Online Appendix

Après-ski: The Spread of Coronavirus from Ischgl through Germany

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In this appendix, we perform a number of robustness checks to determine whether distance elasticities are sensitive to variable definitions or model choice. In all prior regressions, we used continuous measures of distance. However, we can divide the measure into bins in order to test whether the relationship between case counts and distance from Ischgl is non-linear. We therefore alter our baseline specification by introducing a series of dummies for the various deciles of road distance to Ischgl. The estimated coefficients then capture cases relative to the first decile i.e. relative to counties that are nearest to Ischgl. Figure 1 plots this sequence of coefficients and reveals a close to linear relationship. To explain with an example, counties belonging to the 10th decile that are farthest away from Ischgl have approximately 0.5% fewer cases in comparison to the reference group of counties closest to Ischgl.

Figure 1: Distance coefficients by decile

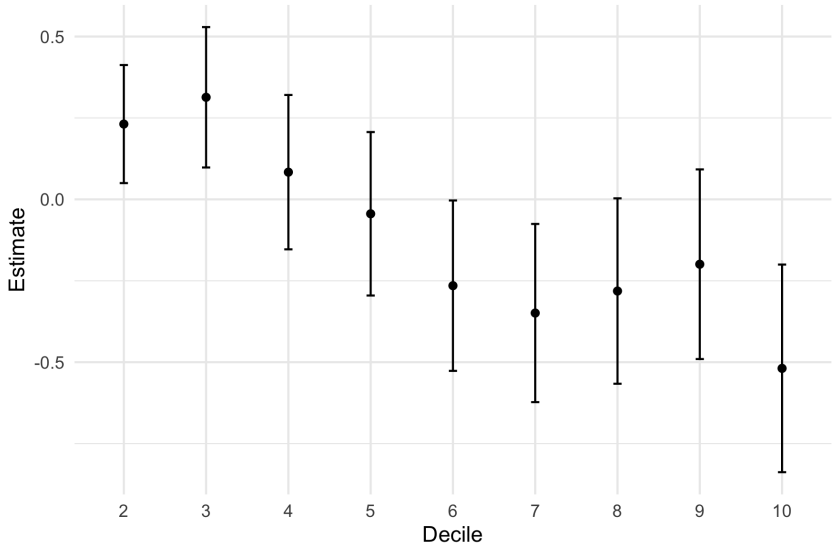

Table 1 compares our baseline negative binomial specification for confirmed cases in column (1) with regressions that employ alternative measures of distance. We find that Ischgl dominates over Heinsberg and Mulhouse as a super-spreader location even when switching from road distance to travel time. The results for other controls closely follow the pattern observed in Table 1 in the paper. While the elasticities on population size, testing and share of Catholics are highly significant and comparable across specifications, the coefficients on other demographic and economic factors remain largely insignificant. There in no marked improvement in the model's Pseudo R^2 either when estimating with alternative definitions of distance. Switching to a great circle distance, which should not matter for the spread of the disease, yields a much smaller and statistically insignificant elasticity. Note that now relative latitude to Ischgl has a negative, albeit statistically insignificant coefficient, as it is highly collinear to the great circle distance. All other coefficients remain largely unchanged.

The following robustness checks relate to the choice of the dependent variable and the estimation strategy. In Table 2, we move towards analysing CIR as opposed to the number of cases. With CIR as our outcome variable, we are now no longer in a count-model and can estimate regressions with simple OLS. Consistent with prior findings, we observe that distance to Ischgl is a significant predictor for infections. In a similar vein, we move from count models for fatalities to estimating OLS regressions for CFR in Table 3. This change does not undermine our main results. While testing capacity and share of the elderly influence CFR, distances of counties from super-spreader locales do not.

