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Tax Potential, Effort, and Gap Estimates

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Tax Potential, Effort, and Gap and why they matter

- **Tax Potential:** The percentage of a country's national income above the minimum level required for people's sustenance and intact productive capacity of an economy.
  - Maximum tax revenues a government can receive with existing macroeconomic and socioeconomic characteristics, assuming efficient policy design and perfect tax compliance.

- **Tax Effort:** This is the ratio of actual tax revenues collected in a country relative to its tax capacity.
  - How much of a country's tax capacity is being collected in tax revenues?

- **Tax Gap:** The difference between the estimated tax potential and a country's actual tax collections;
  - Can be estimated by tax type or in terms of overall tax revenue collections.

- **Importance:** The estimates are an indicator of the sufficiency of government revenues

- The estimates give policymakers an indication of how much domestic revenues a country can realistically be expected to collect, conditional on its income level.
  - On the one hand, poverty reduction policies demand sufficient revenue to improve access and quality of services for the people.
  - On the other hand, growth promotion policies require certain amount of income to be left for private consumption and investment.

Data: Total Number of Countries by Income Group

Year	High Income countries	Upper middle-income countries	Lower Middle Income	Low Income countries	Total
1995	44	28	33	14	119
1996	43	30	33	15	121
1997	45	31	34	15	125
1998	45	31	35	15	126
1999	45	31	35	15	126
2000	46	31	35	15	127
2001	46	31	35	15	127
2002	46	31	35	15	127
2003	46	31	35	15	127
2004	46	31	35	15	127
2005	46	31	34	15	126
2006	47	32	34	15	128
2007	47	32	34	15	128
2008	47	33	34	15	129
2009	47	33	34	16	130
2010	47	33	34	16	130
2011	47	33	34	17	131
2012	47	34	34	17	132
2013	47	34	34	17	132
2014	47	35	34	17	133
2015	47	35	33	17	132
2016	47	35	33	17	132
2017	47	35	33	17	132
2018	47	35	33	17	132
2019	46	34	32	17	129
2020	45	34	32	16	127
2021	36	30	24	12	102
Total	**1,236**	**874**	**905**	**422**	**3,437**

The World Bank currently classifies 217 countries into different income group categories, with 38 percent of those countries classified as high income, the middle and upper-middle income category accounts for 50 percent of the countries and 12 percent of the countries are classified as low income. The countries included in the sample are representative of countries from the different income groups, their inclusion is based on data availability.

- **Part of World Bank's Core Diagnostics:** As part of the Public Finance Review revamp, the World Bank estimates tax potential and overall tax gaps for several countries.
  - About 135 countries, they are representative of the different income groups

- An unbalanced panel from 1995 to 2021
  - With about 3,437 observations

- No resource dependent countries in sample

- Some small states are problematic for estimation.
  - Okay if small but with substantial level of economic activity.

How are tax potential, effort and gap estimated?

Tax Potential

The main results are estimated from a Stochastic Frontier Approach and the estimation equation is:

$$Y_{it} = \alpha_i + \beta' Z_{it} + \tau time + v_{it} - \mu_{it} \qquad (1)$$

- Y_{it} is the Tax to GDP ratio for country i at time t;

- α_i is a country specific fixed effect

- $time$ is a time trend which captures the effect of time specific shocks,

- $v_{it} - \mu_{it}$ is a composite error term for country i at time t, the error term includes both the inefficiency term (μ_{it}) and the random (stochastic) term;

- Z_{it} is a vector of time-varying determinates of the tax to GDP ratio for country i at time at time t.
  - GDP per capita and its squared term, an indicator for trade openness, agricultural value added; age dependence ratio; ICRG's indicator of quality of government; and a year dummy for the last year in the series.

Tax Effort

- The estimates from Equation (1) are used to predict the Tax to GDP ratio ($\hat{Y}_{it}$) for country i at time t,
  - Interpreted as a country's tax potential.

- A country's tax effort (TE) is then estimated as the ratio of actual tax revenues to the country's tax potential
  - $\left(TE_{it} = \frac{Y_{it}}{\hat{Y}_{it}} \right)$.

Overall Tax Gap

- The difference between the estimated tax potential and a country's actual tax collections ($\hat{Y}_{it} - Y_{it}$) can be interpreted as the overall tax gap;

Determinants of tax potential: SFA estimates.

