Erasmus School of Economics

Job Matches and Mobility of High Wage Workers Across National Borders

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Assortative matching in labor market

- Complementarities between firms and workers in production

  + frictionless movement in labor market

  $\implies$ More productive workers at more productive firms

  = "positive assortative matching"

- Restrictions on free movement

  $\implies$ Welfare losses from 'mismatch'

- National border = friction

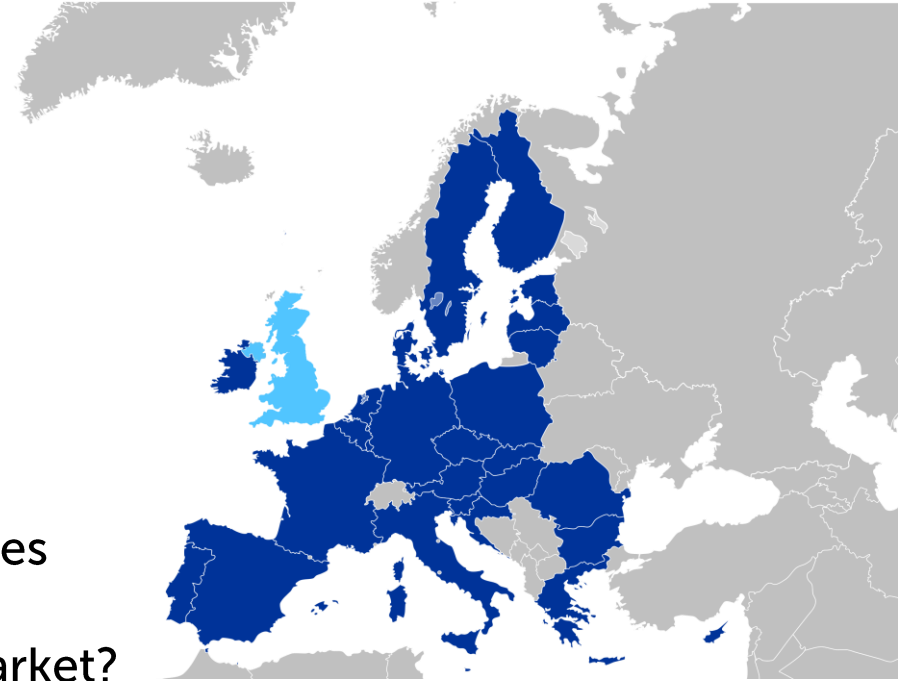 $\implies$ Large potential gains when workers move across borders

Labor market integration in Europe

- Gradually removing market frictions
  - 1957 Treaty of Rome: 4 freedoms
  - 1985 Schengen: end border control
  - 2002 Euro: monetary union
  - 2016: Brexit?

$\Rightarrow$ EEA: 530 million people in 32 countries

$\Rightarrow$ Is this a frictionless "unified" labor market?

Labor market integration in Europe

- National border reduces spatial correlation between neighboring regions

  Bartz & Fuchs-Schündeln (EER, 2012)

- Steep decline intra EEA-migration frictions since 1970

  Head & Mayer (JEP, 2021)

- Persistent trans-national differences in EU labor market outcomes

  Dorn & Zweimuller (JEP, 2021)

- Swiss migration reform solved high-skill worker shortage

  Beerli et al (AER, 2021)

$\Rightarrow$ Has integration caused assortative matching in high skilled labor market?

Our result and contribution

Our result:

Strong evidence assortative matching across European countries

- High stakes, high skilled environment

- Driven both by international mobility and initial allocation of workers

Our contribution:

1. International vs. within country assortative matching

2. Study mobility vs initial allocation

3. Consistent high frequency data on worker and firm output

4. Use separate info to estimate worker and firm productivity

$\Rightarrow$ Avoid methodological issue in literature

Empirical setting

- European labor market football managers

  - 9 countries over 2008-2019

  - All employment matches firm-worker

  - First game of season
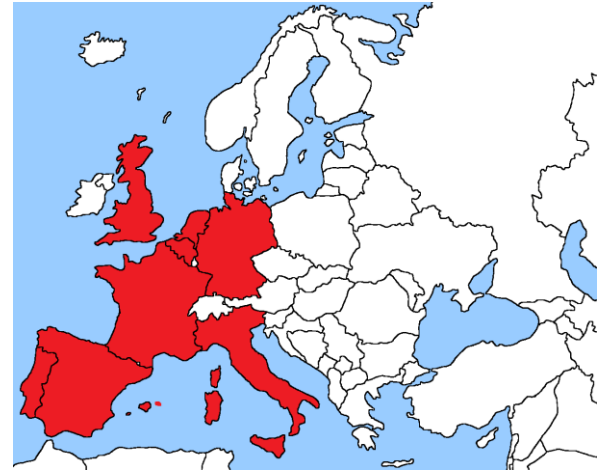
Sample:	Full	Raw	Wage
Total Matches	2,722	2,229 (82%)	2,148 (79%)
Unique Workers	868	601 (69%)	551 (63%)
Unique Firms	354	329 (93%)	301 (85%)

Why this setting?

1. Observe firm financials + worker output

   - 1 worker = 1 firm

   - No reliance on national registers

   - No individual wage data

2. Uniform profession over all countries

3. High stakes economic environment

4. Worker mobility aids in identification

$\Rightarrow$ External validity: academics, CEOs, pop stars

Empirical approach

01

Rank workers by contribution to 'physical' output

= manager FE in goal difference

Normalize average worker to 0.

02

Rank firms by 'revenue' productivity

= extra revenues generated from winning

Expressed in 100k€

03

Investigate rank correlations

– Overall

– By country

– By year

04

Study mobility and initial allocation

– Plots

– Regressions

Assortative matching by country

	Obs.	Worker productivity		Firm productivity		Spearman correlation	
		Mean	(Std. dev.)	Mean	(Std. dev.)	Coef.	Sign.
Overall	2,148	0.049	(0.366)	326	(448)	0.461	0.000
Federations							
Belgium D1	131	-0.023	(0.404)	147	(102)	0.302	0.001
England D1+D2	481	0.032	(0.324)	456	(542)	0.576	0.000
France D1+D2	441	-0.026	(0.295)	192	(262)	0.535	0.000
Germany D1	120	0.065	(0.405)	751	(567)	0.229	0.012
Italy D1+D2	419	0.150	(0.273)	293	(343)	0.482	0.000
Netherlands D1	178	-0.215	(0.328)	156	(166)	0.480	0.000
Portugal D1	116	0.106	(0.455)	192	(256)	0.569	0.000
Scotland D1	52	-0.327	(0.552)	119	(143)	0.471	0.001
Spain D1	210	0.360	(0.311)	515	(688)	0.364	0.000

Note: All calculations are based on estimations in the wage sample. Worker productivity is expressed in added goal difference per game. Firm productivity refers to 1000 euros per marginal unit of goal difference.
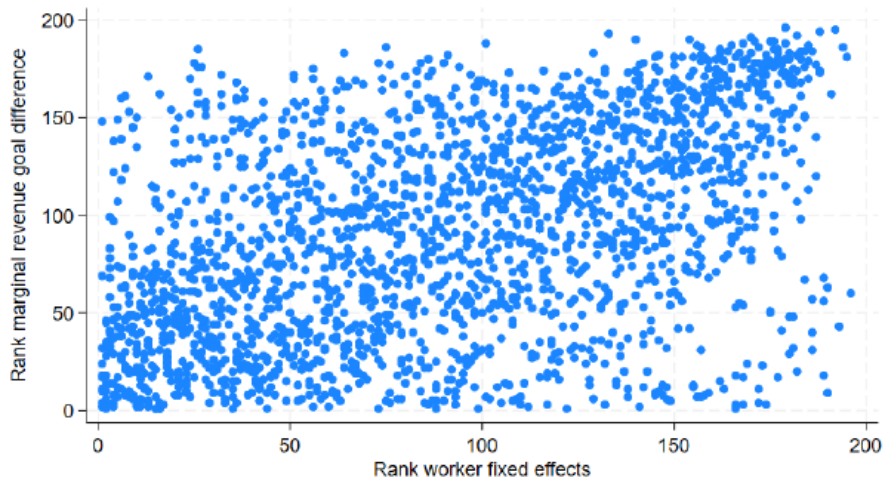
Assortative matching by year

