FAPESP PIPE Program and Location of Knowledge-Intensive Entrepreneurship in São Paulo

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Topics

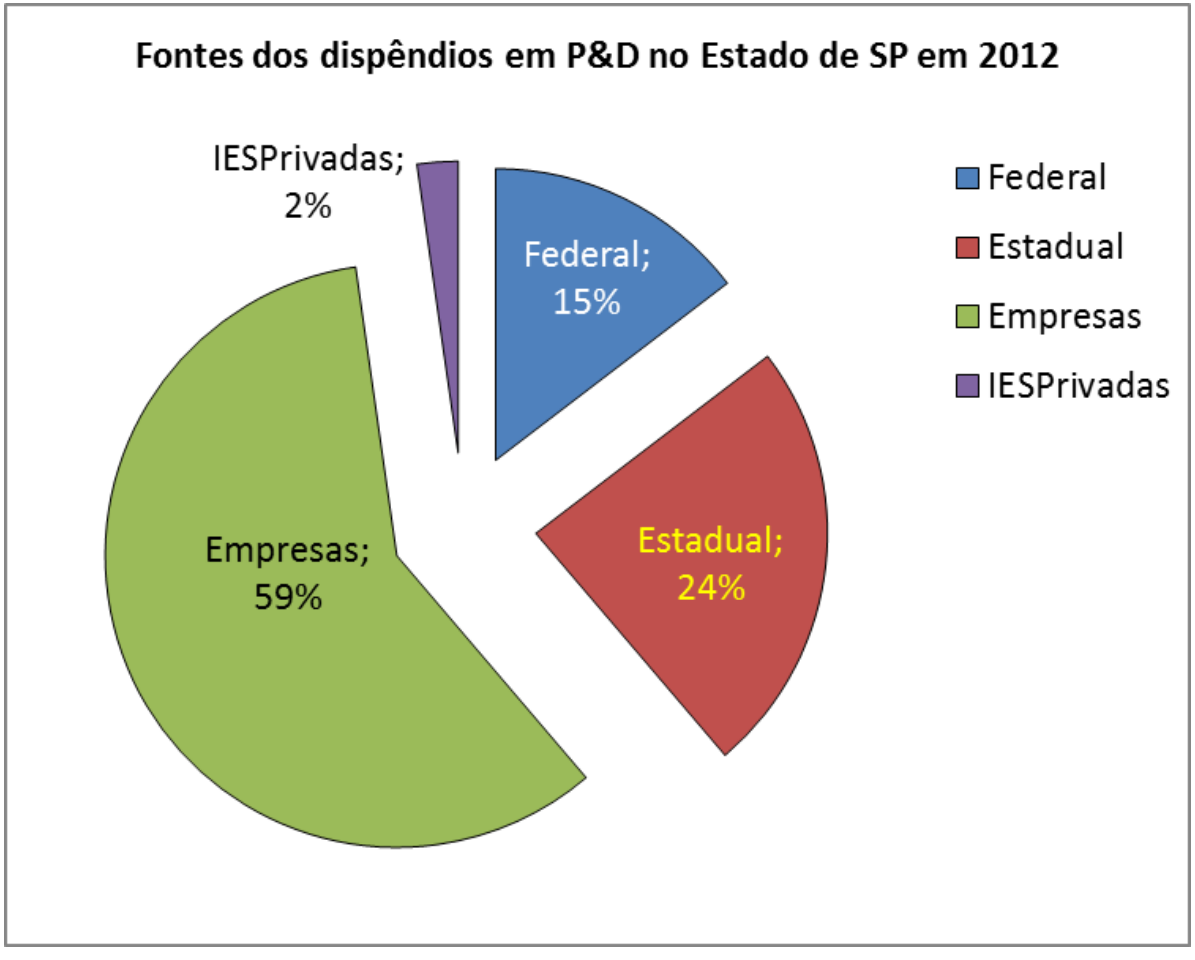
- FAPESP Research for Technological Innovation in Small Businesses (PIPE) Program
- On the Location of Knowledge-Intensive Entrepreneurship (KIE) in São Paulo

