Entrepreneurship capital spillovers at the local level

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Abstract The paper analyses three underexplored issues in the entrepreneurship capital spillover literature, namely, its local nature, the generators and the receptors of such spillovers. For that purpose, we take advantage of the Ecuadorian census of establishments. Unlike previous evidence, we can estimate the spillovers at the establishment level, compute the entrepreneurship capital at the local level, and compare different permissiveness levels in the application of registration and tax legislation to businesses (i.e., the relative importance of the informal economy). In general, we find entrepreneurship capital spillovers at the local level. The spillover effects are lower when the entrepreneurship capital has been accumulated in informal businesses. By contrast, informal, large and more technologically developed establishments benefit more from these spillover effects. The paper discusses the implications of those findings for the design of public policies for promoting entrepreneurship.

Keywords Entrepreneurship capital · Production spillovers · Cities · Informal economy

JEL classifications L26 · O4 · R11

1 Introduction

Public policies that promote entrepreneurship have been justified by its positive spillovers on the productivity of the other firms in the region (Acs et al. 2016). Although there is extensive evidence of entrepreneurship capital spillovers, much less evidence is available on how the spillovers are produced, and therefore there is a lack of insights about how the public policies have to be developed (Acs et al. 2008). Theoretical arguments justifying the existence of entrepreneurship capital spillovers, like the Knowledge Spillover Theory of Entrepreneurship, KSTE (Audretsch and Keilbach 2005; Audretsch et al. 2006a, b; Acs and Szerb 2007; Acs et al. 2009; Acs et al. 2013; Audretsch and Lehmann 2017), do not specify its geographical extension nor exclude its heterogeneity among firms and industries. We use a unique database containing information for the 445,490 establishments in Ecuador in the year 2010 in order to analyze the presence of entrepreneurship capital spillovers at the local level and explore whether there are differences in the generation and reception of such spillovers between different types of firms. Those questions and evidence are crucial for policy makers and are appealing for theoretical debate.

At the time the data were collected, Ecuador was administratively organized in 24 provinces, among which 224 cantons were distributed (see Table 1 and Graph 1 for more detailed information). The governments of the...
country, provinces and cantons were all elected by their inhabitants. The presence of entrepreneurship capital spillovers at the level of Eurostat NUTS-3 regions or are even more aggregated (NUTS2) is well documented. However, as far as we know, there is no evidence of such spillovers at the local level (formerly NUTS-5 or new LAU2). We provide evidence that establishments in cantons with more entrepreneurship capital than the other cantons of the same province are on average more productive. This evidence seems quite relevant for the justification of the local development of public policies for promoting entrepreneurship beyond those developed at superior administrative levels, in the case of Ecuador provincial or country governments.

This study analyses the spillover effects of local entrepreneurship capital in a Latin American country. A distinctive feature of Latin American countries from European or North American ones (the previously most analyzed countries) is the weight of the informal economy, those economic activities partially or fully outside of government regulation and taxation. Based on our data, the informal economy represented 34.96% of the establishments in 2010. These figures are similar to estimates for other Latin American countries from previous studies (Schneider and Enste 2000 or La Porta and Shleifer 2008). From a theoretical perspective, it has been suggested that the level of the informal economy is in part a consequence of political decisions (Acs et al. 2008). Therefore, in order to develop public policies, it is important to know the role and weight of the informal economy in entrepreneurship capital spillovers. Public policies for promoting specific types of entrepreneurs are justified when those entrepreneurs have been identified among the main generators of spillovers. Although some efforts have been made to identify those generators of spillovers (Audretsch and Keilbach, 2004a, b, c, 2008), those efforts are mostly focused on the technological capabilities of the entrepreneurs.

The data is taken from the census of establishments in Ecuador. Data at the establishment level provides a better identification of entrepreneurship capital receptors. This research line is academically appealing as a way to develop theoretical arguments for explaining these differences. This paper provides a tentative explanation that combines the arguments from the KSTE and the absorptive capacity theory (Cohen and Levinthal 1990; Qian and Acs 2013). Information at the establishment level has been unusual in the previous literature. Massón-Guerra and Ortín-Ángel (2017b) argued that data at the regional level does not allow researchers to clearly distinguish when the relationship between regional GDP and entrepreneurship capital is due to spillovers or technologies with decreasing returns to scale. Therefore, data at the establishment level provides a better estimation of the entrepreneurship capital spillover than data aggregated at the regional level.

The paper is organized as follows. In Section 2, we discuss the related literature and state the hypotheses. Section 3 presents the data. Section 4 presents the production functions estimated at the establishment level. Section 5 discusses the implications and concludes the paper.

2 Related literature

There is a stream of literature (Audretsch and Keilbach 2004a, b, c, 2005, 2008; Mueller 2006, 2007; Audretsch, 2007) that estimates the impacts of regional entrepreneurship capital on the production of a given region. In those studies, the regions vary from countries (Cravo et al. 2010; Stough et al. 2008; Chang 2011; Hafer 2013; Laborda et al. 2011; Mendonça and Grimpe 2015) to regions equivalent to a NUTS-3 level according to the Eurostat classification (Salas-Fumás and Sánchez-Asín 2008, 2010, 2013a, b). As far as we know, there are no studies based on the local level, equivalent to cantons, with data aggregated at the establishment level.

We adapt the methodology that is usually employed in the cited literature to the available data. In fact, the main contribution of this literature is to introduce measures of entrepreneurship capital in production functions that have been extensively estimated in other contexts (see Syverson 2011 for a further methodological discussion). Therefore, we propose the estimation of a Cobb and Douglas (1928) function where establishment $j$’s output ($Y_{ij}$) is obtained as a combination of the inputs purchased by the establishment and other public inputs of the region $i$ where it is placed:

For further information, see [http://ec.europa.eu/eurostat/web/nuts/history].
| Province | Canton | Inhabitants | km² | Province | Canton | Inhabitants | km² |
|----------|--------|-------------|-----|----------|--------|-------------|-----|
| Azuay    | Cuenca | 505,585     | 3.191 | Esmeraldas | San Lorenzo | 42,486 | 3.051 |
| Azuay    | Girón  | 12,607      | 354  | Esmeraldas | Atacames     | 41,526 | 509  |
| Azuay    | Gualaceo| 42,709      | 350  | Esmeraldas | Rioverde     | 26,869 | 1.508 |
| Azuay    | Nabón  | 15,892      | 633  | Esmeraldas | La Concordia | 42,924 | 323  |
| Azuay    | Paute  | 25,494      | 271  | Guayas     | Guayaquil    | 2,350,915 | 4.196 |
| Azuay    | Pucará | 10,052      | 585  | Guayas     | Alfredo Baquerizo Moreno (Jujan) | 25,179 | 219  |
| Azuay    | San Fernando | 3,993 | 139  | Guayas     | Balao       | 20,523 | 410  |
| Azuay    | Santa Isabel | 18,393 | 605  | Guayas     | Balzar      | 53,937 | 1,186 |
| Azuay    | Sigsig | 26,910      | 659  | Guayas     | Colimes     | 23,423 | 758  |
| Azuay    | Oña    | 3,583       | 293  | Guayas     | Daule       | 120,326 | 462  |
| Azuay    | Chordeleg | 12,577 | 105  | Guayas     | Durán       | 235,769 | 300  |
| Azuay    | El Pan | 3,036       | 132  | Guayas     | El Empalme | 74,451 | 716  |
| Azuay    | Sevilla de Oro | 5,889 | 315  | Guayas     | El Trinifo | 44,778 | 395  |
| Azuay    | Guachapala | 3,409  | 40   | Guayas     | Milagro     | 166,634 | 405  |
| Azuay    | Camilo Ponce Enríquez | 21,998 | 639  | Guayas     | Naranjal    | 69,012 | 1,740 |
| Bolívar  | Guaranda | 91,877     | 1,892 | Guayas     | Naranjito   | 37,186 | 225  |
| Bolívar  | Chillanes | 17,406     | 663  | Guayas     | Palestina  | 16,065 | 194  |
| Bolívar  | Chimbo | 15,779      | 261  | Guayas     | Pedro Carbo | 43,436 | 935  |
| Bolívar  | Echeandía | 12,114     | 230  | Guayas     | Samborondón| 67,590 | 368  |
| Bolívar  | San Miguel | 27,244    | 574  | Guayas     | Santa Lucía | 38,923 | 358  |
| Bolívar  | Caluma | 13,129      | 177  | Guayas     | Salitre (Urbina Jado) | 57,402 | 393  |
| Bolívar  | Las Naves | 6,092      | 149  | Guayas     | San Jacinto de Yaguachi | 60,958 | 510  |
| Cañar    | Azogues | 70,064      | 611  | Guayas     | Playas (General Villamil) | 41,935 | 273  |
| Cañar    | Biblián | 20,817      | 227  | Guayas     | Simón Bolivar | 25,483 | 292  |
| Cañar    | Cañar | 59,323      | 1,798 | Guayas     | Marcelino Maridueña | 12,033 | 254  |
| Cañar    | La Troncal | 54,389    | 320  | Guayas     | Lomas de Sargentillo | 18,413 | 67   |
| Cañar    | El Tambo | 9,475       | 64   | Guayas     | Nobol       | 19,600 | 135  |
| Cañar    | Déleg | 6,100       | 76   | Guayas     | General Antonio Elizalde (Bucay) | 10,642 | 154  |
| Cañar    | Suscal | 5,016       | 50   | Guayas     | Isidro Ayora | 10,870 | 487  |
| Carchi   | Tulcán | 86,498      | 1,828 | Imbabura | Ibarra     | 181,175 | 1,093 |
| Carchi   | Bolívar | 14,347     | 359  | Imbabura | Antonio Ante | 43,518 | 82   |
| Carchi   | Espejo | 13,364      | 554  | Imbabura | Cotacachi  | 40,036 | 1,687 |
| Carchi   | Mira | 12,180      | 587  | Imbabura | Otavalo   | 104,874 | 490  |
| Carchi   | Montúfar | 30,511    | 383  | Imbabura | Pimampiro | 12,970 | 449  |
| Carchi   | San Pedro de Huaca | 7,624  | 69   | Imbabura | San Miguel de Urcuquí | 15,671 | 785  |
| Cotopaxi | Latacunga | 170,489   | 1,386 | Loja     | Loja     | 214,855 | 1,895 |
| Cotopaxi | La Maná | 42,216      | 656  | Loja     | Calvas   | 28,185 | 841  |
| Cotopaxi | Pangua | 21,965      | 722  | Loja     | Catamayo | 30,638 | 652  |
| Cotopaxi | Pujili | 69,055      | 1,302 | Loja     | Celica  | 14,468 | 521  |
| Cotopaxi | Salcedo | 58,216     | 486  | Loja     | Chaguarpamba | 7,161 | 313  |
| Cotopaxi | Saquisíli | 25,320   | 205  | Loja     | Espíndola | 14,799 | 516  |
| Cotopaxi | Sigchos | 21,944     | 1,352 | Loja     | Gonzanamá | 12,716 | 698  |
| Province     | Canton          | Inhabitants | km² | Province     | Canton          | Inhabitants | km² |
|--------------|-----------------|-------------|-----|-------------|-----------------|-------------|-----|
| Chimborazo   | Riobamba        | 225,741     | 983 | Loja        | Macará          | 19,018      | 576 |
| Chimborazo   | Alausí          | 44,089      | 1,657| Loja        | Paltas          | 23,801      | 1,155|
| Chimborazo   | Colta           | 44,971      | 836 | Loja        | Puyango         | 15,513      | 638 |
| Chimborazo   | Chambo          | 11,885      | 164 | Loja        | Saraguro        | 30,183      | 1,083|
| Chimborazo   | Chunchi         | 12,686      | 273 | Loja        | Sozoranga       | 7,465       | 411 |
| Chimborazo   | Guamote         | 45,153      | 1,222| Loja        | Zapotillo       | 12,312      | 1,213|
| Chimborazo   | Guano           | 42,851      | 460 | Loja        | Pindal          | 8,645       | 202 |
| Chimborazo   | Pallatanga      | 11,544      | 379 | Loja        | Quilanga        | 4,337       | 237 |
| Chimborazo   | Penipe          | 6,739       | 367 | Loja        | Olmedo          | 4,870       | 113 |
| Chimborazo   | Cumandá         | 12,922      | 159 | Los Ríos    | Babahoyo        | 153,776     | 1,087|
| El Oro       | Machala         | 245,972     | 330 | Los Ríos    | Baba            | 39,681      | 517 |
| El Oro       | Arenillas       | 26,844      | 808 | Los Ríos    | Montalvo        | 24,164      | 363 |
| El Oro       | Atahualpa       | 5,833       | 278 | Los Ríos    | Puebloviejo     | 36,477      | 336 |
| El Oro       | Balsas          | 6,861       | 70  | Los Ríos    | Quevedo         | 173,575     | 305 |
| El Oro       | Chilla          | 2,484       | 332 | Los Ríos    | Urdaneta        | 29,263      | 378 |
| El Oro       | El Guabo        | 50,009      | 607 | Los Ríos    | Ventanas        | 66,551      | 815 |
| El Oro       | Huaquillas      | 48,285      | 64  | Los Ríos    | Vinces          | 71,736      | 697 |
| El Oro       | Maracabé        | 5,450       | 149 | Los Ríos    | Pallenque       | 22,320      | 580 |
| El Oro       | Pasaje          | 72,806      | 456 | Los Ríos    | Buena Fe        | 63,148      | 581 |
| El Oro       | Piñas           | 25,988      | 617 | Los Ríos    | Valencia        | 42,556      | 978 |
| El Oro       | Portovelo       | 12,200      | 288 | Los Ríos    | Mocache         | 38,392      | 568 |
| El Oro       | Santa Rosa      | 69,036      | 822 | Los Ríos    | Quinualoma      | 16,476      | 280 |
| El Oro       | Zaruma          | 24,097      | 649 | Manabí      | Portoviejo      | 280,029     | 961 |
| El Oro       | Las Lajas       | 4,794       | 298 | Manabí      | Bolivar         | 40,735      | 538 |
| Esmeraldas   | Esmeraldas      | 189,504     | 1,350| Manabí      | Chone           | 126,491     | 3,037|
| Esmeraldas   | Eloy Alfaro     | 39,739      | 4,273| Manabí      | El Carmen       | 89,021      | 1,261|
| Esmeraldas   | Muisne          | 28,474      | 1,243| Manabí      | Flavio Alfaro   | 25,004      | 1,347|
| Esmeraldas   | Quinindé        | 122,570     | 3,875| Manabí      | Jipijapa        | 71,083      | 1,467|
| Manabí       | Junín           | 18,942      | 246 | Pichincha   | Rumiñahui       | 85,852      | 136 |
| Manabí       | Manta           | 226,477     | 303 | Pichincha   | San Miguel de los Bancos | 17,573 | 850 |
| Manabí       | Montecristi     | 70,294      | 739 | Pichincha   | Pedro Vicente Maldonado | 12,924 | 624 |
| Manabí       | Paján           | 37,073      | 1,088| Pichincha   | Puerto Quito    | 20,445      | 695 |
| Manabí       | Pichincha       | 30,244      | 1,075| Tungurahua  | Ambato          | 329,856     | 1,018|
| Manabí       | RocaFuerte      | 33,469      | 280 | Tungurahua  | Baños de Agua Santa | 20,018 | 1,066|
| Manabí       | Santa Ana       | 47,385      | 1,025| Tungurahua  | Cevallos        | 8,163       | 19  |
| Manabí       | Sucre           | 57,159      | 694 | Tungurahua  | Mocha           | 6,777       | 86  |
| Manabí       | Tosagua         | 38,341      | 375 | Tungurahua  | Patate          | 13,497      | 316 |
| Manabí       | 24 de Mayo      | 28,846      | 526 | Tungurahua  | Quero           | 19,205      | 174 |
| Manabí       | Pedernales      | 55,128      | 1,907| Tungurahua  | San Pedro de Pelileo | 56,573 | 202 |
| Manabí       | Olmedo          | 9,844       | 254 | Tungurahua  | Santiago de Píllaro | 38,357 | 447 |
| Manabí       | Puerto López    | 20,451      | 429 | Tungurahua  | Tisaleo         | 12,137      | 59  |
| Manabí       | Jama            | 23,253      | 579 | Zamora Chinchipe | Zamora | 25,510 | 1,898 |
| Manabí       | Jaramijó        | 18,486      | 97  | Zamora Chinchipe | Chinchipe | 9,119 | 1,156 |

