

Table A1. Firms by city and country

Countries	Cities	Firms	Countries	Cities	Firms
Antigua and Barbuda	Entire country	21	El Salvador	Greater San Salvador	53
Argentina	Buenos Aires	640	El Salvador	San Salvador	316
Argentina	Chaco	11	El Salvador	Rest of Country	157
Argentina	Córdoba	70	Grenada	Entire country	17
Argentina	Mendoza	119	Guatemala	Guatemala City	381
Argentina	Rosario	134	Guatemala	Rest of Country	158
Argentina	Tucumán	12	Guyana	Entire country	58
Bahamas	Entire country	22	Honduras	Tegucigalpa	110
Barbados	Entire country	50	Honduras	San Pedro Sula	77
Belize	Entire country	63	Honduras	Rest of Country	128
Bolivia	Cochabamba	57	Jamaica	Kingston	51
Bolivia	La Paz	131	Jamaica	Rest of Country	22
Bolivia	Santa Cruz	97	Mexico	Chihuahua	44
Brazil	Amazonas	14	Mexico	Coahuila	50
Brazil	Bahia	38	Mexico	Estado de Mexico	409
Brazil	Brasilia DF	4	Mexico	Guanajuato	85
Brazil	Ceara	29	Mexico	Jalisco	337
Brazil	Goias	13	Mexico	Mexico DF	454
Brazil	Maranhao	1	Mexico	Nueva Leon	229
Brazil	Mato Grosso	9	Mexico	Puebla	124
Brazil	Minas Gerais	93	Mexico	Veracruz	24
Brazil	Paraiba	9	Nicaragua	Managua	185
Brazil	Parana	85	Nicaragua	East	21
Brazil	Pernambuco	16	Nicaragua	North	6
Brazil	Rio Grande do Sul	69	Nicaragua	West	10
Brazil	Rio de Janeiro	50	Nicaragua	Rest of Country	169
Brazil	Santa Catarina	61	Panama	Colon	6
Brazil	Sao Paulo	177	Panama	Panama city	135

Chile	Antofagasta	53	Panama	Rest of Country	7
Chile	Bío Bío	40	Paraguay	Asuncion	125
Chile	Los Lagos	77	Paraguay	Central	104
Chile	Santiago	725	Peru	Arequipa	105
Chile	Valparaiso	78	Peru	Chiclayo	25
Chile	Valparaíso	40	Peru	Lima	831
Colombia	Barranquilla	135	Peru	Piura	2
Colombia	Bogotá	717	Peru	Trujillo	48
Colombia	Cali	180	St. Kitts and Nevis	Entire country	17
Colombia	Cartagena	14	St. Lucia	Entire country	47
Colombia	Medellín	416	St. Vincent and the Granadines	Entire country	37
Costa Rica	San José	156	Suriname	Paramabiro and Nickerie	26
Costa Rica	Rest of Country	28	Suriname	Rest of Country	73
Dominica	Entire country	13	Trinidad and Tobago	Port of spain	25
Dominican Republic	Santo Domingo	49	Trinidad and Tobago	Rest of Country	60
Dominican Republic	Santiago	4	Uruguay	Canelones	43
Dominican Republic	Rest of Country	38	Uruguay	Montevideo	292
Ecuador	Azuay	51	Venezuela	Caracas	5
Ecuador	Guayas	127	Venezuela	Maracay	7
Ecuador	Pichincha	237	Venezuela	Valencia	20
El Salvador	East	24	Total		11044
El Salvador	West	34			

