Appendices

Appendix A. Brief discussion of empirical work that identifies systemic and framework conditions of entrepreneurial ecosystems.

Institutions play an important role both for the prevalence of different types of entrepreneurial activity and for economic development (Baumol, 1990; Hall & Sobel, 2008; North, 1990), and physical infrastructure enhances human interactions and increases connectivity, reducing costs, helping not only individuals to recognise entrepreneurial opportunities (Audretsch, Heger, & Veith 2015), but more general, economic activity as well. To conclude the framework conditions, the level and variety in demand for goods and services also acts as pull mechanism for entrepreneurship and economic activity, whereas active networks of entrepreneurs provide information flows, enabling opportunity recognition and resource allocation (Aldrich & Zimmer, 1986).

When it comes to the systemic conditions, entrepreneurs are seen not only as an output of the system but also as creators (or leaders) of the system by Feld (2012). Leadership within the entrepreneurial ecosystem approach should be seen as having certain role models or otherwise visible entrepreneurs (Stam, 2018). Accessible financing for entrepreneurs was shown to be an important condition for entrepreneurs' ability to grow and to sustain competitiveness, and ultimately for economic development as well (Kerr and Nanda 2009; King & Levine, 1993), whereas the supply of talent or human capital in the form of high skilled and creative individuals is important for entrepreneurial activity and economic development (Acs & Armington 2004; Lee et al. 2004). The creation and the growing stock of knowledge form important sources of spillovers for entrepreneurial opportunities (Audretsch, 1995; Audretsch & Lehmann, 2005). And lastly, the presence of intermediate and support services was shown to be important in assisting new entrepreneurs and increase the efficiency of the economy.

Appendix B. Sorting regions into clusters based posterior probabilities

The next step is to classify regions into homogenous groups based on their effect of entrepreneurial activity on (residual) growth. To do so, we calculate the posterior probability that observation (E, ϵ) belongs to class j, given by

$$P(j|\epsilon, E, \theta) = \frac{\pi_j f(\epsilon_i | E_i, \theta_j)}{\sum_k \pi_k f_k(\epsilon_i | E_i, \theta_k)} \qquad (B1)$$

