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
- 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:

   - 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:
  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

- New evidence on how tax evasion in a developing country responds to changes in the state’s enforcement capacity

- 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)
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
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
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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.

\[ d_{ff'}_t = \delta^b_f + \delta^s_{f'} + \delta_t + r_{ff'}_t \]

- \( d_{ff'}_t \equiv y^b_t - y^s_t \) is the nominal value of the discrepancy between buyer \( f \) and seller \( f' \) in month \( t \).
- \( \delta^b_f \) and \( \delta^s_{f'} \) denote buyer and seller fixed effects (defined at firm level).

- Interpretation:
  - For a given firm, \( \delta^b_f > 0 \) means that, as a buyer, it is more likely to be involved in **seller shortfall** than the average buyer.
  - For a given firm, \( \delta^s_{f'} > 0 \) 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:

$$Q_f \equiv \left( \frac{y^s_f}{y^s_f + y^b_f} \right) \hat{\delta}^s_f + \left( \frac{y^b_f}{y^s_f + y^b_f} \right) \hat{\delta}^b_f$$

- **Consistent** firm: $Q_f = 0$ (allowing for small rounding errors)
- **Disadvantageous** firm: $Q_f < 0$
- **Advantageous** firm: $Q_f > 0$
  - *Conspicuous*: $\hat{\delta}^s_f \geq 0$ and $\hat{\delta}^b_f \geq 0$, firm underreports its sales and overreports its purchases
  - *Looking small*: $\hat{\delta}^s_f \geq 0$ and $\hat{\delta}^b_f < 0$, firm underreports both sales and purchases
  - *Looking big*: $\hat{\delta}^s_f < 0$ and $\hat{\delta}^b_f \geq 0$, firm overreports both sales and purchases
Different Types of “Advantageous” Behavior

True Sales and Purchases  Conspicuous  "Looking Small"  "Looking Big"

S  P  S  P  S  P  S  P
Average Q Statistic by Firm Size
Firm Types based on Estimated Fixed Effects

<table>
<thead>
<tr>
<th>Percent underreported final sales:</th>
<th>0% of final sales (baseline)</th>
<th>10% of final sales</th>
<th>40% of final sales</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># Firms</td>
<td>Share</td>
<td># Firms</td>
</tr>
<tr>
<td>Consistent</td>
<td>85</td>
<td>0.01</td>
<td>170</td>
</tr>
<tr>
<td>Disadvantageous</td>
<td>5,548</td>
<td>0.29</td>
<td>4,555</td>
</tr>
<tr>
<td>Advantageous</td>
<td>13,528</td>
<td>0.71</td>
<td>14,436</td>
</tr>
<tr>
<td>Conspicuous</td>
<td>10,371</td>
<td>0.56</td>
<td>11,864</td>
</tr>
<tr>
<td>Looking small</td>
<td>345</td>
<td>0.02</td>
<td>818</td>
</tr>
<tr>
<td>Looking big</td>
<td>2,812</td>
<td>0.15</td>
<td>1,754</td>
</tr>
</tbody>
</table>

- 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

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

Almunia, Hjort, Knebelmann & Tian

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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.

- 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 Verhooguen, 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 (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:

$$\text{SellerShortfall}_{it} = \delta_1 \text{ImportShare}_{it} + \delta_2 \text{sales}_{it} + \delta_3 \text{inputs}_{it} + \gamma_i + \gamma_t + \epsilon_{it}$$

- Estimate this regression separately for advantageous and disadvantageous firms to analyze differential behavior across firm types
## VAT Compliance by Firm Type

<table>
<thead>
<tr>
<th>Dep. Variable:</th>
<th>Full (1)</th>
<th>Advantageous (2)</th>
<th>Disadvantageous (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**OLS Specification**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Coefficient</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>ImportShare</td>
<td>-0.256***</td>
<td>(0.008)</td>
<td>-0.280***</td>
<td>(0.010)</td>
<td>-0.194***</td>
<td>(0.012)</td>
</tr>
</tbody>
</table>

**2SLS Specification**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Coefficient</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>ImportShare</td>
<td>-0.558***</td>
<td>(0.150)</td>
<td>-0.772***</td>
<td>(0.175)</td>
<td>-0.081</td>
<td>(0.272)</td>
</tr>
</tbody>
</table>

| 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)

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