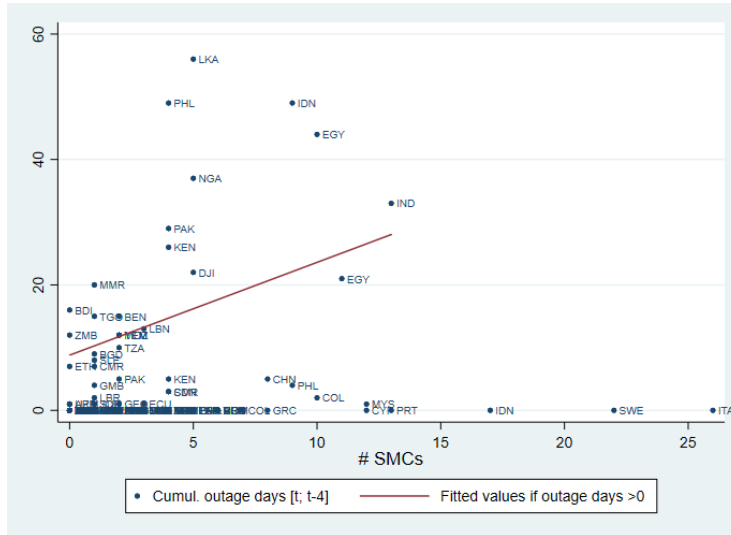


# Spatial internet spillovers in manufacturing

## Online Appendix

### Appendix A. Instrumental Variable setting.

#### Appendix A.1. SMC number versus cumulative outage days



Appendix A.2. Instrument set calibrations.

Dep. Var: Total sales (ln, USD)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	First stage estimates					Reduced form estimations				
	Baseline sample					Excl. East-Asia & Pac	Unrestricted IVs	Baseline sample		
<b>IV1</b>	<b>0.03584***</b>	<b>0.183***</b>	<b>.1853***</b>	<b>0.1902***</b>			<b>0.1903***</b>	<b>0.5159***</b>		<b>-0.0273</b>
	<b>(0.0021)</b>	<b>(0.0576)</b>	<b>(0.0577)</b>	<b>(0.0582)</b>			<b>(.0583)</b>	<b>(0.0338)</b>		<b>(0.231)</b>
<b>IV2 -- calibrations</b> <b>(<math>\tau_1 = 0</math>; <math>\tau_2 = 2</math>)</b>		<b>-0.0078***</b>								
		<b>(0.0030)</b>								
<b>(<math>\tau_1 = 0</math>; <math>\tau_2 = 3</math>)</b>			<b>-0.0105***</b>							
			<b>(0.0040)</b>							
<b>(<math>\tau_1 = 0</math>; <math>\tau_2 = 4</math>)</b>				<b>-0.0137***</b>	<b>0.0019***</b>	<b>-0.0712***</b>	<b>-0.0137***</b>		<b>0.0460***</b>	<b>0.0482**</b>
				<b>(0.0050)</b>	<b>(0.000158)</b>	<b>(0.02698)</b>	<b>(0.0050)</b>		<b>(0.00351)</b>	<b>(0.0216)</b>
<b>Control variables:</b>										
Email adoption	-0.0052**	-0.0056***	-0.0056***	-0.0056***	-0.0048*	-0.0041***	-0.0054***	-	-	-
	(0.0024)	(0.0021)	(0.0021)	(0.0021)	(0.0026)	(0.0008)	(0.0023)	-	-	-
Website adoption	0.0015***	0.0016***	0.00156***	0.0016***	0.0014***	0.00098**	0.0018***	-	-	-
	(0.0003)	(0.0003)	(0.00036)	(0.00036)	(0.0004)	(0.00045)	(0.0004)	-	-	-
Exports	0.0000	-0.0000	-0.0000	-0.0000	0.0000	-0.0000	0.0000	-	-	-
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	-	-	-
Initial # perm. FT employees	-0.00015	-0.00006	0.0000	-0.00006	-0.00014	-0.00016	-0.00006	-	-	-
	(0.00012)	(0.0001)	(0.0001)	(0.00016)	(0.00012)	(0.00023)	(0.00015)	-	-	-
% non-production workers	-0.0068**	-0.0059**	-0.0058**	-0.0058**	-0.0063**	-0.0011	-0.0041**	-	-	-
	(0.0035)	(0.0027)	(0.0027)	(0.0027)	(0.00318)	(0.0007)	(0.0020)	-	-	-
% skilled workers	0.0042	0.0042	0.00424	0.0043	0.0042	0.0005*	0.0060	-	-	-
	(0.0037)	(0.0037)	(0.0037)	(0.00374)	(0.0037)	(0.0003)	(0.00398)	-	-	-
Manager exp	-0.0019	-0.0019	-0.0019	-0.0019	-0.0023	0.00008	-0.0018	-	-	-
	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0017)	(0.00032)	(0.0014)	-	-	-
Firm's age	0.0020	0.0018	0.0018	0.0017	0.00219	-0.00037	0.00165	-	-	-
	(0.0016)	(0.0013)	(0.0013)	(0.0013)	(0.0017)	(0.0003)	(0.00128)	-	-	-
% of foreign ownership	-0.0000	-0.0000	-0.0000	-0.0000	0.0000	0.00002**	-7.92E-06	-	-	-
	(0.0000)	(0.0000)	(0.0000)	(0.00001)	(0.0000)	(0.00001)	(0.00001)	-	-	-
% of state ownership	-0.00001*	-0.00001**	-0.00001*	-0.00001**	-0.000013*	-0.00006***	-0.00003**	-	-	-
	(0.000006)	(0.0000)	(0.0000)	(0.0000)	(0.000007)	(0.00002)	(0.00001)	-	-	-
Bank loan (0 or 1)	0.0019	0.0017*	0.0017*	0.0017*	0.0019	0.00057**	0.0019	-	-	-
	(0.0012)	(0.00099)	(0.00099)	(0.00099)	(0.0012)	(0.0002)	(0.0012)	-	-	-
Electricity obstacle	0.00115	0.0009	0.0009	0.0009	0.0011	-0.0003**	0.00080	-	-	-
	(0.00096)	(0.00076)	(0.00076)	(0.00075)	(0.0009)	(0.00012)	(0.00068)	-	-	-
Distance to connectivity infra	0.0095***	0.0468***	0.0472***	0.0484***	0.00059	0.0010	0.0495	-	-	-
	(0.0019)	(0.0148)	(0.0148)	(0.0149)	0.00202	(0.0021)	(0.0159)	-	-	-

