Can Rural Property Tax Generate Revenue?*

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June 29, 2022

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*I would like to thank Tamba Moitenga and Komba Gando for excellent research assistance. I would also like to thank Wilson Prichard for helpful comments. The International Center for Tax and Development generously provided funding for data collection.

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1 Introduction

There is agreement in policy circles that governments in Sub-Saharan Africa—and governments of developing countries more generally—need to increase their share of "own source" revenue. There are two primary motivations for this push. First, non-tax sources of revenue, most notably foreign aid and natural resources, have been linked to various governance perversities.[1] Second, it is often argued that the expansion of taxation is linked to the development of accountable government, as taxation changes incentive structures for both political leaders and citizens (tax payers).[2] Where governments need citizens' tax dollars to operate, political leaders have more incentive to be responsive. Moreover, when governments increase tax demands on citizens, citizens increase their participation in political affairs, further disciplining the behavior of political leaders.

How should governments in Sub-Saharan Africa boost own-source revenue? Currently, governments in Sub-Saharan Africa rely heavily on indirect taxes compared to their counterparts in rich countries. Between 2010 and 2020, governments in Sub-Saharan Africa, on average, raised nearly twice as much tax revenue from indirect taxes (9.3%) as they did from direct taxes (5%).[3] Whereas, between 2010 and 2020 governments in rich countries, on average, raised roughly the same amount of revenue from both direct and indirect taxes (11% of GDP from both sources).[4] A key component of direct tax revenue in rich countries is property tax, which accounted for roughly 10% of direct taxes between 2010 and 2020.[5] In contrast, property tax revenue is marginal in Sub-Saharan Africa. For the 27 (of 48) countries where at least one year of property tax revenue data is available between 2010 and 2020, property tax revenue is equals .13% of GDP, accounting for roughly 2.6% of direct taxes on average. This likely overestimates average property tax revenue across the continent, as the 21 countries with missing property tax revenue in the GRD dataset likely generate below average property tax revenue.

To the extent that governments in Africa currently collect property tax, they focus on urban centers. There is a clear logic for prioritizing urban centers: they contain higher-value properties that are more densely concentrated than rural areas, presumably increasing the return and lowering the cost of collection for each property. However, that property tax might be more efficiently collected in urban centers compared to rural areas does not imply that property tax *should not* be collected in rural areas. In this research note, I explore the policy makers decision to expand property taxation into rural areas in the context of developing countries.

A policy maker weighing the costs and benefits of rural taxation must first consider the

[1] For example, see Moss et al. (2006) for the impact of foreign aid; the large "resource curse" literature deals with the deleterious impacts of revenue derived from natural resources. See, for example, Ross (2015).

[2] For these dynamics in Africa see Prichard (2015); for a classic statement see Bates and Lien (1985).

[3] Indirect taxes include taxes on goods and services and taxes on international trade. Direct taxes refer taxes on income, payroll taxes, and taxes on property.

[4] Calculations made by the author using the UNU-WIDER Government Revenue Dataset (Version 2021). I use variables for direct and indirect revenue that excluded social contributions and resource revenue. For each country, I average across available data for years between 2010 and 2020. "Rich countries" refers to the set of "high-income" in the World Bank's income group classification.

[5] Again, calculated by author. Averaging across country averages using available data for high-income countries.

potential net revenue that can be extracted from rural areas. Ultimately, this is an empirical question that requires reliable data on the costs and potential revenue associated with rural taxation. Unfortunately, little such reliable data exists. In this project, I seek to fill this gap by measuring village-level costs and potential revenue associated with property taxation in rural Sierra Leone (Kono District).[6] The primary variable cost associated with rural tax collection in this context is tax collector transportation costs. I estimate village-level travel costs by obtaining quotes from motorbike drivers on the travel cost between a tax collector's residence and the set of villages for which a given collector is responsible. I estimate village-level potential revenue with data on the number and type of building structures in each village. I investigate potential revenue under several scenarios through simulation exercises.

Based on a set of simulations, I find that property tax in poor, sparsely populated rural areas can generate positive net revenues, but these gains are modest, especially when taking into consideration additional costs that are not fully captured in the simulations. These simulations also highlight several features of rural tax collection. First, to increase net revenue, policy makers should prioritize increasing compliance over reducing collection costs. While both compliance rates and collection costs are clearly important factors determining net revenue, my simulations show that plausible gains in compliance are more important than even extreme reductions in collection costs. For example, I present simulations where slashing total collection costs by 31.5% increases net revenue by 9.8%; by contrast, a 10 percentage point increase in the compliance rate increases net revenue by over 43%. Second, I show that much of the potential net revenue from rural taxation is generated in a small subset of the total villages. This implies that resources can more efficiently be extracted by focusing on these high yielding towns. Third, my simulations highlight a trade-off between salary-based and pay-for-performance (i.e., tax farming) models of tax collector compensation. When compliance rates are held fixed, salary-based compensation models out perform tax farming models, as tax-farming collectors visit less villages, even if doing so would generate positive net revenue for the government. However, if tax farming increases tax-payer compliance it can outperform salary-based models in generating net revenue.[7]

I conclude by situating these results in a policy maker's broader calculus for taxing rural areas. Efficiently extracting resources from rural areas may not be the only, or even the primary motivation for rural taxation. I argue that policy makers must weigh this alongside two additional considerations. First, the decision of if and how to tax rural areas may impact citizens' perceptions about the fairness of the tax system, thereby affecting compliance rates in both rural and urban areas. If this is the case, counter-intuitively, taxing rural areas may a pro-poor policy. Second, policy-makers also face state-building motivations for taxing rural areas, where taxation serves the broader function of legitimating state institutions, which may help state leaders achieve their other policy objectives.

