Appendix

I. World Openness Rankings

The Openness index rankings of the 129 economies are shown in the following table. The changes in the last two columns refer to the 2019 reading relative to that in 2008.

A.1   **Openness Index Rankings, 2008-2019**

(Sorted by the 2019 rankings)

	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	Change in place	Change in index %
Singapore	1	1	1	1	1	2	2	2	2	2	2	2	*+1*	*2.5*
Germany	**2**	**3**	**3**	**3**	**4**	**4**	**4**	**4**	**4**	**4**	**3**	**3**	*+1*	*3.8*
Hong Kong, SAR	3	2	2	2	2	3	3	3	3	3	4	4	*+1*	*3.4*
Ireland	4	4	4	4	6	5	7	7	8	8	9	11	*+7*	*7.3*
United Kingdom	**5**	**6**	**5**	**6**	**9**	**7**	**6**	**6**	**5**	**5**	**5**	**5**	*0*	*2.2*
Switzerland	**6**	**5**	**6**	**5**	**8**	**6**	**5**	**5**	**6**	**7**	**7**	**10**	*+4*	*4.1*
The Netherlands	7	9	8	8	7	9	8	8	7	10	8	8	*+1*	*1.8*
France	**8**	**7**	**9**	**9**	**10**	**11**	**10**	**11**	**10**	**11**	**10**	**9**	*+1*	*1.8*
Canada	**9**	**8**	**11**	**10**	**11**	**10**	**9**	**10**	**9**	**9**	**11**	**7**	*-2*	*1.0*
Malta	10	10	14	12	12	12	12	12	11	6	6	6	*-4*	*-1.0*
Italy	**11**	**11**	**13**	**13**	**13**	**13**	**13**	**13**	**13**	**13**	**14**	**15**	*+4*	*2.6*
Belgium	12	12	15	14	15	14	14	15	14	14	17	16	*+4*	*2.1*
Israel	13	13	16	16	17	16	15	14	15	15	18	17	*+4*	*2.6*
Korea	**14**	**15**	**17**	**19**	**22**	**19**	**28**	**36**	**41**	**43**	**50**	**51**	*+37*	*11.4*
Cyprus	15	16	28	32	32	30	51	40	19	18	19	19	*+4*	*2.9*

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	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	Change in place	Change in index %
Australia	**16**	**14**	**12**	**11**	**14**	**17**	**18**	**21**	**22**	**22**	**25**	**25**	*+9*	*3.8*
Sweden	17	21	21	22	20	18	20	18	17	17	20	22	*+5*	*3.0*
Spain	18	17	18	17	19	20	21	22	20	19	22	20	*+2*	*2.7*
Czech Republic	19	18	19	20	21	24	24	23	23	24	26	27	*+8*	*4.1*
Luxembourg	20	31	7	15	5	8	11	9	27	23	15	41	*+21*	*7.8*
Japan	**21**	**28**	**25**	**26**	**16**	**15**	**16**	**16**	**12**	**12**	**12**	**12**	*-9*	*-1.5*
United States	**22**	**19**	**10**	**7**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	*-21*	*-17.8*
Austria	23	20	22	24	23	22	19	19	18	20	21	21	*-2*	*2.7*
Denmark	24	23	24	23	24	23	23	20	21	21	24	23	*-1*	*3.2*
Hungary	25	26	26	21	26	25	26	26	26	27	27	26	*+1*	*3.5*
Norway	26	22	20	18	18	21	17	17	16	16	16	13	*-13*	*-0.5*
Estonia	27	25	27	28	27	27	22	24	24	28	29	29	*+2*	*4.5*
New Zealand	28	24	23	25	25	26	25	25	25	25	13	14	*-14*	*-0.4*
Latvia	29	27	29	27	29	28	29	28	30	31	35	36	*+7*	*5.4*
Costa Rica	30	29	31	30	33	59	43	43	43	59	57	58	*+28*	*10.6*
Lithuania	31	30	30	36	50	47	47	52	45	42	39	37	*+6*	*5.1*
Finland	32	32	32	31	31	29	27	27	29	29	28	28	*-4*	*2.7*
Portugal	33	34	35	33	34	31	31	31	31	30	30	30	*-3*	*2.9*
Uruguay	34	37	39	39	39	36	33	32	35	34	31	31	*-3*	*2.9*
Chile	35	33	36	40	37	37	36	33	28	26	23	18	*-17*	*-0.7*
Nicaragua	36	36	38	37	36	44	42	41	42	39	40	40	*+4*	*4.7*
Macao, SAR	37	40	43	48	47	42	44	50	44	44	46	48	*+11*	*5.9*
Panama	38	38	34	35	30	35	37	37	34	36	36	34	*-4*	*2.6*
Peru	39	35	37	47	46	53	49	49	51	61	58	60	*+21*	*8.7*
China	**40**	**42**	**41**	**42**	**43**	**43**	**45**	**47**	**53**	**58**	**61**	**62**	*+22*	*9.6*
Bahrain	41	39	40	38	38	34	30	29	40	38	37	39	*-2*	*4.1*
Slovakia	42	41	42	41	40	40	38	39	39	41	41	47	*+5*	*4.8*
Poland	43	44	45	44	45	58	57	57	57	54	56	57	*+14*	*7.3*
Georgia	44	47	58	58	60	56	58	62	99	99	87	78	*+34*	*11.5*
Trinidad and Tobago	45	45	44	29	28	38	35	34	36	40	47	49	*+4*	*5.8*
Guatemala	46	43	46	43	41	51	48	51	49	45	45	46	*0*	*4.0*
Oman	47	48	47	45	42	45	41	44	47	50	51	52	*+5*	*6.3*
Malaysia	48	46	48	46	44	39	55	56	58	55	42	24	*-24*	*-1.2*
Greece	49	51	55	55	56	33	32	30	32	33	33	33	*-16*	*0.8*
Iceland	50	49	49	62	78	73	73	76	75	79	80	83	*+33*	*11.4*
Bulgaria	51	52	33	34	35	32	34	35	33	32	34	35	*-16*	*0.4*
Croatia	52	53	56	56	58	54	56	58	59	56	52	53	*+1*	*4.8*

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	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	Change in place	Change in index %
Cambodia	53	50	50	49	48	57	59	60	64	68	76	81	*+28*	*10.4*
Mexico	**54**	**54**	**53**	**54**	**55**	**52**	**50**	**48**	**48**	**46**	**43**	**42**	***-12***	***1.5***
Slovenia	55	57	57	57	57	55	54	54	50	47	44	38	*-17*	*0.8*
Antigua and Barbuda	56	56	54	52	53	50	53	53	52	52	67	71	*+15*	*8.2*
Jordan	57	55	52	50	49	41	40	38	38	37	32	32	*-25*	*-1.0*
Mauritius	58	58	51	53	52	49	52	45	37	35	38	44	*-14*	*0.6*
Salvador	59	59	59	60	59	61	60	59	56	51	48	43	*-16*	*0.2*
Kuwait	60	60	61	63	62	62	61	68	69	67	66	72	*+12*	*5.7*
Botswana	61	62	63	61	61	60	63	55	55	49	53	59	*-2*	*2.3*
Guyana	62	61	62	51	51	48	46	42	46	48	55	55	*-7*	*1.2*
Romania	63	63	64	64	65	63	67	67	67	72	72	77	*+14*	*5.5*
Russia	**64**	**64**	**60**	**59**	**54**	**46**	**39**	**46**	**54**	**57**	**62**	**69**	***+5***	***4.0***
Colombia	65	65	67	69	81	90	98	103	102	102	100	92	*+27*	*8.8*
Argentina	**66**	**71**	**76**	**80**	**87**	**88**	**89**	**90**	**78**	**78**	**77**	**79**	***+13***	***4.6***
Ecuador	67	66	65	66	64	87	88	86	84	62	54	54	*-13*	*-0.7*
Saudi Arabia	**68**	**67**	**66**	**65**	**63**	**68**	**65**	**66**	**66**	**65**	**68**	**64**	***-4***	***1.5***
Mongolia	69	70	69	70	70	72	71	70	80	83	86	80	*+11*	*3.7*
Zambia	70	69	68	67	67	64	62	61	61	63	63	66	*-4*	*1.7*
Dominica	71	68	70	78	75	70	70	65	62	60	73	76	*+5*	*2.5*
Paraguay	72	72	74	72	74	76	75	74	71	69	60	61	*-11*	*-0.8*
Uganda	73	74	71	75	71	71	72	71	73	74	75	74	*+1*	*1.0*
Barbados	74	73	77	71	76	82	81	82	82	88	96	100	*+26*	*9.0*
Vietnam	75	75	72	76	80	81	82	84	87	86	88	90	*+15*	*4.5*
Indonesia	**76**	**76**	**82**	**79**	**79**	**79**	**78**	**79**	**85**	**66**	**70**	**67**	***-9***	***-0.2***
North Macedonia	77	78	75	74	73	77	77	73	77	77	71	73	*-4*	*0.2*
Honduras	78	77	81	83	84	91	90	93	91	91	79	56	*-22*	*-4.0*
Armenia	79	80	79	81	69	67	68	69	68	70	65	68	*-11*	*-0.7*
Philippine	80	79	78	77	77	75	94	92	96	93	85	88	*+8*	*2.6*
Albania	81	81	80	82	82	83	80	75	76	87	99	102	*+21*	*7.9*
Papua New Guinea	82	82	86	87	68	66	64	64	65	76	82	89	*+7*	*2.3*
Thailand	83	83	83	85	85	85	86	87	90	96	93	82	*-1*	*-0.1*
India	**84**	**84**	**87**	**86**	**86**	**86**	**85**	**89**	**89**	**89**	**92**	**94**	***+10***	***4.3***
Gambia	85	86	84	84	83	80	79	81	83	81	81	86	*+1*	*0.3*
Ukraine	86	85	98	98	104	107	106	106	106	108	109	99	*+13*	*5.4*
Jamaica	87	87	85	68	66	65	66	63	63	64	59	50	*-37*	*-6.5*
Morocco	88	88	88	89	91	92	91	91	92	90	91	93	*+5*	*2.3*

