Does e-government improve government capacity? Evidence from tax compliance cost, tax revenue and public procurement competitiveness

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**Motivation**

- Many countries lack capacities to **raise** and **spend fiscal resources** effectively (Besley and Persson, 2010)
  - High tax compliance costs deter investment, encourage tax evasion, and undermine economic growth (Djankov et al., 2006; Coolidge, 2012; Alm et al. 2016)
  - Public procurement is often rife with collusive practices and corruption, resulting in the misallocation of resources (Auriol, 2016; Center for Global Development, 2014)
- Many countries have invested in ICT and e-government over the last two decades
  - But very little is known about the returns on such investments
OVERVIEW

- Whether the use of ICT by government (e-government) can strengthen governments capacity to raise and spend fiscal resources?
  - E-filing of taxes → tax compliance costs, tax revenue, corruption
  - E-procurement → public procurement competitiveness, corruption
- Approach: Difference-in-difference
- Result:
  - E-filing adoption reduces tax compliance costs; mixed results on tax revenue; almost no effect on bribes
  - E-procurement adoption increases the likelihood of bidding by firms and reduces corruption only in more developed countries
<table>
<thead>
<tr>
<th>Introduction and motivation</th>
<th>Empirical strategy</th>
<th>Results</th>
<th>Conclusion</th>
</tr>
</thead>
</table>

**MECHANISMS**

- **E-filing of taxes**
  - reduce time and resources spent on gathering information to file taxes
  - reduce errors in filing tax forms, delays in submitting tax forms and receiving tax refunds
  - reduce face-to-face interactions with tax officials

- **E-procurement**
  - more widely available and transparent information
  - reduce the costs of submitting bids
  - attract bidders of higher quality and from outside of existing collusive cartels

- **E-government initiative** may fail if countries lack human capital, technology, and good institutions to exploit the advantages of ICT (Yilmaz and Coolidge, 2013; Lewis-Faupel et al., 2016; Heeks, 2005)
LITERATURE

- ICT and various outcomes: development, health, financial inclusion, industry competition and aggregate economic performance

- Empirical research on the impact of e-government is scarce
  - Electronic machines to record sales transactions improved tax compliance and raised revenue in Ethiopia and Rwanda (Ali et al., 2014; Eissa and Zeitlin, 2014)
  - E-filing of taxes significantly reduced tax compliance costs for firms in South Africa, but not in Ukraine or Nepal (Yilmaz and Coolidge, 2013)
  - E-procurement increased the amount of market transactions and improved supply chain management in several European countries (Nepelski, 2006)
  - E-procurement reduced prices of contracts and government administrative costs in Chile (Singer et al., 2009)
LITERATURE

▶ Empirical research on the impact of e-government is scarce

▶ E-procurement in India and Indonesia improved the quality of public infrastructure projects (Lewis-Faupel et al., 2016)

▶ Biometric registration, authentication, and payment systems reduced corruption and inefficiencies in government workfare in India (Muralidharan et al., 2014 and Barnwal, 2014)

▶ E-government reduces fiscal leakages, but does not necessarily improve outcomes of public programs in one Indian state (Banerjee et al., 2014)

▶ Importance of organizational changes within firms (Bresnahan et al., 2002; Brynjolfsson and Hitt, 2000) or in public sector (Garicano and Heaton, 2010; Seri and Zenfei, 2013) to reap the benefits of ICT
DATA

  - E-filing adoption dates: transactional systems and transactional with e-payment functionality systems
  - E-procurement adoption dates: informational, transactional and connected systems [graph]
  - Time required to prepare and pay taxes
  - Proxy for reform pace: PCA of several doing business indicators
- World Revenue Longitudinal Dataset:
  - Income tax revenue to GDP ratio
  - Goods and services tax revenue to GDP ratio
125 countries implemented e-filing systems and 73 countries did not implement.

142 countries implemented e-procurement systems and 56 countries did not implement any system during the period 1990-2014.
DATA

- World Bank Enterprise Surveys (WBES) (at least 2 waves per country, 2006 - 2015)
  - whether the firm was visited or inspected by tax officials
  - the frequency of such visits
  - whether a gift or informal payment was expected or requested in any of the inspections
  - the extent to which tax administration is perceived as an obstacle to business operations
  - whether the firm has secured or attempted to secure a government contract over the last year
  - whether the firm had to pay a bribe to get the contract
DATA

- World Development Indicators Database
  - GDP per capita in PPP terms
  - Number of internet uses per capita
  - Secondary school enrolment
- World Governance Indicators Database
  - Rule of law, government efficiency
- Polity IV Database
  - Polity score
- Heritage Foundation
  - Business freedom
**Method / Identification**

- Difference-in-difference method in a fixed effects regression framework
- Control group: countries that have never implemented e-government AND those that implemented before the sample period [graph]
  - Solution: individual-specific trends for countries that adopted earlier
- Assumption #1 of DID: the control and treated groups have similar trends in the outcome variable prior to treatment
  - Solution: test if pre-treatment effects are zero (Autor, 2003)
- Assumption #2 of DID: e-government implementation dates are exogenous
  - Solution: control for time-varying variables (GDP, Polity, Reform); full set of region-time fixed effects
TIME TO PREPARE AND PAY TAXES

![Graph showing the time to prepare and pay taxes from 2004 to 2014. The graph compares four categories:
- None
- Had transactional
- Had transactional with e-payment
- Adopted transactional
- Adopted transactional with e-payment.](image-url)
EMPIRICAL SPECIFICATION