	Obs.	Worker productivity		Firm productivity		Spearman correlation	
		Mean	(Std. dev.)	Mean	(Std. dev.)	Coef.	Sign.
Overall	2,148	0.049	(0.366)	326	(448)	0.461	0.000
Seasons							
2007-08	152	-0.005	(0.347)	258	(339)	0.330	0.000
2008-09	166	0.008	(0.382)	256	(317)	0.416	0.000
2009-10	174	-0.003	(0.378)	272	(359)	0.557	0.000
2010-11	181	-0.029	(0.349)	260	(344)	0.565	0.000
2011-12	179	-0.001	(0.354)	284	(394)	0.491	0.000
2012-13	183	0.001	(0.358)	281	(384)	0.393	0.000
2013-14	196	0.031	(0.354)	284	(391)	0.416	0.000
2014-15	189	0.047	(0.350)	321	(436)	0.395	0.000
2015-16	186	0.073	(0.337)	346	(460)	0.489	0.000
2016-17	190	0.110	(0.380)	394	(533)	0.499	0.000
2017-18	184	0.147	(0.370)	442	(584)	0.394	0.000
2018-19	168	0.193	(0.366)	507	(628)	0.517	0.000

Note: All calculations are based on estimations in the wage sample. Worker productivity is expressed in added goal difference per game. Firm productivity refers to 1000 euros per marginal unit of goal difference.
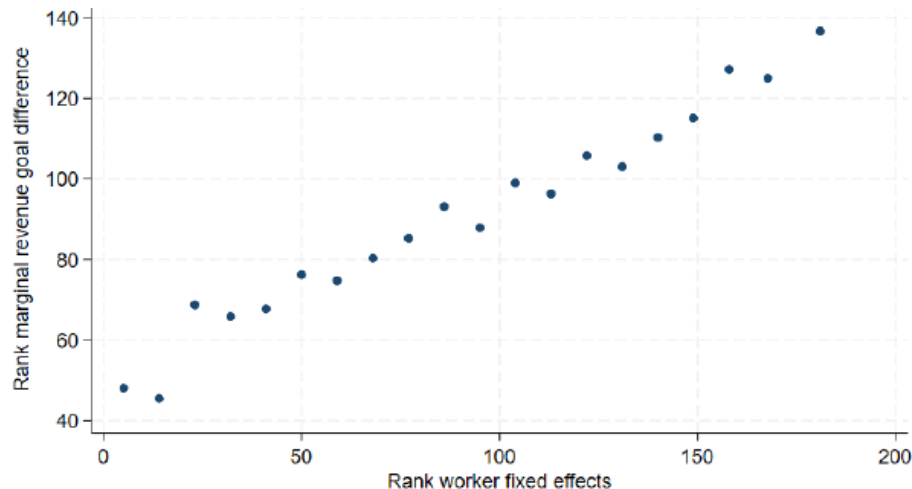
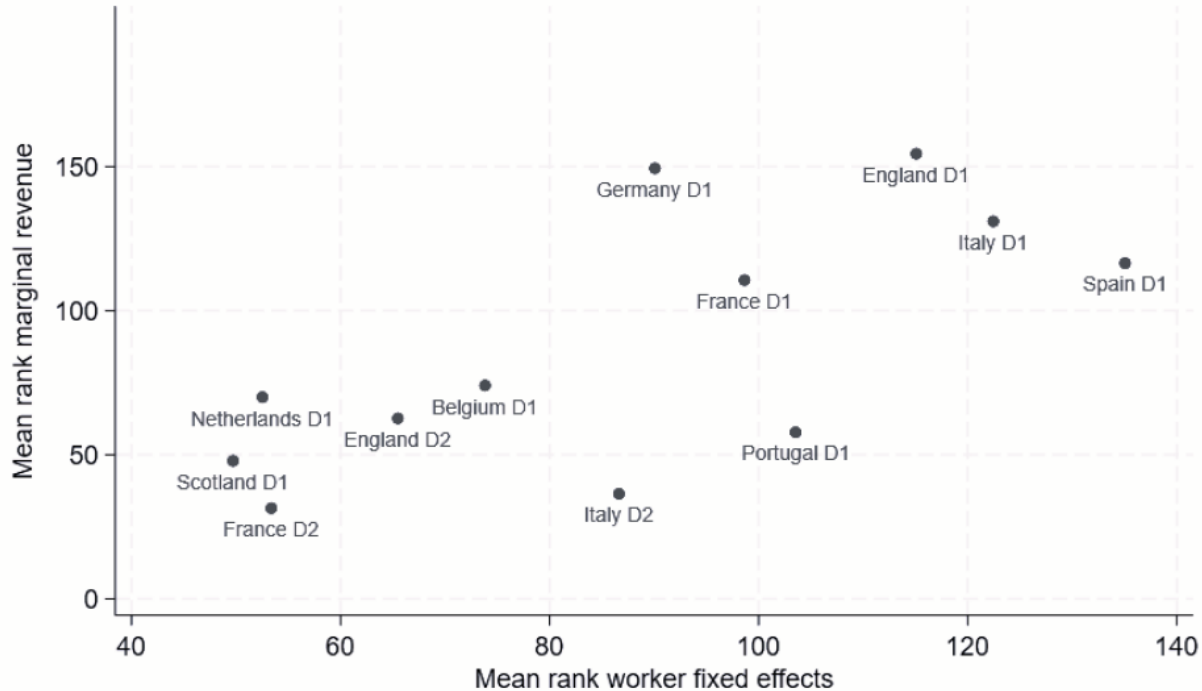# Assortative matching across borders

