983. Recall also that tax credits cost another J$325.2 million in tax revenues. The total revenue erosion therefore exceeds J$674 million, an amount equivalent to 1.6 times the amount actually collected.

Aside from credits, the bulk of the forgone tax revenues stems from evasion by self-employed. Nonfiling generates a revenue loss of J$161.9 million, and underreporting reduces revenues by J$50.7 million. The receipt of compensation in allowances lowers revenues by

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J$116.9 million, and the preferential treatment of overtime income leads to a J$19.4 million loss.

Given the pattern of base erosion across income classes, and the nominal progressive rate structure of the income tax, the bulk of this revenue loss can be seen as a transfer to higher-income individuals. Taxes actually paid as a proportion of taxes on comprehensive income fall steadily as income rises (see fig. 1). For those with an income of less than J$10,000, this ratio always exceeds .6; for those making more than J$20,000, the ratio is roughly .5, and falls to .3 for the top income classes. Of the J$349 million in forgone revenues, only 20% comes from those with an income of less than J$10,000; over 36% of the revenue loss comes from those with an income of more than J$20,000, even though this group receives only 10% of total statutory income and only 15% of total comprehensive income.

Because comprehensive income is not taxed, measurement of the actual tax burden in relation to statutory, or fully taxed, income gives a very misleading picture of the true incidence of the income tax. If the average tax rate is calculated by dividing taxes paid by statutory income, then the income tax appears to be quite progressive. The average tax rate on statutory income is 6.6% on the lowest income class, and rises steadily to 43.7% on those earning more than J$50,000 (these rates are given in table 1 and fig. 1). However, if the average tax rate is calculated by dividing taxes paid by comprehensive income, a very different picture emerges. As shown in figure 1, the average tax rate rises somewhat as income initially rises but then falls substantially for the top income classes. The income tax therefore changes from an apparently progressive tax to one that is in fact highly regressive. Again, the reduction in the progressivity of the tax occurs because evasion is the main avenue of noncompliance and evasion is more often used by higher-income, self-employed individuals. The taxation of comprehensive income would significantly increase tax collections, even allowing for adverse behavioral responses. In addition, the taxation of comprehensive income would restore the statutory progressivity of the individual income tax. As shown in figure 1, the ratio of taxes on comprehensive income to comprehensive income rises steadily and steeply with income. More important, the taxation of an expanded base would allow significant rate reductions with constant revenues. Such rate reductions would dampen noncompliance and other distortive effects of high marginal tax rates.

V. Comparison with a "Gap Approach"

It is possible to obtain estimates of base erosion by use of a cruder method, called a "gap approach." The gap approach uses aggregate data from the national income accounts or the tax department to estimate the amount of base erosion and the corresponding revenue loss.[19]

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This method is more easily applied than our micro-level methods and so is more commonly used in fiscal analysis.[20] An interesting question is whether the gap approach gives the same results as those using our suggested methodology.

The most common gap estimation method compares compensation reported on tax returns with that shown in the national income accounts. The national income accounts indicate that in 1983 the total compensation of Jamaican employees was J$3,935 million, while total statutory income for all taxpayers in the samples here is J$2,181 million. The gap between total compensation and reported income is therefore J$1,754 million. If this amount were taxed at the average rate for all taxpayers currently in the system (or 19.1%), then forgone revenues from base erosion would equal J$335 million. This estimate is close to the amount estimated using the micro approach developed here (J$349 million), which suggests that the national income gap approach may give a reasonable first approximation to base erosion.

