Technology, Taxation and Corruption: Evidence from the Introduction of Electronic Tax Filing

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Motivation

- Technology is transforming the way governments deliver services and interact with citizens
  - Monitoring of social programs (Banerjee et al. 2016, Muralidharan et al., 2016)
  - E-procurement (Lewis-Faupel et al. 2016)
  - Elections (Fujiwara 2015)
- Goals:
  - Improve service delivery and efficiency
  - Combat corruption by restricting behavior of officials

Motivation

- Increasing adoption of technology in **tax administration:** electronic billing machines, e-invoicing, e-filing
- E-filing: Growing usage (most popular reform for tax administrations in 2015) but limited evidence on impact.
  - Typically replaces in-person submission in developing countries with unreliable mail systems
- Many developing country tax systems are characterized by extensive interactions between tax officials and taxpayers.
  - Provide tax education, monitoring but may also provide opprtunity for extortion or collusion for tax evasion
- This feature may, in part, explain low tax collection (as share of GDP) in developing countries

This Paper

- **Question:** How does the introduction of electronic tax filing (to replace in-person submissions) affect firms' compliance costs, tax payments and unofficial payments?
- **Context:** Small and medium firms in Tajikistan
- **Approach:** Randomized encouragement of e-filing (93% adoption vs. 60% in control)
- **Outcomes:**
  - E-filing adoption
  - Compliance costs
  - Tax payments
  - Bribe payments (list experiment)
- **Framework:** Outcomes will depend on nature of interactions between taxpayers and tax officials at baseline

Related Literature

- Growing use of technology in many areas of governance (Lewis-Faupel et al. 2016, Fujiwara 2015, Banerjee et al. 2017, Muralidharan et al. 2016, World Development Report 2016, Ali et al. 2015, Eissa et al. 2015)
  - Voluntary adoption of technology
  - Potential heterogeneous impacts
- Rapidly growing literature on public finance in developing countries
  - Examine central role of tax collectors in developing context (Khan et al. 2016)
- Understanding corruption and effectiveness of strategies to reduce it (Olken and Pande, 2012)

Outline

1. Context
2. Experiment Design and Data
3. Conceptual Framework
4. Data and Empirical Strategy
5. Results
   - E-filing Adoption
   - Impact of E-filing
   - Mechanisms
6. Conclusion

Context: Tajikistan provides an interesting setting

- Firms face high tax compliance costs:
  - Monthly and quarterly tax filing obligations (income tax, social tax, turnover tax)
  - Low ranking on the World Bank's Ease of Paying Taxes (178th/185) in 2013
- Corruption is a major concern:
  - 32% of firms expect to give gifts in meetings with tax officials (Enterprise Survey 2013)
- Tax e-filing became available for all firms in Dushanbe in 2012, but take-up was low especially for SMEs

Experiment Design

Firms were randomly assigned to one control and two treatment groups designed to address the constraints to e-filing adoption.

- Stratified on legal status, district and sector

Group A (600 firms)	Group B (300 firms)	Group C (600 firms)
• General Training on Taxation • Information and Training on E-filing • Logistical Help for Registration	• General Training on Taxation • Information and Training on E-filing	• General Training on Taxation

All firms: internet access at public terminals in the tax office

Program implementation

- Trainings were conducted by an implementing partner firm with support of Tax Committee (Oct 2014 - Jan 2015)
- Firms were invited to a training by phone calls from trained operators
  - Same script was used to invite all firms
  - Firms were not aware of their group before attending the training
- General training lasted about 1 hour
- E-filing training lasted one extra hour
- Logistical help was conducted on a one-on-one basis with each firm in the few weeks following the trainings

Data

- Administrative data from Tax Authority
  - Some baseline firm characteristics: sector, employees, district, **risk profile score**
  - Monthly tax data on e-filing use, tax payments etc.
- Baseline Survey Data: short and self-administered
- Endline survey: compliance costs, audits, list experiment
  - 97% of firms completed the survey, 12% have liquidated (balanced across groups)

Baseline Risk of Tax Evasion

- We use risk score at baseline as a proxy for likelihood of tax evasion
  - Approach used by many countries to target audits (Khwaja et al. 2011)
  - Calculated by tax authority using proprietary algorithm based on observed firm characteristics and outcomes of prior audits
  - Correlates with some baseline characteristics:
    - ★ Trade sector (-)
    - ★ Recent audit (-)
    - ★ No employee (+),
    - ★ Penalty from previous audit (+)
  - Only available for legal entities (75% of sample)

- Some evidence that risk score is predictive of tax non-compliance
  - Controlling for observables (incl. employees and turnover), high risk firms at baseline (in 2014) paid lower taxes in 2015

