COVID-19 Confirmed Cases Prediction as of April 10, 2020

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Summary of the situation:

- Europe records a 5.3% growth rate of confirmed infections today, the same as yesterday, with outbreak progress in medium scenario decreasing from 68.2% to 66.5%, due to the up-adjusted estimated final total confirmed cases in the medium scenario to 1.18 million today. This is the third consecutive increase in the daily-confirmed cases in Europe after the recently identified inflection point[1]. It is possible that Europe and other after-peak countries may have a slow decay in the after-peak period. It is also important to understand that confirmed infections undershoot actual infections by a very large margin. Figure 1 allows us to suggest that all rich cool north[2] countries are converging except Sweden, while hot north[2] and S hemisphere[2] countries are not. The fact that Europe taken as a whole is not in the middle of the distribution (Figure 1) is mainly due to the weight of Russia on the average, which has only 82 confirmed cases per million population.

- The US records a 7.8% growth rate of the number of total confirmed cases today, compared with 8.4% yesterday. The epidemic in the USA is both geographically diverse and has not yet passed the inflection point, so the uncertainty is still large for the future developments. Readers can refer to Supplements to COVID-19 Confirmed Cases Prediction (April 7th, 2020)[2] for our analysis on the US test numbers and the confirmed case numbers.

- The daily confirmed cases in Austria is 279 today, compared with 329 yesterday, which is within our prediction range of yesterday. As shown in Figure 2, our prediction is more accurate compared to earlier reports when we tended to underestimate, this is because the situations become more mature in more countries and thus the Logistic models become more reliable. In addition to the four early stage countries (Turkey, Brazil, Sweden and Japan), we also underestimated Netherlands today, which has made a new peak in the daily incidence curve.

- Spain, Switzerland, Belgium, Italy, Germany, Portugal, and France continue to present the signs that inflection points have been passed, although most of their converged distributions of the final confirmed cases have been adjusted up today. This shows that the epidemics in these countries are not abating quickly as in a standard Logistic after-peak trajectory, although they have most probably passed their inflection points. This behavior could be due to the combination of real cases combining with an increase in testing rate. Therefore, the positive scenario modeled by the classical Logistic curve no longer applies and readers should not trust the outbreak progress and other estimates in the positive scenarios. Confirmed cases are a leading indicator while deaths are a lagging indicator and we anticipate that daily mortality numbers may begin to fall ~ 2 to 3 weeks after the peak in new confirmed cases.

- There are no clear signs of decaying daily confirmed cases in UK and Netherlands, which suggest high uncertainties. Brazil, Sweden, Turkey and Japan continue their previous exponential growth, indicating highly uncertain future scenarios as well, as shown by their non-converged ensemble distributions of final confirmed cases (Figure 1). The transmission in Japan seems to accelerate as do reported deaths, but the death rate figures in Japan are very low and fluctuating from day to day. Unraveling the "epidemic" in Japan remains a work in progress.

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[1] On a logistic curve, the inflection point indicates where the curvature changes its sign. As we model the total number of confirmed cases, it is equal to the peak of the daily increase curve, after which the daily number of cases is decreasing. If the inflection point has been passed, the worst of the outbreak is over.

[2] https://ethz.ch/content/dam/ethz/special-interest/mtec/chair-of-entrepreneurial-risks-dam/documents/Covid-19/Covid_Supplements_7April2020.pdf

-The irregular dips and spikes in the data most likely reflect data aggregation and reporting delays where numbers not included one day are included in the following day.

Method:

This report updates predictions for the number of COVID-19 confirmed cases at four time horizons (1-day, 5-day, 10-day and end of the outbreak) and for various countries/regions, based on a phenomenological approach detailed in [1]. We employ 3 versions of the generalized logistic growth equation to model the total number of confirmed cases, resulting in a positive, medium and negative scenario for the final expected number of cases. Note that, for countries/regions at early growth stages, the predictions for long-term horizon (10-day and end of the outbreak) are highly uncertain and will vary a lot as the situation changes. The predicted ranges overlap and, as time passes, we anticipate our methodology to zero in on more reliable numbers.

Data source: European Centre for Disease Prevention and Control (ECDC) [2] updated every day at 1pm CET, reflecting data collected up to 6:00 and 10:00 CET. Thus the daily data in some countries is one day delayed compared to other online live sources.

Key Figures & Tables:

-In Table 1, we report the latest confirmed cases per million population and the estimated outbreak progress in the positive and medium scenario (today's confirmed cases divided by the estimated total final confirmed case in positive and now additionally in medium scenarios).

-In Table 2, we report the prediction results in each selected country/region at four time horizons (1-day, 5-day, 10-day and end of the outbreak) in three scenarios. The detailed fitting results for each country/region are plotted in the figures at the end of this report.-

-In Figure 1, we present a distribution of the estimated final total confirmed numbers per million population based on the positive and medium scenario.

-In Figure 2, we show the 1-day prediction error of yesterday's report.

Comment: We need to emphasize that reported confirmed cases are a leading indicator that is subject to a large number of extraneous variables such as sampling rate[3], sample targeting and reliability of testing. See note at end of this report. The real number of cases in the population is likely to be many multiples higher than those computed from confirmed tests. We strongly recommend that national governments should publish the number of daily tests and implement random testing (polling) in the population, to facilitate all modeling work and therefore better understanding of the epidemic to help guide appropriate policy responses.

[3] For instance, The UK is experiencing issues with raising the testing rate linked to a global shortage of certain key reagents and swabs. From since April 1st, all testing is to be targeted at health sector staff and this will obviously bias future data compared with past data.

Table 1. Current confirmed cases per million population and estimated outbreak progress in positive and medium scenarios (today's confirmed cases divided by the estimated total final confirmed cases in positive and medium scenario). Numbers in brackets are 80% confidence intervals. As positive scenarios predict a smaller final number of total infected cases, the outbreak progress is thus larger in the positive scenario. Note that the estimated final confirmed numbers tend to underestimate the final results, thus the estimated outbreak progress serves both as a lower bound for future developments and as a guide of the dynamics of the evolution of the epidemics[4]. The number of tests per million population and confirmed cases per test are presented in the last two columns based on the information from Wikipedia [3].

	Confirmed per Million Population (Apr-10)	Outbreak Progress in Positive Scenario	Outbreak Progress in Medium Scenario	Tests per Million Population (update date in brackets)	Confirmed Cases per Test (update date in brackets)
Spain	3263	100.2% (94.5%, 106.1%)	82.2% (78.0%, 86.5%)	7596 (Mar 21)	5.6% (Mar 21)
Switzerland	2759	93.0% (87.0%, 100.4%)	81.3% (74.5%, 87.7%)	19536 (Apr 07)	12.9% (Apr 07)
Italy	2377	100.0% (94.1%, 106.8%)	81.6% (78.0%, 85.4%)	15035 (Apr 10)	15.8% (Apr 10)
Belgium	2187	71.9% (62.9%, 79.8%)	68.2% (55.9%, 76.3%)	7316 (Apr 07)	24.7% (Apr 07)
Austria	1497	96.0% (89.6%, 101.9%)	95.0% (89.4%, 100.7%)	15135 (Apr 10)	9.8% (Apr 10)
United States	1424	67.6% (57.5%, 75.5%)	55.8% (44.6%, 65.1%)	7245 (Apr 09)	18.2% (Apr 09)
Germany	1369	85.7% (80.3%, 91.5%)	75.1% (68.5%, 81.1%)	15850 (Apr 08)	7.8% (Apr 08)
Portugal	1357	77.6% (69.2%, 86.1%)	72.6% (62.4%, 82.1%)	12760 (Apr 08)	9.5% (Apr 08)
France	1289	84.8% (76.3%, 93.6%)	75.3% (64.6%, 85.1%)	3346 (Apr 02)	25.4% (Apr 02)
Netherlands	1263	95.7% (88.9%, 102.5%)	67.3% (60.2%, 72.8%)	5827 (Apr 08)	19.3% (Apr 08)
Europe	1048	81.4% (77.3%, 85.3%)	66.5% (61.4%, 70.6%)	NA	NA
United Kingdom	979	64.1% (56.4%, 71.2%)	61.1% (52.1%, 69.4%)	3799 (Apr 10)	25.4% (Apr 10)
Sweden	898	37.0% (7.0%, 55.0%)	Not reliable	6383 (Apr 07)	13.2% (Apr 07)
Iran	810	Not reliable	Not reliable	2538 (Apr 07)	28.7% (Apr 07)
Turkey	514	69.8% (57.5%, 80.0%)	Not reliable	3694 (Apr 10)	13.8% (Apr 10)
South Korea	202	Not reliable	Not reliable	9231 (Apr 07)	2.2% (Apr 07)
Brazil	85	Not reliable	Not reliable	261 (Apr 02)	12.5% (Apr 02)
Japan	42	Not reliable	Not reliable	545 (Apr 10)	7.8% (Apr 10)

[4]One uncertainty with Italy (and other countries) is whether the main outbreak that is focused on the North may spread through other parts of the country. In other words, does the dynamics aggregated over a whole country represent correctly the dynamics in different parts?

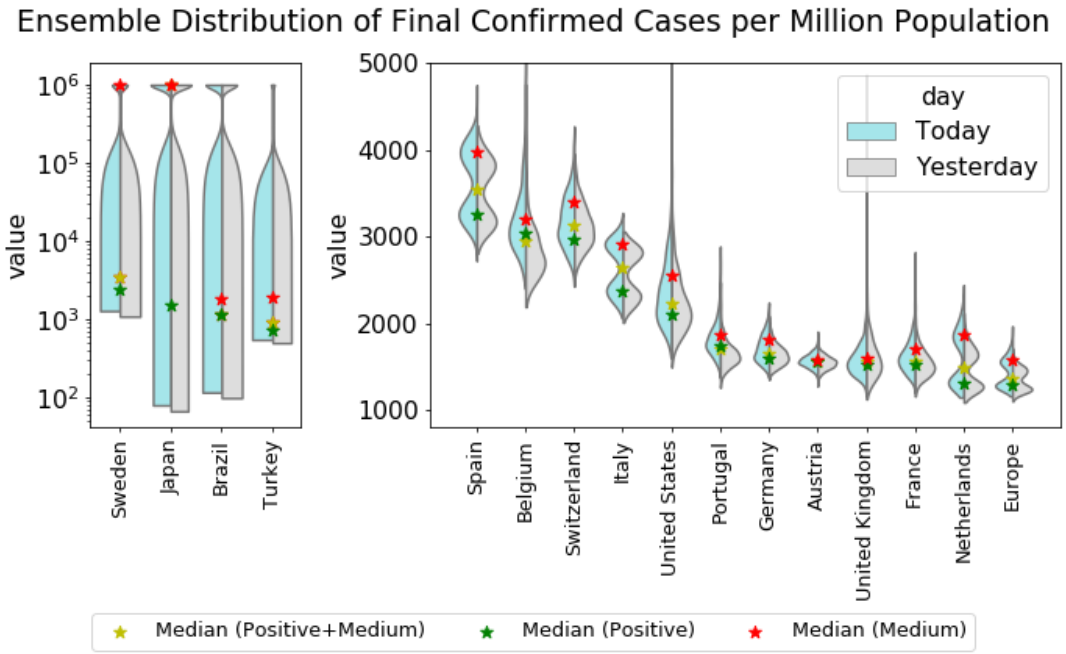


Figure 1. Violin plot of the distributions of the final total number of confirmed cases per million derived by combining the distributions of the positive and medium scenarios. The left side of each violin in cyan is today's distribution, while the right side of each violin in grey is yesterday's distribution. The model setup in the negative scenario does not incorporate a maximum saturation number and thus cannot be used. The yellow star indicates the median prediction for the combined distribution, while the green and red stars indicate the median of the positive and of the medium scenarios respectively. Note that, where we have >1 million infections per 1 million of population, the results are deemed to be unreliable (Table 2).

