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**State restructuring and subnational innovation spaces
across Chinese prefectures**

Journal:	<i>Environment and Planning C: Government and Policy</i>
Manuscript ID	EPC-15/155.R1
Manuscript Type:	Article
Keywords:	China, industrial parks, innovation, state restructuring, transition
Abstract:	<p>This paper maps the emergence of “subnational innovation spaces” in China as they result from the interaction between state restructuring and the diffusion of innovative activities. Several countervailing forces have played a part in outlining a number of supra-urban regions that diverge by their own capability to develop and govern innovation-related socio-economic processes. On the one hand, the downscaling of state power enables the local administrative units to plan place-based strategies to embed technological upgrading, such as driving indigenous innovative activities to cluster around industrial and technological parks. On the other hand, this clustering entails reconfiguring socio-spatial interactions, while experiencing new networked connections to be governed. Thus, technological upgrading and state restructuring are intertwined and mutually reinforcing. Following from this perspective, the authors have rearranged various data sets at the prefectural level and processed them to disentangle some of the main underlying processes: first, the distribution of innovation-related “infrastructures” across cities; second, the evolution of innovative activities; third, the transition towards a firm-centred S&T system. These factors have been then combined together with neighbourhood relations to outline different subnational innovation spaces. The result is a country-wide map describing how the geography of innovative activities in China exhibits features that are connected to the long-term processes of transition, industrialisation and state restructuring. This picture suggests that the catching up with “upgraded development” in laggard regions could be further promoted identifying “up-scaled” regional hubs to coordinate the development of wider areas.</p>

1 Introduction

State restructuring is a dynamic process moulding the geography of institutions and unfolding into a multi-scalar reorganisation of state power. Introduced in Brenner (2004a), this concept refers both to the institutional organisation of power *per se* and the process or action of rescaling power across various perimeters and configurations. The organisation of the state is therefore not given. It is rather constitutive of a fluid, even path-dependent, process of change (Brenner, 2009; Jessop, 2002). Such a perspective is particularly appealing when attempting to disentangle the developmental puzzles, which actually mix endogenous socio-economic dynamics and policy actions at different scales remodelling the “matrixes of socio-spatial interactions” (Brenner, 2004b).

Technological change is one relevant dynamic in these puzzles (North, 1990). Technological change is a structural process in the sense that it consists of an upgrading of technical capabilities coupled with a reconfiguring of socio-spatial interactions. In “upgraded” contexts, for instance, the effective functioning of Regional Innovation Systems (RIS) is a matter of “agglomeration, trust building, innovation, institutions, and learning in regional systems” (Cooke et al., 1998: 1563). Technological change is thus endogenous when all these elements “take off”, that is, start fostering changes themselves. Consequently, each involved force must be enabled to self-propel change from a downscaling of state power that allows local “matrices” to restructure.

Technological change and state restructuring are thus intertwined and mutually

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9 reinforcing based on a bidirectional linkage. Bottom-up, the societal components taking
10 part in the knowledge-creation and capability-building process experience new
11 networked connections that pressure the formal institutional arrangements into
12 renovating (Leydesdorff, 2006). Top-down, those institutional arrangements work as
13 “social technologies” (Nelson and Sampat, 2001), so that a reorganisation of state
14 power enables to embed such evolving dynamics into places.
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22 Rearrangements often follow from main conceptual and political shifts. In studying
23 and governing technological change, that shift was the growing attention to the regional
24 dimension of innovation systems beginning in the 1990s (Cooke et al., 1997).
25 Specifically concerning China, an upsurge of innovative activities occurred a few years
26 later (Fan, 2014), while their increasing concentration at the local level was furthering
27 the opportunities of decentralised institutional arrangements and policy experiments
28 (Heilmann, 2008). On its side, a process of governance downscaling in China started in
29 1978 due to a new political perspective on the country’s future, encouraging the
30 emergence of an “urban entrepreneurialism” (Li and Wu, 2012). This very attitude is
31 supposed here to have been crucial in pushing local governments, or at least some of
32 them, to embed the developmental opportunities that the diffusion of innovative
33 activities has offered.
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48 This paper aims to shed light on this interaction between state restructuring and
49 endogenous technological upgrading in China. The first side is narrated primarily based
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9 on the literature and then on the place-based promotion of innovative activities in
10 industrial and technological parks. Innovative activities are observed through the
11 distribution of patent data across prefectural cities and groups of innovators. As a result,
12 the paper sketches a countrywide map of “Subnational Innovation Spaces” (SIS) to
13 describe the linkage between the accumulation of technological capabilities, where
14 innovative activities have clustered, and the practice of state-power rescaling, where
15 local administrations have experienced the governance of innovation-related
16 “infrastructures”.
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26 The remainder of the paper is structured as follow. Section 2 summarises the main
27 steps of state restructuring along the economic transition in China, while Section 3
28 focusses on those actions having addressed technological change within the wider
29 governmental strategy of national development. Section 4 describes how innovative
30 activities have expanded and evolved over time. Then, based on the empirical
31 approximation and overlap of these intertwined dynamics, Section 5 builds and
32 discusses a descriptive map of SIS. Such a picture is expected to make way for a
33 number of policy implications for an “upgraded” model of coordinated regional
34 development in China in Section 6.
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48 **2 Transition and state restructuring**