Each region is then assigned to the group for which its posterior probability is the highest. Before we can classify regions into groups and estimate equation (7), we need to establish the appropriate value for K. We first estimate the equation with $K = 1$ and then re-estimate the equation, each time adding an additional group. The maximum number of groups is theoretically only limited by the number of observations in the sample; however, overfitting the data (when for instance the estimated parameters of 2 classes are statistically indistinguishable) restricts the number of classes in practice. We obtain the appropriate number for K by selecting the configuration with the lowest Bayesian Information Criterion (BIC) value. Following the discussion in section 2, we can interpret this number K as the number of different entrepreneurial ecosystems the data suggests exist in our set of European regions. These K types of regions are characterised by a different constant and/or slope coefficient, where a different slope coefficient can be interpreted as suggestive of a different entrepreneurial ecosystem. We then verify that suggestion by comparing the means of a list of potentially relevant systemic and framework elements of the entrepreneurial ecosystem.
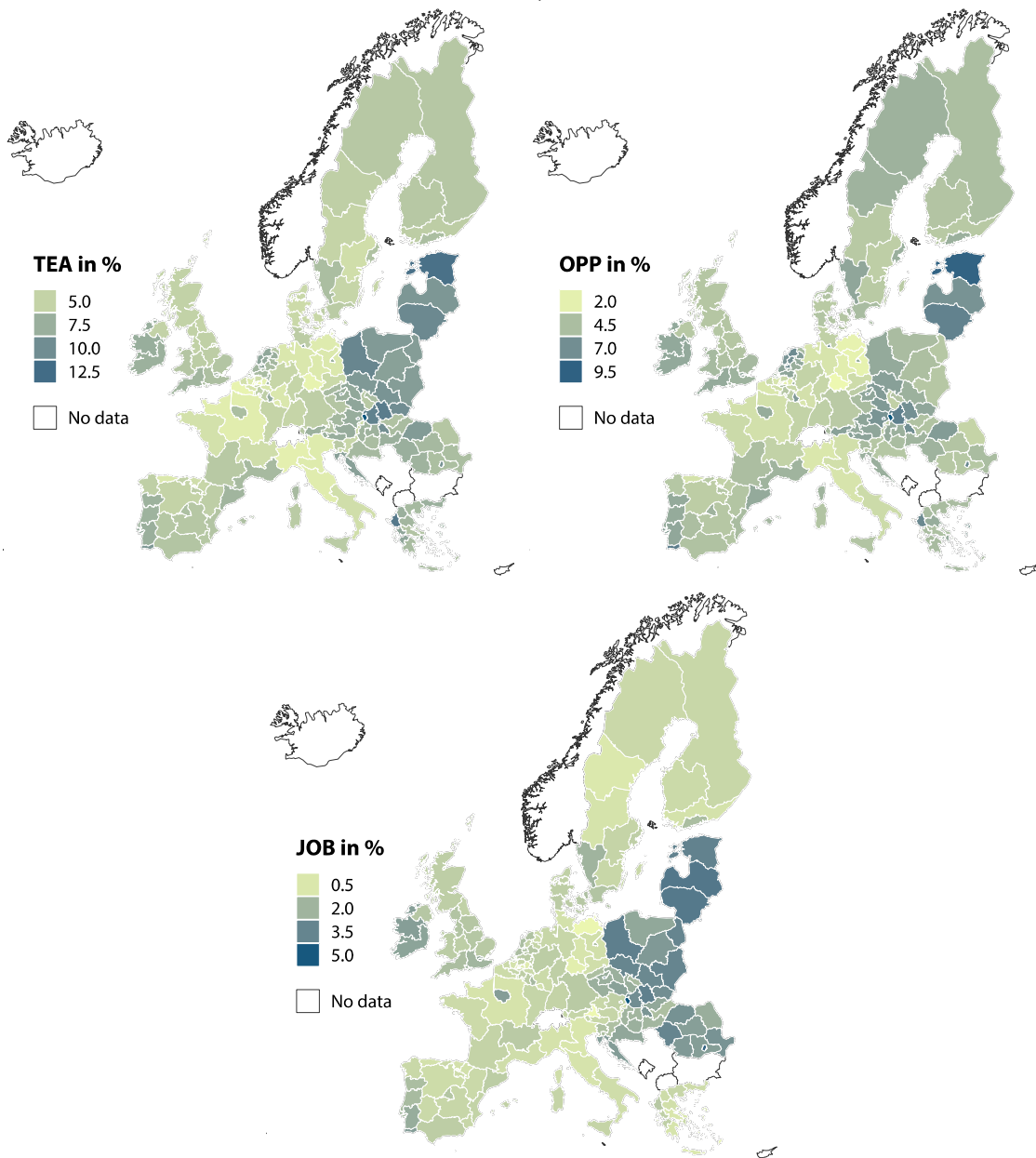
Table B1: Model fit comparison (BIC criterion)

k	E^{TEA}	E^{OPP}	E^{JOB}
1	-849.92	-841.66	**-918.52**
2	-853.41	-832.69	-908.00
3	-847.48	-812.18	-889.31
4	-826.96	**-853.34**	-891.22
5	**-856.85**	-835.93	-885.73
6	-848.45	-760.50	-867.46
7	-844.35	-818.76	-864.79

Appendix C. Prevalence rates of the different types of entrepreneurship

Figure 1 depicts the prevalence rates of the different types of entrepreneurial activity in European regions. The countries that are not covered by the GEM survey are left grey. The figure shows that all three types of entrepreneurial activity are especially high in Eastern Europe, while only a select number of regions in West and Central Europe appear to have substantial rates of early-stage entrepreneurial activity. As OPP and JOB are subcategories of TEA, the correlation among them is positive by construction and lower for the more exclusive JOB. It ranges from 0.56 of TEA with JOB to 0.90 of TEA with OPP.

Figure C1: Maps of entrepreneurial activity in Europe (left = TEA, right = OPP, bottom = JOB)

TEA in %
- 5.0
- 7.5
- 10.0
- 12.5
- No data

OPP in %
- 2.0
- 4.5
- 7.0
- 9.5
- No data

JOB in %
- 0.5
- 2.0
- 3.5
- 5.0
- No data

NUTS level between parentheses: Austria (2), Belgium (2), Czech Republic (2), Germany (1), Denmark (2), Estonia (2), Greece (2), Spain (2), Finland (2), France (1), Croatia (2), Hungary (2), Ireland (2), Italy (1), Lithuania (2), Luxembourg (2), Latvia (2), Netherlands (2), Norway (2), Poland (1), Portugal (2), Romania (2), Sweden (2), Slovenia (2), Slovakia (2), and United Kingdom (1).