Table 1: Alternative distance measures

	Dependent variable:		
	Number of confirmed cases		
	(1)	(2)	(3)
log(Population)	1.074***	1.076***	1.050***
	(0.053)	(0.055)	(0.054)
log(Number of tests)	0.183***	0.189***	0.204***
	(0.044)	(0.045)	(0.045)
log(Distance to Ischgl)	−0.877***	−0.815***	−0.150
	(0.296)	(0.250)	(0.208)
log(Distance to Heinsberg)	−0.081	−0.043	−0.037
	(0.092)	(0.155)	(0.109)
log(Distance to Mulhouse)	−0.088	−0.092	0.001
	(0.112)	(0.128)	(0.108)
log(Latitude)	0.208	0.081	−0.239
	(0.235)	(0.179)	(0.194)
log(Population / Area)	−0.004	0.0001	−0.003
	(0.047)	(0.048)	(0.049)
Share of Catholics	0.747**	0.825**	0.767**
	(0.295)	(0.336)	(0.323)
Share of Protestants	0.183	0.164	0.207
	(0.253)	(0.263)	(0.263)
Share of 65+	−0.752	−0.570	−1.161
	(2.227)	(2.253)	(2.313)
Share of Foreigners	−0.783	−0.652	−0.770
	(1.151)	(1.192)	(1.196)
log(GDP p.c.)	0.062	0.043	0.061
	(0.122)	(0.122)	(0.121)
Work-from-Home Index	1.168	1.015	1.351
	(1.205)	(1.205)	(1.246)
log(China Trade)	−0.004	0.005	0.039
	(0.069)	(0.069)	(0.068)
Distance measure	Road	Travel time	Great circle
Pseudo R2	0.76	0.75	0.75
Observations	401	401	401
θ	4.378***	4.322***	4.237***
	(0.306)	(0.302)	(0.296)

Note: Constant not reported. Robust standard errors: *p<0.1; **p<0.05; ***p<0.01

Table 2: Case Incidence Rate, OLS Regressions

	Dependent variable:				
	Number of confirmed cases / Population x 100.000				
	(1)	(2)	(3)	(4)	(5)
Number of tests	0.090***	0.056***	0.050***	0.043***	0.042***
	(0.008)	(0.008)	(0.009)	(0.009)	(0.010)
log(Distance to Ischgl)		−0.134***	−0.158**	−0.148**	−0.146*
		(0.018)	(0.073)	(0.075)	(0.081)
log(Distance to Heinsberg)			−0.025	−0.013	−0.016
			(0.021)	(0.030)	(0.030)
log(Distance to Mulhouse)			0.015	0.010	0.010
			(0.029)	(0.034)	(0.036)
log(Latitude)			−0.003	0.021	0.019
			(0.058)	(0.069)	(0.074)
log(Population / Area)				−0.011	−0.019*
				(0.009)	(0.011)
Share of Catholics				0.103	0.111
				(0.076)	(0.078)
Share of Protestants				−0.024	−0.018
				(0.045)	(0.044)
Share of 65+				−0.174	−0.074
				(0.465)	(0.489)
Share of Foreigners				0.164	0.100
				(0.219)	(0.234)
log(GDP p.c.)					0.012
					(0.029)
Work-from-Home Index					0.273
					(0.245)
log(China Trade)					−0.001
					(0.016)
Observations	401	401	401	401	401
R^2	0.247	0.354	0.361	0.382	0.385

Note: Constant not reported. Robust standard errors: *p<0.1; **p<0.05; ***p<0.01.

Table 3: Case Fatality Rate, OLS Regressions

	Dependent variable:				
	Number of deaths / Confirmed cases 18 days ago				
	(1)	(2)	(3)	(4)	(5)
Log(Lagged Number of confirmed cases)	1.355***	1.825***	1.825***	2.120***	2.089***
	(0.319)	(0.371)	(0.368)	(0.366)	(0.361)
log(Population)	−1.737***	−2.295***	−2.295***	−2.378***	−1.807***
	(0.383)	(0.442)	(0.445)	(0.479)	(0.522)
log(Number of tests)	−0.028	0.176	0.176	0.403	0.274
	(0.223)	(0.244)	(0.245)	(0.279)	(0.279)
log(Distance to Ischgl)		1.572	1.572	1.056	1.777
		(1.515)	(1.561)	(1.562)	(1.612)
log(Distance to Heinsberg)		0.533**	0.533**	0.435*	0.377
		(0.216)	(0.216)	(0.241)	(0.249)
log(Distance to Mulhouse)		−0.281	−0.281	−0.660	−0.517
		(0.452)	(0.473)	(0.571)	(0.592)
log(Latitude)		0.114	0.114	0.827	0.279
		(1.019)	(1.037)	(1.108)	(1.141)
log(GDP p.c.)			0.0004	0.437	1.034
			(0.738)	(0.958)	(1.033)
log(Population / Area)				−0.574**	−0.389
				(0.279)	(0.264)
Share catholics				−0.607	−0.619
				(1.201)	(1.221)
Share protestants				−0.481	−0.531
				(1.491)	(1.514)
Share population 65+				38.036***	40.848***
				(9.454)	(9.650)
Share foreigners				14.963	13.939
				(9.478)	(9.580)
log(Number of hospital beds)					−0.778**
					(0.314)
Observations	401	401	401	401	396
R^2	0.097	0.119	0.119	0.175	0.183

Note: Constant not reported. Robust standard errors: *p<0.1; **p<0.05; ***p<0.01.