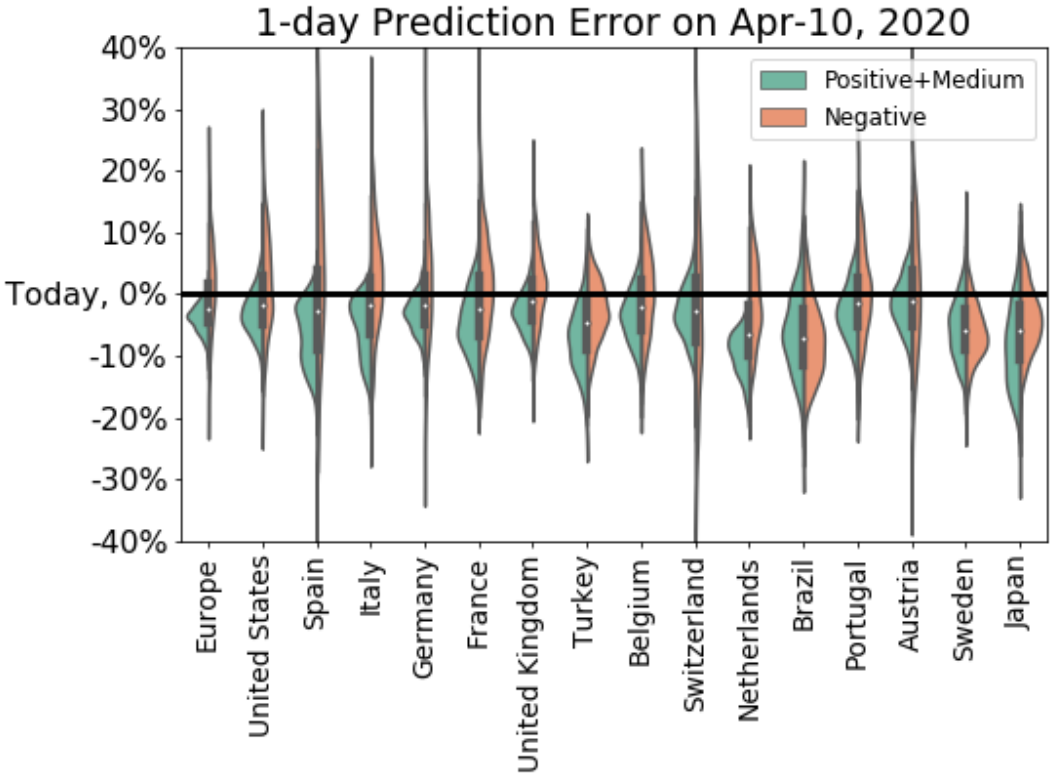


Figure 2. One-day prediction error of the 13 countries/regions. The horizontal line corresponds to today's empirical data. We show the full distribution of errors for each of the two scenarios.

Table 2. Predictions for the number of confirmed cases at four time horizons (1-day, 5-day, 10-day and end of the outbreak) and for various countries/regions. The values in parentheses are 80% prediction intervals based on 500 simulations using a negative binomial error structure. In Today's validation column, today's empirical data is presented below yesterday's 1-day predictive interval. "Not reliable" is declared if more than 10% of the simulations produce extreme numbers (larger than total population). All numbers are in thousands.

Country	Scenario*	Today's validation	11-Apr	15-Apr	20-Apr	Final Total Confirmed
Europe	Positive	(721, 766) 783	774 (750, 798)	856 (826, 884)	913 (877, 950)	962 (917, 1010)
	Medium	(744, 781) 783	804 (784, 826)	916 (891, 945)	1020 (981, 1060)	1180 (1110, 1270)
	Negative	(725, 865) 783	838 (769, 916)	1040 (951, 1130)	1330 (1200, 1460)	Not Reliable
United States	Positive	(429, 482) 466	480 (457, 510)	573 (538, 620)	637 (588, 712)	689 (618, 810)
	Medium	(433, 472) 466	488 (466, 509)	599 (563, 636)	700 (641, 768)	836 (716, 1050)
	Negative	(428, 525) 466	509 (455, 564)	691 (616, 774)	978 (846, 1140)	Not Reliable
Spain	Positive	(130, 144) 152	141 (134, 149)	148 (140, 156)	151 (143, 160)	152 (144, 161)
	Medium	(144, 154) 152	155 (150, 161)	169 (162, 174)	178 (170, 185)	186 (176, 195)
	Negative	(131, 191) 152	162 (135, 201)	203 (163, 250)	254 (205, 318)	Not Reliable
Italy	Positive	(124, 138) 144	135 (128, 144)	140 (131, 148)	142 (133, 151)	144 (135, 153)
	Medium	(137, 145) 144	146 (141, 150)	155 (151, 161)	164 (158, 169)	176 (168, 184)
	Negative	(131, 164) 144	151 (135, 169)	175 (157, 197)	208 (183, 235)	Not Reliable
Germany	Positive	(105, 114) 114	113 (108, 119)	122 (116, 129)	128 (121, 136)	132 (124, 141)
	Medium	(106, 115) 114	117 (112, 121)	129 (123, 135)	139 (132, 148)	151 (140, 166)
	Negative	(103, 130) 114	121 (107, 136)	148 (132, 167)	186 (163, 216)	Not Reliable
France	Positive	(76.5, 88.5) 86.3	85.6 (79.5, 91.8)	93.3 (86.3, 101)	98.3 (90.3, 107)	102 (92.3, 113)
	Medium	(76.3, 88.6) 86.3	87.1 (81.8, 93.1)	97.5 (90.9, 105)	105 (96.7, 116)	115 (101, 134)
	Negative	(78.7, 96.6) 86.3	92.2 (83, 103)	114 (102, 129)	146 (129, 167)	Not Reliable
United Kingdom	Positive	(60.2, 66.7) 65.1	67.8 (64.7, 71)	82.1 (77.5, 87)	92.7 (85.9, 101)	102 (91.5, 115)
	Medium	(60.4, 65.8) 65.1	67.1 (64.7, 69.9)	82.1 (77.9, 86.8)	94.4 (87, 103)	106 (93.7, 125)
	Negative	(61, 70.9) 65.1	70.3 (64.5, 76.6)	97.1 (88.1, 106)	141 (125, 158)	Not Reliable
Turkey	Positive	(35.5, 40.2) 42.3	41.2 (38.9, 43.8)	51.8 (47.5, 57.1)	57.8 (51.3, 67)	60.6 (52.8, 73.5)
	Medium	(38.4, 43.1) 42.3	44.7 (42.4, 47.2)	62.3 (56.9, 68)	84 (71.1, 102)	Not Reliable
	Negative	(38.1, 43.8) 42.3	45.3 (42.6, 48.6)	66.5 (61.8, 71.6)	100 (91, 111)	Not Reliable
Belgium	Positive	(22.7, 25.7) 25	26.1 (24.5, 28)	29.7 (27.7, 32)	32.4 (29.8, 35.5)	34.8 (31.3, 39.7)

	Medium	(22.6, 25.4) 25	25.7 (24.3, 27.1)	29.7 (27.7, 31.8)	33 (30.4, 36.6)	36.6 (32.8, 44.7)
	Negative	(22.8, 27.4) 25	26.8 (24.4, 29.2)	34.3 (31.2, 37.6)	45.2 (40.8, 50.7)	Not Reliable
Switzerland	Positive	(21.5, 24.2) 23.5	23.2 (21.7, 24.6)	24.3 (22.6, 25.7)	24.9 (23.1, 26.5)	25.3 (23.4, 27)
	Medium	(22.5, 25.1) 23.5	24.5 (23.2, 26)	26.1 (24.7, 27.8)	27.4 (25.8, 29.4)	28.9 (26.8, 31.5)
	Negative	(19.5, 29.2) 23.5	24.9 (19.9, 30.6)	29.6 (23.8, 36.4)	36.1 (28.7, 45.1)	Not Reliable
Netherlands	Positive	(18.6, 20.7) 21.8	20.4 (19.2, 21.7)	21.6 (20.4, 23.1)	22.4 (20.9, 23.9)	22.7 (21.2, 24.5)
	Medium	(20.3, 21.8) 21.8	22.5 (21.7, 23.3)	25.5 (24.5, 26.5)	28.2 (26.8, 29.8)	32.3 (29.9, 36.1)
	Negative	(20.7, 24.8) 21.8	24.1 (22.3, 25.8)	29.8 (27.2, 32.1)	37.8 (34.4, 41.6)	Not Reliable
Brazil	Positive	(15, 17.8) 17.9	18.3 (16.9, 19.8)	27.6 (23.6, 31.4)	42.6 (29.9, 55.7)	Not Reliable
	Medium	(15.7, 18.9) 17.9	19.5 (17.8, 21.2)	30 (25.7, 33.8)	49.2 (33.2, 63.9)	Not Reliable
	Negative	(15.1, 18.1) 17.9	18.5 (17.1, 20.1)	28.8 (25.9, 31.9)	46.8 (40.4, 55.8)	Not Reliable
Portugal	Positive	(12.8, 14.6) 14	14.7 (13.6, 15.6)	16.3 (15, 17.4)	17.2 (15.8, 18.9)	18 (16.2, 20.2)
	Medium	(12.7, 14.2) 14	14.4 (13.5, 15.3)	16.2 (15.1, 17.4)	17.7 (16.2, 19.3)	19.2 (17, 22.4)
	Negative	(12.6, 15.6) 14	14.8 (13.4, 16.2)	18.7 (16.9, 20.4)	24.2 (21.6, 26.7)	Not Reliable
Austria	Positive	(12.3, 13.9) 13.2	13.3 (12.6, 14.2)	13.6 (12.8, 14.5)	13.7 (12.9, 14.7)	13.8 (13, 14.8)
	Medium	(12.3, 13.8) 13.2	13.3 (12.5, 14)	13.6 (12.9, 14.4)	13.8 (13.1, 14.7)	13.9 (13.2, 14.8)
	Negative	(11.5, 15.2) 13.2	13.6 (11.8, 15.7)	15.9 (13.8, 18.5)	18.9 (16.3, 22.2)	Not Reliable
Sweden	Positive	(8.18, 9.36) 9.14	9.41 (8.75, 10.1)	12.1 (11, 13.4)	15.4 (13.2, 19.2)	24.7 (16.6, 130)
	Medium	(7.96, 9.05) 9.14	9.23 (8.68, 9.82)	12 (11.1, 12.9)	16.3 (14, 18.1)	Not Reliable
	Negative	(8.09, 9.14) 9.14	9.28 (8.68, 9.86)	12.2 (11.4, 13.1)	16.7 (15.4, 18)	Not Reliable
Japan	Positive	(4.35, 4.97) 5.35	5.19 (4.85, 5.54)	8.02 (7.18, 8.81)	13.5 (10.2, 16.3)	Not Reliable
	Medium	(4.76, 5.51) 5.35	5.81 (5.48, 6.25)	8.25 (7.59, 8.94)	12.8 (11, 14.1)	Not Reliable
	Negative	(4.78, 5.53) 5.35	5.84 (5.48, 6.26)	8.29 (7.76, 9.01)	12.9 (11.8, 14.3)	Not Reliable
Iran	Positive	(53.4, 61.9) 66.2	58.8 (54.1, 63.5)	62.6 (57.7, 68.1)	65.1 (59.9, 71.2)	Not Reliable
	Medium	(60.9, 68) 66.2	64.4 (60.4, 68.4)	72.4 (67.2, 78.2)	80.4 (73.4, 88.8)	Not Reliable
	Negative	(64.7, 73.9) 66.2	70.9 (65.7, 76.4)	83.4 (77.2, 90.3)	100 (92.5, 109)	Not Reliable

* Note:

-The scenarios are based on the final total confirmed numbers. The positive and medium scenarios are derived from the Generalized Logistic Model and the Logistic Model. The model with the lower mean predicted final total confirmed number K is classified as the positive scenario, and the other one is classified as the medium scenario. The negative scenario is based on the Generalized Growth model, which should only describe the early stage of the epidemic outbreak and is therefore least reliable for countries in the more mature stage.

-Trajectories from Iran have largely deviated from a typical logistic type growth (S curve), and can't be properly described by our models. Although we still report its calibration results in Table 1, they should not be taken as reliable in all scenarios and time horizons. This is probably a result of unreliable reported data from Iran.

