The State of European Entrepreneurship: Trends in Quantity and Quality in France, Germany, and the UK (2009–2023)

Massimo G. Colombo[1], Lena Füner[2, 3, 4], Massimiliano Guerini[1], Hanna Hottenrott[2,3], Daniel Souza[1]

Polytechnic University of Milan[1]
Technical University Munich[2]
Leibniz Centre for European Economic Research (ZEW)[3]
Institute for Employment Research (IAB)[4]

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Motivation

Why does **entrepreneurial quality** - measured as high-growth entrepreneurship - matter for Europe?

- Little fraction of high-growth entrepreneruship accounts for a disproportionate share of innovation, job, and value creation (Kortum and Lerner, 2000; Samila and Sorenson, 2011; Decker et al., 2016)
- Moving beyond assessing the **number of entry** requires evaluating **ex-ante growth potential** and the ability of ecosystems to translate this potential into realized growth (Guzman and Stern, 2020; Andrews et al., 2022)
- Existing empirical evidence is concentrated on the **United States**, while systematic and comparable evidence on entrepreneurial quality across European regions remains scarce.

Past growth in Europe boosted by past Entrepreneurial Quality



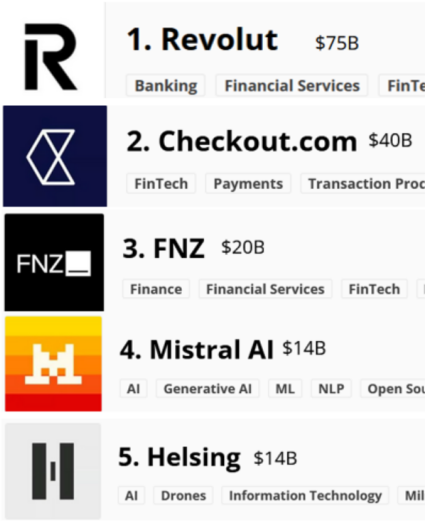


Quality entrepreneurship of the **Gründerzeit** (1850s–1870s) contributed to

- Innovation
- Technological leadership
- Employment

Many of these firms disappeared, while others became today's European industrial champions.

New technologies – new opportunities



Entrepreneurial quality matters for Europe

- Lack of business dynamism
- Missed growth opportunities
- Innovation bottleneck: strong science but weak scaling

But how big is the problem really?

Research question and contribution

- *How have entrepreneurial quantity and quality evolved in major European economies in recent years?*

This paper:

- Estimates a **measure of entrepreneurial quality** at national and regional levels for France, Germany, and the United Kingdom.
- Assesses the **performance of entrepreneurial ecosystems** – the agents and institutions shaping regional business environments.

Contributions

Contribution to two streams of literature:

- **Entrepreneurial Dynamics and Growth** (Guzman and Stern 2020, Tartari and Guzman 2021, Andrews et al. 2022, Stuart and Sorenson 2003, Glaeser and Kerr 2009, Samila and Sorenson 2011). First systematic and wide (around 52% of GDP) estimation of entrepreneurial quality in Europe.
- **Regional innovation & entrepreneurial ecosystems** (Feldman and Francis,2004; Lerner, 2009; Audrestch and Lehmann, 2005; Stam, 2015): measuring the performance of national and regional entrepreneurial ecosystems in Europe.

Measuring Entrepreneurial Quality

Guzman and Stern's (2015, 2017, 2020) approach builds on three key insights:

- Growth-oriented entrepreneurs must ***register*** their businesses.
- Certain startup characteristics linked to entrepreneurial quality are observable ***at or near registration***.
- While rare, some firms achieve ***notable growth outcomes***.

Measuring Entrepreneurial Quality

We estimate entrepreneurial quality θ for firm i, born in region r at time t with start-up characteristics H_{irt} and growth outcome after s years $g_{ir(t+s)}$ as:

$$\theta_{irt} = Pr(g_{ir(t+s)}|H_{irt}) = f(\beta H_{irt}) \tag{1}$$

Then, we calculate the Entrepreneurial Quality Index (EQI), which is the average quality of an area-year:

$$EQI_{rt} = \frac{1}{N_{rt}} \sum_{i \in I_{rt}} \hat{\theta}_{irt} \tag{2}$$

Measuring Entrepreneurial Quality

We use the EQI to measure the Regional Entrepreneurship Cohort Potential Index (RECPI), which measures the overall growth potential of a firm in a region-year:

$$RECPI_{rt} = EQI_{rt} \times N_{rt} \tag{3}$$

Finally, to assess the extent to which realized outcomes diverge from this expectation, we calculate Regional Entrepreneurial Acceleration Index (REAI), which is defined as the ratio of realized to expected growth events:

$$REAI_{rt} = \frac{\sum_{i \in I_{rt}} g_{irt}}{RECPI_{rt}}, \tag{4}$$

Identifying Growth Events and Startup Characteristics at Foundation

Growth events:

- Firm achieves IPO or acquisition within 6 years. Growth is defined for firms born before 2016.