Table A2. Description of variables

Variable	Description	Measurement	Source
Total Factor Productivity	The ability to generate greater value or output with fewer inputs	It is calculated as the sum of firm-level errors aggregated by industry	WBES based on Francis et al. (2020)
Inadequately educated workforce	Perception whereby firms consider inadequately educated workforce as an obstacle to firm operation.	Where the variable is equal to 0 when there is a minor perception of obstacle and no obstacle, but takes the value 1 if it is equal to a moderate, major, and a very severe obstacle.	WBES
Informality	Perception whereby firms consider practices of competitors in the informal sector as an obstacle to firm operation (at the city level).	Measured as the mean of the perception values of firms (where 0 is equal to no obstacle, 1 is equal to a minor obstacle, 2 represents a moderate obstacle, 3 is equal to a major obstacle, and 4 is equal to a very severe obstacle) as an obstacle at the city level. This variable is the average value at the city level.	WBES
Total taxes and contribution rate	The total tax and contribution rate measures the amount of taxes borne by the business in the second year of operation, expressed as a percentage of "commercial profit"	It is the sum of all of the different business tax liabilities borne by the company at the country level.	WDI
Website	The firms' use their own website	Dummy variable that takes the value of 1 when the firm affirms that it uses a website and 0 otherwise	WBES
High Speed Internet	Firms have a high-speed Internet connection on its premises	Dummy variable that takes the value of 1 when the firm have a high-speed Internet connection on its premises and 0 otherwise	WBES
Full-time female employee	Total number of full-time female employees during the last fiscal year	Number of employees	WBES
Small firm	Firms size	Dummy variable: if the company is small [≥ 5 and ≤ 19 employees] takes the value of 1, 0 otherwise	WBES
Medium firm	Firms size	Dummy variable: if the company is small [≥ 20 and ≤ 99 employees] takes the value of 1, 0 otherwise	WBES

Large firm	Firms size	Dummy variable: if the company is small [≥ 100 employees] takes the value of 1, 0 otherwise	WBES
Electricity	Perception whereby firms consider electricity is an obstacle to firm operation (at the city level)	Measured as the mean of the perception values of firms (where 0 is equal to no obstacle, 1 is equal to a minor obstacle, 2 represents a moderate obstacle, 3 is equal to a major obstacle, and 4 is equal to a very severe obstacle) as an obstacle at the city level.	WBES
Transport	Perception whereby firms consider transport is an obstacle to firm operation (at the city level)	Measured as the mean of the perception values of firms (where 0 is equal to no obstacle, 1 is equal to a minor obstacle, 2 represents a moderate obstacle, 3 is equal to a major obstacle, and 4 is equal to a very severe obstacle) as an obstacle at the city level.	WBES
National sales	National sales as a percentage of the firm's total sales in the last fiscal year	Percentage of total sales	WBES
Indirect export sales	Sold domestically to third party that exports products	Percentage of total sales	WBES
Direct export sales	Own exports	Percentage of total sales	WBES
Labour force	Labour force comprises people ages 15 and older who supply labour for the production of goods and services during a specified period.	Participation rate	WDI
Mobile cellular subscriptions	Subscriptions to a public mobile telephone service that provide access to the PSTN using cellular technology.	Per 100 people	WDI
Gross capital formation	Gross capital formation (formerly gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories	% GDP	WDI
GDP per capita	Gross Domestic Product divided by midyear population	Current US\$	WDI

Table A3. Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
(1) Total Factor Productivity	1.000																		
(2) Human capital skills deficiency	0.006	1.000																	
(3) Informal competition	-0.055*	0.106*	1.000																
(4) Tax burden	-0.068*	-0.035*	-0.275*	1.000															
(5) Website	0.063*	0.147*	0.077*	-0.013	1.000														
(6) High-Speed Internet	0.046*	0.120*	0.022	-0.039*	0.246*	1.000													
(7) Full-time female employee	0.032*	0.051*	0.038*	-0.005	0.163*	0.073*	1.000												
(8) Small firm	-0.027*	-0.148*	-0.035*	-0.032*	-0.368*	-0.163*	-0.200*	1.000											
(9) Medium firm	0.007	0.076*	0.014	0.005	0.098*	0.021	-0.119*	-0.631*	1.000										
(10) Large firm	0.023	0.085*	0.024	0.032*	0.317*	0.167*	0.367*	-0.437*	-0.423*	1.000									
(11) Electricity	-0.007	-0.035*	-0.122*	0.044*	-0.102*	-0.020	-0.009	0.025*	-0.005	-0.024	1.000								
(12) Transport	-0.031*	0.135*	0.477*	-0.291*	0.106*	0.098*	0.029*	-0.058*	0.039*	0.023	0.229*	1.000							
(13) National sales	0.066*	0.004	0.054*	-0.124*	0.001	-0.004	0.000	0.047*	0.003	-0.059*	0.176*	0.036*	1.000						
(14) Indirect export sales	-0.053*	-0.012	0.083*	-0.107*	-0.058*	-0.047*	0.009	-0.013	-0.003	0.018	-0.060*	-0.007	-0.647*	1.000					
(15) Direct export sales	-0.060*	-0.001	-0.098*	0.176*	0.019	0.019	-0.002	-0.051*	-0.004	0.064*	-0.189*	-0.042*	-0.968*	0.437*	1.000				
(16) Labour force	-0.035*	-0.014	0.039*	0.155*	-0.042*	-0.128*	-0.017	-0.001	0.010	-0.010	-0.004	0.115*	-0.004	0.179*	-0.056*	1.000			
(17) Mobile cellular subscriptions	0.105*	0.127*	0.209*	-0.528*	0.158*	0.232*	0.051*	-0.036*	-0.009	0.053*	-0.089*	0.324*	0.111*	-0.033*	-0.118*	-0.180*	1.000		
(18) Gross capital formation	-0.029*	0.044*	0.327*	-0.439*	0.082*	0.166*	0.015	0.020	-0.014	-0.007	-0.061*	0.268*	0.064*	-0.129*	-0.030*	-0.562*	0.302*	1.000	
(19) GDP per capita	0.093*	-0.026*	0.057*	-0.283*	-0.046*	0.122*	0.020	0.002	-0.051*	0.058*	-0.088*	-0.115*	-0.024	0.057*	0.017	-0.202*	0.440*	-0.031*	1.000