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	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	Change in place	Change in index %
Kyrgyzstan	89	91	91	91	108	104	104	97	74	73	74	70	-19	-3.5
South Africa	**90**	**89**	**95**	**95**	**94**	**93**	**92**	**94**	**94**	**94**	**89**	**91**	**+1**	**0.3**
Turkey	**91**	**93**	**73**	**73**	**72**	**74**	**76**	**77**	**81**	**80**	**83**	**85**	**-6**	**-1.2**
Egypt	92	90	89	105	103	103	100	83	60	53	49	45	-47	-9.5
Lebanon	93	92	90	88	89	69	69	72	72	71	64	63	-30	-4.9
Moldova	94	94	94	93	96	98	115	118	119	117	112	107	+13	5.5
Belize	95	95	93	92	92	94	95	95	95	100	105	105	+10	5.2
Kenya	96	97	92	94	90	89	87	88	86	84	84	87	-9	-1.7
Bolivia	97	96	96	90	88	84	83	85	88	85	78	75	-22	-4.3
Lesotho	98	99	102	101	106	105	102	107	104	101	101	106	+8	4.4
Brazil	**99**	**98**	**97**	**96**	**93**	**78**	**74**	**78**	**79**	**75**	**69**	**65**	**-34**	**-6.3**
Tunisia	100	101	100	99	95	95	93	96	98	92	97	96	-4	0.5
Samoa	101	103	105	106	105	109	109	109	107	107	106	109	+8	3.9
Laos	102	102	101	100	101	99	103	104	110	113	117	119	+17	5.8
Azerbaijan	103	104	99	97	100	101	101	102	103	112	116	101	-2	1.7
Cape Verde	104	105	120	129	128	128	127	128	128	127	127	126	+23	11.7
Zimbabwe	105	108	104	103	98	114	117	99	93	97	115	117	+12	4.9
Bosnia and Herzegovina	106	100	103	102	99	97	84	80	70	82	90	84	-22	-5.3
Mozambique	107	106	108	107	111	106	105	105	114	114	110	114	+7	3.3
Sudan	108	109	109	122	122	121	124	125	127	128	129	125	+17	9.6
Kazakhstan	109	111	107	110	113	112	111	113	113	116	111	112	+3	3.0
Fiji	110	107	106	104	102	100	96	100	101	103	103	103	-7	0.5
Bangladesh	111	110	110	108	107	108	107	108	105	105	104	104	-7	1.0
Nigeria	112	112	111	109	109	102	99	101	100	98	98	98	-14	-0.5
Namibia	113	113	114	113	112	113	112	114	115	109	114	118	+5	3.6
Belarus	114	114	113	114	120	123	116	116	117	118	118	115	+1	2.8
Algeria	115	115	112	111	110	110	108	110	108	104	102	108	-7	0.7
Madagascar	116	116	115	116	97	96	97	112	111	111	95	97	-19	-2.0
Mali	117	118	117	112	115	116	113	117	118	115	113	113	-4	1.1
Ghana	118	119	124	121	119	120	121	120	112	110	108	111	-7	0.6
Pakistan	119	117	116	115	114	111	110	111	109	106	107	110	-9	0.6
Sri Lanka	120	120	118	117	116	117	119	98	97	95	94	95	-25	-4.3
Republic of Congo	121	121	119	119	118	122	122	122	121	121	119	120	-1	1.9
Malawi	122	122	121	120	121	119	120	126	125	125	124	123	+1	2.3
Ethiopia	123	123	123	123	123	118	118	119	120	120	121	122	-1	1.1
Tanzania	124	124	122	118	117	115	114	115	116	119	120	116	-8	-1.1
Cote d'Ivoire	125	125	126	125	125	125	123	121	122	122	122	121	-4	0.3

(Continued)

	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	Change in place	Change in index %
Nepal	126	126	125	124	124	124	128	123	123	123	123	129	*+3*	*84.7*
Burundi	127	127	127	126	126	126	126	124	124	124	125	124	*-3*	*0.9*
Gabon	128	128	128	127	127	127	126	127	126	126	126	127	*-1*	*2.8*
Central African Republic	129	129	129	129	129	129	129	129	129	129	128	128	*-1*	*0.7*

Note: Those in bold black type refer to G20 members. Unless otherwise specified, the following shall be the same.

II. World Openness Index

A.2   **World Openness Index, 2008-2019**

(Sorted by 2019 reading)

		2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008
	World	**0.7480**	**0.7462**	**0.7492**	**0.7494**	**0.7591**	**0.7655**	**0.7658**	**0.7621**	**0.7692**	**0.7711**	**0.7712**	**0.7790**
1	Singapore	0.8646	0.8630	0.8536	0.8501	0.8557	0.8587	0.8571	0.8546	0.8499	0.8411	0.8357	0.8438
2	**Germany**	**0.8552**	**0.8508**	**0.8394**	**0.8352**	**0.8350**	**0.8365**	**0.8350**	**0.8259**	**0.8297**	**0.8251**	**0.8236**	**0.8243**
3	Hong Kong, SAR	0.8503	0.8580	0.8467	0.8471	0.8494	0.8579	0.8542	0.8486	0.8475	0.8392	0.8212	0.8221
4	Ireland	0.8371	0.8249	0.8266	0.8276	0.8272	0.8196	0.8054	0.7978	0.7946	0.7879	0.7842	0.7802
5	**United Kingdom**	**0.8171**	**0.8080**	**0.8147**	**0.8026**	**0.8054**	**0.8036**	**0.8055**	**0.8063**	**0.8036**	**0.8035**	**0.7997**	**0.7998**
6	Switzerland	0.8133	0.8173	0.8100	0.8111	0.8071	0.8047	0.8078	0.8084	0.8021	0.7909	0.7845	0.7814
7	Netherlands	0.7997	0.7865	0.7916	0.7939	0.8072	0.7920	0.8000	0.7870	0.7947	0.7801	0.7844	0.7856
8	**France**	**0.7986**	**0.7985**	**0.7904**	**0.7877**	**0.7862**	**0.7872**	**0.7864**	**0.7837**	**0.7833**	**0.7797**	**0.7806**	**0.7848**
9	**Canada**	**0.7953**	**0.7867**	**0.7878**	**0.7848**	**0.7846**	**0.7896**	**0.7888**	**0.7864**	**0.7876**	**0.7806**	**0.7791**	**0.7874**
10	Malta	0.7838	0.7809	0.7748	0.7751	0.7731	0.7849	0.7738	0.7745	0.7797	0.7951	0.7915	0.7921
11	**Italy**	**0.7814**	**0.7805**	**0.7754**	**0.7725**	**0.7729**	**0.7734**	**0.7728**	**0.7674**	**0.7716**	**0.7687**	**0.7651**	**0.7618**
12	Belgium	0.7777	0.7765	0.7706	0.7711	0.7679	0.7701	0.7704	0.7652	0.7701	0.7612	0.7571	0.7618
13	Israel	0.7772	0.7746	0.7672	0.7654	0.7646	0.7662	0.7654	0.7653	0.7667	0.7595	0.7567	0.7575
14	Korea	**0.7718**	**0.7695**	**0.7630**	**0.7577**	**0.7549**	**0.7572**	**0.7406**	**0.7279**	**0.7220**	**0.7080**	**0.6973**	**0.6928**
15	Cyprus	0.7696	0.7681	0.7527	0.7418	0.7420	0.7399	0.7065	0.7216	0.7544	0.7488	0.7517	0.7481
16	**Australia**	**0.7681**	**0.7722**	**0.7855**	**0.7761**	**0.7685**	**0.7643**	**0.7567**	**0.7500**	**0.7491**	**0.7432**	**0.7410**	**0.7397**
17	Sweden	0.7674	0.7643	0.7583	0.7571	0.7565	0.7580	0.7550	0.7513	0.7557	0.7492	0.7482	0.7453
18	Spain	0.7669	0.7668	0.7611	0.7585	0.7577	0.7569	0.7546	0.7494	0.7534	0.7478	0.7453	0.7466
19	Czech Republic	0.7668	0.7661	0.7591	0.7575	0.7562	0.7543	0.7501	0.7491	0.7485	0.7410	0.7357	0.7367

