The Long Shadow of an Infection: COVID-19 and Performance at Work

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Summary

We use

- Highly granular data from professional mens' soccer in Germany and Italy to study infections as a natural experiment

We apply

- A Difference-in-Differences (DiD) setting to estimate causal effects of a COVID-19 infection on performance at the workplace

We find

- Persistent negative effects at the intensive margin
- → Performance (measured by # passes) is ∼ 5% lower even 6 months after being recovered and back on the field
- This is different to other injuries and respiratory infections

Data

- Player and match data from 'Opta Sports' – main data provider for many European leagues
- Countries: Germany (1. Bundesliga) and Italy (Serie A)
- Seasons: 2019/2020 and 2020/2021 (begin in late summer, end in late spring)
- COVID-19 infections: Meticulous analysis of newspapers online
- 257 infections announced – 233 players identified (coverage > 90%). 1,406 players in total
- Infection data uses announcement as infection date
  → reliable measure as clubs tested several times a week
- Data on injuries and infections of players obtained from `transfermarkt.de`, one of the world's largest platforms for such data
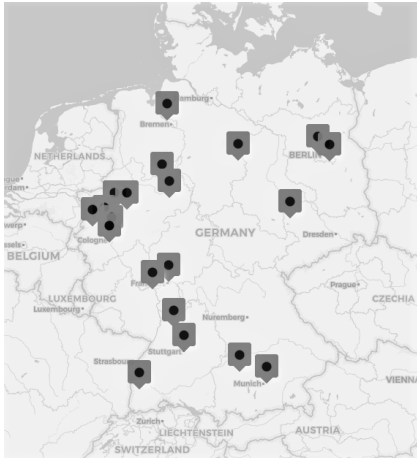
Setting
7 day Incidences in Germany and Italy

Infections of Players and General Incidences in Germany

Infections of Players and General Incidences in Italy
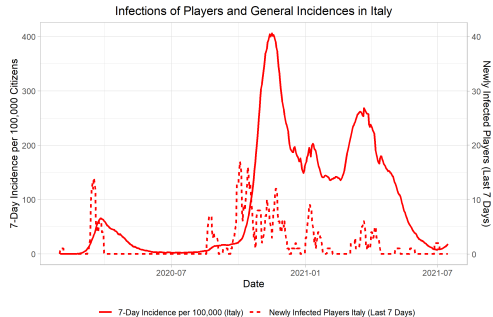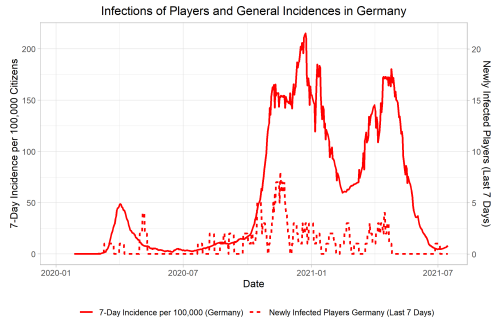
Setting

Locations of the Soccer Clubs

- Sports: Occupation with low confounding of individual productivity
- Productivity hard to measure
- In soccer: A function of various health aspects; mainly physical measures: acceleration, condition, and endurance, but also the cognitive capability
$\Rightarrow$ Main measure of performance: #passes $\rightarrow$ related to all productivity drivers
- Robustness checks with #touches and possessions.
- Mechanism:
  COVID-19: Shock to the underlying health aspects $\rightarrow$ deterioration in performance

Empirical Strategy
Econometric Estimation

- Apply Difference-in-Differences setting for causal inference:
  - Compare pre- and post-infection outcomes with not-infected players
  - Identification via COVID-19 infections as unanticipated exogenous shock

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- Two different estimation types
  - Basic DiD setting:

$$\text{Performance}_{pm} = \beta \, \text{Post-Infection}_{pm} + X'_{pm}\gamma + Z'\zeta + \epsilon_{pm} \qquad (1)$$

  - Event Study setting:

$$\text{Performance}_{pm} = \sum_{\tau = \underline{k}, \tau \neq 0}^{\bar{k}} \beta_\tau \, \text{Post-Infection}_{pm,\tau} + X'_{pm}\gamma + Z'\zeta + \epsilon_{pm} \qquad (2)$$

  - X_{pm}: Covariates ζ: Fixed Effects ϵ_{pm}: Idiosyncratic error term

Empirical Strategy
Econometric Estimation cont'd

- *Fixed Effects:* Player, team-season, opponent-season, matchday & Fixed Effect capturing variation before and after the break in spring 2020
- *Covariates:* Minutes played, Minutes played squared, age, home/away game, ghost game
- DiD estimation: Two way Fixed Effects
- No double 'treatment' of players in our dataset