Startup Characteristics at Foundation:

- **Intelectual property observables**: Patents and Trademarks
- **Name-based observables**: Eponymity and short name
- **Legal structure**: Different legal structure by country
- **Industry measures**: Main NACE code

Methodology

To estimate entrepreneurial quality, I compare three predictive models:

- Benchmark: Close replication of Guzman & Stern (2020) using unregularized logistic regression and aggregated features
- Logistic regression with L2 (ridge) regularization
- Extreme Gradient Boosting (XGBoost)

Model performance is evaluated using out-of-sample prediction (expanding-origin cross-validation).

Data

Registry data

- Companies House (UK)
- SIRENE (France)
- Mannheim Enterprise Panel (Germany)

Complementary data sources

- BODACC
- Statistical Yearbooks
- Orbis M&A (Zephyr)
- Orbis IP
- ISI Trademark Data Collection (ISI-TM)
- Eurostat

Predictive Analytics

Table 3: Growth Predictive Model - Baseline Logit Regression on IPO or Acquisition within Six Years

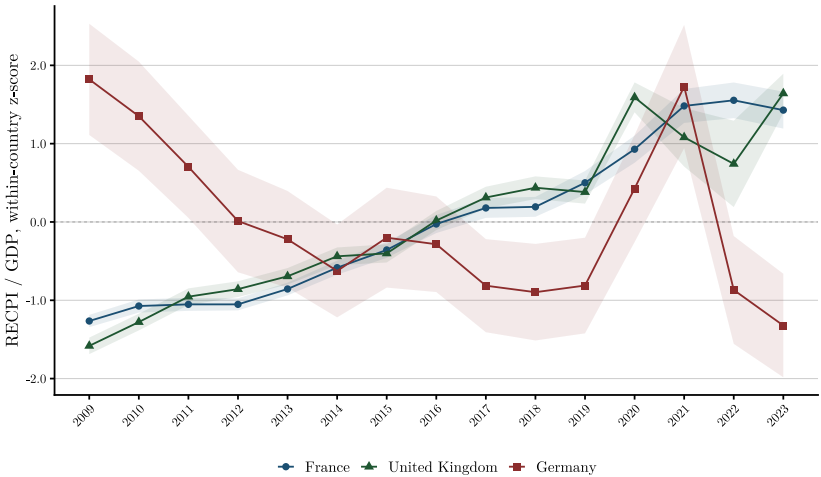
Dependent variable	IPO or M&A within 6 years			
	France (1)	UK (2)	Germany (3)	US (4)
Corporate governance measures				
Joint-stock Company	23.915***	72.852***	21.528***	3.050***
	(5.297)	(4.539)	(2.621)	(0.071)
Modal Legal Structure	4.692***		3.352***	
	(0.374)		(0.272)	
Delaware				14.452***
				(0.319)
Name-based measures				
Eponymous	0.447***	0.607***	0.177***	0.432***
	(0.081)	(0.034)	(0.034)	(0.024)
Short Name	1.355**	1.126***	0.990	2.485***
	(0.161)	(0.035)	(0.058)	(0.050)
Intellectual property measures				
Patent	9.622***	9.668***	5.968***	10.713***
	(1.798)	(0.893)	(0.551)	(0.386)
Trademark	4.022***	4.256***	4.217***	4.018***
	(1.087)	(0.601)	(0.591)	(0.246)
Industry Dummies	YES	YES	YES	YES
Observations	1,541,158	4,449,796	989,948	18,764,856
Pseudo R^2	0.141	0.113	0.130	0.165