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| Province     | Cantons     | Inhabitants | $km^2$ | Province     | Cantons     | Inhabitants | $km^2$ |
|-------------|-------------|-------------|--------|-------------|-------------|-------------|--------|
| Manabí      | San Vicente | 22.025      | 709    | Zamora      | Nangaritza  | 5.196       | 2.023  |
| Morona      | Morona      | 41.155      | 4.657  | Chinchipe   | Yacuambi    | 5.835       | 1.254  |
| Morona      | Gualaquiza  | 17.162      | 2.208  | Chinchipe   | Yantzaza    | 18.675      | 1.014  |
| Morona      | Limón       | 9.722       | 1.821  | Chinchipe   | El Pangui   | 8.619       | 631    |
| Morona      | Palora      | 6.936       | 1.455  | Chinchipe   | Centinela del Cóndor | 6.479       | 262    |
| Morona      | Santiago    | 9.295       | 1.405  | Chinchipe   | Palanda     | 8.089       | 1.991  |
| Morona      | Sucúa       | 18.318      | 893    | Chinchipe   | Paquisha    | 3.854       | 354    |
| Morona      | Huamboya    | 8.466       | 664    | Galápagos   | San Cristóbal | 7.475       | 849    |
| Morona      | San Juan Bosco | 3.908   | 1.055  | Galápagos   | Isabelra    | 2.256       | 5.368  |
| Morona      | Taisha      | 18.437      | 6.170  | Galápagos   | Santa Cruz  | 15.393      | 1.794  |
| Morona      | Logroño     | 5.723       | 1.171  | Sucumbios   | Lago Agrio  | 91.744      | 3.143  |
| Morona      | Pablo Sexto | 1.823       | 1.390  | Sucumbios   | Gonzalo Pizarro | 8.599       | 2.229  |
| Morona      | Tiwintza    | 6.995       | 1.170  | Sucumbios   | Putumayo    | 10.174      | 3.575  |
| Napo        | Tena        | 60.880      | 3.922  | Sucumbios   | Shushufindi | 44.328      | 2.470  |
| Napo        | Archidona   | 24.969      | 3.029  | Sucumbios   | Sucumbios   | 3.390       | 1.511  |
| Napo        | El Chaco    | 7.960       | 3.500  | Sucumbios   | Cascales    | 11.104      | 1.250  |
| Napo        | Quijos      | 6.224       | 1.589  | Sucumbios   | Cuyabeno    | 7.133       | 3.906  |
| Napo        | Carlos Julio Arosemena Tola | 3.664 | 502    | Orellana    | Orellana    | 72.795      | 7.079  |
| Pastaza     | Pastaza     | 62.016      | 19.930 | Orellana    | Aguarico    | 4.847       | 11.260 |
| Pastaza     | Mera        | 11.861      | 528    | Orellana    | La Joya de los Sachas | 37.591       | 1.202  |
| Pastaza     | Santa Clara | 3.565       | 314    | Orellana    | Loreto      | 21.163      | 2.151  |
| Pastaza     | Arajuno     | 6.491       | 8.869  | Santo Domingo de los Tsáchilas | Santa Domingo | 368.013       | 3.447  |
| Pichincha   | Quito       | 2.239.191   | 4.218  | Santa Elena | Santa Elena | 144.076     | 3.597  |
| Pichincha   | Cayambe     | 85.795      | 1.191  | Santa Elena | La Libertad | 95.942      | 25     |
| Pichincha   | Mejía       | 81.335      | 1.485  | Santa Elena | Salinas     | 68.675      | 68     |
| Pichincha   | Pedro Moncayo | 33.172  | 338    | Manabi*     | Manga del Cura | 20.758       | 487    |
|             |             |             |        |             | Imbabura**  | 6.329       | 127    |
|             |             |             |        |             | Guayas**     | 5.302       | 170    |

Source: National Institute of Statistics and Censuses, INEC, 2010

(*) Manga del Cura was incorporated in 2017 into the province of Manabí. Originally it was not assigned to a concrete province. In the analyses, it is considered as a canton of Manabí. La Concordia was incorporated in 2013 into the province of Santo Domingo de los Tsáchilas. In 2010 and in the analyses, was a canton of Esmeraldas

(**) In the case of Las Golondrinas and El Piedrero, there is no information about establishments. Therefore, they are excluded from the analyses
\[
\ln Y_{j,i} = \beta \ln L_{j,i} + \alpha \ln K_{j,i} + \phi \ln I_{j,i} + \rho \ln Z_{j,i} \\
+ \mu \ln R_i + \delta \ln E_i + \varepsilon_{j,i}
\]  

(1)

Then, the inputs considered at the establishment level are labour \((L_{j,i})\), (physical) capital \((K_{j,i})\), intermediate goods \((I_{j,i})\), and private knowledge \((Z_{j,i})\), while inputs at the regional level are regional knowledge \((R_i)\), regional entrepreneurship capital \((E_i)\), being \(\varepsilon_{j,i}\) the usual error term. The parameters to be estimated are the production elasticities with respect to labour \((\beta)\), capital \((\alpha)\), intermediate goods \((\rho)\), private knowledge \((\rho)\), public regional knowledge \((\mu)\) and regional entrepreneurship capital \((\delta)\) or entrepreneurship capital spillovers, which in previous studies have usually been positive and statistically significant. The existence of such positive spillovers has been interpreted as a call to arms (Acs et al. 2016) for the development of public policies to promote entrepreneurship. However, less consensus exists on how those policies should be developed.