49 China operated a centrally planned economy until 1978. Its substantial characteristics
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9 were a strong vertical administration and a state-owned monopolistic system of
10 production. Five-year planning had command of social and economic activities, as well
11 as the development process, which was primarily focussed on channelling industrial
12 projects to the interior area of the country. As an example, during the 1960s, several
13 industrial plants were relocated from cities on the First Front (Eastern region), such as
14 Beijing, Shanghai and Tianjin, to the Second and Third Front (the Central and Western
15 regions, respectively) (Li and Wu, 2012). Of course, the state power structure was tight,
16 mirroring that of the economy, based on several local governing bodies broadly
17 organised around the same functional departments of national government to favour the
18 top-down administration of territories (Yeh and Wu, 1999). Local initiatives were thus
19 products of central decisions and regional administrations were largely responsible for
20 enforcing plan implementation rather than being cornerstones of local autonomy.
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35 A planning mentality is typical of the developmental-state models, and catching-up
36 countries frequently adopt this model to support and foster economic growth under a
37 centralised push (Cooke et al., 2007). The same was true for China before 1978, but the
38 following transition towards a market economy has fostered the evolution into a “state-
39 sponsored” model, where decentralised and indigenous experiences are equally critical
40 to the nation-level initiatives and guidelines (Zhang et al., 2011). A deep reconfiguring
41 of state spatiality started in the early-1980s (Li and Wu, 2012) and has become an
42 important topic in international research agenda more recently. This section focusses on
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9 those findings that are most relevant for the scope of the paper, that is, those facts and
10 reforms that opened into cases of local leadership in supporting innovative activities and
11 technological upgrading.
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15 The creation of Special Economic Zones (SEZ) in Shenzhen, Shantou and Zhuhai
16 (Guangdong) and Xiamen (Fujian) in 1980 was the early significant step towards state
17 downscaling in China. These sites' locations close to those extraterritorial spaces of
18 market economy, like Hong Kong, Macau and Taiwan, were strategic to launching the
19 transition (Zeng, 2010). SEZ are geographically delimited areas eligible for a number of
20 benefits, especially related to taxation, land use, finance and trade tariffs, and managed
21 by a single administration (Akinci and Crittle, 2008). In China, the administrative
22 decentralisation in these zones mainly consisted of developing municipal laws and
23 regulations to create a business-friendly environment. Of course, this required a
24 consistent reorganisation of state power. Shenzhen, for instance, was first given the
25 same political status as Guangzhou (the capital city) by the Guangdong provincial
26 authority in 1981, then the substantive rank of province by the national authority in
27 1988 and finally legislative power in 1992 (Zeng, 2010).
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44 Shenzhen undoubtedly represented one of the most active laboratories of
45 decentralised governance in China (Heilmann, 2008). The success of these types of
46 practices thus fostered the creation of additional SEZ: Hainan in 1988, Shanghai
47 Pudong New Area in 1989, and finally, Tianjin Binhai New Area in 2006 (Zeng, 2010).
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Nonetheless, the potentiality of state rescaling gained its own acknowledgement despite the “exceptionality” of the SEZ, so that the experience of empowered local administrations leaked soon from these zones. A similar, even “softened”, model of development-policy decentralisation in suburban areas followed in industrial parks beginning in 1984 and technological parks in 1988. (Zeng, 2010). Nonetheless, local administrative units increased in number at the same time. The total count of cities, which include state-administered, prefecture- and county-level municipalities, almost doubled between 1982 (245) and 1990 (467) and continued growing until 1998 (668) (Chung, 2007). This process of administrative reorganisation resulted in a period of flourishing city-level governance. Overall, during the 1980s and 1990s, cities gained autonomy in place-based development, which included the practice of more independent-from-state urban government through local fiscal authority and economic planning (Li and Wu, 2012).