Predictive Analytics – Out of Sample Performance

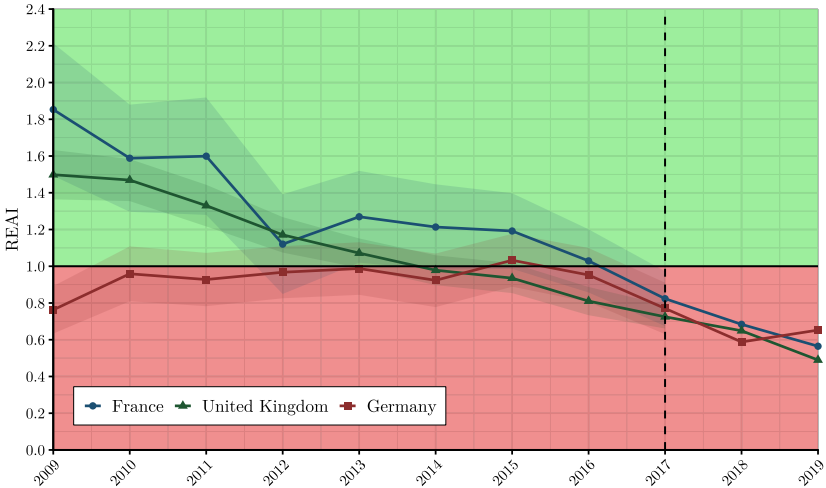
Table 5: Out-of-sample performance by expanding-origin cross-validation

	Logit (1)	Logit (L2) (2)	XGBoost (3)
Panel A: France			
PR-AUC	0.0086	0.0079	0.0091
	[0.0052–0.0162]	[0.0047–0.0121]	[0.0055–0.0196]
ROC-AUC	0.8242	0.8285	0.8351
	[0.7945–0.8548]	[0.8027–0.8564]	[0.7907–0.8559]
Recall at top 1%	19.4%	18.0%	18.9%
	[18.1% - 21.2%]	[16.5% - 19.1%]	[16.5% - 20.5%]
Recall at top 5%	42.5%	43.5%	42.6%
	[33.0% - 47.6%]	[36.5% - 48.8%]	[36.5% - 50.0%]
Recall at top 10%	59.4%	59.9%	56.5%
	[52.7% - 63.8%]	[52.7% - 65.0%]	[47.8% - 61.3%]
Panel B: United Kingdom			
PR-AUC	0.0456	0.0459	0.0445
	[0.0252–0.0809]	[0.0250–0.0809]	[0.0288–0.0737]
ROC-AUC	0.7889	0.7895	0.7884
	[0.7609–0.8104]	[0.7638–0.8104]	[0.7695–0.8024]
Recall at top 1%	19.3%	19.5%	19.4%
	[16.1% - 24.3%]	[16.1% - 24.3%]	[16.5% - 24.3%]
Recall at top 5%	37.7%	37.8%	38.3%
	[33.5% - 42.2%]	[33.7% - 42.2%]	[35.1% - 42.0%]
Recall at top 10%	51.0%	51.0%	50.6%
	[46.9% - 57.0%]	[47.1% - 57.0%]	[47.6% - 54.6%]
Panel C: Germany			
PR-AUC	0.0119	0.0119	0.0144
	[0.0084–0.0160]	[0.0084–0.0160]	[0.0090–0.0190]
ROC-AUC	0.8027	0.8027	0.8305
	[0.7609–0.8475]	[0.7608–0.8475]	[0.8005–0.8545]
Recall at top 1%	14.9%	14.9%	18.0%
	[10.9% - 24.5%]	[10.9% - 24.5%]	[14.8% - 23.8%]
Recall at top 5%	34.1%	34.1%	36.6%
	[30.1% - 36.7%]	[30.1% - 36.7%]	[32.1% - 43.5%]
Recall at top 10%	47.3%	47.3%	48.8%
	[43.2% - 52.7%]	[43.2% - 52.7%]	[40.1% - 56.5%]

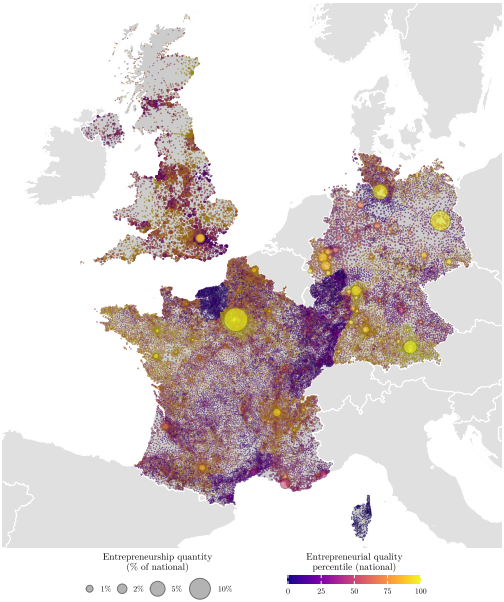
Results - RECPI



Results - REAI



Regional Quantity-Quality Variation



Conclusion

- We provide the first large-scale application of the **G&S framework** to measure entrepreneurial quality and ecosystem performance in Europe.
- The **predictive model generalizes well** beyond the US, confirming the robustness approach based on business registry data across institutional contexts.
- We document strong **heterogeneity** in entrepreneurial performance across countries.
- The framework provides the empirical foundation for **designing effective place-based policies** that strengthen regional entrepreneurial ecosystems and Europe's innovation capacity.

