Supplementary Material of 10.1007/s42524-025-4188-x

Table A Additional analysis to test for reverse causality

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
	NB Regression	NB Regression	NB Regression	NB Regression	OLS	OLS	OLS	OLS
	$IP_{i,t+2}$	$IP_{i,t+2}$	$IP_{i,t+2}$	$IP_{i,t+2}$	RE_{wc}	SE_{wc}	RE_{cc}	SE_{cc}
$IP_{i,t+1\sim t+2}$					0.026	0.000	0.000	0.000
					(1.619)	(1.026)	(0.577)	(0.917)
$Comple_{colla}\ (m)$	0.074	0.019	-0.008	-0.010	-2.096***	-0.104***	-0.014***	-0.023***
	(1.241)	(0.321)	(-0.144)	(-0.182)	(-10.835)	(-8.129)	(-2.645)	(-4.204)
$RE_{wc}(a)$	0.039***							
	(5.285)							
$SE_{wc}(b)$		0.324**						
		(2.295)						
$RE_{cc}(c)$			0.827***					
			(3.445)					
$SE_{cc}(d)$				0.404*				
				(1.675)				
_cons	-2.974***	-2.890***	-2.881***	-2.882***	3.041***	0.097***	0.030***	0.047***
	(-11.979)	(-11.631)	(-11.600)	(-11.571)	(10.954)	(6.111)	(5.357)	(4.952)
Control Variables$_{i,t}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2528	2528	2528	2528	2576	2576	2576	2576
chi2	873.06	830.76	835.01	824.04				

Notes: *T-value* is in parentheses. $^{*}p<0.1$, $^{**}p<0.05$, $^{***}p<0.01$

Table B Negative binomial regression model with random-effects

	model 1	model 2	model 3	model 4	model 5	model 6	model 7	model 8	model 9
Firm size (log)	0.035***	0.035***	0.034***	0.031***	0.034***	0.035***	0.030***	0.033***	0.030***
	(2.911)	(2.961)	(2.974)	(2.621)	(2.886)	(2.953)	(2.579)	(2.858)	(2.622)
ROA (log)	0.038	0.038	0.043	0.039	0.038	0.041	0.041	0.047	0.040
	(0.873)	(0.871)	(1.005)	(0.885)	(0.887)	(0.950)	(0.959)	(1.095)	(0.937)
RDI (log)	0.072	0.071	0.056	0.065	0.065	0.069	0.055	0.054	0.055
	(1.569)	(1.546)	(1.245)	(1.416)	(1.417)	(1.502)	(1.232)	(1.204)	(1.215)
Profits (log)	-0.013	-0.012	0.003	0.003	-0.006	-0.015	0.011	0.009	0.017
	(-0.286)	(-0.273)	(0.060)	(0.061)	(-0.140)	(-0.329)	(0.241)	(0.214)	(0.388)
Community Size	0.002***	0.002***	0.001	0.003***	0.002**	0.002**	0.001	0.001	0.001
	(3.392)	(2.953)	(1.210)	(4.031)	(2.443)	(2.310)	(0.750)	(1.092)	(0.637)
Global Network Density	207.245***	207.029***	185.141***	195.590***	197.677***	204.878***	198.310***	184.563***	195.797***
	(9.900)	(9.887)	(8.802)	(9.267)	(9.362)	(9.780)	(9.172)	(8.671)	(9.002)
$Comple_{colla}(m)$		-0.047	0.089	0.033	-0.027	-0.020	0.033	0.081	0.023
		(-0.840)	(1.487)	(0.545)	(-0.477)	(-0.353)	(0.485)	(1.259)	(0.343)
$RE_{wc}(a)$			0.055***				0.014	0.054***	0.012
			(7.698)				(0.695)	(5.645)	(0.528)
$SE_{wc}(b)$				0.550***			-0.208	0.116	-0.245
				(3.839)			(-0.520)	(0.706)	(-0.612)
$RE_{cc}(c)$					1.080***		-0.398	2.775**	3.546***
					(4.384)		(-0.993)	(2.172)	(2.755)
$SE_{cc}(d)$						0.707***	0.243	-3.069***	-2.569**
						(2.969)	(0.748)	(-2.960)	(-2.425)
m*a							0.062**		0.068*
							(2.203)		(1.920)
m*b							0.594		0.656
							(0.860)		(0.952)
m*c								-4.615**	-6.175***
								(-2.408)	(-3.103)
m*d								5.261***	4.385***
								(3.488)	(2.806)
_cons	-3.375***	-3.330***	-3.435***	-3.347***	-3.350***	-3.355***	-3.373***	-3.449***	-3.409***
	(-12.565)	(-12.164)	(-12.722)	(-12.339)	(-12.303)	(-12.290)	(-12.407)	(-12.718)	(-12.500)
ln_r	0.384***	0.386***	0.498***	0.425***	0.416***	0.402***	0.521***	0.532***	0.543***
	(3.210)	(3.225)	(3.981)	(3.498)	(3.438)	(3.343)	(4.120)	(4.198)	(4.263)
ln_s	0.692***	0.694***	0.900***	0.771***	0.753***	0.734***	0.938***	0.944***	0.961***
	(4.893)	(4.906)	(5.855)	(5.274)	(5.196)	(5.109)	(5.985)	(6.023)	(6.077)
N	2576	2576	2576	2576	2576	2576	2576	2576	2576
chi2	891.53	891.20	1011.81	923.37	913.19	907.27	1056.82	1043.68	1072.89