This rapid downscaling of state power was functional to decentralise governance as required by the advancement along transition. One of the main consequences, however, was “urban entrepreneurialism” (Wu, 2003). Urban entrepreneurialism increased the competition across local entities, frequently based more on emulation than coordination, with the side effect of decreasing the opportunities of region-level integrated development (Chien and Gordon, 2008). Shanghai, for instance, massively invested in building its own seaport, although one already existed nearby in Ningbo (Zhejiang). No

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doubt, this played a part in making local development in China approximate a zero-sum process and stressing long-term gaps (Chien, 2008).

A changed perspective on regional development coordination appeared approximately 2000 to face this challenging trend. Coordination was partially returned to the central government according to three proposals: “Developing the Western Region” in 1999, “Reviving the North-East Industrial Base” in 2003 and “Boosting the Midland Economic Growth” in 2004 (Li and Wu, 2012). This renovated region-wide perspective on development rested on a handful of experiences dating back to the early-1990s. During those years, some solutions of inter-city cooperation, government partnership and other types of regional collaborations gained popularity as a brake on the rise of urban entrepreneurialism. They actually initiated a reversal trend towards horizontal and network-based functional planning (Xu, 2008). At the same time, the State Planning Commission (the central agency for socio-economic planning) also began paying more attention to inter-provincial integration, making use of the allocation of central resources to increase regional coordination (Hu, 2006). In addition, this new approach contributed to a new wave of urban policies that proceeded from the partial re-upscaling of power. For instance, counties and cities were no longer free to expand their boundaries without being part of a wider plan (Li and Wu, 2012).

Conversely, in province-level cities that had already become metropolitan areas, decentralisation was necessary to coordinate the governance of a large and dynamic

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9 territory. Shanghai, for instance, devolved a large set of authoritative powers to city
10 districts in the early-1990s, such as taxation, urban planning and investment regulation
11 (Wu, 2000). Furthermore, the Pudong New Area, which hosts an SEZ, gained a higher
12 administrative rank than other city districts (Wu, 2003). Thus, while the issue in the
13 remainder of the country was going back to coordination among cities and regions to
14 promote further development, metropolitan areas were instead stepping into a new
15 model of urbanisation (Wu and Phelps, 2008). Of course, this has influenced the
16 evolution of socio-economic processes within the same metropolitan areas and these
17 cities' capacity for leading the "upgraded" development of larger regions.
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29 In summary, the restructuring of state power in China has followed three main
30 directions along the economic transition. The first one at the very beginning was finding
31 places to experiment with a market economy and fast economic growth. The second
32 step was to bring such experiences out of the "exceptionality" of the SEZ by identifying
33 cities as the main places for furthering local development. Nonetheless, strong
34 competition proceeded from the extensive empowerment of local authorities. Thus, the
35 subsequent guidelines sought to partially re-balance the governance of economic
36 dynamics by promoting higher-scale coordination. Each one of these steps corresponds
37 to a different phase of economic development, which represents the other side of the
38 deep transformation that has enabled China, or at least some Chinese regions, to "climb
39 the ladder" of the global economy.
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3 Development, industrialisation and S&T policy

The increasing interaction of China with international markets progressed through a series of industrial and technological accomplishments specifically addressed as transition pillars by the central government (Brandt et al., 2008). Change in China has actually been a matter of combining “structural transformation, economic liberalization, and institutional transition into one” (Lin and Wang, 2012: 2). The initial step in unbinding change, of course, was beginning to dismantle the state control of the economy (Naughton, 2007). This meant making way for market dynamics but also, and maybe more importantly, introducing new indispensable asymmetries.

