UNIVERSITÄT DES SAARLANDES

Industry structure, entrepreneurship, and culture: An instrumental variable analysis using historical coal mining in Great Britain

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What determines entrepreneurship across geographic space?

- "What is the most striking feature of the geography of economic activity? The short answer is surely concentration…production is remarkably concentrated in space."
  --Paul Krugman,

- The Geography of Trade (MIT Press, 1991)

- Entrepreneurship activity similarly varies substantially across geographic space
  (Glaeser, Kerr, & Kerr, "Entrepreneurship and Urban Growth: An Empirical Assessment with Historical Mines," Review of Economics and Statistics, 2015)

Entrepreneurship across geographic space: Economics literature

- Factors & Resources – human capital, social capital, knowledge, labor force composition, diversity (human & industry), growth, industry composition

- Mandate for Entrepreneurship Policy
  --U.S. Small Business Innovation Research (SBIR) Program
  -- Lisbon Council of Europe, 2000

Alternative view why entrepreneurship varies across geographic space

- Culture

  -- Saxenien, *Regional Advantage*, (Harvard University Press, 1994)

  -- Acemoglu & Robinson, *Why Nations Fail: The Origins of Power, Prosperity* (Profile Books, 2012)

Purpose of paper

- Contemporary observed spatial patterns of entrepreneurship activity actually reflect and are shaped by the variation of a very long-term underlying context of entrepreneurship culture

- Entrepreneurship culture across geographic space reflected by historical presence of large-scale industries that negatively impacts entrepreneurship → Chinitz-Hypothesis (Pittsburgh vs. New York)
  (Chinitz, B., 1961. Contrasts in agglomeration: New York and Pittsburgh. *American Economic Review 51*, 279-289)

Research on the entrepreneurial personality

- Geographical psychology (Rentfrow et al., 2008; Hofstede & McCrae, 2004) studies the emergence, persistence, and expression of regional cultural differences
- Psychological research on regional entrepreneurial culture
- Personality-based, person-oriented measure of local entrepreneurial culture

Research on the entrepreneurial personality

- Entrepreneurial Big Five profile
  - Individual-level research showed this profile to predict entrepreneurial intentions and attitudes and related motivational variables such as entrepreneurial self-efficacy, attitudes, self-identity, passion, and human and social capital (Obschonka et al., 2010, 2011, 2012; 2015; Stuetzer et al., 2012; Fritsch & Rusakova, 2010)
  - Growing evidence at regional level (Obschonka et al., 2013, 2015) → valid measures of regional local entrepreneurial culture
  - For example, it predicts regional entrepreneurship rates, economic resilience during major economic shocks, and helps explaining the "knowledge paradox" (Obschonka et al., 2013, 2015, 2015)