State of São Paulo, Brasil

44	Million people
32%	of Brazil's GDP
48%	of Brazilian science
13%	of State budget to HE and R&D
1.6% GDP for R&D	

3	State Universities
3+1	Federal H. E. Institutions
52	State Tech Faculties
45%	of the PhDs graduated in Brazil (5,754 in 2013)
22	Research Institutes (19 state/3 federal)
1	Research Foundation

São Paulo: R&D Expenditures, 2012, by source



R&D expenditures total 1.6% of State GDP (Brazil is 1.2%)

- Grew from 1.52% in 2008

Public expenditures

- State 63%
- Federal 37%

Unicamp: 254 start-ups, >19.000 jobs, annual revenues R$ 3 billions

FAPESP contribution to research for innovation in SP

Research for Technological Innovation

- PITE – The Partnership for Technological Innovation Program
  - Research projects developed in partnership with R&D institutions in the State of São Paulo and businesses located in Brazil and abroad
- ERCs – Engineering Research Centers
  - Research program addressing medium and long term challenges of high scientific and technological impacts
- PIPE – The Research for Technological Innovation in Small Businesses Program
  - Research projects developed by researchers in small companies

Research for Technological Innovation (PIPE)

- Initiated in 1997
- Two phases
- Up to R$ 1,200,000 per project, non refundable funding
- Requirements for the PI related to experience and competence in the area of the project, not to formal degree
- PI must be an employee of the SB (research carried out within the firm)

Research for Technological Innovation (PIPE)

- FAPESP can review the proposal of a company to be created
- Money is intended to solve a research problem (Fapesp supports research)
- More than one project per week approved since its creation
  - Three per week last year

Research for Technological Innovation (PIPE)

Phase I

- To test the technical and commercial feasibility of the proposed ideas
- Up to 9 months
- Up to R$ 200,000 per project
- Outsourcing limited to 1/3 of the total budget, including consultancy services

Research for Technological Innovation (PIPE)