Rank correlation all years

Rank correlation in bins

Assortative matching: league heterogeneity

Mobility => assortative matching?

- Large heterogeneity
  - Between firms in country
  - Between country averages

  $\Rightarrow$ Mobility necessary for assortative matching
- Assess importance of
  - Initial allocation of workers = 1st observation in our data
  - Mobility across firms = rank of mobile worker's next firm in dataset

Mobility => assortative matching?

Federations	Obs.	Firms	Workers	Obs./worker		Worker mobility			
				1	> 1	No	W.C.	B.C.	Total
Belgium (D1)	131	19	40	8	32	17	12	3	15
England (D1+D2)	481	55	107	17	90	61	22	7	29
France (D1+D2)	441	51	101	16	85	66	18	1	19
Germany (D1)	120	17	32	3	29	21	6	2	8
Italy (D1+D2)	419	64	111	16	95	37	56	2	58
Netherlands (D1)	178	24	49	4	45	27	14	4	18
Portugal (D1)	116	24	38	3	35	17	15	3	18
Scotland (D1)	52	9	12	0	12	9	3	0	3
Spain (D1)	210	34	61	12	49	30	15	4	19
Total	2,148	297	551	79	472	285	161	26	187

Note: Mobility of workers in the wage sample; Obs. = Number of observations (worker-firm); Firms = Number of firms; Workers = Number of workers; W.C. = Within Country; B.C. = Between Country.

Mobility => assortative matching?

