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Informal Taxation

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Informal Taxation*

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Abstract

Informal payments are a frequently overlooked source of local public finance in developing countries. We use microdata from ten countries to establish stylized facts on the magnitude, form, and distributional implications of this "informal taxation." Informal taxation is widespread, particularly in rural areas, with substantial in-kind labor payments. The wealthy pay more, but pay less in percentage terms, and informal taxes are more regressive than formal taxes. Failing to include informal taxation underestimates household tax burdens and revenue decentralization in developing countries. We discuss various explanations for and implications of these observed stylized facts.

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1 Introduction

A key function of government is the finance and provision of local public goods. Taxation allows communities to overcome the free rider problem that would otherwise lead to underprovision of these goods. In many developing countries, formal direct taxation of households is limited, comprising only 18% of total tax revenues on average compared with 45% in developed countries (Roger Gordon and Wei Li 2009).[1] Agricultural sectors are often entirely exempt from taxation, and local taxation is generally quite constrained (Richard M. Bird 1990; Robin Burgess and Nicholas Stern 1993). These facts would suggest that local public goods are primarily financed outside the local community, either through direct provision or intergovernmental grants.

Substantial anecdotal evidence, however, suggests that local residents in many communities throughout the developing world do contribute substantially – outside the formal tax system – to the construction and maintenance of local public goods (e.g., Elinor Ostrom 1991). People pay in both money and labor to these projects, with often complex arrangements determining how much each household should pay and what penalties apply for those who free ride. Many countries even have specific vocabulary to describe these systems, such as *gotong royong* in Indonesia and *harambee* in Kenya.

We refer to these mechanisms of financing of local public goods as "informal taxation." We define informal taxation as a system of local public goods finance coordinated by public officials but enforced socially rather than through the formal legal system.[2] Our distinction between formal and informal (legal versus social enforcement) parallels the use of these terms in the informal insurance literature (e.g. Robert Townsend 1994). The involvement of public officials, discussed in more detail below, distinguishes informal taxation from, for example, provision of local public goods by charities or other non-governmental organizations.

In this paper, we develop some of the first systematic micro-evidence on the magnitude, distrib-

[1] These figures refer to personal income taxation and are calculated from Table 1 of Gordon and Li (2009).

[2] This is not to be confused with bribe payments, which are occasionally also referred to as informal taxation. To the best of our knowledge, the system of financing local public goods through these types of payments was first described as informal taxation by Remy Prud'homme (1992), who, in his study of local public goods provision in Zaire, defined informal taxation to include any "nonformal means utilized to finance the provision of public goods and services."

utional implications, and forms of informal taxation, using a micro dataset we assembled consisting of survey data from ten developing countries throughout the world. We then discuss a variety of potential explanations for the phenomenon and the broader implications of our findings for public finance and policy in developing countries.

The first stylized fact we document is that informal taxation is a widespread phenomenon, and it can form a substantial share of local revenue. The share of households making informal tax payments is 20% or higher in all but one country in our sample and exceeds 50% in several countries. Participation rates are always higher in rural areas than in urban areas. Across our sampled countries, informal taxes generally comprise a small share of household expenditure (0.85% in the median country) and a modest share of total taxes paid by households (15.7% in the median country). However, informal taxes can still be an important source of local public finance. In our Indonesia sample, for example, including informal taxes increases the estimates of the amount of revenue under local control by over 50%.

The second stylized fact we document is that, within individual communities, informal taxation is redistributive but regressive. Wealthier households in a community are generally more likely to participate in informal taxation schemes than poorer households. The elasticity of total payment with respect to household expenditure is positive but less than one in all countries, indicating that informal taxes rise with expenditure, but the average informal tax rate (i.e., informal taxes divided by total expenditure) falls with expenditure. Informal taxation is therefore regressive, but still provides redistribution if the local public good it finances is valued equally across the income distribution. Informal taxes are more regressive than formal taxes, both within communities and when examined in aggregate at the national level.

The third stylized fact we document is that the form of payment differs from a traditional tax; in particular, in-kind labor payments play a substantial role in informal taxation. Moreover, both the participation gradient and the elasticity of payment with respect to household expenditure are smaller for labor payments than for money payments, so that labor payments are relatively more important for poorer households. All three stylized facts we observe are remarkably consistent across countries.

We then consider a variety of possible explanations for the observed stylized facts. First, informal taxation may be a response to constraints on the revenue raising capacity of local governments: informal taxes may be the only way for these governments to meet their demand for public goods. Second, informal taxation may arise as the solution to a constrained optimal tax problem even when formal taxation is available. In particular, if communities in developing countries have information about people's incomes that is not verifiable by courts (and therefore cannot be used in a formal tax system), it may be optimal to levy informal taxes to use this information. Third, informal tax payments may represent a user fee or benefits tax for the associated public goods provided. Finally, these payments may represent purely voluntary contributions to community projects, motivated by altruism.

In Section 5, we discuss these (non mutually exclusive) hypotheses as well as their relation to the empirical evidence on informal taxation. A limit to the constraints on formal taxation story is that it does not make direct predictions about the form or distribution of payments. In contrast, the optimal tax story can reconcile many of the observed facts (prevalence in rural areas, positive income gradients, and the prevalence of labor payments), although we do find that in cases where the good is excludable, such as water supplies or schools, informal taxes may behave more like a type of user fee. Finally, while payments may be at least partly motivated by altruism, survey evidence from Indonesia suggests that informal tax payments cannot be thought of as purely akin to charitable contributions: when asked who decides which households should participate, for example, only 8% of households report that they decide for themselves; 81% report that a local leader decides.

The paper proceeds as follows. Section 2 provides an overview of the existing literature and Section 3 describes the data. Section 4 presents the stylized facts. Section 5 considers various explanations for the observed stylized facts. Section 6 discusses the implications of our findings and concludes.

2 Existing Evidence on Informal Taxation

As noted above, we define informal taxation as a system for financing local public goods, characterized by social enforcement and the involvement of public officials. Qualitative evidence from a variety of settings suggests that informal taxation is a common form of local finance for the construction and maintenance of public goods such as roads, schools, and water systems throughout the developing world (e.g., Ostrom 1991), although formal empirical evidence on informal taxation remains fairly limited. A range of studies have documented the presence of informal taxation in various countries in Latin America, Africa, and Asia.[3]

In many of these countries, informal tax systems appear to form a very important component of community development. In Indonesia, for example, the concepts of *gotong royong* (mutual assistance) and *swadaya* (self-help) have become deeply institutionalized within local communities: residents are expected to make labor and monetary payments toward development projects – for example, 37% of the cost of village public goods examined by Rao (2004) in Indonesia are contributed by the community. In Kenya, *harambee* (pull together) projects accounted for 11.4% of national development expenditure between 1967 and 1973, and *harambee*-financed spending on particular sectors, such as education, matched or exceeded government expenditure (Mbithi and Rasmusson 1977).

Several patterns emerge from the range of anecdotes and studies of informal taxation. First, payments do not appear to be chosen by households individually. Rather, expected payments are generally coordinated by community leaders or a project committee. Households may be expected to provide a given monetary payment, as in the case of school fees in Kenya (Miguel and Gugerty 2005), or provide a certain number of days of labor (Ostrom 1991; Sharon R. Roseman 1996). In some cases, there may be a choice between paying in labor or in money (Njoh 2003).

Second, many of these studies document the existence of non-contributers and describe a range of punishments that may be imposed on such individuals. Miguel and Gugerty (2005) provide

[3] A non-exhaustive list of countries includes Cameroon (Ambe Njoh 2003), China (Richard S. Eckaus 2003), India (Vijayendra Rao 2004), Indonesia (Rao 2004; Victoria A. Beard 2007), Kenya (Philip M. Mbithi and Rasmus Rasmusson 1977; Peter M. Ngau 1987; Barbara P. Thomas 1987; Joel D. Barkan and Frank Holmquist 1989; Edward Miguel and Mary Kay Gugerty 2005), Nigeria (Joel D. Barkan, Michael L. McNulty, and M.A.O. Ayeni 1991), Pakistan (Asim Khwaja 2009), Peru (Jaime L. Larrabure 1966), and Zaire (Prud'homme 1992).

several anecdotal examples of social sanctions in the context of school financing in western Kenya.[4] A common sanction is the public announcement of the names of parents who are late with fees; other forms of sanctions include "sending letters to the homes of parents late with fees, asking local church leaders to encourage payment during sermons, and making personal visits to the individual homes of debtors accompanied by the local Chief" (Miguel and Gugerty 2005). Other examples of punishments include fines (Ostrom 1991) and the denial of access to communal resources, such as the use of a cattledip (Thomas 1987).[5] It is possible that punishments could also include exclusion from community credit or risk-sharing arrangements or other types of social enforcement, as in the informal insurance and microfinance literatures.

Our own direct experience with informal taxation in a village in Central Java, Indonesia, echoes many of these themes. In 2002, a village where one of the authors was staying received 29 drums of raw asphalt from the district government. In order to make use of the raw asphalt to resurface a road, the village needed to raise funds for additional materials (e.g., finely crushed gravel, coarse gravel, sand) as well as labor. To solve this problem, the village head called a meeting in the neighborhood where the road would be built. At that meeting, the village head, neighborhood head and an informal community leader (a local school teacher) went around the room "assigning" payments to each household. These payments increased with income: poorer households would be asked to pay a small amount (usually a few days of labor), whereas wealthier households were asked to pay in money, with the wealthiest households asked to pay the most. The meeting did not specify what sanctions would be for non-payment; however, given that payments were assigned in a public meeting, one can presume that there would have been social pressure applied to those who failed to meet their assigned payment level.

To the best of our knowledge, quantitative work on the distribution of informal tax burdens has focused on two countries: Indonesia and Kenya. Beard (2007) finds that Indonesian households with more assets or more education pay more in labor and money toward informal taxation; those with high household expenditure pay less. Note that these effects are not unconditional: regressions

[4] The paper argues that limited ability to impose social sanctions in ethnically diverse communities leads to lower financing of local public goods.

[5] Note that in this case, the cattledip was not the good for which contributions were being raised; rather, it was a separate (excludable) resource used to enforce contributions.

include all of these factors as independent variables. In surveys of particular communities in Kenya, Thomas (1987) finds that labor payments are widespread and that the rich are more likely to make cash payments than the poor, and Barkan and Holmquist (1989) find that participation and labor payments tend to follow an inverse U-shape with respect to landholding while payments in cash are increasing in landholding.

An open question is whether or not informal tax mechanisms appear similar across the broad range of countries in which they are observed. In the next sections of the paper, we provide systematic cross-country evidence to document several stylized facts about informal taxation.

3 Data

We compiled microdata from around the world to create a dataset that covers the phenomenon of informal taxation in as many countries as possible. We examined over 100 household surveys, including (but not limited to) every publicly available World Bank Living Standards Measurement Study (LSMS) survey.[6] To be included in our sample, a survey needed to elicit information specifically about payment towards the provision of local public goods. A typical example of such a question is: "In the last 12 months did you personally or any other member of the household participate in any of the following ... participate in the collective construction of community works (roads, schools etc.)."[7] Our sample includes every household survey that met this criterion. We did not include surveys that asked only about labor sharing agreements among neighbors or contributions to local social organizations or cases in which the labor was clearly compensated, such as paid public works days.[8]

In addition to these pre-existing datasets, we designed a special survey module on informal taxation for the Health and Education Service Survey in Indonesia. This survey module included detailed questions on labor and monetary payments as well as questions on the decision-making process and enforcement of informal taxation not available on the other surveys in the sample. The

[6] The review of surveys was conducted in the summer of 2006.

[7] Guatemala, National Survey of Living Conditions, 2000.

[8] It is still possible that in some cases those paying labor are partially compensated by being provided food or other benefits not observed in our data.

Indonesia survey was conducted by Gadjah Mada University and The World Bank as a baseline survey for a poverty-alleviation program. The survey took place in 5 provinces from June-September 2007, and covered a total of 12,000 households in over 2,300 villages. More details about the survey can be found in Benjamin A. Olken, Junko Onishi, and Susan Wong (2008).

The types of community works mentioned on these surveys include roads, water and sanitation systems, schools, health centers, dams and irrigation systems, electricity systems, and cleaning of public roads and areas.[9] While we refer to these goods as local public goods, they may be excludable in some cases. We return to this issue in Section 5.

The resulting sample consists of household surveys from 10 countries: Albania, Ethiopia, Guatemala, Indonesia, Nigeria, Nicaragua, Panama, the Philippines, Vietnam and Zambia. A potential concern with our sample of countries is that relevant survey questions are more likely to be included in countries where the phenomenon is prevalent. However, we can see that informal taxation is not geographically isolated to a particular region of the world: the sample contains countries from Europe, Latin America, Africa, and Asia. In addition, as discussed in Section 2, anecdotal evidence indicates that informal taxation is common in many other countries that are similar to our sampled countries.

Table 1 provides an overview of our sample of household surveys. The surveys were conducted between 1997 and 2007, and sample sizes range from approximately 1,500 to 30,000. The surveys are nationally representative with the exceptions of Ethiopia, Indonesia, and the Philippines, which were conducted in rural areas only. Indonesia and the Philippines focus on a poorer-than-average selection of rural areas, since both surveys were conducted as baseline surveys for poverty alleviation programs. As shown in the table, all surveys contain information on in-kind labor payments toward public goods; monetary payments and quantity data are available for subsets of countries. Note that the recall period varies across surveys: while most surveys ask about payments over the past year, one survey (Philippines) asks only about the previous six months and two surveys (Nicaragua and Zambia) ask about the previous 5 years (Web Appendix A provides more details on the specific questions and survey sample for each country).

[9] The Indonesia and Philippines surveys also includes payments towards religious places. All results remain very similar if we exclude those who only made these types of payments.

Summary statistics for each survey are given in Table 2. The summary statistics (as well as per-capita GDP from the World Development Indicators) indicate the breadth of countries covered by our data. For example, per-capita GDP in the surveyed countries ranges from a low of PP$774 in Zambia to a high of PP$6129 in Panama, and mean years of education for the household head ranges from a low of 2.5 in Ethiopia to a high of 9.6 in Albania.

We include survey data from all available countries in our empirical analysis in order to paint as complete a picture as possible of the informal taxation phenomenon. One caveat, however, is worth noting explicitly. To the best of our knowledge, public labor contributions are legally mandated in Vietnam. If an individual cannot fulfill his required contribution, he must find a replacement worker or make a monetary payment equivalent to hiring a replacement at local labor costs.[10] The payments observed in Vietnam may therefore be a formal tax rather than an informal tax.

4 Stylized Facts and Implications

This section presents several stylized facts about informal taxation. We focus on the following questions that are relevant when thinking about any tax: where is it most prevalent? how large is it? who pays it? and how is it collected? The first subsection summarizes the prevalence and magnitude of informal taxation and compares the magnitude of informal taxation to formal tax payments made by households and to formal government expenditure. In the second subsection, we examine the distributional implications of informal tax payments and discuss the progressivity of informal taxation relative to formal taxation. The third subsection discusses how these taxes are collected and explores a feature of informal taxation that sharply distinguishes it from conventional taxation: payments are often in labor rather than money. The final subsection provides a brief discussion of the implications of these findings for public finance in developing countries.