The central government indeed intervened in boosting the attraction for foreign investment soon after 1978, focussing on specific locations (Chen et al., 1995). Despite the barriers to the local absorption of the imported technologies (Fu et al., 2011), SEZ were main “doorways” to technological upgrades. They opened the possibility of operating in China to multinational enterprises, introducing a competitive pressure that was unknown before (Brandt and Thun, 2010) in addition to new technological concerns (Fu, 2008). The first four SEZ accounted for almost 60% of the national inflow of FDI in 1981, then decreased to 26% in 1984, but nevertheless produced an unprecedented income-growth performance that exceeded the yearly rate of 50% between 1981 and 1984 in Shenzhen (Wong, 1987). SEZ have thus contributed to

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9 strengthening economic disequilibria across regions and demonstrating the potential of
10 a greater local autonomy. This very potential was also considered a main drive to
11 address the diffusion of development out of SEZ. The central government then
12 established 14 new industrial parks or, more formally, Economic and Technology
13 Development Zones (ETDZ), in Coastal cities between 1984 and 1988. Other parks
14 were added in 1992; the number of parks peaked at 69 in 2010, some of them in the
15 Central and Western regions as well (Zeng, 2010).
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24 The target of reforms expanded at the beginning of the 1990s, embracing the
25 restructuring of State-Owned Enterprises (SOE) (Li and Putterman, 2008). They
26 became bigger, more capital- and knowledge-intensive, more productive and capable of
27 making a profit (Gabriele, 2010). Thus, they represented renovated resources for a new
28 stage in industrial and technological upgrades and a country that was ready to more
29 extensively involve domestic firms and the Science and Technology (S&T) system in
30 economic development.
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40 The bases were built under the sixth five-year plan (1981-1985) through
41 interventions such as the National Key Technologies R&D Program (1984), the State
42 Key Laboratory Program (1984), and the University reform (1985) (Huang et al., 2004).
43 The action range was then extended under the seventh and eighth five-year plans (1986-
44 1995), transforming public laboratories into business entities, promoting industrial
45 collaborations and introducing competitive mechanisms into public funding (OECD,
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9 2008). Interventions such as the Spark (1985), the Torch (1988), and the Technology
10 Spreading Program (1990) were principally conducive to the R&D activities in science
11 parks and incubators (Huang et al., 2004).
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15 These years represented a turning point for place-based development and the
16 related process of state downscaling in China. The Torch Program in particular initiated
17 local solutions by creating High-Tech and Industrial Development Zones (HTIDZ),
18 where the top-down commitment of national government works alongside “the
19 discovery and activation of context-specific potential” (Heilmann et al., 2013: 3).
20 Aiming to use the technological endowments of research institutes, universities,
21 enterprises and favouring the commercialisation of R&D, the first HTIDZ was the
22 Zhongguancun Zone in Beijing in 1988, intended to be developed as China’s own
23 “Silicon Valley” (Zhou, 2005: 1114). Based on this and other pioneering experiences,
24 the national government promoted the creation of new technological parks, acting
25 primarily as a “central policy patron” (Heilmann et al., 2013: 9). In 2010, there were 54
26 HTIDZs, 25 in the Coastal and 29 in the Interior areas (Zeng, 2010). As EDTZ, they are
27 mainly state-level initiatives administered locally. Thus, industrial and technological
28 parks represented powerful vehicles of state restructuring beyond their formal
29 administrative level, as they mobilise administrative, managerial and social capabilities
30 at a local level (Ngo, this issue). In addition, “local tests” will have gained the status of
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9 key guidelines for building a “socialist market economy” as of now⁽¹⁾.

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11 Figure 1 shows how the endowment of industry and technology “infrastructures” in
12 China evolved over the period from 1980 to 2010. This evolution is exemplified by the
13 land area in km² covered by parks, based on information from the Hong Kong Trade
14 Development Council (HKTDC Research)⁽²⁾, and when necessary, on complementary
15 information from China Knowledge (CK)⁽³⁾. Data on mission, prefectural location, land
16 area, administrative scale and year of establishment are complete for 207 of the 231
17 parks identified as being innovation- and technology-oriented (89.6%).
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33 These parks symbolise innovation “infrastructures” around which “upgraded”
34 processes of industrial clustering with innovative activities is promoted (Hu, 2007). Of
35 course, nurturing clustering and upgrading contextually required deeper institutional
36 reforms, such as the regulation of private ownership introduced in 1999 (OECD, 2008)
37 and the protection of intellectual property rights first enacted in 1985 and then twice
38 amended in 1993 and 2001 (Hu and Jefferson, 2009). This allowed further forward
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48 ⁽¹⁾ CPC Central Committee, 14th November 1993: <http://www.china.com.cn/chinese/archive/131747.htm>