The gap approach, however, can never be more than a general statement of the dimensions of the problem. There are other, powerful arguments in favor of the micro approach. First, the micro approach allows analysis of the components of tax base erosion, such as underreporting versus nonfiling versus legal avoidance. This is important evidence that can help policymakers determine whether the biggest return lies in investment in improved auditing to capture underreporters, an information system to identify nonfilers, or a structural reform in the tax code to eliminate loopholes. Second, micro estimates provide information on the distribution of taxpayers, evaders, and their incomes, across sectors and across income brackets. This enables us to estimate the tax loss under the actual tax law (vs. an assumed average rate), as well as the vertical and horizontal equity implications of erosion. Finally, micro estimates allow the estimation of individual behavioral responses to tax rate changes. Of course, these advantages are not costless. The effort necessary to estimate base erosion at the individual level is substantial and lengthy, while the sole virtue of the gap measures is their simplicity. Still, the benefits of having individual measures of avoidance and evasion may be well worth the cost. In the case of Jamaica, these measures played a central role in the tax reform process.

VI. Summary and Conclusions

It is perhaps not surprising that erosion of the individual income tax base lowers both the revenues and the progressivity of the tax. However, the extent of these effects is striking. Avoidance and evasion of the income tax have cost the government of Jamaica enormous amounts of revenues, equal to 84% of actual collections. The equity

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cost of evasion and avoidance is no less striking. The nominally progressive Jamaican income tax has been converted to one that is overwhelmingly a tax on low- to moderate-wage workers in the PAYE sector of the economy. Horizontal equity has also been compromised. The rate of compliance, and therefore the effective tax burden, varies dramatically depending on whether a worker is in the public or private sector, PAYE or self-employed. This variation in tax burdens across and within income classes likely has reinforcing effects on noncompliance through taxpayer attitudes. Noncompliance also exacerbates the resource allocation distortions introduced by the tax system. The often dramatic differences in effective tax rates across sectors, occupations, and income classes are likely to have significant effects on economic choices. Moreover, the narrow base that is finally taxed forces a higher marginal tax rate, which discourages savings, investment, and work effort, while leading to capital (and human) flight. This point is probably best made by noting that, if Jamaica taxed comprehensive income instead of statutory income, the same revenues could be raised with an average effective tax rate of only 13%, instead of the current 19% rate. Clearly, tax base erosion has seriously compromised the statutory goals of the Jamaican income tax.

It must be stressed that these estimates should be viewed as rough orders of magnitude. As we have indicated throughout, there are substantial difficulties in measuring erosion. One problem is that these estimates assume no behavioral changes in response to tax base and rate changes, that is, they are "impact" estimates, which assume that the level and distribution of "comprehensive" income does not change when the tax system is changed. Another issue is that we have failed to measure some forms of erosion, such as income from illegal activities (drugs, e.g.). The potential tax base is almost certain to exceed our estimates.

The methods that we used are clearly specific to Jamaica and its institutions. However, these or similar methods are feasible in many other developing countries. The major form of erosion in developing countries is likely to be nonfiling of tax returns, and our procedures for identifying the hard to tax can be easily adapted elsewhere. The major forms of avoidance are apt to be the use of credits or deductions and the receipt of nontaxed fringe benefits; again, access to individual and employer tax records makes estimation of both forms of erosion feasible. Other countries will face different forms of erosion. Still, our procedures demonstrate that, despite apparent obstacles, the magnitudes of these forms of erosion can be estimated.

Estimates of the actual and the potential tax base are essential to tax policy discussion. In Jamaica, over 200 rate and base combinations of the income tax were analyzed before a final reform structure was

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chosen. It is unlikely that so sweeping a reform could have occurred without these simulations, since the empirical work demonstrated features of the tax system that were either unknown or hidden.

Of more importance, perhaps, is what governments can do to reduce base erosion. Our analysis suggests two major lessons for government policy. First, incentives matter, and the tax base will likely increase systematically and predictably to reductions in marginal tax rates. The estimation results for allowances and underreporting demonstrate directly the potential impact of rate reduction; it seems likely that other forms of erosion will respond in the same way. Second, a central component of tax policy and tax reform in all developing countries should involve administrative improvements that attack nonfiling by self-employed individuals: establishing a complete tax roll of the self-employed, assigning taxpayer identification numbers, developing methods for low-cost assessment, and training income tax personnel. To the extent the largest source of base erosion arises from administrative weaknesses that allow nonfiling, such administrative improvements are likely to have a more immediate and more productive impact on the tax base than, say, training of auditors.[21]

The tax reform in Jamaica implemented these tax rate and administrative changes. Although it is too soon to assess their lasting effects, initial evidence suggests that these changes will allow the individual income tax in Jamaica to achieve more closely its distributional and revenue goals. More generally, tax base erosion is a complicated, multistage process. There are many opportunities that an individual can pursue, and all must be considered—and, more important, quantified—in formulating strategies to combat erosion.