[10] Specifically, as of the year 2000, each citizen (men 18-45 yrs old, women 18-35) is required to participate in public service work, for 10 days per year. If one cannot participate, the individual needs to find some replacement worker or submit a financial contribution either to the commune/ward people's committee or to the individual's employing institution/enterprise. This payment is once per year (per individual), and the required amount is set equivalent to the hiring of replacements at local labor costs. The law specifies different degrees of formal punishments depending the type of violations: for example, avoidance for the first time gets a warning and fine. We thank Trang Nguyen for providing this information. The features of the system may result in over-reporting if individuals do not believe their responses will be confidential.

4.1 Prevalence and Magnitude of Informal Taxation

4.1.1 Descriptive statistics on prevalence and magnitude

We begin by presenting descriptive statistics to examine the most basic question about informal taxation: prevalence. Table 3 presents three sets of descriptive statistics: the share of households making informal taxation payments over the recall period (Panel A), the share of households making in-kind labor payments vs. payments in money and materials (Panel B), and the average amounts of those payments (Panel C) for each country in our sample.[11]

Informal taxation is prevalent in all surveyed countries (Panel A). With the exception of Albania, participation rates are 20% or higher in all countries and exceed 50% in Ethiopia, Indonesia, and Vietnam. Informal taxation is more prevalent in rural areas in every country in our sample for which we have data on both. Across the sample, participation rates are between 27% (Vietnam) and 183% (Guatemala) higher in rural areas than in urban areas.

In-kind payments in the form of labor are common in all countries (Panel B). The share of households paying in labor is higher than the share of households paying in money in 3 of the 5 countries for which we have data on both labor and monetary payments (Indonesia, Nicaragua, and Zambia). In the other two countries (Panama and Vietnam), labor payments are still quite common, with 19 and 24 percent of households making payments in labor, respectively. The gap between urban and rural is smaller for monetary payments than for labor payments in all cases.

Panel C shows the magnitude of informal tax payments for all countries for which quantity data are available. The figures shown represent annualized labor payments (in days) and annualized monetary payments (in 2000 PPP US dollars). Average labor payments vary from 0.2 days per year in Albania to 14.1 days per year in Ethiopia.

[11] As noted above, the recall period differs across surveys. We report annualized amounts for quantities but do not adjust the participation data. To facilitate interpretation, the surveys in this and subsequent tables are sorted by survey recall period. For surveys in which respondents were asked only about labor payments, the listed participation rates for "overall participation" can be thought of as lower bounds on true participation rates.

4.1.2 Informal taxes and formal taxes paid by households

To better gauge the magnitude of informal taxation, we compare it to two types of benchmarks. In this subsection, we examine the burden it imposes on households by comparing informal tax payments to household expenditure and to total taxes paid by households. These benchmarks are available for the same households for whom we have data on informal taxation payments, ensuring consistent samples for comparison. In the next subsection, we compare informal taxation to government budgets.

In order to make these comparisons, we monetize the labor payments made by households to construct a measure of total informal tax payments. To do so, for each country we predict the wage for all working household members based on their education, age, gender, and urban/rural status, and value the labor contributions at the average predicted wage for all working household members. We use the predicted daily wage rate, rather than the household daily wage rate, so that when we regress payments on household expenditures below, we will not be using expenditures on both the left hand and right hand sides of the same regression.[12] This method values the marginal and average wage of the household equally. This assumption is consistent with Dwayne Benjamin (1992) who shows that household composition does not affect own-farm labor supply for agricultural households in Indonesia, suggesting that labor markets for these households are competitive and complete. Using predicted wages measures the magnitude of informal taxation as the social cost of production, which may differ from the value of output produced if the opportunity cost differs from the marginal product on the project.

It is important to note the implications of using the household's predicted wage rate to monetize days of contributions, rather than a measure of the "true" wage. First, taking the average predicted wage across the household, rather than trying to estimate the wage for each individual, means that if contributions are made by those with the lowest opportunity cost of time, our estimate of the average household wage may be an overestimate. On the hand, it is possible that some people who are listed as "working" in the household do not work a full 260 work days per year, which would lead us to underestimate their true wage rate, or that those who contribute are prime-age

[12] Details of the wage prediction methodology are given in Appendix **??**.

males with a higher marginal product than the average in the household. Second, predicting the household's wage rate using demographics, rather than using total consumption divided by total number of works, has the advantage of removing variation arising from unearned income or labor supply, which would otherwise lead to an upward bias in the estimated wage; however, it also does not take into account dimensions of skill not captured by the included demographics, which could lead to a downward bias. The ideal thought experiment would be to measure the true marginal wage for each household member at the time of year they contribute to informal taxes, though this is not feasible in our data. As an alternative, we therefore discuss specifications using labor measured in days rather than monetized days below.

Income data from developing country household surveys is often unreliable, so we follow the standard convention of using household expenditures as a proxy for household income throughout the paper. Specifically, we use an equivalence scale adjusted measure of household expenditure to take into account children in the household and economies of scale. (Details provided in Web Appendix A.) As an alternative, we have verified that all empirical results are qualitatively similar if we use log total household expenditure and a set of household size dummies instead of log equivalent expenditure.

Data on total tax payments comes from two sources. Direct formal taxes paid by households are calculated as the sum of all direct tax payments observed in the data, and include items such as land and buildings taxes and personal income taxes. Indirect formal taxes (VAT) are imputed from consumption data and commodity specific VAT and excise rates for each country. We do not include expenditures on food in our VAT estimates, since most households in developing countries are unlikely to pay VAT on most food consumption in practice; nevertheless, we may be overestimating VAT if evasion on non-food items is prevalent. Total formal taxes are the sum of direct and imputed indirect taxes. Further details on the calculation of direct and indirect taxes are given in Web Appendix A.

Using this data, we calculate informal taxes as a share of total household expenditure and informal taxes as a share of total household taxes (informal + direct formal + indirect formal). Table 4 presents the mean of these variables for each country in the dataset. Since some households

may live in areas where informal taxation does not occur, we present both results for all households (rows 1 and 3) and for all households that have non-zero informal tax payments (rows 2 and 4).

Overall, informal taxation appears to comprise a small share of household expenditure, although there is substantial heterogeneity across countries. Mean informal taxation payments range from a low of 0.04% of household expenditure in Albania to a high of 3.8% in Ethiopia. Conditional on making any informal tax payments, shares range from 0.37% (Albania) to 6.8% (Ethiopia).

Informal taxes are a moderate share of total taxes paid by households: mean shares are 0.5% in Albania, 7% in the Philippines, 16% in Vietnam, 17% in Indonesia, and 27% in Ethiopia. As a share of total tax payments, informal taxes are of the same order of magnitude as subnational taxes in developed countries: in 2001, the OECD average of subnational revenue as a share of total revenue was 21.9% (Isabelle Journard and Per Marhis Kongsrud 2003).

4.1.3 Informal taxes and formal government expenditure

To understand how important informal taxation is to local public finance, we compare informal taxation to government budgets. We focus on Indonesia, where for the 2007 budget year we have data on both district expenditures and village expenditures for the districts and villages in our survey area.[13] We convert all amounts to 2000 PPP dollars, and express them in per-household terms. We calculate the mean per-household level of informal taxes and formal taxes from the household survey, as well as the mean per-household level of village and district revenues and village and district expenditures for our sample area; results are given in Table 5.[14]

We find that informal taxes are large relative to village budgets. Average annual per household village budgets are 117.64 dollars per year, whereas our household survey suggests that per household informal taxes are 49.86 dollars per year. The official village budget includes payments in-kind, suggesting that at least some informal taxation is already included in the village budget. The magnitudes demonstrate that informal taxation is one of the primary ways through which local

[13] District budgets come from the Ministry of Finance's Directorate of Fiscal Balancing. Village budgets come from the 2008 PODES (Census of Villages), which reports on the 2007 fiscal year.

[14] Note that the village budgets were available for 19 of the 20 districts in our household survey area. We have therefore calculated all statistics in Table 5 on the same set of 19 districts to ensure maximum comparability. Note also that the household survey sample only includes subdistricts that are no more than 70% urban, so it potentially excludes the very urban central areas of a few districts.

public goods are financed by these villages.

We next compare informal taxation to district budgets. Since Indonesia's decentralization began in 2001, Indonesian districts have primary responsibility for virtually all local public goods, including local infrastructure, water, health, and education. The budget is divided into expenditures on salaries, goods and services, and capital expenditures.[15] These district budgets also include the intergovernmental transfers to villages, so these budgets should be viewed as a superset of the village budgets. Informal taxation payments are 4.4% as large as total district budgets, and 12.6% as large as district spending on capital expenditures. This implies that a non-trivial share of all spending on local public goods occurs through the informal taxation mechanism.

Third, we compare informal taxes with the other taxes that are under the control of local government: formal taxes and fees collected by the village and district governments. Table 5 shows that, other than informal taxation, sources of formal tax revenue under direct control of local governments are limited, as most revenue comes from intergovernmental grants from the national government (which administers the VAT and other taxes). Informal taxes are 1.5 times larger than total village taxes (which likely include at least some "on the books" informal taxation) and 1.15 times as large as total district level formal taxes and fees. Informal taxes are therefore the largest source of finance that is under local control.

The above figures present estimates of informal taxes in which labor payments are monetized as described in the previous section. We have also constructed estimates of informal taxes in which labor payments are monetized using the local unskilled wage rate.[16] The resulting estimates of per household informal taxes decline only slightly, from 49.86 to 44.30 dollars per year. This adjustment does not substantively affect any of our conclusions about the importance of informal taxes as a local revenue source.

[15] Note that the sum of the expenditure categories does not exactly equal the total, as there are a few misc. categories that are not included. Note also that informal taxation payments are not reported in district budgets, so double-counting is not an issue in this comparison.

[16] The local unskilled wage rate is calculated using survey information provided by the village head. We sum the daily wage of a male laborer in the month of the interview in the village/ward with the average value per day of goods provided for consumption while working (if applicable). We then divided by the number of hours worked by laborers on an average day and multiplied by 6 to get the value of labor for a "normal" work day at the village level.

4.2 Distributional Implications of Informal Taxation

This section examines the distributional implications of informal taxation by looking at the relationship between informal taxation payments and household expenditure. We begin by examining the distribution of informal taxation payments within communities, which tells us how the burden for financing a given level of public goods is borne across high and low income individuals in those communities. Since informal taxation payments are determined at the community level, this within-community analysis is the level of analysis one needs for developing models of informal taxation. We then compare the aggregate burden of informal and formal taxation across the income distribution.

4.2.1 Informal taxation within communities

We first examine the participation margin – i.e., which households make informal taxation payments. Since we are interested in looking within communities, we estimate a fixed-effects logit model of the form

$$\mathbf{P}\left(PAY_{hc}=1\right)=\frac{\exp\left[\alpha_c+\gamma LN\left(EQUIVEXP_{hc}\right)\right]}{1+\exp\left[\alpha_c+\gamma LN\left(EQUIVEXP_{hc}\right)\right]} \tag{1}$$

where c is a community, h is a household, α_c is a community fixed effect, and PAY_{hc} is a dummy for whether household h in community c made any payments.[17] The key coefficient is γ, which is the log odds-ratio of the probability of making payments with respect to log equivalent household expenditure. Given the incidental parameters problem, we estimate (1) as a conditional logit model, which conditions out the α_c in estimation. Robust standard errors in this and subsequent regressions are adjusted for clustering at the community level.

The results are presented in Panel A of Table 6. Each cell in the table reports the coefficient on log equivalent household expenditure (γ) from a separate regression of the form in equation (1).[18] The estimated overall participation-expenditure gradient is statistically significantly positive in 6 of

[17] Note that for the Philippines, Albania, Ethopia, Guatemala, and Nigeria, the PAY variable refers to in-kind labor payments only. For all other countries, the PAY variable captures both monetary and in-kind payments.

[18] As discussed above, we obtain similar results in this and subsequent specifications if we regress contributions on log household expenditure and add as controls dummies for household size (not shown).

the 10 countries in our sample and is never negative and statistically significant. The median log-odds ratio among all 10 countries in the sample is 0.19. This demonstrates that the probability of payment is increasing with household expenditure within communities, and this pattern is generally consistent throughout the the countries in our sample.

We next examine the relationship between the quantity of payments and expenditure for countries for which data on the quantity of payments are available. Given the large number of observations with no payments, as well as the large number of fixed effects we wish to condition out, we estimate this relationship as a fixed-effects Poisson quasi-MLE regression with robust standard errors (Jerry A. Hausman, Bronwyn H. Hall, and Zvi Griliches 1984; Jeffrey M. Wooldridge 1999; see also Wooldridge 2002). This estimates, by MLE, equations such that

$$\mathbf{E}\left(PAYMENTAMOUNT_{hc}\right) = \alpha_c \exp\left(\chi LN\left(EQUIVEXP\right)_{hc}\right) \tag{2}$$

where α_c is a community fixed-effect, and $PAYMENTMOUNT$ is the quantity of total payments (in local currency). Given the Poisson QMLE specification, the resulting coefficients χ can be interpreted as elasticities.

To calculate $PAYMENTAMOUNT$, we monetize labor payments using the imputed average household wage as described above.[19] By allowing the wage to vary with household income, we incorporate the fact that providing a day of labor is more costly for those with high opportunity cost.

The results (Table 6, Panel B) show that total payments are increasing in expenditure in all countries for which we have quantity data, and the coefficients are statistically significant in all cases. The estimated elasticities of informal taxation payments with respect to equivalent expenditure are 0.40 in the Philippines, 0.33 in Albania, 0.13 in Ethiopia, 0.39 in Indonesia, and 0.08 in Vietnam. These elasticities are also strictly and statistically significantly less than 1, indicating that while

[19] As an alternative, we have considered a specification in which we examine days, rather than monetizing by the wage rate (results not reported). As one would expect, the coefficients examining just days are generally smaller than in the monetized days specification, although the gradient remains positive and significant in Albania and Indonesia and positive and insignificant in the Philippines and Ethiopia. The coefficient for Vietnam is negative and significant, which may reflect features of the mandatory labor payment system.

payments increase with expenditure, the share of household expenditures devoted to informal tax payments (i.e., the average tax rate) is declining with expenditure.[20] Payments are also increasing in expenditure even conditional on making a positive informal tax payment (Table 6, Panel C), so the overall effects are driven by the intensive margin as well as the extensive margin.[21]

One might be concerned that measurement error in household expenditure data could cause the estimates to be less than one even if informal taxation is truly progressive. However, applying the classical measurement error attenuation bias formula to our estimates shows that measurement error would have to account for more than 60% of the total variation in observed household expenditures in all countries in order for this to be the case. Moreover, as we show below, we estimate that formal taxes are indeed progressive (with an elasticity > 1). Measurement error, if present, also should not affect our overall conclusions about the relative progressivity of informal and formal taxation, discussed in the next subsection.

Together, the results tell a consistent story: within communities, the wealthy pay more in informal taxes than the poor on an absolute level, though they pay less as a share of their total resources.

4.2.2 Comparing formal and informal taxation

We next compare informal taxes to formal direct and indirect tax payments by households. The results are presented in Table 7. For comparison purposes, Panel A shows the relationship between informal taxes and equivalent household expenditures with community fixed effects and Panel B repeats the same regressions for direct formal taxes.

The results in Table 7 show that in all countries we examine, the estimated elasticities of formal taxes with respect to household expenditure are greater than the estimated elasticities for informal

[20] Note that monetizing labor payments at a common rate, rather than at the predicted household wage rate as we do, would make informal taxation appear even more regressive.