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A4. Robustness check: digital technology bias (high-speed internet)

	(1)	(2)	(3)	(4)	(5)	(6)
	Mixed Effects		Mixed Effects		Mixed Effects	
	HS internet=0	HS internet=1	HS internet=0	HS internet=1	HS internet=0	HS internet=1
Obstacle: at firm level						
Inadequately educated workforce	-0.685*** (0.152)	-0.174 (0.196)				
Obstacle: at city level						
Informality			-0.703* (0.355)	-0.570 (0.464)		
Obstacle: at country level						
Total tax and contribution rate					-0.004 (0.005)	-0.008 (0.005)
Control variables at firm level						
Full-time female employee	-0.008 (0.013)	0.005* (0.002)	-0.010 (0.013)	0.005* (0.002)	-0.012 (0.014)	0.004* (0.002)
Small firm (<20)	1.367 (0.705)	0.078 (0.239)	1.487* (0.669)	0.105 (0.237)	1.415* (0.710)	0.056 (0.229)
Medium firm (20-99)	1.173 (0.752)	0.267** (0.098)	1.315 (0.735)	0.281** (0.101)	1.271 (0.762)	0.198 (0.103)
Large firm (=>100)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Control variables at city level						
Electricity	-1.881 (2.115)	0.297 (1.815)	-2.933 (2.187)	-0.387 (1.424)	-2.684 (2.695)	-0.444 (1.320)

Transport	-1.609* (0.757)	0.274 (0.456)	-0.906 (0.841)	0.676 (0.489)	-1.225 (0.798)	0.241 (0.391)
National sales	1.669*** (0.302)	-0.136 (0.325)	0.929** (0.320)	-0.461 (0.495)	1.335*** (0.253)	0.159 (0.275)
Indirect export sales	1.830*** (0.378)	-0.180 (0.354)	1.126** (0.368)	-0.481 (0.511)	1.558*** (0.338)	0.110 (0.309)
Direct export sales	1.693*** (0.298)	-0.111 (0.321)	0.932** (0.324)	-0.440 (0.493)	1.322*** (0.239)	0.194 (0.272)
Control variables at country level						
Labour force	0.015 (0.014)	0.007 (0.031)	0.015 (0.015)	0.008 (0.029)	0.011 (0.015)	0.001 (0.030)
Mobile cellular subscriptions	0.010 (0.008)	0.010 (0.006)	0.005 (0.008)	0.009 (0.005)	0.003 (0.010)	0.002 (0.006)
Gross capital formation	0.079*** (0.013)	-0.009 (0.031)	0.078*** (0.012)	0.000 (0.025)	0.069*** (0.015)	-0.020 (0.032)
GDP per capita	0.000 (0.000)	-0.000 (0.000)	0.000** (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)
Time fixed effects						
Dummy 2009_2010	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Dummy 2016_2018	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Constant	-165.617*** (29.514)	14.822 (32.506)	-90.729** (32.161)	48.040 (50.399)	-131.371*** (24.879)	-12.172 (26.687)
Observations	421	3379	421	3379	421	3379