Acs et al. (2008) emphasize that entrepreneurship is a local phenomenon. Policies developed by local authorities can enhance the probability that clusters of entrepreneurs favoring the economic development of the zone appear. Those entrepreneurs can help each other and stimulate the economic growth of the place (Feldman, 2014). In accordance with the KSTE, entrepreneurship facilitates the dissemination of knowledge among entrepreneurs. Therefore, public policies enhancing the generation of knowledge, the attractiveness of the place and the communication infrastructures can aid this purpose (Acs et al. 2016). In this sense, it has been argued that big cities have better conditions than more rural areas for the generation of such entrepreneurial clusters (Acs, et al. 2011). Furthermore, there is some evidence that entrepreneurship capital spillovers are higher in more urban regions (Audretsch and Keilbach 2005). Although some empirical evidence exists about the determinants of the level of entrepreneurial activity at the city level (Audretsch and Belitski 2017; Bosma...
and Sternberg 2014; Barreneche-García 2014; Sutter and Stough 2009), there is no evidence on the entrepreneurship capital spillovers at the city or similar local levels, which is the main justification for such policies. We can provide such evidence for the case of Ecuadorian cantons by controlling for provincial dummy variables. Therefore, those spillovers are beyond those produced by other provincial inputs, thus justifying the intervention of local governments.

Hypothesis 1: The production is higher in establishments placed in cantons with more entrepreneurship capital than other cantons of the same province.

A second important issue for the development of public policies is whether they are more efficient when they foster specific kinds of entrepreneurs. For that purpose, some previous studies (Audretsch and Keilbach 2004a, b, c, 2008) sought to identify the type of entrepreneurship capital that generates more spillover effects. For example, Audretsch and Keilbach (2004a, b, c, 2008) classified entrepreneurship capital on the basis of the technological intensity of the sectors (high technology, ICTs, and other sectors). The theoretical argument behind this classification is that the newness of the knowledge used in these sectors is different. Therefore, in accordance with the KSTE, one would expect higher spillover effects in regions with a higher relative presence of technological entrepreneurs. The evidence is mixed. Higher relative weights of technological sectors generated more spillover effects in Audretsch and Keilbach (2004c), while they generated less spillover effects in Audretsch and Keilbach (2004a, b, c, 2008).

Acs et al. (2008) highlight legal infrastructure as an important part of the public policies for promoting entrepreneurship. In their words, “State and local regulations can also affect entrepreneurship, as they do for other businesses activities. For decades, economists have argued that many forms of regulation help large businesses that can pay the fixed costs of meeting those regulations, but harm smaller firms. (...) States and localities also may wish to consider exempting smaller businesses from certain regulation” (p.20). The informal economy is the usual term for identifying businesses exempted from government taxes and regulation. The data available allow us to distinguish between formal and informal entrepreneurship capital. Although several theories have been proposed for explaining the transition from informal to formal businesses (see, for example, Bennett 2010), the empirical evidence (La Porta and Shleifer 2008; Bruhn 2011, 2013) suggests that there is not much mobility between informal and formal businesses. The informal economy is mainly composed of entrepreneurs with very low human capital that engage in small businesses with low value added and are in the less innovative sectors (La Porta and Shleifer 2008). Therefore, one would expect less knowledge spillovers from informal establishments.

From the discussion above, we propose to test whether the entrepreneurship capital spillovers are higher in those cantons with a higher weight of technological establishments and a lower weight of informal ones.

Hypothesis 2: The effect of regional entrepreneurship capital is a) higher when it is accumulated in technological sectors and b) lower when it is accumulated in informal establishments.

A third important issue related to public policies is who provides the financial support. Some taxpayers can support the government policies without benefitting from the spillovers. Therefore, it is interesting to identify whether some sort of established business receives systematically higher entrepreneurship capital spillovers. Theoretical arguments justifying such spillover differences can be built based on the KSTE and the absorptive capacity theory. From the KSTE perspective, entrepreneurship is a facilitator of knowledge dissemination. From the absorptive capacity theory, established businesses have different levels of knowledge and capacity to accumulate further knowledge or absorptive capacities. Therefore, entrepreneurship capital spillover effects are expected to be higher in those establishments with lower current levels of knowledge and/or higher absorptive capacities. Therefore, entrepreneurship capital spillover effects are expected to be higher in those establishments with lower current levels of knowledge and/or higher absorptive capacities. From Cohen and Levinthal (1990), several authors have related the technological intensity of the firms with their absorptive capacities. Tentatively, we postulate that large establishments have more resources and can learn faster, while the establishments of the same size that remain informal have accumulated lower levels of knowledge and thus have more to learn. Data at the establishment level allow us to estimate the elasticities of production with respect to entrepreneurship capital for each different group of establishments. The next hypothesis summarizes the expected results:
Hypothesis 3: The benefits from entrepreneurship capital spillover effects (a) increase with the size of the establishment, (b) increase with its technological intensity, and (c) and increase with the level of informality.

Finally, Audretsch and Keilbach (2004a, c, 2008) suggest that the entrepreneurship capital may be correlated with the production function error term in Eq. (1). Therefore, the estimation of the entrepreneurship capital spillovers can suffer from an endogeneity problem. This seems quite reasonable when it is estimated with aggregated data. Those regions with higher production can also be the ones producing more entrepreneurs. Data at the establishment level seems to alleviate these problems. Nonetheless, we provide simultaneous estimations of the determinants of the establishments’ production, Eq. (1), and the determinants of the cities’ entrepreneurial capital, Eq. (2):

\[ \ln E_i = \sum_{x} \theta_x X_{x,i} + e_i \quad (2) \]

where \( e_i \) are the usual error terms and \( \theta_x \) are the parameters to be estimated. As much as possible, we consider \( x \) similar determinants \( X_x \) than the ones highlighted by the previous literature that analyzed the determinants of the cities’ entrepreneurial capital. Consistent with previous findings, we expect positive relationships between the city’s entrepreneurial capital, the city’s agglomeration and its public resources. Using different measures related with the population density of the cities, Acs et al. (2011), Bosma and Sternberg (2014) and Barreneche-García (2014) find evidence of a positive relationship between a city’s agglomeration and its entrepreneurial capital. Acs et al. (2011) and Audretsch and Belitski (2017) highlighted and provided evidence of the importance of a city’s amenities and infrastructures for stimulating the entrepreneurship capital of the city. Finally, we also include variables related to the economic situation in the city, namely, its GDP per capita. In accordance with Audretsch and Belitski (2017), previous literature has made ambiguous predictions about the relationship between the variables related to the economic situation and the cities’ entrepreneurial capital. All the determinants of the entrepreneurship capital of a city are going to be lagged one year.