(Continued)

		2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008
20	Luxembourg	0.7667	0.7503	0.7925	0.7675	0.8289	0.8013	0.7856	0.7868	0.7427	0.7411	0.7603	0.7115
21	**Japan**	**0.7666**	**0.7593**	**0.7554**	**0.7533**	**0.7647**	**0.7677**	**0.7643**	**0.7631**	**0.7750**	**0.7713**	**0.7689**	**0.7782**
22	**United States**	**0.7666**	**0.7653**	**0.7904**	**0.7985**	**0.8370**	**0.8607**	**0.8681**	**0.8628**	**0.8875**	**0.9084**	**0.9145**	**0.9328**
23	Austria	0.7664	0.7644	0.7582	0.7561	0.7548	0.7561	0.7552	0.7505	0.7545	0.7464	0.7453	0.7459
24	Denmark	0.7662	0.7634	0.7563	0.7566	0.7547	0.7546	0.7536	0.7501	0.7511	0.7447	0.7426	0.7424
25	Hungary	0.7632	0.7597	0.7537	0.7574	0.7530	0.7521	0.7479	0.7443	0.7457	0.7366	0.7323	0.7374
26	Norway	0.7632	0.7635	0.7585	0.7582	0.7579	0.7567	0.7581	0.7564	0.7597	0.7547	0.7600	0.7666
27	Estonia	0.7628	0.7621	0.7528	0.7498	0.7499	0.7487	0.7546	0.7472	0.7472	0.7360	0.7312	0.7296
28	new Zealand	0.7622	0.7624	0.7568	0.7538	0.7537	0.7518	0.7484	0.7470	0.7464	0.7381	0.7684	0.7656
29	Latvia	0.7610	0.7595	0.7493	0.7502	0.7440	0.7427	0.7390	0.7375	0.7384	0.7287	0.7217	0.7220
30	Costa Rica	0.7595	0.7589	0.7458	0.7445	0.7413	0.6963	0.7217	0.7167	0.7186	0.6862	0.6852	0.6868
31	Lithuania	0.7568	0.7568	0.7475	0.7383	0.7220	0.7172	0.7131	0.7095	0.7171	0.7116	0.7134	0.7202
32	Finland	0.7523	0.7501	0.7442	0.7441	0.7421	0.7427	0.7434	0.7398	0.7401	0.7350	0.7322	0.7321
33	Portugal	0.7495	0.7485	0.7411	0.7400	0.7382	0.7383	0.7373	0.7325	0.7367	0.7296	0.7285	0.7286
34	Uruguay	0.7488	0.7454	0.7365	0.7358	0.7355	0.7351	0.7345	0.7325	0.7308	0.7246	0.7252	0.7274
35	Chile	0.7485	0.7491	0.7404	0.7351	0.7359	0.7342	0.7307	0.7320	0.7413	0.7371	0.7450	0.7535
36	Nicaragua	0.7459	0.7455	0.7380	0.7377	0.7365	0.7225	0.7218	0.7199	0.7216	0.7163	0.7128	0.7122
37	Macao, SAR	0.7456	0.7428	0.7322	0.7243	0.7250	0.7251	0.7192	0.7102	0.7180	0.7078	0.7042	0.7038
38	Panama	0.7427	0.7440	0.7417	0.7389	0.7426	0.7362	0.7274	0.7273	0.7313	0.7230	0.7196	0.7237
39	Peru	0.7423	0.7456	0.7394	0.7250	0.7251	0.7113	0.7125	0.7104	0.7070	0.6842	0.6829	0.6826
40	**China**	**0.7420**	**0.7392**	**0.7349**	**0.7299**	**0.7268**	**0.7248**	**0.7188**	**0.7107**	**0.7028**	**0.6883**	**0.6747**	**0.6768**
41	Bahrain	0.7417	0.7431	0.7364	0.7376	0.7356	0.7368	0.7389	0.7347	0.7230	0.7226	0.7169	0.7123
42	Slovakia	0.7413	0.7397	0.7328	0.7315	0.7288	0.7266	0.7246	0.7228	0.7238	0.7151	0.7128	0.7071
43	Poland	0.7380	0.7376	0.7298	0.7282	0.7255	0.6965	0.6973	0.6941	0.6957	0.6906	0.6856	0.6876
44	Georgia	0.7373	0.7345	0.7131	0.7107	0.6987	0.6984	0.6971	0.6797	0.6249	0.6187	0.6428	0.6610
45	Trinidad and Tobago	0.7368	0.7375	0.7312	0.7469	0.7441	0.7307	0.7310	0.7315	0.7285	0.7155	0.7024	0.6964
46	Guatemala	0.7357	0.7387	0.7294	0.7284	0.7272	0.7129	0.7127	0.7100	0.7119	0.7077	0.7060	0.7073
47	Oman	0.7356	0.7330	0.7294	0.7277	0.7272	0.7224	0.7231	0.7156	0.7151	0.6989	0.6957	0.6923
48	Malaysia	0.7336	0.7361	0.7277	0.7261	0.7260	0.7289	0.6995	0.6944	0.6947	0.6906	0.7124	0.7422
49	Greece	0.7300	0.7275	0.7163	0.7139	0.7116	0.7372	0.7351	0.7328	0.7328	0.7249	0.7234	0.7243
50	Iceland	0.7296	0.7320	0.7241	0.6953	0.6614	0.6650	0.6675	0.6622	0.6671	0.6567	0.6540	0.6547
51	Bulgaria	0.7261	0.7252	0.7433	0.7397	0.7375	0.7379	0.7333	0.7301	0.7321	0.7252	0.7219	0.7232
52	Croatia	0.7257	0.7246	0.7150	0.7118	0.7081	0.7057	0.6991	0.6940	0.6942	0.6903	0.6922	0.6923