	Second-stage estimates									
<b><i>Internet</i></b>	<b>14.397***</b>	<b>3.868***</b>	<b>3.805***</b>	<b>3.620***</b>	<b>24.07***</b>	<b>8.944***</b>	<b>3.596***</b>	-	-	-
	<b>(1.385)</b>	<b>(0.734)</b>	<b>(0.728)</b>	<b>(0.712)</b>	<b>(1.564)</b>	<b>(1.924)</b>	<b>(0.711)</b>	-	-	-
Email adoption	0.695***	0.648***	0.648***	0.647***	0.738***	0.732***	0.661***	0.620***	0.622***	0.622***
	(0.0774)	(0.0982)	(0.0983)	(0.0987)	(0.0651)	(0.0882)	(0.0946)	(0.1026)	(0.103)	(0.103)
Website adoption	0.640***	0.655***	0.655***	0.655***	0.627***	0.701***	0.665***	0.6623***	0.662***	0.662***
	(0.0589)	(0.0562)	(0.0562)	(0.0562)	(0.0620)	(0.0557)	(0.0554)	(0.0565)	(0.0566)	(0.0565)
Exports (% sales)	0.00615***	0.0063***	0.0063***	0.0063***	0.0060***	0.00863***	0.00661***	0.0062***	0.00620***	0.00620***
	(0.00152)	(0.00151)	(0.00151)	(0.00151)	(0.00153)	(0.00106)	(0.00160)	(0.0015)	(0.0015)	(0.0015)
Initial # perm. FT employees	0.655***	0.653***	0.653***	0.653***	0.656***	0.552***	0.651***	0.6526***	0.652***	0.652***
	(0.0373)	(0.0375)	(0.0375)	(0.0375)	(0.0370)	(0.0454)	(0.0375)	(0.0375)	(0.0375)	(0.0374)
% non-production workers	0.268	0.213	0.213	0.212	0.318	0.177	0.210	0.1696	0.166	0.166
	(0.176)	(0.155)	(0.155)	(0.154)	(0.194)	(0.188)	(0.144)	(0.138)	(0.137)	(0.136)
% skilled workers	-0.554***	-0.510***	-0.510***	-0.509***	-0.595***	-0.480***	-0.500***	-0.4933***	-0.493***	-0.493***
	(0.0718)	(0.0455)	(0.0454)	(0.0452)	(0.101)	(0.0839)	(0.0446)	(0.0416)	(0.0414)	(0.0414)
Manager exp	0.0625	0.0328	0.0327	0.0321	0.0897	0.0399	0.0352	0.0350	0.0350	0.0349
	(0.0558)	(0.0547)	(0.0547)	(0.0548)	(0.0640)	(0.0339)	(0.0498)	(0.0562)	(0.0563)	(0.0563)
Firm's age	0.166***	0.192***	0.192***	0.192***	0.143**	0.298***	0.152***	0.1950***	0.196***	0.196***
	(0.0535)	(0.0485)	(0.0485)	(0.0485)	(0.0622)	(0.0465)	(0.0472)	(0.0479)	(0.0479)	(0.0480)
% of foreign ownership	0.00786***	0.00774***	0.00774***	0.00774***	0.00797***	0.00829***	0.0072***	0.0078***	0.0078***	0.0078***
	(0.000943)	(0.00095)	(0.00095)	(0.00095)	(0.00096)	(0.00185)	(0.000992)	(0.0009)	(0.0009)	(0.0009)
% of state ownership	0.00533***	0.00516***	0.00516***	0.00516***	0.00549***	-0.00114	0.00517***	0.0052***	0.0052***	0.0052***
	(0.000817)	(0.00086)	(0.00086)	(0.00086)	(0.00079)	(0.00454)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
Bank loan	0.529***	0.547***	0.548***	0.548***	0.511***	0.568***	0.545***	0.5559***	0.557***	0.557***
	(0.0546)	(0.0484)	(0.0483)	(0.0482)	(0.0604)	(0.0768)	(0.0478)	(0.0464)	(0.0462)	(0.0461)
Electricity obstacle	0.0316	0.0407	0.0408	0.0410	0.0232	0.0281*	0.0294	0.0481*	0.0488*	0.0489*
	(0.0313)	(0.0280)	(0.0280)	(0.0279)	(0.0353)	(0.0163)	(0.0280)	(0.0269)	(0.0269)	(0.0269)
Distance to connectivity infra	-0.0646**	-0.0565***	-0.0564***	-0.0563***	-0.0720	-0.0679**	-0.0560***	0.0721***	-0.0579***	-0.0648
	(0.0329)	(0.0208)	(0.0208)	(0.0207)	(0.0500)	(0.0267)	(0.0207)	(0.0231)	(0.0202)	(0.0650)
Control variables ( $X_{it}$ ) & FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Kleibergen-Paap Wald F stat	281.55	118.33	119.40	125.62	146.01	6.97	125.91	-	-	-
LM stat	1.995	8.377**	8.416**	8.595**	1.685	1.769	8.629**	-	-	-
Hansen J test (P-val.)	-	0.19	0.20	0.20	-	-	0.19	-	-	-
<i>N</i>	40,154	40,154	40,154	40,154	40,154	33,820	42,245	40,154	40,154	40,154

