Predicting Transfer Fees in Professional European Football Before and During COVID-19

Previous title: *Accuracy of a Prediction Model of Transfer Fees for European Soccer Players Traded during the COVID-19 Pandemic*

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European Football Transfer Market and Transfer Fees

Talented players are traded on the international market ($6 billion, FIFA 2021).

Transfer date		
Season 17/18 - Aug 3, 2017		
Barcelona	Neymar →	Paris SG
LaLiga	competition	Ligue 1
First Tier	League type	First Tier
Ernesto Valverde	Coach	Unai Emery
Pep Segura	Manager	Antero Henrique
Market value at time of transfer: $110.00m		
Age at time of transfer: 25 years 05 months 29 days		
Remaining contract duration at Barcelona: 03 Years 10 Months 27 Days (Jun 30, 2021)		
Fee: $244.20m		

***Industry*: FIFA 2022**: (Men's football)

- International transfers INCREASE
- Transfer fees DECREASE
- Back to pre-pandemic

***Academia*: Key determinants of transfer fees?**

Player characteristics
Age, height, remaining contract length

Player performance
Goals, minutes played, injury

Selling- and buying-club characteristics
Market size (spectators), performance

Other variables
Time effects

- How to make comparably accurate predictions?
- Did the COVID-19 affect the relevance and accuracy of common predictors?

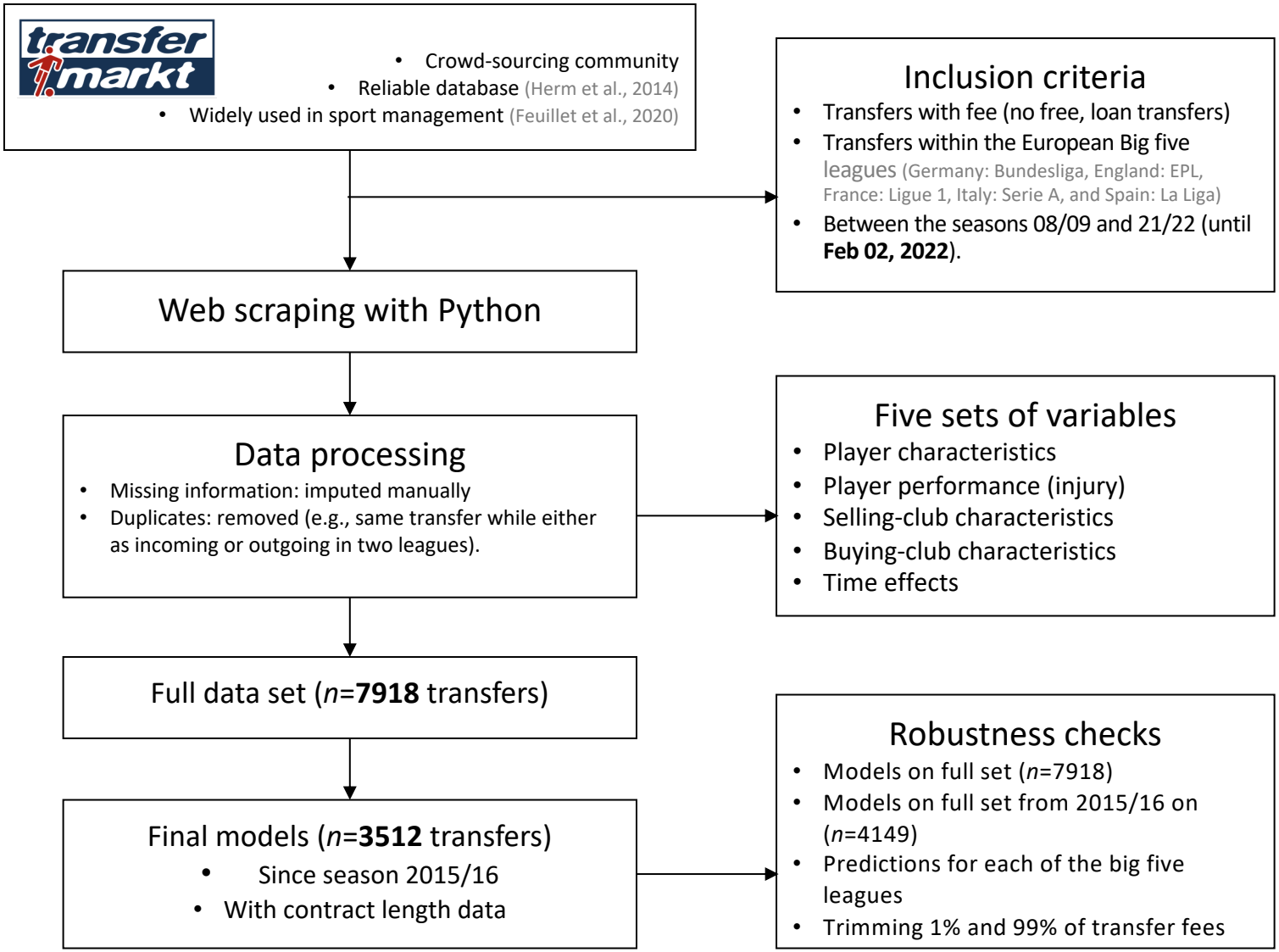
Literature: Determinants of Transfer Fees