Extensive Margin: Likelihood to Play & Minutes Played
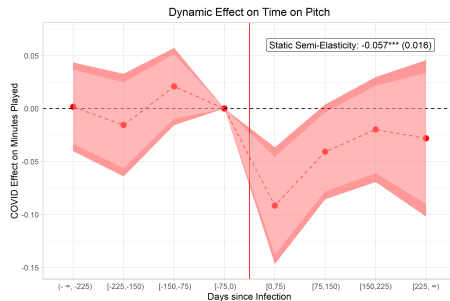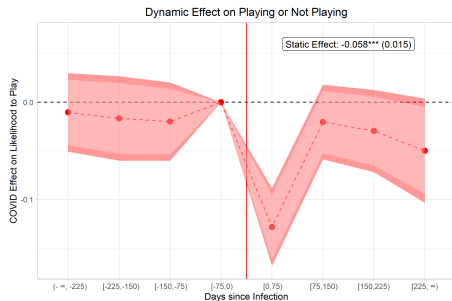
COVID-19 effect on the likelihood to play (LHS) and minutes played (RHS)
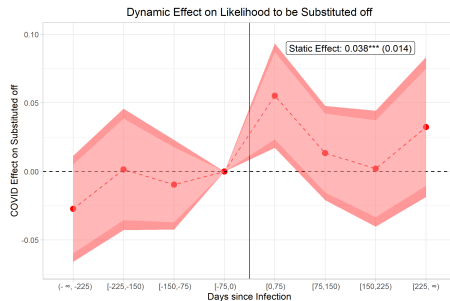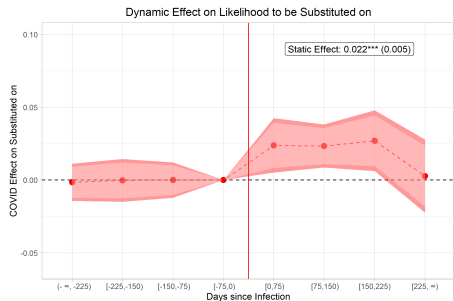
COVID-19 effect on being substituted *on* (LHS) or *off* (RHS) the pitch

Extensive Margin: Takeaways

- Increasing likelihood to be substituted on and off
- Players on average play for a shorter time
$\rightarrow$ Insufficient fitness to participate for 90 minutes?
- Extensive margin findings indicate a return to initial levels over time
$\rightarrow$ No persistent effects

Intensive Margin

How do recovered players perform conditional on being on the pitch?

Dynamic Effect on Pass Performance
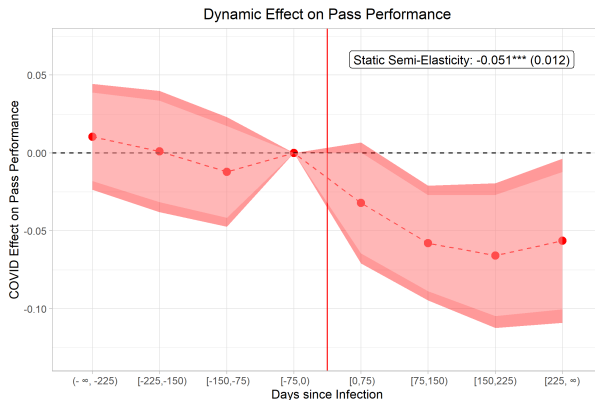
Static effect of -5.1% significant for $p < 0.01$, dynamic effect persistent Robustness

Effect Heterogeneity

The negative effect of an infection on performance varies across dimensions, e.g.: age (LHS) and length of the rest break between two matches (RHS)

Age Heterogeneity and COVID Effects

Rest Break Heterogeneity and COVID Effects
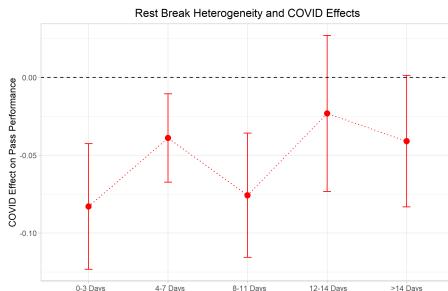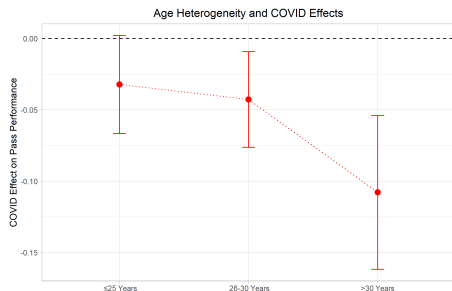
# Comparison to other Injuries

