Strategic or Confused Firms? Evidence from Missing Transactions in Uganda

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Are firms sophisticated maximizers?

- We routinely assume that firms are sophisticated maximizers
  - ▸ Despite pervasive evidence that *individuals* often make mistakes (Bernheim et al, 2019)
- Growing evidence that firms often deviate from profit maximizing behavior
  - ▸ DellaVigna & Gentzkow (2017), Kremer, Rao & Schilbach (2019)
- If a significant proportion of firms make suboptimal choices, the consequences for policy design could be far-reaching

The "self-enforcing" VAT

- We study firms' sophistication in the context of the VAT, a tax that has become extremely popular among economists based on two arguments:
    1. Production efficiency: undistorted input choices
    2. Revenue efficiency: "self-enforcing" property due to opposing (mis)reporting incentives and possibility of cross-checking (Pomeranz 2015)

- Limitations of revenue efficiency argument:
    - VAT compliance is far from perfect, esp. in developing countries
    - Implicit assumptions:
        - Some degree of *state* capacity, as cross-checks are costly
        - High degree of firm sophistication, i.e. *taxpayer capacity*

This paper

- We analyze firms' tax-reporting behavior in a low-income country, Uganda

- Using transaction-level data from VAT returns and Customs records for all VAT-registered firms in 2013-2016, we:

  1. Cross-check seller and buyer reports to identify reporting discrepancies

  2. Develop a two-way fixed-effects method to estimate the share of each discrepancy due to seller vs buyer

  3. Estimate the share of firms that misreport in a way that reduces (or increases) their tax liability

  4. Analyze firm behavior under stricter enforcement conditions, when imported goods pass through Customs

Contributions and related literature

- Direct evidence of mistakes vs strategic behavior by firms in the context of tax evasion
  - DellaVigna and Gentzkow (2017), Tourek (2018)

- New evidence on how tax evasion in a developing country responds to changes in the state's enforcement capacity
  - Fisman and Wei (2004), Besley and Persson (2009, 2010), Pomeranz (2015), Best et al. (2015), Naritomi (2019)

- Evidence on the limitations of "self-enforcement" of the VAT and third-party information more broadly
  - Emran and Stiglitz (2005), Bird and Gendron (2007)
  - Carrillo, Pomeranz and Singhal (2017), Slemrod et al. (2017), Almunia and Lopez-Rodriguez (2018)

Context and VAT Data in Uganda

- Uganda has a standard VAT system ▸ VAT in Uganda
  - ▸ Established in 1996; general rate is 18%
- Monthly VAT declarations filed electronically since 2012-13
- VAT declaration has two components:
  - ▸ Monthly VAT summary: total sales and purchases
  - ▸ **VAT Schedules**: transaction-level information (tax ID number (TIN) of counterpart, date, amount, description of goods)
    - ⋆ Schedule 1 (VS1): sales
    - ⋆ Schedule 2 (VS2): input purchases
    - ⋆ Schedule 3 (VS3): imports
    - ⋆ Schedule 4 (VS4): admin expenses

▸ Domestic VAT statistics

Defining discrepancies in VAT declarations

- Reporting incentives: seller wants to underreport sales, buyer wants to overreport purchases
- We sum up monthly transactions between firm **pairs**
  - $y^S =$ sales reported by a seller to a given buyer
  - $y^B =$ purchases reported by a buyer from a given seller
- Three possible cases:

$$y^S = y^B \iff \text{Consistent reporting}$$
$$y^S < y^B \iff \textbf{Seller shortfall} \text{ (lower tax liability)}$$
$$y^S > y^B \iff \textbf{Buyer shortfall} \text{ (higher tax liability)}$$

Cross-checking seller vs buyer reported amounts

Cross-checking seller vs buyer reported amounts

- We find discrepancies in 79% of seller-buyer-month observations for 2013-2016
  - Of these, 60% "seller shortfall" ($y^S < y^B$) and 40% "buyer shortfall" ($y^S > y^B$)
- Pervasive discrepancies in firms' VAT returns despite the possibility of cross-checking
  - Not specific to Uganda (see Mascagni et al. 2018 for Rwanda)
- High frequency of buyer shortfall ($y^S > y^B$) defies standard intuition about VAT evasion. Two hypotheses:
  - H1: Firms make **mistakes**: poor accounting, misunderstanding of tax rules, etc.
  - H2: **"Looking small"** strategy: underreport both sales and input purchases to appear small and reduce audit probability
    - ★ Consistent with evidence from Ecuador (Carrillo et al, 2017)