Phase II

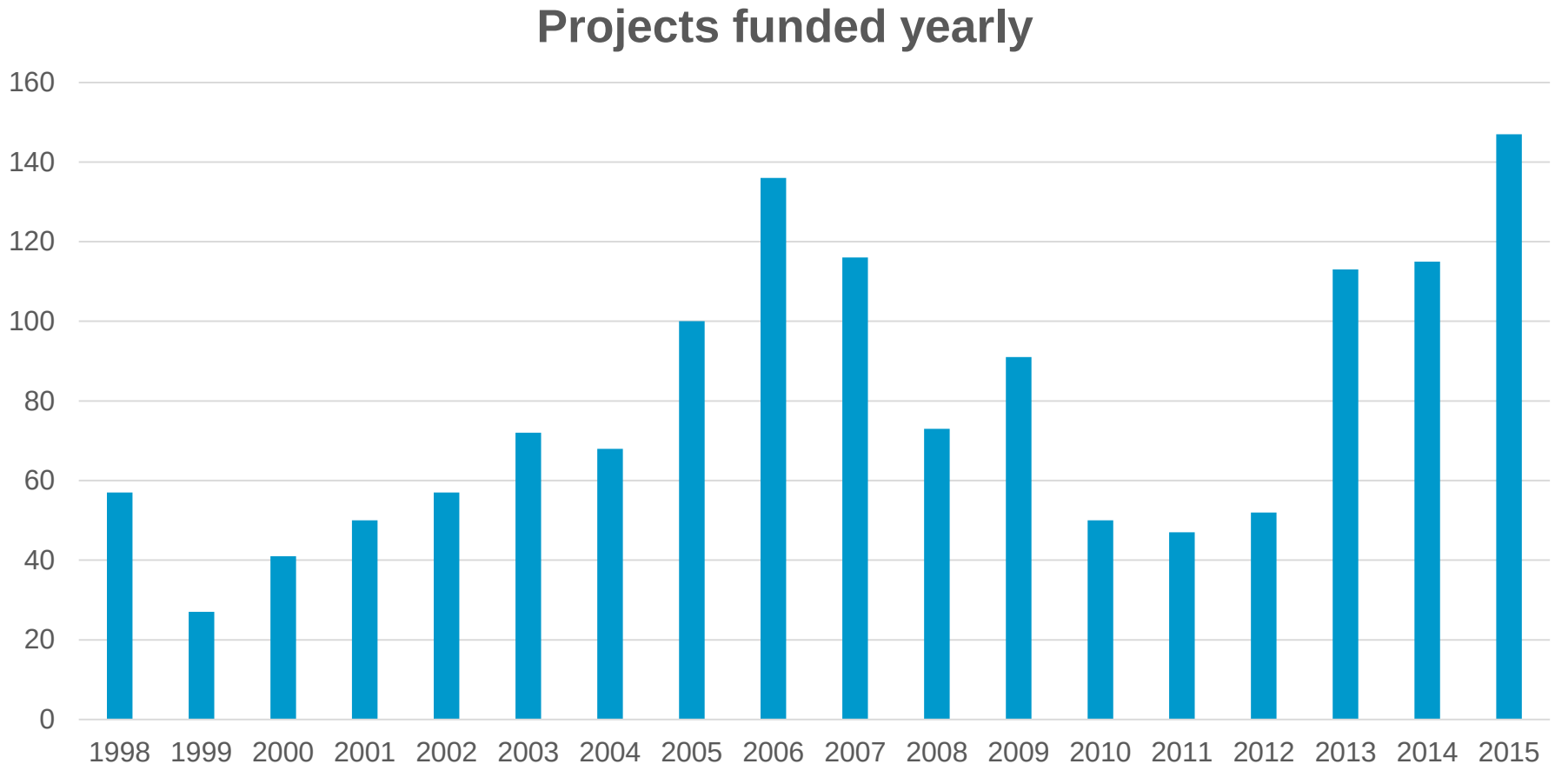
- To develop the research
- Up to 2 years
- Up to R$ 1,000,000 per project
- Outsourcing limited to 1/2 of the total budget, including consultancy services

Research for Technological Innovation (PIPE)

