Covid-19 in Germany

Explaining the past, projecting the future and understanding public health measures

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April 2020
1. Introduction
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- How can we understand its spread up to today?
- What do we expect for the future?
- What are the effects of public health measures?
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Talk consists of two parts

- Spread up to today
  (and what this tells us about public health)
- What we expect for the future
  (and what this will tell us about public health)
2. The spread up to today

There are three (regulatory) phases:

- Unrestricted spread before 13 March 2020
- Social restrictions and restrictions on firms as of 16/17 March
- Partial exit as of 20 April (relatively heterogeneous across Federal States)

Do we see effects of public health measures?

- Purely statistical approach (search for structural breaks)
- Model based approach (extension of epidemiological SIR models)
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2.1 Statistical approach

Public health measures (regulatory phases)
- 16 March onwards: no schooling, no major sports events
- 22 March onwards: no restaurants, theaters, public sports facilities

Effects should be visible one week later due to incubation period and contacting a doctor and testing

Hypotheses
- Hypothesis 1: Measures of 16 March are visible around one week later
- Hypothesis 2: Measures of 22 March are visible one week later as well
2. The spread up to today

2.1 Statistical approach

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2.1 Statistical approach

- Statistical findings

![Graph of reported infections](image)

**Figure 1**: Number of reported infections (logarithmic scale on right) (Donsimoni et al., 2020, PWP, Hartl et al., 2020, Covid-Econ)
2. The spread up to today

2.1 Statistical approach

- Statistical findings

![Graph showing number of reported infections](image)

Figure 1: Number of reported infections (logarithmic scale on right) (Donsimoni et al., 2020, PWP, Hartl et al., 2020, Covid-Econ)

- Effects are visible one week after policy measures
- Three to four Covid-19 phases
- Public health measures were successful in reducing the number of reported infections
2. The spread up to today

2.2 Model based approach
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2.2 Model based approach

- Extend existing SIR models to cover Covid-19 specificities
- Calibrate/estimate parameters of model using RKI data
- Two assumptions: share of hidden infections and long-run infection rates
2. The spread up to today

2.2 Model based approach

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- Calibrate/estimate parameters of model using RKI data
- Two assumptions: share of hidden infections and long-run infection rates
- The model (graphically speaking)

![Extended SIR Model for Covid-19](Donsimoni et al., 2020, GER)

Figure 2: An extended SIR model for Covid-19 (Donsimoni et al., 2020, GER)
2. The spread up to today

2.2 Model based approach

Figure 3: The quality of the fit for incidences (left) and total incidences (right) (Donsimoni et al., 2020, PWP and submit)
2. The spread up to today

2.3 Summary

What have we learned?

Growth rates of number of reported infected has clear kinks

Kinks can be explained by public health measures

Public health measures significantly reduced increase in reported infections

Model based analysis confirms and illustrates more clearly the positive effect of public health measures shows implications of standard assumption in virology and epidemiology illustrates what would have happened without interventions
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  - illustrates what would have happened without interventions
3. What we expect for the future

3.1 Starting point

We are/were/still are in a relatively stable regime
relatively constant rules since 15 March
relative acceptance by population
purely statistical evidence confirms this
(fewer assumptions than with mathematical model)

Let us assume we could stay in this regime for another month or two
What would happen?

This is our reference scenario for evaluating relaxed restrictions of
social contacts (RSC)

Klaus Wälde (Johannes-Gutenberg University Mainz CESifo and Visiting Research Fellow at IZA)

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Figure 4: Where Germany would end up if RSC were upheld: Observations (dots), prediction (red) and confidence band (green) (Donsimoni et al., 2020, PWP)
3. What we expect for the future

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Figure 5: Where Federal States would end up (number of infected per 100,000 inhabitants)
(Donsimoni et al., 2020, PWP)
3. What we expect for the future

3.3 The effect of relaxing restrictions of social contacts
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- A model-based illustration

Figure 6: The unrestricted regime (red), restriction of social contacts (RSC) between 15 March and 20 April (yellow) and potential effects as of 27 April (green) (Donsimoni et al., 2020, PWP and submit)
3. What we expect for the future

3.3 The effect of relaxing restrictions of social contacts

- The econometric approach (future work)
  - Diff-in-diff in spatial regression setup (Prof. Reinhold Kosfeld, Kassel)
  - Learn from differences across Federal States
  - Understand which policy measures (schools, shops, masks ...) are most useful/ most harmful for keeping infection numbers low
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- Picture of the day

Figure 7: Incidences (by report date) from RKI 22. April 1 p.m.
(last bar Tuesday 21 April, arrows indicate Mondays)
4. Summary

Quo vadis CoV2?
Leaves us alone (simple statistical view based on "picture of the day")
Comes back next week (view based on virologists' and epidemiologists' view as captured in model)?
We need to wait and see ...

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Thank you!
More information on our Covid-19 research is available at

- https://www.macro.economics.uni-mainz.de/corona-blog/  
  (General public / student information in German)
- https://www.macro.economics.uni-mainz.de/klaus-waelde/ongoing-work-and-publications/  
  (Covid-19 research papers)
even more hope?

Figure 8: Number of reported sick by RKI (22 April, 5 p.m.) by date of first symptoms