Who misreports? Two-way FE Model

- We use a data-driven approach to understand the origin of the discrepancies

- Regression specification (inspired by Abowd et al. 1999, AKM)

$$d_{ff't} = \delta_f^b + \delta_{f'}^s + \delta_t + r_{ff't}$$

   - $d_{ff't} \equiv y_t^b - y_t^s$ is the nominal value of the discrepancy between buyer f and seller f' in month t
   - δ_f^b and $\delta_{f'}^s$ denote firm-specific buyer and seller fixed effects

- Interpretation:
   - $\delta_{f'}^s > 0$ means that firm is relatively more likely than the average firm to be involved in seller shortfall **as a seller**
   - $\delta_f^b > 0$ means that firm is relatively more likely than the average firm to be involved in seller shortfall **as a buyer**

Characterizing Firm Types

We add up seller and buyer FE for each firm to categorize firms into groups:

$$Q_f \equiv \hat{\delta}_f^s + \hat{\delta}_f^b$$

- Consistent firm: $Q_f = 0$ (allowing for small rounding errors)
- **Disadvantageous** firm: $Q_f < 0$
- **Advantageous** firm: $Q_f > 0$
    - *Conspicuous*: $\hat{\delta}_f^s \geq 0$ and $\hat{\delta}_f^b \geq 0$, firm underreports sales and overreports purchases
    - *Looking small*: $\hat{\delta}_f^s \geq 0$ and $\hat{\delta}_f^b < 0$, firm underreports both sales and purchases
    - *Looking big*: $\hat{\delta}_f^s < 0$ and $\hat{\delta}_f^b \geq 0$, firm overreports both sales and purchases

Characterizing firm types
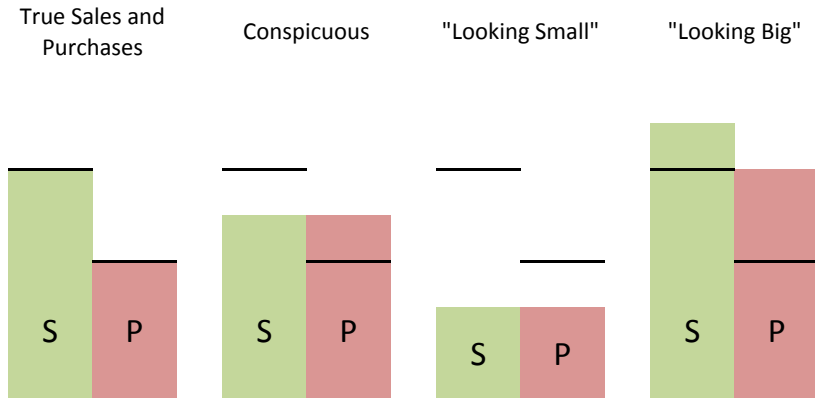
Firm types based on estimated fixed effects

Percent underreported final sales:	0% of final sales (baseline)	
	# Firms	Share
Consistent	0	.00
Disadvantageous	5,245	**.27**
Advantageous	13,916	**.73**
Conspicuous	9,750	.51
Looking small	545	.03
Looking big	3,621	.19

Firm types based on estimated fixed effects

Percent underreported final sales:	0% of final sales (baseline)		10% of final sales	
	# Firms	Share	# Firms	Share
Consistent	0	.00	0	.00
Disadvantageous	5,245	**.27**	4,102	**.17**
Advantageous	13,916	**.73**	15,059	**.79**
Conspicuous	9,750	.51	11,770	.61
Looking small	545	.03	1,146	.05
Looking big	3,621	.19	2,412	.13

Firm types based on estimated fixed effects

Percent underreported final sales:	0% of final sales (baseline)		10% of final sales		50% of final sales	
	# Firms	Share	# Firms	Share	# Firms	Share
Consistent	0	.00	0	.00	0	.00
Disadvantageous	5,245	**.27**	4,102	**.17**	2,703	**.14**
Advantageous	13,916	**.73**	15,059	**.79**	16,458	**.86**
Conspicuous	9,750	.51	11,770	.61	14,076	.73
Looking small	545	.03	1,146	.05	1,318	**.07**
Looking big	3,621	.19	2,412	.13	1,064	**.06**

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- Advantageous/Disadvantageous behavior is **persistent**: 77% (58%) of firms labelled as Advantageous (Disadvantageous) retain that label in the subsequent year