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- Randomization achieved balance on baseline characteristics (overall and within high and low-risk groups) Balance Tables

Conceptual framework

Firms will adopt e-filing if expected benefits outweigh expected costs.

$$\sum_{t=1}^{T} \beta\delta^t E((CC_{p,t} - CC_{e,t}) + (UP_{p,t} - UP_{e,t}) + (Tax_{p,t} - Tax_{e,t})) > AC_e \quad (1)$$

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	Expected Impact of E-filing on:		
	Compliance Costs	Unofficial payments	Tax payments
High risk firms	Decrease	Decrease (voluntary bribes)	Increase
Low risk firms	Decrease	Decrease (extortion)	Decrease

Empirical Specification

- Adoption results:

$$D_i = \beta_0 + \beta_1 T_{A,i} + \beta_2 T_{B,i} + \lambda X_i + \epsilon_i \quad (2)$$

D_i is an indicator for whether a firm registers for and uses e-filing
$T_{A,i}$ and $T_{B,i}$ are indicators for the treatment groups.
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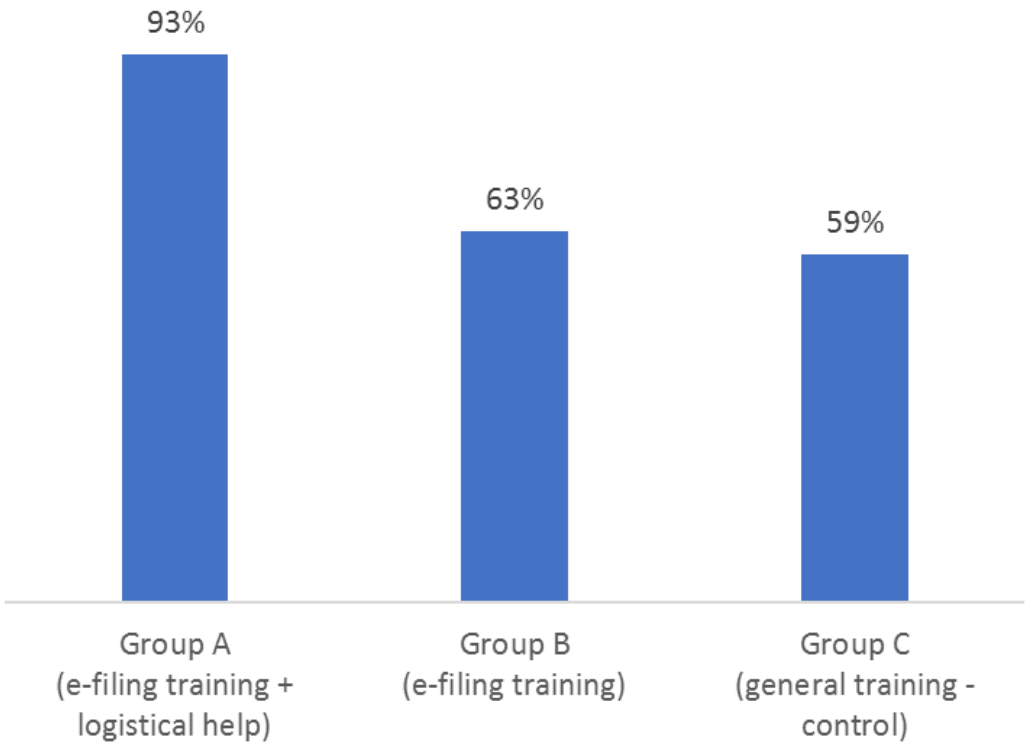
  - Heterogenous impacts:

$$Y_i = \beta_0 + \gamma \widehat{Efile} * LowRisk + \alpha \widehat{Efile} * HighRisk + \rho HighRisk + \lambda X_i + \epsilon_i \quad (4)$$

Results on E-filing adoption

Treatment impact:



Selection Effects:

- Group A treatment brought in more high risk firms: compliers are 9 percent more likely to be high risk

Determinants of E-filing adoption

Dependent variable:	***Firm used E-Filing***		
	Group B & C All Sample		***Group B & C Only Legal entities***
No employee	-0.133***	-0.092**	-0.147***
	(0.040)	(0.041)	(0.052)
Number of employees	0.018***	0.018***	0.017***
	(0.005)	(0.005)	(0.005)
Standardized risk profile score in 2014$^{\lambda}$		-0.072***	-0.060***
		(0.019)	(0.019)
Firm has an accountant	0.059	0.062	0.039
	(0.038)	(0.038)	(0.048)
Time spent on tax related activities during a typical month (hours)	0.010**	0.011**	0.011*
	(0.005)	(0.005)	(0.006)
Other Firm Characteristics	yes	yes	yes
Observations	894	894	634
R-squared	0.173	0.188	0.161
Mean Dep Var in control	0.590	0.590	0.563