R-squared						
AIC	31.548	35.496	31.557	37.492	31.560	39.479
BIC	92.188	121.251	92.197	129.372	92.200	137.484
log-likelihood (LR) & F test	-0.77***	-3.74***	-0.77***	-3.74***	-0.78***	-3.73***

Note: Standard errors in parentheses: * p<0.05; ** p<0.01; *** p<0.001. **Dependent variable:** total factor productivity. **Technological bias:** HS refers to High Speed internet variable. **Control variables at the firm level:** the number of female employees (Non-Production Workers) and the firm's size (dummy variables if the firm is small [≥ 5 and ≤ 19] if the company is medium [≥ 20 and ≤ 99], and if the firm is large [≥ 100], taking large firms as the reference category). **At the regional level:** electricity and transport obstacles for firms, sales, indirect export sales, and direct export sales. **At the country level:** labor force and participation rate, mobile cellular subscription, and gross capital formation. **Time (waves) fixed effects,** using 2006 wave as reference category, these variables were automatically dropped by the run specification, standard errors are represented by (.). AIC and BIC are the respective information criteria.

Table A5. Robustness check: Cluster-level confounding bias for firm level obstacle

	(1)	(2)	(3)
	OLS	Mixed Effects	
		Website=0	Website=1
Obstacle: at firm level			
Inadequately educated workforce	-0.209 (0.111)	-0.347* (0.175)	-0.086 (0.115)
Cluster bias: at city level			
Inadequately educated workforce average	-0.415 (0.278)	-0.928* (0.388)	-0.316 (0.261)
Cluster bias: at country level			
Inadequately educated workforce average	0.529 (0.344)	1.541*** (0.416)	-0.099 (0.196)
Control variables at firm level			
Full-time female employee	0.003* (0.001)	-0.005 (0.005)	0.003* (0.001)
Small firm (<20)	-0.062 (0.117)	-0.095 (0.169)	0.136 (0.082)
Medium firm (20-99)	0.155 (0.108)	0.175 (0.135)	0.168* (0.083)
Large firm (>=100)	0.000 (.)	0.000 (.)	0.000 (.)
Control variables at city level			
Electricity	-0.037 (0.633)	0.525 (1.168)	-0.374 (0.760)
Transport	0.244	0.434	0.015

	(0.326)	(0.646)	(0.276)
National sales	-0.478* (0.188)	-0.513 (0.290)	-0.610*** (0.179)
Indirect export sales	-0.515** (0.200)	-0.493 (0.344)	-0.690*** (0.204)
Direct export sales	-0.495** (0.192)	-0.547 (0.288)	-0.611*** (0.176)
Control variables at country level			
Labour force	-0.014 (0.009)	-0.013 (0.015)	-0.016 (0.009)
Mobile cellular subscriptions	0.005 (0.003)	-0.001 (0.005)	0.009*** (0.002)
Gross capital formation	-0.014 (0.009)	0.002 (0.020)	-0.024 (0.014)
GDP per capita	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)
Time fixed effects			
dummy2009_2010	0.214 (0.146)	0.366** (0.124)	0.092 (0.245)
dummy2016_2018	-0.053 (0.202)	0.236 (0.306)	-0.333 (0.252)
Constant	51.323** (18.921)	52.847 (28.946)	66.153*** (17.911)
Observations	9175	3803	5372

R-squared	0.034		
AIC	36136.956	44.234	45.071
BIC	36265.193	150.375	157.083
log-likelihood (LR) & F test	2.97***	-5.12***	-5.53***

Note: Standard errors in parentheses: * p<0.05; ** p<0.01; *** p<0.001. **Dependent variable:** total factor productivity. **Cluster bias:** are the average of the firm-level obstacle at the city and country level. **Control variables at the firm level:** the number of female employees (Non-Production Workers) and the firm's size (dummy variables if the firm is small [≥ 5 and ≤ 19] if the company is medium [≥ 20 and ≤ 99], and if the firm is large [≥ 100], taking large firms as the reference category). **At the regional level:** electricity and transport obstacles for firms, sales, indirect export sales, and direct export sales. **At the country level:** labor force and participation rate, mobile cellular subscription, and gross capital formation. **Time (waves) fixed effects,** using 2006 wave as reference category. Some variables are dropped by the run specification, that is why standard errors are represented by (.). AIC and BIC are the respective information criteria.