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		2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008
53	Cambodia	0.7248	0.7280	0.7223	0.7236	0.7242	0.6981	0.6934	0.6888	0.6813	0.6742	0.6598	0.6563
54	**Mexico**	**0.7222**	**0.7242**	**0.7192**	**0.7161**	**0.7123**	**0.7128**	**0.7117**	**0.7106**	**0.7130**	**0.7075**	**0.7103**	**0.7114**
55	Slovenia	0.7219	0.7211	0.7131	0.7115	0.7090	0.7057	0.7023	0.6997	0.7083	0.7070	0.7095	0.7162
56	Antigua and Barbuda	0.7204	0.7212	0.7177	0.7191	0.7172	0.7150	0.7030	0.7021	0.7058	0.6937	0.6714	0.6659
57	Jordan	0.7197	0.7217	0.7197	0.7234	0.7221	0.7260	0.7238	0.7235	0.7249	0.7228	0.7234	0.7273
58	Mauritius	0.7137	0.7141	0.7216	0.7161	0.7177	0.7153	0.7041	0.7117	0.7276	0.7232	0.7136	0.7092
59	Salvador	0.7119	0.7137	0.7045	0.7023	0.7007	0.6856	0.6854	0.6900	0.6958	0.6967	0.7017	0.7101
60	Kuwait	0.7039	0.7050	0.6974	0.6943	0.6892	0.6853	0.6828	0.6742	0.6738	0.6758	0.6718	0.6658
61	Botswana	0.7012	0.7029	0.6888	0.6981	0.6944	0.6932	0.6808	0.6949	0.7003	0.7010	0.6905	0.6853
62	Guyana	0.7000	0.7030	0.6941	0.7224	0.7195	0.7160	0.7169	0.7169	0.7157	0.7036	0.6858	0.6915
63	Romania	0.6980	0.6959	0.6878	0.6859	0.6827	0.6815	0.6769	0.6743	0.6766	0.6713	0.6647	0.6614
64	**Russia**	**0.6947**	**0.6953**	**0.7016**	**0.7069**	**0.7153**	**0.7223**	**0.7241**	**0.7113**	**0.7004**	**0.6898**	**0.6735**	**0.6678**
65	Colombia	0.6940	0.6946	0.6790	0.6732	0.6574	0.6392	0.6227	0.6189	0.6153	0.6127	0.6109	0.6379
66	**Argentina**	**0.6880**	**0.6787**	**0.6643**	**0.6590**	**0.6432**	**0.6442**	**0.6424**	**0.6382**	**0.6650**	**0.6599**	**0.6582**	**0.6578**
67	Ecuador	0.6873	0.6891	0.6852	0.6821	0.6838	0.6444	0.6445	0.6489	0.6545	0.6820	0.6860	0.6920
68	**Saudi Arabia**	**0.6818**	**0.6827**	**0.6811**	**0.6823**	**0.6843**	**0.6728**	**0.6797**	**0.6766**	**0.6767**	**0.6773**	**0.6704**	**0.6715**
69	Mongolia	0.6813	0.6797	0.6705	0.6706	0.6680	0.6693	0.6717	0.6724	0.6615	0.6501	0.6462	0.6573
70	Zambia	0.6798	0.6799	0.6750	0.6775	0.6735	0.6806	0.6820	0.6852	0.6850	0.6805	0.6728	0.6687
71	Dominica	0.6796	0.6810	0.6693	0.6599	0.6631	0.6714	0.6720	0.6774	0.6843	0.6861	0.6644	0.6631
72	Paraguay	0.6746	0.6736	0.6658	0.6652	0.6641	0.6637	0.6650	0.6637	0.6719	0.6739	0.6759	0.6800
73	Uganda	0.6719	0.6714	0.6661	0.6638	0.6664	0.6711	0.6692	0.6695	0.6688	0.6661	0.6618	0.6650
74	Barbados	0.6708	0.6731	0.6643	0.6658	0.6624	0.6544	0.6540	0.6559	0.6567	0.6414	0.6230	0.6153
75	Vietnam	0.6704	0.6700	0.6659	0.6616	0.6583	0.6560	0.6530	0.6511	0.6483	0.6457	0.6392	0.6414
76	**Indonesia**	**0.6668**	**0.6696**	**0.6571**	**0.6592**	**0.6587**	**0.6614**	**0.6586**	**0.6585**	**0.6523**	**0.6765**	**0.6673**	**0.6681**
77	North Macedonia	0.6666	0.6669	0.6646	0.6638	0.6652	0.6637	0.6607	0.6644	0.6657	0.6631	0.6657	0.6653
78	Honduras	0.6634	0.6672	0.6584	0.6560	0.6544	0.6382	0.6361	0.6344	0.6366	0.6304	0.6551	0.6913
79	Armenia	0.6631	0.6637	0.6614	0.6573	0.6707	0.6734	0.6746	0.6728	0.6755	0.6731	0.6720	0.6681
80	Philippine	0.6630	0.6645	0.6631	0.6611	0.6621	0.6642	0.6322	0.6357	0.6286	0.6286	0.6464	0.6461
81	Albania	0.6624	0.6630	0.6595	0.6564	0.6553	0.6533	0.6542	0.6632	0.6667	0.6432	0.6150	0.6140
82	Papua New Guinea	0.6583	0.6607	0.6453	0.6449	0.6727	0.6756	0.6806	0.6776	0.6784	0.6633	0.6529	0.6437
83	Thailand	0.6546	0.6565	0.6524	0.6499	0.6491	0.6508	0.6463	0.6486	0.6401	0.6247	0.6295	0.6552
84	**India**	**0.6524**	**0.6537**	**0.6450**	**0.6452**	**0.6476**	**0.6499**	**0.6507**	**0.6435**	**0.6429**	**0.6370**	**0.6308**	**0.6256**
85	Gambia	0.6518	0.6523	0.6515	0.6511	0.6548	0.6577	0.6543	0.6564	0.6555	0.6546	0.6530	0.6497
86	Ukraine	0.6491	0.6528	0.6287	0.6269	0.6180	0.6159	0.6139	0.6144	0.6110	0.6068	0.6014	0.6156

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		2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008
87	Jamaica	0.6483	0.6493	0.6506	0.6755	0.6790	0.6791	0.6792	0.6782	0.6828	0.6801	0.6812	0.6936
88	Morocco	0.6471	0.6470	0.6445	0.6414	0.6375	0.6348	0.6335	0.6374	0.6336	0.6323	0.6340	0.6325
89	Kyrgyz	0.6430	0.6439	0.6386	0.6392	0.6122	0.6174	0.6166	0.6243	0.6684	0.6670	0.6640	0.6662
90	**South Africa**	**0.6422**	**0.6458**	**0.6337**	**0.6329**	**0.6318**	**0.6339**	**0.6333**	**0.6323**	**0.6319**	**0.6280**	**0.6356**	**0.6401**
91	**Turkey**	**0.6420**	**0.6415**	**0.6658**	**0.6646**	**0.6658**	**0.6649**	**0.6628**	**0.6606**	**0.6596**	**0.6561**	**0.6525**	**0.6498**
92	Egypt	0.6410	0.6448	0.6441	0.6179	0.6189	0.6201	0.6202	0.6542	0.6854	0.6918	0.6993	0.7084
93	Lebanon	0.6400	0.6422	0.6389	0.6417	0.6413	0.6723	0.6723	0.6684	0.6713	0.6724	0.6724	0.6729
94	Moldova	0.6385	0.6403	0.6337	0.6363	0.6267	0.6260	0.6022	0.6013	0.5997	0.5982	0.5990	0.6051
95	Belize	0.6382	0.6394	0.6361	0.6369	0.6367	0.6311	0.6292	0.6292	0.6292	0.6169	0.6042	0.6070
96	Kenya	0.6358	0.6352	0.6364	0.6361	0.6386	0.6427	0.6452	0.6461	0.6490	0.6494	0.6491	0.6465
97	Bolivia	0.6355	0.6361	0.6336	0.6398	0.6418	0.6526	0.6513	0.6495	0.6477	0.6485	0.6564	0.6642
98	Lesotho	0.6329	0.6344	0.6220	0.6200	0.6148	0.6165	0.6176	0.6139	0.6123	0.6160	0.6095	0.6064
99	**Brazil**	**0.6284**	**0.6348**	**0.6303**	**0.6325**	**0.6348**	**0.6632**	**0.6660**	**0.6604**	**0.6635**	**0.6659**	**0.6680**	**0.6704**
100	Tunisia	0.6283	0.6271	0.6267	0.6238	0.6285	0.6311	0.6329	0.6266	0.6271	0.6286	0.6221	0.6252
101	Samoa	0.6258	0.6253	0.6176	0.6172	0.6152	0.6115	0.6099	0.6086	0.6098	0.6073	0.6042	0.6024
102	Laos	0.6246	0.6264	0.6228	0.6213	0.6216	0.6225	0.6175	0.6185	0.6065	0.6021	0.5927	0.5907
103	Azerbaijan	0.6245	0.6249	0.6276	0.6290	0.6236	0.6215	0.6193	0.6193	0.6127	0.6021	0.5939	0.6142
104	Cape Verde	0.6215	0.6225	0.5899	0.5569	0.5560	0.5577	0.5568	0.5585	0.5599	0.5579	0.5559	0.5564
105	Zimbabwe	0.6214	0.6203	0.6185	0.6186	0.6263	0.6039	0.5981	0.6233	0.6333	0.6243	0.5943	0.5923
106	Bosnia and Herzegovina	0.6180	0.6293	0.6219	0.6194	0.6236	0.6271	0.6509	0.6583	0.6727	0.6517	0.6355	0.6525
107	Mozambique	0.6170	0.6218	0.6144	0.6163	0.6100	0.6161	0.6154	0.6147	0.6035	0.6005	0.5994	0.5975
108	Sudan	0.6166	0.6168	0.6134	0.5856	0.5831	0.5856	0.5801	0.5722	0.5634	0.5555	0.5474	0.5629
109	Kazakhstan	0.6163	0.6159	0.6144	0.6109	0.6054	0.6068	0.6051	0.6053	0.6038	0.5989	0.5994	0.5982
110	Fiji	0.6160	0.6213	0.6149	0.6183	0.6198	0.6218	0.6242	0.6230	0.6198	0.6124	0.6091	0.6126
111	Bangladesh	0.6155	0.6167	0.6128	0.6115	0.6138	0.6139	0.6113	0.6088	0.6122	0.6098	0.6081	0.6097
112	Nigeria	0.6144	0.6150	0.6118	0.6112	0.6116	0.6206	0.6205	0.6198	0.6204	0.6220	0.6200	0.6172
113	Namibia	0.6129	0.6148	0.6065	0.6046	0.6061	0.6067	0.6039	0.6033	0.6025	0.6042	0.5945	0.5917
114	Belarus	0.6095	0.6117	0.6067	0.6043	0.5848	0.5839	0.5999	0.6027	0.6013	0.5964	0.5919	0.5932
115	Algeria	0.6074	0.6075	0.6079	0.6107	0.6106	0.6094	0.6105	0.6083	0.6094	0.6119	0.6091	0.6033
116	Madagascar	0.6058	0.6056	0.6051	0.6028	0.6264	0.6297	0.6230	0.6058	0.6060	0.6022	0.6237	0.6184
117	Ghana	0.6045	0.6017	0.5829	0.5879	0.5873	0.5858	0.5847	0.5898	0.6052	0.6032	0.6021	0.6008
118	Mali	0.6045	0.6040	0.6012	0.6048	0.6032	0.6037	0.6038	0.6013	0.5997	0.5993	0.5960	0.5981
119	Pakistan	0.6042	0.6052	0.6040	0.6032	0.6040	0.6070	0.6062	0.6073	0.6067	0.6076	0.6039	0.6009
120	Sri Lanka	0.5983	0.5980	0.5988	0.5997	0.6007	0.5967	0.5933	0.6241	0.6275	0.6258	0.6238	0.6254

