

Strategic or Confused Firms? Evidence from “Missing” Transactions in Uganda

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Outline

- 1 Motivation
- 2 Context & Data
- 3 Discrepancies
- 4 Classifying Firms' Reporting Behavior
- 5 Reporting Behavior under Enhanced Fiscal Capacity
- 6 Conclusion

Are firms as sophisticated as we think they are?

- Economic models routinely assume that firms are sophisticated maximizers
 - ▶ Despite pervasive evidence that *individuals* often make mistakes (Bernheim et al, 2019)
- Growing evidence that firms also deviate from profit-maximizing behavior
 - ▶ DellaVigna & Gentzkow (2017), Kremer, Rao & Schilbach (2019)
- If a significant proportion of firms make suboptimal choices, what are the consequences for policy design?
- In this paper, we approach this question in the context of the VAT in a low-income country, Uganda

The “self-enforcing” VAT

- The value-added Tax (VAT) has been adopted by dozens of countries in recent decades based on two arguments:
 - ① Revenue efficiency: “self-enforcing” property (Pomeranz 2015)
 - ★ Seller and buyer have opposing misreporting incentives
 - ★ Invoices can be cross-checked by the tax authority
 - ② Production efficiency: undistorted input choices
- However, VAT compliance is far from perfect
 - ▶ VAT compliance gap estimated to be 60% in Uganda (IMF 2014), compared to about 30% in Latin America and 10% in Europe
- Revenue efficiency argument implicitly assumes:
 - ▶ Some degree of *state* capacity, as cross-checks are costly
 - ▶ High degree of firm sophistication, i.e. *taxpayer* capacity

This paper

- We study firms' sophistication in a low-income country context by analyzing tax-reporting behavior
- Using transaction-level data from VAT returns and customs records for all VAT-registered firms in Uganda in 2013-2016, we:
 - ① Cross-check seller and buyer reports to identify reporting discrepancies – similar to Fisman and Wei (2004) “mirror data” approach
 - ② Develop a two-way fixed-effects method to estimate the share of each discrepancy due to seller vs buyer
 - ★ Do firms always misreport in a way that reduces their tax liability?
 - ★ What are the aggregate revenue consequences of misreporting?
 - ③ Analyze behavior of firms under different levels of tax enforcement intensity

Summary of results

- ① 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” ($y^S > y^B$)
- ② About **one in four** firms misreport in a way that *increases* their tax liability → Taxpayer mistakes
- ③ Despite this, misreporting estimated to reduce aggregate VAT revenue by at least 27% (\$445 million over 2013-2016)
 - ▶ Lower bound, as we cannot measure underreporting of final sales
- ④ Firms with a higher share of imported inputs (facing arguably stricter enforcement) are less likely to misreport, *only if they generally misreport in a self-advantageous way*
 - ▶ Mistake-prone firms do not respond to changes in enforcement

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 (forthcoming)
- Evidence on the limitations of “self-enforcement” of the VAT in low-income countries, 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)

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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

Data & VAT reporting requirements in Uganda

- Monthly VAT declarations filed electronically since 2012-13
- VAT declaration (Form DT-2031) has two components:
 - ▶ Monthly VAT summary (MS): total output tax charged, total input tax paid, filing date
 - ▶ **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

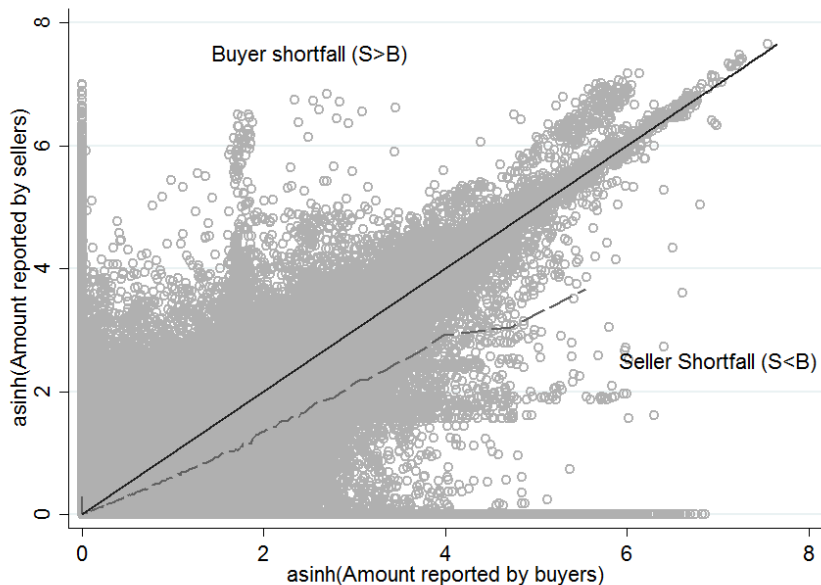
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Defining discrepancies in VAT returns