[21] As a robustness check for the results in Panel B, we have run OLS regressions of log (total payments + 1) on the log of equivalent expenditure with community fixed effects. This provides a simple way of dealing with the mass at zero contributions in an OLS model while retaining a proportional structure to the model. The OLS coefficients are also all between zero and one, and are broadly similar to the Poisson estimates (although the coefficients for the Philippines and Ethiopia are no longer statistically significant). The results in Panel C are also extremely similar if we instead run OLS regressions of log payments on equivalent expenditure with community fixed effects. These results are available on request.

taxes. For example, the elasticity of formal direct taxes with respect to household consumption is 1.526 in the Philippines, 1.433 in Albania, and 1.372 in Indonesia, so that formal direct taxes are progressive in these countries. By comparison, the analogous elasticity for informal taxes is 0.395 in the Philippines, 0.334 in Albania, and 0.387 in Indonesia, so informal taxes are on average regressive. Note that we use the terms progressive and regressive in reference to the distributional implications of the tax schedules. If informal and formal taxation fund different types of public goods, the distributional consequences of the full tax and expenditure system could differ. However, the difference in progressivity on the revenue side is substantial.

The same overall conclusions hold if we examine income gradients without community fixed effects (Table 7, Panels C and D). The gradients on informal tax payments are between 0 and 1 (with the exception of Vietnam), and the gradients on formal direct tax payments are greater than 1 (with the exceptions of Ethiopia and Vietnam). For all countries, formal direct tax payments are more progressive than informal tax payments.

Figure 1 illustrates these differences graphically, plotting informal taxes, direct formal taxes and total formal taxes (i.e., direct + indirect), all expressed as percentages of total household expenditure. In this graph, a proportional relationship (equivalent to a coefficient of 1 in the table) would would correspond to a horizontal line, so a positive slope indicates progressivity (coefficient > 1 in the table) and a negative slope indicate regressivity (coefficient < 1 in the table). For each country, we plot the results of a non-parametric Fan regression (Jianqing Fan 1992) of each variable against log equivalent household expenditure. These regressions do not include community fixed effects, so they are most comparable to Panels C and D of Table 7. The solid lines in Figure 1 show informal taxes, the dashed lines shows direct formal taxes, and the dotted line shows total formal taxes. For comparison, we also plot a histogram of log equivalent household expenditure. To keep the graphs readable, we have excluded the bottom 0.5% and top 0.5% of the household expenditure distribution. The most striking fact about these graphs is that the formal tax system is progressive in most countries whereas the informal tax system is regressive. Including informal taxation therefore makes the total tax burden look more regressive than previously thought, both looking within communities and at the national level.

4.3 Monetary vs. In-Kind Payments

A notable feature of informal taxation is that payments are often made in labor rather than money (Table 3). To better understand this phenomenon, it is useful to understand in more detail which types of households pay in labor versus money.

To do so, we re-estimate equations (1) and (2) separately for each type of payment, focusing on the countries for which we have data on both monetary and in-kind labor payments. In the quantity analysis, to be consistent with the previous tables, we continue to value labor payments at the household's predicted average wage rate. Using days instead of monetized labor payments generally makes the reported estimates for labor smaller and accentuates the difference between labor and money more than shown in the tables here.

The results for the participation margin – does the household pay any labor or any money – are presented in Panel A of Table 8, and the results on the quantity paid are presented in Panel B of Table 8. The results in both panels show a very clear pattern: for almost all countries in the sample, monetary payments increase more quickly with overall household expenditure than in-kind labor payments. This is true both on the participation margin and, for the two countries where we have quantity data, on the quantity margin as well. For example, looking within communities in Indonesia, the elasticity of labor payments with respect to household expenditure is 0.26, but the elasticity of monetary payments with respect to household expenditure is 1.45 (see Panel B of Table 8). This implies that monetary contributions are particularly concentrated at higher income levels.

4.4 Implications

These stylized facts have several implications for public finance in developing countries. First, a substantial share of households in many developing countries participate in these mechanisms. The results from Indonesia suggest that informal taxation can, at least in some cases, be the largest source of revenue for local communities and may be a non-trivial component of national spending on public capital improvements. Failing to take informal taxation into account will lead to underestimates of the tax burden faced by households, the size of the public sector, and the level

of decentralization. Second, informal taxation is redistributive but regressive, and this pattern is observed in almost all of our sample countries. Formal taxes appear to be more progressive than informal taxes, so estimates of formal taxes alone may result in overestimates of the overall progressivity of the tax system. Finally, a notable feature of informal taxation is that in-kind labor payments are an important source of finance and are made even by households with relatively high household expenditure.

These findings also raise a number of questions. Why would communities choose such mechanisms of finance, and why do they tend to be concentrated in developing countries and poor and rural areas? What determines the distribution of payments across individuals within a community, and why do wealthier households pay more than poorer households? Why are in-kind payments so prevalent in informal tax systems when they are rarely seen as part of modern formal tax systems and why labor payments arise in equilibrium. In the next section, we discuss several possible explanations for the patterns observed in the data.

5 Explaining the Stylized Facts

There are a number of (non-mutually exclusive) possible explanations for the observed stylized facts. This section outlines four potential such explanations: informal taxes as a response to explicit legal constraints on formal taxes, informal taxes as an optimal response to information and enforcement problems, informal taxes as user fees, and informal taxation as altruistic voluntary contributions.

5.1 Informal taxation as a response to legal constraints on formal taxes

A first possibility is that informal taxation is simply a response to constraints on the ability of local governments to raise formal taxes to meet their demand for local public goods. Local governments may be legally prohibited by the center from levying certain types of taxes, or capacity problems may prevent them from being able to set up effective systems of formal taxation. If their demand for public goods exceeds intergovernmental transfers, informal taxation may be the only mechanism through which additional public goods can be financed.

This story is consistent with observed instances of informal taxation in the United States, which appear to arise when there are explicit constraints on local ability to raise revenue. When Vermont's school finance redistribution law made financing schools through higher local taxes more expensive, for example, some communities responded by explicitly pressuring households and businesses to make "voluntary" contributions to schools.[22] School fund leaders in Manchester, VT, for example, published lists of compliers and encouraged residents to call or visit non-contributer neighbors.[23] Residents described a variety of sanctions levied on non-contributers, ranging from specific punishments ("if there is a restaurant that didn't pay, I know that I'm not going to eat there") to more intangible social sanctions ("it's hard to look at those people in the same way"). Similar extragovernmental mechanisms were observed in California when Proposition 13 limited local property taxes (Eric Brunner and Jon Sonstelie 2003). Labor and money contributions to fire departments, libraries, and recreational services have also been shown to increase in response to fiscal limitations (e.g., James M. Ferris 1984; Douglas C. Bice and William H. Hoyt 2000).

While limits on formal taxes may be important, further explanation is required to explain how informal taxation is sustained or to make predictions about the distribution or form of informal taxation. The remaining explanations suggest these types of testable implications, and help understand now just how informal taxation occurs when it is the only choice, but also suggest when it might be optimal even if formal taxes are feasible.

5.2 Informal taxation as an optimal response to information and enforcement constraints

A second possibility is that informal taxation could in fact arise as the solution to a constrained optimal tax problem. In this framework, outlined in detail in Web Appendix B, local governments wish to finance public goods in a social welfare maximizing way and are making a choice between formal and informal taxation. Communities face an enforcement constraint (punishments for non-compliance may be limited) and a hidden income constraint (high ability types can pretend to be low

[22] Winerip, Michael. "On Education; Giving Green or Turning Red." *The New York Times*, February 26, 2003. http://www.nytimes.com/2003/02/26/nyregion/on-education-giving-green-or-turning-red.html

[23] Tomsho, Robert. "Fund-Raising Drive for Schools Leaves Vermont Town Disunited." *Wall Street Journal*, February 6, 2001. http://online.wsj.com/article/SB981415618347518787.html

ability types). We model formal and informal taxation as having different constraint parameters, arising from differences in their tax technologies. In the informal system, enforcement happens through social sanctions rather than through courts. This means that the informal tax system can use information that is observable but not legally verifiable, so informal taxation mechanisms effectively have better information on earnings ability than the formal tax system. On the other hand, by foregoing formal legal proceedings, the informal system must use less severe punishments – i.e., social sanctions instead of jail time – which limits the progressivity of the informal taxation system. The choice between formal and informal taxes therefore represents a trade-off between enforcement and information.

As we show formally in Web Appendix B, informal taxes are likely to be preferred to formal taxes if evasion costs are low or if the community can effectively levy social sanctions. The prevalence of informal taxation throughout our sample of developing countries, particularly in rural areas, is consistent with the existing evidence that informal insurance and credit markets may function more effectively in rural areas, where information is better and villagers are better able to levy informal sanctions for default (Timothy Besley and Stephen Coate 1995; Townsend 1995; Abhijit Banerjee and Andrew Newman 1998; Maitreesh Ghatak 1999) and with existing evidence that local communities have more information about actual income levels than the central government (Harold Alderman 2002; Vivi Alatas et al. 2010). The ability to verify income legally may also be more difficult in developing countries, since many individuals work in or can easily shift into the informal sector. Unsurprisingly, informal taxation mechanisms are not generally observed in developed countries, where it is harder to hide income and where social sanctions may be less effective.

This framework rationalizes the observed positive participation and payment gradients: depending on the distribution of abilities, it may be optimal for the lowest ability types not to participate, and payments should increase with earnings ability. The framework also reconciles the use of in-kind labor payments. In the presence of asymmetric information, labor payments can be used as a screening device, since unobservably high ability types face a higher cost of in-kind labor payments

relative to monetary payments.[24] While use of labor as a screening device has been considered in the design of income maintenance programs (e.g., Besley and Coate 1992), it has not, to the best of our knowledge, been considered in the context of raising revenue. While it may be optimal for individuals to make payments in labor even if their opportunity cost of time exceeds their marginal value on the project, the highest ability type will always pay in money: the equivalent of the "no distortion at the top" result from the optimal tax literature (James A. Mirrlees 1971).

This story implies that communities may choose to make use of informal taxation as a financing mechanism either when there are exogenous constraints on formal taxation, or when formal taxation is possible, but the information advantages of informal taxation allow a system that is more progressive than would be possible under formal taxation.

5.3 Informal taxation as user fees

A third hypothesis is that these payments represent pre-paid user fees or benefits taxes. A pure user fee model would not necessarily generate a positive correlation between household expenditure and payments unless demand for the goods was correlated with household income. If payments represent benefits taxes, then it is possible that payments could be correlated with income; under Lindahl pricing, for example, each household should pay for the public good according to their marginal benefit (in utility terms).

To examine these hypotheses, we look at whether households are more likely to pay for goods for which they benefit and whether this could explain the observed positive participation gradient of informal tax payments. We focus on the two types of goods for which we can clearly separate users from non-users: we examine whether households who have their own private well are less likely to contribute to water projects, and whether those with school-age children are more likely to contribute to schools.[25]

[24] In theory, the screening benefits of using labor taxes extends to formal tax systems as well. However, monitoring in-kind payments may be challenging. If the ability to monitor labor payments informally is greater than the ability to monitor formally (up to the standard of evidence required by the legal system), we would expect labor tax payments to be more common in informal tax systems than in formal tax systems. The model in Web Appendix B introduces a shirking constraint (those supposed to be working on public projects can shirk) to formalize this intuition.

[25] Note that the within-community sample sizes are not large enough for us to construct meaningful overlapping samples. Therefore, the results for project type should be interpreted as illustrating the distribution of payments for the sample of communities for which the share of households making payments to that project type are strictly

For countries for which we have disaggregated data on project type, we do see some mixed evidence of user fees: in some countries, those who are likely to need public water are more likely to pay for water projects and those with children are more likely to pay for schools (Table 9).[26] However, with the exception of Zambia, we do not observe a positive expenditure gradient on participation for schools or water projects, even in regressions where we do not control for having children or not having access to private water. This suggests that while these goods may be financed partially through user fees, these goods are not explaining the overall positive correlation we found above between participation rates and household expenditure. The evidence also does not support a Lindahl pricing mechanism for water and schools, unless demand for these goods is inversely correlated with income, which seems unlikely.

5.4 Informal taxation as altruistic voluntary contributions

Finally, it is possible that these payments are more akin to voluntary charitable contributions than taxes. The range of models of charitable contributions is vast, but it is difficult to reconcile the evidence with a charitable contributions story alone. For example, many of the studies discussed in Section 2 specifically describe the punishments that are imposed on those who do not meet their expected obligations, suggesting that payments are unlikely to be motivated solely by altruism or warm glow preferences (e.g., James Andreoni 1990).

To investigate more systematically the process through which informal tax payments are determined and enforced, we asked both households and village heads in the Indonesia survey to describe who makes decisions regarding household payments and what the consequences are for households who do not participate. The first question we asked was who makes decisions about which households participate in such mechanisms (Table 10). Although respondents were allowed to give multiple responses, only 8% of individual respondents and village heads reported that households make these decisions for themselves; 81% of households report that decisions are made by

between zero and one.

[26] It is difficult to interpret the coefficient on children in the household since we also include equivalent scale expenditure. We use this specification because we are primarily interested in the difference in the relationship between payment and having children in the household across the school and water regressions rather in the level of the coefficient.

neighborhood, hamlet, or village heads. We observe a similar pattern when respondents are asked who makes decisions about how much each household is expected to pay: only 20% of households and 15% of village heads report that households make these decisions for themselves. These consistent responses from individual households and from village heads suggest that the these payments are not decided unilaterally by households, but are rather part of a system determined at the community level.

We then ask respondents about the consequences for not making the determined level of payment. A substantial number of respondents indicated that they would be expected to make up the contribution in another way, either by payment at a different time or in a different form. Most strikingly, 17% of individual respondents and 22% of village heads indicated that non-participating households would be expected to pay a fine. Interestingly, we find that the probability that a household reports a sanction for failure to pay is significantly higher for wealthier households; this could be consistent with poorer households not reporting sanctions because they are not expected to make payments (results not reported in the table). Conditional on some type of sanction being levied, 47% of households stated that the sanction was determined by either the village head or at a village meeting. Charitable contributions motives may be part of what is driving observed payments, but the facts that payment schedules are set by the leader or group, not by the individual, and there are consequences imposed for non-payment suggest that there are other forces at play as well.

Note that use of labor payments is not directly predicted by any of the above stories, with the exception of the optimal constrained tax story discussed in Section 5.2 in which labor payments serve as a screening device. The use of labor payments could also be a response to other types of market failures. If local governments are corrupt, residents may prefer to make payments toward public projects in a form that cannot be expropriated. Another possibility is failures in the labor market, arising from incomplete markets or asymmetric information. If there is excess supply of labor, the opportunity cost of supplying labor may be very low. Local residents may also be more productive than outside hired workers, either because they have better information about how best to implement the project in the local context or because they have less incentive to engage in moral

hazard.

Another important point to note when comparing informal tax mechanisms and formal taxation is that the two types of systems may fund different types of public goods. Under the optimal tax model, production may be limited by the ability of community residents since much of the financing is in the form of in-kind labor. In addition, the requirement that communities impose social sanctions may mean that production is limited to goods for which activities are visible, such as construction of public infrastructure. Alternatively, under the user fee model, these mechanisms are only sustainable for goods that are excludable or for which use can be monitored and fees enforced, and under a "warm glow" voluntary contributions model, the choice of public goods may depend heavily on the preferences of those who are motivated to make such contributions.