Notes

1. A good discussion of the administrative dimension of base erosion is in Richard M. Bird, "The Administrative Dimension of Tax Reform in Developing Countries," in *Tax Reform in Developing Countries,* ed. Malcolm Gillis (Durham, N.C.: Duke University Press, 1989), pp. 315–46; and Charles E. McLure, Jr., John Mutti, Victor Thuronyi, and George R. Zodrow, *The Taxation of Income from Business and Capital in Colombia* (Bogota: Dirección General de Impuestos Nacionales, 1988). For case studies in developing countries, see Federico J. Herschel, "Taxation of Agriculture and Hard-to-Tax Groups," in *Fiscal Reform for Colombia,* ed. Richard Musgrave and Malcolm Gillis (Cambridge, Mass.: Harvard Law School, International Tax Program, 1971), pp. 387–415, and "Tax Evasion and Its Measurement in Developing Countries," *Public Finance* 33 (1978): 232–66; Daniel M. Holland, "Measuring and Combating Tax Evasion," in *Proceedings of the 38th Congress of the International Society of Public Finance, Copenhagen* (Detroit: Wayne State University Press, 1982); and National Tax Research Center, "A Study on Tax Administration and Compliance," Republic of the Philippines, National Economic Development Authority, 1986.

2. Some country studies have attempted to quantify noncompliance (e.g., for the Philippines, National Tax Research Center, "A Study on Tax Adminis-

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tration and Compliance"; for Argentina and Colombia, Herschel, "Taxation of Agriculture and Hard-to-Tax Groups"), but so far as we can determine no developing country makes such estimates on a regular basis. For a discussion and critique of the approaches to measuring income tax evasion, see Somchai Richupan, "Determinants of Income Tax Evasion," in *Supply Side Tax Policy*, ed. Ved Gandhi (Washington, D.C.: International Monetary Fund, 1987), pp. 140–74.

3. We confine our analysis of illegal base erosion to income tax nonfiling and underreporting as it relates to legal source income. The broader focus on illegal source income and the underground economy is beyond the scope of this article. Estimation of the size of the underground economy is discussed in Vito Tanzi, ed., *The Underground Economy in the United States and Abroad* (Lexington, Mass.: Lexington Books, 1982).

4. The exchange rate between Jamaican and U.S. dollars was 1.93 in 1983, 3.94 in 1984, and 5.56 in 1985.

5. The tax rate schedule prior to reform was:

Income	*Tax Rate*
Under J$7,000	.30
7,000–10,000	.40
10,001–12,000	.45
12,001–14,000	.50
Over J$14,000	.575

At 1983 exchange rates, the 30% bracket applied to the first US$3,627 of income, and the 57.5% bracket began at US$7,254. Per capita Jamaican income in 1983 was US$1,614.

6. The sample was drawn in the summer of 1983, and 1980 was chosen because it was feared that lags in filing would lead to incomplete samples if more recent years were selected.

7. For example, a taxpayer with income of J$10,000 and credits of J$2,000 has an implied tax liability of J$1,300 (or J$3,300–J$2,000). If taxes actually paid via employer withholding are only J$1,100, then there is imputed overtime of J$2,000, since the tax liability on J$8,000 of regularly taxed income and J$2,000 of overtime income is J$1,100 (or just J$3,100–J$2,000).