3 Data

We use data from the Censo Nacional Económico (CENEC). This is a census of the establishments in all 224 cantons of Ecuador from between September and November of 2010. The objective was to identify and collect information about all (visible) establishments where economic activity is conducted out and is physically separated from a home. Therefore, the census includes formal and informal establishments. Due to that, it is not based on the fulfillment of any regulations or tax payments. For this study, we excluded public and government establishments (10.310) and mining and oil extraction establishments (87). The census does not include those establishments that have a head office in the same canton. However, we have identified and omitted some establishments in which this is the case (55.278). We ended up with 445,490 establishments.

We identify the canton \((i)\) and province where the establishments are placed, and therefore introduce fixed effects for provinces and cantons. Due to the lack of establishments, two cantons were omitted (El Piedrero y Las Golondrinas), leaving 222 cantons in the sample (see Table 1 for further details).

We use the following information regarding each establishment.

The establishment’s annual production (Output, \( Y_{j,i} \)) measured by sales volume, the number of employees engaged in production activities (Labour, \( L_{j,i} \)), the fixed assets of the establishment (Capital, \( K_{j,i} \)), the current assets of the establishment (Intermediate Goods, \( I_{j,i} \)) and the investment in R&D activities and training (establishment’s Knowledge, \( Z_{j,i} \)). All the monetary variables are in US dollars, the currency in Ecuador in 2010.

The CENEC provides information about the economic activities of the establishments (two-digit NACE codes). Following the Organization for Economic Co-operation and Development (OECD) and EUROSTAT, we identify a set of NACE two-digit sectors as technological businesses. See Table 2 for further details. The dummy variable \( D_{Tech, j,i} \) takes a value of 1 when the establishment belongs to a technological sector.

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3 For further details about the census, see [http://www.ecuadorencifras.gob.ec/censo-nacional-economico].
4 Further details and references can be found in [https://www.oecd.org/sti/ind/48350231.pdf].
The CENEC also indicates whether the establishment is included in the Registro Único de Contribuyentes\(^5\) (in other words, whether or not it pays taxes). In fact, the Ecuadorian governmental statistical office\(^6\) (INEC) considers an establishment as an informal one when it is not included in the Registro Único de Contribuyentes and has fewer than 100 workers. Using these criteria, we classify each establishment as either formal or informal. The dummy variable \(D_{\text{Informal}, j,i}\) takes a value of 1 when the establishment belongs to the informal economy.

For each canton \((i = 1, \ldots, 222)\), we have collected the following information.

The cantons’ knowledge is measured by the investments in R&D activities and training. We differentiate among the Regional Public Knowledge (accumulated by public and government establishments, \(R_{\text{PUB}}\)) from the Regional Private Knowledge (accumulated by the rest of establishments, \(R_{\text{PRIV}}\)). Following Acs et al. (2012), entrepreneurship capital is measured by the ratio between the number of establishments and the canton’s population, \(E_i = n_i/P_i\). Graph 2 shows its distribution among the different cantons. The measurement of entrepreneurship capital is open to discussion (Erikson 2002; Audretsch and Keilbach 2004a; Böente et al. 2008; Marcotte 2013). Several authors use start-ups instead of the stock of establishments. In Appendix 1, we reproduce the main analyses using the average of the last three years of the start-ups per inhabitant ratio in each canton following the method established in Audretsch and Keilbach (2004a, b, 2008). The main conclusions do not depend on the measure of entrepreneurship capital used. In each canton, we can compute the number of establishments in technological sectors, Knowledge-based Entrepreneurship Capital \((KE_i)\), and its relative importance over the regional entrepreneurship capital \((KE_i/E_i)\). In a similar way, we can compute the number of establishments in the informal economy, informal entrepreneurship capital \((IE_i)\), and its relative importance \((IE_i/E_i)\).

Regarding the determinants of entrepreneurship capital, the cantons’ agglomeration \((DEN_{i,t-1})\) is measured by its population density, which is the number of inhabitants per square kilometer. As a proxy of the cantons’ public resources \((TAX_{i,t-1})\), we have collected information about the ratio of total taxes paid by the establishments over the GDP (in thousands of dollars). Related to the economic situation of the canton, we have collected information about the GDP (in thousands of dollars) per capita for each region \((y_{i,t-1})\). We collected this information from the INEC. These variables have been included in the logarithms and are one period lagged. Therefore, they refer to 2009.

The descriptive statistics are presented in Table 3. The correlations between variables are in Table 4.

### 4 Results

Table 5 shows different estimations of Eq. (1). The differences between the columns or models are the additional variables included. In the best case, the increase in the explanatory power of the model \(R^2\) is 0.0236. As an indicator of the collinearity magnitude,
we use the variance inflator factor (VIF). In all cases, the values are below 10, which is the usual maximum acceptable level.

Model 1 is the basic model. Much of the coefficients are output elasticities that indicate the percentage change of the production associated with a 1% increase in the input amount. The elasticity of production with respect to labour ($\beta$) is 0.7376, the elasticity with respect to capital ($\alpha$) is 0.1656, the elasticity with respect to current capital ($\phi$) is 0.2190, the elasticity of production with respect to private knowledge ($\rho$) is 0.0587. All of these coefficients are statistically significant at the 1% level. The values of those elasticities are quite stable among the different Models, except when interactions are included, see Model 4. Model 1 also includes Provincial fixed effects (i.e., we control for all the public inputs at the province level). The inclusion of these 24 dummies is associated with an $R^2$ increase of 0.0054.

Model 2 is estimated for testing Hypotheses 1 and 2. In this case, we present a three-stage simultaneous estimation of Eqs. (1) and (2). Regarding Eq. (1), we add

Graph 2 Entrepreneurship Capital Density. Source: Own elaboration, using CENEC data

Table 3 Descriptive statistics

| Establishments | Mean   | Standard Deviation |
|----------------|--------|--------------------|
| ln$Y_{j,i}$    | 9.2404 | 1.6141             |
| ln$I_{j,i}$    | 5.6803 | 2.4177             |
| ln$K_{j,i}$    | 7.3621 | 1.8953             |
| ln$L_{j,i}$    | 0.4981 | 0.6668             |
| ln$Z_{j,i}$    | 0.0255 | 0.4556             |
| ln$R_{PUBi}$   | 13.1216| 5.2355             |
| ln$R_{PRVi}$   | 11.0444| 6.2526             |
| ln$E_i$        | −3.4060| 0.3515             |
| ln$(IE_i/E_i)$ | −1.1005| 0.3283             |
| ln$(KE_i/E_i)$ | −2.5117| 0.2295             |
| $D_{Inform_{j,i}}$ | 0.3496 | 0.4769             |
| $D_{Tech_{j,i}}$ | 0.0831 | 0.2760             |
| ln$y_{i,t-1}$  | 1.3314 | 0.4677             |
| ln$DEN_{j,t-1}$| 5.3861 | 1.2129             |
| ln$TAX_{j,t-1}$| 2.6093 | 1.3963             |