- Equation (1) is estimated under different sets of assumptions:
  - unobserved time-varying country specific inefficiency is assumed to be correlated with other observed determinates of a country's tax to GDP ratio [Specifications (1) and (3)].
  - the inefficiency term is purely random and not correlated with the other determinants of a countries tax to GDP ratio [Specifications (2) and (4)].

- Equation (1) is further estimated for a subsample of Middle – and Low – countries only [Specification (3) and (4)].
  - A country with a tax to GDP ratio of between 8 – 12 percent with a tax effort of 0.98!

- When controls for governance are added, they are statistically significant, however the sample size decreases.

	Log Tax to GDP ratio			
	(1)	(2)	(3)	(4)
	Full Sample		Middle – and Low – Income countries	
Log GDP per capita	2.605***	1.127***	1.745	1.394***
	(0.617)	(0.082)	(1.323)	(0.249)
Log GDP per capita squared	-0.155***	-0.062***	-0.106	-0.085***
	(0.034)	(0.004)	(0.084)	(0.016)
Log imports	0.165*	0.057*	0.202*	0.095**
	(0.092)	(0.033)	(0.107)	(0.044)
Log Exports	-0.008	0.013	0.041	0.003
	(0.106)	(0.038)	(0.131)	(0.044)
Agriculture, forestry, and fishing, value added (% of GDP)	-0.022***	-0.002	-0.022***	-0.003*
	(0.008)	(0.001)	(0.008)	(0.002)
Log age dependency ratio	-0.314	-0.187***	0.460	-0.078***
	(0.217)	(0.008)	(0.395)	(0.016)
Country fixed effects	Yes	No	Yes	No
Country random effects	No	Yes	No	Yes
Time trend	Yes	Yes	Yes	Yes
Dummy for year 2021	Yes	Yes	Yes	Yes
Observations	3,437	3,437	2,201	2,201
Number of countries	135	135	88	88

Application of estimates in WB core diagnostics

Country X's tax effort lags other peers in the region and income group
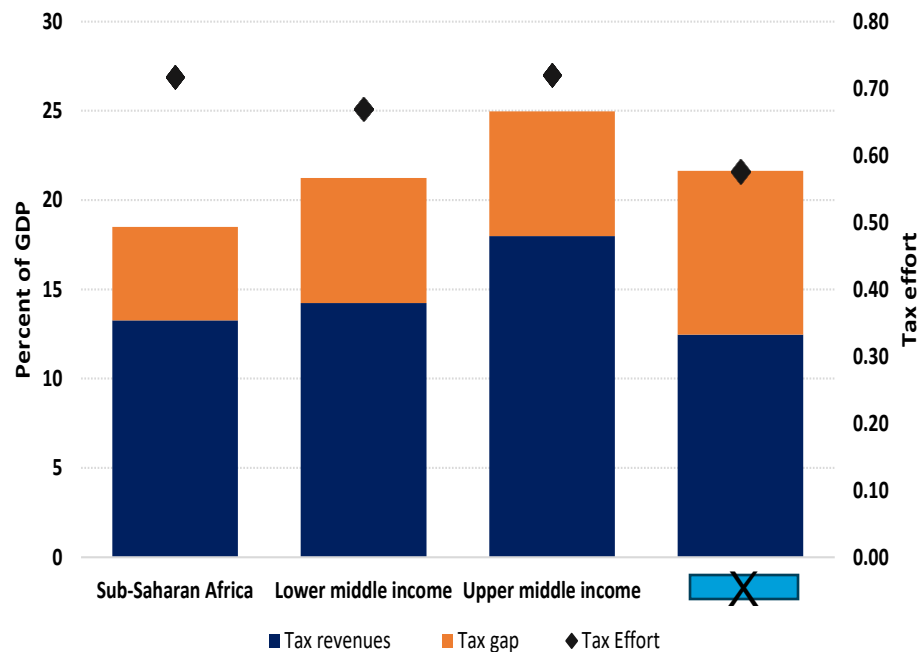
Despite Y's level of tax collections, there is scope to improve its tax effort
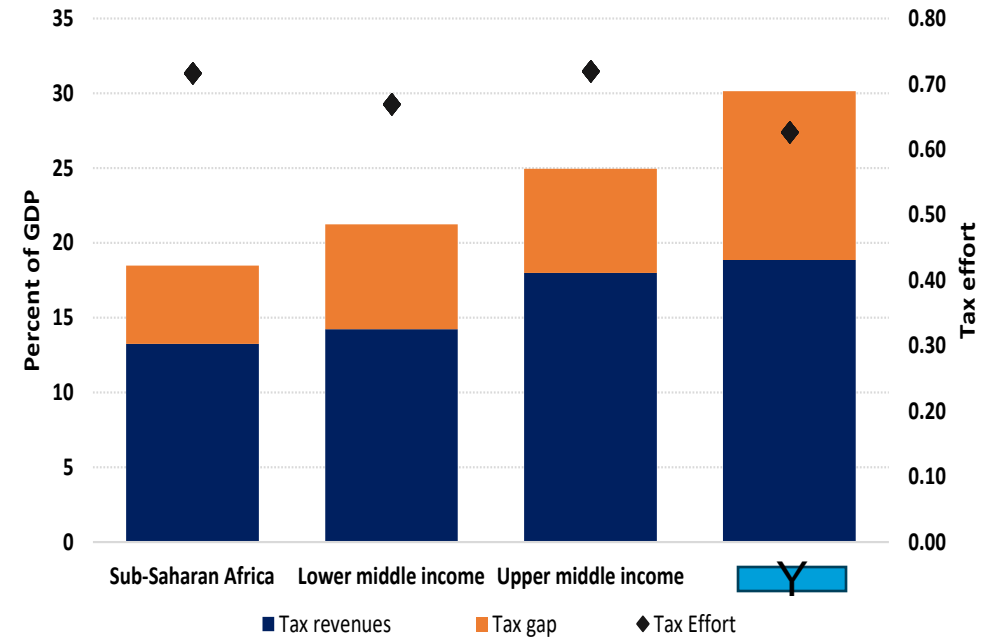
Tax gaps and beyond