Research on the entrepreneurial personality

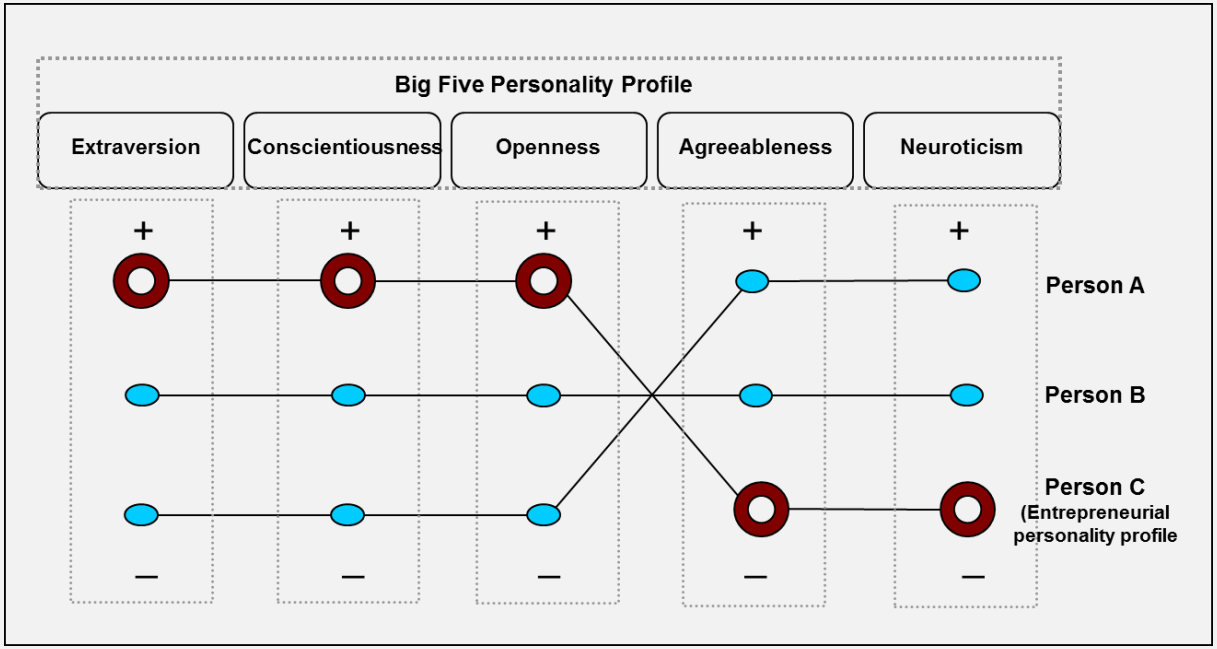


Figure 1: Personality profiles of person A, B, and C. C's profile is most entrepreneurial, and