Observations: 445,490
Table 4  Correlation Matrix

|                | \(\ln Y_{j,t}\) | \(\ln K_{j,t}\) | \(\ln I_{j,t}\) | \(\ln L_{j,t}\) | \(\ln Z_{j,t}\) | \(\ln R_{pub_{j,t}}\) | \(\ln R_{priv_{j,t}}\) | \(\ln E_{t}\) | \(\ln (IE_{t}/E_{t})\) | \(\ln KE_{t}/E_{t}\) | \(\ln y_{\Delta t}\) | \(\ln DEN_{\Delta t}\) |
|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|----------------|-------------------|-----------------|-----------------|-----------------|
| \(\ln K_{j,t}\) | 0.4067 *** | 0.4275 *** 0.2325 *** |                    |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| \(\ln I_{j,t}\) | 0.4484 *** 0.4291 *** 0.1677 *** |                    |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| \(\ln L_{j,t}\) | 0.0803 *** 0.0889 *** 0.0300 *** 0.1183 *** |                    |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| \(\ln Z_{j,t}\) | 0.0934 *** 0.0702 *** 0.0267 *** 0.0665 *** 0.0240 *** 0.7423 *** |                    |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| \(\ln R_{pub_{j,t}}\) | 0.0402 *** 0.0586 *** 0.0292 *** 0.0021 |                    |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| \(\ln R_{priv_{j,t}}\) | 0.0100 *** 0.0865 *** 0.0366 *** 0.0557 *** 0.0167 *** 0.5302 *** 0.6859 *** 0.4351 *** |                    |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| \(\ln (IE_{t}/E_{t})\) | 0.0672 *** 0.0344 *** 0.0085 *** 0.0680 *** 0.0133 *** 0.4464 *** 0.7066 *** 0.3845 *** 0.2092 *** 0.3408 *** 0.4320 *** |                    |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| \(\ln DEN_{\Delta t}\) | 0.0100 *** 0.0865 *** 0.0366 *** 0.0557 *** 0.0167 *** 0.5302 *** 0.6859 *** 0.4351 *** |                    |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| \(\ln TAX_{\Delta t}\) | 0.0260 *** 0.0458 *** 0.0200 *** 0.6677 *** 0.7472 *** 0.6559 *** |                    |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |

*: Significant at the 0.10 level. **: Significant at the 0.05 level. ***: Significant at the 0.01 level. p-values are in brackets.
Table 5 Hypotheses Tests

| Independent Variable | Model | Coefficient | Equations [1] Dependent Variable: \( \ln Y_{ji} \) |
|----------------------|-------|-------------|------------------------------------------------|
|                      |       | 1           | 2           | 3           | 4           |
| Constant             |       | 6.3644 ***  | 6.7851 ***  | 6.3857 ***  | 6.7959 ***  |
|                      |       | [0.016]     | [0.095]     | [0.016]     | [0.017]     |
| \( \ln K_{ji} \)    | \( \alpha \) | 0.1656 ***  | 0.1645 ***  | 0.1655 ***  | 0.1359 ***  |
|                      |       | [0.002]     | [0.001]     | [0.002]     | [0.002]     |
| \( \ln I_{ji} \)    | \( \phi \) | 0.2190 ***  | 0.2188 ***  | 0.2194 ***  | 0.1998 ***  |
|                      |       | [0.001]     | [0.001]     | [0.001]     | [0.001]     |
| \( \ln Z_{ji} \)    | \( \rho \) | 0.0587 ***  | 0.0583 ***  | 0.0580 ***  | 0.0593 ***  |
|                      |       | [0.005]     | [0.004]     | [0.005]     | [0.005]     |
| Province Dummies     |       | Yes         | Yes         | No          | No          |
| \( \ln R_{pub} \)   | \( \mu_{pub} \) | 0.0017 ***  |             |             |             |
|                      |       | [0.001]     |             |             |             |
| \( \ln R_{priv} \)  | \( \mu_{priv} \) | 0.0026 **   |             |             |             |
|                      |       | [0.001]     |             |             |             |
| \( \ln E_i \)       | \( \delta \) | 0.1937 ***  |             |             |             |
|                      |       | [0.017]     |             |             |             |
| \( \ln(KE_i/E_i) \) | \( \delta_{KE} \) | -0.0549 *** |             |             |             |
|                      |       | [0.018]     |             |             |             |
| \( \ln(IE_i/E_i) \) | \( \delta_{IE} \) | -0.0261     |             |             |             |
|                      |       | [0.017]     |             |             |             |
| \( \ln E_i \cdot \ln L_{ji} \) | \( \delta_S \) | 0.3344 ***  |             |             |             |
|                      |       | [0.015]     |             |             |             |
| \( D_{Tech \ ji} \) | \( d_T \) | 0.2584 ***  |             |             |             |
|                      |       | [0.084]     |             |             |             |
| \( \ln E_i \cdot D_{Tech \ ji} \) | \( \delta_T \) | 0.1282 ***  |             |             |             |
|                      |       | [0.025]     |             |             |             |
| \( D_{Inform \ ji} \) | \( d_I \) | -0.2082 *** |             |             |             |
|                      |       | [0.049]     |             |             |             |
| \( \ln E_i \cdot D_{Inform \ ji} \) | \( \delta_I \) | 0.0814 ***  |             |             |             |
|                      |       | [0.014]     |             |             |             |
| Canton Dummies       |       | Yes         |             | Yes         |             |
| \( R^2 \)           |       | 0.3653      | 0.3662      | 0.3698      | 0.3889      |

Equation [2] Dependent Variable: \( \ln E_i \)

| Independent Variable | Coefficient | Equation [2] Dependent Variable: \( \ln E_i \) |
|----------------------|-------------|------------------------------------------------|
| Constant             | -4.2159 *** |             |
|                      | [0.002]     |             |
| \( \ln y_{i,t-1} \)  | \( \theta_1 \) | 0.2735 ***  |             |
|                      | [0.001]     |             |
| \( \ln DEN_{i,t-1} \) | \( \theta_2 \) | 0.1076 ***  |             |
|                      | [0.001]     |             |
| \( \ln TAX_{i,t-1} \) | \( \theta_3 \) | 0.0689 ***  |             |

\( Springer \)
the basic variables related to the KTSE theory, the regional knowledge, the entrepreneurship capital and its composition. The coefficient associated with the regional entrepreneurship capital is 0.1937, which is positive and statistically significant at the 1% level, which supports Hypothesis 1. There are entrepreneurship capital spillovers at the cantonal level after controlling for the public inputs at the provincial level. We also find that the elasticity of production with respect to the cities’ knowledge generated by public institutions is 0.0017, while knowledge generated by private institutions is 0.0026; both elasticities are positive and statistically significant at the usual levels. With respect to Hypothesis 2, we find that the establishments in cantons with higher weights of informal and technological establishments have lower production. The estimated elasticities are respectively $-0.0549$ and $-0.0261$, and only the first one is statistically significant. Therefore, we only find support for Hypothesis 2b; informal businesses generate fewer spillovers.