Country-level specification:

\[ y_{ct} = \sum_{n=-4}^{5} \alpha_{1,-n} Egov2_{ct-n} + \sum_{n=-4}^{5} \alpha_{2,-n} Egov3_{ct-n} + \beta X_{ct} + \]

\[ + \eta_c + \lambda_t + \nu_r \times \lambda_t + e_c \times t + \varepsilon_{ct} \]

- \( y_{ct} \) - outcome variable
- for \( n < 0 \), \( Egov2_{ct-n} \) (\( Egov3_{ct-n} \)) is an indicator for an observation taking place \(|n|\) years before the adoption of a transactional e-filing system (with e-payment functionality)
- for \( n \geq 0 \), \( Egov2_{ct-n} \) (\( Egov3_{ct-n} \)) is an indicator for an observation taking place \( n \) years after the adoption of a transactional e-filing system (with e-payment functionality)
- \( X_{ct} \) - logarithm of GDP per capita (PPP), Polity, Reform index
- \( \eta_c \) - country fixed effects; \( \lambda_t \) - time fixed effects; \( \nu_r \) - region fixed effects; \( e_c \) - earlier adopters; \( t \) - time trend
EMPIRICAL SPECIFICATION

Firm-level specification:

\[ y_{ict} = \alpha_1 Egov2_{ct} + \alpha_2 Egov3_{ct} + \beta X_{ct} + \gamma Z_{ict} + \mu_s + \eta_c + \lambda_t + e_c \times t + \epsilon_{ict} \]

- **\( y_{ict} \) - outcome variable**
- **\( Egov2 \) - indicator for transactional (e-filing) / informational (e-procurement)**
- **\( Egov3 \) - indicator for transactional with e-payment (e-filing) / transactional (e-procurement)**
- **\( Z_{ict} \) - firm-level characteristics**
- **\( \mu_s \) - sector fixed effects**
- **\( \epsilon_{ct} \) and \( \epsilon_{ict} \) are clustered at the country level**
COUNTRY-LEVEL RESULTS: TIME TO PREPARE AND PAY TAXES

The reference groups are observations taking place 5 years or more before the adoption of e-filing systems.
COUNTRY-LEVEL RESULTS: INCOME TAX REVENUE TO GDP RATIO

The reference groups are observations taking place 5 years or more before the adoption of e-filing systems.
COUNTRY-LEVEL RESULTS: GOODS AND SERVICES TAX REVENUE TO GDP RATIO

The reference groups are observations taking place 5 years or more before the adoption of e-filing systems.
## Country- and Firm-level Results

<table>
<thead>
<tr>
<th></th>
<th>Tax income</th>
<th>Goods tax</th>
<th>Tax visit</th>
<th>Tax visit N</th>
<th>Tax obstacle</th>
<th>Tax bribe</th>
<th>Proc.</th>
<th>Proc. bribe</th>
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</thead>
<tbody>
<tr>
<td>E-filing2</td>
<td>0.025</td>
<td>0.746**</td>
<td>0.226</td>
<td>-0.075*</td>
<td>-0.111*</td>
<td>-0.043</td>
<td>-0.047</td>
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<td></td>
<td>(0.047)</td>
<td>(0.300)</td>
<td>(0.339)</td>
<td>(0.044)</td>
<td>(0.058)</td>
<td>(0.087)</td>
<td>(0.053)</td>
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<tr>
<td>E-filing3</td>
<td>-0.124***</td>
<td>0.200</td>
<td>-0.647**</td>
<td>-0.033</td>
<td>-0.062#</td>
<td>-0.140***</td>
<td>0.075***</td>
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<td></td>
<td>(0.047)</td>
<td>(0.227)</td>
<td>(0.275)</td>
<td>(0.050)</td>
<td>(0.041)</td>
<td>(0.052)</td>
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<table>
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<td>R2 w/adj</td>
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</table>

All fixed effects are included. Standard errors are clustered at the country level.

*** < 0.01, ** < 0.05, * < 0.1, # < 0.15
## Firm-level results, ECA region, firm fixed effects

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<th></th>
<th>Tax visit number</th>
<th>Tax obstacle</th>
<th>Tax bribe</th>
<th>Procurement</th>
<th>Procurement bribe</th>
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<td>R2 adjusted</td>
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<td>0.084</td>
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<td>0.094</td>
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*** <0.01, ** <0.05, * <0.1, # <0.15
### Development and E-Government

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<tr>
<th></th>
<th>Tax time</th>
<th>Income tax</th>
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<td>E-filing</td>
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<td>67,655</td>
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<td>R2 w/adj</td>
<td>0.410</td>
<td>0.312</td>
<td>0.262</td>
<td>0.153</td>
<td>0.231</td>
<td>0.099</td>
<td>0.155</td>
<td>0.099</td>
<td>0.159</td>
</tr>
</tbody>
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### Other proxies for development: GDP per capita in PPP, secondary school enrolment, rule of law, government efficiency, business freedom
ROBUSTNESS CHECKS

- Drop region-specific shocks from specification
- Drop individual-specific trends for countries earlier adopters
- Drop countries earlier adopters
- “Balanced sample” - restrict the sample of countries to those that implemented e-filing systems during the 2006-2012 period, and exclude those that implemented in 2004-2005 and 2013-2014
- Falsification/placebo tests, by randomly assigning years of e-government implementation to a group of random countries
CONCLUSION

▶ We assess the impact of e-government adoption on public sector capacity to raise and spend resources across countries
  ▶ e-filing of taxes and tax compliance costs, tax revenue
  ▶ e-procurement and public procurement competitiveness
▶ We show that e-government can improve government capacity
  ▶ but the estimated effects vary by the type and functionality of e-government systems adopted
▶ country context