Thank you for your attention!

danielfernando.desouza@polimi.it
lena.fuener@zew.de

Legal Structures

Table 1: Legal Forms of Companies in the France, UK and Germany

	Number of Firms	Share
Panel A: France		
Société par actions simplifiée	1,507,889	50.43%
Société à responsabilité limitée (SARL)	1,478,487	49.45%
Société anonyme à conseil d'administration	3,350	0.11%
Société anonyme à directoire	239	<0.01%
Total	2,989,965	100%
Panel B: UK		
Private Limited Company	8,821,646	99.93%
Public Limited Company	6,256	0.07%
Total	8,827,902	100%
Panel C: Germany		
GmbH	1,006,624	60.76%
UG	377,210	22.77%
GmbH & Co. KG	187,113	11.29%
Foreign GmbH-Type	50,394	3.04%
UG & Co. KG	19,006	1.15%
AG	11,935	0.72%
Foreign GmbH-Type & Co. KG	3,976	0.24%
Foreign AG-Type Company	387	0.02%
GmbH & Co. KGaA	167	0.01%
AG & Co. KG	13	<0.01%
Foreign AG-Type Company & Co. KG	10	<0.01%
Foreign GmbH-Type & Co. KGaA	3	<0.01%
UG & Co. KGaA	3	<0.01%
Total	1,656,841	100%

Summary Statistics

Table 2: Summary Statistics

	France		UK		Germany	
Variable	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Outcome variable						
Growth	0.0005	0.0223	0.0007	0.0270	0.0012	0.0344
Corporate governance measures						
Joint-stock Company	0.0012	0.0346	0.0007	0.0266	0.0076	0.0866
Modal Legal Structure	0.5043	0.5000	0.9993	0.0266	0.6076	0.4883
Name-based measures						
Short Name	0.8773	0.3281	0.5729	0.4947	0.4659	0.4988
Eponymous	0.1152	0.3193	0.1242	0.3298	0.1542	0.3612
Intellectual property measures						
Patent	0.0007	0.0273	0.0011	0.0327	0.0094	0.0963
Trademark	0.0009	0.0299	0.0011	0.0332	0.0040	0.0627
Industry Measures						
Mining and quarrying	0.0002	0.0135	0.0018	0.0425	0.0005	0.0214
Manufacturing	0.0390	0.1935	0.0376	0.1902	0.0491	0.2162
Electricity, gas, steam and air conditioning supply	0.0101	0.1001	0.0032	0.0568	0.0209	0.1432
Water supply; sewerage, waste management	0.0021	0.0459	0.0030	0.0543	0.0028	0.0525
Construction	0.1426	0.3497	0.0910	0.2876	0.0663	0.2487
Wholesale and retail trade; repair of vehicles	0.1953	0.3964	0.1357	0.3424	0.1295	0.3357
Transportation and storage	0.0384	0.1921	0.0371	0.1891	0.0263	0.1601
Accommodation and food service activities	0.0997	0.2996	0.0560	0.2299	0.0316	0.1749
Information and communication	0.0553	0.2286	0.0909	0.2875	0.0577	0.2332
Financial and insurance activities	0.0711	0.2571	0.0299	0.1704	0.0981	0.2974
Real estate activities	0.0543	0.2266	0.0597	0.2369	0.0841	0.2776
Professional, scientific and technical activities	0.1449	0.3520	0.1094	0.3122	0.1480	0.3551
Administrative and support service activities	0.0583	0.2342	0.0874	0.2824	0.1257	0.3315
Public administration and defence	0.0000	0.0053	0.0022	0.0467	0.0004	0.0204
Education	0.0170	0.1291	0.0157	0.1242	0.0098	0.0985
Human health and social work activities	0.0147	0.1204	0.0392	0.1941	0.0192	0.1371
Arts, entertainment and recreation	0.0127	0.1119	0.0189	0.1363	0.0113	0.1057
Other service activities	0.0359	0.1860	0.0486	0.2151	0.0415	0.1996
Missing	0.0085	0.0917	0.1326	0.3392	0.0772	0.2669
Observations	2,989,965		8,827,902		1,656,841	

Predictive Analytics - Detailed

Table 4: Growth Predictive Model - Detailed Legal Form, Industry, and Region Dummies