- How can we measure the effect of a tax admin or policy intervention on compliance and/or tax revenues?
  - How do we know if the intervention worked?
  - How do firms respond to the intervention?

- Suppose we cannot randomly select firms to be audited, how can we know if audits are have any effect on compliance?
  - How do firms respond to audits?

- **Excise Taxes and Digital Tax Stamps: Do Digital Tax Stamps Work?**

Background

- Excise taxes are designed to correct for negative externalities associated with the production or consumption of goods that are socially costly
  - sin goods – alcoholic beverages, cigarettes,
  - Minimize their consumption
  - pollutants with high carbon emissions – fuels

- The scope of excise goods is much wider in Uganda
  - Includes phone talk time, water, cooking oil, mobile money, bank interest
  - Expanding the tax base and raising more government revenue
  - The Ugandan government increases the excise tax rates regularly

- However, effectiveness of changes in policy-generate the required revenue with minimal distortions- depends;
  - Ability of tax administration to enforce changes
    - Track and trace production and sales revenues

- Does a track and trace mechanism affect firm behavior?
  - What happens to firm's ex-factory prices, and sales revenues?
  - Does the Government actually collect more in excise tax revenues?

Motivation cont'd

- In FY2019/20 the Government of Uganda Introduced Digital Tax Stamps on some excisable goods
  - manufacturers or importers of the gazetted products to affix digitally traceable tax stamps
  - Part of the implementation of DRMS

- DTS can be physical paper stamps or markings:
  - Are fixed on excisable goods or their packaging.
  - Contain security features and codes
  - Prevent counterfeiting, tamperproof features,
  - Have track and trace capabilities

- Estimate the effect of introducing DTS on firm ex-factory prices, excisable sales revenue, and government excise tax revenues (outcome variables)
  - "Treated" firms: Manufacturers of excisable goods whose goods are designated to affix DTS
  - Comparison group firms: Manufacturers of excisable goods whose goods are not required to affix tax stamps.