8. There is some doubt that what we have calculated as "overtime income" is in fact compensation for true overtime activities, given the observed distribution by income class and the nature of the Jamaican economy. Government officials have identified several possible explanations for the discrepancies: random error, business expenses of salespeople, and outright PAYE evasion. We and the government personnel with whom we worked concluded that the most likely reason for the discrepancies was evasion. Note, however, that the magnitude of the tax discrepancies and their impact on revenue loss are unaffected by the true reason for their existences. We have chosen to attribute the discrepancies to overtime simply for expositional convenience. The issue is explored at length in James Alm, Roy Bahl, and Matthew N. Murray, "Tax Structure and Tax Compliance," *Review of Economics and Statistics* 72, no. 4 (November 1990): 603–13.

9. The Ministry of Health was extremely helpful in identifying barbers and beauticians, since these individuals must be registered with the government. The Inland Revenue Department also facilitated the identification of beverage and spirit outlet operators.

10. In fact, the classification procedures were somewhat more complex. Seven categories of filing status were identified: (1) A return was located, and

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relevant data were recorded. (2) No taxpayer reference number could be located but neither a file nor a charge-out card (i.e., a record indicating the return had been taken from the file by ITD personnel) could be located. (4) A taxpayer file was found, but no return was present. (5) A taxpayer file was charged out and could not be located. (6) Two taxpayers had the same taxpayer reference number. (7) The taxpayer was not liable for a return. Filers were identified as category 1, and all other categories were classified as nonfilers. This procedure may lead to some overestimate of the extent of nonfiling. However, any upward bias is small, since categories 2 and 4 are clearly nonfilers, and these two categories account for 9,943, or 90 percent, of the 10,995 non-category-1 classifications.

11. The self-employed sample covered the period 1982 to 1984. Approximately 4,100 names were drawn each year of the sample. Results for the 1983 self-employed sample were used in order to make comparable the information across the various samples.

12. For example, see the discussion of U.S. data by Charles T. Clotfelter, "Tax Evasion and Tax Rates: An Analysis of Individual Returns," *Review of Economics and Statistics* 65 (1983): 363–73.

13. Only Clotfelter has had access to direct, individual measures of tax evasion, obtained from the U.S. Internal Revenue Service Taxpayer Compliance Measurement Program (TCMP). Virtually all other empirical work on compliance has been for the United States and has used TCMP data for 1969 aggregated to the three-digit zip code level. See, e.g., Ann D. Witte and Diane F. Woodbury, "The Effect of Tax Laws and Tax Administration on Tax Compliance: The Case of the U.S. Individual Income Tax," *National Tax Journal* 38 (1985): 1–13; and Jeffrey A. Dubin and Louis L. Wilde, "An Empirical Analysis of Federal Income Tax Auditing and Compliance," *National Tax Journal* 41 (1988): 61–74.

14. Results for the constant and for dummy variables for the year in which the audit or examination took place are omitted for brevity. The full set of results is available on request.

15. The second sample also consists of audited tax returns from the ITD. This "tax audit sample" includes 148 audited returns for 1980–82, with 67, 56, and 25 returns from the respective years. Unfortunately, the same information was not recorded for the two samples. For the tax audit sample, all pre- and postaudit tax return entries were recorded, including detailed information on types of income and credits. For the self-employed sample, all preaudit information was recorded, but the only postaudit data recorded were corrected income and tax liabilities. In addition, the self-employed sample consists of examinations, while the tax audit sample comprises exclusively more detailed line-by-line audits. Consequently the two samples were not combined in estimation. Nevertheless, we also used the tax audit sample to estimate the determinants of underreporting. The Tobit maximum likelihood estimation results are:

	Dependent Variable	
Independent Variable	*Underreported Income*	*Underreported Taxes*
MTR	2.03	4.58
	(2.94)	(6.01)
INCOME	2.0×10^{-5}	4.6×10^{-5}
	(1.23)	(2.80)
FAMILY	−.05	−.09
	(1.40)	(2.23)