What if we discuss a phenomenon that is typical for injuries and other types of infections?
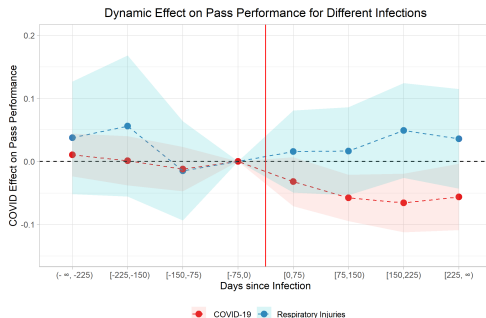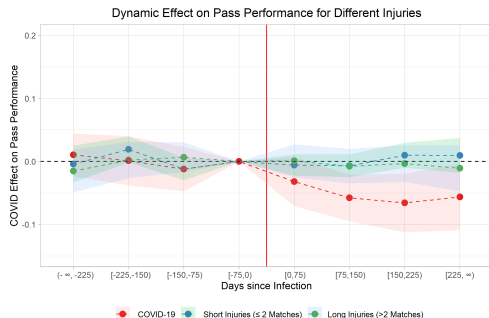
Injuries and respiratory infections do not show the same or similar pattern
→ Persistent effects unique to COVID-19

Within Match Performance Effects

Due to the granularity of our data, we can go into even more detail:

COVID Effect on Within-Match Passing
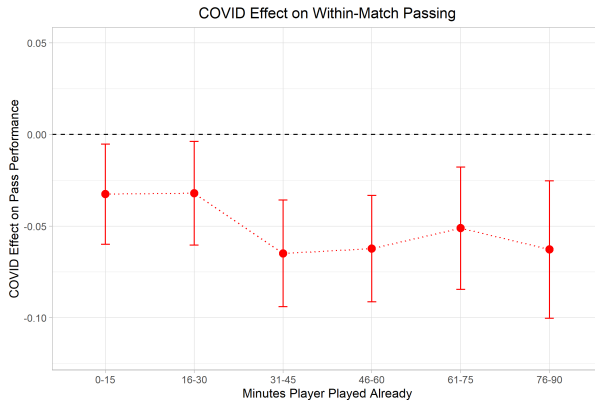
Team Spillovers

Soccer is a discipline played in teams – as most of the jobs. Less performance by one recovered player could have two spillover effects:

↗ Teammates (over)compensate the decrease in individual performance

↘ Teammates suffer from the decrease in individual performance

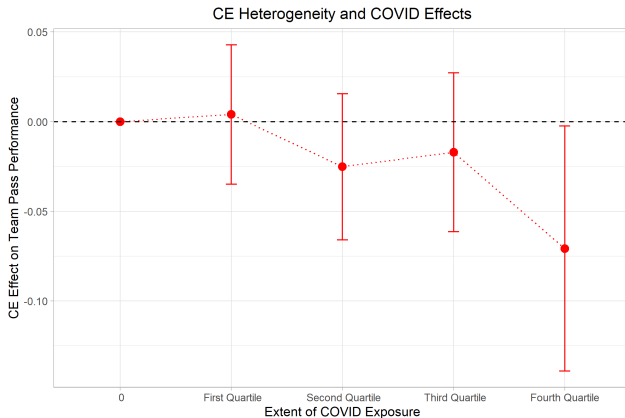Measurement: 'Covid Exposure' (CE) as share of recovered players of a team:

$$CE_{tm} = \frac{\sum_{p \in t} \text{Post-Infection}_{pm}}{\#\text{Players}_{tm}} \tag{3}$$

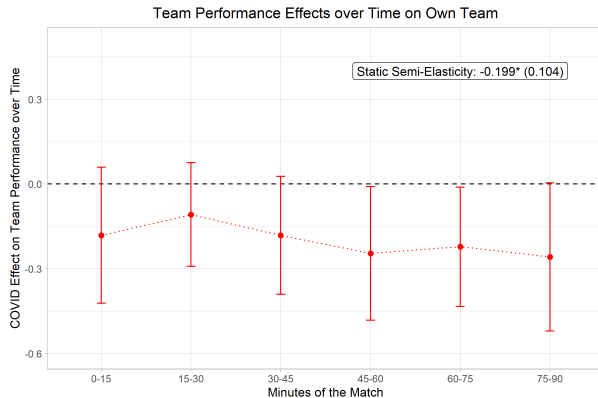→ Captures also extensive margin effects

Team Spillovers cont'd

Splitting 'Covid Exposure' in four quartiles
Significant deterioration by $\sim 7\%$ in the fourth quartile $\in [0.241, 1]$ with mean 0.352

CE Heterogeneity and COVID Effects

Within-Match Performance: Team Level

Static Semi-Elasticity: 0.199 (for $\Delta CE = 1$), significant only on 10% level.