Regarding the determinants of entrepreneurship capital, we find that all the estimated elasticities in Eq. (2) are positive and statistically significant. Therefore, ceteris paribus, those cantons that are wealthier, have denser populations and have higher tax pressures have higher levels of entrepreneurship capital.

Model 3 includes in Eq. (1) cantons’ fixed effects. This implies an increase of 0.0036 in the $R^2$, which can be interpreted as the importance of the omitted cantonal inputs. For testing Hypothesis 3, we add interaction terms between the entrepreneurship capital and the establishments’ size, its technological intensity, and its formalization level. The results are presented in Model 4. The elasticity of production with respect to the entrepreneurship capital is 0.1282 and 0.0814 points higher in technological and formal establishments than in non-technological and informal ones, respectively. Take note that in this specification, the elasticity of production with respect to labour depends on the entrepreneurship capital of the canton. For example, when this is evaluated at the average value of the entrepreneurship capital ($-3.4060$), the elasticity is 0.7080, being 0.8257 when there is an increase of one standard deviation (0.3515) in the entrepreneurship capital. All the coefficients are statistically significant at the 1% level. These results support Hypothesis 3; larger, more technological and more informal establishments benefit more from the spillover effects of regional entrepreneurship capital. Furthermore, ceteris paribus, low technological and informal establishments have on average 25.84% and 20.81% less production than technological and formal establishments, respectively.

5 Conclusions

This paper provides evidence related to the local existence of entrepreneurship capital spillovers and the characteristics of entrepreneurs that generate and benefit more from those spillovers. These are important issues for the design and development of public policies to promote entrepreneurship.

Data about the entrepreneurship capital of 222 Ecuadorian cantons show that the spillovers are a local phenomenon. The evidence seems consistent with the KSTE arguments. Personal contacts between the staffs of different firms help to disseminate knowledge and those contacts are mostly produced at the local level. Therefore, important spillovers are produced at the local level. Our evidence confirms this, but we need further evidence to extend the results to other geographic areas and for a better understanding of their determinants. Meanwhile, the evidence provided in this study suggests that the development and implementation of public policies to promote entrepreneurship is in part a responsibility of the local authorities.

A second piece of evidence is related to the kind of establishments that generate more spillovers. The evidence comes from a Latin American country, an institutional environment scarcely analyzed until now (Acs
and Amorós 2008; Laborda et al. 2011), in which the informal economy plays an important role. It has been argued (Acs et al. 2008) that the laxity in business regulation is a political decision. Therefore, it is important to know its implications. The evidence shows that in those cantons with higher weights of informal establishments, the entrepreneurship capital spillovers are lower. The kind of businesses developed by the informal economy seem to be those that generate lower spillovers. Further evidence is needed to confirm those results in other contexts. Furthermore, we also test whether the relative importance of technological firms in a canton increases or decreases the entrepreneurship capital spillovers. Although we found a negative effect, it is not statistically significant. Therefore, the debate about the importance of technological firms as a higher source of spillovers remains open.

Finally, the use of data at the establishment also provided a third piece of evidence related to the type of firms that benefited the most from the entrepreneurship capital spillover effects. From our analyses, we detect that technological, large and informal establishments receive the most benefits from such spillover effects. The evidence can be interpreted to mean that technological and large firms have, on average, higher absorptive capacities (Cohen and Levinthal 1990; Qian and Acs 2013), while informal firms have more to learn. Further studies using data at the establishment level are needed to confirm such relationships and identify whether some type of firms systematically benefit from entrepreneurship capital spillovers.

This research has limitations. This study uses cross-sectional data, which makes it difficult to address endogeneity and causality problems. The data come from a specific country and institutional setting, so we cannot guarantee its generality. The data do not allow for the determination of how these spillover effects are produced and consequently the sources of such spillover effects. Further evidence could help to overcome these limitations.

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Appendix 1. Entrepreneurship capital measured by city start-ups.

In the table below, the entrepreneurship capital is measured by the average of the last three year’s ratios between the start-ups per inhabitant of each city.

Table 6 Hypothesis Test (Entrepreneurship Capital: Start-Ups)

| Model | Independent Variable | Coefficient | 1     | 2     | 3     | 4     |
|-------|----------------------|-------------|-------|-------|-------|-------|
|       | Constant             |             | 6.3644***| 7.1993***| 6.3857***| 6.8058***|
|       | lnK_{ij}             | \(\alpha\)  | 0.1656***| 0.1645***| 0.1655***| 0.1359***|
|       | lnI_{ij}             | \(\phi\)    | 0.2190***| 0.2188***| 0.2194***| 0.1998***|
|       | lnL_{ij}             | \(\beta\)   | 0.7376***| 0.7352***| 0.7339***| 2.6456***|
|       | lnZ_{ij}             | \(\rho\)    | 0.0587***| 0.0583***| 0.0580***| 0.0583***|
| Province Dummies | Yes | Yes | No | No |
| lnRpub_{ij} | \(\mu_{pub}\) | 0.0019 *** |
Table 6 (continued)

| Equation [1] Dependent Variable: ln\(Y_{j,i}\) |
|-----------------------------------------------|
| ln\(R_{priv}\)  | \(\rho_{priv}\) | 0.0027 | *** |
| ln\(E_{i}\)  | \(\delta\) | 0.2032 | *** |
| ln\((KE_{i}/E_{i})\)  | \(\delta_{KE}\) | −0.0616 | *** |
| ln\((IE_{i}/E_{i})\)  | \(\delta_{IE}\) | −0.0304 | * |
| ln\(E_{i} \times lnL_{j,i}\)  | \(\delta_{S}\) | 0.3608 | *** |
| \(D_{Tech_{j,i}}\)  | \(d_{T}\) | 0.6240 | *** |
| ln\(E_{i} \times D_{Tech_{j,i}}\)  | \(\delta_{T}\) | 0.1495 | *** |
| \(D_{Inform_{j,i}}\)  | \(d_{I}\) | −0.1284 | * |
| ln\(E_{i} \times D_{Inform_{j,i}}\)  | \(\delta_{I}\) | 0.0666 | *** |
| Canton Dummies | Yes | Yes |
| R^2 | 0.3653 | 0.3660 | 0.3698 | 0.3892 |

| Independent Variable | Coefficient | Equation [2] Dependent Variable: ln\(E_{j,i}\) |
|-----------------------------------------------|
| Constant  | −6.1872 | *** |
| ln\(y_{i,t-1}\)  | \(\theta_{1}\) | 0.2377 | *** |
| ln\(DEN_{i,t-1}\)  | \(\theta_{2}\) | 0.1198 | *** |
| ln\(TAX_{i,t-1}\)  | \(\theta_{3}\) | 0.0534 | *** |
| Province Dummies | Yes | |
| R^2 | 0.7212 | |

| Observations | 445,490 | |

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**References**

Acs, Z., & Amorós, J. (2008). Entrepreneurship and competitiveness dynamics in Latin America. *Small Business Economics*, 31(3), 305–322. https://doi.org/10.1007/s11187-008-9133-y.
Acs, Z., Audretsch, D., & Lehmann, E. (2013). The knowledge spillover theory of entrepreneurship. Small Business Economics, 41(4), 757–774. https://doi.org/10.1007/s11187-013-9505-9.