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		2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008
121	Republic of Congo)	0.5961	0.5947	0.5960	0.5933	0.5944	0.5854	0.5827	0.5815	0.5850	0.5884	0.5918	0.5848
122	Malawi	0.5909	0.5917	0.5898	0.5890	0.5848	0.5892	0.5885	0.5676	0.5668	0.5666	0.5646	0.5777
123	Ethiopia	0.5885	0.5894	0.5851	0.5848	0.5821	0.5917	0.5946	0.5904	0.5921	0.5907	0.5850	0.5822
124	Tanzania	0.5867	0.5869	0.5857	0.5987	0.5965	0.6038	0.6029	0.6031	0.6016	0.5942	0.5914	0.5930
125	Cote d'Ivoire	0.5843	0.5828	0.5735	0.5754	0.5749	0.5793	0.5804	0.5819	0.5797	0.5817	0.5812	0.5823
126	Nepal	0.5785	0.5813	0.5784	0.5793	0.5789	0.5810	0.5661	0.5755	0.5721	0.5743	0.5739	0.3132
127	Burundi	0.5723	0.5720	0.5710	0.5697	0.5690	0.5716	0.5729	0.5728	0.5699	0.5686	0.5640	0.5671
128	Gabon	0.5709	0.5705	0.5676	0.5679	0.5679	0.5676	0.5692	0.5659	0.5641	0.5617	0.5602	0.5555
129	Central African Republic	0.5508	0.5500	0.5488	0.5513	0.5491	0.5504	0.5519	0.5489	0.5494	0.5518	0.5495	0.5470

III. Theoretical Models of One Economy Opening-up to the Outside World

Based on the summary of various frontier mainstream cross-border trade models by Costinot & Rodríguez-Clare (2014) [①], p_{ij} as price of the product of economy i in economy j can be expressed as:

$$p_{ij} = \tau_{ij} c_i^p \times \left(\left(\frac{E_j}{c_{ij}^x} \right)^{\frac{\delta}{1-\sigma}} \frac{\tau_{ij} c_i^p}{P_j} \right)^{\eta} \times \left(\frac{R_i}{c_i^e} \right)^{\frac{\delta}{1-\sigma}} \times \zeta_{ij}$$

In the equation, τ_{ij} is the bilateral variable trade cost of economy i and j. c_i^p, c_{ij}^x, and c_i^e represent impact of input prices on production costs, export costs, and market entry costs, respectively. E_j is the total expenditure of economy j and R_i is the total income of economy i. P_j is the price index of j, that is, $P_j = (\sum_\omega p_j(\omega)^{1-\sigma} d\omega)^{1/(1-\sigma)}$, with σ being the substitution elasticity of the CES utility function. δ takes different values in accordance with the setting of the market structure as follows. It takes 1 when the market structure is monopolistic competition, and 0 when the market structure is fully competitive. η represents the degree of product difference, and 0 is taken when there is no business heterogeneity. ζ_{ij} is a function of structural parameters that do not include variable trade

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① Costinot. A. & Rodríguez-Clare, A. (2014). Trade theory with numbers: Quantifying the consequences of globalization. *Handbook of international economics,* Elsevier, 4, 197-261.

costs. In this model, $\zeta_{ij} = (\frac{\tilde{\sigma}}{\eta\sigma})^{1/(1-\sigma)}(\frac{\sigma f_{ij}}{\tilde{\sigma}})^{\eta/(\sigma-1)}(f_i^e)^{1/(\sigma-1)} = \zeta_{ij}(f_{ij}, f_i^e)$, where $\tilde{\sigma} = (\frac{\sigma}{\sigma-1})^{1-\sigma}$, and f_{ij} is the fixed cost of economy i entering economy j, while f_i^e is the entry cost of economy i. Therefore, $\zeta_{ij}(f_{ij}, f_i^e)$ is and increasing function of f_{ij} and f_i^e.

Some variables in the above model are not directly related to cross-border openness, such as the economy's total expenditure E_j, total income R_i, or price index P_j. Although they are important, they are not the focus of this report. Here we focus on variables directly related to cross-border openness. In order to measure cross-border openness in multiple fields, this report makes the following assumptions based on these variables.

1. Trade openness

The fallouts of trade policies, such as tariff rates and non-tariff measures, can be reflected in the bilateral trade cost τ_{ij}. Trade openness not only includes the opening-up of final products, but also the opening-up of intermediate products; the latter affects cross-border trade, but they also obviously promote the economic development of trading partners. For this reason, this article assumes that production includes trade in intermediate goods, and all output can become end-use goods and intermediate inputs. The end-use products and intermediate inputs of an economy can be domestic products or overseas products, and the trade cost of overseas products is unified as t. Studies, such as Costinot & Rodríguez-Clare (2014) and Caliendo & Parro (2015)[①], can serve as a reference and the production cost $c_{i,s}^p$ of industry s can be expressed in the form of Cobb-Douglas function:

$$c_{i,s}^p = Y_i^{1-\alpha_{is}} \prod_{k=1}^{S} P_{i,k}^{\alpha_{iks}} = Y_i^{1-\alpha_{is}} \prod_D P_{i,k}^{\alpha_{iks}} \prod_F (t_i P_{ik})^{\alpha_{iks}} = c_{i,s}^p(t_{ij})$$

In the equation, Y_i is the total income of economy I. a_{is} and a_{iks} are the parameters of the production function, satisfying $\alpha_{is} = \sum_{k=1}^{S} \alpha_{iks}$. t_i is the variable trade cost of intermediate product imports, and P_{ik} is price index of industry k. The intermediate goods input can be divided into domestic part and foreign part, belonging to Set D and Set F, respectively. Therefore, $c_{i,s}^p(t_i)$ is an increasing function of t_i, which is the level of openness of intermediate goods trade. In addition, if we assume that the costs of

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① Caliendo., L. & Parro, F. (2015). Estimates of the Trade and Welfare Effects of NAFTA. *The Review of Economic Studies*, 82(1), 1-44.

production, export, and entry into use are homogeneous, and, at the same time, $c_{i,s}^x$ and $c_{i,s}^e$ do not use intermediate products, then it has nothing to do with t_{ij}. τ_{ij} is the trade cost incurred when economy i exports to economy j, and it is highly influenced by the trade policy of host economy j. t_i is the trade cost of economy i using overseas intermediate goods, which is significantly influenced by economy i's own trade policy.