Notes: *T-value* is in parentheses. $^{*}p<0.1$, $^{**}p<0.05$, $^{***}p<0.01$

Table C Ordinary least squares regression model

	model 1	model 2	model 3	model 4	model 5	model 6	model 7	model 8	model 9
Firm size (log)	-0.000	-0.000	0.001	-0.001	-0.000	0.000	-0.001	-0.000	-0.002
	(-0.032)	(-0.028)	(0.189)	(-0.213)	(-0.027)	(0.026)	(-0.086)	(-0.034)	(-0.282)
ROA (log)	-0.009	-0.009	-0.010	-0.010	-0.009	-0.007	-0.016	-0.012	-0.018
	(-0.374)	(-0.397)	(-0.448)	(-0.429)	(-0.368)	(-0.317)	(-0.719)	(-0.540)	(-0.780)
RDI (log)	0.028	0.028	0.028	0.026	0.026	0.028	0.032	0.031	0.032
	(1.130)	(1.134)	(1.152)	(1.059)	(1.055)	(1.129)	(1.324)	(1.271)	(1.355)
Profits (log)	0.012	0.012	0.026	0.016	0.014	0.013	0.035	0.031	0.036
	(0.475)	(0.476)	(1.044)	(0.636)	(0.543)	(0.534)	(1.440)	(1.260)	(1.486)
Community Size	0.002***	0.002***	0.001**	0.003***	0.002***	0.002***	0.000	0.001	-0.000
	(5.540)	(5.081)	(2.254)	(6.043)	(4.759)	(4.345)	(0.089)	(1.447)	(-0.032)
Global Network Density	-1.978	-2.088	-9.813	-4.596	-2.585	-1.775	10.468	-7.574	9.499
	(-0.296)	(-0.313)	(-1.490)	(-0.689)	(-0.387)	(-0.266)	(1.516)	(-1.149)	(1.369)
$Comple_{colla}(m)$		-0.017	0.093***	0.024	-0.011	-0.008	0.003	0.088***	0.001
		(-0.624)	(3.273)	(0.847)	(-0.419)	(-0.281)	(0.104)	(3.004)	(0.047)
$RE_{wc}(a)$			0.054***				-0.020*	0.062***	-0.020
			(10.002)				(-1.661)	(9.449)	(-1.451)
$SE_{wc}(b)$				0.391***			-0.144	0.019	-0.133
				(4.481)			(-0.687)	(0.198)	(-0.639)
$RE_{cc}(c)$					0.437**		-1.031***	-0.159	1.142
					(2.357)		(-3.954)	(-0.219)	(1.540)
$SE_{cc}(d)$						0.400***	0.276	-1.859***	-1.384***
						(2.718)	(1.448)	(-3.468)	(-2.589)
m*a							0.153***		0.156***
							(7.429)		(6.461)
m*b							0.150		0.136
							(0.359)		(0.326)
m*c								-1.049	-3.625***
								(-0.917)	(-3.053)
m*d								3.683***	2.729***
								(4.474)	(3.307)
_cons	0.117*	0.135*	-0.017	0.097	0.124*	0.117	0.054	-0.011	0.060
	(1.792)	(1.892)	(-0.242)	(1.353)	(1.728)	(1.627)	(0.755)	(-0.159)	(0.837)
N	2576	2576	2576	2576	2576	2576	2576	2576	2576