A's profile least entrepreneurial.

Research on the entrepreneurial personality

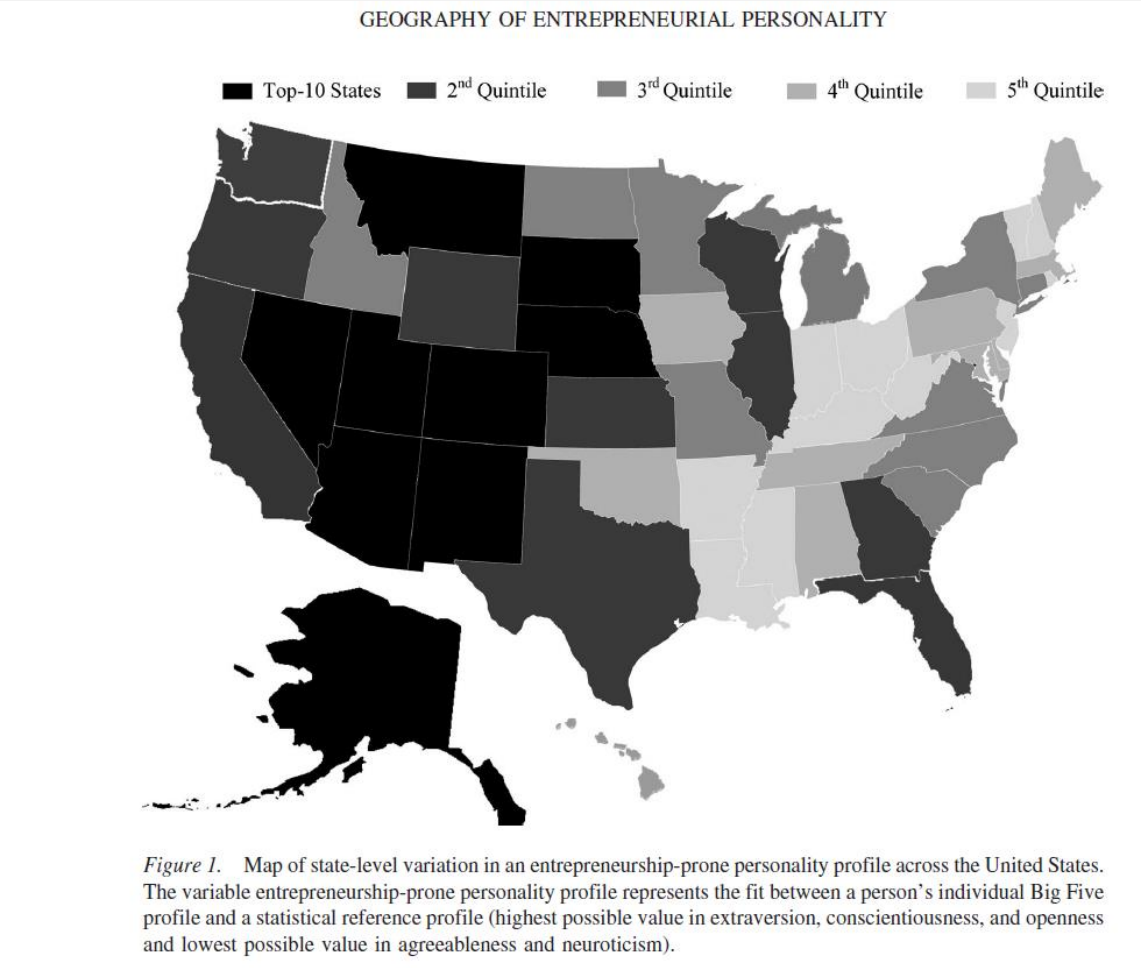
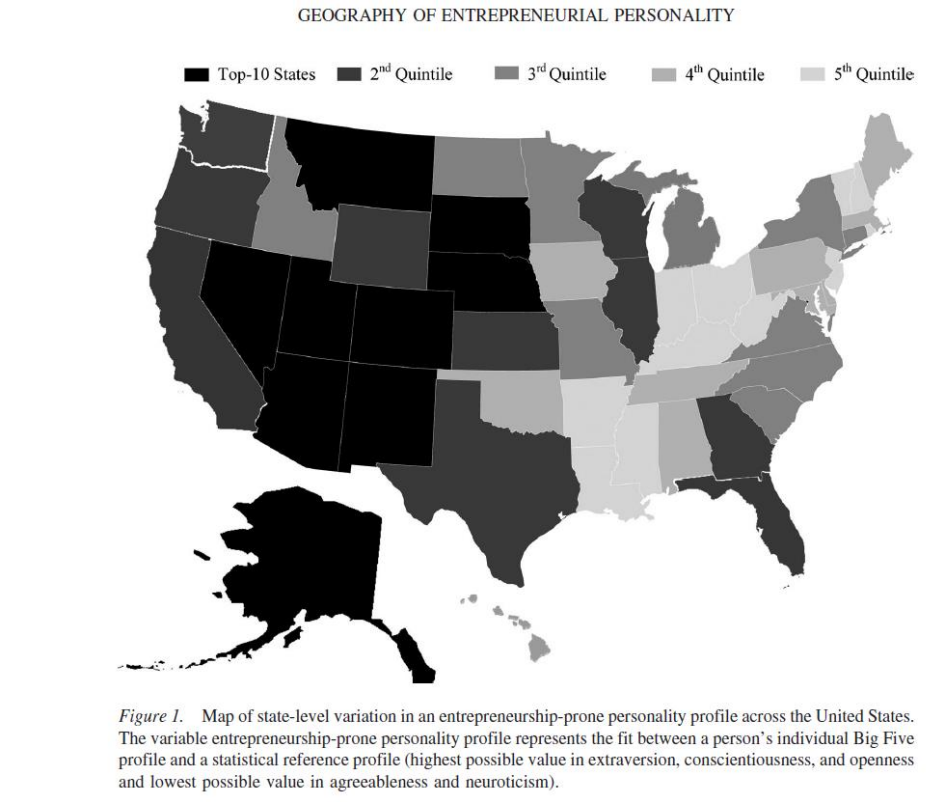