[6]Rural, in this context, implies the set of villages and small towns outside of the district HQ town. I consider a set of 1139 towns and villages across Kono Disitrct; the largest town has 841 building structures; the median town/village has 17. The 75th and 25th percentile towns have 33 and 8 buildings, respectively.

[7]In my simulations, tax farming would outperform salary-based compensation models if it could increase compliance by by 7-8 percentage points over the salary-based model.

2 Estimating Travel Costs

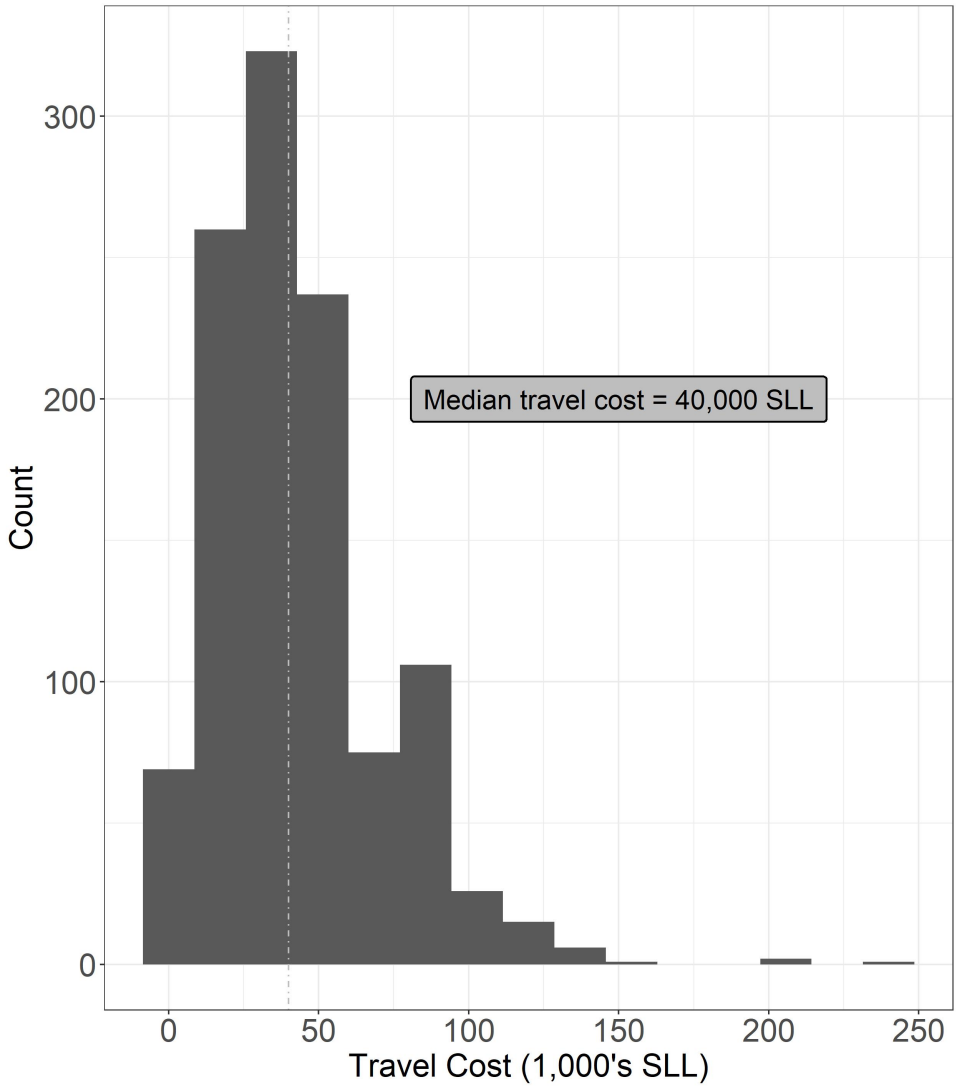
2.1 Travel Cost Data

In 2021, as in prior years, tax collection was done in person. The KDC has divided the district in 27 tax zones (see appendix A), with a single resident collector being responsible for collecting property tax in each tax zone.

I compiled a dataset of the travel cost from each tax collectors' residence to each village in their tax zone. To do this, I had a research assistant visit the "bike park"—a place where motorcycle taxis gather to wait for customer—closest to each tax collectors' residence and ask the price to visit each of the villages in the tax zone. We collect this data for all tax zones except the four tax zones in Nimikoro chiefdom, where tax collectors were not named in 2021.

Figure 1 below presents a histogram of the travel costs. It is important to note that the cost of visiting a given village to collect taxes is not necessarily the full cost from the collector's residence to that village—a collector may visit multiple villages in the same day. These data allow us to construct simulations that we investigate in section 3.

Figure 1: Distribution of travel cost from collector's house to each village in tax zone



3 Estimating Village-level Potential Revenue

This section describes my strategy for estimating potential property tax revenue in 1,139 rural villages the 23 tax zones in Kono that had tax collectors assigned in 2021.[8] In 2021, building were classified as one of nine types, each with its own tax rate. Table 1 maps each building type to its 2021 tax rate.

[8]Recall that tax collectors were not assigned in four tax zones in Nimikoro Chiefdom.