Conclusion

What is the effect of a COVID-19 infection on performance of soccer players?

- Temporary effects on the extensive margin $\rightarrow$ not surprising due to convalescence and quarantine obligations
- Significant and persistent deterioration on the intensive margin
  - Static DiD effect of -5.1%, persistent over more than 6 months
  - Heterogeneous effects for age and rest breaks
  - Findings are robust to variations in performance measures
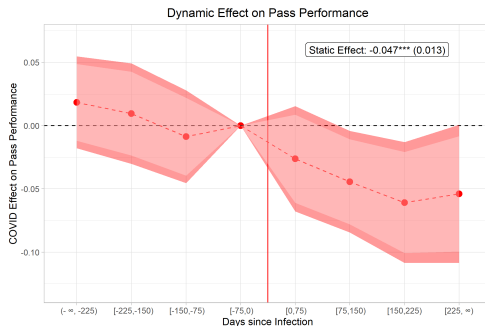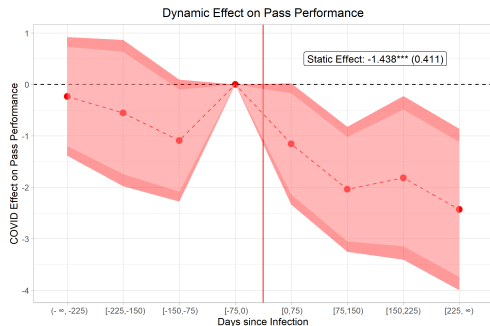- Negative spillover effects might be a hint that we underestimate the true effect size
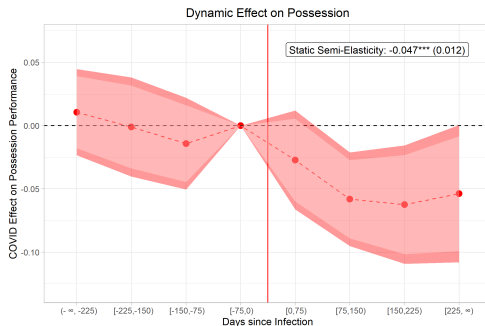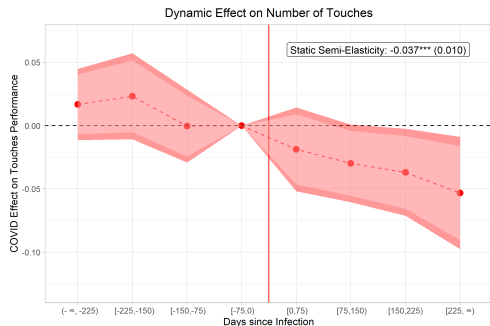
Touches (LHS) and Possessions (RHS)

back

Appendix

Alternative Variable Specifications: Levels and Hyperbolic Sine Transformation

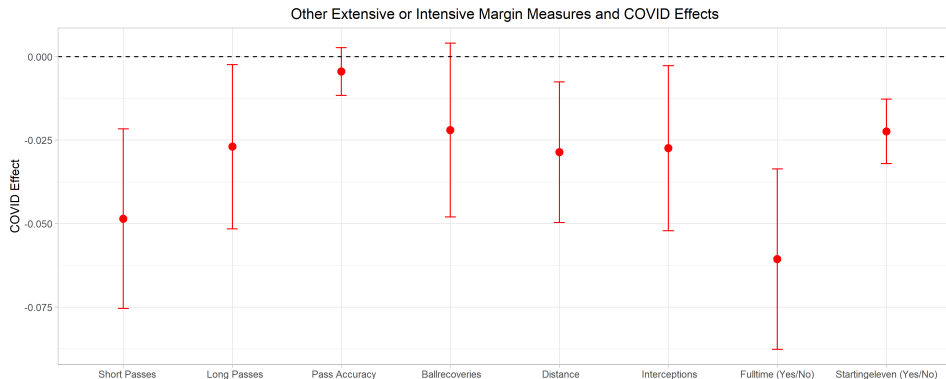Outcome in Levels (LHS) and as Hyperbolic Sine Transformation (RHS)

back

Other Extensive or Intensive Margin Measures and COVID Effects

Short Passes, Long Passes, Pass Accuracy, Ball recoveries, Distance, Interceptions,
Full-time (Y/N), Starting Eleven (Y/N)