Dependent variable	IPO or M&A within 6 years			
	France (1)	UK (2)	Germany (3)	US (4)
Corporate governance measures				
SARL	0.219***			
	(0.018)			
SA (cons. adm.)	4.990***			
	(1.093)			
SA (directoire)	2.277			
	(2.079)			
Public Limited Company		74.442***		
		(4.689)		
UG (All)			0.259***	
			(0.027)	
AG (All)			6.712***	
			(0.700)	
Foreign GmbH-Type (All)			0.048***	
			(0.048)	
Foreign AG-Type Company (All)			0.000***	
			(0.000)	
Corporation				2.988***
				(0.072)
Delaware				12.930***
				(0.298)
Name-based measures				
Eponymous	0.459***	0.603***	0.185***	0.312***
	(0.083)	(0.034)	(0.036)	(0.018)
Short Name	1.343**	1.130***	1.228***	2.278***
	(0.159)	(0.035)	(0.071)	(0.046)
Intellectual property measures				
Patent	9.293***	9.634***	5.932***	8.474***
	(1.725)	(0.891)	(0.551)	(0.309)
Trademark	3.955***	4.303***	3.783***	3.909***
	(1.061)	(0.608)	(0.534)	(0.233)
Industry Dummies	YES	YES	YES	YES
Region Dummies	YES	YES	YES	YES
Observations	1,541,158	4,449,796	989,948	18,764,856
Pseudo R^2	0.148	0.114	0.139	0.184

Predictive Analytics - Alternative Outcome Employment

	Base rate	PR-AUC	ROC-AUC	Recall at top 1%	Correlation with Baseline
	(1)	(2)	(3)	(4)	(5)
Panel A: France					
IPO/M&A in 6y (baseline)	0.063%	0.0091	0.8351	18.9%	1
Medium-sized Firm	0.378%	0.0768	0.8412	21.2%	0.598
Large-sized Firm	0.126%	0.0381	0.8983	29.6%	0.600
Employment >100	0.195%	0.0537	0.8840	26.6%	0.622
Employment >250	0.081%	0.0244	0.8915	30.3%	0.559
Employment >500	0.041%	0.0263	0.9119	42.9%	0.622
Employment >1000	0.019%	0.0207	0.9155	49.2%	0.596
Panel B: United Kingdom					
IPO/M&A in 6y (baseline)	0.090%	0.0439	0.7882	19.8%	1
Medium-sized Firm	0.622%	0.0598	0.8253	17.9%	0.358
Large-sized Firm	0.160%	0.0562	0.8701	37.2%	0.413
Employment >100	0.257%	0.0586	0.8494	30.0%	0.449
Employment >250	0.116%	0.0453	0.8639	37.2%	0.397
Employment >500	0.063%	0.0392	0.8754	43.5%	0.368
Employment >1000	0.034%	0.0398	0.8778	48.7%	0.361
Panel C: Germany					
IPO/M&A in 6y (baseline)	0.144%	0.0143	0.8312	18.6%	1
Medium-sized Firm	2.379%	0.0905	0.7897	8.0%	0.555
Large-sized Firm	0.370%	0.0391	0.8416	16.8%	0.692
Employment >100	0.768%	0.0604	0.8414	14.0%	0.677
Employment >250	0.305%	0.0363	0.8568	19.0%	0.696
Employment >500	0.157%	0.0257	0.8456	20.0%	0.653
Employment >1000	0.085%	0.0169	0.8684	21.1%	0.633

Predictive Analytics - Alternative Outcome France

Table 19: Robustness - Employment Growth Outcomes - France

	Full Model (1)	Employment > 500 (2)	Employment > 1000 (3)
Corporate governance measures			
SARL	0.219***	0.074***	0.056***
	(0.018)	(0.011)	(0.015)
SA (cons. adm.)	4.990***	2.647***	1.554
	(1.093)	(0.677)	(0.619)
SA (directoire)	2.277	10.823***	0.000***
	(2.079)	(5.364)	(0.000)
Name-based measures			
Eponymous	0.459***	0.685**	0.600*
	(0.083)	(0.122)	(0.174)
Short Name	1.343**	0.747**	0.834
	(0.159)	(0.087)	(0.153)
Intellectual property measures			
Patent	9.293***	18.241***	16.963***
	(1.725)	(3.258)	(4.043)
Trademark	3.955***	5.293***	6.148***
	(1.061)	(1.638)	(2.348)
Industry Dummies	YES	YES	YES
Region Dummies	YES	YES	YES
Observations	1,541,158	1,541,158	1,541,158
Pseudo R^2	0.148	0.252	0.286