Structure Type	Tax Rate (SLL)
Mud house ("wattle house") with thatch roof	SLL 20,000
Mud house ("wattle house") with zinc roof	SLL 30,000
Mud brick house (Not plastered)	SLL 40,000
Mud brick house (plastered)	SLL 50,000
Mud bricks house with toilet facilities	SLL 80,000
Cement house without toilet facilities	SLL 120,000
Cement house with toilet facilities	SLL 150,000
Two-story house (i.e., one above ground)	SLL 300,000
Multi-story house (more than 2 stories)	SLL 400,000

Table 1: Tax Rates by building type

As the village potential revenue is simply the sum of the tax rate levied on each building in a given village, we could calculate village-level potential revenue by observing the number of building in each of the nine building categories in each village. In reality, I do not have such fine-grained data for all villages. Instead, I combine three sources of data to estimate village level potential revenue.

1. *2021 Tax Collector Potential Revenue Assessment:* Collectors completed this assessment in 128 villages in 2021. In this survey, tax collectors count the number of building that fall under each of the nine housing categories, before commencing tax collection. In villages where I have this data, I exactly calculate potential revenue.

2. *2019 Tax Collector Potential Revenue Assessment:* Tax collectors also completed a potential revenue assessment in 2019. In the 2019 assessment (and tax season), there were only four categories of housing type: (i) wattle house, (ii) mud brick house, (iii) concrete house, and (iv) multi-story house. In this survey, tax collectors count the number of buildings that fall under each of these four housing categories. I have data from this assessment in an additional 2017 villages, beyond the 128 villages where I have the 2021 assessment data.

3. *2015 National Census data:* In villages where I do not have data from either the 2021 or 2019 potential revenue assessment, I rely on data from the 2015 National Census. Census data contain a measure of the number of building structures in each community. Unfortunately, census data does not contain information about the type of building structure.

For villages where I have the 2021 assessment, I exactly calculate potential revenue.[9] For villages where I have data from a 2019 assessment, but no 2021 assessment, I estimate 2021 potential revenue by reweighing 2019 assessment data. As noted above, the 2019 assessment categorizes building into one of four possible structure types, rather than the nine structure categories used in 2021. However, the nine categories for 2021 fit within the five housing categories used in 2019. For example, a building recorded as "mud house" in the 2019

[9]The village potential revenue is calculated as the number of building structures in a given category, multiplied by the tax associated with that category, summing across each category.

assessment may have either a thatched or zinc roof, which would imply different tax rates in 2021. In these cases, I estimate the 2021 tax rate as the sum of the possible tax rates times the proportion of buildings in each category in the 2021 tax assessment. For example, in the 2021 assessment, 69% of mud houses had zinc roofs and 31% had thatch roofs.[10] Therefore, I use 26,900 SLL (0.69*30,000 SLL + 0.31*20,000 SLL) as the potential revenue for a house listed as "wattle house" in the 2019 tax collector survey. In villages where I have data from neither the 2019 or 2021 assessment, I rely on 2015 National Census data. As noted above, the census data contains information about the number of building structures in each village, but not the type of building. To estimate potential revenue from the census data, I multiply the number of building structures in a villages times the tax-zone level average potential revenue for each building (calculate from assessment data).[11] Table 2 displays the number of villages that rely on each of the above three strategies to estimate potential revenue.

Potential Revenue Estimation Strategy	**N**
Relies on 2021 tax assessment	128
Relies on 2019 tax assessment	217
Relies on 2015 census data	794
Total	**1139**

Table 2

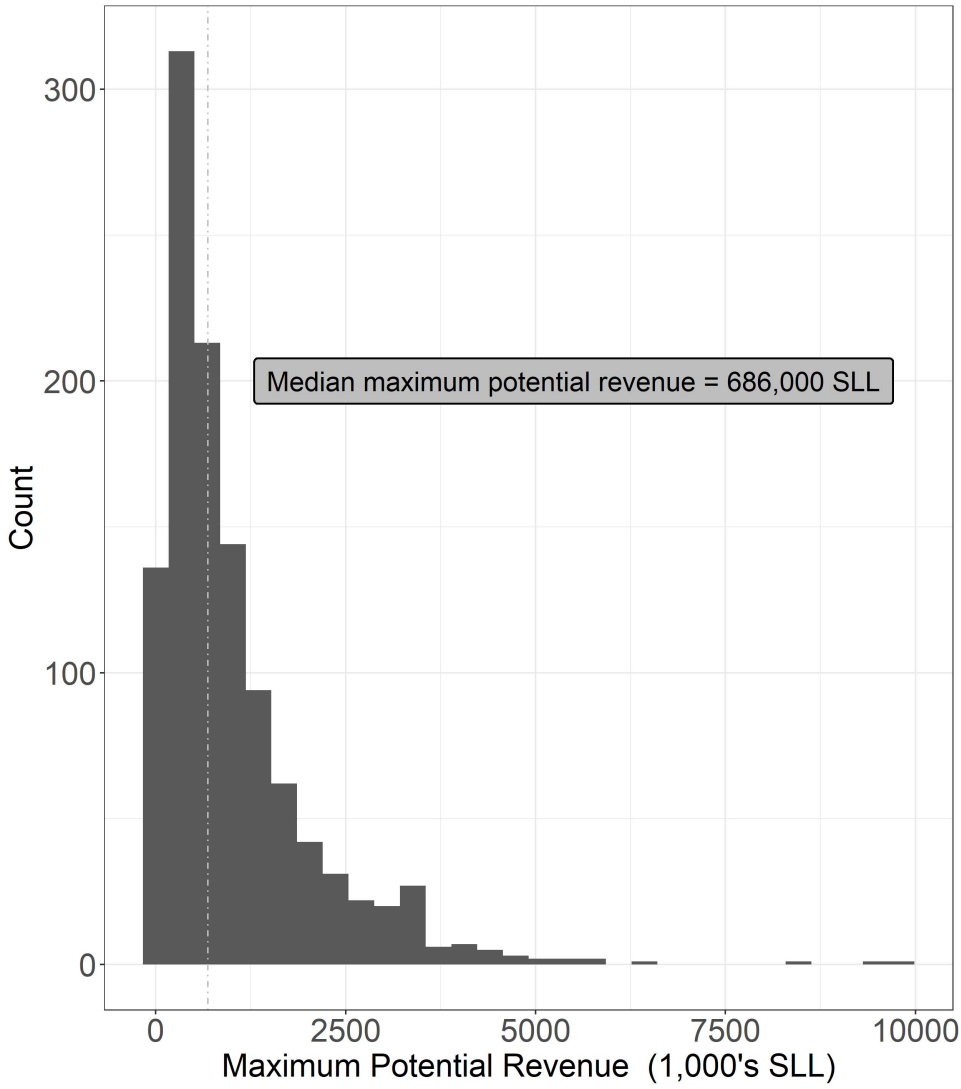
Figure 2 displays the distribution of potential revenue across villages.[12] The long right tail implies that potential revenue is fairly concentrated in a handful of major towns. For example, villages with the highest 1% of potential revenue (11 villages) contain 11.2% of the district's potential revenue; villages in the top 10% of potential revenue account for 38.3% of the district's total potential revenue. In contrast, villages that have potential revenue below the median (i.e., bottom 50% in potential revenue) account for only 15.4% of the district's potential revenue.