- Analysis: we sum up domestic transactions at the firm pair \times month level
 - ▶ Let y^S be the sales reported by a seller to a given buyer
 - ▶ Let y^B be the purchases reported by a buyer from a given seller
- Basic framework of VAT reporting:
 - ▶ Seller wants to underreport S , buyer wants to overreport B
 - ▶ At the pair level, we can observe:
 - $y^S = y^B \iff$ Truthful reporting (or collusive evasion)
 - $y^S < y^B \iff$ **Seller shortfall** by seller or buyer (or both)
 - $y^S > y^B \iff$ **Buyer shortfall** by seller or buyer (or both)

Cross-checking seller vs buyer reported amounts



Intentional evasion or mistakes?

- Pervasive discrepancies in firms' VAT returns despite the possibility of cross-checking
 - ▶ Not specific to Uganda: similar evidence for Indian states (Gadenne et al. 2019) and Rwanda (Mascagni et al. 2018)
 - ▶ Note: we only observe firm-to-firm trade; misreporting on sales to final consumers could be even higher
- High frequency of buyer shortfall ($y^S > y^B$) is puzzling, as it doesn't fit standard intuition about VAT evasion. Two hypotheses:
 - ▶ H1: Some firms make mistakes due to poor accounting, misunderstanding of tax rules, etc.
 - ▶ H2: **“Looking small”** strategy: firms that underreport their final sales may also underreport their inputs to appear smaller and less suspicious (VAT liability close to zero, but non-negative)
 - ★ Consistent with evidence in Ecuador (Carrillo et al, 2017)

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Assigning the Blame: Two-way FE Model

- We use a data-driven approach to understand the origin of the discrepancies
- Model inspired by the work of Abowd, Kramarz and Margolis (1999, AKM). Steps:
 - ① Identify the largest connected set allowing to run the AKM estimation procedure
 - ② Regress each seller-buyer-month discrepancy on seller, buyer and time fixed effects
 - ③ For each discrepancy, assign a share to each firm based on the relative estimated fixed effects
 - ④ Use the estimated fixed effects to compute a firm-level statistic that classifies firms into “advantageous” and “disadvantageous”

Estimation Strategy: Two-way Fixed-Effects Model

- Dataset contains over 4mn seller-buyer-month observations. Largest connected set: 99% of obs., 86% of sellers, 64% of buyers.

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

- ▶ $d_{ff't} \equiv y_t^b - y_t^s$ is the nominal value of the discrepancy between buyer f and seller f' in month t
 - ▶ δ_f^b and $\delta_{f'}^s$ denote buyer and seller fixed effects (defined at firm level)
- Interpretation:
 - ▶ For a given firm, $\delta_f^b > 0$ means that, **as a buyer**, it is more likely to be involved in **seller shortfall** than the average buyer
 - ▶ For a given firm, $\delta_{f'}^s > 0$ means that, **as a seller**, it is more likely to be involved in **seller shortfall** than the average seller