2. Investment Openness

Investment openness can be divided into two categories; one is openness to foreign investment and the other is openness to outbound investment. The introduction of foreign capital can not only ease funding shortage, but also raise the productivity of enterprises in the host economy through the competition effect and the spillover effect of technology and management expertise. The role of outbound investment also mainly lies in full utilization of overseas resources to enhance international competitiveness. Therefore, the level of investment openness mainly affects technical parameters. If the investment openness parameter is *fdi*, then $A_i=A_i(dif, fdi)$, which is an increasing function of fdi.

3. Financial Openness

The financing constraints caused by the dysfunctional financial system are a serious restrictive factor for the production and international operation of enterprises. Financial opening-up can reduce the financing costs of export and outbound investment of enterprises, and can significantly boost those internationalization activities that require huge fixed costs. Both theoretical models (such as Muûls 2008[1]) and empirical studies (such as Yu et al. 2011) emphasize the impact of the financial system on the fixed costs of export by enterprises. Therefore, this report sets the financial openness index fin as a factor that affects the fixed cost of export by enterprises, and the export cost $f_{ij}(fin)$ is a decreasing function of *fin*.

4. Technology openness

In previous chapters, wages are standardized as 1. Here the concept of effective production cost is introduced in this report; let $\widetilde{c_{i,s}^p} = \frac{c_{i,s}^p}{A_i}$, where $\widetilde{c_{i,s}^p}$ is the effective

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[1] Muûls, M. (2008). Exporters and credit constraints: A firm-level approach. *NBB Working Paper* No. 139.

production cost, and A_i is a technical parameter, which involves the concept of total factor productivity. The openness of knowledge and technology can enable a country to use the world's advanced technology. It is especially important for latecomer countries, represented by China. If we let the parameter of the technology diffusion level be dif, then $A_i(dif)$ is an increasing function of the technology diffusion parameter *dif*.

5.Institutional Openness

Different from the openness of commodity factor flows, institutional openness is committed to removing institutional barriers to international economic and trade exchanges, creating a favorable business environment, and improving institutional quality (Antràs & Yeaple, 2014[1]). The impact of institutional quality on the production and operation of enterprises has been explained in two theoretical frameworks, namely, the contract theory and the property theory, in institutional economics. When they are introduced into the basic model of international trade, those two theoretical frameworks can both be treated as a variable of institutional cost to become part of the variable cost of corporate decision-making (Antràs & Yeaple, 2014). Therefore, this report introduces institutional cost Γ_i, which is a structural variable that is composed of a series of parameters that measure the level of contract perfection and strength of property rights protection, and constitutes the variable cost of corporate production in the form of a denominator, that is, $\frac{1}{\Gamma_i}$.

Based on the above 5 assumptions, the price of goods in cross-border trade can ultimately be expressed as:

$$p_{ij} = \tau_{ij} \frac{c_i^p(t_i)}{A_i(dif,\ fdi)} \times \left(\left(\frac{E_j}{c_{ij}^x}\right)^{\frac{\delta}{1-\sigma}} \frac{\tau_{ij} \frac{c_i^p(t_i)}{A_i(dif,\ fdi)}}{P_j} \right)^{\eta} \times \left(\frac{R_i}{c_i^e}\right)^{\frac{\delta}{1-\sigma}} \times \zeta_{ij}\left(f_{ij}(fin), f_i^e\right) \times \frac{1}{\Gamma_i}$$

The formula takes the logarithm and fully differentiates the key variables to obtain the following formula:

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① Antràs, P. & Yeaple, S. (2014). Multinational firms and the structure of international trade. *Handbook of international economics,* Elsevier, 4, 55-130.

$$dlnp_{ij} = \frac{1}{\tau_{ij}}d\tau_{ij} + \frac{1+\eta}{c_i^p(t_i)}\frac{\partial c_i^p(t_i)}{\partial t_i}dt_i - \frac{1+\eta}{A_i(dif, fdi)}\frac{\partial A_i(dif, fdi)}{\partial dif}ddif$$

$$- \frac{1+\eta}{A_i(dif, fdi)}\frac{\partial A_i(dif, fdi)}{\partial fdi}dfdi + \frac{\frac{\partial \zeta_{ij}(f_{ij}(fin),f_i^e)}{\partial f_{ij}(fin)} \times \frac{\partial f_{ij}(fin)}{\partial fin}}{\zeta_{ij}(f_{ij}(fin),f_i^e)}dfin - \frac{1}{\Gamma_i}d\Gamma_i$$

Among them, $\frac{1}{\tau_{ij}}d\tau_{ij}$ is the impact of openness of final product trade; $\frac{1+\eta}{c_i^p(t_i)}\frac{\partial c_i^p(t_i)}{\partial t_i}dt_i$ is the impact of openness of intermediate product trade; $\frac{1+\eta}{A_i(dif, fdi)}\frac{\partial A_i(dif, fdi)}{\partial dif}dfdi$ is the impact of openness of technology openness; $\frac{1+\eta}{A_i(dif, fdi)}\frac{\partial A_i(dif, fdi)}{\partial fdi}dfdi$ is the impact of openness of investment; $\frac{\frac{\partial \zeta_{ij}(f_{ij}(fin),f_i^e)}{\partial f_{ij}(fin)} \times \frac{\partial f_{ij}(fin)}{\partial fin}}{\zeta_{ij}(f_{ij}(fin),f_i^e)}dfin$ is the impact of financial openness; and $\frac{1}{\Gamma_i}d\Gamma_i$ is the impact of institutional quality and openness.

IV. Treatment of Missing Values of Indicators

1. For a country that has a value for only one year in the entire sample period, this value is used for all years.

2. For a country that has a value for two or more uninterrupted years throughout the sample period, the data of other years shall be made complete in accordance with the principle of proximity. For example, when the country has a value for 2011 and 2012, then its value for the year before 2011 should be the same as that for 2011, and its value for the year after 2012 should also be the same as that for 2012.

3. For a country that has values for more than one year in the entire sample period, and there are discontinuities, the values between the two discontinuous years are also taken according to the principle of proximity. For example, when it has only values for 2011 and 2014, then its value for 2012 should be taken as that for 2011, while that for 2013 should be the same as that for 2014. When a country lacks a value for an odd number of years, then its value for the year in the middle should be the average of the two values for the years at the two ends. For example, when there are only values for the year 2011 and 2015, the value for 2011 should be the same as that for 2012; and the value for in 2014 should be the same as that for 2015; the value for 2013 (in the middle of the 2011-2015 period), however, should be the average of the values for 2011 and 2015.

4. For a country that has no value during the entire sample period, based on its economic development, social and cultural conditions, institutional characteristics, and

geographical features, countries that are most similar to it should be picked so that the value of a similar country can be taken as its missing values.

V. Dimensionless Calculation of Indicators

1. Principles

Dimensionless treatment is a necessary step for basic index data processing. It should adhere to the following principles: design processing methods in according with economics principle of supply and demand.

Opening-up to the outside world is a two-way opening-up. First, it is inward opening-up. That is, economy A opens its market to other economies to meet A's own needs, which is reflected by economy A importing commodities, capital, technology, and personnel from other economies. Second, it is outward opening-up from other economies. That is, other economies open their economy to economy A to meet their own needs, which is reflected by economy A exporting goods, capital, technology, and personnel to other economies.