6 Conclusion

Informal taxation systems appear to play an important role in local public finance in developing countries. We present some of the first systematic, cross-country evidence on the prevalence, magnitude, distributional implications, and forms of informal taxation. We find that informal taxation is prevalent, with 20% or more of households participating in informal taxation schemes in all but one surveyed country, and more than 50% of households participating in several countries. Informal taxes exceed formal direct tax payments by most households and can form a substantial share of households' total tax burdens. In Indonesia, where we can compare informal taxes to local budgets, we find that informal taxation represents the largest source of public finance under local control and comprises a non-trivial share of all capital expenditures. In all of our sample countries, in-kind payments in the form of labor appear to be an important component of these financing systems, and informal taxation is redistributive but regressive.

Why do these systems arise, and why are they more common in developing countries? One possibility is that they are simply a response to local fiscal constraints: local communities are unable to raise formal taxes to fund their preferred level of public goods, and informal taxation is therefore the only financing mechanism available to them. While this constraint may be important,

it does not fully explain the informal taxation phenomenon, since it suggests no direct predictions about the form or distribution of payments. As we have seen, there are in fact systematic patterns that appear to hold across countries. One possibility is that informal taxation reflects the desire of communities to impose more redistributive (socially enforced) tax schedules than are feasible under formal taxation, by taking advantage of local information about income within the community that is observable but not verifiable. Informal taxation may also represent pre-paid user fees, particularly for goods that are excludable. Finally, contributions may be purely voluntary, reflecting "warm glow" in the provision of public goods. In practice, a combination of these forces may be at work.

Regardless of the underlying mechanism(s) at work, our findings have a number of implications for thinking about public finance in developing countries and for development policy. First, a substantial share of households in many developing countries participate in extragovernmental mechanisms for the finance of local public goods. Policies such as the imposition of formal taxes, paid public works programs, and intergovernmental grants may therefore affect households and communities both directly as well as indirectly, through their effects on informal taxation mechanisms. To the best of our knowledge, this type of crowd-out has not traditionally been considered in the analysis of public programs in developing countries.

Second, to the extent that these payments are thought of as a tax, estimates of formal taxes may understate the true tax burden faced by households. In particular, the conventional wisdom that poor households and households in rural areas do not generally pay taxes other than VAT may be misleading. The potential efficiency costs of these taxes have not, to the best of our knowledge, been considered.

Third, failing to take informal taxation into account will lead to underestimates of the size of the public sector and the level of decentralization. In particular, informal taxation can be the dominant source of revenue for local communities and may be a non-trivial component of national spending on public capital improvements in developing countries. While there has been an increasing push toward decentralization in developing countries, such reforms have generally led to greater decentralization of expenditures than of revenue collection (Pranab Bardhan 2002). Since informal taxes are collected at the community level, these findings indicate that a larger share of

local public goods is financed locally than the formal budget figures would suggest. In addition, informal taxation generally pays for particular types of goods, so formal tax figures will distort estimates of the mix as well as the level of government expenditures.

Finally, formal taxes appear to be more progressive than informal taxes, so failing to take informal taxation into account will result in overestimates of the overall progressivity of the tax system. The findings also suggest that a marginal expansion of the formal tax system through expansion of the VAT, used to allow communities to reduce informal taxes, could substantially increase the overall progressivity of the tax system. However, it is important to keep in mind that most of these formal taxes are not raised by the local community, and determining the appropriate community-specific intergovernmental transfers is challenging. This is a primary reason why local public goods in developed countries are often financed through local taxation.

The findings also have important implications for development policy. Many government programs, such as community-driven development programs championed by the World Bank and others, encourage local co-financing of public goods. Given that financing through informal taxation is more regressive than financing through the overall tax system, there would need to be other benefits of local co-financing to make this co-financing optimal. For example, requiring local co-financing might help reveal information about the local willingness to pay for local public goods, or it could improve project sustainability by encouraging ongoing maintenance of local public goods. Alternatively, as discussed above, it is possible that additional central financing of public goods might crowd out these types of locally-financed public goods, altering both the level and type of public goods provided. There could also be other consequences of formal versus informal financing on community institutions and social networks. Understanding how central government policies interact with informal taxation is an important direction for future research.

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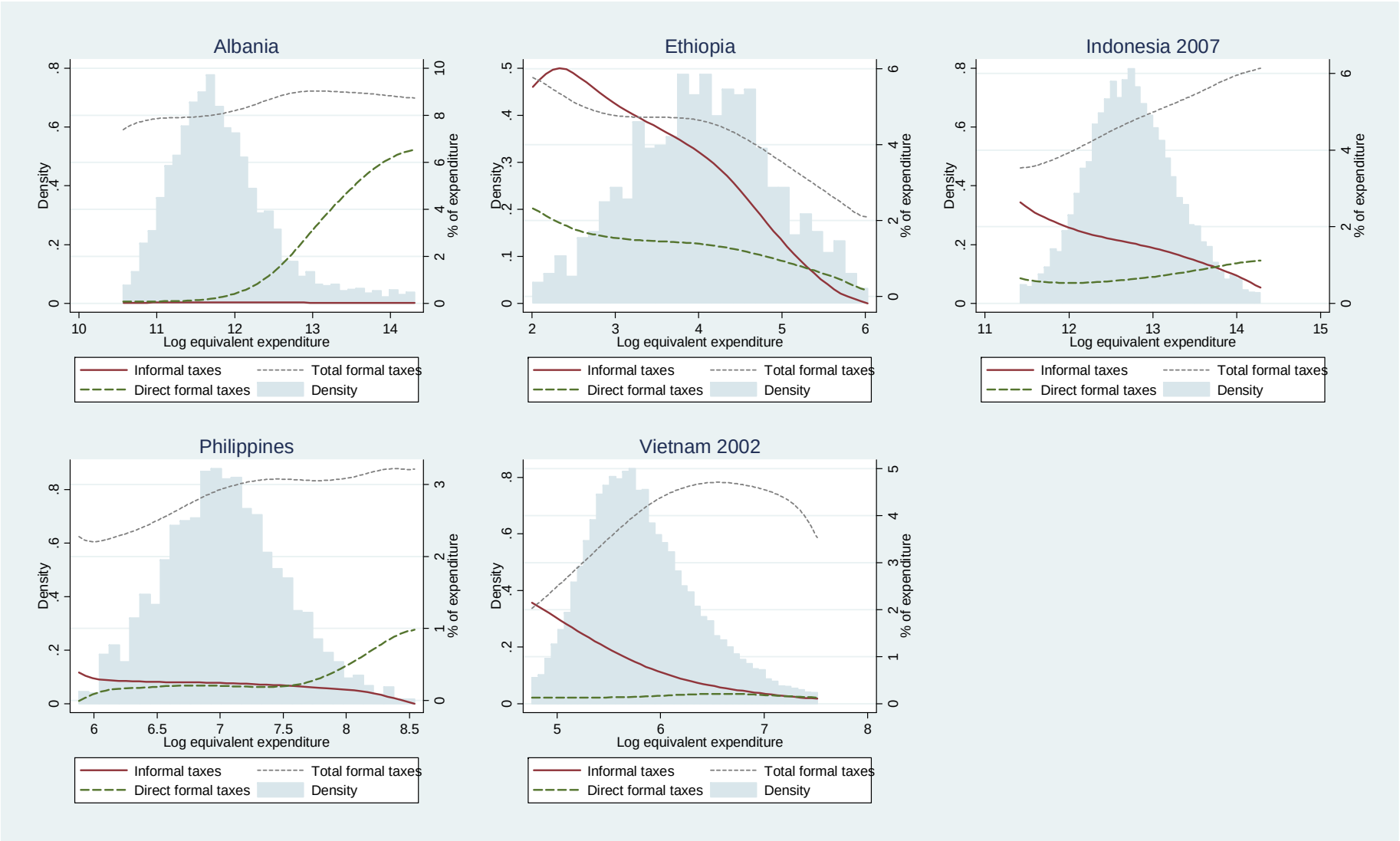
Figure 1: Comparison of formal and informal taxes as a share of expenditure (without community fixed effects)



Notes: Tax variables are plotted as non-parametric Fan regressions of each variable against log equivalent household expenditure. The y-axis shows tax payments *as a share of expenditure*; a negative line therefore corresponds to regressivity. These regressions *do not* include community fixed effects. For comparison, we also plot a histogram of log equivalent household expenditure. To keep the graphs readable, we exclude the bottom 0.5% and top 0.5% of the household expenditure distribution.

Table 1: Data sources

	Database Name	Year	Sample	Sample size (number of households)	Recall period	Labor		Money	
						Payment indicator	Quantity	Payment indicator	Quantity
Albania	Living standards measurement survey	2005	Nationally representative	3,840	1 year	X	X		
Ethiopia	Ethiopian rural household survey	1997	Only rural areas	1,482	1 year	X	X		
Guatemala	National survey of living conditions	2000	Nationally representative	7,276	1 year	X			
Indonesia	Health and education service survey	2007	Only rural areas, focus on poorer areas	11,676	1 year	X	X	X	X
Nicaragua	Living standards measurement study survey	1998	Nationally representative	4,209	5 years	X		X	
Nigeria	Nigeria living standards survey	2004	Nationally representative	19,159	1 year	X			
Panama	Living standards survey	2003	Nationally representative	6,363	1 year	X		X	
Philippines	Living condition Survey	2003	Only rural areas, focus on poorer areas	2,398	6 months	X	X		
Vietnam	Household living standards survey	2002	Nationally representative	29,426	1 year	X	X	X	X
Zambia	Living condition monitoring survey	1998	Nationally representative	16,788	5 years	X		X	

Notes: For more details on each of the surveys, please see Appendix A..

Table 2: Summary statistics

	Albania	Ethiopia	Guatemala	Indonesia	Nicaragua	Nigeria	Panama	Philippines	Vietnam	Zambia
Household size	4.4	7.3	5.2	3.8	5.5	4.8	4.0	5.1	4.4	5.4
Number of workers per household	1.6	1.6	2.1	1.7	1.7	1.5	1.4	1.9	2.5	1.9
Expenditure per capita (in PPP $)	3396	554	2338	1112	2850	489	3514	938	1368	744
GDP per capita (in 2000 PPP$)	4731	814	4048	3423	2910	941	6129	4250	2274	774
% urban	47	0	43	0	57	45	64	0	24	36
Age (Household head)	52	47	44	47	45	48	48	47	48	41
Years of education (Household head)	9.6	2.5	4.1	6.5	4.3	5.1	8.3	5.7	7.0	6.6

Notes: Each cell presents the mean of the variable in the row in the dataset listed in the column weighted using household weights (available for all countries except Ethiopia). When GDP is not available for the survey year, we used the most recent data.

Table 3: Summary of informal tax payments

			Philippines	Albania	Ethiopia	Guatemala	Indonesia	Panama	Nigeria	Vietnam	Nicaragua	Zambia
	Recall Period		6 months	1 year	1 year	1 year	1 year	1 year	1 year	1 year	5 years	5 years
Panel A	Any payment	All	0.33	0.09	0.51	0.37	0.76	0.32	0.26	0.59	0.20	0.23
		Rural	0.33	0.12	0.51	0.51	0.76	0.48	0.32	0.62	0.26	0.27
		Urban		0.07		0.18		0.24	0.20	0.49	0.16	0.15
Panel B	Any labor payment	All	0.33	0.09	0.51	0.37	0.76	0.19	0.26	0.24	0.15	0.18
		Rural	0.33	0.12	0.51	0.51	0.76	0.34	0.32	0.28	0.22	0.23
		Urban		0.07		0.18		0.11	0.20	0.13	0.09	0.08
	Any money payment	All					0.28	0.22		0.50	0.07	0.08
		Rural					0.28	0.30		0.51	0.07	0.07
		Urban						0.18		0.45	0.08	0.09
	Both money and labor payments	All					0.27	0.09		0.15	0.02	0.03
		Rural					0.27	0.16		0.16	0.03	0.04
		Urban						0.06		0.09	0.02	0.02

Notes: Each cell presents the mean of the variable listed in the row in the dataset listed in the column weighted using household weights (available for all countries except Ethiopia). The unit of observation is the household. Some surveys only contained information about labor payments; for these surveys, participation rates given in Panel A will be identical to participation rates for "any labor payment" given in Panel B.

Table 3: Summary of informal tax payments (continued)

			Philippines	Albania	Ethiopia	Guatemala	Indonesia	Panama	Nigeria	Vietnam	Nicaragua	Zambia
Panel C	Amount of labor payment (in days)	All	1.1	0.2	14.1		5.7			3.1		
			(4.2)	(0.6)	(28.3)		(13.2)			(7.3)		
		Rural	1.1	0.2	14.1		5.7			3.5		
			(4.2)	(0.6)	(28.3)		(13.2)			(7.7)		
		Urban		0.1						1.6		
				(0.6)						(5.6)		
	Conditional amount of labor payment (in days)	All	3.3	1.8	27.6		7.5			12.8		
			(6.8)	(1.2)	(34.6)		(14.7)			(9.8)		
		Rural	3.3	1.6	27.6		7.5			12.8		
			(6.8)	(1.0)	(34.6)		(14.7)			(9.7)		
		Urban		2.1						12.9		
				(1.3)						(10.1)		
	Amount of money payment (in 2000 PPP US$)	All					8.9			13.5		
							(167.4)			(19.8)		
		Rural					8.9			13.2		
							(167.4)			(18.4)		
		Urban								14.5		
										(23.6)		
	Conditional amount of money payment (in 2000 PPP US$)	All					32.5			27.2		
							(318.2)			(20.4)		
		Rural					32.5			25.8		
							(318.2)			(18.3)		
		Urban								31.9		
										(25.8)		

Notes: The figures in Panel C represent annualized quantities; numbers in parentheses indicate standard deviations. For reference in interpreting the monetary amounts in Panel C, the average annual per capita expenditure in these samples (in PPP$) is 1112 for Indonesia and 1368 for Vietnam. Conditional amounts reported are conditional on making any payment. Weighted using household weights (available for all countries except Ethiopia).

Table 4: Informal Taxation, Expenditure, and Formal Taxation

	Philippines	Albania	Ethiopia	Indonesia	Vietnam
Informal tax as a share of HH expenditure					
All households	0.23%	0.04%	3.77%	1.43%	0.85%
Conditional on informal tax > 0	0.66%	0.37%	6.81%	1.83%	1.41%
Informal tax as a share of HH Total Formal + Informal Tax payments					
All households	6.94%	0.48%	26.8%	16.56%	15.70%
Conditional on informal tax > 0	20.36%	4.57%	49.22%	21.15%	26.07%

Notes: The included countries are the countries for which we have quantity data on informal tax payments. Please see Appendix A for details on the formal tax payment calculations. Weighted using household weights (available for all countries except Ethiopia).