Appendix D. Additional results

Table D1: Correlation matrix

		1	2	3	4	5	6	7	8	9	10
1	GRP p/c growth	1									
2	Initial GRP p/c	-0.41	1								
3	Physical capital investment rate	0.60	0.14	1							
4	Human capital investment rate	-0.06	0.16	-0.03	1						
5	Population growth	-0.46	0.63	-0.05	0.01	1					
6	Population density	0.05	0.40	0.17	0.13	0.37	1				
7	Related variety	0.23	-0.18	0.09	0.09	-0.11	-0.11	1			
8	Unrelated variety	0.52	-0.02	0.46	0.08	-0.11	0.04	0.57	1		
9	Total early-stage entrepreneurial	0.24	-0.21	-0.09	0.25	-0.11	-0.01	-0.10	-0.06	1	
10	Opportunity entrepreneurial activity	0.13	0.07	-0.02	0.24	0.07	0.06	-0.10	-0.04	0.90	1
11	Job growth expecting entrepreneurial	0.60	-0.38	0.14	0.22	-0.21	0.08	0.09	0.25	0.75	0.62

Table D2: Cluster means total entrepreneurial activity

	1	2	3	4
Formal institutions				
Corruption	0.54	-0.35	-1.08	-0.35
Quality of government	0.53	-0.35	-1.39	-0.12
Impartiality	0.53	-0.33	-1.13	-0.24
Entrepreneurship culture				
Entrepreneurship is a good career choice	0.58	0.61	0.66	0.54
Successful entrepreneurs have status	0.68	0.67	0.64	0.65
Fear of failure	0.41	0.54	0.49	0.44
Physical infrastructure				
Household access to internet	84.78	74.15	69.75	79.04
Accessibility of motorways	99.60	46.12	32.97	78.28
Accessibility of railways	94.80	54.22	41.50	79.47
Accessibility of passenger flights	1083.1	326.1	140.5	890.5
Demand				
GRP p/c	27214	23154	12805	18558
Population density	503.2	291.5	185.7	162.8
Networks				
SMEs with innovation co-operation	0.44	0.27	0.09	0.31
Know someone that started a firm	0.33	0.31	0.36	0.30
Talent				
Human capital	6.44	6.51	8.50	4.49
Creative class employment	9.70	6.73	7.10	6.72
Knowledge workers	42.18	31.60	30.44	34.75
New knowledge				
R&D ratio	1.89	1.03	0.55	1.57
Patent applications p/mil. inhabitants	175.9	62.2	12.3	340.1

Table D3: Cluster means opportunity-driven entrepreneurial activity

	1	2	3	4
Formal institutions				
Corruption	0.31	-1.06	0.78	-1.31
Quality of government	0.34	-1.43	0.44	-1.05
Impartiality	0.32	-1.14	0.63	-1.16
Entrepreneurship culture				
Entrepreneurship is a good career choice	0.58	0.68	0.54	0.62
Successful entrepreneurs have status	0.67	0.65	0.75	0.69
Fear of failure	0.42	0.50	0.48	0.66
Physical infrastructure				
Household access to internet	82.69	69.03	86.46	63.00
Accessibility of motorways	87.19	29.93	120.19	8.17
Accessibility of railways	85.29	37.78	121.69	15.93
Accessibility of passenger flights	909.4	106.0	1242.5	48.2
Demand				
GRP p/c	25981	11183	25420	19763
Population density	455.3	178.6	356.0	58.8
Networks				
SMEs with innovation co-operation	0.40	0.08	0.33	0.29
Know someone that started a firm	0.33	0.35	0.27	0.32
Talent				
Human capital	6.30	7.83	5.10	8.50
Creative class employment	9.03	6.88	8.15	5.42
Knowledge workers	39.94	28.88	41.00	25.18
New knowledge				
R&D ratio	1.65	0.50	2.56	0.44
Patent applications p/mil. inhabitants	156.70	11.70	341.97	5.20