[10] 167 houses were recorded as "mud house with thatch" and 366 were recorded as "mud house with zinc".

[11] As a robustness analysis, I also plan to use a more sophisticated approach that models potential revenue in each villages as a function of a set of census data covariates. Results from this exercise are not included in this draft.

[12] Note that I exclude from the histogram four villages that have potential revenue above 10 million SLL: Njaiama - Sewafe (39,145,000); Yormandu (23,710,000); Kayima (13,050,000);Kombayendeh (12,810,000)

Figure 2: Distribution of village level maximum potential property tax revenue



4 Revenue Under Tax Collection Scenarios

Now that we have a village level data-set of travel costs and potential revenue, how can we estimate net revenue? I start by outlining a simple model of net revenue generation in the context of in-person tax collection, where net revenue is a function of three factors: (i) tax compliance rates, (ii) the number of villages tax collectors visit in a single trip, and (iii) tax collectors' compensation structure.

A collector travels from her resident village to a different village in her tax zone to collect property tax. After collection, she either moves on to another village or returns back to her resident village. In this set-up, the gross revenue in a given village is a function of the potential revenue and the compliance rate; for a given level of potential revenue, gross revenue is higher when compliance rates are higher. Costs come from two sources. First, there are

travel costs associated with the collection; second, the collector is compensated for her work, either with a day rate or with a portion of the revenue collected (pay-for-performance / tax farming). The total net revenue is obtained by subtracting these costs from the gross revenue across all visited villages.

Which villages does the tax collector visit in her tax zone? It seems naive to assume collectors will visit all villages in their zone, regardless of the situation. In the simulations below, I model the decision for a tax collector to visit a village as a function of (i) the expected net revenue and (ii) the structure of the compensation package offered to tax collectors. Where tax collectors receive a day rate, they visit villages that the local government instructs them to visit. To maximize revenue, government will instruct collectors to visit villages where the expected net revenue of the visit is positive—that is, where the potential revenue times the expected compliance rate outweighs the costs of traveling to the village and paying (some or all, depending on whether the collector can visit more than one village per day) the collector's day rate. However, if tax collectors' compensation package is of the "pay-for-performance" variety, where tax collectors pay their own transportation costs but receive a portion of the collected revenue, the calculation is slightly different. In this case, a tax collector will only visit a village if their take home portion of the revenue is more than the cost of traveling to that village plus the collector's opportunity cost.[13]

In the rest of this section, I estimate total net revenue under different scenarios, varying (i) tax compliance rates, (ii) the number of villages tax collectors visit in a single trip, and (iii) tax collectors' compensation structure across scenarios. In **scenario 1** (4.1) I assume that the collector receives a flat daily compensation rate and that collectors only visit one village per day. I then estimate net revenue at different compliance rates. In **scenario 2** (4.2), I allow tax collectors to visit more than one village per day, again estimating total net revenue at different compliance rates. In **Scenario 3** (4.3) I consider a pay-for-performance contract (which I refer to as "tax farming"), where the collector only visits one village at a time. **Scenario 4** (4.4) again considers a tax farming arrangement, but where the tax collector visits wo villages per day.

Across each scenario, I consider the following compliance rates: 100%, 50%, 40%, 30%, 20%, and 10%. While full compliance is clearly unrealistic in any context, I provide these statistics to get a sense of the maximum potential revenue. I use 10% as the minimum compliance rate as it approximates my estimate of the compliance rate early in the reform.[14] Other factors that limit compliance in this context include (i) minimal enforcement (ii) low trust in government and (iii) tax collector shirking. While enforcement and government trustworthiness are issues even when collection is not done in-person, in-person tax collection suffers from a principle-agent problem where tax collectors can shirk responsibility (i.e., low effort collection). In Scenarios 1 and 2, the tax collector gets paid not based on the amount of taxes she collects, but based on a daily salary. While it is fairly straightforward to confirm that a tax collector has at least visited a village (for example, by collecting a GPS location), it is less straightforward

[13]For example, say the tax collectors receives 10% of collected taxes and their opportunity cost is 20,000 Leones, which they could make as wage labor. This means tax collectors should only visit villages where 10% of expected revenue is greater than travel cost plus opportunity cost.