Table 5: Comparison to other local budgets in Indonesia

Per household value of:	Mean	Informal taxes as percent of….
From Indonesia household survey:		
Informal taxes	49.86	.
Direct formal taxes	29.16	171%
Indirect formal taxes	158.88	31%
From village budget data:		
Total annual village budget:	117.64	42.4%
Village revenue from inter-governmental transfers:	86.20	57.8%
Village revenue from local taxes/fees (including informal tax):	31.44	158.6%
From district budget data:		
Total annual district budget	1138.45	4.4%
Expenditures on salaries:	474.89	10.5%
Expenditures on goods & services	224.70	22.2%
Capital expenditures:	396.90	12.6%
District revenue from central government transfers:	933.07	5.3%
District revenue from local formal taxes/fees:	43.41	114.9%
District revenue from other sources:	31.77	156.9%

Notes: All data comes from Indonesia, and all data are for 2007. All are the per-household amounts for the 19 districts where we have complete data from the household survey, the village budget data, and the district budget data. For the village data, the source is the 2008 Census of Villages, matched to the same villages included in the household survey. These district budgets also include the intergovernmental transfers to villages, so these budgets should be viewed as a superset of the village budgets. All amounts are reported in 2000 PPP US$, as in the previous tables, which translates to US$1 = Rp. 3571. Note that districts have budget deficits. Informal taxation payments are not reported in district budgets, so double-counting is not an issue in this comparison. Some amount of informal taxes may be included in "village revenue from local taxes / fees" since this includes some in-kind revenues. Household survey data weighted using household weights.

Table 6: Informal taxation vs. household expenditure

	Philippines	Albania	Ethiopia	Guatemala	Indonesia	Panama	Nigeria	Vietnam	Nicaragua	Zambia
Panel A:Participation margin, with community fixed effects (conditional logit model)										
Any payment	0.035	0.392***	0.159	0.228***	0.228***	0.460***	0.064	0.407***	-0.075	0.117***
	(0.114)	(0.077)	(0.159)	(0.073)	(0.061)	(0.061)	(0.048)	(0.048)	(0.086)	(0.033)
Observations	2200	2487	1165	5074	6188	5963	9036	24521	2669	10271
Panel B: Total payments, with community fixed effects (Poisson model)										
Total payments	0.395*	0.334***	0.127***		0.387***			0.080***		
	(0.213)	(0.053)	(0.054)		(0.041)			(0.025)		
Observations	2143	1784	1062		10840			26899		
Panel C: Total payments, with community fixed effects, conditional on payments > 0 (Poisson model)										
Total payments	0.229*	0.122***	0.111**		0.364***			0.001		
	(0.117)	(0.043)	(0.049)		(0.041)			(0.021)		
Observations	655	254	587		9053			17310		

Notes: Each cell reports the estimates from a separate regression, with robust standard errors clustered at the village level in parentheses. Panel A reports results from conditional logit estimates, where the dependent variable is a dummy for making any informal tax payments, the independent variable is log household expenditure per equivalent adult, and the conditioning variable is the village. Panel B reports results from conditional Poisson QMLE models, where the dependent variable is the quantity of informal tax payments (where labor payments are converted to monetary units at the household's predicted wage rate), the independent variable is log household expenditure per equivalent adult, and the conditioning variable is the village. Panel C reports results from an analogous model to Panel B but without conditioning on the household having made a positive informal tax payment. * Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 7: Formal taxes vs. household expenditure: quantities ($H_0 : \chi=0$)

	Philippines	Albania	Ethiopia	Indonesia	Vietnam
Panel A: Informal taxes, with community fixed effects					
Total payments	0.395*	0.334***	0.127***	0.387***	0.080***
	(0.213)	(0.053)	(0.054)	(0.041)	(0.025)
Observations	2143	1784	1062	10840	26899
Panel B: Direct formal taxes, with community fixed effects					
Total payments	1.526***	1.433***	0.418***	1.372***	0.691***
	(0.198)	(0.083)	(0.134)	(0.075)	(0.114)
Observations	2073	3358	1197	11591	20407
Panel C: Informal taxes, without community fixed effects					
Total payments	0.323*	0.384***	0.119	0.438***	-0.156***
	(0.170)	(0.049)	(0.112)	(0.035)	(0.049)
Observations	2200	2923	1062	11015	28858
Panel D: Direct formal taxes, without community fixed effects					
Total payments	1.483***	1.421***	0.587**	1.467***	0.998***
	(0.211)	(0.056)	(0.257)	(0.135)	(0.067)
Observations	2259	3838	1197	11674	29422

Notes: Each cell reports the estimates from a separate regression, with robust standard errors clustered at the village level in parentheses. All results are from conditional Poisson QMLE models, where the dependent variable is given in the table, the independent variable is log household expenditure per equivalent adult, and (in Panels A and B) the conditioning variable is the village. Significance is reported relative to the null hypothesis $\chi=0$. * Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 8: Labor and money payments ($H_0 : \chi = 0$)

	Indonesia	Panama	Vietnam	Nicaragua	Zambia
Panel A: Participation margin					
Labor payment	0.210***	0.206**	-0.074	-0.071	0.097***
	(0.060)	(0.080)	(0.066)	(0.096)	(0.035)
Observations	6433	5782	14753	2225	8902
Money payment	0.705***	0.682***	0.538***	0.003	0.128***
	(0.055)	(0.068)	(0.047)	(0.121)	(0.049)
Observations	7313	5716	23780	1405	6701
Panel B: Quantities					
Labor payment	0.260***		-0.018		
	(0.039)		(0.036)		
Observations	10840		15826		
Money payment	1.446***		0.220***		
	(0.208)		(0.026)		
Observations	7632		25429		

Notes: See Notes to Table 6. All specifications include community fixed effects. Significance is reported relative to the null hypothesis χ=0. * Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 9: User fees

	Indonesia		Nicaragua		Nigeria		Panama		Zambia		Philippines	
Panel A: School Contributions												
Children in the HH	0.477**		0.617***		0.172		2.106***		0.827***		1.094*	
	(0.199)		(0.173)		(0.113)		(0.228)		(0.112)		(0.626)	
No private water	-0.117		0.186				-0.37		0.464*		-0.204	
	(0.345)		(0.263)				(0.359)		(0.248)		(0.538)	
Log expenditure per equivalent adult	0.348	0.307	-0.09	-0.137	0.0246	-0.0107	-0.204**	-0.459***	0.130***	0.0786*	0.362	0.284
	(0.232)	(0.248)	(0.122)	(0.115)	(0.098)	(0.096)	(0.102)	(0.095)	(0.049)	(0.047)	(0.362)	(0.394)
Observations	1308	1308	1743	1743	2860	2860	4767	4767	8389	8389	384	384
Panel B: Water Contributions												
Children in the HH	0.319**		0.436				0.365***		0.183		-1.077	
	(0.150)		(0.393)				(0.112)		(0.167)		(1.145)	
No private water	0.122		3.382***				1.190*		1.438***		-0.653	
	(0.237)		(0.484)				(0.623)		(0.375)		(1.032)	
Log expenditure per equivalent adult	0.227	0.192	-0.167	-0.088			0.048	0.004	0.132	0.146*	-0.191	-0.170
	(0.167)	(0.165)	(0.258)	(0.221)			(0.135)	(0.133)	(0.089)	(0.082)	(2.030)	(1.817)
Observations	1398	1398	1076	1076			3282	3282	4096	4096	102	102

Notes: Each column reports results from conditional logit regressions, as in Panel A of Table 6, except the dependent variable is restricted to participation in payments for schools (Panel A) or participation in payments for water systems (Panel B). The first column for each country includes a dummy variable for missing water source. Households were defined as beneficiaries of public water if their listed primary source of drinking water was publicly provided, man-made, and more complex than a simple dug well. Natural sources (river, spring, rain, etc.), public or private dug wells, and other private water sources (piped water, tube wells, etc.) are not counted. Sources such as shared tube/piped wells and community water systems (publicly provided piped water, etc.) are included. Households were defined as beneficiaries of schools if they had at least one member of school age (defined as between ages 4 and 14 years). * Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 10: Decisions about informal tax payments

	Respondent	
	Individual	Village Head
1. Who makes decisions about which households participate?		
Village/hamlet/neighborhood head	81.3	79.5
Village/hamlet/neighborhood meeting	38.5	54.8
Each household decides for themselves	8.2	8.2
2. Who determines how much is expected from each household?		
Village/hamlet/neighborhood head	63.4	56.8
Village/hamlet/neighborhood meeting	40.7	61.2
Each household decides for themselves	20.9	15.0
3. What is the sanction imposed on a household if they do not participate?		
Replace at another time	10.5	12.9
Give materials/food	11.1	20.0
Replace with other person	5.2	9.3
Pay another person to replace you	2.0	5.9
Pay a fine	16.9	21.6
Not allowed to use result of activity	0.1	0.6
Excluded from local activities	0.5	0.6
No specified sanction	63.0	54.5
4. If applicable, who determines this sanction?		
Village/hamlet/neighborhood head	47.2	36.7
Village/hamlet/neighborhood meeting	47.8	61.6
Each household decides for themselves	22.0	20.8

Notes: All data comes from Indonesia. Multiple responses were allowed for each question. The full set of choices given for questions 1, 2, and 4 were: village head, hamlet head, neighborhood head, village meeting, hamlet meeting, neighborhood meeting, each household decides for themselves, religious leaders, other informal leaders, and other. For question 4, the choice of no sanction / not applicable was also given. The full set of choices given for question 3 was: replace at another time, give materials/food, replace with another person, pay another person to replace you, pay a fine, not allowed to use result of activity, excluded from local activities, other, and no official sanction.

Informal Taxation (Web Appendix)

Benjamin A. Olken and Monica Singhal

1 Appendix A: Data

1.1 Survey Data

As described in the text, the data used in this paper stems from household surveys from 10 countries around the world, which were selected because they included questions on payments to local public good provision. Since each of the surveys is somewhat different in terms of sampling and questionnaire design, this section briefly describes each of these surveys one by one, including details on the informal tax question, sampling design, and the definition of a community used for community fixed effects. Since the derivation of VAT tax rates is somewhat more involved, Section 2 separately discusses the construction of implied VAT rates in each country in more detail.

In constructing the data, we use several normalizations to standardize the data. To standardize units of time (e.g, for labor contributions) between surveys, we assume that each "day" worked is equivalent to 6 hours worked, and that there are 260 working days per year. When including "village" fixed effects, we use the smallest geographic unit available in the data. When the smallest geographic unit includes both urban and rural areas, we interact the geographic unit with an urban/rural dummy, so that each "village" is entirely rural or entirely urban. We convert all local currency units to 2000 PPP dollars after obtaining the exchange rate by dividing each country's GDP in local currency units for that year by the GDP in PPP constant 2000 international dollars. This data is available in the World Bank World Development Indicators.

All our surveys (with exception of Ethiopia) provide a household level weight variable to account for the sampling procedure. We used these weights in calculating the descriptive statistics (Table 3), as well as in all our regression analysis.

1.1.1 Albania

We use the Albanian Living Standards Measurement Survey, conducted in mid-2005 by the Living Standards Unit of Albania's National Statistical Institute, with the technical assistance of the World Bank. This survey is the fourth round of a series of LSMS, which began in 1996. The survey covers 3,840 households in urban and rural areas and is nationally representative.

Our estimation of payments is based on questions 12 and 13 of the Social Capital module of the household questionnaire. These questions ask about the payment of the entire household and cover "participation in any activities, in which people come together to do some work for the benefit of community." Conditional on a positive response to this question, the following question asks about "how many times in the past year" the household has participated in such activities. Each "time" was counted as a working day.

Communities are defined as villages, which are subgroups of districts and municipalities.

1.1.2 Ethiopia

We use the Ethiopia Rural Household Survey, which covers 1,507 rural households. This survey was been conducted by the International Food Policy Research Institute in 1997 as the fourth round of the series of household surveys started in 1989.

We examine questions from the Community Work section of the household questionnaire. The first question asks whether the "household engaged in community work in the last 12 months." The following question inquires about "how many days the household engaged in community work." The survey documentation notes that "... these data are not nationally representative. However, they can be considered broadly representative of households in non-pastoralist farming systems as of 1994."

Communities are defined as peasant associations, which are subgroups of regions and woredas (subdistricts).

1.1.3 Guatemala

We use the Guatemala Living Standards Survey (Encuesta Nacional Sobre Condiciones de Vida), which covers 8,940 household in rural as well as urban areas. This nationally representative survey was conducted in 2000 by the Guatemalan National Statistics Institute, with the technical and financial assistance of the World Bank and the Inter-American Development Bank.

We used question II.A.1.l, which asks whether households "participate in the collective construction of community works (roads, schools, etc)." Two other questions, II.A.1.h and IX.E.3, which asked respectively about cash or in-kind donations and the amount of hours contributed per household, were not used. The decision to exclude those is due to the ambiguity of the former and the fact that the recall period of the latter was only one day.

Communities are defined as sectors, which are subgroups of regions, departments, and municipios.

1.1.4 Indonesia

We use Wave I of the Indonesian Health and Education Service Survey, which was conducted by Gadjah Mada University and the World Bank as a baseline survey for the evaluation of the PNPM-Generasi program (see Olken, Onishi and Wong 2008). The survey was conducted in June – August 2007, and took place in rural areas of 5 provinces in Indonesia. 12,000 households were interviewed, spread over approximately 2,400 villages. Because the survey followed the placement of the PNPM-Generasi program (and associated control areas), the 20% richest districts in each province are not included.

We designed short modules on informal taxation administered to households and to village heads. The module began by asking "Has there been community activities in repair/ cleaning/ maintenance/ construction of village/neighborhood infrastructure and facilities during the last 12 months?" If yes, the household was asked if they participated in the activities, and if so, what type of activity (road/bridge, schools, water/sanitation systems, irrigation systems, or religious/cemetery projects). Households were then asked how many total person-hours the household contributed as well as total cash and materials payments over the previous 12 months. Finally, both households and village heads were asked a series of questions about who decides how much each household should contribution and the sanctions for non-contribution; these questions are described in detail in the text.

Communities are defined as villages, which are subgroups of provinces, districts, and subdistricts.

1.1.5 Nigeria

We examine the 2004 Nigerian Living Standards Survey. This nationally representative survey is a continuation of the series of National Integrated Surveys of Households conducted since 1981 by Federal Office of Statistics of Nigeria. The survey collected data on 19,158 households from September 2003 to August 2004.

We use questions four and five of section eight, Social Capital and Community Participation. These questions asked "Do you or any member of your household participate in community program(s)?" and, if yes, "Which of the following programs do you or a member of your household participate in?" We include in our estimation participation in the following categories: "construction of community school," "maintenance of community roads and bridges," and participation "in community development project." While the survey does not specify a recall period for these questions, the instructions to the interviewer specify a recall period of 1 year for the previous question regarding "Coping Mechanisms in times of need." We therefore take the recall period as 1 year.

Communities are defined as the urban or rural subsections of unique rics, which are subgroups of states.

1.1.6 Nicaragua

We use data from the second Nicaraguan LSMS, "Encuesta Nacional de Hogares sobre Medición de Niveles de Vida." They survey was conducted in 1998 by the National Institute for Statistics and the Census of Nicaragua with technical assistance from the World Bank. It covers 4,209 households in both urban and rural areas of all 15 departments and two autonomous regions, and is nationally representative

Question 57 of the household survey asks about household payments to construction and/or improvement of public facilities, such as schools, health centers, etc. The question also asks the respondent to indicate what "the contribution of this household was/were," allowing us to separate labor and monetary payments. Note, however, that question 57 is conditional on a question 55, which asks households whether they were beneficiaries of any construction or improvement projects. Thus, our estimation is a lower-bound for the real proportion of household payments, since households who do not receive benefits might also contribute.