Figure 1. Map of state-level variation in an entrepreneurship-prone personality profile across the United States. The variable entrepreneurship-prone personality profile represents the fit between a person's individual Big Five profile and a statistical reference profile (highest possible value in extraversion, conscientiousness, and openness and lowest possible value in agreeableness and neuroticism).

Obschonka et al., (2013). The regional distribution and correlates of an entrepreneurship-prone personality profile in the United States, Germany, and the United Kingdom: A socioecological perspective. *Journal of Personality and Social Psychology, 105*(1), 104-122.

Research on the entrepreneurial personality



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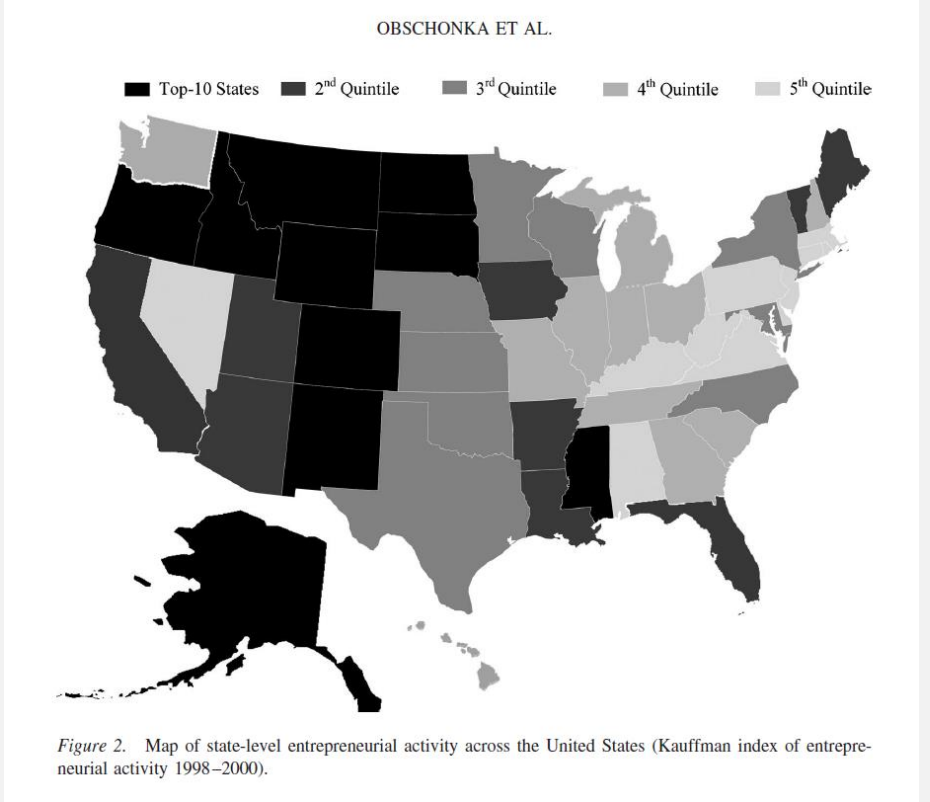
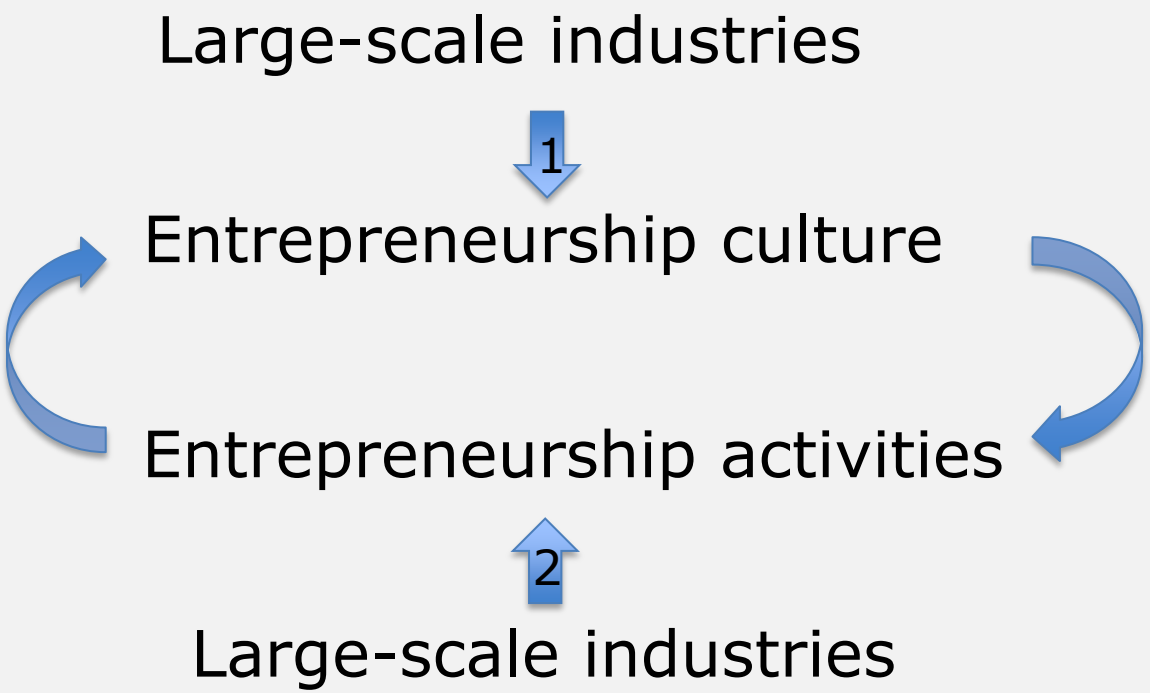


Figure 2. Map of state-level entrepreneurial activity across the United States (Kauffman index of entrepreneurial activity 1998–2000).