Limitations of using the statistics of reported confirmed number

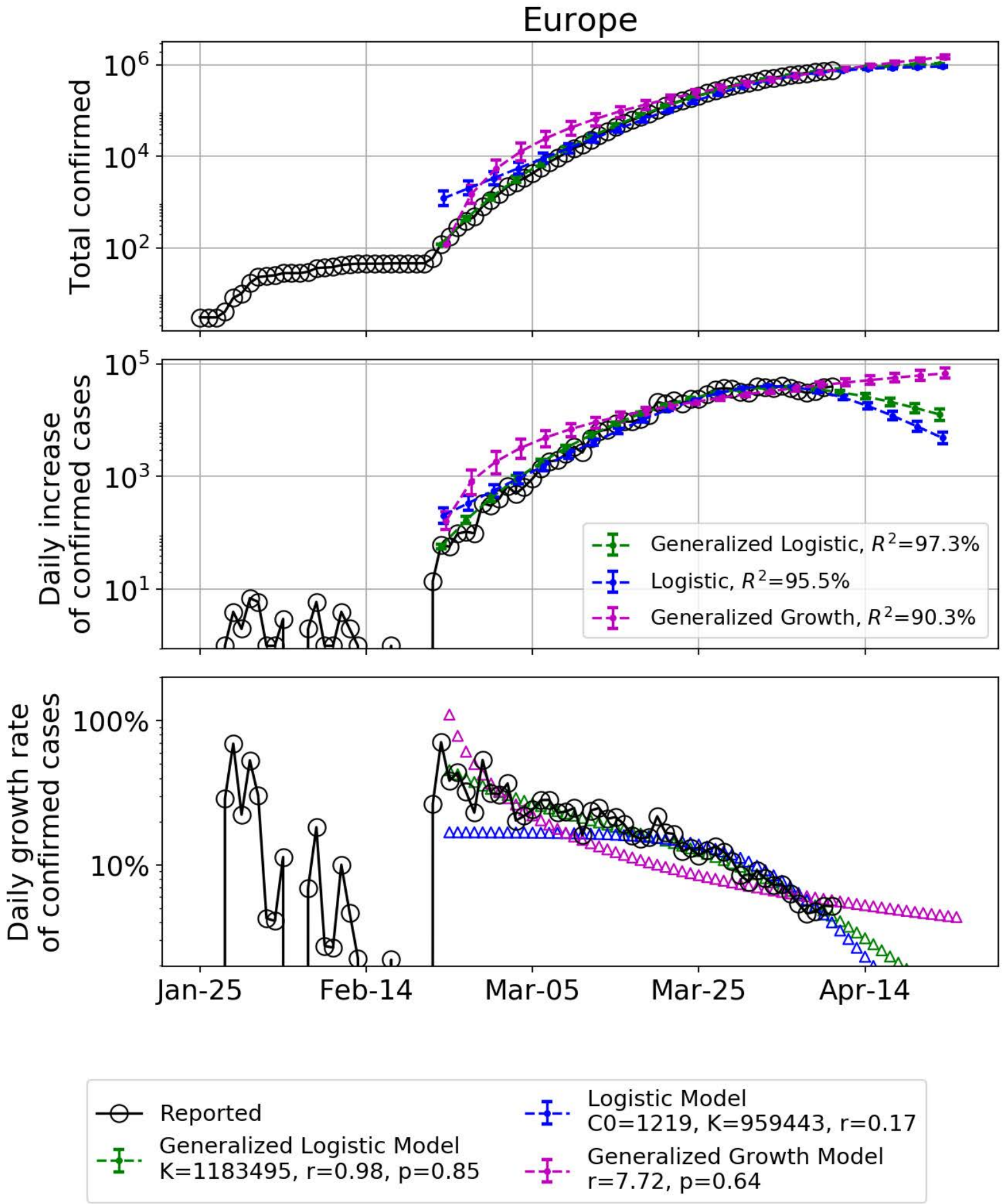
It is important to understand what our prediction models show. The predictions are based on cases identified on the basis of testing and they therefore predict the numbers of future positive tests. Relating positive test results to real levels of infection is subject to a large number of biases. It is a fact that the real number of infections is far higher than those recorded in positive tests since only a tiny fraction of any population has been tested. It is also the case that, in most countries, testing is biased towards those who think they are infected. The first bias, therefore, will underestimate the real number of infections while the second bias will tend to overestimate since it is biased towards those who think they are ill.

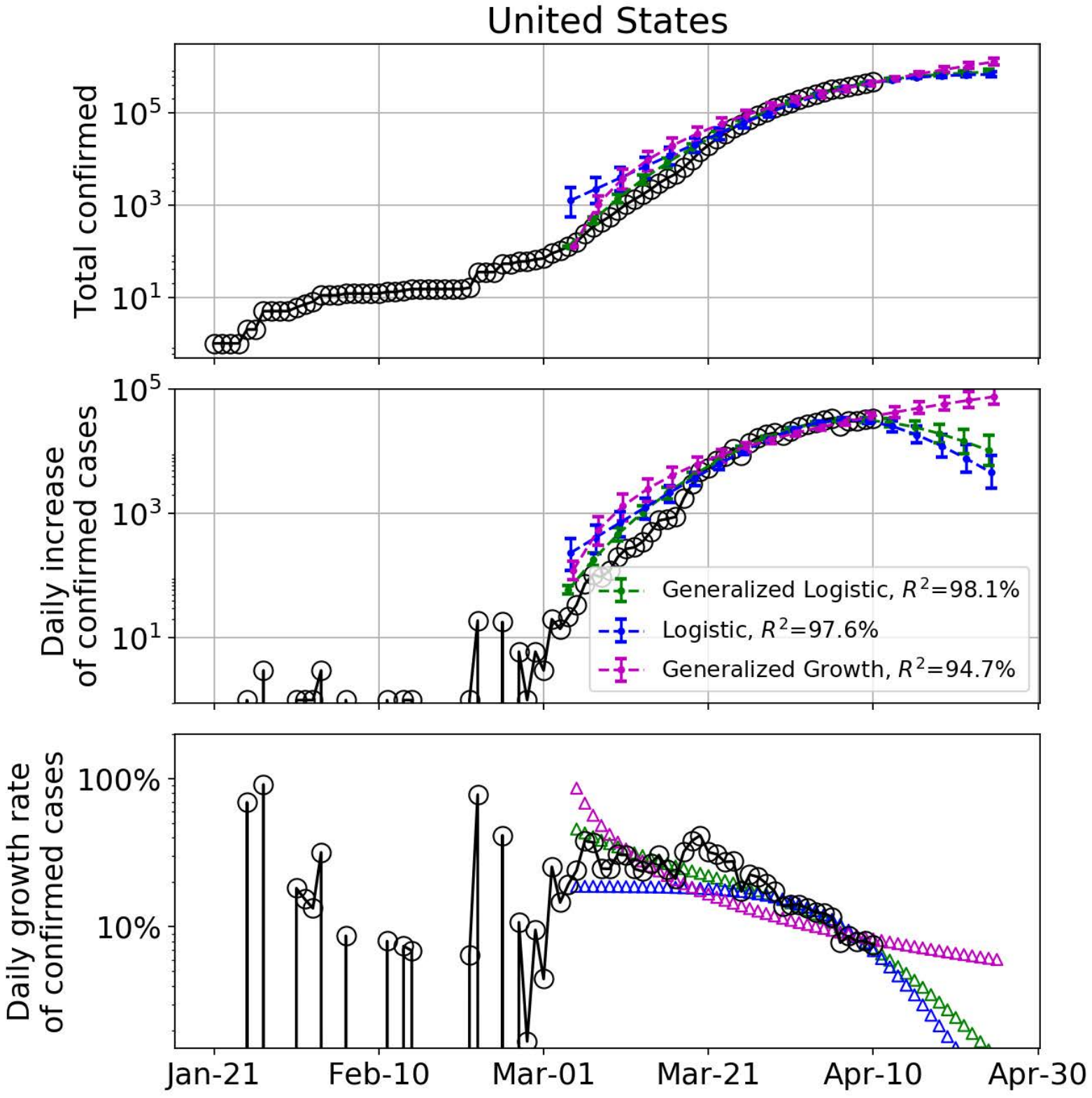
There are further complications. Depending on the testing protocols used, in some instances false positive results have been obtained. In other words, someone without the disease tested positive, probably because they were infected with some other coronavirus. And in other cases, false negative results were obtained, as was the case with the early testing deployed in the USA.
One final complication is the fact that tests are conducted sequentially over time. They do not represent a snapshot of a day in time. Many of those tested early, giving a negative result, may today get a positive result. And many, who tested positive early on, may today be cured.
We anticipate that, over time, our methodology will improve and will provide a more accurate picture of the true levels of infection and where they are headed.

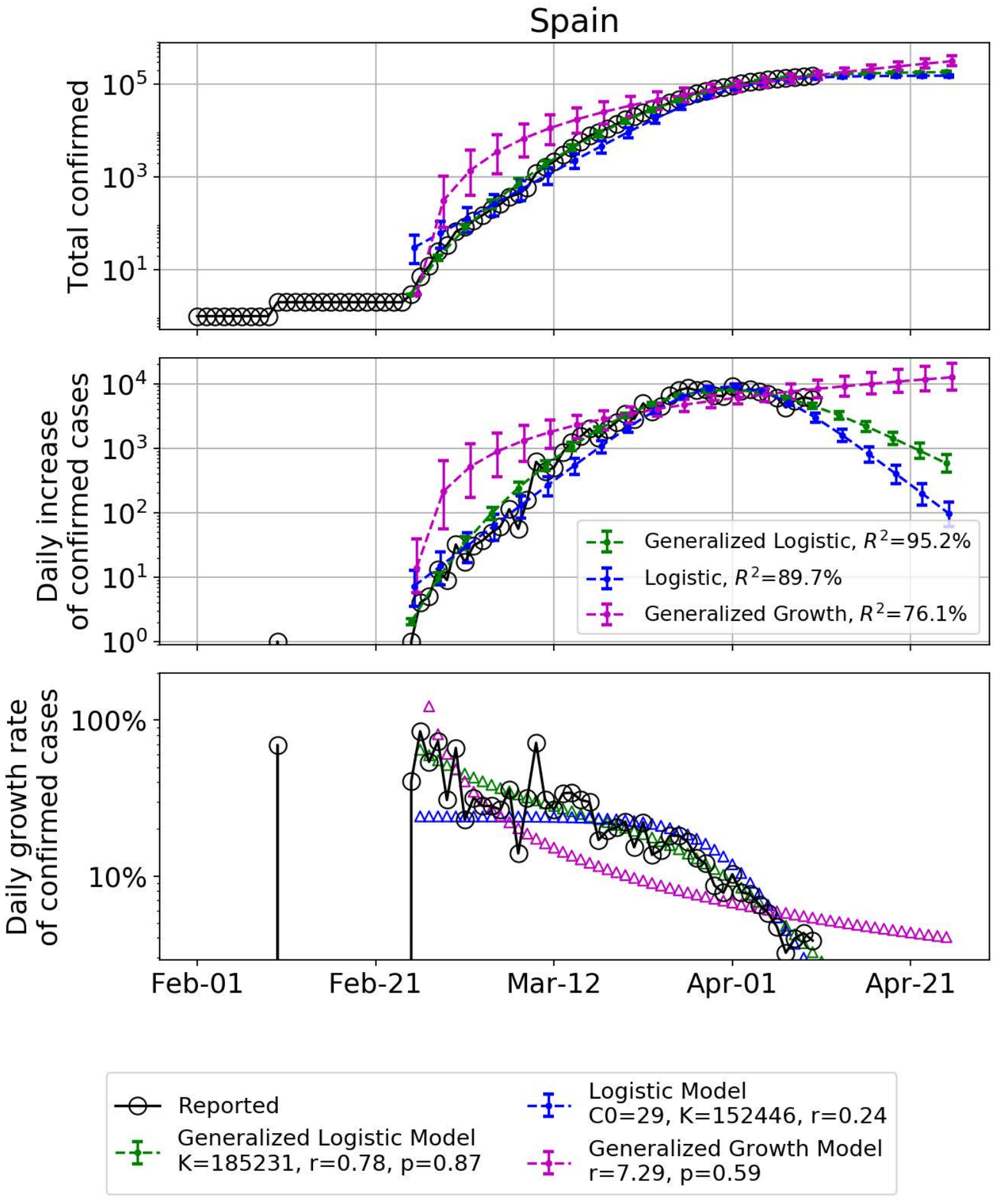
[1] Ke Wu, Didier Darcet, Qian Wang and Didier Sornette, Generalized logistic growth modeling of the COVID-19 outbreak in 29 provinces in China and in the rest of the world, preprint at http://arxiv.org/abs/2003.05681 and
medRxiv: https://medrxiv.org/cgi/content/short/2020.03.11.20034363v1