Impact of E-filing Adoption

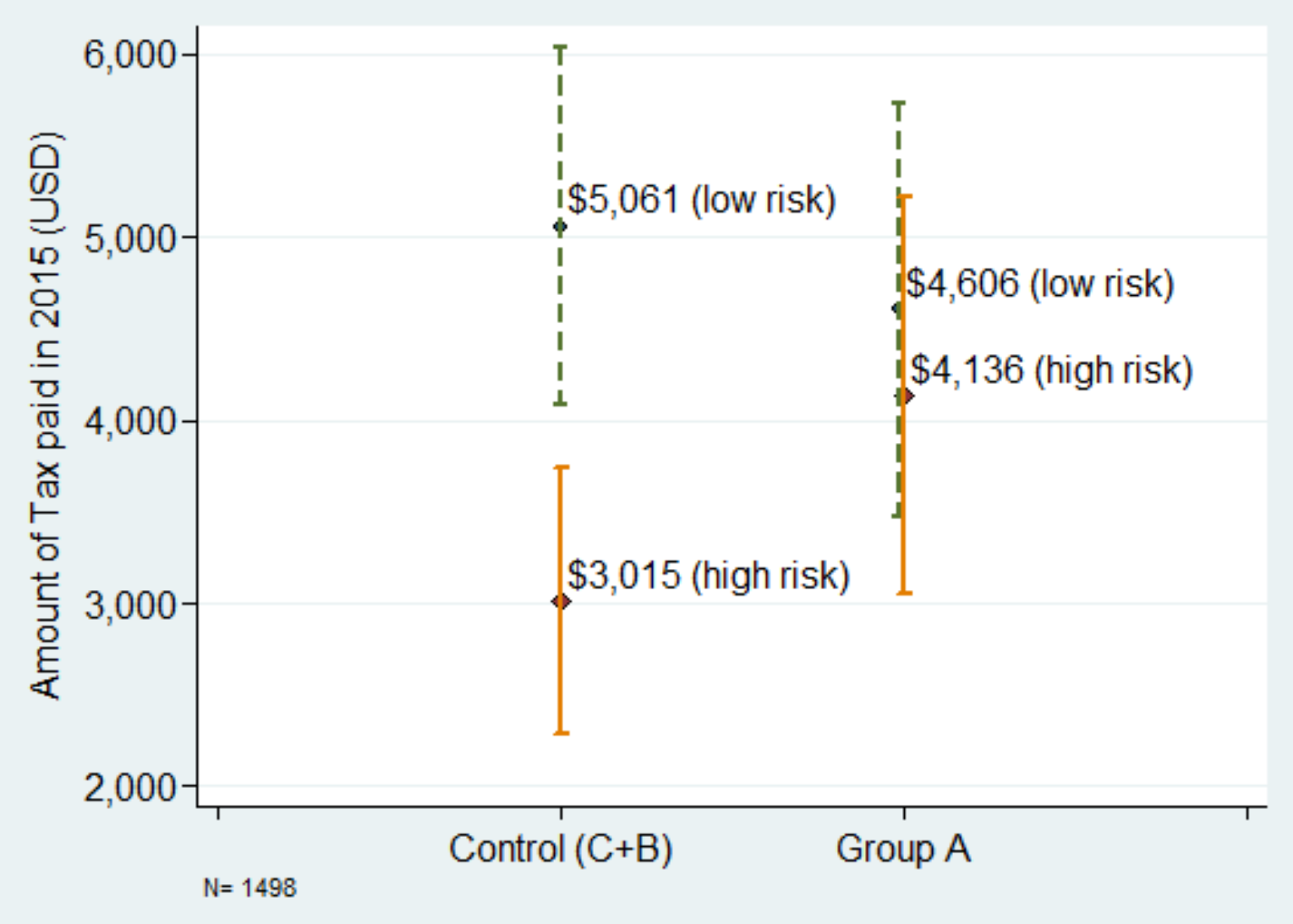
Impact on Compliance Costs: Firms Save About 5 hours per month

Dependent variables:	# visits per month to tax authority office in 2015	Total time spent on tax-related activities by month in 2015 (hours)
E-filing Impact (IV), Legal entities	-1.5***	-4.8***
	(0.1)	(1.2)
Impact by Baseline Risk Profile Score:		
E-filing Impact (IV) for **low risk firms**	-1.6***	-7.0***
	(0.1)	(1.9)
E-filing Impact (IV) for **high risk firms**	-1.3***	-2.8*
	(0.1)	(1.5)
P-val difference (Low risk / High risk):	0.031	0.085
Observations	934	925