Authors	Data: N; source	DV; analysis	Player characteristics	Player performance	Selling-club	Buying-club	Time effects
Carmichael & Thomas (1993)	N = 214; EPL; Season 1990/91; Football yearbook	Log (transfer fee); simple linear (OLS) regression	Age^2 (-)	Career games played (+)	Club goal difference (+); Club in first (+) or second division (+) compared to fourth; Club's league position last season (-)	Club's average attendance last season (+); Club goal difference (+); Club in first (+), second (+), or third division (+) compared to fourth; Clubs' league position last season (-)	NA
...	...	...	...	...	...	...	...
Coates & Parshakov (2021)	N = 3,324; Big five; Seasons 1996/97–2015/16; Transfermarkt + EA Sports	Transfer fee; simple linear (OLS) and quantile regressions	Market value (+); Age (+); Time left on current contract (+)	Goals per 1,000 minutes (+); Assists per 1,000 minutes (-); In national team (+); Market value * in national team (+); FIFA rating (+); In national team * FIFA rating (-)	NA	NA	NA

Gaps & Aims: To extend findings from earlier efforts exploring the factors associated with transfer fees:

- *Variables*: Enlarging the feature space (injury, contract duration)
- *Sample*: Analyzing a larger number of, and more recent transfers
- *Linearity*: Building models beyond linear functional forms (machine learning)
- *COVID-19*: Testing hypothesis that transfer market has changed during COVID-19

Sample


transfermarkt
• Crowd-sourcing community
• Reliable database (Herm et al., 2014)
• Widely used in sport management (Feuillet et al., 2020)
Inclusion criteria
• Transfers with fee (no free, loan transfers)
• Transfers within the European Big five leagues (Germany: Bundesliga, England: EPL, France: Ligue 1, Italy: Serie A, and Spain: La Liga)
• Between the seasons 08/09 and 21/22 (until **Feb 02, 2022**).
Web scraping with Python
Data processing
• Missing information: imputed manually
• Duplicates: removed (e.g., same transfer while either as incoming or outgoing in two leagues).
Five sets of variables
• Player characteristics
• Player performance (injury)
• Selling-club characteristics
• Buying-club characteristics
• Time effects
Full data set (*n*=**7918** transfers)
Final models (*n*=**3512** transfers)
• Since season 2015/16
• With contract length data
Robustness checks
• Models on full set (*n*=7918)
• Models on full set from 2015/16 on (*n*=4149)
• Predictions for each of the big five leagues
• Trimming 1% and 99% of transfer fees

Measures: List of Variables

1. Player characteristics

- Age
- Height
- Nationality: Europe, Asia, Africa, South America, North America
- Position: Defender, goalkeeper, attacker, midfielder
- Remaining contract length (days)

5. Time effects

- Season 08/09 – season 21/22
- Season 15/16 – season 21/22
- Transfer window (summer, winter)

3&4. Selling & buying club characteristics

- Arrivals of players
- Departures of players
- Transfer income
- Transfer expenditure
- Spectators
- UEFA club coefficients
- League ranking
- Leagues (13 types):
  - Premier League (other English leagues)
  - Ligue 1 (other French leagues)
  - Bundesliga (other German leagues)
  - Serie A (other Italian leagues)
  - La Liga (other Spanish leagues)
  - Other European leagues
  - South American leagues
  - Other non-European leagues