Acs, Z., Ástebro, T., Audretsch, D., & Robinson, D. (2016). Public policy to promote entrepreneurship: a call to arms. Small Business Economics, 47(1), 35–51.

Acs, Z., Audretsch, D.B., Braunehjelm, P., & Carlsson, B. (2012). Growth and entrepreneurship. Small Business Economics 39, 289–300. https://doi.org/10.1007/s11187-010-9307-2.

Acs, Z., Bosma, N., & Stemberg, R. (2011). Entrepreneurship in world cities. In M. Minnity (Ed.), The dynamics of entrepreneurial activity (pp. 125–152). Oxford: Oxford University Press.

Acs, Z., Braunehjelm, P., Audretsch, D., & Carlsson, B. (2009). The knowledge spillover theory of entrepreneurship. Small Business Economics, 32(1), 15–30. https://doi.org/10.1007/s11187-008-9157-3.

Acs, Z., Gläser, T., Litan, R., Fleming, L., Goetz, S., Kerr, W., Klepper, S., P nassthal, S., Sorenson, O., & Strange, W. (2008). Entrepreneurship and urban success. Ewing Marion Kaufman Foundation: Toward a Policy Consensus. https://osm.com/abstract/1092493.

Acs, Z., & Szerb, L. (2007). Entrepreneurship, economic growth and public policy. Small Business Economics, 28(2–3), 109–122. https://doi.org/10.1007/s11187-006-9012-3.

Audretsch, D., & Beldtski, M. (2017). Entrepreneurial ecosystems in cities: establishing the framework conditions. The Journal of Technology Transfer, 42, 1030–1051. https://doi.org/10.1007/s11187-016-9473-8.

Audretsch, D., & Keilbach, M. (2004a). Does entrepreneurship capital matter? Entrepreneurship Theory and Practice, 28(5), 419–429. https://doi.org/10.1111/j.1540-6520.2004.00055.x.

Audretsch, D., & Keilbach, M. (2004b). Entrepreneurial capital and regional growth: An evolutionary interpretation. Journal of Evolutionary Economics, 14(5), 605–616. https://doi.org/10.1007/s00191-004-0228-6.

Audretsch, D., & Keilbach, M. (2004c). Entrepreneurship capital and economic performance. Regional Studies, 38(8), 949–959. https://doi.org/10.1080/00343404.2002.900956.

Audretsch, D., & Keilbach, M. (2005). Entrepreneurship capital and regional growth. Annals of Regional Science, 39(3), 457–469. https://doi.org/10.1007/s00168-005-0246-9.

Audretsch, D., & Keilbach, M. (2008). Resolving the knowledge paradox: Knowledge-spillover entrepreneurship and economic growth. Research Policy, 37(10), 1697–1705. https://doi.org/10.1016/j.respol.2008.08.008.

Audretsch, D., Keilbach, M., & Lehmann, E. (2006a). The emergence of entrepreneurship policy in entrepreneurship and economic growth. In D. Audretsch, K. Kellibac, M., and Lehmann, E. Oxford Scholarship Online. https://doi.org/10.1093/acprof:oso/9780198518351.003.0010.

Audretsch, D., Keilbach, M., & Lehmann, E. (2006b). Entrepreneurship capital and economic performance in entrepreneurship and economic growth. Eds. Audretsch, D., Keilbach, M., and Lehmann, E. Oxford Scholarship Online. https://doi.org/10.1093/acprof:oso/9780198518351.003.0004.

Audretsch, D., & Lehmann, E. (2017). Economic performance and the knowledge spillover theory of entrepreneurship: A comment. The Journal of Technology Transfer, 42, 1234–1235. https://doi.org/10.1007/s10961-016-9507-2.
Entrepreneurship capital spillovers at the local level

Massón-Guerra, J.L., & Ortín-Ángel, P. (2017a). Entrepreneurship and regional productivity revisited, Revista Economia Aplicada, XXV, p. 131–142.
Massón-Guerra, J. L., & Ortín-Ángel, P. (2017b). Regional entrepreneurship capital and Firm’s production. Small Business Economics, Online. https://doi.org/10.1007/s11187-017-9851-0.
Mendonça, J., & Grimpe, C. (2015). Skills and regional entrepreneurship capital formation: A comparison between Germany and Portugal. Journal of Technology Transfer, 1–17. https://doi.org/10.1007/s10961-015-9444-5.
Mueller, P. (2006). Exploring the knowledge filter: How entrepreneurship and university-industry relationships drive economic growth. Research Policy, 35(10), 1499–1508. https://doi.org/10.1016/j.respol.2006.09.023.
Mueller, P. (2007). Exploiting entrepreneurial opportunities: The impact of entrepreneurship on growth. Small Business Economics, 28(4), 355–362. https://doi.org/10.1007/s11187-006-9035-9.
Qian, H., & Acs, Z. (2013). An absorptive capacity theory of knowledge spillover entrepreneurship. Small Business Economics, 40, 185–197. https://doi.org/10.1007/s11187-011-9368-x.
Salas-Fumás, V., & Sánchez-Asín, J. (2008). Los emprendedores y el crecimiento económico, in Fundación Bancaja (Eds). El capital humano y los emprendedores en España, 165-208.
Salas-Fumás, V., & Sánchez-Asín, J. (2010). Calidad del Recurso Emprendedor y Productividad en España. El Trimestre Económico LXXVII, 719–757.
Salas-Fumás, V., & Sánchez-Asín, J. (2013a). Entrepreneurial dynamics of the self-employed and of firms: a comparison of determinants using Spanish data. International Entrepreneurship and Management Journal, 9, 417–446. https://doi.org/10.1007/s11365-011-0178-z.
Salas-Fumás, V., & Sánchez-Asín, J. (2013b). The management function of entrepreneurs and countries’ productivity growth. Applied Economics, 45, 2349–2360. https://doi.org/10.1080/00036846.2012.663476.
Schneider, F., & Enste, D. (2000). Shadow economies: Size, causes, and consequences. Journal of Economic Literature, 38(1), 77–114. https://doi.org/10.1257/jel.38.1.77.
Stough, R., Jackson, S., Song, C., & Sutter, R. (2008). Measuring entrepreneurship capital and its role in economic growth. In A. Bailly, L. Gibson, & K. Haynes (Eds.), Applied geography for the entrepreneurial university (pp. 137–150). France: Economica.
Sutter, R., & Stough, R. (2009). Measuring entrepreneurship and knowledge capital: Metropolitan economic efficiency in the USA? Entrepreneurship & Regional Development, 21(4), 351–373. https://doi.org/10.1080/08985620903020052.