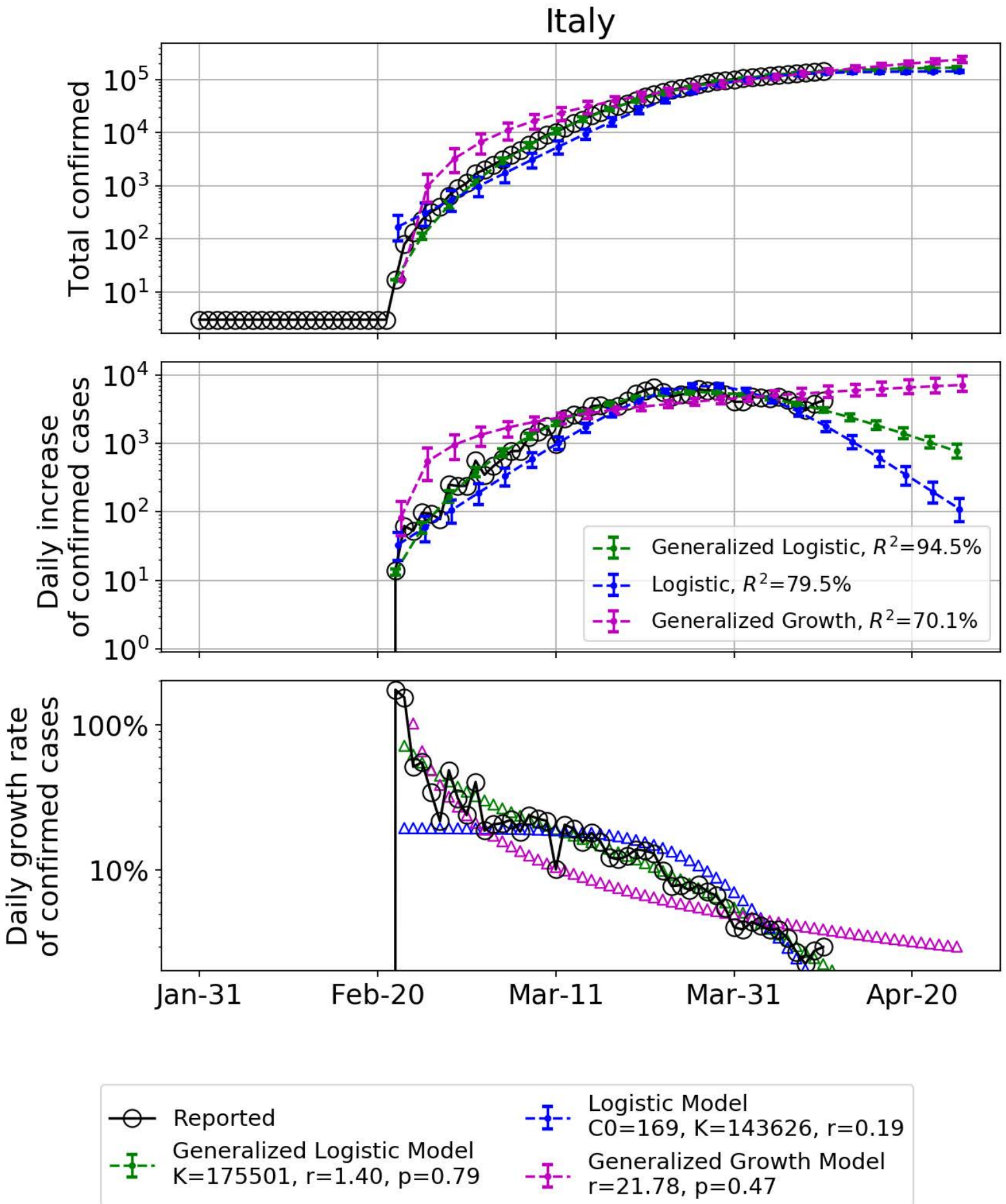
[2] https://www.ecdc.europa.eu/en/geographical-distribution-2019-ncov-cases

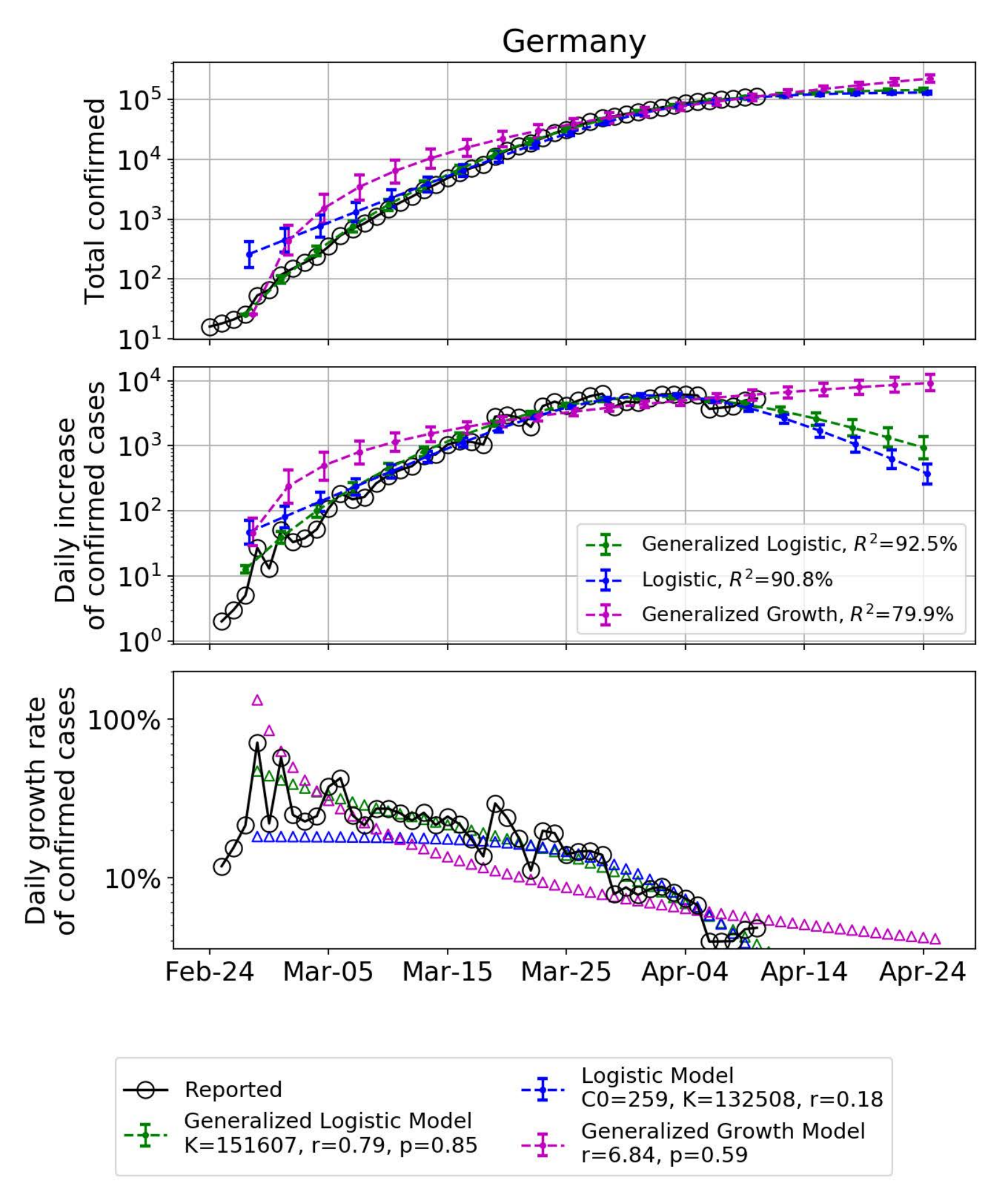
[3] https://en.wikipedia.org/wiki/COVID-19_testing

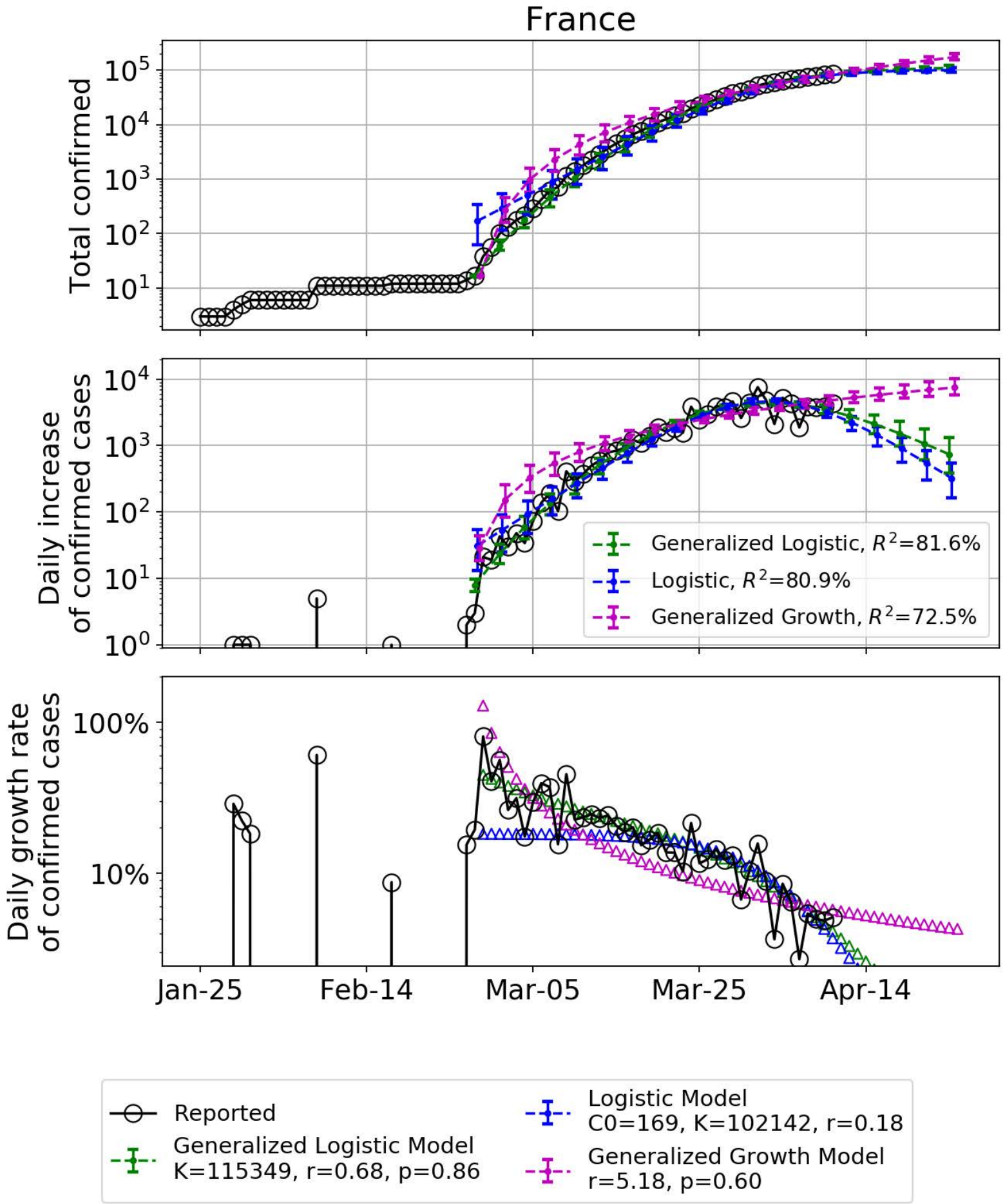

Europe
Total confirmed
10^6
10^4
10^2
Daily increase of confirmed cases
10^5
10^3
10^1
Generalized Logistic, R^2=97.3%
Logistic, R^2=95.5%
Generalized Growth, R^2=90.3%
Daily growth rate of confirmed cases
100%
10%
Jan-25
Feb-14
Mar-05
Mar-25
Apr-14
Reported
Generalized Logistic Model
K=1183495, r=0.98, p=0.85
Logistic Model
C0=1219, K=959443, r=0.17
Generalized Growth Model
r=7.72, p=0.64