2. Player performance

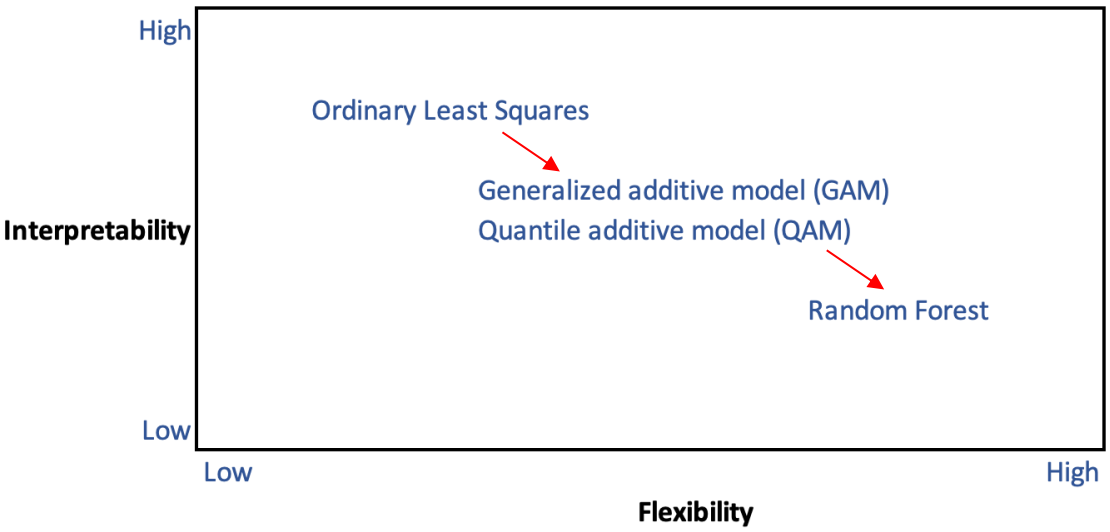
- UEFA Champions League
- Appearances
- Substitution on
- Substitution off
- Minutes played
- Points (/1000 MP)
- Goals (/1000 MP)
- Assists goal (/1000 MP)
- Yellow cards (/1000 MP)
- Player injury history: (Injury days/injury frequency)/age

***Note**. All variables refer to previous season or player career history*

Modelling

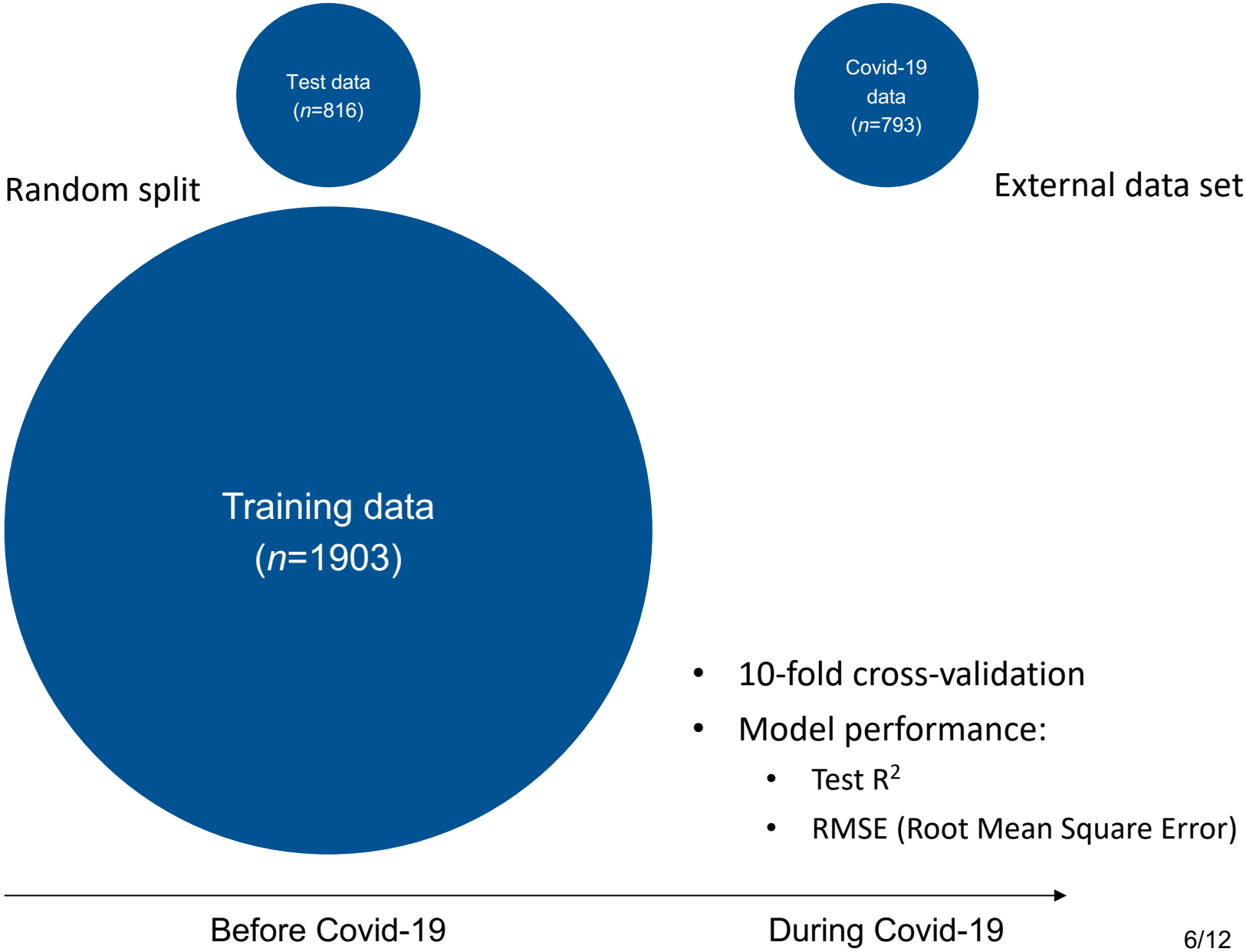
$$\text{Logged transfer fee} = \beta_0 + \beta_1*(\text{player characteristics}) + \beta_2*(\text{player performance}) + \beta_3*(\text{selling-club characteristics}) + \beta_4*(\text{buying-club characteristics}) + \beta_5*(\text{time effects}) + \varepsilon$$

