

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

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)

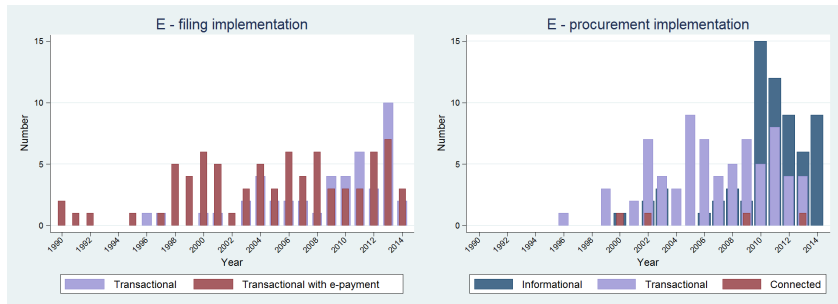
LITERATURE

- ▶ 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

- ▶ Global e-Government Systems Database (World Development Report 2016: Digital Dividends)
 - ▶ E-filing adoption dates: transactional systems and transactional with e-payment functionality systems
 - ▶ E-procurement adoption dates: informational, transactional and connected systems **[graph]**
- ▶ Doing Business Database (2004 - 2014):
 - ▶ 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

E-GOVERNMENT ADOPTION



- ▶ 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

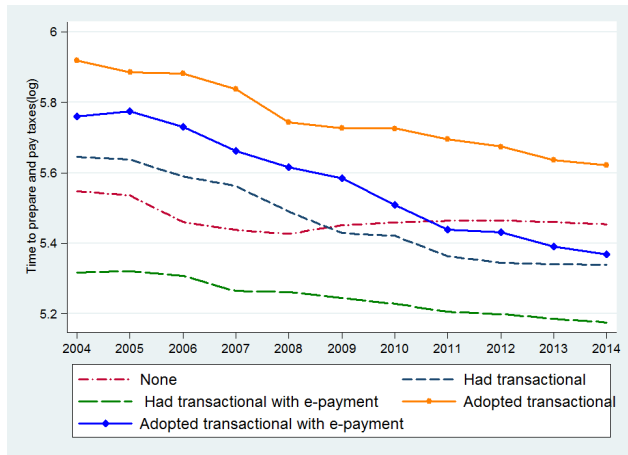
DATA

- ▶ 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



EMPIRICAL SPECIFICATION

Country-level specification:

$$y_{ct} = \sum_{n=-4}^5 \alpha_{1,-n} \text{Egov}2_{ct-n} + \sum_{n=-4}^5 \alpha_{2,-n} \text{Egov}3_{ct-n} + \beta X_{ct} + \\ + \eta_c + \lambda_t + \nu_r \times \lambda_t + e_c \times t + \varepsilon_{ct}$$

- ▶ y_{ct} - outcome variable
- ▶ for $n < 0$, $\text{Egov}2_{ct-n}$ ($\text{Egov}3_{ct-n}$) is an indicator for an observation taking place $|n|$ years before the adoption of a transactional e-filing system (with e-payment functionality)
- ▶ for $n \geq 0$, $\text{Egov}2_{ct-n}$ ($\text{Egov}3_{ct-n}$) 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
- ▶ η_c - country fixed effects; λ_t - time fixed effects; ν_r - region fixed effects; e_c - earlier adopters; t - time trend

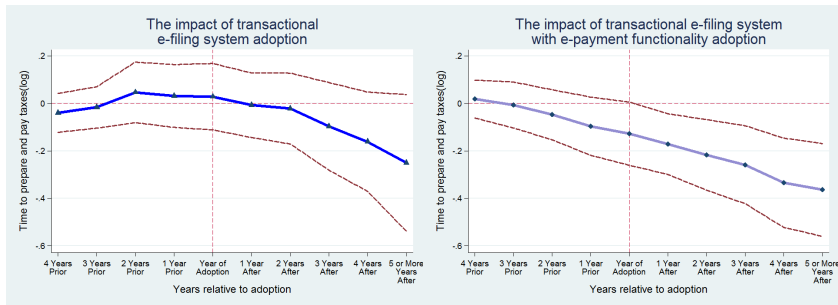
EMPIRICAL SPECIFICATION

Firm-level specification:

$$y_{ict} = \alpha_1 Ego\upsilon 2_{ct} + \alpha_2 Ego\upsilon 3_{ct} + \beta X_{ct} + \gamma Z_{ict} + \mu_s + \eta_c + \lambda_t + e_c \times t + \varepsilon_{ict}$$