Impact on Tax Payments: High-Risk Firms Pay More Taxes, Low Risk Firms Pay Less

	Tax paid in 2015[α] (Admin. data)	Inverse hyperbolic of tax paid in 2015 (Admin. data)	Median of Tax paid in 2015[α] (Admin. data)
E-filing Impact (IV) (Legal Entities)	7,217	-0.049	-216
	(10,937)	(0.771)	(591)
Impact by Baseline Risk Profile Score:			
E-filing Impact (IV) for **low risk firms**	-15,099	-1.920**	-1,896*
	(18,966)	(0.910)	(1,023)
E-filing Impact (IV) for **high risk firms**	25,357**	1.060	1,145*
	(12,728)	(1.075)	(671)
P-val difference (Low risk / High risk)	0.078	0.034	0.013
Observations	1,067	1,067	1,067
Mean outcome control group (B&C)	30,971	8.404	1,660

E-filing closes the revenue gap between firms likely to be evading taxes and those not likely to be evading taxes



This result holds even when controlling for heterogeneity of e-filing impact with risk score correlates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Tax paid in 2015[α]					Inverse hyperbolic of tax paid in 2015				
E-filing Impact (IV) for **low risk firms**	-15,099	-12,821	-11,116	-15,762	-16,833	-1.920**	-1.677*	-1.676*	-1.854**	-1.952*
	(18,966)	(20,536)	(17,728)	(19,950)	(19,834)	(0.910)	(0.925)	(0.885)	(0.915)	(0.999)
E-filing Impact (IV) for **high risk firms**	25,357**	25,016**	29,879**	31,741**	26,276**	1.060	1.026	2.031**	1.080	0.981
	(12,728)	(12,738)	(13,143)	(14,669)	(13,108)	(1.075)	(1.077)	(0.881)	(1.110)	(1.093)
P-val difference (Low risk / High risk):	0.078	0.121	0.068	0.064	0.074	0.034	0.057	0.003	0.043	0.049
Controling for heterogeneity of E-filing impact with variable:	None	Trader	No employee	Tech Practices Used	Time spent on tax	None	Trader	No employee	Tech Practices Used	Time spent on tax
Observations	1,067	1,067	1,067	1,067	1,057	1,067	1,067	1,067	1,067	1,057
R-squared	0.051	0.049	0.106	0.046	0.046	0.124	0.119	0.287	0.128	0.120

Impact on Bribes: Low Risk Firms Less Likely to Pay Bribes

	Think that it is common for firms to make informal payments
E-filing Impact (IV), Legal entities	-0.025
	(0.093)
Impact by Baseline Risk Profile Score:	
E-filing Impact (IV) for **low risk firms**	-0.236
	(0.144)
E-filing Impact (IV) for **high risk firms**	0.161
	(0.119)
P-val difference (Low risk / High risk):	0.035
Observations	934

List Experiment

"*Now, I will read a list of various actions that a company can take to solve or prevent problems with the Tax Administration. After I read the entire list, I would like you to tell me* ***how many of these actions your company took in 2015***."

SHORT LIST (50% of sample)	LONG LIST (50% of sample)
1. Received help from trade associations	1. Received help from trade associations
	2. Made unofficial payments or provided free services/goods
2. Had detailed discussions with tax officials	3. Had detailed discussions with tax officials
3. Provided additional documents	4. Provided additional documents
4. Pursued court action	5. Pursued court action

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E-filing Impact: List Experiment Bribe Result

	(1)	(2)	(3)	(4)	(5)	(6)
	All Legal Entities		Below median of 2014 risk profile score		Above median of 2014 risk profile score	
	Group B&C	Group A	Group B&C	Group A	Group B&C	Group A
Short list (4 questions without the question on informal payments):						
Mean	1.098	1.134	1.109	1.182	1.088	1.075
SE	0.021	0.030	0.03	0.046	0.027	0.035
N	274	179	138	99	136	80
Long list (5 questions, including the question on informal payments):						
Mean	1.221	1.178	1.252	1.143	1.187	1.214
SE	0.036	0.039	0.05	0.05	0.051	0.06
N	285	196	151	98	134	98
Difference short list - long list:						
Difference	0.122***	0.044	0.143**	-0.039	0.098*	0.139*
SE Difference	0.041	0.050	0.06	0.068	0.057	0.074
P-value T-test Difference	0.003	0.375	0.017	0.569	0.087	0.06
Difference in Difference with Control group:						
Difference in Difference		-0.078		-0.182**		0.041
SE Difference		0.065		0.092		0.093
P-value T-test Difference		0.231		0.048		0.658