→ Rust Belt area: low entrepreneurial culture

Effects of industry structure on entrepreneurship



Effects of industry structure on entrepreneurship

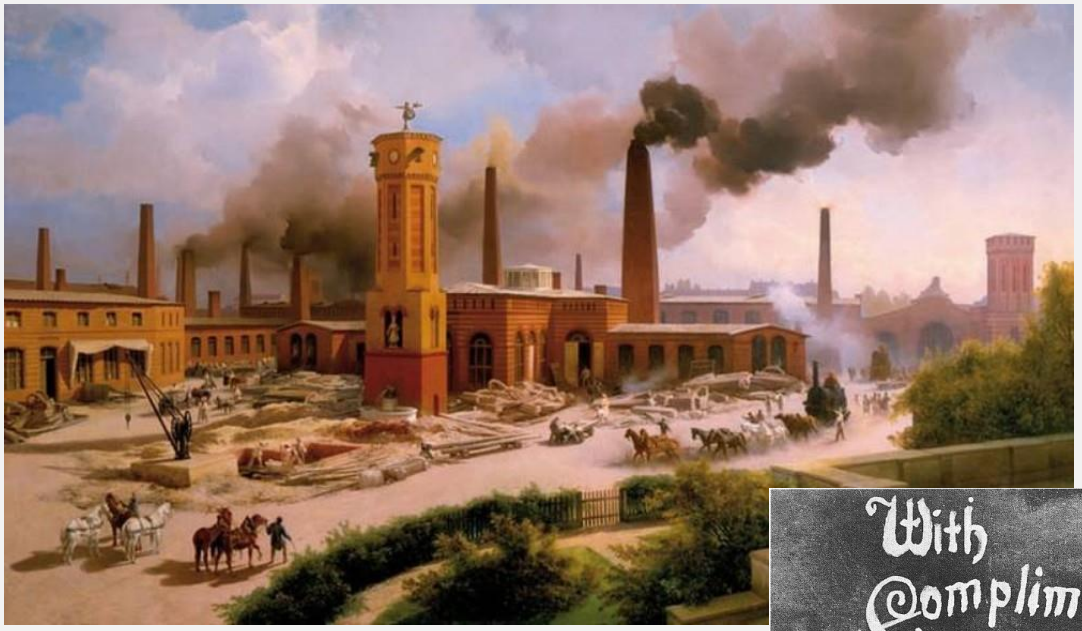
1) Large-scale industries leads to fewer entrepreneurship activities
   - Smaller firms create more entrepreneurs than large firms (Parker, 2009)
   - Larger firms may not put a focus on (the development) of entrepreneurial human capital due to division of labor and less "entrepreneurial" work tasks (Wagner, 2004; Elfenbein et al., 2010)
2) Large-scale industries leads to weak entrepreneurship culture
   - Lack of formal and informal institutions pro entrepreneurship (Etzioni, 1987)
   - Lack of social acceptance/legitimacy of entrepreneurship (Kibler et al., 2014)

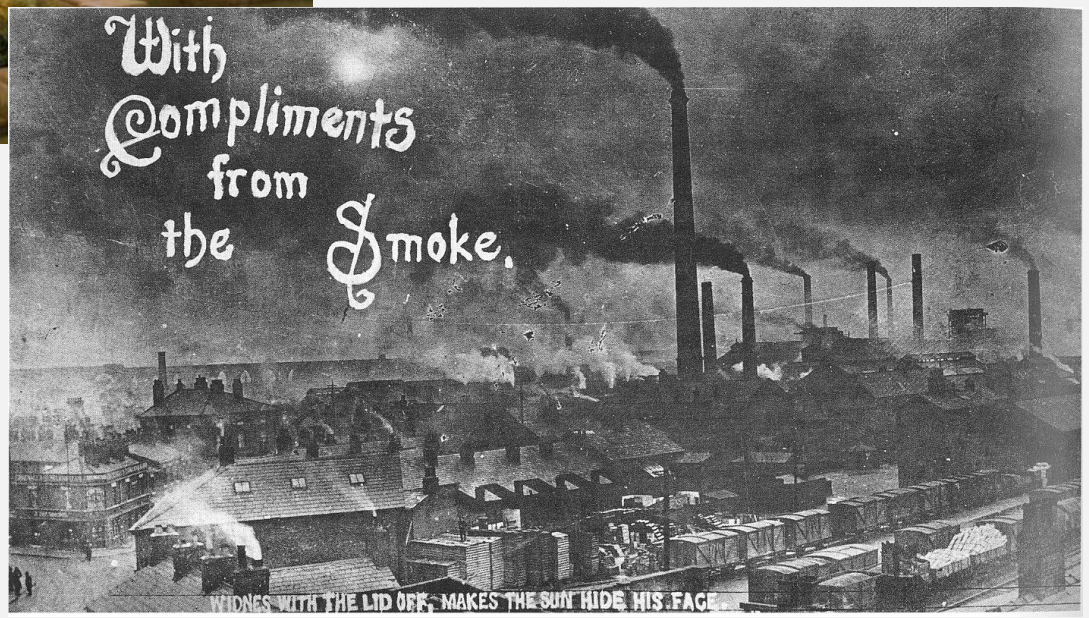
Effects of industry structure on entrepreneurship

- Initial impulse of industry structure on entrepreneurship in the past (industrial revolution) has ceded
- But continuing vicious cycle of few entrepreneurship activities and culture

- Hypothesis: The historic presence of large-scale industries negatively predicts both current entrepreneurship activities and entrepreneurship culture