Supervised machine learning framework



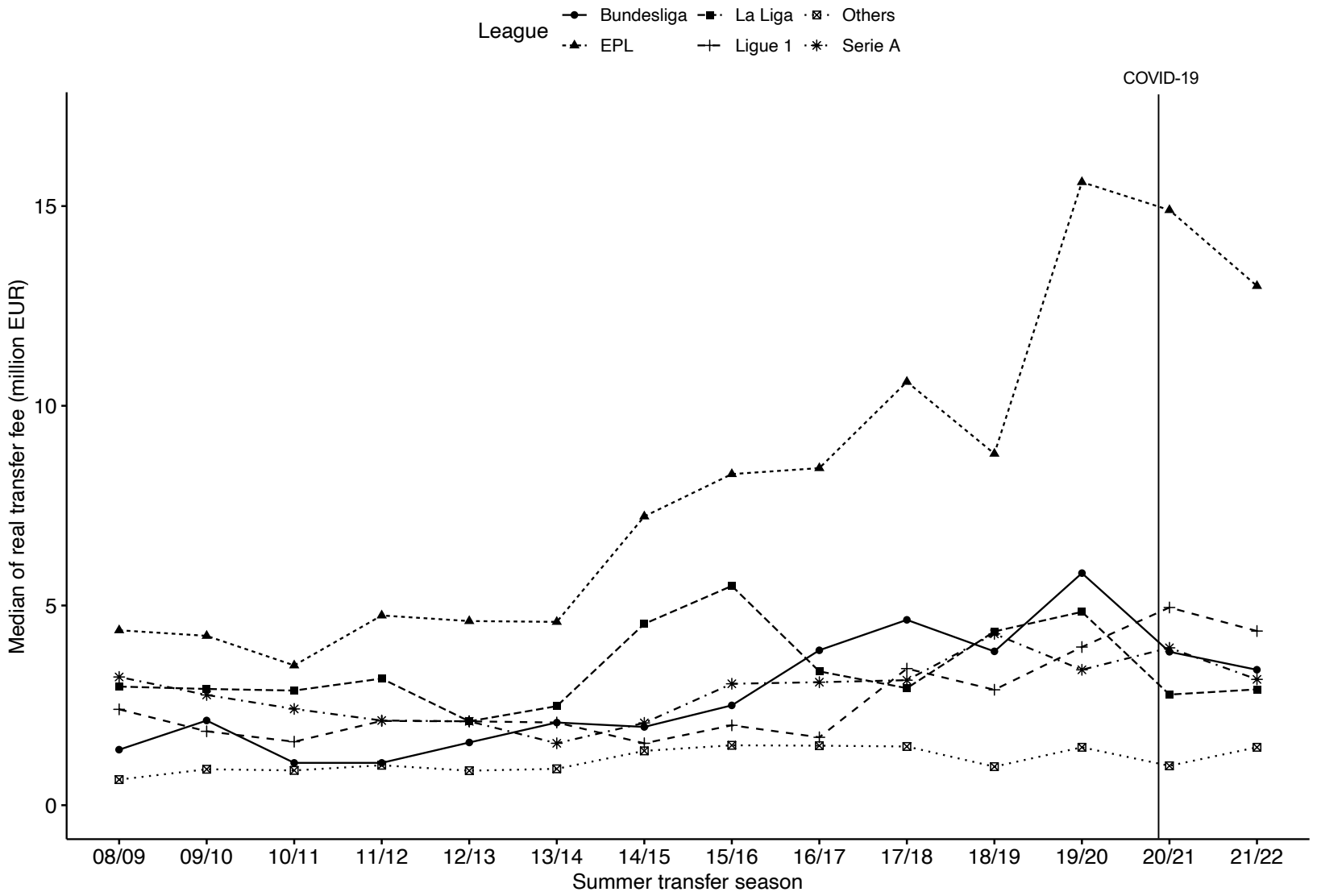
Serving the goal to go beyond linear functional forms (machine learning)