Note: \* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%. Control estimates of 1<sup>st</sup>-stage equation not reported. Standard errors are presented in parentheses, and are robust to heteroscedasticity and clustered by country-year of survey. In column (7), we consider internet outages induced by natural hazards and government interventions in IV2 computation.

### Appendix A.3. IV1 decomposition and identification restrictions.

	(1)	(2)	(3)	(4)		
<b>IV1's fixed component:</b>	<b>Ln distance infrastructure</b>			<b>Connectivity shocks</b>		
<i>Internet</i>	14.05***	21.66***	3.135***	2.411	-5.508***	0.472
	(0.827)	(1.353)	(0.459)	(2.781)	(0.627)	(2.157)
	<b>1<sup>st</sup> stage estimates</b>					
IV1	0.018***		0.1291***	0.0631***		0.0654***
	(0.0008)		(0.03081)	(0.0313)		(0.0315)
IV2†		0.00036***	-0.0032***		-0.0156***	-0.0174***
		0.00003	(0.0009)		(0.00097)	(0.0014)
$X_{it}$ & FEs ( $d_{jt}$ , $d_l$ , $d_k$ )	Yes	Yes	Yes	Yes	Yes	Yes
KP Wald F stat	514.037	198.905	775.608	4.043	259.67	128.99
Hansen J test (P-val.)	-	-	0.20	-	-	0.14
$N$	40,154	40,154	40,154	40,154	40,154	40,154
$R^2$	0.339	0.293	0.369	0.370	0.363	0.370