Communities are defined as segementos, which are subgroups of departamentos, municipios, and areas de supervision.

1.1.7 Panama

The 2003 Panama Living Standards Survey, Encuesta de Niveles de Vida, provides data from 6,363 households in rural and urban areas, and is nationally representative. It was designed and conducted by the Panamanian Ministry of Economy and Finance with the assistance of the World Bank.

Questions 2.A.1.a and 2.A.1.e ask households whether they have participated in works to benefit their or other communities (roads, schools, etc.) and whether they have donated money or goods for community works over the past 12 months.

Communities are defined as corregimientos, which are subgroups of regions, provinces, and districts.

1.1.8 Philippines

We use the baseline survey of the KALAHI-CIDSS project for the Philippines (see Chase and Holmemo 2005). It was conducted by the World Bank by the Asia-Pacific Policy Center as a baseline for the evaluation of the KALAHI program, and covers 2,401 households. Due to the goals of the project, these households were selected only from rural areas of the 42 poorest provinces in the country, although each of the three geographical areas of the Philippines are represented.

Question 1a, part E of the household survey asks whether households participate in community projects: "Over the past six months, did you or any member of your family participate in any bayanihan in the barangay?" If yes, question 1ai asks for the three main activities and 1aiii provides a measure of the total time contributed to these three (per hours) for the period of the six months preceding the administration of the survey. We used a ratio of 6 hours per working day to convert the data to a daily measure. For our measure of participation, we included activities related to public cleaning, beautification, repair, construction, and other infrastructure work.

Communities are defines as barangays, which are subgroups of provinces and municipalities.

1.1.9 Vietnam

The 2002 Vietnam LSMS survey is nationally representative and covers 29,532 households in both rural and urban areas. The survey was conducted by the General Statistical Office of Vietnam with technical assistance from the World Bank.

Question 3.18 of the household survey asks: "Have you contributed any public working days?" If yes, labor quantity information is provided in question 3.19: "In the past 12 months how many public working days without pay did you contribute?"

Information on monetary donations is found in question 6.b.3.1.402, which asks whether contributions were made in the last 12 months to public labor, and question 6.b.3.2.402 which asks the monetary value given in the last 12 months.

Communities are defined as communes/towns, which are subgroups of provinces/cities and districts.

1.1.10 Zambia

The 1998 Zambia Living Conditions Monitoring Survey is nationally representative and covers 16,710 rural and urban households. The survey was conducted by the Central Statistical Office of Zambia.

Question 13.3 asks whether certain community projects (building/rehabilitations of school, health facility, roads, etc.) took place in the previous five years. If yes, question 13.18 of the household survey asks: "Did any member of your household participate in provision of materials, labour, management, or funds to the project?" Respondents can specify which of these categories they contributed, if any.

Communities are defined as centralities, which are subgroups of provinces, districts, census supervisory areas, standard enumeration areas, and stratum.

1.2 Construction of formal taxation variables

We construct formal taxation payments for all countries for which we have data on the quantity of informal tax payments: Albania, Ethiopia, Indonesia, and the Philippines. We consider both direct

tax payments by households, as well as indirect payments in the form of consumption taxes.

1.2.1 Direct taxes

To capture direct tax payments, we use all available questions in household surveys that measure taxation directly, either as part of household expenditure or as part of non-farm business expenditures. Appendix Table 1 (below) shows all these variables and their questions and recall periods. We use the listed recall periods to normalize taxes to an annual basis.

1.2.2 Indirect taxes

The tax structure of each country was investigated to determine the sources of indirect taxation for households. To maintain comparable construction of the variable across countries, we estimate indirect taxes as total value-added tax (VAT) combined with excise taxes paid on fuel, tobacco, and alcohol. Note that this measure does not include tariffs on imports and exports, which are a non-trivial component of indirect formal taxation in developing countries.

We construct the VAT base to include household expenditures unrelated to health, food, or education, as these categories are usually VAT exempt. Even to the extent that food is subject to VAT, since food purchases are predominantly in the informal sector, they are likely to be de facto exempt from VAT in our sample countries. Tobacco, alcohol, and fuel expenditures are considered separately due to their special rates of taxation.

The Ethiopian and Vietnamese surveys record the value of purchased alcohol separately from the value of alcohol self-produced or received as a gift. In these cases, we include only the value of purchased alcohol for tax consideration.

For each expenditure category, we calculate tax paid as follows:

$$Taxes = \frac{Tax\ Rate}{1 + Tax\ Rate} * Expenditure$$

The following sections report the details of the tax rates used in VAT calculations. The sources are shown in Appendix Table 2, and the recall periods for the corresponding questions are shown in Appendix Table 3.

Albania: The VAT and the tobacco excise tax were defined at 20% and 60%, respectively (see Table 2 below for relevant sources). Excise tax was defined at 50% for beer and varied from 16-100% for other types of alcohol. The excise tax on fuel ranged from 50-90% for the most important sources. Using this information, we chose the categorical tax rates for VAT (20%), tobacco (60%), alcohol (50%), and fuel (80%).

Ethiopia: The tobacco and alcohol excise taxes were set officially at 50% and 75%, respectively. A sales tax, rather than a VAT, was defined ranging from 5-15% by type of good or service. The majority of the goods included in our VAT base fell into the upper sales tax category and the only fuel source found to be tax exempt was kerosene. As such, we defined the categorical tax rates for VAT (15%), tobacco (75%), alcohol (50%), and fuel (15%).

Indonesia: The VAT was set at 10% and no fuel tax was charged. Tobacco was subject to an 8.4% VAT, an ad valorem tax ranging from 4-40% by type and production scale, and a specific tax ranging from 0-2%. The World Bank estimated the tobacco tax share as 30% of total retail price in 1999. Alcohol was charged VAT, excise tax, and luxury sales tax. The luxury sales tax was

40% for types of alcohol below 52 proof and 75% for those above. The excise tax on alcohol varied based on proof as well. Taking this information into account, we defined the categorical tax rates for VAT (10%), tobacco (30%), alcohol (75%), and fuel (0%).

Philippines: The VAT was defined at 10% and was included in addition to excise tax for alcohol, tobacco, and fuel. While the tobacco excise tax varied by product type, the World Bank estimated the tobacco tax share as 63% of average retail price in 1999. The excise taxes on fuel and alcohol varied, respectively, by product type and by product type, price, and proof. Taking these facts into consideration, we chose the categorical tax rates for VAT (10%), tobacco (63%), alcohol (50%), and fuel (25%).

Vietnam: The fuel excise tax was defined at 10% and there were three categories of VAT at 5, 10, and 15%, with the majority of VAT base goods falling into the middle category. The tobacco excise tax varied based on product type and was set at 25, 45, or 65%. The World Bank estimated the tobacco tax share as 36% of average retail price in 1999. The alcohol excise tax varied by product type and proof. With this information, we defined the categorical tax rates for VAT (10%), tobacco (36%), alcohol (35%), and fuel (10%).

Table A1: Questions used in total direct tax estimation

	Year		Recall Period
Albania	2005	"Taxes and insurance" reported in non-farm business	1 month
		"Other Taxes (vehicle, radio and TV, etc)" reported in expenditure	12 Months
Ethiopia	1997	"Taxes and Levies" reported in expenditure	4 Months
Indonesia	2007	"Land and house tax; Vehicle tax; Income tax; Other taxes" reported in expenditure	12 months
Philippines	2003	"Taxes (income tax, real estate tax, car registration, etc.)" reported in expenditure	6 Months
Vietnam	2002	"All kinds of taxes (excluding production tax)" reported in expenditure	12 Months

Table A2: Sources for VAT and excise tax rates

Albania	Law No. 7928/1995; Law No. 8437/1998
Ethiopia	Proclamation No.68/1993; Proclamation No. 77/1997
Indonesia	Law No. 17/2000; Jakarta Post/July 19.2004; Tobacco Economics in Indonesia/2008; The Tobacco Source Book, Ministry of Health Republic of Indonesia/2004;
Philippines	Republic Act No. 8424/1997; World Bank Vietnam Tobacco Country Brief/1999
Vietnam	Law No. 2/1997/QH9; World Bank Vietnam Tobacco Country Brief/1999

Table A3: Recall periods for indirect tax questions

	VAT base	Tobacco	Alcohol	Fuel
Albania	30 days	30 days	30 days	30 days
Ethiopia	4 months	4 months	1 week	1 month
Indonesia	12 months	1 week	1 week	12 months
Philippines	6 months	3 days	3 days	1 month
Vietnam	12 months	12 months	12 months	12 months

1.3 Dropping of Outliers

We drop observations for which any of the following three are true: (a) the reported total household days of labor contributed in the last year exceeds 50% of total possible yearly household working days (defined as 250 multiplied by the number of workers in the household); (b) the total monetized value of reported household days of labor contributed in the last year exceeds 50% of total yearly household expenditure; (c) the total reported value of yearly direct taxes exceeds total yearly household expenditure.

These restrictions affect only the data from Indonesia (0.22% dropped), Ethiopia (1.98% dropped), and Vietnam (0.01% dropped).

1.4 Wage Prediction and Household Expenditure Measure

To predict wages, we first approximate monthly household income per worker as annual household expenditure divided by 12 and the number of workers in the household. (We follow the standard convention of using household expenditure as a proxy for household income.) We then regress the household monthly wage rate on each individual's education, age, and age squared interacted with a female dummy, an urban dummy, and a female x urban dummy. We then divide by the number of working days in a month, which we define as 21.7, to get a measure of the household daily wage rate. $21.7 \simeq (365.25/12)*(\ 5/7)$, where 5/7 adjusts the wage rate for working days per week. We repeat this prediction separately for each country.

We use equivalent household expenditure as our household income measure when examining the distributional implications of informal taxation. Since household expenditure includes direct and indirect taxes, it is conceptually a "pre-tax" measure. To be consistent, one might also want to add back income lost as a result of informal tax payments. Since our measure of the household wage rate is likely to be noisy, we do not make this adjustment.

Following Deaton (1997), we define equivalent expenditure as

$$\frac{household\ expenditure}{(adults + \alpha_1 children + \alpha_2 infants)^{\theta}}$$

Infants are defined as those aged 0-4; children are defined as those aged 5 to 14. Combining Deaton's estimates of total child costs and Olken (2005)'s estimates of household economies of scale, we set $\alpha_1 = 0.6$ and $\alpha_2 = 0.5$ and $\theta = 0.85$.

1.5 References

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2 Appendix B: An Optimal Tax Model of Informal Taxation

The stylized facts we observe are remarkably consistent across countries. This appendix develops a simple framework for thinking about informal taxation that does not require non-standard preferences, government corruption, or market failures in labor or credit markets, but instead treats informal taxation as one possible solution to an optimal tax problem, with asymmetric information and screening. We treat the local government as the unit of observation and abstract from the existence of a central government.

In our model, local governments face a standard problem: financing local public goods in a social welfare maximizing way. We consider three sources of departure from the first best. As in standard taxation models, governments face information constraints about true earnings ability. Our model adds two additional constraints: governments may face constraints on their ability to enforce the desired tax schedule, and they may also face constraints on labor taxes, since individuals can shirk on required labor payments. These information and enforcement constraints limit the degree to which the government can achieve redistribution in financing the public good.

We model formal and informal taxes as having different constraint parameters arising from differences in their tax technologies. In the informal system, enforcement happens through social sanctions rather than through courts. This means that the informal system must use less severe punishments than the formal system, i.e., social sanctions instead of jail time. However, the informal tax system can use information that does not meet the burden of proof required in court (i.e., information that is observable but not verifiable), so it effectively has better information than the formal tax system. [1]

We demonstrate that informal taxation may be the optimal solution to the government's constrained maximization problem and show that the model's predictions are consistent with the observed patterns of informal tax prevalence. We also show that the predictions of the model match the stylized facts on the distribution and form of informal tax payments.

Modeling these payments as the equilibrium of a screening mechanism differs from the literature on voluntary contributions to public goods, which often models contributions driven by a personal desire to affect the level of the public good (e.g., Olson 1965), a warm-glow from donations (e.g., Andreoni 1990), or to signal wealth to others (e.g., Glazer and Konrad 1996). others have modeled private provision of public goods in a collective action framework (e.g., Bagnoli and Lipman 1999, Bergstrom, et al. 1986). Masclet, et al. (2003) and Falk et al. (2005) have emphasized the role of social sanctions as a mechanism through which the free rider problem can be overcome, and Fehr and Gachter (2000) show experimentally that cooperators are willing to punish free-riders even if this is costly for them and even if they cannot expect future benefits from their punishment activities.[2] To the best of our knowledge, little work has focused on formally modeling informal tax mechanisms specifically. An exception is Wilson (1992), who argues that cooperation in a repeated prisoner's dilemma game may be sustainable in the context of *harambee* programs in Kenya.

[1] Another possible constraint on redistribution is exit from the local community. Exit would affect both formal and informal taxes in the same way, so for simplicity, we do not consider the issue of exit here. In practice, mobility is often low in developing countries (Bardhan 2002). Abramitzky (2008) explores the issue of exit as a constraint on redistribution in a different context, that of Israeli kibbutzim.

[2] On the empirical side, the lower public good provision in ethnically diverse communities has been explained using the theory of social sanctions: Miguel and Gugerty (2005) argue that social sanctions are harder to enforce between different ethnic groups, which explains the lower contributions to public goods in diverse communities. Alesina et al. (1999) also show empirically that more diverse communities have lower public good provision.

This section proceeds as follows. We begin by setting up the general social planner's maximization problem as a two-type screening model with enforcement and information constraints and discuss characteristics of the general solution. We then introduce informal and formal taxation in the context of this model by varying the enforcement and information constraints. Finally, we discuss the implications of the model for the empirics of informal taxation.

2.1 Model

2.1.1 Setup

Suppose that there are N individuals. A fraction α of the individuals have wage w_H and a fraction $1-\alpha$ have wage w_L where $w_L < w_H$. We assume that w is private information and that each individual has an endowment of time 1 which they spend working. Since we are primarily interested in the tradeoff between enforcement and information, we model all behavioral responses coming through an evasion decision rather than through a labor supply decision. This assumption seems plausible in the contexts we are studying, and also allows us to capture the idea that local communities may have information on earnings ability rather than just earnings. Each individual's wealth is therefore equal to his wage rate. There are no savings, so individuals consume their entire wealth after paying any taxes.

Each individual i can potentially consume two goods, the private good (w_i) and the public good (g). If the public good is provided, all individuals consume it and $g = 1$; if it is not provided, then $g = 0$. We assume that utility over the private good is concave and that the utility from the private and public good are separable, i.e.

$$U = u(w_i) + \theta g$$

where u is concave and θ indicates the value from consuming the public good. We assume that u has the property that the coefficient of relative risk aversion is greater than 1 (i.e., $\frac{-wu''(w)}{u'(w)} > 1$).[3]

The public good costs G to produce, and once produced is both non-rival and non-excludable. G is determined exogenously.[4] For the public good to be provided, total government revenue R must be greater than or equal to G. We assume that providing the public good is efficient, so that the first-best involves providing the public good.

We assume that the goal of the government is to finance the public good in a way that maximizes social welfare. Taxes cannot be negative; in other words, redistribution occurs only through progressive payments toward the public good.[5]

[3] This assumption guarantees a single-crossing property which is necessary to allow screening using labor taxes (λ), discussed in more detail below. To see this, note that

$$\frac{\partial^2 U}{\partial \lambda \partial w} = -wu''(w) - u'(w)$$

If $\frac{-wu''(w)}{u'(w)} > 1$, then $\frac{\partial^2 U}{\partial \lambda \partial w} > 0$, so that the marginal utility cost of an extra hour worked is strictly increasing in wealth.