Such a principle is in essence to make the openness indicators dimensionless based on market supply and demand. First, if the value of Economy A on one certain inward opening-up indicator is an absolute one, it is divided by the total value of Economy A on the *corresponding categorial indicator* to which this indicator belongs. Second, if the value of the Economy A on one certain outward opening-up indicator is an absolute one, it is divided by the total value of the world minus that of Economy A on the *corresponding categorial indicator*. This report stipulates that the *corresponding categorial indicator* of economic openness indicators is GDP, and that of headcount-style openness indicators is total population. The rest can be deduced in the same vein.

2. Specific methods

(1) Outflows measured by value

Such an indicator system includes six indicators, including export of goods, export of services, overseas direct investment, outbound portfolio investment, intellectual property export, and cultural product export.

It is calculated as follows:

$$y_{it} = \frac{x_{it}}{\sum_{j \neq i} GDP_{jt}}$$

In the equation, y_{it} is the final value of the indicator of economy i in period t; x_{it} is the original value of the indicator, and $\sum_{j \neq i} GDP_{jt}$ is the total *GDP* of all the other economies in the world.

(2) Inflows measured by value

Such an indicator system includes six indicators, including import of goods, import of services, foreign direct investment, foreign portfolio investment, intellectual property import, and cultural product import.

It is calculated as follows:

$$y_{it} = \frac{x_{it}}{GDP_{it}}$$

In the equation, y_{it} is the final value of economy i's index in period t; x_{it} is the original value of the indicator; and GDP_{it} is the concerned economy's *GDP*.

(3) Outflows measured by headcount

Such an indicator system includes three indicators: outbound tourists, outbound students, and emigrants.

It is calculated as follows:

$$y_{it} = \frac{x_{it}}{\sum_{j \neq i} POP_{jt}}$$

In the equation, y_{it} is the final value of the indicator of economy i in period t; x_{it} is the original value of the indicator; and $\sum_{j \neq i} POP_{jt}$ is the total population of all the other economies in the world.

(4) Inflows measured by headcount

Such an indicator system includes three indicators: inbound tourists, inbound students, and immigrants.

It is calculated as follows:

$$y_{it} = \frac{x_{it}}{POP_{it}}$$

In the equation, y_{it} is the final value of the indicator of economy i in period t; x_{it} is the original value of the indicator; and POP_{it} is the population of economy i.

(5) Patent application

It includes two indicators: residents applying for patents abroad (*patex*) and non-residents applying for patents within the data reporting economy (*patim*).

patex is calculated as follows:

$$patex_{it} = \frac{abroad_{it}}{\sum_{j\neq i}(resi_{jt} + nonr_{jt})}$$

In the equation, $\mathbf{abroad_{it}}$ refers to the number of patent applications filed abroad in economy i in year t, $\sum_{j\neq i}(resi_{jt} + nonr_{jt})$ refers to the total number of patent applications in other countries except economy i ($resi_{jt}$ is the number of patent applications filed by residents in this economy; $nonr_{jt}$ is the number of patents applied by foreign residents in economy j).

The calculation formula for non-residents applying for patents (*patim*) in the data reporting economy is as follows:

$$patim_{it} = \frac{nonr_{it}}{resi_{it} + nonr_{it}}$$

In the equation, $nonr_{it}$ is the number of patents applied in the concerned country by nonresidents; $resi_{it}+nonr_{it}$ is the total number of patent applications in the concerned economy.

(6) International citations of science documents

It contains only one indicator (paper) and it is calculated by the following equation:

$$paper_{it} = \frac{Citations_{it} - Selfcitations_{it}}{\sum_j Documents_{jt}}$$

In the equation, $Citations_{it}$ is the total citations of science documents with the authors from economy i in year t; $Selfcitations_{it}$ is the citations of science documents written and cited by the authors from economy i; and $\sum_j Documents_{jt}$ is the total number of science documents written by authors from all the other economies.

(7) Outbound openness of concerned international trade and investment agreement(s)

There are two indicators based on free trade agreement and investment agreements, respectively.

The equation goes as follows:

$$T_{it} = \sum_p T_{ipt} \frac{GDP_{pt}}{\sum_{j\neq i} GDP_{jt}}$$

In the equation, T_{it} is the openness of the trade or investment agreement in economy i in year t; GDP_{pt} is the GDP of the contracting partner p, $\sum_{j\neq i} GDP_{jt}$ is the sum of GDP of all the other economies; T_{iPt} is a dummy variable and takes 1 when the agreement(s)

concerned is (are) effective for economy i as its member in year t; otherwise it takes 0.

(8) Inbound openness of concerned international trade and investment agreement(s)

There are two indicators based on free trade agreement and international investment agreement, respectively.

The equation goes as follows:

$$T_{it} = \frac{GDP_{it}}{\sum_p T_{ipt} \times GDP_{pt}}$$

In the equation, T_{it} is the openness index of the trade or investment agreements of economy i in year t; GDP_{it} is GDP of the concerned country; GDP_{Pt} is the GDP of the contracting partner p; T_{iPt} is a dummy variable, when the agreement between economy i and j is effective in year t, it would take 1, otherwise 0.

(9) Non-tariff trade barrier

The equation goes as follow:

$$X_{it} = ntb_{it} \times hs_{it}$$

In the equation, T_{it} refers to non-tariff barrier indicator of country i in year t; ntb_{it} refers to number of non-tariff measures; hs_{it} refers to quantity of concerned products.

(10) Indicators that do not require additional treatment

They include three indicators: weighted tariff rate, financial openness index, and passport convenience index.

In order to achieve the consistency of the standard index dimensions, the following treatments are carried out on each indicztor:

$$y_{it} = \frac{x_{it} - min(x)}{max(x) - min(x)}$$

In the equation, y_{it} is the post-centralization value of indicator x for economy I, x_{it} is the pre-centralization indicator, $max(x)$ is the maximum value of the x in the entire sample period, and $min(x)$ is the minimum value of indicator x in the entire sample period.

For some inverse indicators, such as weighted tariff rate and non-tariff measures, for which the larger the value, the lower the level of openness, the following calculation methods are adopted:

$$y_{it} = 1 - \frac{x_{it} - min(x)}{max(x) - min(x)}$$

This calculation method projects all indicators on [0,1].

VI. On the Results of Openness Measurement

1. The sample of 129 economies

This index covers 129 economies during the 2008-2018 period. It is determined by the availability of the following basic data for each indicator.

First, the original data sequence of each indicator in the indicator system is uneven. The data of some indicators began in 2008, so that the time sequence of the comprehensive index cannot be traced back to earlier years.

Second, from 2008 to 2018, not all indicators in all economies have complete original data. Even if the aforementioned treatment of missing data is applied, there are still some economies that cannot be included in the samples for the lack of necessary original data.

2. Property of the openness index reading

The openness index in this report is a result of calculation based on the aforementioned theories, methods and data, and has the following characteristics.

The index reading is between 0 and 1 (inclusive). The larger the index reading is, the higher the level of openness, and vice versa.

The index readings are comparable across time and space. The index readings of different economies in the same year, those of the same economy in different years, and those of different economies in different years are all comparable.

When the ranking dynamics of the openness of each economy, based on the index reading, is analyzed, it should be combined with the index reading to come to a scientific conclusion.

3. Interpretation of index reading

The time range of this index is limited to 2008-2019, which, very probably, may not be enough to match the observation, analysis and research of the long-term openness trend of economies.

Therefore, the openness trend conclusion based on the current time ranges of this index may be inconsistent with the inference of the openness theory based on the longer-term time ranges. Readers need to interpret it carefully, especially when they

extrapolate the conclusion based on this time range.

More importantly, when judgment is made regarding the appropriateness of openness through global rankings based on the openness index, it is necessary to carefully take into consideration such heterogeneous scenarios as economic, social, and cultural development theories, the development stages of each economy, and the choice of development paths. Openness, nonetheless, is only one of many factors that affect the development of human society, and it is natural that its development effects on different economies or during different time ranges may differ.

VII. Comparison between Openness Index and Other Indices

There are many well-known global indices that measure the performance of economies in many aspects. This report has selected the following highly representative index, which have attracted much attention and which are very authoritative, to make a comparison: KOF Globalization Index, Human Development Index (HDI), Ease of Doing Business, Global Competitiveness Index, Index of Economic Freedom, and Global Innovation Index. The specific situation is shown in the table below. The openness index is for 2018, and the rest of the index readings are for 2017.