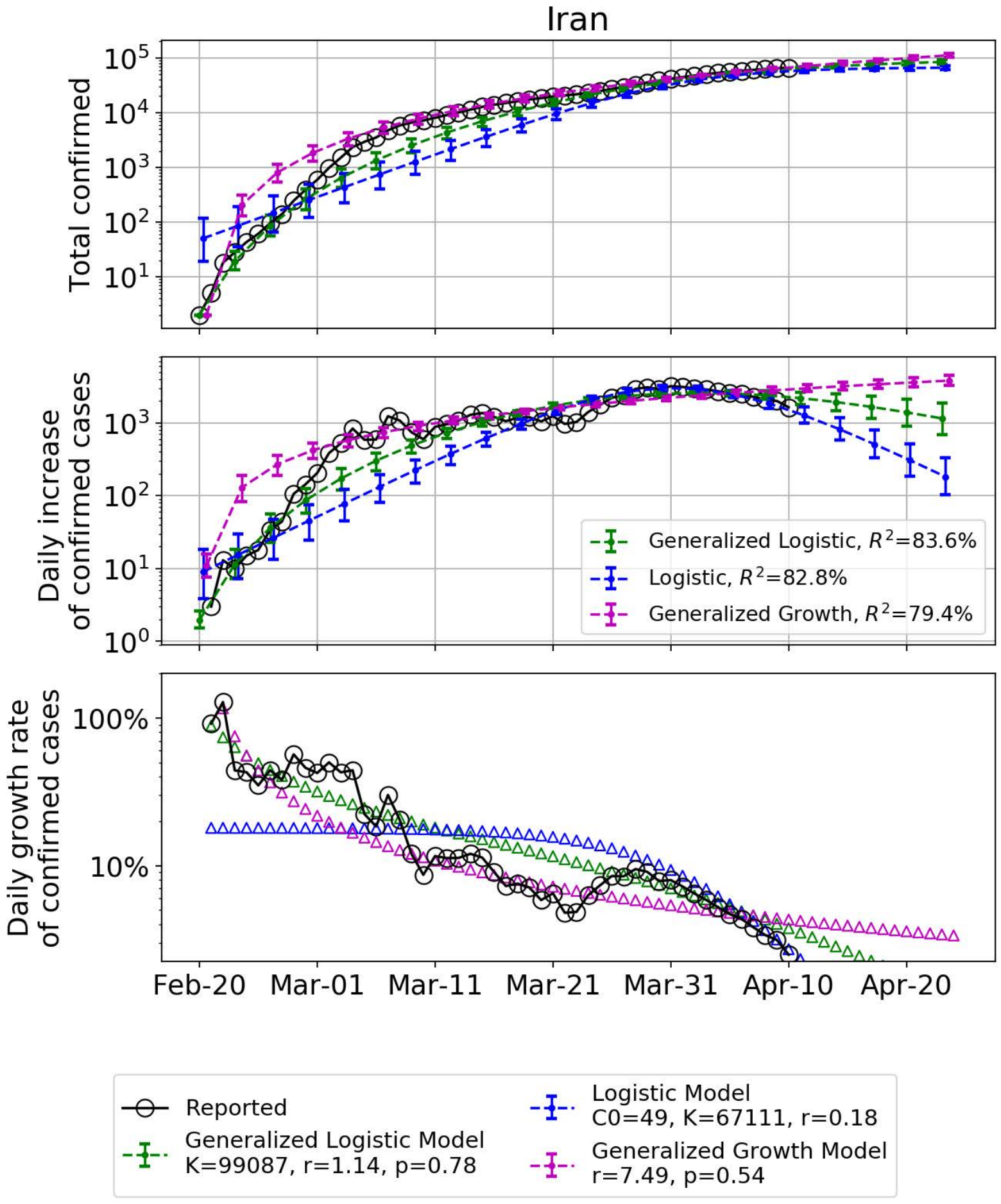

United States
Total confirmed
10^5
10^3
10^1
Daily increase of confirmed cases
10^5
10^3
10^1
Generalized Logistic, R^2=98.1%
Logistic, R^2=97.6%
Generalized Growth, R^2=94.7%
Daily growth rate of confirmed cases
100%
10%
Jan-21
Feb-10
Mar-01
Mar-21
Apr-10
Apr-30
Reported
Generalized Logistic Model
K=836748, r=0.92, p=0.86
Logistic Model
C0=1249, K=695701, r=0.19
Generalized Growth Model
r=4.27, p=0.70

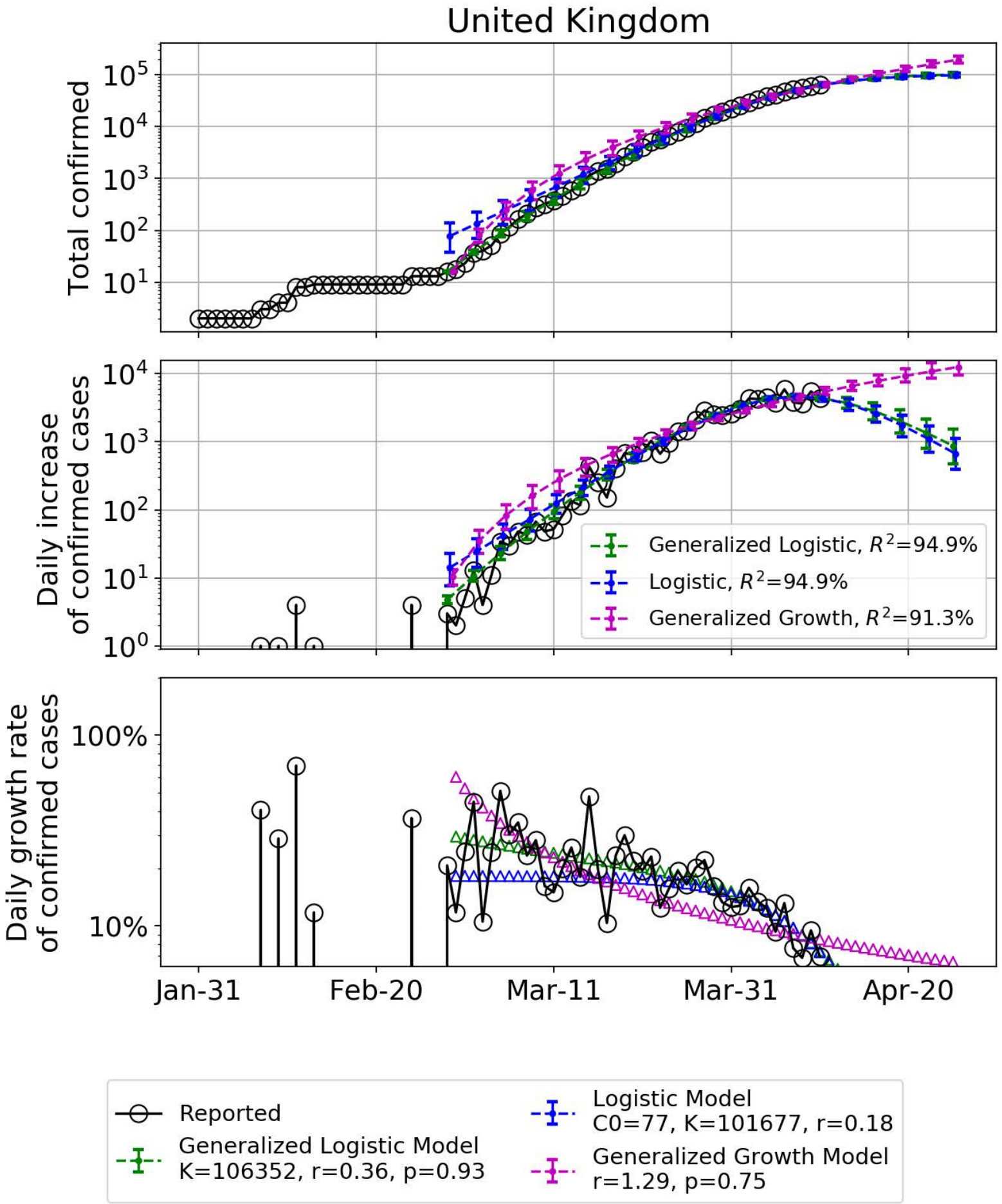

Spain
Total confirmed
10^5
10^3
10^1
Daily increase of confirmed cases
10^4
10^3
10^2
10^1
10^0
Generalized Logistic, R^2=95.2%
Logistic, R^2=89.7%
Generalized Growth, R^2=76.1%
Daily growth rate of confirmed cases
100%
10%
Feb-01
Feb-21
Mar-12
Apr-01
Apr-21
Reported
Generalized Logistic Model
K=185231, r=0.78, p=0.87
Logistic Model
C0=29, K=152446, r=0.24
Generalized Growth Model
r=7.29, p=0.59

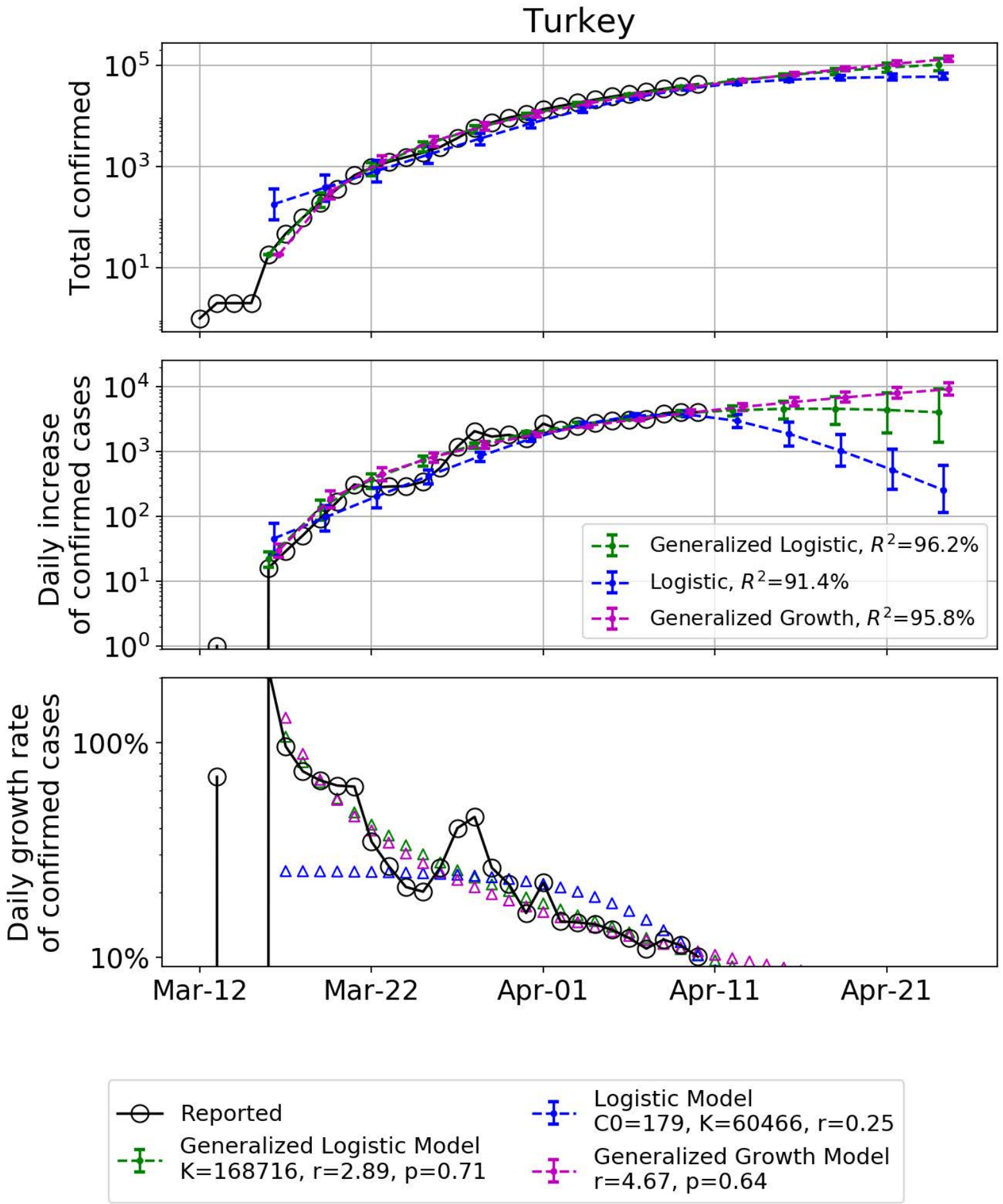

Italy
Total confirmed
Daily increase of confirmed cases
Daily growth rate of confirmed cases
Generalized Logistic, R^2=94.5%
Logistic, R^2=79.5%
Generalized Growth, R^2=70.1%
100%
10%
Jan-31
Feb-20
Mar-11
Mar-31
Apr-20
Reported
Generalized Logistic Model
K=175501, r=1.40, p=0.79
Logistic Model
C0=169, K=143626, r=0.19
Generalized Growth Model
r=21.78, p=0.47