Notes: *T-value* is in parentheses. $^{*}p<0.1$, $^{**}p<0.05$, $^{***}p<0.01$

Table D.1 Alternative measurement of SE_{wc}

	model 1	model 2	model 3	model 4	model 5	model 6	model 7	model 8	model 9
Firm size (log)	0.031**	0.032**	0.032**	0.032**	0.030**	0.031**	0.028**	0.030**	0.028**
	(2.392)	(2.427)	(2.475)	(2.449)	(2.357)	(2.414)	(2.170)	(2.355)	(2.193)
ROA (log)	0.043	0.043	0.047	0.045	0.043	0.045	0.041	0.046	0.042
	(0.963)	(0.965)	(1.076)	(1.009)	(0.980)	(1.027)	(0.932)	(1.059)	(0.950)
RDI (log)	0.097*	0.096*	0.087*	0.095*	0.091*	0.095*	0.090*	0.087*	0.090*
	(1.931)	(1.909)	(1.742)	(1.902)	(1.814)	(1.896)	(1.812)	(1.735)	(1.810)
Profits (log)	-0.004	-0.003	0.011	-0.001	0.003	-0.004	0.011	0.011	0.016
	(-0.080)	(-0.073)	(0.238)	(-0.012)	(0.070)	(-0.086)	(0.250)	(0.242)	(0.352)
Community Size	0.002***	0.002**	0.001	0.002**	0.002*	0.002*	0.000	0.001	0.000
	(2.684)	(2.358)	(1.009)	(2.258)	(1.941)	(1.901)	(0.152)	(0.747)	(0.125)
Global Network Density	201.737***	201.604***	183.890***	212.391***	193.917***	200.218***	180.604***	146.804***	175.606***
	(9.625)	(9.616)	(8.712)	(8.857)	(9.178)	(9.546)	(6.005)	(5.497)	(5.815)
$Comple_{colla}(m)$		-0.036	0.078	-0.092	-0.018	-0.014	0.595**	0.266**	0.518**
		(-0.621)	(1.253)	(-1.102)	(-0.308)	(-0.231)	(2.401)	(2.390)	(2.076)
$RE_{wc}(a)$			0.046***				0.024	0.058***	0.023
			(6.050)				(1.024)	(5.360)	(0.866)
$SE_{wc}(b)$				0.143			0.052	-0.431**	-0.016
				(0.928)			(0.179)	(-2.308)	(-0.056)
$RE_{cc}(c)$					0.916***		-0.159	2.816**	2.972**
					(3.586)		(-0.394)	(2.155)	(2.215)
$SE_{cc}(d)$						0.572**	0.129	-2.591**	-2.184**
						(2.304)	(0.385)	(-2.390)	(-1.970)
m*a							0.043		0.049
							(1.449)		(1.306)
m*b							-0.503*		-0.415
							(-1.855)		(-1.519)
m*c								-4.511**	-4.905**
								(-2.290)	(-2.366)
m*d								4.351***	3.610**
								(2.746)	(2.205)
_cons	-3.347***	-3.313***	-3.407***	-3.442***	-3.330***	-3.337***	-3.433***	-3.072***	-3.400***
	(-12.400)	(-12.023)	(-12.486)	(-11.105)	(-12.140)	(-12.132)	(-9.374)	(-9.938)	(-9.266)
N	2528	2528	2528	2528	2528	2528	2528	2528	2528
chi2	878.04	877.76	957.12	876.46	893.45	888.04	993.08	999.51	1004.60