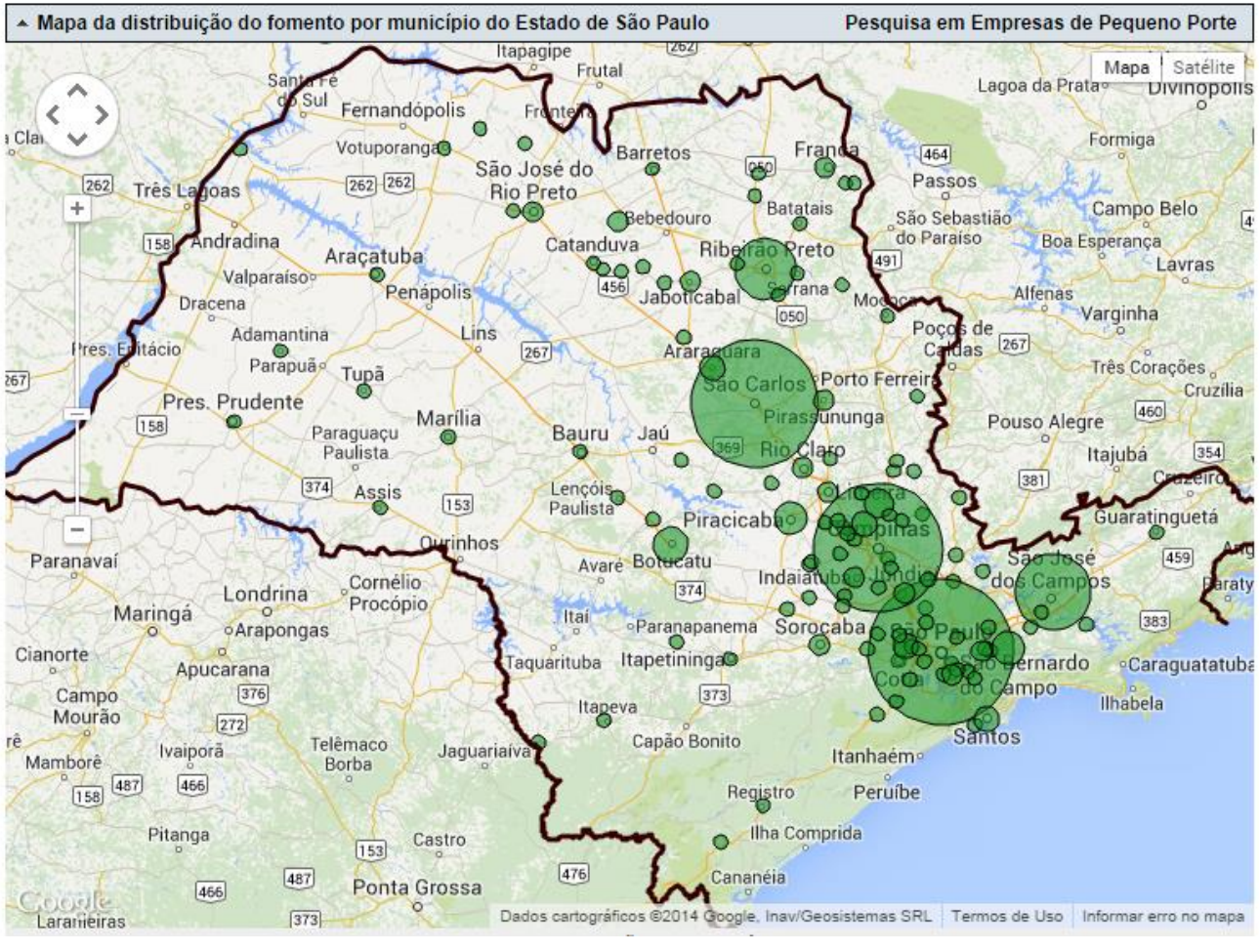
Phase III

- To develop and implement initial commercialization of the product
- Not supported by FAPESP
- Partnerships with FINEP (PAPPE), BNDES and Venture Capital Funds

The challenge of increasing the number of PIPE Projects



Geographical distribution of PIPE projects, 2014



Find at http://www.bv.fapesp.br/pt/266/pesquisa-em-empresas-de-pequeno-porte/

ON THE LOCATION OF KNOWLEDGE-INTENSIVE ENTREPRENEURSHIP IN DEVELOPING COUNTRIES:

A CASE STUDY OF THE STATE OF SÃO PAULO, BRAZIL

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Paper Motivation

- Understanding the determinants and dynamics of emergence of entrepreneurial ecosystems represents a fundamental aspect of defining and orienting public policies.
- The conditions for successfully promoting wealth creation from KIE are often poorly understood, generating misguided and inefficient allocation of public resources.
  - The System of Technology Parks in SP, for example, would benefit from a better understanding of these conditions.

KIE Location: São Paulo State

- This article addresses the determinants of KIE location and density at city-level in the context of a developing country.
- Four core dimensions of interest: *Urban Environment*, *Centrality/Peripherality*, *Infrastructural Conditions*, and *Economic Structure*.
- Rationale: KIE is a systemic phenomenon integrated within innovation systems, and being affected by market, technological and institutional opportunities (Radosevic and Yoruk, 2013).
- Case: PIPE program grants as proxy for KIE activity. The utilized data include 1130 grants located in 114 cities across the State.

Hypotheses

H1. Highly dense urban agglomerations in the context of developing country mega-cities hamper the potential of KIE activity.

H2. Infrastructural conditions, mainly represented by knowledge infrastructure, have positive impacts on the location of KIE activity within the context of developing countries.

H3. The economic structure of a given location, proxied by the level of income per capita and by the existence of localization economies, exert a positive impact upon the location of KIE activity within the context of developing countries.

H4. The conditions of geographical centrality/peripherality of a given location, represented by its distance from economic centers, affect the location of KIE activity within the context of developing countries.

Five important locations

Table 2. City-level distribution of PIPE projects in the State of São Paulo.