[14]More specifically, I estimated the compliance rate at 9% in 2019, based on tax receipts and estimates of potential revenue. This compliance rate was calculated in 307 villages visited by collectors in that year.

to ensure that the collector has actually made a serious attempt at collecting. A collector looking to minimize their time investment and maximize their popularity could simply show up in a village, record a GPS location, say hello to a few friends, then leave reporting they were unable to collect any taxes and collect their day rate. The tax farming model seeks to address shirking, by making tax collector compensation a function of taxes collected, but it runs the risk of incentivizing abusive behavior from tax collectors. The compliance rates in between should not be taken as my predictions for next years rates; rather I show estimates at several rates to get a sense of the compliance rate needed to generate sufficient revenue to make the venture worthwhile.

For each scenario, I estimate a set of additional statistics. These statistics are described in table 3.

Statistic	Description
Compliance Rate	The assumed rate of compliance. This can also be thought of as the percent of total potential revenue that is collected.
Gross Revenue	The total revenue collected in all villages visited. This is calculated as the total potential revenue times the compliance rate in the subset of villages that are visited by the tax collector.
Net Revenue	The net revenue after accounting for the two main administrative costs of collection: (i) tax collector travel costs and (ii)costs of compensating tax collectors. This is the revenue that will go to local government and can be used for future services.
Percent of villages visited	As noted, I assume tax collectors will not visit villages if the village level net revenue is below zero. This statistic shows the percent of the total villages that tax collectors will visit.
Travel Costs	Total tax collector cost of travel to villages.
Compensation Costs	Cost of paying tax collectors.
Cost to Gross ratio	Calculated as total collection costs (travel cost + compensation cost) divided by gross revenue. This can be thought of as a collection efficiency metric—how much of the revenue collected from households is being spent administering the collection?
Revenue Concentration	The percent of net revenue that is collected from villages in the (i) top 1%, (ii) top 10%, (iii) bottom 50% of potential revenue. I display these statistics in a separate table.

Table 3: Simulation Statistics

4.1 Approach 1: Day rate compensation; 1 village per day;

Let's start by assuming that a tax collector (i) visits only one village per day and (ii) tax collectors are compensated at a day rate of SLL 50,000 ($\approx$ \$5). Table 4 displays key statistics under this scenario.

At full compliance, tax collectors visit 95% of villages and net revenue is over \$113,000.[15] The

[15] I convert Leones to USD at 1:10,000. The current exchange rate is currently closer to 1:13,000. But tax

	Revenue (USD)			Costs (USD)		
Compliance Rate	**Gross**	**Net**	**Villages Visited (%)**	**Travel**	**Salary**	**Costs / Gross Revenue**
1.0	123258.61	113328.81	0.95	4594.8	5335	0.08
0.5	60985.88	51910.08	0.88	4155.8	4920	0.15
0.4	48378.14	39755.94	0.84	3922.2	4700	0.18
0.3	35604.98	27756.58	0.77	3533.4	4315	0.22
0.2	22598.77	16114.17	0.64	2879.6	3605	0.29
0.1	9402.48	5600.08	0.40	1577.4	2225	0.40

Table 4: Simulation 1

	Percent of collected net revenue from		
Compliance Rate	**Top 1%**	**Top 10%**	**Bottom 50%**
1.0	0.12	0.41	0.12
0.5	0.13	0.43	0.09
0.4	0.14	0.45	0.08
0.3	0.15	0.47	0.06
0.2	0.17	0.52	0.03
0.1	0.24	0.67	0.00

Table 5: Simulation 1 - Revenue Concentration

total cost of collection represents 8% of the gross revenue collected. Clearly, full compliance is unrealistic. At a compliance rate of 50%, net revenue is $51,910 and 88% of villages are visited. While 50% compliance might seem unattainable without a large overhaul to the enforcement infrastructure, compliance rates in the range of 30% seem attainable. With a compliance rate of 30%, tax collectors will visit 77% of villages and the government will net almost $28,000. Importantly, even with 30% compliance the system of collection is fairly efficient—only 22% of gross revenue collected is spent on collection costs.

Table 5 displays statistics on the concentration of net revenue in scenario 1, at different compliance rates. In the context of full compliance, 12% of net revenue is derived from villages with potential revenue in the top 1% and 41% of net revenue is extracted from villages with potential revenue in the top 10%. At full compliance villages with below median levels of potential revenue only generate 12% of total net revenue. As the compliance rate drops, a greater share of revenue is generated from high revenue potential villages, as collectors stop visiting small villages with little potential revenue. When the compliance rate is 30%, 15% of net revenue comes from the top 1% and 52% of net revenue comes from villages in the top 10% of potential revenue. Only 6% of net revenue comes from villages with below the median potential revenue.[16]

Recall that the figures presented in 4 assume that tax collectors only visit one village per day.[17] How might these estimates change if we allow tax collectors to visit more than one village per day?

rates were decided on when the rate was closer to the former.

[16]Note that in this scenario 23% of villages are not visited.

[17]Note that the compensation assumption of paying a tax collector to visit one village per day is equivalent to a compensation system that pays each collector a fixed rate for visiting a village.