The performance of the 129 economies in this list shows that very few economies are entirely close in their rankings of the seven major indexes. This at least illustrates the following characteristics. First, the themes measured by each index are different from each other, and there is not much overlapping. Second, those indices differ in the concepts, theories, methods, and data processing of their respective themes, which may lead to differences in the measurement results of the same economy at the same time on the same topic. Third, the performance of economies on those themes is not highly consistent. Few economies are "omnipotent" and perform well in all indices, just like the fact that few economies are totally incompetent or mediocre in all the indices; most economies only perform well or poorly on some of the themes.

A.3   A Comparison between World Openness Ranks and Other Six Major Ranks 2017

(Sorted by World Openness Index)

	World Openness Index, 2018	KOF Globalization Index	Human Development Index	Ease of Doing Business	Global Competitiveness Index	Index of Economic Freedom	Global Innovation Index
No. of economies	129	201	201	191	153	184	201
Singapore	1	19	9	37	3	89	6
Hong Kong, SAR	2	69	5	3	6	90	16
Germany	3	8	4	18	5	74	9
Ireland	4	17	3	16	24	77	10
Switzerland	5	1	2	173	1	82	1
United Kingdom	6	5	15	6	8	76	5
France	7	10	26	32	22	63	15
Canada	8	16	13	19	14	79	18
Netherlands	9	2	10	1	4	76	3
Malta	10	39	28	145	37	68	26
Italy	11	22	29	49	43	63	29
Belgium	12	3	17	45	19	68	27
Israel	13	41	22	39	16	70	16
Australia	14	25	5	15	21	81	23
Korea	15	34	22	5	26	74	11
Cyprus	16	35	31	47	63	68	30
Spain	17	12	25	101	34	64	28
Czech Republic	18	13	27	31	31	73	24
United States	19	23	15	10	2	75	4
Austria	20	7	20	22	18	72	19
Sweden	21	4	7	30	7	75	2
Norway	22	11	1	62	11	74	19
Denmark	23	6	11	4	12	75	6
New Zealand	24	38	14	130	13	84	21
Estonia	25	18	30	12	29	79	25
Hungary	26	14	44	53	59	66	39
Latvia	27	32	39	13	54	75	33
Japan	28	36	19	24	9	70	14
Costa Rica	29	53	68	63	47	65	52
Lithuania	30	29	34	59	41	76	40
Luxembourg	31	21	21	170	19	76	12
Finland	32	9	12	17	9	74	8
Chile	33	40	42	52	33	77	46
Portugal	34	15	40	57	42	63	31
Peru	35	60	84	104	72	69	70
Nicaragua	36	97	123	149	92	59	—
Uruguay	37	47	58	87	76	70	67

(Continued)

	World Openness Index, 2018	KOF Globalization Index	Human Development Index	Ease of Doing Business	Global Competitiveness Index	Index of Economic Freedom	Global Innovation Index
Panama	38	48	66	103	50	66	63
Bahrain	39	62	45	61	43	69	66
Macao, SAR	40	133	—	—	—	71	—
Slovakia	41	20	37	34	59	66	34
China	42	81	85	80	27	57	22
Guatemala	43	88	125	88	84	63	97
Poland	44	26	33	28	39	68	38
Trinidad and Tobago	45	79	63	69	83	61	91
Malaysia	46	27	61	139	23	74	37
Georgia	47	42	70	11	67	76	68
Oman	48	90	47	138	62	62	77
Iceland	49	54	7	21	28	74	13
Cambodia	50	103	142	136	94	60	101
Greece	51	24	31	66	87	55	44
Bulgaria	52	31	51	50	49	68	36
Croatia	53	28	46	48	73	59	41
Mexico	54	51	75	51	50	64	57
Jordan	55	46	98	116	63	67	83
Antigua and Barbuda	56	101	73	105	—	—	—
Slovenia	57	30	24	127	48	59	32
Mauritius	58	52	66	46	45	75	64
Salvador	59	73	122	86	109	64	103
Kuwait	60	57	57	100	52	65	56
Guyana	61	126	121	119	—	59	—
Botswana	62	113	97	68	63	70	88
Romania	63	33	51	36	67	70	42
Russia	64	49	49	35	38	57	44
Colombia	65	82	77	60	66	70	64
Ecuador	66	96	83	113	97	49	92
Saudi Arabia	67	78	36	146	30	64	55
Dominican Republic	68	74	91	112	103	63	79
Zambia	69	110	141	153	118	56	124
Mongolia	70	77	94	54	100	55	52
Argentina	71	70	48	115	92	50	76
Paraguay	72	89	98	64	112	62	85
Barbados	73	93	51	111	—	55	—
Uganda	74	128	157	70	114	61	101
Vietnam	75	84	116	123	55	52	47
Indonesia	76	87	110	79	36	62	87

(Continued)

	World Openness Index, 2018	KOF Globalization Index	Human Development Index	Ease of Doing Business	Global Competitiveness Index	Index of Economic Freedom	Global Innovation Index
Honduras	77	91	130	121	96	59	104
North Macedonia	78	—	—	8	—	—	—
Philippine	79	72	105	25	56	66	73
Armenia	80	66	80	55	73	70	59
Albania	81	71	69	82	75	64	93
Papua New Guinea	82	140	152	110	—	51	—
Thailand	83	50	76	131	32	58	50
India	84	95	127	120	39	53	60
Ukraine	85	43	87	27	81	48	50
Gambia	86	136	175	154	117	53	—
Jamaica	87	75	96	65	70	70	84
Morocco	88	59	119	140	71	62	72
South Africa	89	61	110	184	61	62	57
Egypt	90	76	115	124	100	53	105
Kyrgyz	91	85	120	91	100	61	95
Lebanon	92	67	93	128	105	53	81
Turkey	93	56	59	114	53	65	43
Moldova	94	64	105	67	89	58	54
Belize	95	106	102	125	—	59	—
Bolivia	96	105	113	147	—	48	106
Kenya	97	115	145	85	91	54	80
Brazil	98	100	77	126	78	53	69
Lesotho	99	153	161	109	130	54	—
Bosnia and Herzegovina	100	63	74	76	103	60	86
Tunisia	101	68	90	56	94	56	74
Laos	102	170	137	150	97	54	—
Samoa	103	137	109	89	—	58	—
Azerbaijan	104	80	86	81	35	64	81
Cape Verde	105	122	126	134	110	57	—
Mozambique	106	125	177	171	136	50	107
Fiji	107	107	101	92	—	63	—
Zimbabwe	108	146	150	—	124	44	121
Sudan	109	180	165	155	—	49	—
Bangladesh	110	145	133	174	97	55	114
Kazakhstan	111	83	51	38	56	69	78
Nigeria	112	114	154	141	125	57	119
Namibia	113	104	127	108	89	63	97
Belarus	114	65	50	43	—	59	88

(Continued)

	World Openness Index, 2018	KOF Globalization Index	Human Development Index	Ease of Doing Business	Global Competitiveness Index	Index of Economic Freedom	Global Innovation Index
Algeria	115	112	80	161	86	47	108
Madagascar	116	151	159	135	121	57	109
Pakistan	117	130	148	142	115	53	113
Mali	118	157	181	77	123	59	118
Ghana	119	98	139	107	111	56	—
Sri Lanka	120	102	72	129	84	57	90
Congo, Republic of	121	124	133	178	—	40	—
Malawi	122	152	169	23	132	52	115
Ethiopia	123	175	170	167	108	53	109
Tanzania	124	144	157	42	112	59	95
Cote d'Ivoire	125	—	—	—	—	—	—
Nepal	126	155	145	33	87	55	109
Burundi	127	186	182	163	129	53	122
Gabon	128	131	113	168	—	59	—
Central African Republic	129	187	184	186	—	52	—
Correlation Coef. with World Openness index	*1*	*0.808*	*0.809*	*0.510*	*0.787*	*-0.752*	*0.831*

Source:

(1) KOF Globalization Index: https://kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html.

(2) Human Development Index (United Nation Development Programme), http://hdr.undp.org/en/content/human-development-index-hdi.

(3) Ease of Doing Business (The World Bank), https://www.doingbusiness.org/en/reports/global-reports/doing-business-2020.

(4) Global Competitiveness Index (World Economic Forum), https://www.weforum.org/reports/the-global-competitiveness-report-2020.

(5) Index of Economic Freedom (Heritage Foundation), https://www.heritage.org/index/about.

(6) Global Innovation Index (World Intellectual Property Organization), https://www.globalinnovationindex.org/Home.