The Industrial Revolution



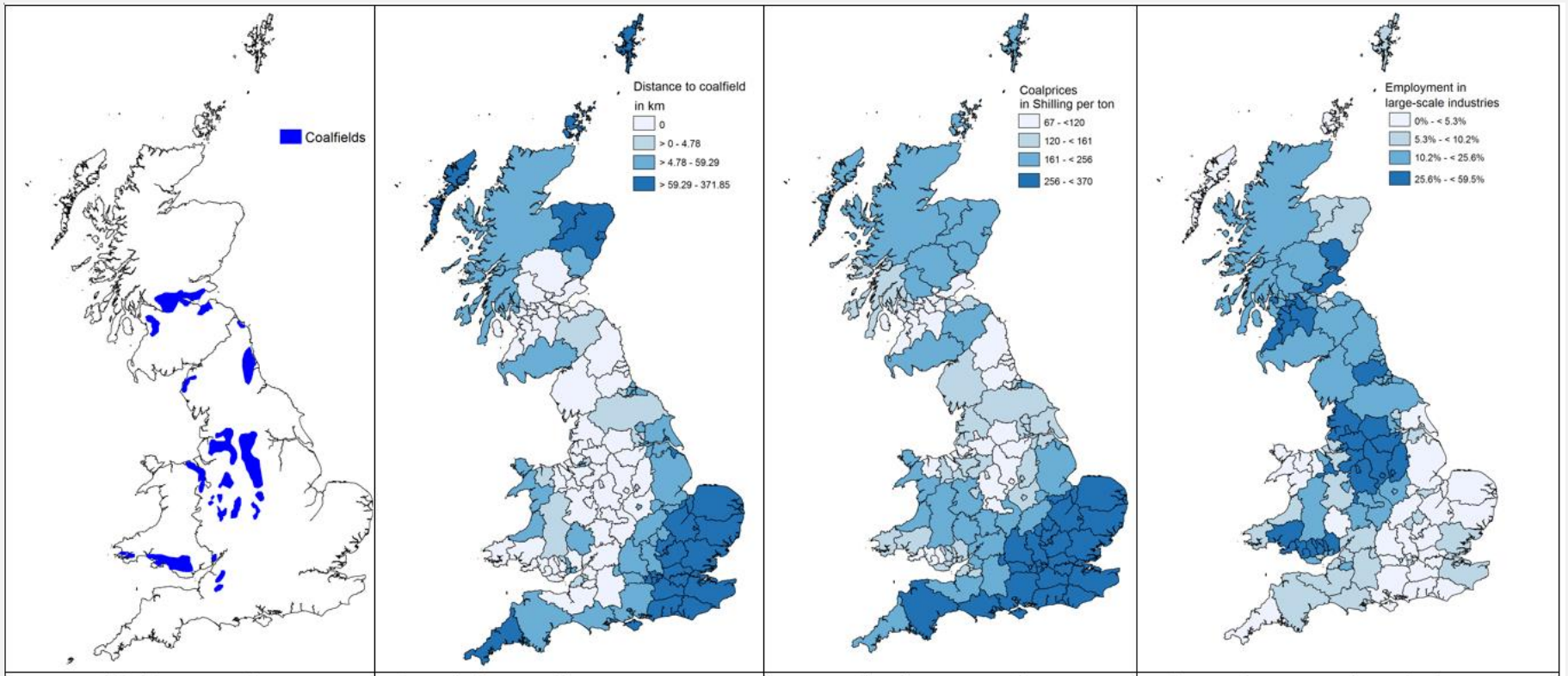


“The steam of the past”

Method

- Collaboration with historians from Cambridge University
- Focus on employment share in large-scale, steam-intensive industries during the Industrial Revolution in Great Britain
- Historical control variables
  - Historical energy supply, wealth, human capital, trade, soil quality, climate etc.
- Instrumental variables analysis
- Coalfield data as instrument (distance to nearest coalfield)

Coalfields



1a. Coalfields around 1700	1b. Minimum distance to nearest coalfield	1c. Coal prices around 1840	1d. Employment share in large-scale industries in 1891

Fig. 1. Coal and employment in large-scale industries

Psychological data

- BBC UK LAB data
- N = 417,217 Great Britain residents
- Counties of Great Britain
- Psychological map: Regional variation in the entrepreneurial Big Five profile

Large-scale, steam-intensive industries

Industry	Average Employment share in British regions in 1891	Steam-use	Average plant-size	White-collar use
Coal mining	5.1	n.a.	n.a.	n.a.
Food, drink & tobacco	5.8	0.94	15.0	13.4
Chemicals	0.7	2.44	35.9	13.8
Metal manufacturers	3.8	7.10	67.6	5.7
Mechanical engineering	2.4	2.5	50.3	8.5
Instrument engineering	0.2	2.5	23.0	12.2
Electrical engineering	0.1	2.5	64.8	8.5
Shipbuilding	1.0	1.96	164.4	5.0
Vehicles	0.6	1.51	62.4	5.2
Metal goods	0.9	1.57	32.6	7.8
Textiles	6.4	5.74	155.3	3.4
Leather	0.5	0.69	28.9	11.6
Clothing & Footwear	8.0	0.45	72.0	10.3
Bricks & pottery	1.2	8.02	39.7	6.1
Timber & furniture	1.6	2.54	22.8	10.1
Paper & publishing	1.4	2.99	21.9	11.8