VAT Revenue Consequences by Firm Type

	Panel A: Main Categories of firms			Panel B: Sub-categories of Adv.		
	(1)	(2)	(3)	(3a)	(3b)	(3c)
	All	Disadv.	Adv.	Conspic.	Looking Small	Looking Big
No. of distinct firms	19,161	5,245	13,916	9,750	545	3,621
Percent of firms	(100%)	(27%)	(73%)	(51%)	(3%)	(19%)
Total net VAT due	1,554,101	809,133	744,969	424,893	46,030	274,046
Seller shortfall						
Number of distinct firms	17,255	4,621	12,634	8,538	532	3,564
Total net VAT due	1,275,946	707,539	568,407	339,447	23,120	205,841
Total seller shortfall	900,099	116,694	783,404	433,464	173,263	176,677
Buyer shortfall						
Number of distinct firms	18,000	4,978	13,022	8,920	537	3,565
Total net VAT due	1,316,829	742,040	574,789	339,467	26,625	208,697
Total buyer shortfall	727,373	495,898	231,475	55,738	51,590	124,148
Net Revenue Consequences						
Impact on net VAT due	446,224	−100,500	546,724	340,800	132,067	73,857
Percent of net VAT due	32.8%	−7.4%	40.1%	25.0%	9.7%	5.4%

Reporting Behavior when Inputs are Imported

- How does reporting behavior change when the tax authority's capacity is enhanced?

- We focus on imports, which are subject to automatic oversight by the tax authority at Customs, making tax evasion more difficult
    - Emran and Stiglitz (2005), Cagé and Gadenne (2018)

- Two approaches:
    1. Are there discrepancies between declared imports at Customs vs. VAT declarations?
    2. Are firms more likely to misreport when a larger share of their inputs is imported?

Discrepancies: Customs vs. VAT Declarations

- Compare amount of imports declared at Customs vs. VAT claimed for imported inputs *by the same firm* in VAT Schedule 3
- Define discrepancies in an analogous way to our domestic VAT analysis:

$$m^C = m^V \iff \text{Compliant reporting (52\% of cases)}$$
$$m^C < m^V \iff \textbf{Self-beneficial (SB, 16\%)}$$
$$m^C > m^V \iff \textbf{Non self-beneficial (NSB, 32\%)}$$

  - m^C = imported amount reported at Customs
  - m^V = imported amount reported in VAT Schedule 3

Discrepancies: Customs vs. VAT Declarations

	Dep. Var: NSB Behavior ($m^C > m^V$)		
	All cases	$m^V = 0$	$m^V > 0$
Domestic VAT	(1)	(2)	(3)
Buyer FE < 0	0.099***	0.120***	0.036**
	(0.014)	(0.014)	(0.014)
Seller FE < 0	-0.033***	-0.024***	-0.027***
	(0.007)	(0.007)	(0.007)
Month-Year FE	Yes	Yes	Yes
Size & Sector FE	Yes	Yes	Yes
N	123304	123304	76510
R2	0.03	0.07	0.01
Mean of Dep.Var.	0.34	0.20	0.23

Import Behavior and Domestic VAT Misreporting

- Alternative estimation approach: does a higher import share reduce the extent of seller shortfall?
- Import decisions are endogenous $\rightarrow$ OLS is biased
- We exploit exchange-rate variation with top-10 trading partners to construct an instrument for each firm's import share (following Bastos, Silva and Verhoogen, 2018)
- Regression specification:

$$SellerShortfall_{it} = \delta_1 \widehat{ImportShare}_{it} + \delta_2 sales_{it}$$
$$+ \delta_3 inputs_{it} + \gamma_i + \gamma_t + \epsilon_{it}$$

▸ Details

Results: Import Shares and VAT Compliance

Dep. Variable:	asinh(Seller Shortfall Amount)		
Sample	Full	Advantageous	Disadvantageous
	(1)	(2)	(3)
OLS Specification			
ImportShare	-0.256***	-0.280***	-0.194***
	(0.008)	(0.010)	(0.012)
2SLS Specification			
ImportShare	-0.558***	-0.772***	-0.081
	(0.150)	(0.175)	(0.272)
Sales decile	Yes	Yes	Yes
Inputs decile	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Month-Year FE	Yes	Yes	Yes
N	442,626	314,766	127,860
Mean of dep.	0.90	1.03	0.57
Kleibergen-Paap LM stat.	344.261	286.455	74.104
Kleibergen-Paap Wald F stat.	53.101	46.381	11.443