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Independent Variable	Dependent Variable: *Underreported Income*	*Underreported Taxes*
BENEFIT	−6.08	4.10
	(1.62)	(1.04)
DWAGE	−.44	−.66
	(1.51)	(2.29)
DIVIDEND	−1.84	−1.18
	(3.05)	(2.64)
DRENT	−.40	−.10
	(1.40)	(.37),

where the dependent variables are in logarithmic form; MTR, INCOME, and FAMILY are defined as in the text; BENEFIT measures the marginal benefits from the various payroll programs, calculated by using postaudit income; DWAGE, DIVIDEND, and DRENT are dummy variables that indicate the presence of wage, dividend, or rental income, respectively; and asymptotic *t*-statistics are in parentheses. The responses of evasion to changes in these variables are generally similar to those in the self-employed sample.

16. There is a large empirical literature on the determinants of compensation choice, at least for the United States. See, e.g., Witte and Woodbury; and James E. Long and Frank A. Scott, "The Income Tax and Nonwage Compensation," *Review of Economics and Statistics* 65 (1982): 211–19. The specification here is based on their work.

17. Results for the constant and for dummy variables for income classes are omitted. The full set of results is available on request.

18. In 1984 Peat, Marwick, and Partners (PMP) surveyed 25 different job classifications in 18 public and private sector companies for the government of Jamaica. In all, 265 positions were surveyed. The PMP survey generated detailed information on the amount and the composition of employee compensation. Average wages are J$26,086, and average allowances are J$22,949, so that allowances average 46.8% of total compensation. The most common and the largest allowances are for housing and cars, followed by entertainment, bonus, and travel. This information was used to estimate the determinants of the allowance share. The estimation results are:

$$\underset{}{\text{ALLOWANCE}} = \underset{(6.58)}{.73} \; \underset{(-3.85)}{-.84 \times (1-\text{MTR})} + \underset{(5.26)}{7.97 \times 10^{-6} \times \text{INCOME}}$$

$$+ \underset{(1.84)}{.05 \times \text{DPRIVATE}}$$

$$R^2 = .23, \; F = 26.86,$$

where ALLOWANCE is the share of allowances in total compensation, other variables are defined in the text, and *t*-statistics are in parentheses. Use of this equation to estimate total allowances for all PAYE employees indicates that allowances are J$258.0 million. Although PMP believes the PMP survey information to be very accurate, there is reason to question whether the information is representative of compensation practices in the entire Jamaican economy. The survey was small and was not randomly drawn, the companies selected were those that had dealt previously with PMP, and the positions selected were predominantly upper-level job classifications. The potential bias from the sampling procedure is shown most clearly by comparing the high average wage in the PMP survey (J$26,086) with the average wage of PAYE workers

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(J$7,630). Therefore, in our analysis, we used results from the Revenue Board Survey. Still, the level of estimated allowances is nearly the same for the two surveys.

19. An alternative is the currency-based gap approach. For a discussion of this methodology, see Tanzi, ed. (n. 3 above).

20. See, e.g., R. K. Datta, "The Parallel Economy in India," *Indian Economic Journal* 3 (1983): 19–54; and Herschel, "Tax Evasion and Its Measurement in Developing Countries" (see n. 1 above).

21. Where the problem is underreporting, investment in improved auditing can pay substantial returns. Malcolm Gillis, "Comprehensive Tax Reform: The Indonesian Experience, 1981–1988," in Gillis, ed. (n. 1 above), p. 108, gives the example of Indonesia where a special audit strike force brought in returns that were 340 times the investment. See also the discussion of tax administration in Bird (n. 1 above); and McLure et al. (n. 1 above).

Oxford

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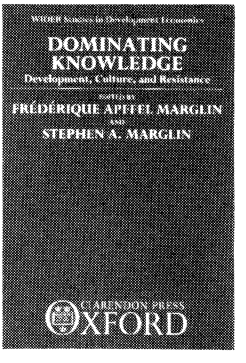
Edited by FRÉDÉRIQUE APFFEL MARGLIN, *Smith College*, and STEPHEN A. MARGLIN, *Harvard University*



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