49 ⁽²⁾ Hong Kong Trade Development Council: <http://china-trade-research.hktdc.com>

50 ⁽³⁾ China Knowledge: <http://www.chinaknowledge.com>
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9 action on innovative activities under the ninth and tenth five-year plans (1996-2005),
10 truly improving the commercialisation of public R&D, differentiating the mechanisms
11 of public support for innovation and enhancing the technological capabilities of both
12 medium-large and small enterprises (OECD, 2008). Then, the eleventh five-year plan
13 (2006-2010) has definitively replaced the “catching-up” argument with the excellence
14 of the S&T system in the national policy agenda (Sun and Liu, 2010).
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22 A comprehensive set of 79 different actions was introduced between 2006 and
23 2008 to implement the new “Medium- and Long-Term Plan for the Development of
24 Science and Technology” (2006–2020). Some exemplificative initiatives include the
25 attraction of foreign talent, continuous professional education, student and research
26 grants for experiences abroad, enhancing research-oriented universities, focus on key
27 topic, attention to innovation in SMEs and certification of innovation (Liu et al., 2011).
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29 Through these actions, the plan has explicitly noted the transformation of China into an
30 “innovation-oriented Country” (Sun and Liu, 2010), moving towards a market-based
31 and firm-centred model (Li, 2009; Motohashi and Yun, 2007).
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42 This phase thus consisted of the alignment of S&T with the overall process of
43 national transition, including a number of drives that lean against the downscaling of
44 state power. This proves the degree to which technological upgrading and state
45 restructuring are entangled processes in China. Innovation policy, for its part,
46 represented a crucial opportunity to proceed in restructuring the state power in terms of
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9 both policy decentralisation and central-local interaction (Heilmann et al., 2013).

10 11 12 13 **4 Innovative activities across province- and prefecture-level cities**

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15 There are several options to measure technological and innovation activities (Keller,
16 2004). The one preferred in this paper accounts for innovation through patent data. The
17 literature has shown that very few examples of economically significant inventions are
18 not patented (Dernis and Guellec, 2001). Furthermore, patents generally exhibit a robust
19 correlation to R&D spending (Griliches, 1990). This section specifically refers to the
20 patent applications from China filed at the European Patent Office (EPO) collected in
21 the OECD, REGPAT database, January 2014. REGPAT offers a larger volume of and
22 more detailed information over alternative databases that allowed refinement at the
23 prefectural level⁽⁴⁾. The data consist of approximately 15 thousand patents filed between
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⁽⁴⁾ The attribution of patents to prefectural cities results from a semantic search of city toponyms within the addresses associated with each applicant (Callaert et al., 2011). Patent applications are then grouped by applicant's prefecture and priority year based on an integer count (OECD, 2009). Some scholars suggest that in the specific case of China, patents filed at the state Intellectual Property Office of the P.R.C. (SIPO) would outperform input measures in comparing regional innovation capabilities (Guan and Liu, 2005; Liu and White, 2001). This motivates the use of patent statistics, while the need for proper geographical details motivates the reference to EPO patent applications.

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9 1980 and 2010 that are distributed over 184 province- and prefecture-level cities⁽⁵⁾.
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11 Patent data were then extended with additional information on the nature of the almost
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13 five thousand applicants, pooled in four categories: public authorities (0.7%),
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15 universities or research institutions (10.4%), persons (32.1%) and firms (56.6%).
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18 As discussed above, economic development and S&T national policies were the
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20 main factors triggering the growth and diffusion of innovative activities in China. The
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22 first acted to create new industrial capabilities and productive connections, while the
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24 second provided new tools to promote and manage processes of technological change.
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26 Based on state downscaling, these factors soon assumed a strong local dimension.
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29 In addition, the implementation of S&T programmes through local actions, the
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31 success in managing pivotal projects and the development of local industry are often
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33 pursued for political reward, accentuating competition at the subnational level. As an
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35 example, provinces and cities launched competing patent-subsidy programmes in 1999.
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37 This race evidently contributed to the upsurge of patents, both at the Chinese patent
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39 office and abroad, as well as the increase in regional patenting gaps (Li, 2012).
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43 Together and irrespective of their scope, these facts produced a two-sided effect on
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45 the dynamics of innovation in China. The first one is the explosive growth in innovative
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47 activities. Figure 2 illustrates the overall trend of inventions from China based on the
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50 ⁽⁵⁾ Although identified as Chinese in REGPAT, patent applications here do not include those from Hong
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52 Kong, Macau and Taiwan because of the specific history of these territories.
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number of patent applications to the EPO. The increase experienced since the late-1990s was impressive: in 2010, the number of inventions was five times greater than in 2005 and no less than twenty-five times greater than in 2000. This evidence is extremely positive, but does not account for the spatial implications that are summarised in Figure 3⁽⁶⁾.