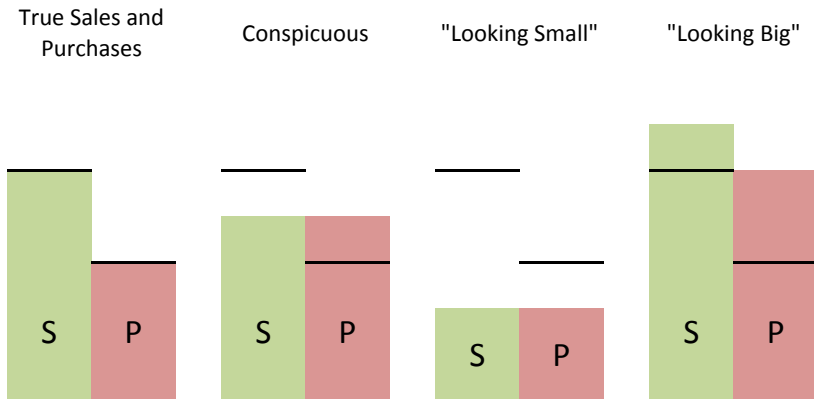
Characterizing Firm Types: Q statistic

We categorize firms into different groups based on the sum of their seller and buyer fixed effects, weighted by the total amounts sold and purchased by each firm:

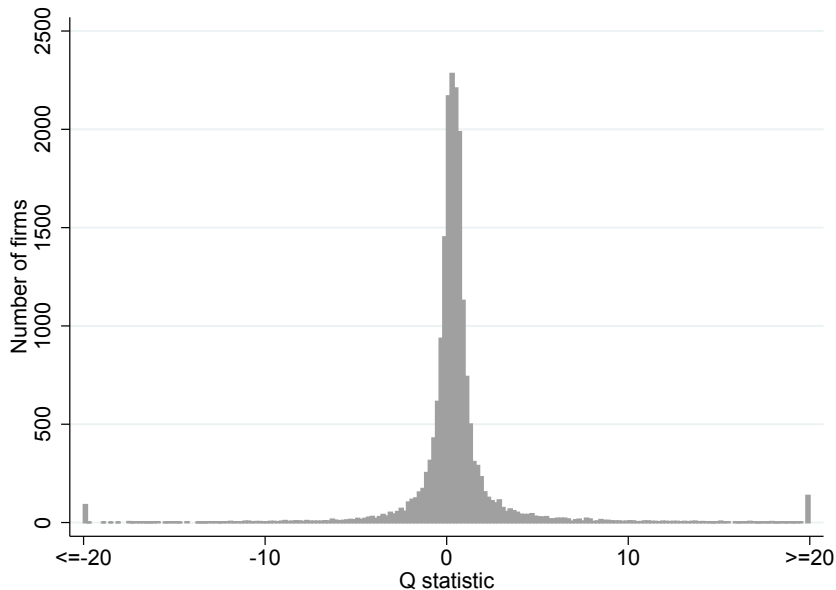
$$Q_f \equiv \left(\frac{y_f^s}{y_f^s + y_f^b} \right) \hat{\delta}_f^s + \left(\frac{y_f^b}{y_f^s + y_f^b} \right) \hat{\delta}_f^b$$

- 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 its sales and overreports its 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

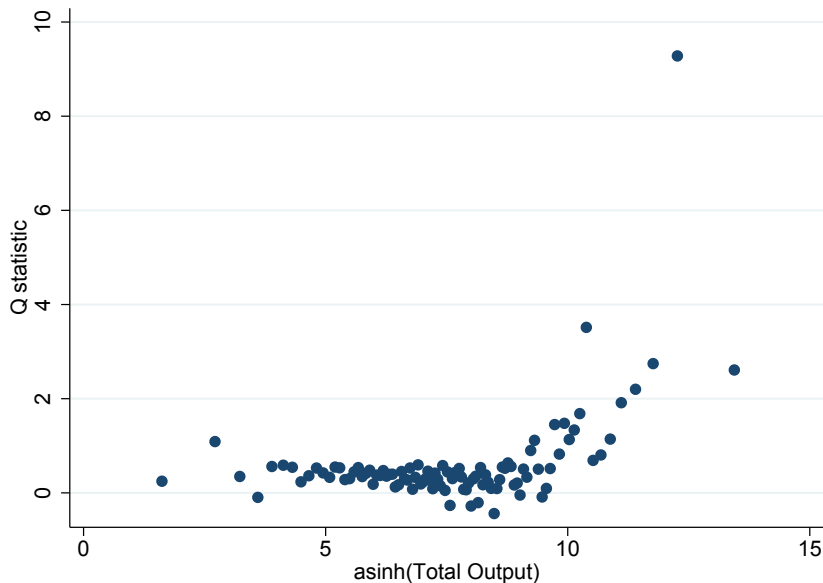
Different Types of "Advantageous" Behavior