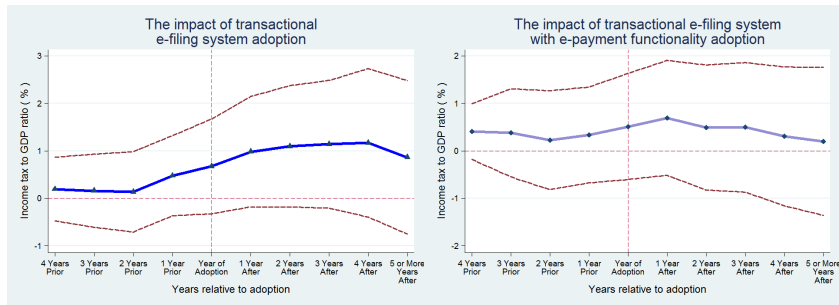
- ▶ y_{ict} - outcome variable
- ▶ $Ego\upsilon 2$ - indicator for transactional (e-filing) / informational (e-procurement)
- ▶ $Ego\upsilon 3$ - indicator for transactional with e-payment (e-filing) / transactional (e-procurement)
- ▶ Z_{ict} - firm-level characteristics
- ▶ μ_s - sector fixed effects
- ▶ e_c and ε_{ict} are clustered at the country level

COUNTRY-LEVEL RESULTS: TIME TO PREPARE AND PAY TAXES



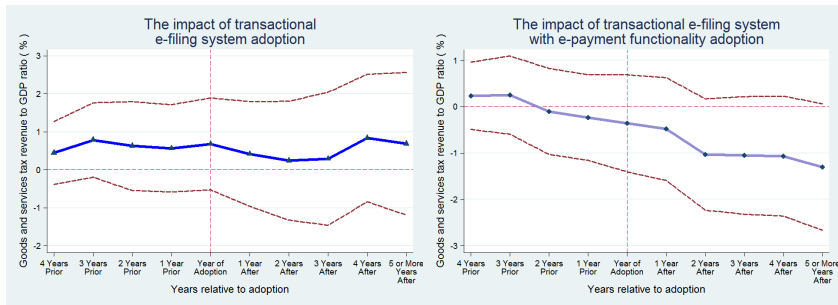
The reference groups are observations taking place 5 years or more before the adoption of e-filing systems

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

	Tax time	Income tax	Goods tax	Tax visit	Tax visit N	Tax obstacle	Tax bribe	Proc.	Proc. bribe
E-filing2	0.025 (0.047)	0.746** (0.300)	0.226 (0.339)	-0.075* (0.044)	-0.111* (0.058)	-0.043 (0.087)	-0.047 (0.053)		
E-filing3	-0.124*** (0.047)	0.200 (0.227)	-0.647** (0.275)	-0.033 (0.050)	-0.062# (0.041)	-0.140*** (0.052)	0.075*** (0.025)		
E-proc.2								0.001 (0.037)	-0.060 (0.073)
E-proc.3								-0.020 (0.027)	0.058 (0.046)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
N obs	1,626	1,226	1,217	67,655	37,227	68,144	39,860	40,588	5,983
N count	150	127	126	68	68	68	68	44	44
R2 w/adj	0.413	0.304	0.251	0.153	0.231	0.099	0.156	0.099	0.158

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

	Tax visit	Tax visit number	Tax obstacle	Tax bribe	Procurement	Procurement bribe
E-filing2	-0.020 (0.036)	-0.073 (0.090)	-0.010 (0.171)	-0.137** (0.044)		
E-filing3	-0.140** (0.041)	-0.218** (0.090)	-0.159 (0.121)	-0.123** (0.041)		
E-procurement2					0.075* (0.044)	-0.200 (0.234)
E-procurement3					0.055* (0.027)	0.005 (0.054)
Controls	YES	YES	YES	YES	YES	YES
N obs	20,477	10,592	20,614	11,495	20,417	3,661
N countries	29	29	29	29	29	29
R2 adjusted	0.055	0.084	0.153	0.094	0.025	0.209

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

*** <0.01, ** <0.05, * <0.1, # <0.15

DEVELOPMENT AND E-GOVERNMENT

	Tax time	Income tax	Goods tax	Tax visit	Tax visit N	Tax obstacle	Tax bribe	Proc.	Proc. bribe
E-filing	0.050 (0.051)	0.912*** (0.279)	0.353 (0.326)	-0.027 (0.072)	-0.016 (0.068)	-0.108 (0.119)	0.050 (0.057)		
E-filing × Internet	-0.412*** (0.159)	-2.023** (0.780)	-2.768*** (0.983)	-0.089 (0.212)	-0.279* (0.169)	0.150 (0.380)	-0.180 (0.151)		
E-proc.								-0.054# (0.033)	0.191* (0.113)
E-proc. × Internet								0.113** (0.055)	-0.389** (0.197)
Internet	-0.116 (0.221)	0.108 (1.192)	1.013 (1.236)	0.010 (0.206)	0.046 (0.255)	-0.324 (0.261)	0.163 (0.125)	-0.117 (0.166)	-0.143 (0.168)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
N obs	1,600	1,220	1,211	67,655	37,227	68,144	39,860	40,588	5,983
N countr	149	127	126	68	68	68	68	44	44
R2 w/adj	0.410	0.312	0.262	0.153	0.231	0.099	0.155	0.099	0.159

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

*** <0.01, ** <0.05, * <0.1, # <0.15

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