4.2 Approach 2: Day rate compensation; 2 villages per day

Table 6 presents results when we assume that tax collectors can visit two villages on the same trip. I construct statistics in table 6 using the following method. I iteratively place villages in pairs based on geographic proximity. Specifically, I randomly select a village and pair it the village closest to it. I then remove both villages from the data set, randomly select another village and pair that to the most geo-graphically proximate village. And so on. I then calculate statistics at the pair level. For example, gross revenue is the sum of the potential revenue of both villages in the pair times the compliance rate. Travel cost to a pair is taken to be the travel highest travel cost value in each pair. Net revenue is calculated at the pair level as pair level gross revenue minus travel cost. Table 6 assumes that tax collector compensation is a day rate and a pair of villages can be visited in a day.

	Revenue (USD)			Costs (USD)		
Compliance Rate	**Gross**	**Net**	**Villages Visited (%)**	**Travel**	**Salary**	**Costs / Gross Revenue**
1.0	121826.76	116244.96	0.98	2836.8	2745	0.05
0.5	60878.92	55344.12	0.97	2804.8	2730	0.09
0.4	48675.42	43170.62	0.97	2789.8	2715	0.11
0.3	36394.60	31020.80	0.95	2713.8	2660	0.15
0.2	23972.68	18939.28	0.89	2528.4	2505	0.21
0.1	11115.37	7209.77	0.71	1905.6	2000	0.35

Table 6: Simulation 2

At all levels of compliance, net revenues are slightly larger in scenario 2 (Table 6) than in scenario 1 (Table 4), by several thousand dollars. For example, at a compliance rate of 30% net revenue in scenario 2 is $31,021, compared to $27,756 in scenario 1. This is as we should expect and reflects the lower costs of administration contained in the assumption of tax collectors visiting two villages per day, rather than one. Overall, however, differences in net revenue are modest.

This suggests that even substantial percentage changes in operating costs do not impact net revenue as much as achievable changes in taxpayer compliance rates. For example, at a compliance rate of 30%, scenario 2 slashes total collection costs by 31.5%, but in absolute terms this is less than $3,000 ($2,714).[18] In contrast, a 10 percentage point change in compliance rate in either scenario is associated with a shift in net revenue of approximately $12,000.

The major difference between scenarios is that tax collectors visit more villages at each level of compliance in scenario 2, especially at low levels of compliance. For example, assuming a tax compliance rate of 20%, tax collectors visit 64% of villages in scenario 1 and 89% of villages in scenario 2. The gap is even wider at a tax compliance rate of 10%, where tax collectors visit 40% of villages in scenario 1 and 71% of villages in scenario 2. Again, note that these differences in village visit rates do not translate to huge differences in net revenue. Again, this is to be expected; the villages that tax collectors avoid in scenario 1 are those with the lowest potential net revenue. While more villages are visited in scenario 2, tax collection

[18] Scenario 1: 3,533 + 4,315 = $7,848
Scenario 2: 2,714+2,660 = 5,374
Difference = 2,474;
%change: 2,474 / 7,848 = 31.5%

is also more efficient, as administrative costs represent a smaller share of the gross revenue collected, because tax collectors visit more villages for each mile they travel.

Table 7 displays statistics on the concentration of net revenue in scenario 2, at different compliance rates. Compared to scenario 1, the major difference is that more villages are visited, as villages can be visited as part of a pair, and therefore more revenue comes from smaller villages. That said, the extracted (net) revenue remains fairly concentrated.

	Percent of collected net revenue from		
Compliance Rate	**Top 1%**	**Top 10%**	**Bottom 50%**
1.0	0.12	0.40	0.15
0.5	0.12	0.41	0.14
0.4	0.13	0.42	0.14
0.3	0.13	0.44	0.13
0.2	0.14	0.48	0.12
0.1	0.19	0.61	0.06

Table 7: Simulation 2 - Revenue Concentration

4.3 Approach 3: Tax Farming; 1 village per day

The status quo approach for compensating tax collectors in Kono District is to use a pay-for-performance model, also known as "tax farming". In this model, tax collectors pay their own travel costs, but keep a percentage of what they collect, as both "cost recovery" for travel and as compensation. In 2021, tax collector kept 13% of the money they collected. This model has important implications for the villages that collectors visit. We would only expect tax collectors to visit a village if their take home portion of the revenue they expect to collect outweighs the cost of traveling there.[19] Moreover, if the collector has an outside option, this difference would have to be larger than the opportunity cost. In these scenarios I assume that tax collectors do not have an outside option and therefore have an opportunity cost of zero. This makes these predictions optimistic.

Table 8 presents results at different compliance rates. The net revenue the government receives under the tax farming model is lower than in scenario 1 (where we make similar assumptions about tax collector travel behavior). For example, at 40% compliance the government receives a net revenue of about $40,000 in Scenario 1 and $33,659 under tax farming (about 16% lower). At 30% compliance, the government receives a net revenue of $27,756 in scenario 1 and $22,567 under tax farming (about 19% lower).

Importantly, these differences are not driven by tax collectors claiming a larger portion of the gross revenue. While tax farming has a higher compensation upside for tax collectors—at 100% compliance the tax collector makes nearly $12,000 under tax farming, compared to $5,335 in scenario 1—at realistic levels of compliance the tax collector in the tax farming model is actually compensated *less* than the collector in scenario 1. For example, at a compliance rate of 30% the collector in scenario 1 makes a salary of $4,315, compared to $2,209 under

[19]Note that the "take home portion of expected revenue" = compliance rate* maximum potential revenue*percent collector keeps.

tax farming.[20]

The lower net revenue in the tax farming model is a product of the relatively less villages visited by collectors under this model. At 30% compliance on 38% of the villages are visited under the tax farming model, compared to 77% in scenario 1.