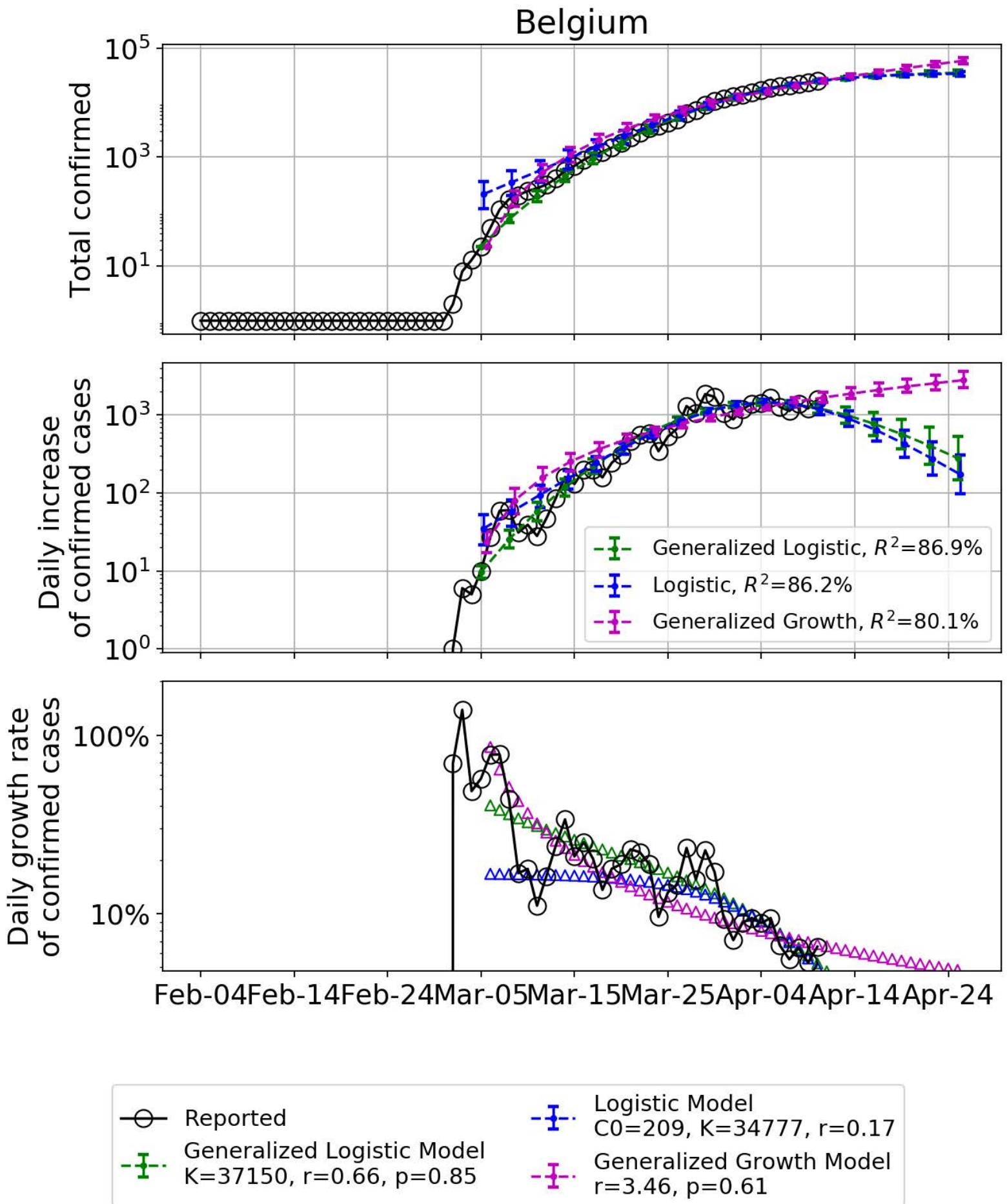

Germany
Total confirmed
Daily increase of confirmed cases
Daily growth rate of confirmed cases
Generalized Logistic, R^2=92.5%
Logistic, R^2=90.8%
Generalized Growth, R^2=79.9%
100%
10%
Feb-24
Mar-05
Mar-15
Mar-25
Apr-04
Apr-14
Apr-24
Reported
Generalized Logistic Model
K=151607, r=0.79, p=0.85
Logistic Model
C0=259, K=132508, r=0.18
Generalized Growth Model
r=6.84, p=0.59

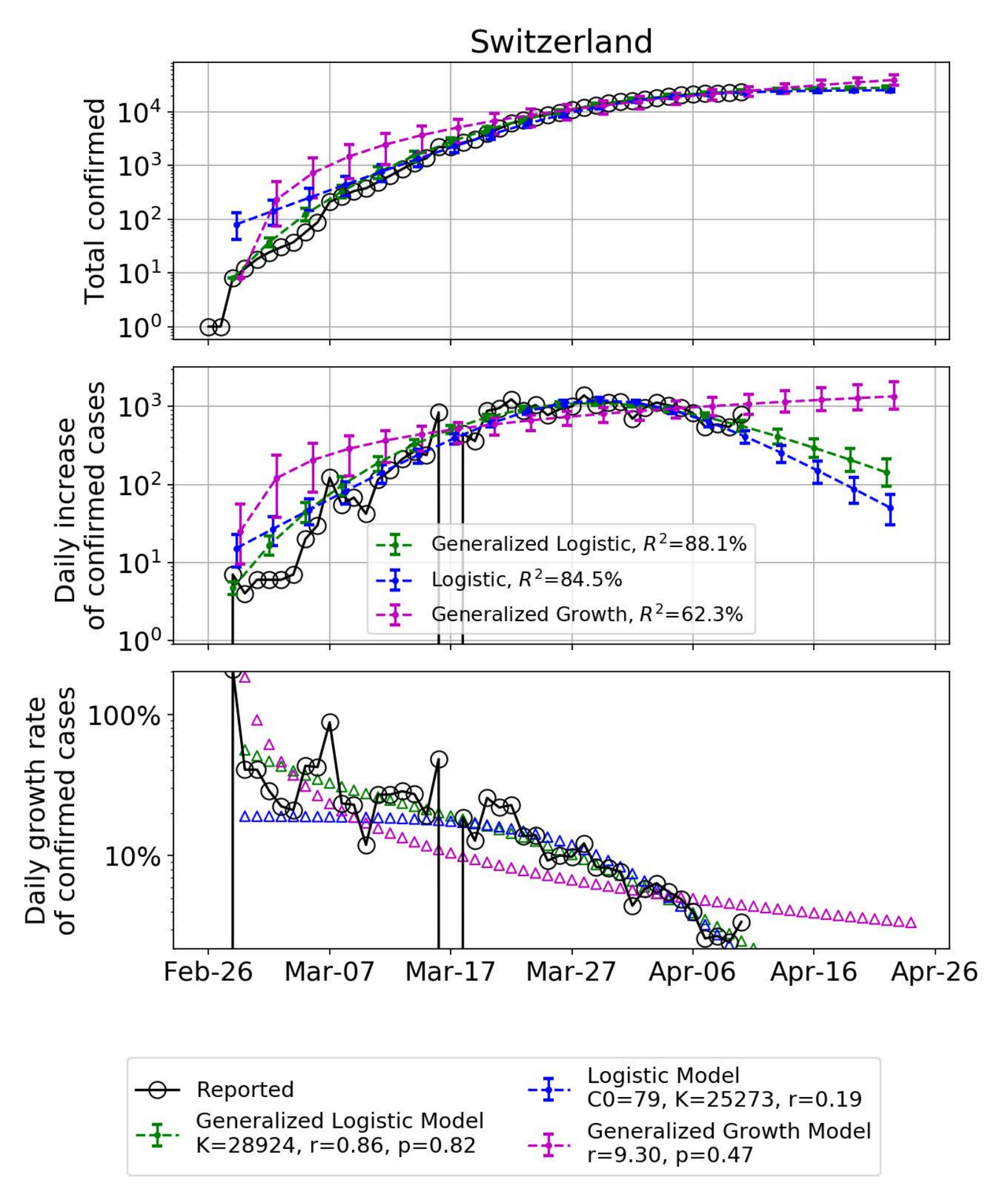

France
Total confirmed
Daily increase of confirmed cases
Daily growth rate of confirmed cases
Generalized Logistic, R^2=81.6%
Logistic, R^2=80.9%
Generalized Growth, R^2=72.5%
100%
10%
Jan-25
Feb-14
Mar-05
Mar-25
Apr-14
Reported
Generalized Logistic Model
K=115349, r=0.68, p=0.86
Logistic Model
C0=169, K=102142, r=0.18
Generalized Growth Model
r=5.18, p=0.60

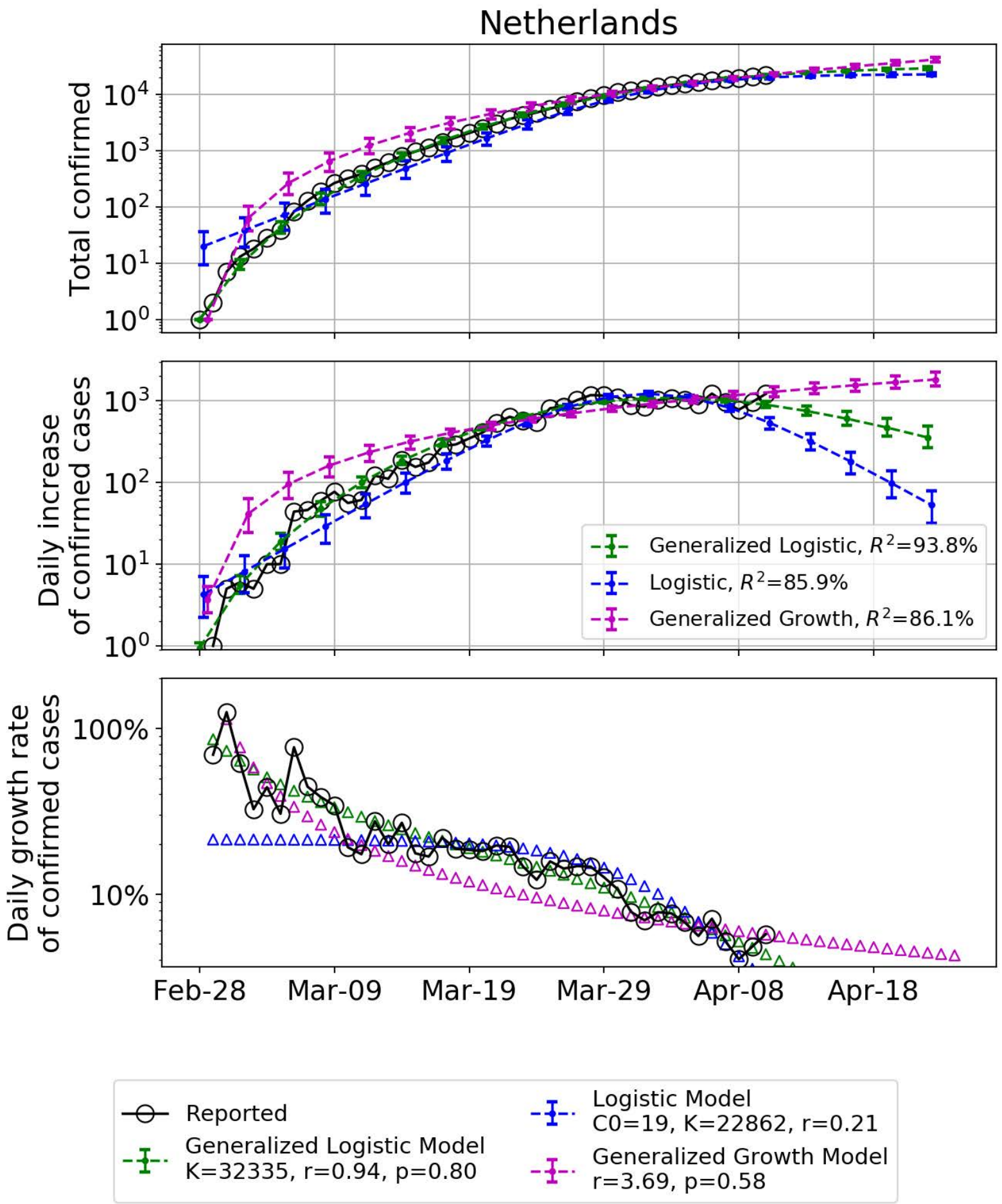

Iran
Total confirmed
10^5
10^4
10^3
10^2
10^1
Daily increase of confirmed cases
10^3
10^2
10^1
10^0
Generalized Logistic, R^2=83.6%
Logistic, R^2=82.8%
Generalized Growth, R^2=79.4%
Daily growth rate of confirmed cases
100%
10%
Feb-20
Mar-01
Mar-11
Mar-21
Mar-31
Apr-10
Apr-20
Reported
Generalized Logistic Model
K=99087, r=1.14, p=0.78
Logistic Model
C0=49, K=67111, r=0.18
Generalized Growth Model
r=7.49, p=0.54