Initial allocation
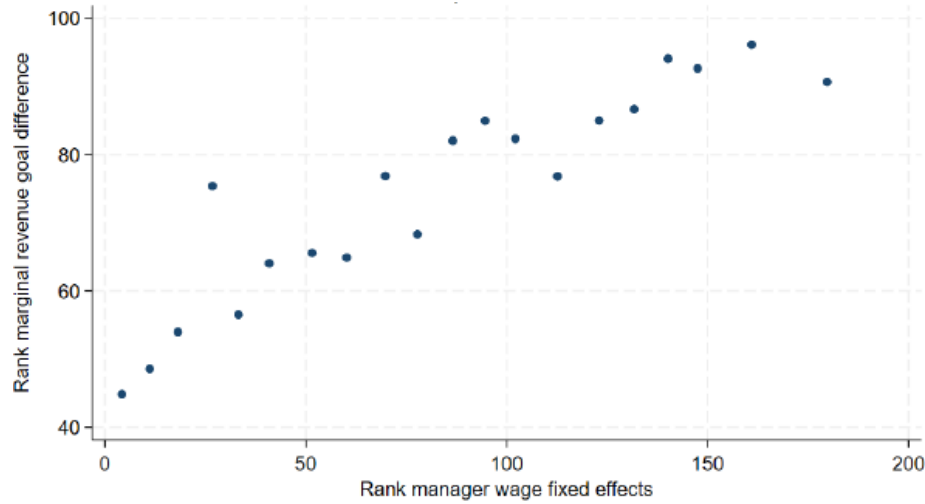
Rank next employer
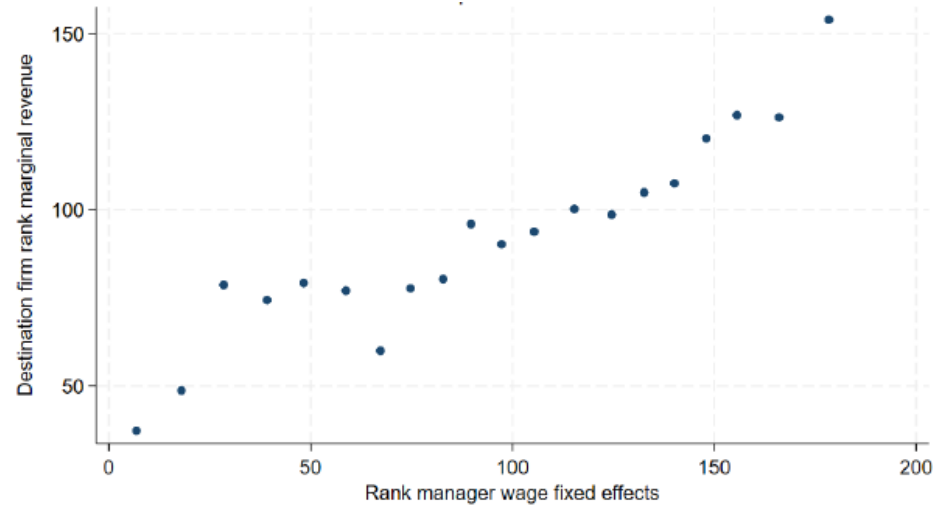
Conclusions

- Strong evidence for assortative matching across EU borders

    >< limited evidence of conversion in 'general' labor market

$\Rightarrow$ Why?

- Observable performance + high stakes
- International mobility + initial allocation

$\Rightarrow$ Are findings football specific or typical in high-skilled labor?

- Academia, arts, inventors...
- Occupational licensing?
- Complementarities largely fulfilled?

Appendix

Measuring assortative matching

- Correlation worker-firm FE in wage regression
  - Abowd et al. (Ec'trica, 1999)

- Estimation and conceptual issues:
  - Limited mobility
    - Andrews et al (JRSS, 2008)
    - Jochmans & Weidner (Ec'trica, 2019)
  - Non-monotonicity
    - Eeckhout & Kirchner (REStud, 2011; Ec'trica, 2018)
    - Lopes de Melo (JPE, 2018)...

- Solution: rank firms/workers by separate productivity measures
  - Mendes et al (Lab Econ, 2010)
  - Bartolucci et al (AEJ appl, 2018)
  - Bagger & Lentz (REStud, 2019)

Measuring assortative matching

- Can sports data help us here?

  - Gandelman (JSE, 2008): Uruguayan football

  - Filippin & van Ours (IR, 2015): Italian runners

  - Drut & Duhautois (JSE, 2017): Italian football

- Our idea:

  - Workers:

    - Productivity = physical output = sporting results

  - Firms:

    - Productivity = transform sporting results into revenues

Observable

Empirical setting

To	From Bel	Eng	Fra	Ger	Net	Ita	Por	Sco	Spa	Total	Total in
Belgium	62	6	4	1	13	0	1	2	2	91	29
England	6	254	7	8	6	15	4	18	12	330	76
France	3	8	185	1	0	4	2	1	7	211	26
Germany	0	2	0	26	8	0	0	0	3	39	13
Netherlands	10	3	0	4	55	0	1	1	3	77	22
Italy	0	11	3	0	1	394	0	0	5	414	20
Portugal	1	0	1	0	0	0	48	1	4	55	7
Scotland	0	21	1	0	0	0	1	22	0	45	23
Spain	2	8	3	0	1	11	5	0	136	166	30
Total	84	313	204	40	84	424	62	45	172	1428	
Total out	22	59	19	14	29	30	14	23	36		

Model ranking workers

Worker 'output' productivity = contribution to on-field result

- Person FE in score difference regression at game level
  ~ Muelheusser et al (JSE, 2018), Peeters et al (JLEO, 2022)

$$y_{ijt} = \beta_{hl} + \beta_{xl}(X_{it} - X_{jt}) + \gamma_i - \gamma_j + \mu_m - \mu_n + \varepsilon_{ijt}$$

- Control for:
  - Home advantage
  - Wages
  - Own + opponent club FE's
 - Own + opponent manager FE
⇒ Rescale to the average manager

Results ranking workers

Dep.Var.: goal dif.	Raw Sample		Wage Sample			
	Home advantage		Home advantage		Log wage	
European cups	0.48***	(0.04)	0.49***	(0.04)	0.48***	(0.09)
Belgium D1	0.43***	(0.03)	0.43***	(0.03)	0.72***	(0.15)
England D1	0.39***	(0.02)	0.38***	(0.02)	0.42***	(0.11)
England D2	0.32***	(0.02)	0.32***	(0.02)	0.42***	(0.07)
France D1	0.39***	(0.02)	0.39***	(0.02)	0.53***	(0.09)
France D2	0.38***	(0.02)	0.38***	(0.02)	0.38***	(0.10)
Germany D1	0.37***	(0.03)	0.47***	(0.05)	0.62***	(0.16)
Italy D1	0.37***	(0.02)	0.36***	(0.02)	0.57***	(0.08)
Italy D2	0.35***	(0.02)	0.33***	(0.03)	0.26***	(0.08)
Netherlands D1	0.50***	(0.03)	0.49***	(0.04)	0.40**	(0.17)
Portugal D1	0.34***	(0.03)	0.37***	(0.04)	0.44***	(0.12)
Scotland D1	0.26***	(0.04)	0.36***	(0.07)	0.65**	(0.28)
Spain D1	0.47***	(0.03)	0.46***	(0.03)	0.33***	(0.09)
Explained variance						
Worker effects	$\frac{Cov(y,\mu)}{Var(y)}$	0.065		0.057		
Firm effects	$\frac{Cov(y,\gamma)}{Var(y)}$	0.122		0.040		
Other covariates	$\frac{Cov(y,X)}{Var(y)}$	0.048		0.141		
R-squared		0.236		0.238		
# Workers		637		555		
# Firms		329		301		
Observations		87,660		74,082		

Note: Every match is included twice in the analysis. Standard errors clustered at the match level in parentheses; *** significant at 1% level, ** significant at 5% level.

Manager output FE
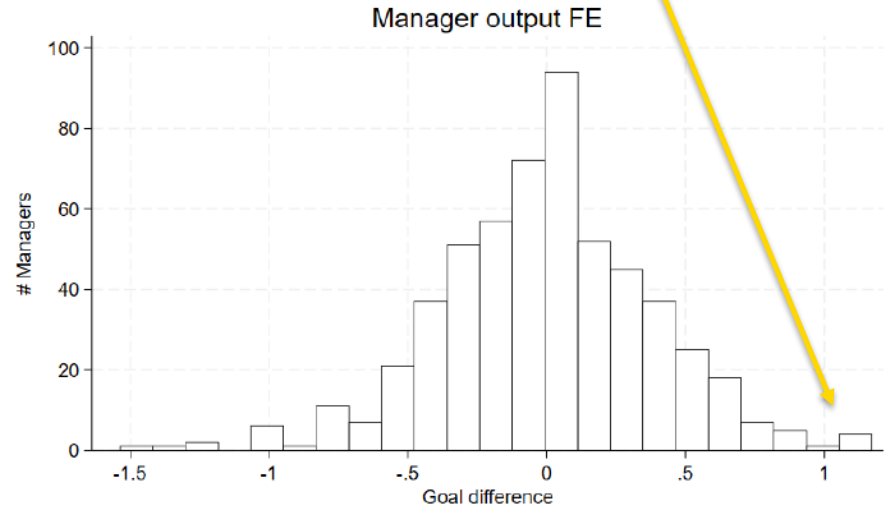
Model ranking firms

Firm 'revenue' productivity = marginal monetary gains from winning

~ Hoey et al. (IJIO, 2021)