Predictive Analytics - Alternative Outcome UK

Table 20: Robustness - Employment Growth Outcomes - UK

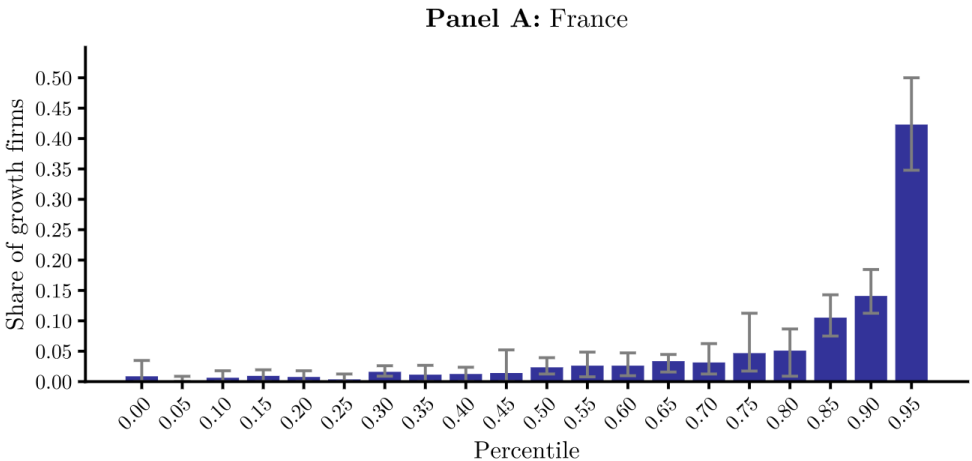
	Full Model (1)	Employment > 500 (2)	Employment > 1000 (3)
Corporate governance measures			
Public Limited Company	74.442***	12.557***	16.928***
	(4.689)	(1.290)	(2.003)
Name-based measures			
Eponymous	0.603***	0.488***	0.444***
	(0.034)	(0.036)	(0.047)
Short Name	1.130***	0.873***	0.885**
	(0.035)	(0.034)	(0.047)
Intellectual property measures			
Patent	9.634***	22.345***	24.301***
	(0.891)	(2.069)	(2.871)
Trademark	4.303***	8.703***	9.720***
	(0.608)	(1.179)	(1.651)
Industry Dummies	YES	YES	YES
Region Dummies	YES	YES	YES
Observations	4,449,796	4,449,796	4,449,796
Pseudo R^2	0.114	0.147	0.165

Predictive Analytics - Alternative Outcome Germany

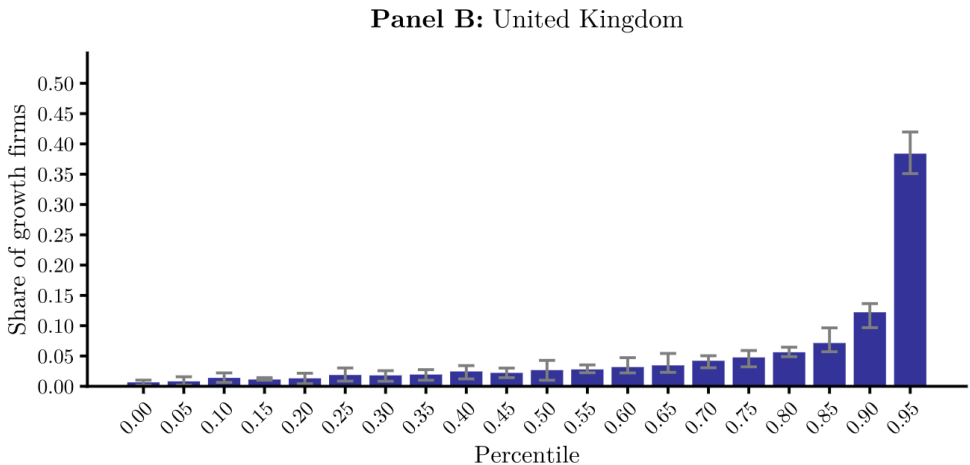
Table 21: Robustness - Employment Growth Outcomes - Germany