City	Number of Projects	Total%	Cumulative%
São Paulo	298	26,35%	26,35%
Campinas	197	17,42%	43,77%
São Carlos	177	15,65%	59,42%
São José dos Campos	72	6,37%	65,78%
Ribeirão Preto	55	4,86%	70,65%
Remaining Cities (109)	332	29,27%	100%

Empirics

KIE location assumed to evolve according to:

- $X = Y\alpha\ e$ (1)

X represents KIE activity, e is a measure of the overall efficiency of unaccounted predictors (error term), and Y (with elasticity α) stands for a representative vector of the following dimensions:

- $Y = A\beta\ B\gamma\ C\delta\ D\varepsilon$ (1.1)

Y dimensions:

i) Urban Environment (A with elasticity β);

ii) Centrality/Peripherality (B with elasticity γ);

iii) Infrastructural Conditions (C with elasticity δ);

iv) Economic Structure (D with elasticity ε).

Empirics

Three different formulations of model (1) tested for Urban Environment, Infrastructure Conditions, Economic Structure.

Centrality/Peripherality (DISTCAP) was kept across models as control for potential latent agglomeration externalities arising from proximity to the core economic center (city of São Paulo).

$$Xi = c + \zeta \ln DISTCAPi + \beta 1 \ln DENSi + \beta 2 \ln URBi + \beta 3 \ln HDIi + \beta 4 \ln TRAFFIC + \beta 5 \ln THEFT + e \quad (1)$$

$$Xi = c + \zeta \ln DISTCAPi + \rho 1 RESUNIi + \rho 2 \ln ENERGYi + \rho 3 \ln EDUCATION + \rho 4 \ln INFRAi + \rho 5 \ln CREDi + e \quad (2)$$

$$Xi = c + \zeta \ln DISTCAPi + \varepsilon 1 \ln BUSCONCi + \varepsilon 2 \ln LABCONCi + \varepsilon 3 \ln GDPPCi + \varepsilon 4 \ln TECHACTi + \varepsilon 5 \ln OPEN + \varepsilon 6 \ln KIJOBS + e \quad (3)$$

Variables

Table 1. Variables

Code	Dimension	Definition	Source
PROJP100	X	Number of projects per 100 thousand inhabitants aged 25-54 (mean city-level population 1993-2014) for each city with PIPE projects.	PIPE/FAPESP and SEADE
PROJ_ORD	X	Ordinal transformation of PROJP100, where: (1=above 75th percentile (29 cities); 2=25th to 75th percentile (56); below 25th percentile (29).	PIPE/FAPESP and SEADE
PROJ_B	X	Binary variable applied to the comparison between cities with PIPE projects and an extended random sample including 185 other cities in the state of São Paulo. It takes the value of 1 for cities with projects, 0 otherwise.	PIPE/FAPESP and SEADE
GDPPC	D	Mean GDP per capita 1999-2012 (constant 2012 Reais).	SEADE
CRED	C	Mean credit operations per capita 1993-2013 (constant 2014 Reais).	SEADE
INFRA	C	Mean municipal investments in infrastructure 1993-2011 (constant 2014 Reais).	SEADE
DENS	A	Mean demographic density (inhab./km2), 1993-2014.	SEADE
HDI	A	Mean city-level Human Development Index 1991, 2000, 2010.	SEADE
URB	A	Mean percentage of urban territory 1992-2014.	SEADE
RESUNI	C	Existence of at least one major research-oriented university or university campus with focus on STEM in the city. Dummy variable.	Brazilian Ministry of Education
DISTCAP	B	Road distance in km from the state capital and economic center, São Paulo.	Google Maps