Conclusion and Takeaways

- Widespread discrepancies between seller and buyer reports in VAT declarations by Ugandan firms (79% of observations)

- Most firms behave in a self-advantageous way, but 14-27% misreport such that VAT liability *increases*

- Reporting discrepancies lead to large VAT revenue losses

- Discrepancies also observed between Customs and VAT declarations for the same firm

- Only strategic misreporters respond to stricter tax enforcement at Customs by reducing their evasion behavior (seller shortfall)

- Models of tax evasion by firms, esp. in low-income country contexts, should incorporate the possibility of mistakes

THANK YOU!

The VAT in Uganda

- VAT introduced in 1996, standard design (e.g., exempt financial services, zero-rated exports)
  - Standard rate is 18%
  - Registration threshold: 13,700 USD annual turnover
  - Around 16,000 VAT-active firms.
- VAT raises 1/3 of total tax revenue, divided almost equally between domestic and import VAT
- 85% of net VAT revenue from largest 10% of firms
- 30% of VAT firms report non-positive total value added
- Some restrictions (e.g., automatic audit) to request VAT refunds
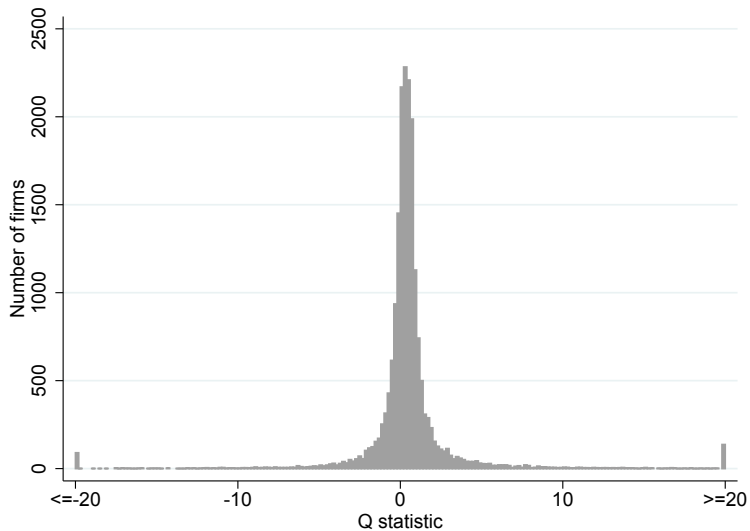
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Domestic VAT Statistics 2013-2016 (USD 1,000s)

	(1) Output VAT - Input VAT	(2) VAT offsets from previous year	(3) VAT liability (1) - (2)	(4) VAT due
All VAT Firms (N = 22,388)	1,830,374	67,500	1,762,874	1,361,909
LTO firms (N = 738)	1,466,848	29,646	1,437,203	979,532
MTO firms (N = 1,635)	222,911	14,055	208,855	214,868
Other VAT firms (N = 20,015)	140,615	23,799	116,816	167,509

Distribution of Q Statistic

Empirical Strategy: Exchange-Rate Variation

- Exploit variation in exchange rates between the Ugandan Shilling (UGX) and the currencies of Uganda's top-10 trading partners
- First-stage regression (Bastos, Silva and Verhoogen, 2018):

$$ImportShare_{it} = \sum_{c=1}^{10} \beta_c log(RER)_{ct} * S_{ic} + \beta_{11} Sales_{it}$$
$$+ \beta_{12} Inputs_{it} + \gamma_i + \gamma_t + \epsilon_{it}$$

  ▸ $ImportShare_{it}$ = share of imported inputs by firm i imports from any country c in month t
  ▸ $log(RER)_{ct}$ = log of real exchange rate between UGX and currency of country c in month t
  ▸ S_{ic} = share of inputs that firm i imports from country c in 2012

Second-Stage Regression

- Second stage: regress seller shortfall (at monthly level) on the instrumented import share ($\in [0,1]$) and the same set of firm and month fixed effects:

$$\begin{aligned}
SellerShortfall_{it} = &\, \delta_1 \widehat{ImportShare}_{it} + \delta_2 sales_{it} \\
&+ \delta_3 inputs_{it} + \gamma_i + \gamma_t + \epsilon_{it}
\end{aligned}$$

- Estimate this regression separately for advantageous and disadvantageous firms to analyze differential behavior across firm types

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