	Full Model (1)	Employment > 500 (2)	Employment > 1000 (3)
Corporate governance measures			
UG (All)	0.259***	0.056***	0.084***
	(0.027)	(0.012)	(0.020)
AG (All)	6.712***	3.302***	4.121***
	(0.700)	(0.472)	(0.718)
Foreign GmbH-Type (All)	0.048***	0.743	1.039
	(0.048)	(0.191)	(0.315)
Foreign AG-Type Company (All)	0.000***	13.898**	24.729***
	(0.000)	(14.563)	(25.706)
Name-based measures			
Eponymous	0.185***	0.562***	0.645***
	(0.036)	(0.053)	(0.078)
Short Name	1.228***	0.614***	0.606***
	(0.071)	(0.035)	(0.047)
Intellectual property measures			
Patent	5.932***	16.861***	16.903***
	(0.551)	(1.214)	(1.593)
Trademark	3.783***	1.243	1.553
	(0.534)	(0.314)	(0.476)
Industry Dummies	YES	YES	YES
Region Dummies	YES	YES	YES
Observations	989,948	989,948	989,948
Pseudo R^2	0.139	0.174	0.168

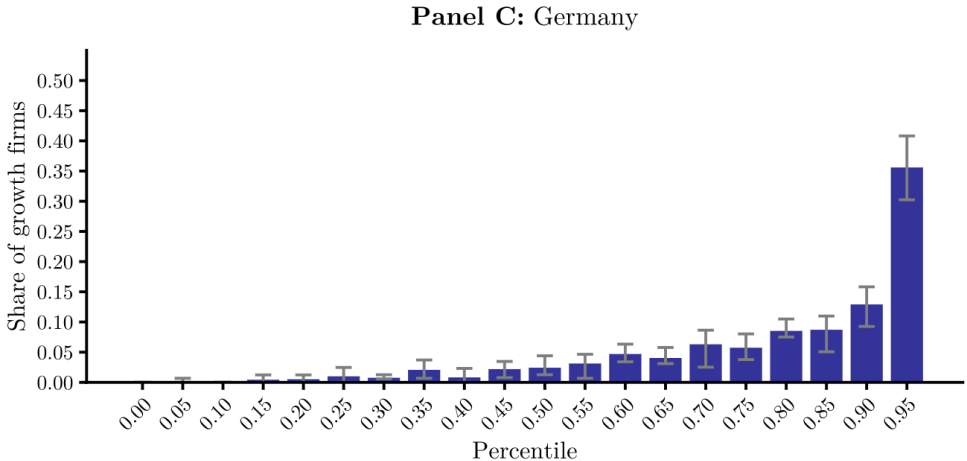
5-Fold Cross-Validation France



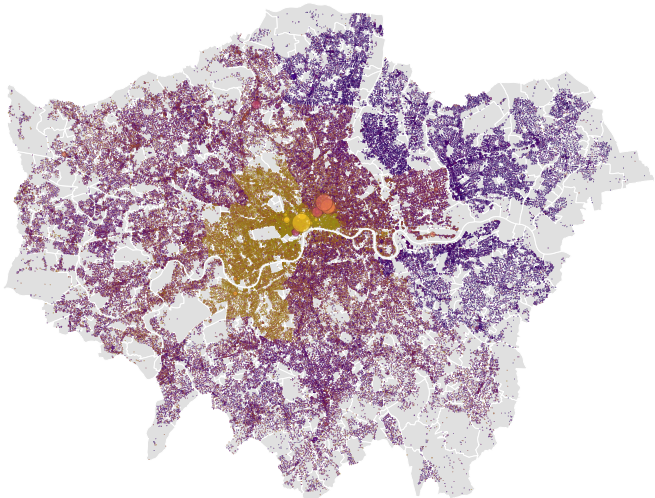