*Table D4: T-tests of cluster means total entrepreneurial activity*

	1-2	1-3	1-4	2-3	2-4	3-4
Formal institutions						
Corruption	5.51**	7.46**	3.67**	3.00**	0.00	-2.40*
Quality of government	6.11**	9.31**	3.05**	4.46**	-0.97	-4.29**
Impartiality	5.77**	8.39**	3.47**	3.52**	-0.36	-3.29**
Entrepreneurship culture						
Entrepreneurship is a good career choice	-1.30	-2.84**	1.28	-3.21**	3.55**	5.04**
Successful entrepreneurs have status	0.34	1.41	0.90	1.41	0.71	-0.28
Fear of failure	-11.2**	-5.73**	-2.01*	2.15*	4.52**	2.93**
Physical infrastructure						
Household access to internet	6.32**	6.61**	2.40*	1.55	-1.67	-3.08**
Accessibility of motorways	3.97**	3.45**	0.98	0.99	-1.80+	-2.48*
Accessibility of railways	3.72**	3.52**	0.92	0.97	-1.63	-2.92**
Accessibility of passenger flights	2.37*	1.95+	0.36	1.08	-1.74+	-1.77+
Demand						
GRP p/c	2.34*	8.75**	4.29**	7.45**	3.12**	-2.49*
Population density	2.18*	1.08	0.63	-0.53	-1.01	-0.58
Networks						
SMEs with innovation co-operation	5.81**	7.75**	2.67**	4.92**	-1.18	-5.03**
Know someone that started a firm	1.68+	-1.42	1.38	-4.22**	0.54	2.27*
Talent						
Human capital	-0.12	-1.50	2.24*	-1.33	2.34*	2.71*
Creative class employment	6.49**	3.8**	4.09**	-0.72	0.02	0.55
Knowledge workers	8.14**	5.87**	3.79**	0.47	-1.41	-1.24
New knowledge						
R&D ratio	3.70**	4.26**	0.84	1.61	-1.31	-2.31*
Patent applications p/mil. inhabitants	3.40**	3.67**	-1.84+	1.34	-2.06*	-1.69

Table D5: T-tests of cluster means opportunity-driven entrepreneurial activity

	1-2	1-3	1-4	2-3	2-4	3-4
Formal institutions						
Corruption	5.58**	-1.85+	5.78**	-9.54**	1.32	17.79**
Quality of government	7.91**	-0.44	5.61**	-6.95**	-1.44	10.04**
Impartiality	6.49**	-1.33	5.77**	-9.41**	0.08	18.25**
Entrepreneurship culture						
Entrepreneurship is a good career choice	-3.50**	1.60	-1.20	8.99**	5.17**	-4.76**
Successful entrepreneurs have status	0.81	-2.96**	-0.77	-4.85**	-2.23*	3.43**
Fear of failure	-4.42**	-3.22**	-12.3**	1.03	-7.98**	-18.8**
Physical infrastructure						
Household access to internet	5.79**	-1.51	7.46**	-5.83**	2.29*	9.91**
Accessibility of motorways	2.97**	-1.56	3.51**	-6.23**	4.45**	6.86**
Accessibility of railways	3.16**	-2.2*	3.96**	-6.94**	3.93**	7.88**
Accessibility of passenger flights	1.75+	-0.66	1.61	-3.06**	1.56	2.74*
Demand						
GRP p/c	8.82**	-0.06	2.11*	-7.41**	-5.69**	2.62*
Population density	0.96	-0.95	2.53*	-2.16*	2.69*	4.67**
Networks						
SMEs with innovation co-operation	6.53**	1.37	1.90+	-7.88**	-5.16**	0.72
Know someone that started a firm	-1.19	3.09**	0.63	6.08**	2.47*	-5.36**
Talent						
Human capital	-1.24	0.96	-1.48	1.79+	-0.28	-1.90+
Creative class employment	2.95**	1.14	4.31**	-2.14*	2.59*	6.04**
Knowledge workers	5.03**	-0.48	6.10**	-4.37**	1.26	9.83**
New knowledge						
R&D ratio	3.65**	-2.41*	3.31**	-3.88**	0.59	3.43**
Patent applications p/mil. inhabitants	2.11*	-2.18*	1.71+	-2.59*	1.59	2.02+

Figure D1: Map of Latent Class Clusters for total entrepreneurial activity (TEA)