	Gov. Revenue (USD)		Collector Costs (USD)	Collector Revenue	
Compliance Rate	**Net**	**Villages Visited (%)**	**Travel**	**Gross**	**Net**
1.0	102047.69	0.77	3283.8	15248.51	11964.71
0.5	44749.10	0.54	1985.4	6686.65	4701.25
0.4	33659.68	0.47	1626.0	5029.61	3403.61
0.3	22567.17	0.38	1163.2	3372.11	2208.91
0.2	12670.83	0.28	724.6	1893.34	1168.74
0.1	3888.10	0.13	191.6	580.98	389.38

Table 8: Simulation 3

	Percent of collected net revenue from		
Compliance Rate	**Top 1%**	**Top 10%**	**Bottom 50%**
1.0	0.12	0.40	0.11
0.5	0.14	0.46	0.05
0.4	0.14	0.48	0.04
0.3	0.16	0.54	0.03
0.2	0.19	0.62	0.02
0.1	0.30	0.72	0.01

Table 9: Simulation 3 - Revenue Concentration

The tax farming model relies more heavily on villages with more potential revenue, as tax collector have less incentive to visit small villages.

4.4 Approach 4: Tax Farming; 2 villages per day

	Gov. Revenue (USD)		Collector Costs (USD)	Collector Revenue	
Compliance Rate	**Net**	**Villages Visited (%)**	**Travel**	**Gross**	**Net**
1.0	105043.86	0.94	2611.8	15696.21	13084.41
0.5	49918.68	0.81	2097.8	7459.11	5361.31
0.4	37958.36	0.71	1765.8	5671.94	3906.14
0.3	26494.11	0.61	1421.0	3958.89	2537.89
0.2	14768.45	0.45	888.0	2206.78	1318.78
0.1	4458.38	0.20	276.6	666.20	389.60

Table 10: Simulation 4

Table 10 presents results when we allow the tax collector to visit villages in pairs, as with

[20]Note that the collector under tax farming at 30% compliance visits 426 villages and therefore makes $5.19 dollars per village. This is slightly more per village than made by the collector in scenario 1, who makes an even $5.00 per village.

scenario 2. As expected the number of visited villages does increase substantially. However, net revenue do not reach the level of scenario 2.

4.5 Results Takeaways

The most important parameter for generating net revenue is the tax compliance rate. Given that the tax liability for nearly all properties in rural areas is below $5, tax compliance rates around 50% seems to be an achievable medium-term goal (which would generate a net revenue of about $50,000). The returns to improving compliance compliance rates outweigh the returns to reducing travel costs. In simulations, I compare scenarios where the tax collector visit only one village per day (Simulations 1 and 3), to scenarios where tax collectors visit two villages per day (Simulations 2 and 4). These scenarios represent extremes—it seems likely that there will be many instances where a collector visit two villages in a day, but that they won't be able to *average* two villages per day. But moving between extremes only impacts net revenue a couple thousand dollars at any given level of compliance. In summary, the travel costs of in-person tax collection are relatively minor, even with conservative assumptions about tax collector travel behavior; collection costs make up sizeable shares of net revenue only at very low compliance rates.

While travel costs have limited impact on net revenue, the structure of the compensation package for tax collectors does substantively to impact net revenue. Holding compliance rates fixed, tax farming models generate less revenue and collectors visit less villages than under salary-based compensation models. However, tax farming models have two potential advantages. First, tax collectors are incentivized to work harder to collect revenue, as they keep a share of what is collected.[21] Our simulations show that if the compliance gains are in the range of 7-8 percentage points, the compliance rate gain from tax farming would make it the better strategy. Compliance gains could come from tax collectors working harder to collect more taxes in a given village or from visiting multiple villages per day (thus reducing per village travel cost, as in scenario 2). Second, with tax farming, governments side-step liquidity constraints that may hem governments into a problematic catch-22: without revenue, how can (especially local) government pay to collect taxes? Tax-farming can get collectors in the field without some of the upfront costs.

4.6 Considering Additional Collection Costs

In the above exercise, total collection cost comprises (1) tax collector compensation and (2) tax collector travel costs. In estimating these costs I have tried to be conservative and place the costs near their upper-bounds. The day rate salary for tax collectors is quite competitive and is high enough to attract many interested applicants; it could likely be reduced by 20% and still attract an abundance of applicants. Transportation costs assume that a collector separately hires a motorbike rider for every leg of the journey. Buying motorbikes outright, or renting them long-term would likely reduce transport costs.

That said, there are several potential costs that I do not consider and therefore I may underestimate the costs associated with collection.

[21] However, this might also increase coercive behavior from tax collector.