5-Fold Cross-Validation UK



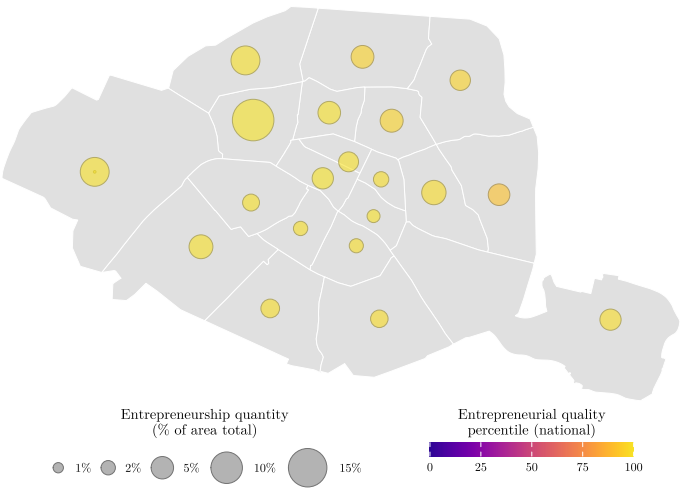
5-Fold Cross-Validation Germany



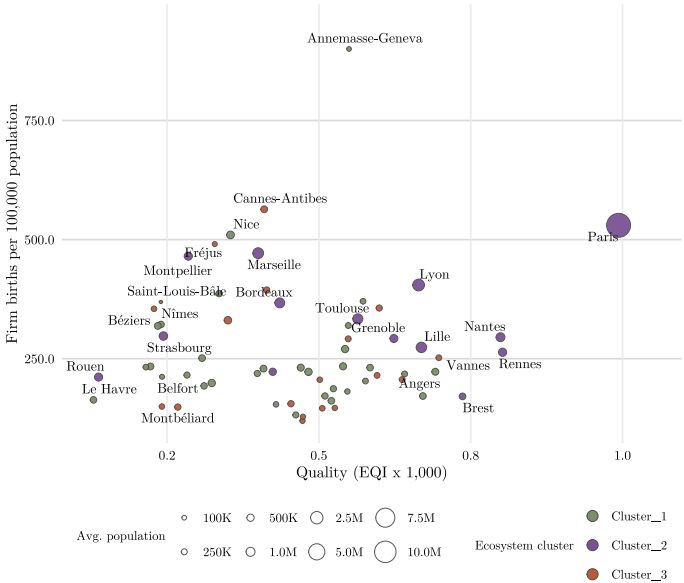
Entrepreneurial Quality and Quantity in London



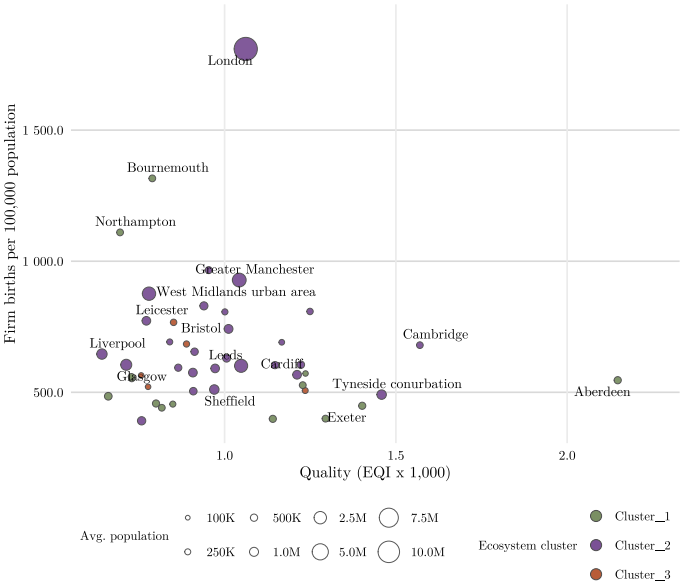
Entrepreneurial Quality and Quantity in Paris



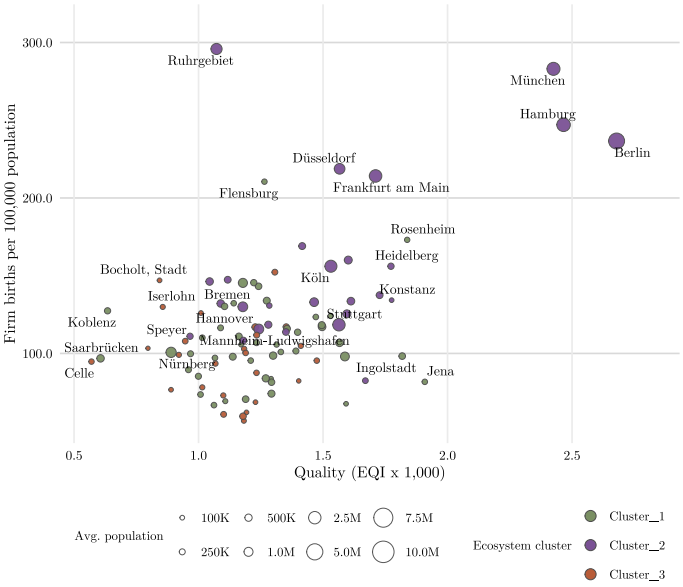
Is there a correlation between Quantity and Quality? France



Is there a correlation between Quantity and Quality? UK



Is there a correlation between Quantity and Quality? Germany



Identifying Growth-Oriented Firms

Population Criteria:

- **Focus**: Limited liability companies (public or private)
- **Exclusions**: Individual entrepreneurs with limited liability (except single-shareholder LLCs)

Key Legal Forms:

- **UK**: Private Limited Company, Public Limited Company
- **France**: SARL, Société par actions simplifiée, Société anonyme
- **Germany**: GmbH, UG, AG