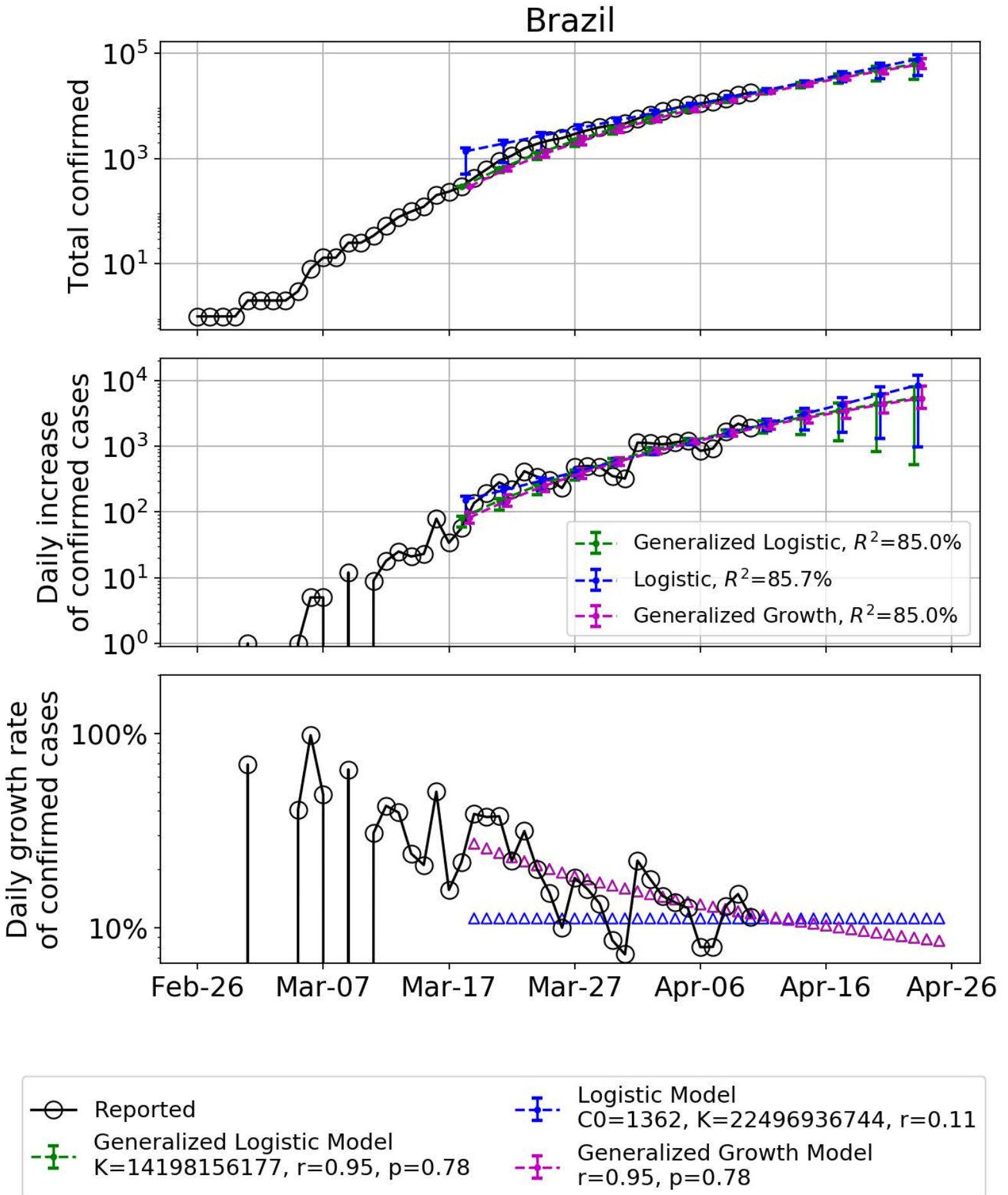

United Kingdom
Total confirmed
Daily increase of confirmed cases
Daily growth rate of confirmed cases
Generalized Logistic, R^2=94.9%
Logistic, R^2=94.9%
Generalized Growth, R^2=91.3%
Jan-31
Feb-20
Mar-11
Mar-31
Apr-20
Reported
Generalized Logistic Model
K=106352, r=0.36, p=0.93
Logistic Model
C0=77, K=101677, r=0.18
Generalized Growth Model
r=1.29, p=0.75

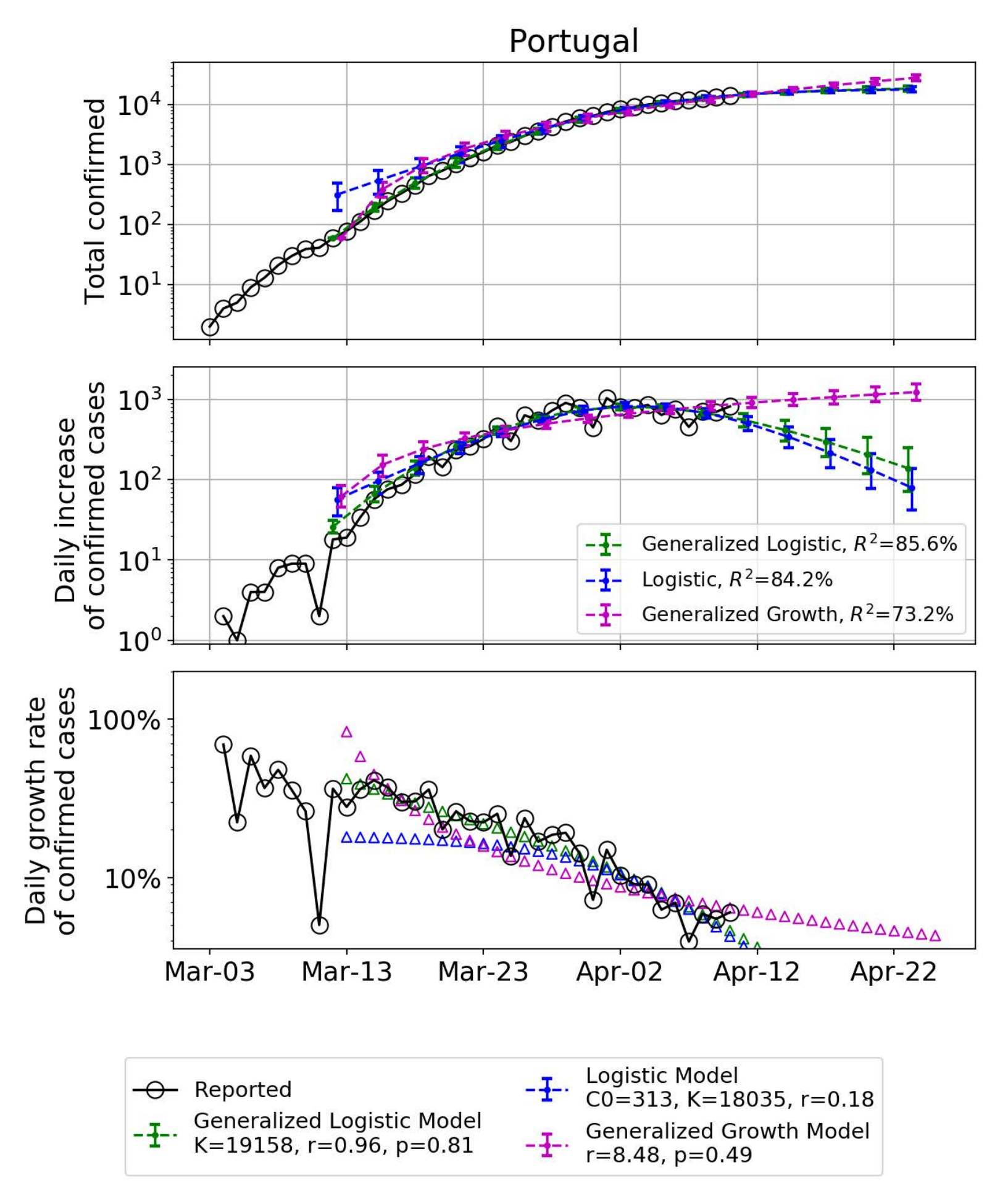

Turkey
Total confirmed
Daily increase of confirmed cases
Daily growth rate of confirmed cases
Generalized Logistic, R^2=96.2%
Logistic, R^2=91.4%
Generalized Growth, R^2=95.8%
100%
10%
Mar-12
Mar-22
Apr-01
Apr-11
Apr-21
Reported
Generalized Logistic Model
K=168716, r=2.89, p=0.71
Logistic Model
C0=179, K=60466, r=0.25
Generalized Growth Model
r=4.67, p=0.64

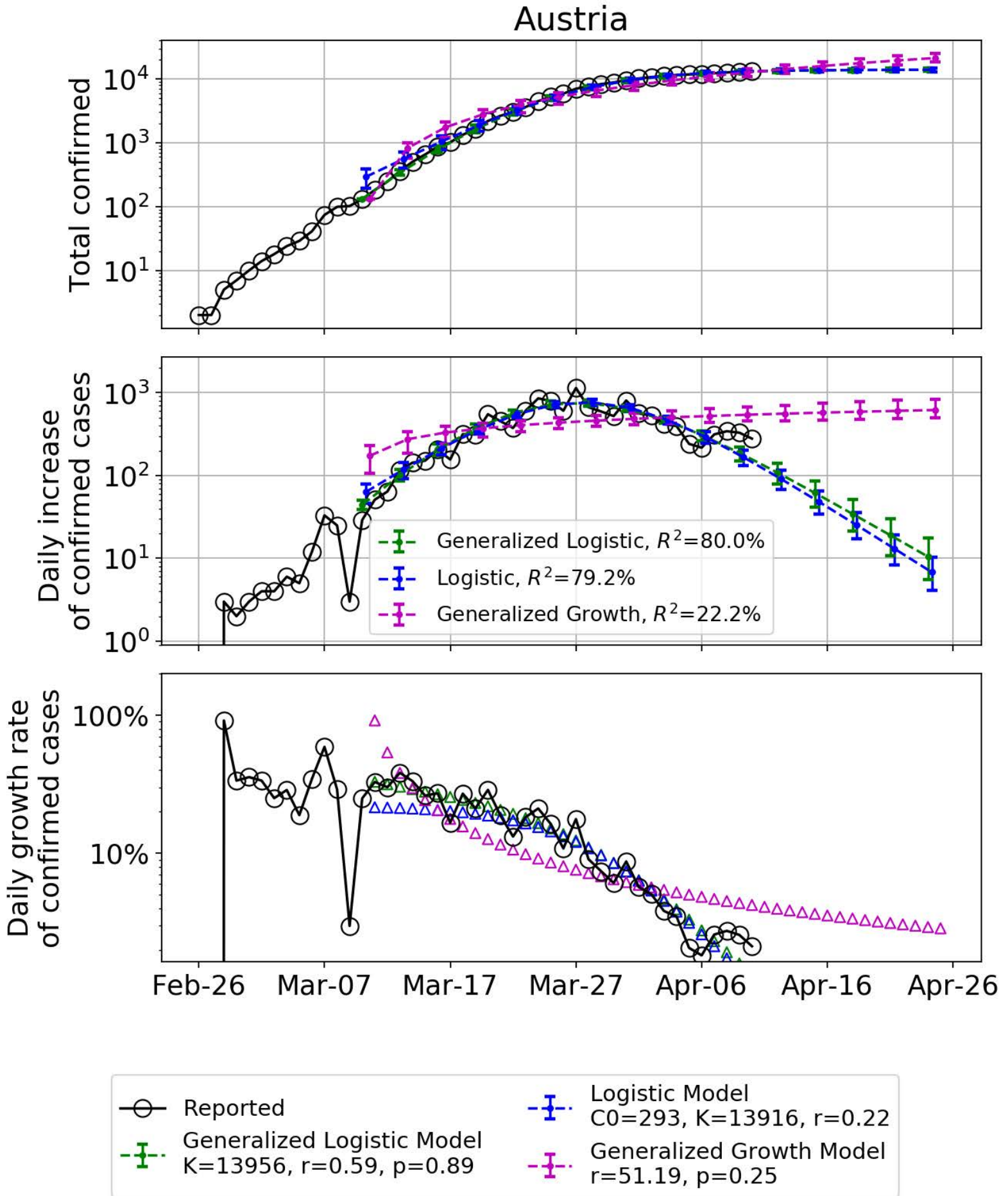

Belgium
Total confirmed
Daily increase of confirmed cases
Daily growth rate of confirmed cases
Generalized Logistic, R^2=86.9%
Logistic, R^2=86.2%
Generalized Growth, R^2=80.1%
Feb-04
Feb-14
Feb-24
Mar-05
Mar-15
Mar-25
Apr-04
Apr-14
Apr-24
Reported
Generalized Logistic Model
K=37150, r=0.66, p=0.85
Logistic Model
C0=209, K=34777, r=0.17
Generalized Growth Model
r=3.46, p=0.61