Impact of E-filing (ITT) on Proportion of Firms that Paid Bribes (Using List Experiment)

- Overall: -0.078 (0.065)
- Low risk: -0.182** (0.092)
- High risk firms: 0.041 (0.093)

Suggestive Evidence on Mechanisms

For **low risk firms**:

- Tax inspector previously constrained the minimum amount of tax they could pay:
  - On average two more months with zero declaration Zero Decl.
  - CDF shows impact of e-filing in lower end of distribution among low risk firms CDF
- Cannot say if firms are now evading or were previously paying excess

Suggestive Evidence on Mechanisms

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  - CDF shows impact of e-filing in lower end of distribution among low risk firms CDF
- Cannot say if firms are now evading or were previously paying excess

For **high risk firms**:

- More time spent on tax preparation and records keeping Time Spent
  - Consistent with tax inspectors providing assistance in preparing tax forms to reduce tax liabilities
  - CDF shows impact of e-filing in upper end of distribution CDF
- More high risk firms in Group A drop out of e-filing after some months (22% vs. 4%) Dropout
  - Impact on payments dissipate after dropouts occur Tax Paid

Conclusion

- E-filing changed the distribution of tax payments across firms in a way arguably more equitable
  - Evidence of higher baseline tax evasion among high risk firms
  - Reduction of unofficial payments among low risk firms
- When technology replaces human discretion, impact will depend on how this discretion was exercised
- When adoption is voluntary, individuals or firms may respond strategically e.g. those that will be most constrained by limited corruption opportunities may be least likely to adopt
- In designing similar policies, important to consider how different potential users will react and how to target

Thank you!

Constraints to e-filing registration and interventions to address them

Reasons why firms were not using e-filing (from focus group discussions):

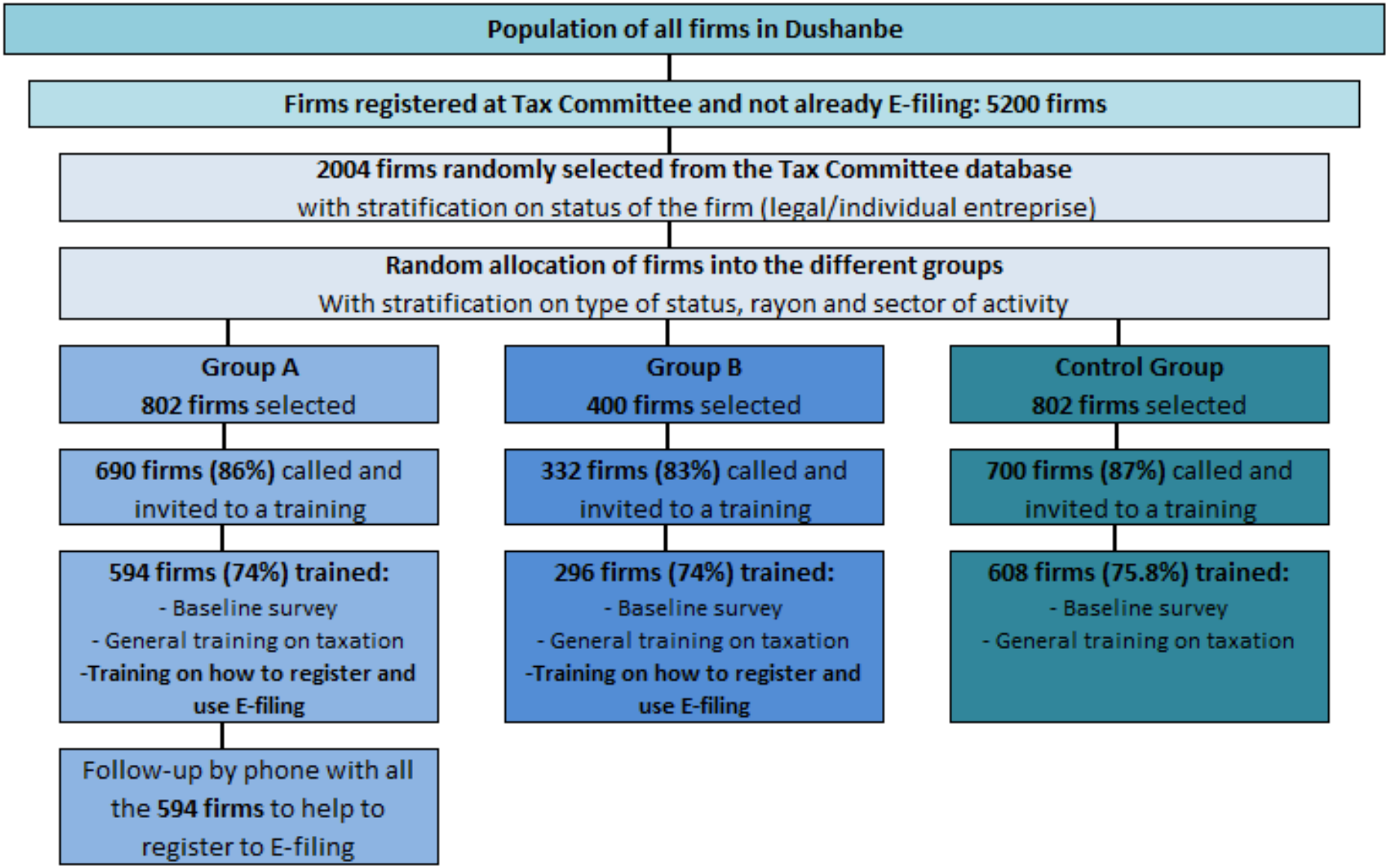
- Lack of awareness → **e-filing information**
- Registration cost → **free registration**
- Lack of internet access → **public terminals in all tax offices**