$$\log(R_{lit}) = \beta_l y_{it} + \beta_x X_{it} + \alpha_i + \tau_t + \lambda_l + \varepsilon_{it}$$

- Control for:
  - Goal difference by season
  - Tangible asset book value
  - Relegated/promoted dummy
  - Firm – Year – League FE

$\Rightarrow$ Calculate marginal revenue per goal difference

Results ranking firms

Regression model

Goal difference	0.157***	(0.015)
Tang. assets	0.078***	(0.007)
Promoted	-0.112***	(0.019)
Relegated	0.473***	(0.032)
R-squared	0.959	

Note: 2,453 observations; club, season and division fixed effects are included; standard errors in parentheses. *** significant at 1% level.

Marginal revenue by league (k€)

League	Mean	Std. dev.	# Club-years
Belgium D1	143	102	134
England D1	849	570	218
England D2	104	52	255
France D1	327	318	219
France D2	56	30	215
Germany D1	729	557	132
Italy D1	485	370	219
Italy D2	60	34	210
Netherlands D1	151	164	196
Portugal D1	163	243	146
Scotland D1	86	123	98
Spain D1	488	672	216
Overall	309	438	2,258

Results ranking firms
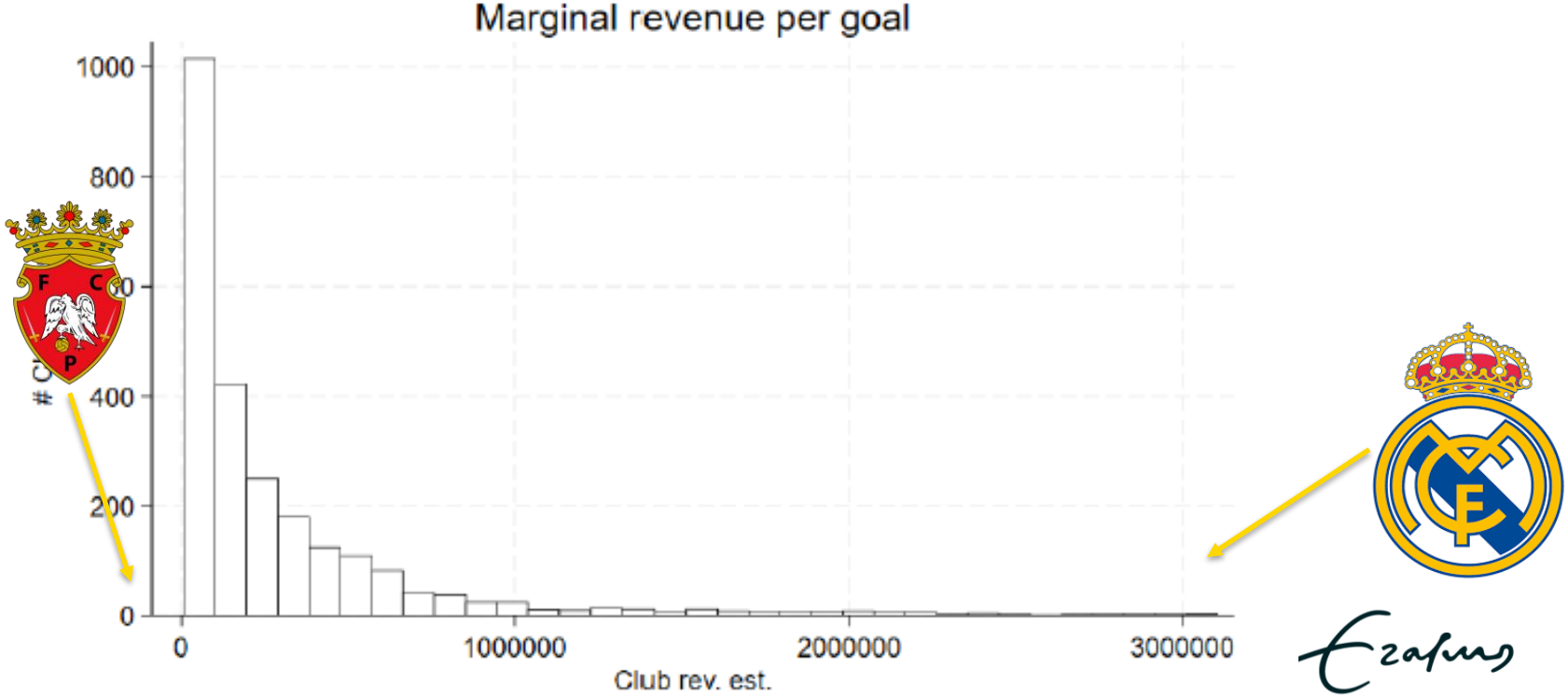
Marginal revenue per goal