Data Splitting (n = 3512)



- 10-fold cross-validation
- Model performance:
  - Test R^2
  - RMSE (Root Mean Square Error)

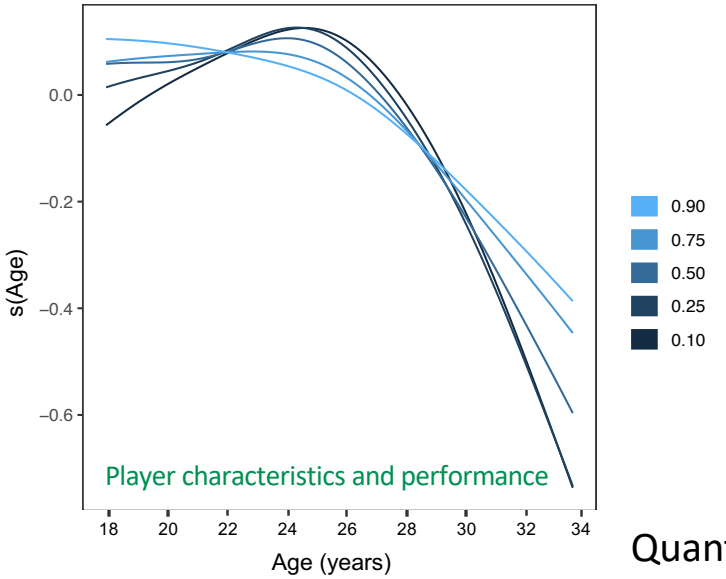
Descriptive: Trends of Median Transfer Fees (Summer)



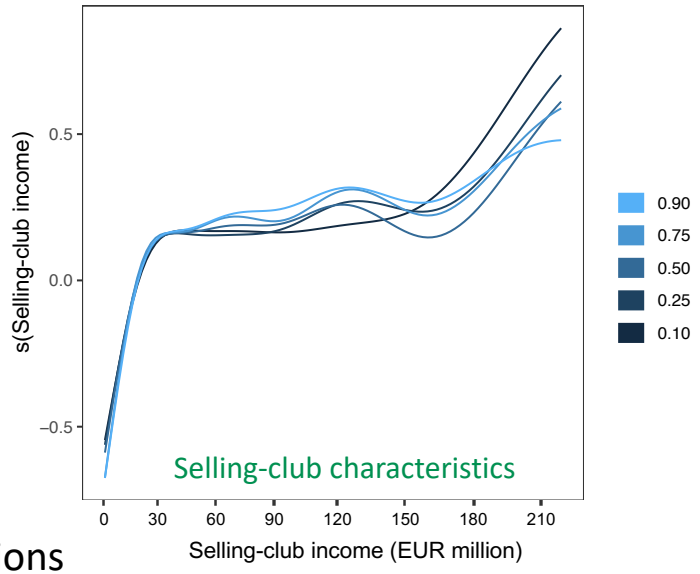
Note. Mean and SDs were calculated while not shown.