[4] We focus here on the decisions made by local government trying to raised a fixed amount of revenue to finance a public good, abstracting from intergovernmental transfers and endogenous public good size.

[5] In a system where a large share of payments take the form of in-kind unskilled labor, positive net transfers (i.e., net receipt of unskilled labor) could be difficult to implement. In addition, we can observe only payments (either zero or positive) to the public good in the data. General transfer payments, if any, may occur through a different mechanism. In this respect, we can think of informal taxation as somewhat analagous to a property tax system (a tax levied to finance a set of goods) that may exist in addition to a traditional income tax and transfer system.

Taxes can potentially be levied in two forms: money and labor. Define τ_H and τ_L as the monetary payments from the high and low type. Define λ_H and λ_L as the labor payments from the high and low type, defined as a share of each type's total time budget. After-tax income for type i is then $w_i(1-\lambda_i)-\tau_i$.

We assume that λ_i is publicly valued at the low type wage rate w_L, i.e., λ is always used for low-skill tasks. This implies that labor by the high type is inefficient, since it is valued at the opportunity cost w_H by the high type but valued at w_L in the government budget constraint. As we show below, this asymmetry in the value of labor means that the government can use labor as a screening device.[6]

We assume that the social planner faces three types of constraints in designing the optimal allocation. First, there is the *enforcement constraint*: if a given type fails to pay his required taxes, the planner can impose a utility punishment up to a maximum of P. This punishment P enters the planner's problem as an IR constraint. Second, there is the *hidden income constraint*: by paying a utility cost D, a high type can hide his income and pretend to be a low type. Third, there is the *shirking constraint*: by paying a utility cost S, the type who is supposed to do the higher amount of work in labor can shirk and do only the lowest amount of labor required of any type (denoted $\underline{\lambda}$).[7] The hidden income and shirking constraints enter the planner's problem as IC constraints. Together, the triplet of costs, (P, D, S), is what we refer to as the technology of the tax system. We will model informal vs. formal taxation as having different tax system technologies.

2.1.2 Planner's problem and characteristics of the solution

Faced with a given tax technology (P, D, S), the social planner's problem is to maximize social welfare subject to the enforcement (IR), hidden income (IC), and shirking (IC) constraints, i.e., he solves:

$$\max_{(\tau_i,\lambda_i)} \alpha\left(u\left(w_H\left(1-\lambda_H\right)-\tau_H\right)\right)+(1-\alpha)\left(u\left(w_L\left(1-\lambda_L\right)-\tau_L\right)\right)+\theta \tag{1}$$

subject to the enforcement constraints (IR):

$$u\left(w_H\right)-P \leq u\left(w_H\left(1-\lambda_H\right)-\tau_H\right) \tag{EC$_H$}$$
$$u\left(w_L\right)-P \leq u\left(w_L\left(1-\lambda_L\right)-\tau_L\right) \tag{EC$_L$}$$

hidden income constraints (IC):

$$u\left(w_H\left(1-\lambda_L\right)-\tau_L\right)-D \leq u\left(w_H\left(1-\lambda_H\right)-\tau_H\right) \tag{HI$_H$}$$
$$u\left(w_L\left(1-\lambda_H\right)-\tau_H\right)-D \leq u\left(w_L\left(1-\lambda_L\right)-\tau_L\right) \tag{HI$_L$}$$

shirking constraints (IC):

$$u\left(w_H\left(1-\underline{\lambda}\right)-\tau_H\right)-S \leq u\left(w_H\left(1-\lambda_H\right)-\tau_H\right) \tag{SC$_H$}$$
$$u\left(w_L\left(1-\underline{\lambda}\right)-\tau_L\right)-S \leq u\left(w_L\left(1-\lambda_L\right)-\tau_L\right) \tag{SC$_L$}$$

[6] While use of labor as a screening device has been considered in the design of income maintenance programs (e.g., **?**), it has not, to the best of our knowledge, been considered in the context of raising revenue.

[7] Note that hiding income allows the high type to pretend to be the low type and pay the labor and money taxes required by the low type, whereas shirking allows each type to do the minimum amount of required labor without affecting the monetary taxes.

the government budget constraint:

$$\alpha\left(\tau_H + w_L\lambda_H\right) + (1-\alpha)\left(\tau_L + w_L\lambda_L\right) = \frac{G}{N}$$

and non-negativity constraints:

$$\tau_i \geq 0,\ \lambda_i \geq 0\ \forall i$$

Note that in the first best (when no constraints bind), the planner will set taxes so that the after-tax marginal utilities are equal for the two types; if the non-negativity constraint binds, the optimum in the first-best will be to set $\tau_L^* = 0$ and $\tau_H^* = \frac{G}{\alpha N}$.

Several comments are worth making about the general solution to this problem. We first examine the form of tax payments of each type and then discuss the distributional implications.

Remark 1 *The high type will always pay in money, not in labor.*

Proof. Suppose that, at the optimum payment level, $\lambda_H > 0$.

(i) Suppose SC_L does not bind.

Let the payment of the high type change to the new levels $\lambda_H^* = \lambda_H - \epsilon$ and $\tau_H^* = \tau_H + w_L\epsilon$, for some small $\epsilon > 0$. At these new payment levels, the shirking constraint for both types would still hold.

For HI_H :

$u\left(w_H\left(1-\lambda_L\right) - \tau_L\right) - D \leq u\left(w_H\left(1-\lambda_H\right) - \tau_H\right) \leq u\left(w_H\left(1-\lambda_H\right) - \tau_H + (w_H - w_L)\epsilon\right) = u\left(w_H\left(1-\lambda_H^*\right) - \tau_H^*\right) \implies HI_H$ still holds for λ_H^* and τ_H^*.

For EC_H : $u\left(w_H\right) - P \leq u\left(w_H\left(1-\lambda_H\right) - \tau_H\right) \leq u\left(w_H\left(1-\lambda_H^*\right) - \tau_H^*\right) \implies EC_H$ still holds for λ_H^* and τ_H^*.

HI_L, EC_L, the government budget constraint and the low type's utility are unaffected by the changes in the high type's payments.

The high type's utility now becomes:

$u\left(w_H\left(1-\lambda_H^*\right) - \tau_H^*\right) = u\left(w_H\left(1-\lambda_H\right) - \tau_H + \epsilon(w_H - w_L)\right) > u(w_H\left(1-\lambda_H\right) - \tau_H)$. Thus, the high type can be made strictly better off without violating any of the constraints.

(ii) Suppose SC_L binds.

This implies $\lambda_L > 0$. Let the payments of the two types change such that, for some small $\epsilon > 0$, $\lambda_L^* = \lambda_L - \epsilon, \lambda_H^* = \lambda_H - \epsilon, \tau_L^* = \tau_L + w_L\epsilon$ and $\tau_H^* = \tau_H + w_L\epsilon$.

Decreasing λ_L and λ_H by ϵ and increasing τ_L by ϵ would not change the low type's income or the SC_L constraint. So SC_L will still hold.

We next check that SC_H is still satisfied at the new payment levels.

At the previous allocation, $S \geq u\left(w_H\left(1-\lambda_L\right) - \tau_H\right) - u\left(w_H\left(1-\lambda_H\right) - \tau_H\right)$. At the new allocation, income in both utility terms is increased by $\epsilon(w_H - w_L) > 0$. Since the utility function is concave, this change will decrease the right-hand side of the inequality, so SC_H will still be satisfied.

As above, HI_H, $E\dot{C}_H$, HI_L, and EC_L will continue to hold at the new payment levels. The government budget constraint and the low type's utility are unaffected by the changes in payments.

As before, the high type's utility now becomes:

$u\left(w_H\left(1-\lambda_H^*\right) - \tau_H^*\right) = u\left(w_H\left(1-\lambda_H\right) - \tau_H + \epsilon(w_H - w_L)\right) > u(w_H\left(1-\lambda_H\right) - \tau_H)$, so the high type can be made strictly better off without violating any of the constraints.

Thus, in both (i) and (ii), $\forall \lambda_H > 0$,social welfare can be increased without violating any of the constraints $\implies$ at the optimum level of payments, $\lambda_H = 0$. ■

The fact that the high type always pays in money, not labor, is the equivalent of the "no distortion at the top" result from the optimal tax literature (Mirrlees 1971). Note that this is not simply a productive efficiency result; as we discuss below, it can be optimal to have low types make inefficient payments in labor, but it will never be optimal to have the highest type do so.

The shirking constraint determines the degree to which labor can be used as a screening device and therefore the form of payment of the low type:

Remark 2 *As the utility cost of shirking* (S) *increases, the low type's taxes will weakly shift towards taxes in labor, i.e.,* $\frac{\partial\left(\frac{w_L\lambda_L}{W_L\lambda_L+\tau_L}\right)}{\partial S} \geq 0$*, with the inequality strict whenever* EC_H *does not bind and* $\tau_L > 0$*.*

Proof. Notice that the non-negativity constraint and the fact that $\lambda_H = 0$ at the optimum (Remark 1) imply $\underline{\lambda} = 0$ and SC_H is slack.

Assume that there exists an allocation $\lambda_L \geq 0$, $\tau_L > 0, \tau_H \geq 0$ such that the constraints are satisfied and the public good is provided. Thus, $S \geq u\left(w_L - \tau_L\right) - u\left(w_L\left(1-\lambda_L\right) - \tau_L\right)$.

Let $S^* = S + \Delta S$, $\Delta S > 0$. Thus, $S^* > u\left(w_L - \tau_L\right) - u\left(w_L\left(1-\lambda_L\right) - \tau_L\right)$ and SC_L is slack.

For some small $\epsilon > 0$, let $\tau_L^* = \tau_L - w_L\epsilon$ and $\lambda_L^* = \lambda_L + \epsilon$. At these new payment levels SC_H and SC_L would still be satisfied.

Since $u\left(w_L\left(1-\lambda_L^*\right) - \tau_L^*\right) = u\left(w_L\left(1-\lambda_L\right) - \tau_L\right)$, HI_L and EC_L are unchanged. EC_H is also unchanged.

However,

$u\left(w_H\left(1-\lambda_L^*\right) - \tau_L^*\right) - D = u\left(w_H\left(1-\lambda_L\right) - \tau_L - \epsilon(w_H - w_L)\right) - D < u\left(w_H\left(1-\lambda_L\right) - \tau_L\right) \leq u\left(w_H\left(1-\lambda_H\right) - \tau_H\right) \implies HI_H$ is slack $\forall D \geq 0$. Thus, HI_H would be satisfied for higher values of τ_H. This is because it would now cost the high type more in foregone income if he were to deviate to the low type's tax package.

Since $u\left(w_H\left(1-\lambda_H\right) - \tau_H\right) > u(w_L(1-\lambda_L^*) - \tau_L^*)$ and the utility function is concave,

$u'\left(w_H\left(1-\lambda_H\right) - \tau_H\right) < u'(w_L(1-\lambda_L^*) - \tau_L^*)$.

Therefore, if EC_H is not binding at τ_H, $\exists \delta > 0$ such that increasing τ_H by δ/α and decreasing τ_L by $\delta/(1-\alpha)$ will still satisfy HI_H and improve social welfare. If EC_H binds at τ_H, then the change in the low type's tax mix (and the resulting slackness of HI_H) does not allow for a change in τ_H.Therefore, the total tax payments and the utilities of the two types will be unaffected.

Hence, as S^* increases, it is weakly optimal to decrease τ_L. Therefore, $\exists S_0 > 0$ such that $\forall S \geq S_0$ setting $\tau_L = 0$ can weakly increase social welfare. In this case, it is weakly better for the low type to pay only in labor and not in money, if his optimal total tax payment is positive. ■

Since an hour of the low type's labor is publicly valued at the low type's outside wage rate, having the low type pay in labor does not affect the government budget constraint. It does, however, allow for screening by affecting the high type's hidden income constraint: it would now cost the high type more in foregone income if he were to deviate to the low type's tax package and pay labor instead of money. As long as EC_H is slack (in other words, as long as it is possible to increase the tax payment of the high type without violating his IR constraint), then shifting the low type toward labor will allow the planner to improve social welfare.

If the shirking constraint for the low type does bind (from Remark 1, we know that $\underline{\lambda} = 0$ at the optimum), then there are limits to the degree to which labor can be used as a screening device.

In this case, τ_L could be positive, and the inability to screen using labor could reduce the overall progressivity of the tax system or make it no longer optimal to provide the public good. Note that if instead the required labor was high skilled (could only be provided by the high type), there would be no screening benefit from labor taxes. One implication is that such projects are less likely to take place.

We next examine the distribution of payments:

Remark 3 *As long as the planner has some information (either $D > 0$ or $S > 0$) and $P > u(w_H) - u\left(w_H - \frac{G}{N}\right)$, then if the public good is provided, total payments will be strictly increasing in household expenditure, i.e., it will always be the case that $\tau_H + w_H\lambda_H > \tau_L + w_L\lambda_L$.*

Proof. First assume the social planner maximizes social welfare when $\tau_H + w_H\lambda_H < \tau_L + w_L\lambda_L$. Now consider the allocation $\tau_H = \tau_L = \frac{G}{N}$. If the constraints for the low type were satisfied at the previous allocation, they will still be satisfied at the new allocation. HI_H and SC_H will be satisfied for $D = 0$ and $S = 0$, and EC_H will be satisfied as long as $P \geq u(w_H) - u\left(w_H - \frac{G}{N}\right)$. Since $w_H > w_L$ and the utility function is concave, the new allocation will result in a social welfare improvement.

Now assume the social planner maximizes social welfare when $\tau_H + w_H\lambda_H = \tau_L + w_L\lambda_L$.

(i) Suppose $S = 0$.

From Remark 1, we know that $\lambda_H = 0$ and therefore $\underline{\lambda} = 0$. $S = 0$ and the government budget constraint then imply that $\lambda_L = 0$ and $\tau_H = \tau_L = \frac{G}{N}$. At this allocation, HI_H will be satisfied at $D = 0$ and is therefore slack $\forall D > 0$. If the condition given in the remark holds (i.e., $P > u(w_H) - u\left(w_H - \frac{G}{N}\right)$), then EC_H will also be slack.

Then $\exists \epsilon > 0$ such that HI_H and EC_H are still satisfied for $\tau_H^* = \tau_H + \epsilon/\alpha$ and $\tau_L^* = \tau_L - \epsilon/(1-\alpha)$. This change in τ_H and τ_L leaves the government budget constraint unchanged. If the constraints for the low type were satisfied at (τ_H, τ_L), they will still be satisfied at (τ_H^*, τ_L^*).

Since the utility function is concave, $u'\left(w_H - \frac{G}{N}\right) < u'\left(w_L - \frac{G}{N}\right)$. Therefore, increasing τ_H by ϵ/α and decreasing τ_L by $\epsilon/(1-\alpha)$ will improve social welfare.

(ii) Suppose $D = 0$.