Distribution of Q Statistic



Average Q Statistic by Firm Size



Firm Types based on Estimated Fixed Effects

Percent underreported final sales:	0% of final sales (baseline)		10% of final sales		40% of final sales	
	# Firms	Share	# Firms	Share	# Firms	Share
Consistent	85	0.01	170	0.01	170	0.01
Disadvantageous	5,548	0.29	4,555	0.24	3,143	0.16
Advantageous	13,528	0.71	14,436	0.75	15,848	0.83
Conspicuous	10,371	0.56	11,864	0.62	13,846	0.72
Looking small	345	0.02	818	0.04	1,118	0.06
Looking big	2,812	0.15	1,754	0.09	884	0.05

- Advantageous/Disadvantageous behavior is persistent: 77% (62%) of firms labelled as Advantageous (Disadvantageous) retain that label in subsequent year

VAT Revenue Consequences by Firm Type

USD 1,000s

	(1)	(2)	(3)	(3a)	(3b)	(3c)	
	All	Consist	Disadv.	Advant.	Conspic.	Looking Small	Looking Big
No. of distinct firms	19,161	85	5,548	13,528	10,371	345	2,812
Percentage of all firms	(100%)	(0%)	(29%)	(71%)	(54%)	(2%)	(15%)
Total net VAT due	1,554,101	531	864,525	689,045	439,360	49,896	199,789
Seller shortfall							
Number of firms	17,255	29	4,902	12,324	9,185	343	2,796
Total net VAT due	1,275,946	11	760,049	515,886	345,909	36,425	133,552
Total seller shortfall	900,099	57	101,680	798,362	455,863	175,719	166,779
Buyer shortfall							
Number of firms	18,000	67	5,287	12,646	9,507	341	2,798
Total net VAT due	1,316,829	236	798,553	518,039	345,640	38,634	133,765
Total buyer shortfall	727,373	649	528,417	198,307	65,996	48,720	83,591
Net Revenue Consequences							
Impact on net VAT due	446,224	26	-130,753	576,950	359,323	131,119	86,508
Percentage of VAT collected	32.8%	0.0%	-9.6%	42.4%	26.4%	9.6%	6.4%

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Reporting Behavior when Import Share is Higher

- We study how Ugandan firms change their reporting behavior when the tax authority's capacity is enhanced
- Use the fact that imported goods are subject to automatic oversight by the tax authority at customs, making tax evasion more difficult
 - ▶ Emran and Stiglitz (2005), Cagé and Gadenne (2018)
- Are firms more likely to misreport when a larger share of their inputs is imported (implying stricter enforcement)?

Empirical Strategy: Exchange-Rate Variation

- Import decision could be endogenous (firm size, sector, etc.)
- 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):

$$\begin{aligned} \text{ImportShare}_{it} = & \sum_{c=1}^{10} \beta_c \log(\text{RER})_{ct} * S_{ic} + \beta_{11} \text{Sales}_{it} \\ & + \beta_{12} \text{Inputs}_{it} + \gamma_i + \gamma_t + \epsilon_{it} \end{aligned}$$

- ▶ ImportShare_{it} = share of imported inputs by firm i imports from any country c in month t
- ▶ $\log(\text{RER})_{ct}$ = 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 (base year)

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

VAT Compliance by Firm Type

Dep. Variable: Sample	<i>asinh(Seller Shortfall Amount)</i>		
	Full (1)	Advantageous (2)	Disadvantageous (3)
<i>OLS Specification</i>			
ImportShare	-0.256*** (0.008)	-0.280*** (0.010)	-0.194*** (0.012)
<i>2SLS Specification</i>			
ImportShare	-0.558*** (0.150)	-0.772*** (0.175)	-0.081 (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

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Conclusion and Takeaways

- We document widespread discrepancies when comparing seller and buyer reports in VAT declarations by Ugandan firms: discrepancies in 79% of pair-month observations
- Reporting discrepancies lead to \$445 million in foregone VAT revenue (27% of total), which is likely a lower bound because we do not observe misreporting of final sales
- Majority of firms behave in a self-advantageous way, but 16-29% misreport such that their VAT liability *increases*, possibly due to mistakes
- Only strategic misreporters respond to stricter tax enforcement 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!

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

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