First, I assume that tax collectors visit each village only once. However, a tax collector (or tax official) might visit villages additional times to either (a) transmit tax demands or (b) make additional collection attempts. We can estimate the upper bound cost associated with transmitting tax demands at $5,582, which is the total cost of a tax collector visiting all villages, assuming they visit two villages at a time (Scenario 2, 100% compliance). More realistically, a delivery team could likely visit three times as many villages per day, and a delivery cost of under $2,000 seems more reasonable. Still, this presents a significant upfront cost and local councils should consider more cost-effective methods of making tax demands. One strategy would be to collaborate with other government agencies to communicate with property owners. For example, the National Election Commission maintains a database of registered voters that contains contact information. Another strategy would be to work with Chiefdom Councils to obtain the phone numbers of all village chiefs in the district and inform these chiefs of the tax liability structure through phone calls and follow-up texts. Of course, it would have to be determined that these are legally viable way of transmitting tax demands. What about the costs associated with revisiting villages for additional collection attempts? A simple back of the envelop calculation can be achieved by multiplying the total collection costs by some constant. For example, I estimated the collection costs in scenario 1 with 30% compliance as $7,848. We could assume that tax collectors revisit half of those towns and multiply the total cost by 1.5 to get USD 11,772. That would lover the net revenue by 3,924 (14%).

Second, supervision costs are not considered. The decision to exclude this costs reflects my belief that any tax collector monitoring in the context of rural tax collection must be light touch and that the associated costs would not be too large. If a supervisory team from the Valuation office makes village visits (a "spot-check"), there is little chance that they meet the tax collector during collection. Instead, the goal of a supervisory visit from the Valuation office would be to visit villages the collector has already visited and looks for signs of collusion and receive any complaints against the collector.[22] Valuation clerks are already salaried and the department has motorbikes for this purpose. Therefore, the cost associated with these spot-checks is fuel cost. With fuel less than $1 per liter, assuming an average of 5 liters per visited village, 100 villages could be spot-checked for under $500.

5 Discussion

If a policy makers only motivation for rural property taxation is to raise revenues from those areas, these simulations suggest rural areas can generate modest, though potentially meaningful revenue for local governments. Certainly, local governments that preside over poor rural areas—such as the Kono District Council (KDC)—are not going to move mountains with the revenue they collect from property tax. That said, Kono residents could greatly benefit from a set of light-touch projects paid for from own-source revenue that could quite plausibly hit $40,000 with the current (rather low) tax rates. One strategy to reach low-hanging benefits

[22]Collusion in our context looks like this: After a tax payer has paid, the collector writes a receipt. The local government can check if the receipts add up to the total amount collected and returned by the collector. However, there is little to stop a collector from, upon visiting a property that should pay 50,000 SLL, write a receipt for 40,000, demand 45,000 and pocket the balance 5,000. A "spot-check" supervisory system may deter this behavior, because the supervisory team can check that property owners have paid the rate that they should have.

would be to use revenue to complement and maintain projects implemented by central government or NGOs. Central government and NGOs have built many school building, heath centers, and water points across Kono. However, often these projects fall into partial or complete disrepair because of a lack of maintenance. For example, rooms of a hospital or school are unusable because of a collapsed roof or a broken hand pump makes a well more difficult to use.[23] KDC could use its own source revenue to maintain these projects—given the low cost of labor (and often times materials), a own-source revenue budget of $40,000 could be used to undertake 50 maintenance projects of $800. In summary, the revenue potential of property tax in rural areas isn't monumental, but given the potential for large impact from low-handing maintenance projects on vital public services, this revenue might be worth pursuing.

If a policy maker's sole goal for rural taxation is to extract revenue from rural areas they should focus on the set of villages that generate most of the net revenue. In most circumstances, a policy-maker with this motive should ignore villages that have potential revenue below the median—these villages contribute little to the overall revenue take. If a policy maker wanted to further simplify their task, focusing on the 10% of villages with the most potential revenue is a good bet, as roughly 50% of the net revenue take would be extracted from these villages.

Of course, policy makers may have motivations for rural taxation that extends beyond extracting revenue from those areas. Even when a policy maker's goal with rural taxation is revenue maximization, policy makers should consider the impact of rural taxation on the perceived fairness of the tax system, and in turn on tax compliance. It seems possible that extending the tax net into rural areas may impact the compliance rates of property owners in urban areas, who have higher tax liabilities. That is, rural taxation may increase perceptions of fairness for urban property owners, and thereby increase compliance. Moreover, the way that rural property tax is collected may affect compliance rates in rural areas themselves. While potential revenue in rural areas may be concentrated in a small subset of villages, compliance rates in these villages may be a function of the breadth of the tax net (i.e., the number of villages tax in rural areas).

If the breadth of taxation impacts compliance rates, their may be pro-poor motivations for taxing poorer, rural areas.[24] If government transfers and public services disproportionately benefit the poor, and expanding the tax net increases revenue raise in richer areas (through higher compliance rates), the tax imposed on rural areas may be outweighed by the additional services paid for by the increased revenue from richer areas. Counter-intuitively, taxing rural areas may do more to redistribute wealth than not taxing them at all. Policy makers who take these arguments seriously may want to avoid focusing their attention solely on high potential areas, whether they be urban or rural. As far as I am aware, their is little evidence for or against the hypothesis that expanding the breadth of taxation increases compliance rates.

Another motivation for tax collection in rural areas follows a state-building logic, where the goal of taxation is to create social contract links between state (or state authorities) and citizens. By this logic, policy makers tax rural areas to engage these citizens with the state and legitimate the state to citizens. In this way, systematic tax expansion is itself be an act

[23] Other examples include: broken lights, leaks, broken generate, etc.

[24] This line of argument runs contrary to suggestions that expanding the tax net into poor, rural areas increases inequalities.

of legitimization. Thus legitimated, state leaders might find that citizens are more likely to comply their other directives and policies, and more likely to engage with state institutions, such as courts, school, and hospitals. Some evidence for this logic can be found in the exciting new research from Weigel and Ngindu (2021).

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Appendices

A Tax Zones

Figure 3: Tax Zones