Note: \* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%. Control estimates not reported. Standard errors, presented in parentheses, are robust to heteroscedasticity and clustered by country-year of survey. In columns (1)-(2), the IV weighting factor (distance to infrastructure) is set to its value at the first survey wave, while in columns (3)-(4), the number of SMCs is set to its value at the first survey wave.

† In order to be able to fix IV2's components, we had to make IV2's calculation differing slightly from equation (4), since here, we weight the sum of outage days over ( $t$ ;  $t-4$ ) with the location distance to infrastructure (km, ln) measured at the year of survey. As reminder, IV2 is the 5-year average of the product between lagged values of outages days and location distance to infrastructure.

## Appendix B. Robustness checks

### Appendix B.1. Controlling for unobserved local economic performance, pre-trend, and non-random exposure to shocks.

	(1)	(2)	(3)	(4)	(5)
<b>Dep var: total sales</b>	<b>Local econ. activity</b>		<b>Pre-trend†</b>		<b>Non-random exposure</b>
Internet spillovers	3.131***	2.765***	-2.943	-	3.145***
	(0.845)	(0.840)	(2.083)	-	(1.060)
Epsilon <sub>Y<sub>i</sub></sub>	-0.118**	-0.127**	-	-	-
	(0.0576)	(0.054)	-	-	-
	<b>First stage estimations</b>				
IV1	0.1933**	0.1988***	0.1948***	-0.6745	
	(0.0765)	(0.065)	(0.0603)	(0.7094)	
IV2 - calibration ( $t$ ; $t-4$ )	-0.0140**	-0.0147**	-0.0140***	0.0791	
	(0.0069)	(0.0061)	(0.0053)	(0.0612)	
Recentered IV1					0.2054***
					(0.0605)
Recentered IV2					-0.0148***
					(0.0053)
$X_{it}$ + FEs ( $d_{jt}$ , $d_l$ , $d_k$ )	Yes	Yes	Yes	Yes	Yes
Epsilon_OLS <sub>Y<sub>i</sub></sub>	Yes	No	-	-	-
Epsilon_IV <sub>Y<sub>i</sub></sub>	No	Yes	-	-	-
KP Wald F-stat	109.58	70.39	120.79	-	249.266
Hansen J test (P-val.)	0.19	0.19	0.30	-	0.19
$N$	40,154	40,154	40,861	38,321	40,154

Note: \* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%. Control estimates not reported. Standard errors, presented in parentheses, are robust to heteroscedasticity and clustered by country-year of survey.

† In columns (3) and (4) the dependent variable is the 3-year lagged total sales. In column (4), a reduced form of our model is estimated, consisting in estimating the direct effect of IV1 and IV2 on the 3-year lagged total sales. In column (5), we generate counterfactual SMC-number (IV1) and outage-days (IV2) shocks from a normal distribution with mean and standard deviation equal to the corresponding moments of these variables' historic distribution.

Appendix B.2. Controlling for unobserved inter-industry linkages and output characteristics.

Dep var: total sales (Ln, USD)	(1)	(2)	(3)	(4)
	Inter-industry FE		ISIC product FE	
(A) $\overline{Internet}$	3.434*** (0.638)		3.443*** (0.655)	
(B) $\overline{Internet\_inter}$		-15.895*** (3.136)		-15.174*** (2.044)
(C) $\overline{Internet\_intra}$		22.951*** (3.130)		21.962*** (2.796)
<b>1<sup>st</sup>-stage statistics</b>				
Weak-id SW F-stat :				
(A)	125.58***		132.93***	
(B)		21.09***		22.64***
(C)		51.94***		50.92***
Under-id Chi-2 stat:				
(A)	256.74***		272.71***	
(B)		21.56***		23.22***
(C)		53.10***		52.24***
Controls	Yes	Yes	Yes	Yes
Country-year FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	No	No
Location FE	Yes	Yes	Yes	Yes
<b>Industry-pair FE</b>	<b>Yes</b>	<b>Yes</b>	<b>No</b>	<b>No</b>
<b>4-digit ISIC product FE</b>	<b>No</b>	<b>No</b>	<b>Yes</b>	<b>Yes</b>
N	40,154	39,673	39,975	39,503

Note: \* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%. Control estimates not reported. Standard errors, presented in parentheses, are robust to heteroscedasticity and clustered by country-year of survey.