Cluster

1
2
3
4

No data
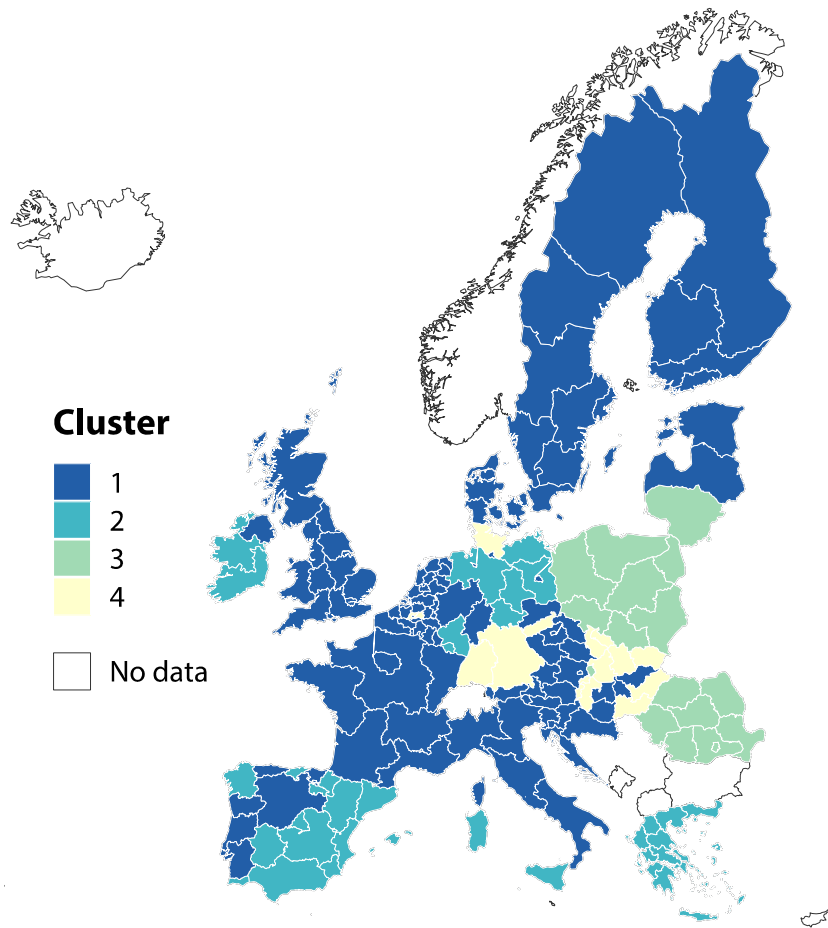
Figure D2: Map of Latent Class Clusters for opportunity-driven entrepreneurial activity (OPP)
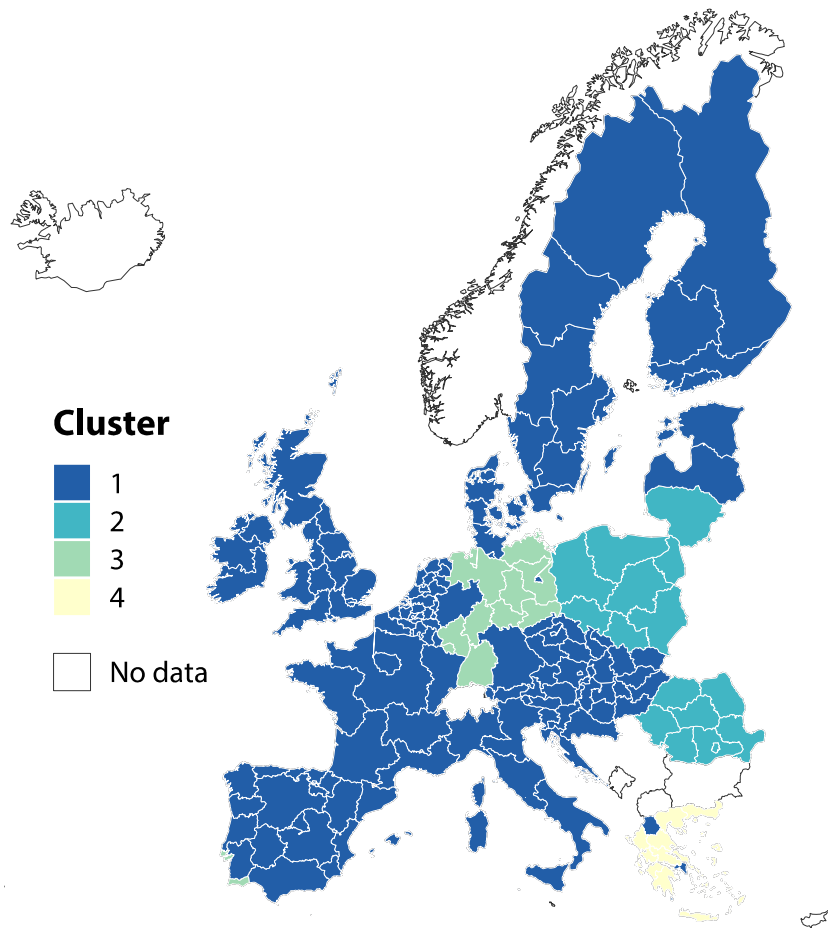
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