From Remark 1, we know that $\lambda_H = 0$ and therefore $\underline{\lambda} = 0$, so SC_H is slack. If $D = 0$, HI_H can be rewritten as

$$u(w_H - \tau_H) \geq u(w_H(1 - \lambda_L) - \tau_L)$$

HI_H will be slack for the allocation given $(\tau_H = \tau_L + w_L\lambda_L)$ as long as $\lambda_L > 0$. As above, if $P > u(w_H) - u\left(w_H - \frac{G}{N}\right)$, then EC_H will also be slack.

If the allocation given has $\lambda_L > 0$, then we can achieve a social welfare improvement by increasing τ_H and reducing τ_L as in case (i) above.

Now suppose the allocation given has $\lambda_L = 0$. SC_L will then be binding at $S = 0$ and slack for $\forall S > 0$. Then, $\exists \eta > 0$ such that we can set $\lambda_L^* = \eta$ and $\tau_L^* = \tau_L - w_L\eta$ and SC_L will still be satisfied. This change does not affect the total tax payment of the low type, the government budget constraint or HI_L. We can then achieve a social welfare improvement by increasing τ_H and reducing τ_L as in case (i) above. ■

Thus as long as the government has any information and sufficient ability to enforce, the tax

system will be redistributive – i.e., the high type will pay more in taxes than the low type.[8] This result comes directly from the fact that the planner is maximizing social welfare and the marginal utility of income is higher for the low type. The difference in tax payments between the two types is weakly increasing in the wage gap between the two types.

The fact that the high type pays more does not necessarily imply that the tax system will be progressive – i.e., it does not imply that the high type will pay more in taxes as a share of income than the low type. In fact, whether the tax system is progressive or regressive is theoretically ambiguous and depends on the parameters of the model.

It is also important to note that while the utility costs (P, D, S) represent a social loss, none of these costs should be borne in equilibrium. Efficiency costs relative to the first best instead take two forms. First, the public good may not be provided whereas it will always be provided in the first best. This may occur if the government cannot satisfy the enforcement and information constraints and still meet its budget constraint or if redistribution is limited enough that providing the public good actually reduces social welfare. Second, in a multiple type case, it may be optimal for the government to require inefficient labor payments from individuals whose wage rate exceeds the unskilled wage rate, since those labor payments serve as a screening device for higher wage types. We discuss extensions to the multiple type case in more detail below.

2.1.3 Formal vs. informal taxes

We model formal and informal taxation as having different technology triplets. Formal taxes are thus represented by the triplet (P_F, D_F, S_F) whereas informal taxes are represented by the triplet (P_I, D_I, S_I). We assume that $P_F \geq P_I$ – i.e., the punishments that can be imposed by the courts, *conditional on detecting non-compliance*, are at least as great as the punishments that can be imposed informally through social sanctions.[9] By using the formal legal system, the social planner can in theory levy an unlimited punishment if the individual does not meet his required payments (for example, through imprisonment); in the informal tax system, there are likely to be limits on the sanctions that can be imposed for non-payment. We can think of the costs of evading income (D) or evading labor taxes (S) as inversely related to the information the community needs to impose punishment. A conviction in the formal legal system is likely to require a higher level of proof than a community needs to impose informal punishments, which implies that $D_F \leq D_I$ and $S_F \leq S_I$. The choice between formal and informal taxation thus entails a trade-off between enforcement (P) and information (D and S).

Considering a limiting case may be useful for intuition. As $P_F \to \infty$ and $D_I \to \infty$, formal taxes are limited by the IC constraints (hidden income and shirking) whereas informal taxes are limited by IR constraints (punishments). Note that there are two potential sources of informational advantage

[8] We monetize labor payments by the high type using the high type's wage rate, since this measure is most relevant for considering the distribution of tax burdens.

[9] Note that social sanctions must be levied by individual community members, not by the social planner directly. However, we can think of the social planner as coordinating the community on a particular equilibrium by choosing the schedule of social sanctions to be implemented by the community. If each individual in the community's cost of enforcing a social sanction on someone else is less than the cost of receiving a social sanction themselves, there is an equilibrium where everyone in the community enforces the social sanction on non tax payers, as well as enforces the social sanction on anyone who deviates and does not enforce a social sanction when they are supposed to do so. Perroni and Scharf (2007) note that *any* tax schedule must ultimately be sustained by the collective willingness of the group to enforce the schedule, and Fehr and Gachter (2000) discuss the willingness of individuals to punish free riders even if such punishments are costly.

in the informal system: communities effectively have more information about true earnings ability and they are better able to monitor labor payments. Either of these advantages is sufficient to generate the result that informal taxation may be preferable to formal taxation; we believe both are relevant in explaining the observed stylized facts, as we discuss below.

2.2 The informal tax framework and the stylized facts

2.2.1 The choice between formal and informal taxes

It is straightforward to see that loosening any of the constraints faced by the local government will weakly allow it to achieve higher social welfare. This framework therefore suggests that informal taxation is likely to result in a social welfare improvement relative to formal taxation when: (1) the ability of the community to levy social sanctions (P_I) is high; (2) there is more available information about incomes informally than formally ($D_F < D_I$); and (3) the ability to monitor labor payments informally is greater than the ability to monitor formally ($S_F < S_I$).

The prevalence of informal taxation throughout our sample of developing countries, particularly in rural areas, is consistent with the existing evidence that informal insurance and credit markets may function more effectively in rural areas, where information is better and villagers are better able to levy informal sanctions for default (Townsend 1995, Besley and Coate 1995, Banerjee and Newman 1998, Ghatak 1999). The ability to verify income legally may also be more difficult in developing countries, since many individuals work in or can easily shift into the informal sector.[10] Unsurprisingly, informal taxation mechanisms are not generally observed in developed countries, where it is harder to hide income and where social sanctions may be less effective.

Our model has considered the choice between formal and informal taxation made by a given local government. Even within developing countries, information and social enforcement are likely to be effective within small communities. This is consistent with the observation that informal taxes tend to be levied at local levels, rather than by higher levels of government.

The framework also clarifies why labor payments are more commonly observed in informal taxation systems rather than in formal tax systems. Although labor payments are always desirable as a screening device, they are also likely to be hard to verify legally. Therefore, the community can more easily make use of labor payments as a screening device through the informal system. Note that labor taxes are sometimes implemented through the formal tax schedule. Systems of corvee labor, for example, were common at one time in Europe and elsewhere, and mandatory labor taxes still exist in some countries, such as Vietnam. It may be that in at least some of these contexts, local landlords or officials did not have to meet the burden of proof required by a court in order to punish non-compliers, resulting in a high S_F.[11]

2.2.2 The distribution and form of informal taxes

The informal tax model makes a number of predictions about the distribution and form of informal tax payments. As discussed above, the framework suggests that informal tax payments should be

[10] Similarly, while landholding may be legally verifiable in theory, land taxes in developing countries have also proven difficult to implement in practice (Burgess and Stern 1993).

[11] A number of studies have documented substantial absenteeism in sectors such as health and education in developing countries (e.g., Banerjee and Duflo 2006), which suggests that the effectiveness of formal public works projects may be constrained by shirking as well.

increasing with household expenditures. We find that the elasticity of total payment with respect to household expenditure is positive in all countries (shown in Table 6), consistent with the prediction of the model. Moreover, in the simple two-type case, it will be optimal for the public good to be financed solely by the high types if income inequality is sufficiently high and the planner has the ability to satisfy the high type's IR and hidden income IC constraints. The data is also consistent with this prediction: we observe significantly positive participation gradients in the majority of sample countries (Table 6).

In our simple framework, we have focused on the local government making a choice between formal and informal taxes. In practice, the optimal solution may involve the government levying both types of taxes. The observation that formal direct taxes are generally more progressive than informal taxes could result from local governments levying formal taxes until D binds. While such a formal tax system could be progressive, once D binds, a marginal expansion of the formal tax system could then only be achieved by a (very regressive) poll tax. The local government might instead choose to expand financing through informal taxes, where some degree of redistribution can be achieved by making use of the higher information (D and S) available informally. The fact that formal direct taxes tend to be very small (Figure 1) is consistent with the idea that local governments are constrained in their ability to levy formal taxes, i.e., D may be binding.[12]

Our framework also rationalizes the prevalence of labor payments observed in the data. In the first best case, the government will be indifferent between having the low type pay in labor versus money. In our framework, the government will always prefer to have the low type pay in labor if the shirking constraint does not bind, since doing so allows the government to extract greater payments from those with (unobservably) higher income. If the shirking constraint does bind, the low type may make payments in both money and labor, consistent with what we observe in the data (Table 3, Panel B). Conversely, high types should pay in money rather than in labor, which is what we observe in almost all countries (Table 8).

2.3 Extensions to multiple types

This section discusses two extensions of the model. First, we consider the case where the low type's wage is above the unskilled wage rate, so that having the low type pay in labor imposes social costs. Second, we consider what happens when we introduce more than two types into the model. Together, these two extensions allow the model to closely match all of the stylized facts demonstrated above.

First, consider the case when both the high and low wages are above the unskilled wage rate. Specifically, suppose that a fraction α of the population earns wage w_H and a fraction $1-\alpha$ earns wage w_M, where $w_H > w_M$. The labor payments of each type are valued by the government at wage rate w_L, where $w_L < w_M$. The enforcement, hidden income and shirking constraints are the same as above, with the difference that the low skilled type is now receiving wage w_M and paying taxes $\lambda_M w_M + \tau_M$. In this case, the general pattern of the equilibrium – with the high type paying more in total and the high type never paying labor taxes – still holds, i.e.:

Remark 4 *Even if $w_M > w_L$, $\lambda_H = 0$ and $\tau_H > \tau_M + w_M \lambda_M$ under conditions analogous to those given in Remarks 1 and 3.*

[12] By contrast, indirect formal taxes (VAT) are large, but these tend to be levied by state and national governments and could be administratively difficult to administer at the local level.

Proof. We denote the low type's income and tax payments by the subscript M, to differentiate them from the notation for the unskilled wage rate at which government values labor, w_L.The fact that at the optimum level of payments $\lambda_H = 0$ can be shown using a proof similar to the one used for Remark 1 with the additional condition that if SC_M does not bind, then it must be the case that $D > u(w_M(1-\lambda_H) - \tau_H) - u(w_M(1-\lambda_M) - \tau_M)$ in order for HI_M to be satisfied.

To show that the tax payments are strictly increasing in income, the proof is similar to the one used to prove Remark 3. ■

The key difference if $w_M > w_L$ is that using labor as a screening device now has real social costs, so it affects the attractiveness of using labor as a screening device. Nevertheless, we show with a numerical example that it is still possible to obtain similar equilibria, i.e.:

Remark 5 *Even if $w_M > w_L$, it is still possible to obtain an equilibrium where the high type pays only in money and the low type pays only in labor.*

Example 1 *Let $U(y_i, g) = \ln(y_i) + \theta g$, where $y_i = w_i(1-\lambda_i) - \tau_i$. We take $w_H = 9$, $w_M = 4, w_L = 3.5, \alpha = 1/3, P = 1, D = \ln(10/7), S = \ln(3/2)$, $G/N = 2$ and $\theta = 2$.*

In the first best, when no constraints bind, the optimal solution would involve $\tau_H = 16/3$ and $\tau_M = 1/3$.The social planner would not use any labor taxes since both individuals' labor is publicly valued at a lower rate than their outside wage.

If we introduce the enforcement, hidden income and shirking constraints, then the hidden income constraint for the high type would not be satisfied at the first-best values of τ_H and τ_M. Thus, labor would have to be used as a screening device to make the low type's tax mix less attractive to the high type. By requiring the low type to pay some taxes in labor, the high type's utility cost of switching to the low type's tax mix is increased since the high type values his labor at a higher wage rate than the government. However, the introduction of labor payments also increases the low type's total tax payment, since his labor is also valued at a lower rate than his outside wage. Thus, P, D and S must be high enough so that the constraints hold even after these changes in the tax mix.

In this example, after switching the low type's payment to labor instead of money, the hidden income constraint for the high type will be satisfied with equality. Solving the constrained maximization numerically, at the optimal level, $\tau_H^* = 4.26$, $\lambda_H^* = 0$ and $\tau_M^* = 0, \lambda_M^* \simeq 0.25$. The total tax payment for the low type increases to $w_M \lambda_M \simeq 1$, reflecting the need to use the low type's payment as a screening device. One can check, for example, that welfare under this scenario is greater than, for example, setting $\tau_H = \tau_L$, or setting $\lambda_L = 0$ and setting τ_H and τ_L such HI_H binds.

Note that we can always guarantee that it will continue to be optimal to provide the public good by setting θ high enough.

The model thus provides a potential explanation for labor payments made by those with an opportunity cost above the unskilled wage rate, despite the fact that these in-kind payments are inefficient.

Second, we examine the case when there are three types in the model. With three types, we can simultaneously consider participation gradients (i.e., does the household pay anything at all) and the quantity paid conditional on participating. With a numerical example we can show the following possibility result:

Remark 6 *If there are multiple types and if the cost of hiding income increases with the amount of income hidden, it is possible to get both a positive participation gradient and a positive income gradient conditional on participating.*

Example 2 *As in the previous example, let* $U(y_i, g) = \ln(y_i) + \theta g$, *where* $y_i = w_i(1 - \lambda_i) - \tau_i$. *Assume there are three types of individuals in the community: high-skilled, medium-skilled and low-skilled, each representing a share* $\alpha = 1/3$ *of the population. We take* $w_H = 11$, $w_M = 5, w_L = 4.5$, $G/N = 2$ *and* $\theta = 2$.*Let* D_{ij} *denote the utility cost for individual of type* i *to hide income and pretend to be of type* j. *Assume the punishment and utility cost of shirking* P *and* S *are identical for all types. We let* $P = 1$, $S = \ln(3/2)$, $D_{HM} = D_{MH} = \ln(1.45)$, $D_{HL} = D_{LH} = \ln(1.9)$, $D_{ML} = D_{LM} = \ln(1.3)$. *Notice that the cost of hiding income is increasing with the amount hidden in such a way that switching to the medium type's tax rates is always more attractive for the high type than switching to the low type's tax rates.*

In the first best case, when no constraints bind, the optimal allocation involves $\tau_H = 6, \tau_M = 0$, $\tau_L = 0$ *and no labor payments. This allocation reflects the large difference in income between the high type and the other two types. However, at this allocation, the hidden income constraint would not hold for the high type, who would have an incentive to switch to be the medium type's schedule. Therefore, the constrained maximization problem will use labor payments as a method of making the medium type's payment less attractive to the high type. (In this example, the large gap between the high and medium wages makes increasing the medium type's labor payments preferable to increasing his monetary payments.)*

Solving the constrained maximization problem numerically yields $\tau_H = 5$, $\tau_M = 0$, $\lambda_M = 0.214$, $\tau_L = 0$ *and* $\lambda_L = 0$. *In this example, we obtain a case in which the lowest type is not required to pay anything, the medium-skilled type is required to supply labor, and the high-skilled type only pays in money.*

Note that we can always guarantee that it will continue to be optimal to provide the public good by setting θ *high enough.*

This example provides parameter values for which the pattern outlined in the above remark will hold at the optimal solution. Moreover, in this numerical example, it is also be optimal for the middle type, whose wage rate is greater than the unskilled wage rate, to pay in the form of labor, since these payments serve as a screening device. We have thus provided an example that encompasses many of the stylized facts: a positive participation gradient, a positive income gradient conditional on paying, prevalent labor payments, a steeper gradient on money payments than on labor payments, and labor payments by those whose incomes are greater than the unskilled wage rate.

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