Quantile Additive Non-linear Effects of Predictors (3/9)

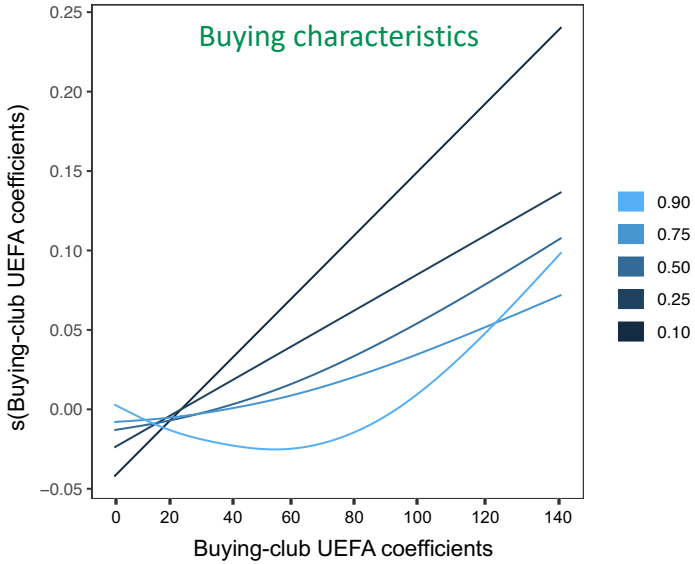
Precise non-linear relations



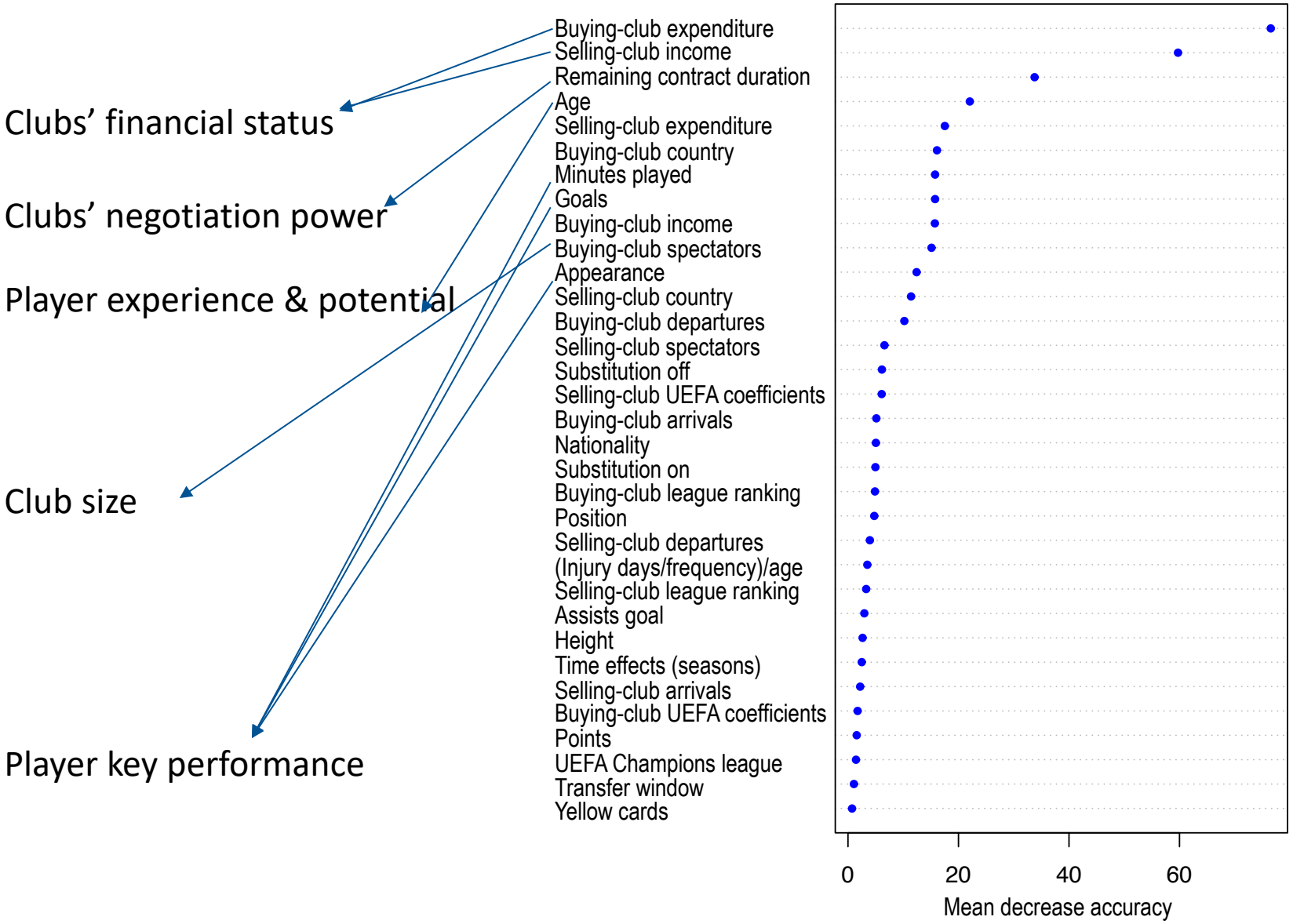
Positive yet decreasing margines



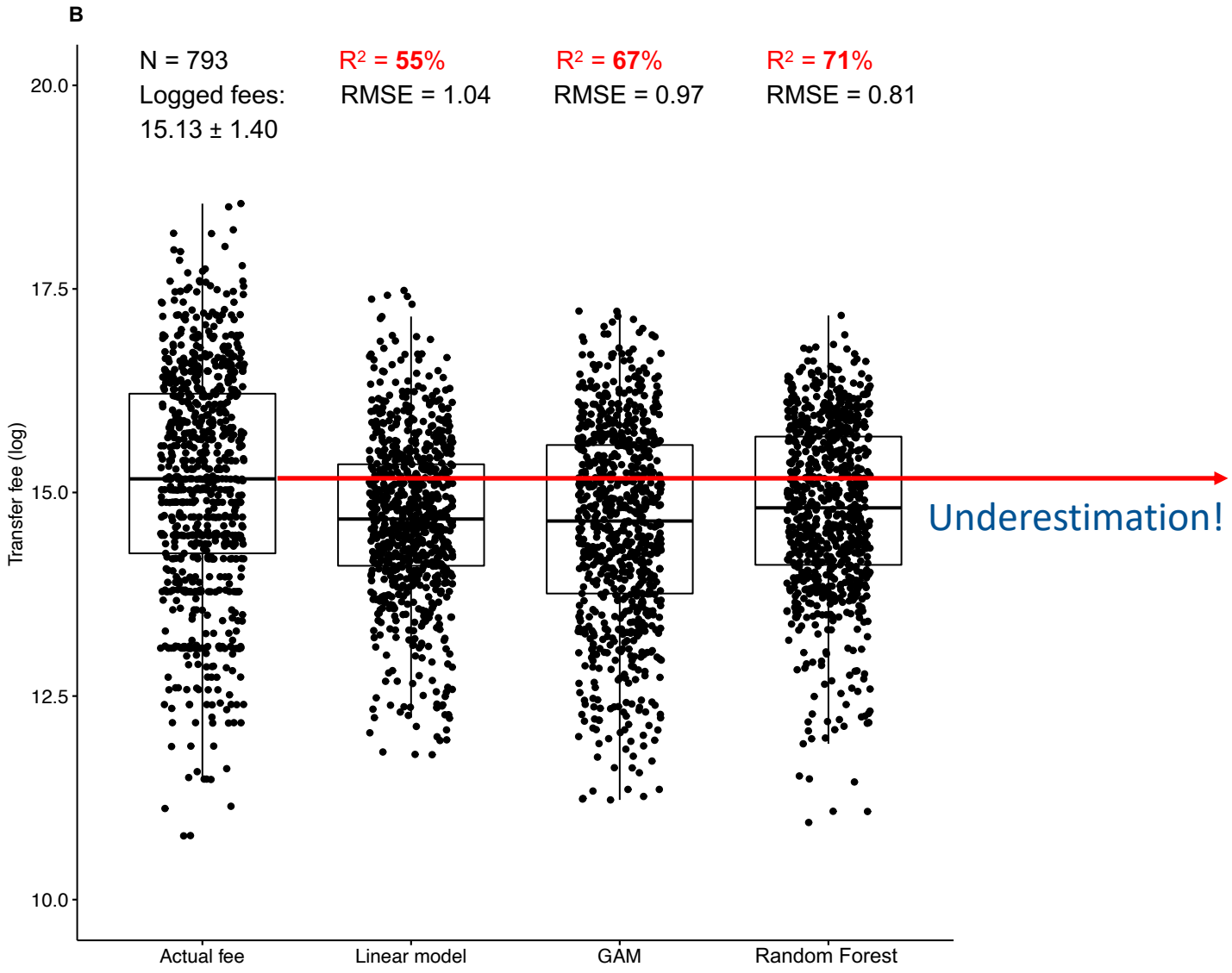
Quantile-dependent relations



Random Forest-based Variable Importances

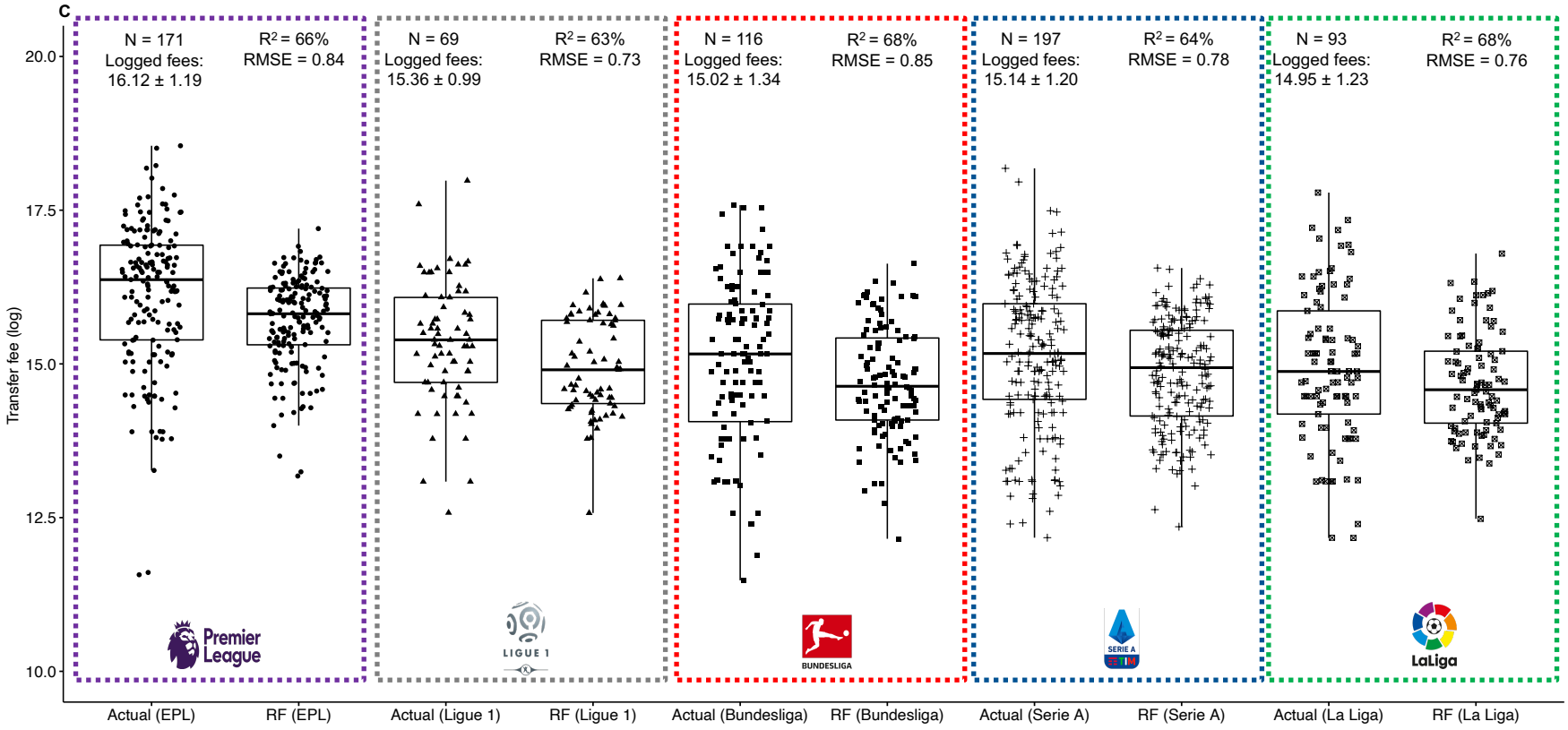


Predicted vs. Actual Transfer Fees During COVID-19



Note. Non-significant mean differences between predicted and actual fees

Robustness Checks: European Big Five Leagues



Underestimation: clubs paid *higher* transfer fees than predicted during COVID-19

We conducted a series of robustness checks (e.g., sample, contract length, trimming); our main findings remain.

Discussion

Contribution, Outlook, & Limitation:

- *Theoretically*: Moving beyond linearity is insightful:
  - Precise nonlinear relationships
  - Variable importance
  - Make predictions (vs. correlational)
- *Prediction*: No evidence of cooling-off effect of the transfer market during COVID-19
- Enlarging variable space was appropriate (e.g., Player injury history, Player remaining contract length; Club UEFA coefficients)

- *Outlook*: AI aiding decision making and predictions in football
- *Limitations*:
  - Causality
  - Sample selectivity & incomplete data

Thank you very much for your feedback!

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