Appendix B.3. Excluding landlocked countries.

Dep var (Ln, USD):	(1)	(2)	(3)	(4)
	Total sales		Sales per worker	
(A) $\overline{Internet}$	2.953*** (0.508)		3.500*** (0.524)	
(B) $\overline{Internet\_inter}$		-15.824*** (3.1047)		-13.073*** (2.009)
(C) $\overline{Internet\_intra}$		23.236*** (3.132)		20.286*** (1.768)
<b>1<sup>st</sup>-stage statistics</b>				
Weak-id SW F-stat :				
(A)	137.63		137.63	
(B)		18.67		18.67
(C)		48.44		48.44
Under-id Chi-2 stat:				
(A)	281.83		281.83	
(B)		19.12		19.12
(C)		49.61		49.61
$X_{it} + FEs (d_{jt}, d_l, d_k)$	Yes	Yes	Yes	Yes
Hansen test p-val.	0.19	-	0.21	-
N	34,662	34,344	34,662	34,344

Note: \* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%. Control estimates not reported. Standard errors, presented in parentheses, are robust to heteroscedasticity and clustered by country-year of survey.

#### Appendix B.4. Internet spillovers for inward-oriented SMEs.

	(1)	(2)	(3)	(4)
<b>Dep var (Ln, USD):</b>	<b>Total sales</b>		<b>Sales per worker</b>	
(A) <i>Internet</i>	1.061** (0.548)		1.358** (0.585)	
(B) <i>Internet_inter</i>		-7.727*** (0.885)		-5.949*** (1.159)
(C) <i>Internet_intra</i>		10.01*** (0.787)		8.087*** (0.933)
	<b>1<sup>st</sup>-stage statistics</b>			
Weak-id SW F-stat :				
(A)	123.97		123.97	
(B)		71.35		71.35
(C)		174.14		174.14
Under-id Chi-2 stat:				
(A)	256.63		256.63	
(B)		73.86		73.86
(C)		180.27		180.27
$X_{it} + \text{FEs } (d_{jt}, d_l, d_k)$	Yes	Yes	Yes	Yes
Hansen test p-val.	0.23	-	0.26	-
<i>N</i>	22,040	21,761	22,040	21,761

Note: \* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%. Control estimates not reported. Standard errors, presented in parentheses, are robust to heteroscedasticity and clustered by country-year of survey.

#### Appendix B.5. Internet spillovers in locations with $N \geq 50$ observations.

	(1)	(2)	(3)	(4)
<b>Dep var (Ln, USD):</b>	<b>Total sales</b>		<b>Sales per worker</b>	
(A) <i>Internet</i>	3.466*** (0.508)		3.694*** (0.514)	
(B) <i>Internet_inter</i>		-16.298*** (3.485)		-14.934*** (2.878)
(C) <i>Internet_intra</i>		21.947*** (2.447)		20.371*** (1.648)
	<b>1<sup>st</sup>-stage statistics</b>			
Weak-id SW F-stat :				
(A)	115.44		115.44	
(B)		29.21		29.21
(C)		73.65		73.65
Under-id Chi-2 stat:				
(A)	235.57		235.57	
(B)		29.81		29.81
(C)		75.15		75.15
$X_{it} + \text{FEs } (d_{jt}, d_l, d_k)$	Yes	Yes	Yes	Yes
Hansen test p-val.	0.20	-	0.21	-
<i>N</i>	38,622	38,326	38,622	38,326

Note: \* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%. Control estimates not reported. Standard errors, presented in parentheses, are robust to heteroscedasticity and clustered by country-year of survey.