Instrumental variables analysis

	first-stage		second-stage		
	1	2	3	4	5
	DV: Employment share in large-scale industries 1891	DV: Employment share in large-scale industries 1891	DV: Self-employment rate 2011	DV: Start-up rate 2011	DV: Entrepreneurial culture 2009-2011
Distance to coalfield	-0.274***	-0.297***	---	---	---
	(0.2030)	(0.0252)			
Employment share in large-scale industries 1891	---	---	-0.154***	-0.169***	-0.188***
			(0.0256)	(0.0241)	(0.0617)
Water mills around 1800	---	-0.116**	0.0469***	-0.000477	0.0187
		(0.0531)	(0.0137)	(0.0124)	(0.0294)
Market potential 1891	---	-1.88e-06	6.12e-07	3.24e-06***	-5.05e-08
		(2.19e-06)	(7.24e-07)	(7.24e-07)	(1.50e-06)
Cities around 1290	---	-0.646***	-0.0285	-0.0781	-0.0286
		(0.206)	(0.0443)	(0.0626)	(0.134)
Universities prior 1500	---	-0.0305	-0.209***	0.0946	-0.0215
		(0.167)	(0.0435)	(0.0976)	(0.0975)
Harbours around 1290	---	0.164	-0.0375	0.0243	-0.0518
		(0.136)	(0.0420)	(0.0412)	(0.0767)
Limits to agricultural use	---	-0.0911	-0.0917	-0.0993	0.0648
		(0.224)	(0.0793)	(0.0739)	(0.134)
Depth to rock	---	-0.0388	-0.0193	0.0268*	0.0436
		(0.0559)	(0.0161)	(0.0150)	(0.0280)
Mean July temperature	---	-0.0114	0.0392***	0.0178	0.0848*
		(0.0688)	(0.0152)	(0.0194)	(0.0470)
Ruggedness	---	-0.000155	0.000129*	6.06e-05	0.000156
		(0.000231)	(6.99e-05)	(7.00e-05)	(0.000167)
Employment 1891	---	5.81e-07*	1.55e-07**	3.60e-07***	2.78e-07**
		(3.37e-07)	(6.43e-08)	(7.33e-08)	(1.37e-07)
Population density 1891	---	-3.08e-05	-5.85e-05*	-3.22e-05	-2.72e-05
		(0.000111)	(3.19e-05)	(3.42e-05)	(5.65e-05)
Constant	3.125***	4.013***	2.339***	2.143***	-21.88***
	(0.071)	(1.093)	(0.267)	(0.332)	(0.824)
Observations	143	143	143	143	143
First-stage F-statistics	182.8	139.5	---	---	---
F-values	182.8	17.49	10.65	13.7	4.01
R-squared	0.498	0.556	0.504	0.517	0.297

Robustness check with contemporary controls

	first-stage	second-stage		
	1	2	3	4
	DV: Employment share in large-scale industries 1891	DV: Self-employment rate 2011	DV: Start-up rate 2011	DV: Entrepreneurial culture 2009-2011
Distance to coalfield	-0.287***	---	---	---
	(0.0246)			
Employment share in large-scale industries 1891	---	-0.168***	-0.170***	-0.185***
		(0.0256)	(0.0250)	(0.0651)
Water mills around1800	-0.187***	0.0488***	0.0117	0.0473
	(0.0629)	(0.0157)	(0.0151)	(0.0393)
Market potential 1891	2.83e-06	1.45e-06*	2.77e-06***	-1.12e-06
	(2.29e-06)	(7.98e-07)	(9.48e-07)	(1.50e-06)
Cities around 1290	-0.705***	-0.0351	-0.0644	-0.00163
	(0.167)	(0.0506)	(0.0590)	(0.130)
Universities prior 1500	0.0929	-0.182***	0.0840	-0.0525
	(0.172)	(0.0371)	(0.0974)	(0.0866)
Harbours around 1290	0.197	-0.0377	0.0186	-0.0651
	(0.126)	(0.0428)	(0.0418)	(0.0759)
Limits to agricultural use	-0.141	-0.117	-0.101	0.0692
	(0.215)	(0.0739)	(0.0779)	(0.144)
Depth to rock	0.00842	-0.0135	0.0229	0.0325
	(0.0574)	(0.0152)	(0.0154)	(0.0297)
Mean July temperature	0.0307	0.0437***	0.0139	0.0734
	(0.0632)	(0.0169)	(0.0194)	(0.0477)
Ruggedness	-8.46e-05	0.000134**	5.49e-05	0.000140
	(0.000229)	(6.84e-05)	(6.82e-05)	(0.000167)
Employment 1891	7.79e-07***	8.48e-08	2.81e-07***	1.45e-07
	(2.84e-07)	(5.96e-08)	(6.61e-08)	(1.28e-07)
Change unemployment rate 2001-2011	-0.0105***	-0.00223***	0.000966	0.00222
	(0.00261)	(0.000855)	(0.00112)	(0.00203)
Change GVA per head 2001-2011	-0.00945**	-0.00263*	0.00125	0.00253
	(0.00454)	(0.00154)	(0.00155)	(0.00304)
Population density 2011	-0.000120**	-1.67e-05	8.19e-06	3.46e-05
	(5.34e-05)	(1.73e-05)	(1.81e-05)	(3.88e-05)
Constant	3.816***	2.379***	2.124***	-21.88***
	(1.041)	(0.294)	(0.335)	(0.823)
Observations	143	143	143	143
First-stage F-statistics	136.25	---	---	---
F-values	21.14	8.98	13.95	4.87
R-squared	0.603	0.520	0.518	0.306