Notes: *T-value* is in parentheses. $^{*}p<0.1$, $^{**}p<0.05$, $^{***}p<0.01$

Table D.2 Alternative measurement of $Comple_{colla}$

	model 1	model 2	model 3	model 4	model 5	model 6	model 7	model 8	model 9
Firm size (log)	0.031**	0.032**	0.032**	0.029**	0.031**	0.032**	0.031**	0.034***	0.034***
	(2.392)	(2.451)	(2.512)	(2.220)	(2.384)	(2.440)	(2.434)	(2.656)	(2.608)
ROA (log)	0.043	0.042	0.047	0.044	0.043	0.045	0.048	0.048	0.048
	(0.963)	(0.955)	(1.079)	(0.986)	(0.973)	(1.019)	(1.102)	(1.104)	(1.117)
RDI (log)	0.097*	0.095*	0.086*	0.092*	0.091*	0.095*	0.087*	0.083*	0.084*
	(1.931)	(1.901)	(1.730)	(1.847)	(1.805)	(1.887)	(1.733)	(1.662)	(1.677)
Profits (log)	-0.004	-0.002	0.010	0.008	0.004	-0.003	0.010	0.009	0.007
	(-0.080)	(-0.049)	(0.218)	(0.166)	(0.088)	(-0.069)	(0.219)	(0.199)	(0.151)
Community Size	0.002***	0.002**	0.001	0.003***	0.001*	0.001*	0.001	0.001	0.001
	(2.684)	(2.226)	(0.916)	(2.952)	(1.818)	(1.800)	(0.787)	(0.803)	(0.597)
Global Network Density	201.737***	201.176***	184.388***	193.487***	193.705***	199.985***	184.399***	186.936***	188.952***
	(9.625)	(9.592)	(8.734)	(9.147)	(9.167)	(9.533)	(8.668)	(8.801)	(8.851)
$Comple_{colla}$(m)		-0.057	0.045	-0.000	-0.040	-0.035	0.050	0.045	0.029
		(-1.056)	(0.789)	(-0.002)	(-0.743)	(-0.636)	(0.764)	(0.723)	(0.447)
RE_{wc}(a)			0.045***				0.040***	0.043***	0.030*
			(5.879)				(2.721)	(4.297)	(1.748)
SE_{wc}(b)				0.386***			0.078	0.016	0.035
				(2.584)			(0.285)	(0.094)	(0.129)
RE_{cc}(c)					0.904***		-0.009	2.163***	2.334***
					(3.540)		(-0.023)	(2.902)	(3.045)
SE_{cc}(d)						0.551**	0.172	-1.393**	-1.211*
						(2.216)	(0.507)	(-2.017)	(-1.695)
m*a							0.005		0.030
							(0.218)		(0.932)
m*b							-0.099		-0.064
							(-0.150)		(-0.097)
m*c								-4.911***	-5.367***
								(-3.241)	(-3.347)
m*d								3.539***	3.140**
								(2.694)	(2.276)
_cons	-3.347***	-3.292***	-3.377***	-3.305***	-3.310***	-3.316***	-3.375***	-3.443***	-3.427***
	(-12.400)	(-11.985)	(-12.411)	(-12.107)	(-12.104)	(-12.095)	(-12.295)	(-12.460)	(-12.369)
N	2528	2528	2528	2528	2528	2528	2528	2528	2528
chi2	878.04	878.73	953.29	895.66	894.03	888.31	955.45	974.43	978.12

Notes: *T-value* is in parentheses. $^{*}p<0.1$, $^{**}p<0.05$, $^{***}p<0.01$

Table E Division into two stages

	2002-2010						2011-2017			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
$Comple_{colla}(m)$	0.295**	0.296**	0.239**	0.228*	0.123	0.039	-0.015	-0.014	-0.014	-0.061
	(2.284)	(2.314)	(1.997)	(1.902)	(0.824)	(0.474)	(-0.182)	(-0.180)	(-0.179)	(-0.664)
$RE_{wc}(a)$	0.028				-0.160***	0.026**				0.011
	(1.468)				(-3.061)	(2.571)				(0.323)
$SE_{wc}(b)$		0.591*			1.525*		0.061			-1.010*
		(1.688)			(1.667)		(0.343)			(-1.933)
$RE_{cc}(c)$			0.499		4.714*			0.740*		2.633
			(1.111)		(1.701)			(1.944)		(1.267)
$SE_{cc}(d)$				0.218	-0.854				0.224	-2.852**
				(0.357)	(-0.254)				(0.745)	(-2.126)
$m*a$					0.380***					0.020
					(3.902)					(0.404)
$m*b$					-3.378					1.545*
					(-1.637)					(1.756)
$m*c$					-8.377*					-3.965
					(-1.812)					(-1.327)
$m*d$					1.423					4.222**
					(0.275)					(2.152)
	(-4.470)	(-4.423)	(-4.335)	(-4.241)	(-3.860)	(-7.081)	(-6.797)	(-6.949)	(-6.838)	(-6.695)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	864	864	864	864	864	1036	1036	1036	1036	1036
chi2	39.14	39.92	38.36	37.09	59.71	170.87	162.31	165.18	162.77	187.04

Notes: *T-value* is in parentheses. $^{*}p<0.1$, $^{**}p<0.05$, $^{***}p<0.01$