Variables

Table 1. Variables

Code	Dimension	Definition	Source
TECHACT	D	Patent activity (National Office) per 100.000 inhabitants, 2002-2005. This variable contains data for microregions, thus being extended for municipalities included in each of these larger locations.	FAPESP
BUSCONC	D	Mean weight (%) of total city-level businesses in the State's total, 2008-2011.	IBGE
LABCONC	D	Mean weight (%) of city-level labor force in the State's total, 2008-2011.	IBGE
TRAFFIC	A	Mean ratio of inhab./cars, 2002-2014.	SEADE
OPEN	D	Mean condition of trade openness at the city level ([X+I]/GDP), 2003-2012	SEADE
ENERGY	C	Mean percentage of households connected to the electrical grid, 2000 and 2010	SEADE
EDUCATION	C	Mean score in the education index, 2008, 2010 and 2012. The education index takes into account primary and secondary school attendance and grades (varying from 0 to a 100).	SEADE
KIJOBS	D	Mean weight of selected knowledge-intensive jobs (STEM activities) in cities' total labor force, 2001-2014.	CAGED
THEFT	A	Mean levels of theft occurrences per thousand inhabitants, 2001-2014.	SEADE
POP	Control	Mean total population, 1993-2014	SEADE

Empirics: 2-steps analysis

1. Factors influencing the location of KIE activity, differentiating between cities with and without KIE activity.
   - 185 cities without v. 114 cities with PIPE projects. Probit estimations.

2. Factors influencing the density of KIE activity in the cities where such activity was located.
   - Heteroscedasticity-corrected estimations.
     - A robustness test for this second step of the empirical assessment was undertaken using ordinal regressions with a probit link function

Results Step 1

- **Model 1 (Urban environment):** (i)Total population a good indicator of KIE – but lack of significance of LnDENS does not allow to conclude that relevant agglomeration economies are behind this phenomenon.

  (ii) LnTRAFFIC is strongly negative and significant. Issues related to congestion seem to have negative impacts upon the location of KIE.

  (iii) LnTHEFT, a proxy for crime (agglomeration diseconomies) insignificant.

- **Model II (Infrastructure):** (i) highest R2 among three estimations.

  (ii) Knowledge infrastructure, represented by presence of a research-oriented university and the educational conditions at the city level, matters the most.

  (iii) Investments in physical infrastructure and the availability of credit are not significant factors in determining KIE activity in a city.

- **Model III (Economic structure):** (i) few significant insights.

  (ii) The weight of local businesses over the state's total (LnBUSCONC) is significant and positive, indicating some level of agglomeration economies.

Step 2: KIE density

Table 6. Cluster analysis (log-likelihood distances) based on the number of projects per 100 thousand inhabitants (age cohorts 25-54) - variable PROJP100 (centroids).

		N	% of Combined	% of Total	Centroid	Main Examples
Cluster	*KIE-intensive*	3	2,63%	2,63%	154,98	São Carlos
	Moderate levels of KIE	10	8,77%	8,77%	51,24	Campinas
	Low levels of KIE	101	88,60%	88,60%	7,39	São José dos Campos, São Paulo, Ribeirão Preto
Total		114	100,00%	100,00%		

Results Step 2

- H1 supported: evidence of agglomeration diseconomies (centrifugal forces). Demographic density (DENS) has a significant negative influence on the density of levels of KIE activity. Congestion issues are significant and negative. Other unobserved factors could play a role in these dynamics, such as housing costs and business location rents in densely populated areas. Demographic density (DENS) has a significant negative influence on the density of levels of KIE activity.
- H4 supported: agents benefitting from relative proximity to the highly dense metropolitan area (city of São Paulo) while not incurring the socioeconomic costs of being part of this local environment. Distance from the capital (DISTCAP) is negative and significant in models I and II.

Results Step 2

- H2 supported: infrastructural conditions, especially knowledge infrastructure, positively affect KIE activity. RESUNI (presence of a research university) once again a significantly strong predictor of KIE activity. Investments in physical infrastructure and credit conditions also significant predictors.

- H3 not substantiated: regional economic conditions weakly related to the location of KIE activity. Only LnLABCONC somewhat significant (a weak sign of agglomeration economies).

Final remarks

- The role of the knowledge infrastructure
  - Universities

- Importance of economic centers as attractors of innovation-driven entrepreneurial activity
  - **However**, indications of agglomeration diseconomies affecting the levels of knowledge-intensive entrepreneurship