- Lack of knowledge about how to use it → **e-filing training**
- Lack of trust → **e-filing training**

- Complex registration process → **Logistical help to register**
- Procrastination → **Logistical help to register**

- Preference for interacting with same tax official

Sampling frame and randomization



Process of E-filing Registration

1. Firms fill out application forms and contract; submit with copies of firm registration documents to central tax office
2. After approval and processing, specialists from Tax Committee come to firm's office to install software for e-filing
   - Firms without computers or internet can e-file on public terminals at the tax office
3. Specialists also issue firm hardware- an electronic token that bears the firm's electronic signature

Baseline Characteristics and Balance Tests (admin data)

	All sample			Below median of 2014 risk profile score (low risk)			Above median of 2014 risk profile score (high risk)		
	Mean [SD] Control group (B&C)	Diff. in Group A	N	Mean [SD] Control group (B&C)	Diff. in Group A	N	Mean [SD] Control group (B&C)	Diff. in Group A	N
ANEL A: Administrative data from Tax Committee (2014)									
Legal entities$^{\beta}$	0.729	-	1,498	1	-	547	1	-	520
	[0.445]			[0]			[0]		
Sector of activity is Trade$^{\beta}$	0.415	-	1,498	0.374	-	547	0.248	-	520
	[0.493]			[0.485]			[0.432]		
Sector of activity is Service$^{\beta}$	0.42	-	1,498	0.495	-	547	0.582	-	520
	[0.494]			[0.501]			[0.494]		
Sector of activity is Manufacture	0.116	0.012	1,498	0.1	-0.003	547	0.113	0.012	520
	[0.321]	(0.011)		[0.301]	(0.017)		[0.317]	(0.021)	
Female owner	0.076	0.023	1,498	0.07	0.007	547	0.048	0.032	520
	[0.266]	(0.015)		[0.255]	(0.023)		[0.215]	(0.024)	
Number of employees	3.287	-0.127	1,498	4.271	-0.57*	547	3.257	0.108	520
	[3.443]	(0.171)		[3.71]	(0.306)		[3.781]	(0.331)	
Risk profile score in 2014$^{\lambda}$	62.6	0.1	1,067	41.3	1.6*	547	85.1	-0.3	520
	[28.9]	(1.7)		[10.5]	(0.9)		[24.7]	(2.1)	
Risk profile score in 2014 above median$^{\lambda}$	0.486	-0.015	1,067	0	-	547	1	-	520
	[0.5]	(0.031)		[0]			[0]		

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Baseline Characteristics and Balance Tests (survey data)