- With four year of data: Allows for non-parallel linear trends to estimate the effect of introducing DTS
  - compare outcome variables of treated firms to those of the comparison group

Goods required to affix DTS and the respective Unit Cost

Excisable Good	Unit Cost of Tax Stamp in FY 2019/20 (Uganda Shillings)	Excise Tax rate changed in FY 2019/20	Excise Tax rate change in FY 2020/21
Cigarettes	110	No	No
Beer	55	No	Yes
Spirits	240	No	Yes
Wines	200	No	No
Soft drinks	20	No	Yes
Other Alcoholic beverages	55	No	No
Bottled water	15	No	No
Sugar	0	No	No
Cement	0	No	No
Cooking oil	0	No	No

- DTS introduced in FY2019/20, Government paid for stamps that year
  - A one-off payment of Shs. 62 billion
  - Cost of DTS implemented in the second-year post policy intervention
- Cost revised in Feb 2022
- Tax rates for some products on DTS changed – effective excise tax rate imputed and used as a control variable
- A dummy variable equals 1 for firms whose products are required to affix DTS and 0 for firms whose products are not required to affix DTS
  - Continuous treatment variable that captures the cost of DTS?
    - Was not possible : Throwing away the first year since the monetary cost to firms was zero

Data

Table 2: Number of Excise Tax Returns and the Percent of Treated

Financial Year	Treated tax returns	Comparison group tax returns	All returns	Percent of treated
2017/18	4,258	7,895	12,153	35.0%
2018/19	4,363	8,777	13,140	33.2%
2019/20	4,539	8,340	12,879	35.2%
2020/21	5,846	8,812	14,658	39.9%
Total	**19,006**	**33,824**	**52,830**	**35.8%**

- An increase in treated returns by 4% and 34% in the first and second year post-DTS, respectively – relative to the baseline period.
  - Improved compliance, more firms filing returns.

- A decrease of 5% and an increase of 0.4% in comparison group returns in the first and second year post-DTS, respectively – relative to the baseline.
  - Attrition not a problem
  - Treated firms are actually filing more, increased compliance?

What is observed graphically?

Figure 1: Trends in Ex-factory Prices, Excisable Sales Revenues and Excise duty Revenues
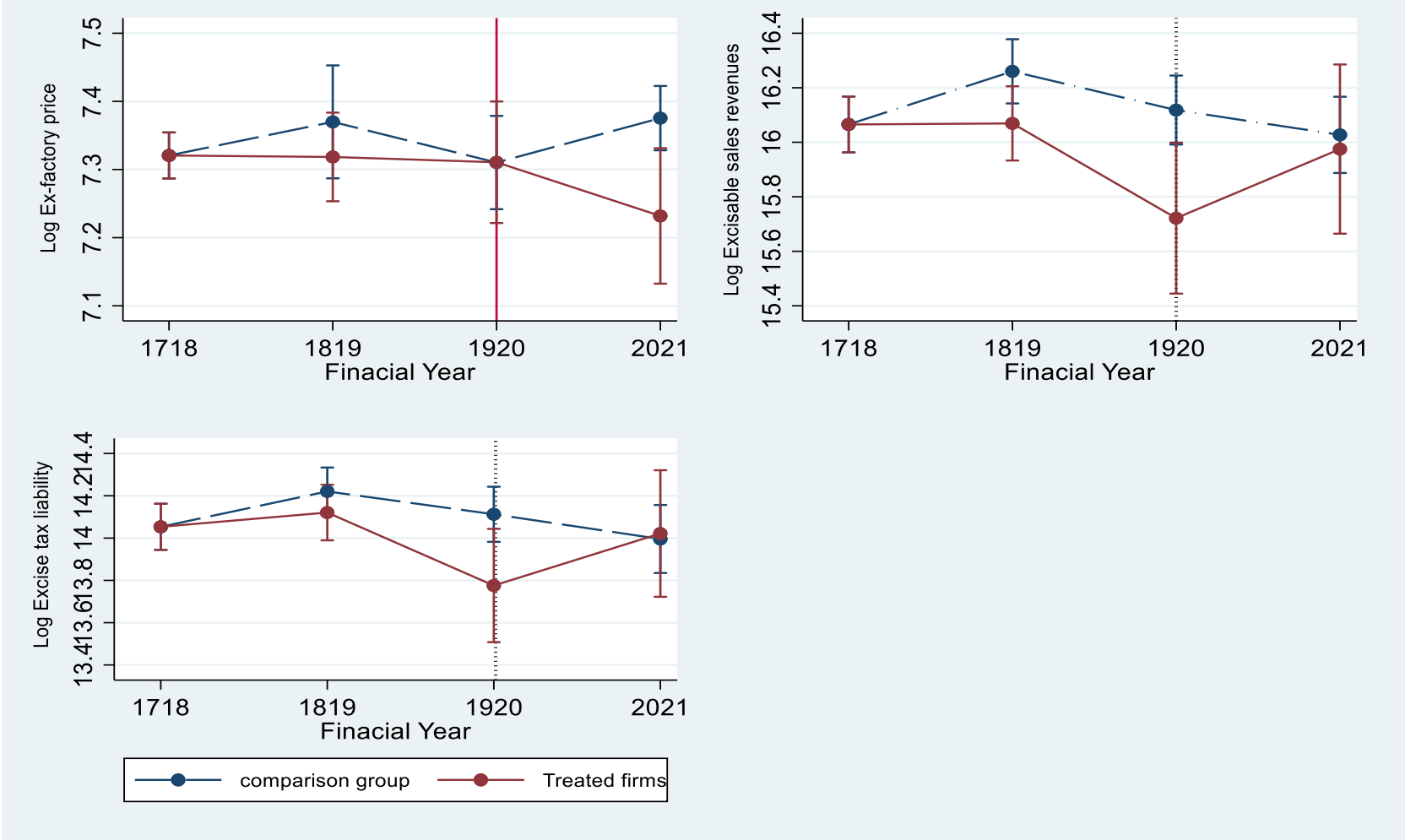
- May be the parallel trends assumption not reasonable?