Assortative matching: robustness

	Obs.	Worker productivity		Firm productivity		Spearman correlation	
		Mean	(Std. dev.)	Mean	(Std. dev.)	Coef.	Sign.
Overall	2,229	0.068	(0.381)	319	(443)	0.530	0.000
Seasons							
2007-08	158	0.015	(0.388)	252	(334)	0.385	0.000
2008-09	171	0.030	(0.395)	250	(314)	0.481	0.000
2009-10	181	0.027	(0.386)	267	(354)	0.622	0.000
2010-11	188	-0.010	(0.357)	255	(340)	0.589	0.000
2011-12	186	0.006	(0.378)	280	(390)	0.588	0.000
2012-13	191	0.020	(0.368)	278	(379)	0.509	0.000
2013-14	205	0.047	(0.372)	275	(386)	0.510	0.000
2014-15	198	0.067	(0.359)	310	(430)	0.477	0.000
2015-16	191	0.097	(0.361)	340	(456)	0.517	0.000
2016-17	193	0.135	(0.379)	391	(530)	0.538	0.000
2017-18	193	0.169	(0.382)	428	(576)	0.474	0.000
2018-19	174	0.211	(0.395)	497	(621)	0.618	0.000
Federations							
Belgium D1	131	0.015	(0.382)	147	(102)	0.324	0.000
England D1+D2	486	0.084	(0.346)	452	(540)	0.629	0.000
France D1+D2	441	-0.077	(0.342)	193	(262)	0.595	0.000
Germany D1	132	0.228	(0.432)	723	(549)	0.241	0.005
Italy D1+D2	430	0.113	(0.277)	287	(341)	0.497	0.000
Netherlands D1	188	-0.119	(0.347)	151	(163)	0.574	0.000
Portugal D1	126	0.254	(0.322)	188	(255)	0.579	0.000
Scotland D1	84	-0.321	(0.528)	97	(130)	0.397	0.000
Spain D1	211	0.389	(0.311)	511	(687)	0.409	0.000

Note: All calculations are based on estimations in the raw sample. Worker productivity is expressed in added goal difference per game. Firm productivity refers to 1000 euros per marginal unit of goal difference.

Assortative matching: robustness

	Obs.	Worker productivity		Firm productivity		Spearman correlation	
		Mean	(Std. dev.)	Mean	(Std. dev.)	Coef.	Sign.
Sample							
Wage sample	2,148	0.048	(0.366)	326	(448)	0.461	0.000
No small fed.	1,729	0.060	(0.339)	325	(452)	0.534	0.000
First div.	1,497	0.109	(0.378)	436	(498)	0.425	0.000
Second div.	651	-0.091	(0.293)	73	(44)	0.125	0.001

Note: All calculations are based on estimations in the wage sample. Worker productivity is expressed in added goal difference per game. Firm productivity refers to 1000 euros per marginal unit of goal difference.