	All sample			Below median of 2014 risk profile score (low risk)			Above median of 2014 risk profile score (high risk)		
	Mean [SD] Control group (B&C)	Diff. in Group A	N	Mean [SD] Control group (B&C)	Diff. in Group A	N	Mean [SD] Control group (B&C)	Diff. in Group A	N
Firm has an accountant	0.73	0.028	1,498	0.799	-0.032	547	0.762	0.041	520
	[0.444]	(0.023)		[0.401]	(0.037)		[0.427]	(0.036)	
Share of technological practices implemented	0.538	0.024	1,498	0.639	-0.011	547	0.665	0.074**	520
	[0.437]	(0.021)		[0.422]	(0.038)		[0.402]	(0.036)	
Number of visits to tax authority office in Jan-Jun 2014	6.382	0.13**	1,498	6.514	0.109	547	6.444	0.158	520
	[0.948]	(0.056)		[1.027]	(0.101)		[1.111]	(0.106)	
Time spent on tax related activities during a typical month (hours)	6.185	0.131	1,483	6.26	-0.005	544	6.657	0.188	513
	[2.926]	(0.162)		[2.852]	(0.241)		[3.195]	(0.359)	
Number of times tax inspectors visited the company in Jan-Jun 2014	1.324	-0.027	1,498	1.271	-0.044	547	1.199	0.022	520
	[0.948]	(0.054)		[0.871]	(0.107)		[0.879]	(0.08)	
Ever used e-filing (with another company)	0.14	-0.013	1,498	0.198	-0.037	547	0.177	0.000	520
	[0.348]	(0.018)		[0.399]	(0.034)		[0.382]	(0.035)	
Think that it is common for firms to make informal payments	0.18	0.004	1,498	0.255	-0.046	547	0.174	0.019	520
	[0.385]	(0.02)		[0.437]	(0.035)		[0.379]	(0.035)	

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Firms with Higher Risk Scores Pay Lower Taxes and Have Higher Audit Penalties

	(1)	(2)	(3)
Dependent variables:	Inverse hyperbolic of tax paid in 2015		Inverse hyperbolic of total audit fine in 2015
Standardized risk profile score in 201	-1.287***	-1.229***	0.037**
	(0.119)	(0.144)	(0.017)
The firm was audited in 2015			10.582***
			(0.119)
Controlling for:			
- Trade, Services, gender, no employee, number of employees and	yes	yes	yes
- Index of profit and turnover in Jun and Dec 2015		yes	
Observations	1,424	934	1,424
R-squared	0.335	0.368	0.978
Mean Dependent Variable	8.561	9.118	1.249

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Low Risk Firms More Likely to Submit Zero Declarations

	# months with a positive amount of tax paid in 2015 (Admin. data)
E-filing Impact, Legal Entities Sample:	
E-filing Impact (IV) (Legal Entities)	-0.18
	(0.85)
Impact by Baseline Risk Profile Score:	
E-filing Impact (IV) for **low risk firms**	-2.1**
	(1.0)
E-filing Impact (IV) for **high risk firms**	1.1
	(1.2)
P-val difference (Low risk / High risk):	0.037
Observations	1,067

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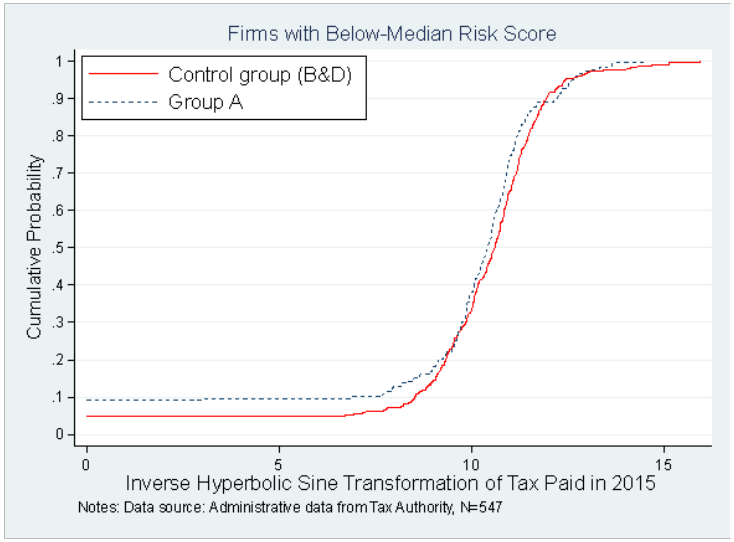
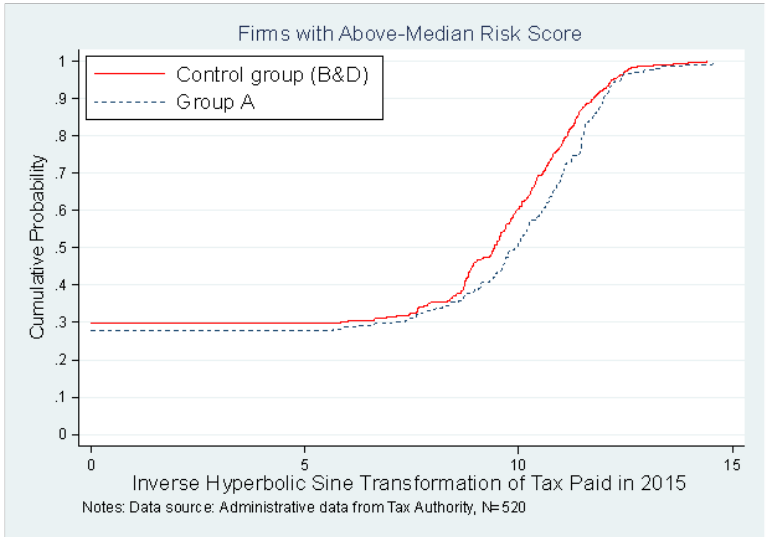
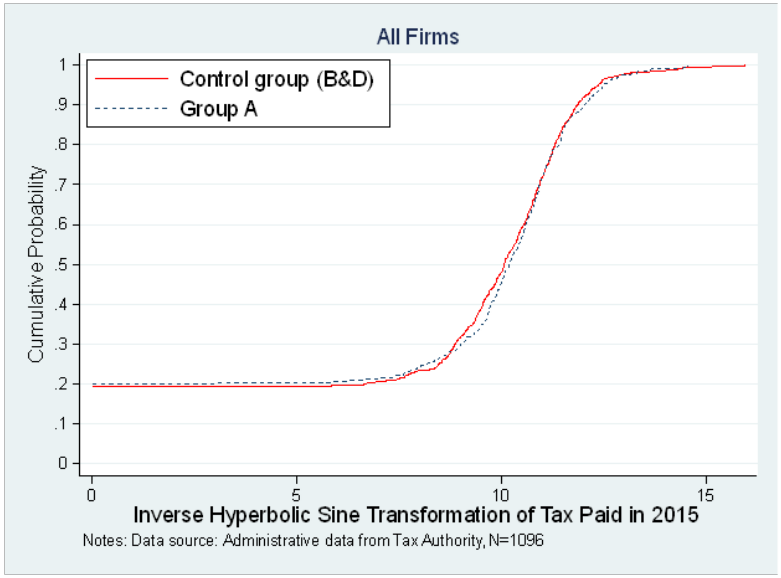
Distribution of Tax Payments by Treatment and Firm Risk