- Can one allow for non-parallel linear trends?
  - Can test if there are non-parallel trends?

- Can one allow for the treatment effect to be different over time?

Table 7: The Effect of Digital Tax Stamps on Outcome Variables for Times Government Pays for the Digital Tax Stamps (t=3) and When Firms Meet the Cost (t=4)

	(1) Log Ex-factory Prices	(2) Log Excisable Sales Revenues	(3) Log Excise Tax Revenues
Product has Digital Tax Stamp * Government pay for DTS (t=3)	-0.049 (0.037)	-0.249*** (0.069)	-0.248*** (0.069)
Product has Digital Tax Stamp * Companies pay for DTS (t=4)	-0.174* (0.098)	0.307* (0.157)	0.293* (0.160)
Time trend	-0.003 (0.021)	0.050* (0.030)	0.019 (0.047)
Time trend * Product has Digital Tax Stamp	0.017 (0.037)	-0.115 (0.086)	-0.087 (0.093)
Dummy variable for FY2020/21 (t=4)	Yes	Yes	Yes
Firm-level fixed effects	Yes	Yes	Yes
Log effective excise tax rates	Yes	Yes	Yes
Observations	52,830	52,830	52,830
R-squared	0.012	0.061	0.005
Number of clusters/firms	517	517	517

Robust standard errors in parentheses and are clustered at a firm level; ***, **, and * show the statistical significance at the 1, 5 and 10 percent levels, respectively. Effective excise tax rates refer to the portion of excisable sales revenues that are spent on the excise tax liability. This variable captures the effects of any changes in excise tax rates.

- Main results of this study:
  - Firms responded to DTS by decreasing ex-factory prices, partly shifts the cost to government
  - More sales revenues declared in the second-year post tax change, firms gradually embracing the technology
  - Gains in declared sales offset the negative effects of decreased ex-factory prices, hence positive effects on excise tax revenues

Conclusion

- Estimate the effect of introducing DTS on firms' ex-factory prices, sales revenue, and government tax revenues;

  - Treated firms' ex-factory prices decreased by 5% and 17.4% percent in the first and second years post-DTS, respectively.

  - Firms' excisable sales revenues decreased by 24.9 percent for the time that government paid for DTS relative to the comparison group firms
  - Increased by 30.7 percent when firms paid for DTS, relative to comparison group firms-second year post policy-intervention

  - Government Excise tax revenues decreased by 24.8 percent for the time that government paid for DTS, relative to comparison group firms
  - Increased by 29.3 percent when firms paid for DTS-second year post policy-intervention

- DTS might have posted negative effects in the first year of implementation
  - adapting new technologies takes time
  - Implementation challenges
  - Issues around pricing
- Maybe a uniform and relatively lower price for the stamps,
  - minimizes tax avoidance responses by firms
  - leave issues of influencing consumption, minimizing externalities to the main excise law
- Improve implementation to minimize the downtime by firms, mitigates the negative effects of the track and trace mechanism

Thank you!