Migration?

- Effect of large-scale, steam-intensive industries on entrepreneurial culture robust when considering migration?

- We used the residence during youth (where respondents grew up) -> same results re: prediction of regional variation in the entrepreneurial Big Five profile

Robustness check using 1813-1820 male employment data

	first stage	second stage		
	1	3	4	5
	DV: Employment share in large-scale industries 1813-1820	DV: Self-employment rate 2011	DV: Start-up rate 2011	DV: Entrepreneurial culture 2009-2011
Distance to coalfield	-0.445***	---	---	---
	(0.0313)			
Employment share in large-scale industries 1813-1820		-0.126***	-0.124***	-0.160***
		(0.0157)	(0.0172)	(0.0395)
Watermills around 1800	-0.205***	0.0539***	0.00113	0.0580*
	(0.0728)	(0.0130)	(0.0141)	(0.0299)
Market potential 1811	5.11e-06	-6.18e-07	6.52e-06***	4.02e-06*
	(4.07e-06)	(1.01e-06)	(1.00e-06)	(2.17e-06)
Cities around 1290	-0.171	0.00794	-0.0226	0.0231
	(0.331)	(0.0590)	(0.0621)	(0.129)
Universities prior 1500	0.194	-0.140**	-0.0899**	-0.0106
	(0.210)	(0.0688)	(0.0354)	(0.107)
Harbours around 1290	0.225*	-0.0265	0.00201	-0.0261
	(0.130)	(0.0494)	(0.0379)	(0.0868)
Limits to agricultural use	-0.760***	0.224***	0.216**	0.284**
	(0.283)	(0.0674)	(0.0841)	(0.120)
Depth to rock	-0.0654	-0.000166	0.0225	0.0121
	(0.0616)	(0.0160)	(0.0161)	(0.0270)
Mean July temperature	-0.205**	0.0175	-0.0165	0.0176
	(0.103)	(0.0203)	(0.0199)	(0.0422)
Ruggedness	-0.000294	0.000196**	3.01e-05	-9.25e-05
	(0.000347)	(8.55e-05)	(7.93e-05)	(0.000156)
Population 1811	1.81e-06**	2.43e-07***	7.00e-07***	4.55e-07***
	(7.32e-07)	(7.50e-08)	(1.07e-07)	(1.66e-07)
Population density 1811	0.000245	-4.02e-05	-1.54e-05	0.000215
	(0.000309)	(7.50e-05)	(8.07e-05)	(0.000152)
Constant	6.157***	2.476***	2.173***	-21.38***
	(1.590)	(0.357)	(0.346)	(0.720)
Observations	111	111	111	111
First-stage F-statistics	202.2	---	---	---
F-values	20.85	11.83	23.01	7.03
R-squared	0.682	0.531	0.557	0.327

Mediation test: Human capital

	Indirect effect			Direct effect		
	Observed coefficient	LLCI	ULCI	Observed coefficient	LLCI	ULCI
Human capital on start-up rate	-.026** (.013)	-.055	-.007	-.200*** (.042)	-.026	-.095
Human capital on self-employment rate	.002 (.018)	-.034	.038	-.208*** (.053)	-.308	-.104
Human capital on entrepreneurship culture	-.006** (.003)	-.014	-.002	-.013* (.007)	-.027	.001

Conclusion

- The existing literature on regional variation in entrepreneurship has generally focused on cross-sectional empirical evidence, thus impeding causal analyses

- We apply a causal method and quantify the effect of historical factors, i.e., local industry structure during the Industrial Revolution

- The concentration of large-scale steam-intensive industries left a long-lasting imprint that negatively affects entrepreneurship (e.g., vicious cycle of latent and manifest entrepreneurship)

- This historical imprint is present even after the large-scale industries have lost their dominating role in the local economy

Thank you very much!