High Risk Firms Spend More Time on Tax Preparation

Dependent variables:	Monthly time spent by type of task: (hours)		
	Collate records	*Submit tax returns and get reconciliation act (including travel time)*	*Prepare primary documents used for tax purposes*
Impact by Baseline Risk Profile Score:			
E-filing Impact (IV) for **low risk firms**	-0.7	-3.9***	-2.4
	(0.7)	(0.3)	(1.7)
E-filing Impact (IV) for **high risk firms**	1.2*	-3.2***	-0.8
	(0.6)	(0.2)	(1.4)
P-val difference (Low risk / High risk):	0.042	0.025	0.479
Observations	925	925	925

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High Risk Firms are More Likely to Stop Using E-filing

	Control	Group A	Group B
Only legal entities:			
Registered to e-filing before June 2015	38%	86%	39%
# of firms registered before June 2015	169	378	83
Stopped to e-filing after registering	2%	15%	5%
Below median risk profile score in 2014: ***(Low-risk)***			
Registered to e-filing before June 2015	32%	68%	24%
# of firms registered before June 2015	94	192	34
Stopped to e-filing after registering	3%	9%	3%
Above median risk profile score in 2014: ***(High-risk)***			
Registered to e-filing before June 2015	27%	65%	35%
# of firms registered before June 2015	75	186	49
Stopped to e-filing after registering	0%	22%	6%

Notes: Risk profile scores are only calculated for legal entities

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Impact on Tax Payments Dissipate After Dropouts of High Risk Firms

	Tax paid in Jan-June 2015 (Admin. data)	Tax paid in Jul-Dec 2015 (Admin. data)
E-filing Impact, Legal Entities Sample:		
E-filing Impact (IV) (Legal Entities)	4,386	426
	(5,882)	(5,647)
Impact by Baseline Risk Profile Score:		
E-filing Impact (IV) for **low risk firms**	-12,106	-9,030
	(10,145)	(9,235)
E-filing Impact (IV) for **high risk firms**	18,089**	7,944
	(7,169)	(6,604)
P-val difference (Low risk / High risk):	0.016	0.139
Observations	1,067	1,067

Cost-Effectiveness Analysis

- The program cost $25 USD per firm in Group A, $17 in Group B and $12 in Group C
- Given take-up impact of 34%, cost per additional e-filing adoption is $37
- Estimated amount saved by firms from lower compliance cost is $5 per month
  - In 7 months, private benefits from time saved will cover program costs
- Other benefits include
  - Lower uncertainty ("less jitters")
  - Savings for tax authority from increased efficiency (e.g. fewer staff needed to collect tax filings and enter data, fewer mistakes in data entry)

Cost Effectiveness