## Appendix C. Additional estimations.

### Appendix C.1. Intra and inter-industry internet spillovers, with alternative industry grouping.

Dep var (Ln, USD): total sales	(1)	(2)	(3)
(A) $\overline{Internet\_inter}$	-13.073*** (1.855)	-26.050*** (3.479)	
(B) $\overline{Internet\_intra}$	18.970*** (1.606)		188.30 (207.62)
(C) $\overline{Internet\_inter}^2$		28.770*** (2.565)	
(C) $\overline{Internet\_intra}^2$			-163.27 (196.45)
$\overline{Internet\_intra}$		0.821*** (0.3098)	
$\overline{Internet\_inter}$			-6.456 (6.807)
Weak-id SW F-stat :			
(A)	30.90	81.91	3.75
(B)	124.37		
(C)		151.31	3.50
Under-id Chi-2 stat:			
(A)	31.59	83.75	3.83
(B)	127.16		
(C)		154.70	3.58
$X_{it} + FEs (d_{jt}, d_l, d_k)$	Yes	Yes	Yes
Lind & Melhum U-shape T-test (threshold)	-	7,49*** (0.45)	0.75 (0.58)
N	39,516	39,673	39,673

Note: \* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%. Control estimates not reported. Standard errors, presented in parentheses, are robust to heteroscedasticity and clustered by country-year of survey. Compared to Table 5, i) firms operating in “manufactures of rubber and plastic products” and “manufactures-sales-maintenance of motor vehicles” sectors have been dropped from the “manufacture of vehicle, machinery and equipment” industry, and considered as separate industries; ii) firms (91) operating in “mining” and “manufacture of petroleum products” sectors have been dropped from the “Manufacture of extracted resource” industry. See Appendix B.4.

### Appendix C.2. Internet spillovers and outward orientation.

Var. dep.: Total sales (Ln, USD)	(2)	(3)	(4)
(A) $\overline{Internet\_inter}$	-5.487 (5.082)	-5.430 (3.533)	2.546 (2.861)
<b>(B):</b>			
$\overline{Internet\_inter}$ x dir. & indir. exports	1.323*** (0.301)		
$\overline{Internet\_inter}$ x foreign own.		80.50*** (16.53)	
$\overline{Internet\_inter}$ x multi-plant.			51.48*** (4.919)
$\overline{Internet\_inter}$ x inward. orient.			
$\overline{Internet\_inter}$ x website adopt.			
Interaction var.	-0.858*** (0.217)	-52.35*** (10.97)	-33.55*** (2.854)
Weak-id SW F-stat :			
(A)	5.06	5.06	94.36
(B)	18.03	37.57	96.48
Under-id Chi-2 stat:			
(A)	5.18	5.17	76.70
(B)	18.43	38.41	96.48
$X_{it} + FEs (d_{jt}, d_l, d_k)$	Yes	Yes	Yes

$N$ 
40,154
39,280
40,154

Note: \* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%. Control estimates not reported. Standard errors are presented in parentheses, and are robust to heteroscedasticity and clustered by country-year of survey.

### Appendix C.3. Internet spillovers and workforce composition.

	(2)	(3)	(4)	(5)
Var. dep.: Employment variables (Ln, #)	# FT perm. workers	FT temp. workers	FT perm. non prod. work.	FT perm. prod. workers
<i>Internet</i>	<b>-1.019***</b> (0.293)	<b>0.129</b> (0.476)	<b>-1.482***</b> (0.334)	<b>-1.207***</b> (0.290)
IV1	0.01902*** (0.0582)	0.19105*** (0.0581)	0.01902*** (0.0582)	0.1902*** (0.0582)
IV2	-0.0137*** (0.0050)	-0.0137*** (0.0050)	-0.0137*** (0.0050)	-0.0137*** (0.0587)
Controls + FEs	Yes	Yes	Yes	Yes
Total sales (ln, USD))	Yes	Yes	Yes	Yes
F-stat	124.58	125.72	124.58	124.58
Hansen J test (P-val.)	0.23	0.14	0.21	0.20
$X_{it}$ + FEs ( $d_{jt}$ , $d_l$ , $d_k$ )	Yes	Yes	Yes	Yes
$N$	40,154	39,280	40,154	40,154

Note: \* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%. Control estimates not reported. Standard errors are presented in parentheses, and are robust to heteroscedasticity and clustered by country-year of survey.