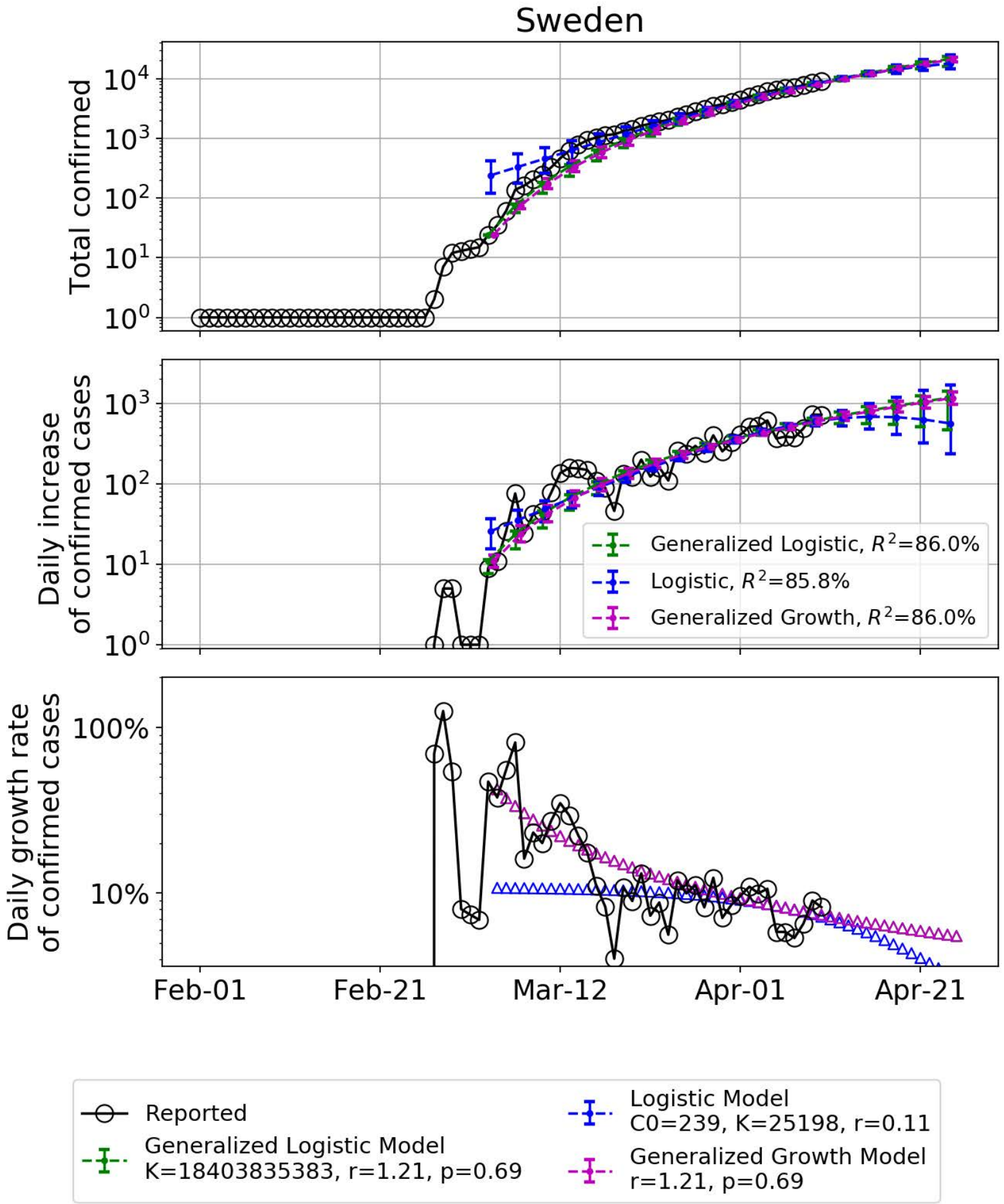

Switzerland
Total confirmed
Daily increase of confirmed cases
Daily growth rate of confirmed cases
Generalized Logistic, R^2=88.1%
Logistic, R^2=84.5%
Generalized Growth, R^2=62.3%
100%
10%
Feb-26
Mar-07
Mar-17
Mar-27
Apr-06
Apr-16
Apr-26
Reported
Generalized Logistic Model
K=28924, r=0.86, p=0.82
Logistic Model
C0=79, K=25273, r=0.19
Generalized Growth Model
r=9.30, p=0.47

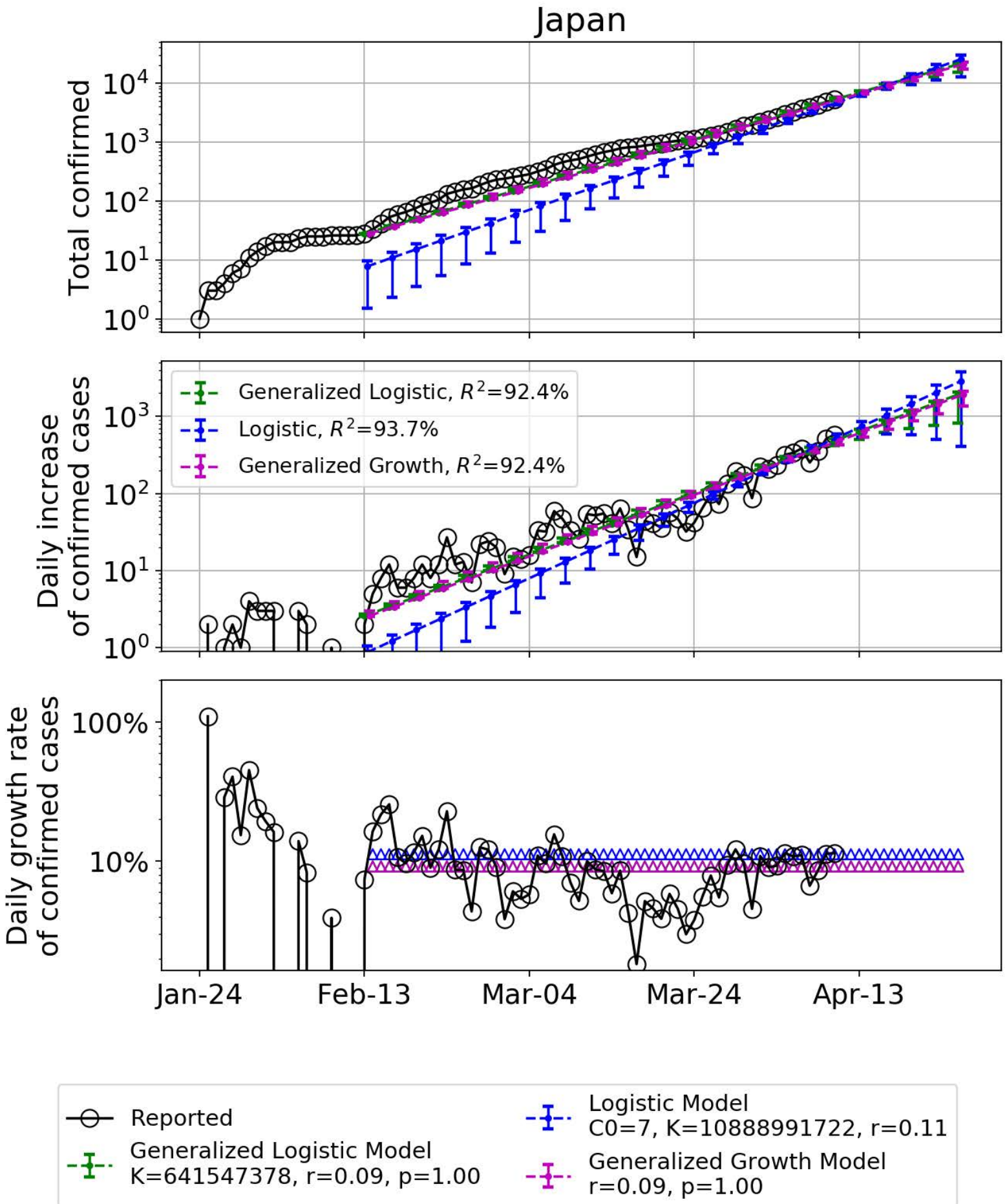

Netherlands
Total confirmed
Daily increase of confirmed cases
Daily growth rate of confirmed cases
Generalized Logistic, R^2=93.8%
Logistic, R^2=85.9%
Generalized Growth, R^2=86.1%
100%
10%
Feb-28
Mar-09
Mar-19
Mar-29
Apr-08
Apr-18
Reported
Generalized Logistic Model
K=32335, r=0.94, p=0.80
Logistic Model
C0=19, K=22862, r=0.21
Generalized Growth Model
r=3.69, p=0.58


Brazil
Total confirmed
Daily increase of confirmed cases
Daily growth rate of confirmed cases
Generalized Logistic, R^2=85.0%
Logistic, R^2=85.7%
Generalized Growth, R^2=85.0%
Feb-26
Mar-07
Mar-17
Mar-27
Apr-06
Apr-16
Apr-26
Reported
Generalized Logistic Model
K=14198156177, r=0.95, p=0.78
Logistic Model
C0=1362, K=22496936744, r=0.11
Generalized Growth Model
r=0.95, p=0.78


Portugal
Total confirmed
10^4
10^3
10^2
10^1
Daily increase of confirmed cases
10^3
10^2
10^1
10^0
Generalized Logistic, R^2=85.6%
Logistic, R^2=84.2%
Generalized Growth, R^2=73.2%
Daily growth rate of confirmed cases
100%
10%
Mar-03
Mar-13
Mar-23
Apr-02
Apr-12
Apr-22
Reported
Generalized Logistic Model
K=19158, r=0.96, p=0.81
Logistic Model
C0=313, K=18035, r=0.18
Generalized Growth Model
r=8.48, p=0.49


Austria
Total confirmed
Daily increase of confirmed cases
Daily growth rate of confirmed cases
Generalized Logistic, R^2=80.0%
Logistic, R^2=79.2%
Generalized Growth, R^2=22.2%
Feb-26
Mar-07
Mar-17
Mar-27
Apr-06
Apr-16
Apr-26
Reported
Generalized Logistic Model
K=13956, r=0.59, p=0.89
Logistic Model
C0=293, K=13916, r=0.22
Generalized Growth Model
r=51.19, p=0.25


Sweden
Total confirmed
Daily increase of confirmed cases
Daily growth rate of confirmed cases
Generalized Logistic, R^2=86.0%
Logistic, R^2=85.8%
Generalized Growth, R^2=86.0%
100%
10%
Feb-01
Feb-21
Mar-12
Apr-01
Apr-21
Reported
Generalized Logistic Model
K=18403835383, r=1.21, p=0.69
Logistic Model
C0=239, K=25198, r=0.11
Generalized Growth Model
r=1.21, p=0.69


Japan
Total confirmed
10^4
10^3
10^2
10^1
10^0
Daily increase of confirmed cases
Generalized Logistic, R^2=92.4%
Logistic, R^2=93.7%
Generalized Growth, R^2=92.4%
Daily growth rate of confirmed cases
100%
10%
Jan-24
Feb-13
Mar-04
Mar-24
Apr-13
Reported
Generalized Logistic Model
K=641547378, r=0.09, p=1.00
Logistic Model
C0=7, K=10888991722, r=0.11
Generalized Growth Model
r=0.09, p=1.00