< **Figure 2** about here >

< **Figure 3** about here >

Since the mid-1990s, the number of cities performing innovative activities increased as much as the number of inventions. The countrywide growth of EPO patent applications and the diffusion of EPO applicants across cities, however, is not strong enough to offset the dramatic accumulation of innovative activities in a few regions, which are mainly located on the eastern coast and renowned as Chinese super-centres of innovation (Crescenzi et al., 2012). Except for Beijing, whose innovative capacity is grounded mainly in the city's academic presence (Zhang et al., 2011), these regions

⁽⁶⁾ The coefficient of variation is the ratio between the standard deviation and mean in the yearly distribution of the number of patents across cities. Higher values correspond to a higher geographical dispersion of innovative activities; that is, the intensity in some regions is remarkably higher or lower than the average. Distribution is thus concentrated at a local level.

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9 were formerly opening-up areas attended by the national strategy and they currently
10 host stronger connections between technological and industrial development than
11 elsewhere (Liu and Sun, 2009).
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15 Domestic and foreign investment in R&D is important in drawing the map of
16 innovative activities in China (Zhang et al., 2012). Nonetheless, innovative processes do
17 not cluster exclusively around the effort in R&D, which is more a measure of their
18 inputs than their potential (Cooke et al., 1998). Other relevant components, such as the
19 quality and arrangement of activities (e.g., specialisation, relational networks,
20 knowledge flows and interaction with complementary services), agree with the
21 boundaries of local innovation systems. Based on these very elements, second-tier areas
22 have also emerged as attractive for foreign companies, like, for instance, Xi'an, Nanjing
23 and Chengdu (Lu and Liu, 2004). This produced a variegated national geography of
24 innovative activities where both laggard and frontier regions were climbing rapidly, at
25 least until 2010.
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40 The final aspect to consider is the shift towards a firm-centred S&T model (OECD,
41 2008). By the end of the 1990s, innovation policy started targeting firms and businesses
42 more closely (Li, 2009). For their part, firms responded with a significant increase in the
43 number of new inventions, as shown in Figure 4, where time is simplified over five-year
44 planning periods. Thus, under the ninth five-year plan (1996-2000), S&T in China
45 switched from a system in which innovators were mainly individuals or research
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9 institutions to one where inventions typically come from firms. In fact, their share has
10 grown from 20% of all patents filed at the EPO during these years to 85% under the
11 eleventh five-year plan (2006-2010). In addition, the number of patent applications
12 exclusively filed by Chinese private firms rose from 9.2% under the ninth five-year plan
13 (1996-2000) to 47.1% under the eleventh (2006-2010). This picture does not imply that
14 other groups of innovators have scaled down their contributions to technological
15 upgrading. As a matter of fact, individuals, public authorities and R&D institutions
16 sustained 13.3% of total patenting growth between 1995 and 2010.
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33 **5 Innovation-related patterns of state restructuring**

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35 In summation, innovative activities started rising in the mid-1990s in China. Although
36 an increasing number of regions became involved, innovation activities remained
37 concentrated in first-mover cities. Furthermore, firms have concurrently emerged as the
38 largest group of innovators (Section 4). As a whole, this dynamic appears to be
39 congruent with a wider process that goes far beyond an upsurge in patents and includes
40 relevant institutional changes that regulatory reforms introduced to restructure state
41 power (Section 2). In addition, “infrastructural initiatives” to support innovative
42 activities (i.e., industrial and technological parks) represented opportunities for living
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the experience of multi-scalar policymaking (Section 3). This section aims to outline the map that results from this overlapping.

The strategy is to combine three main factors through an empirical approximation at the prefectural level: the intensity of effort in innovative activities (EPO patent applications per million inhabitants); the transition towards a firm-centred S&T system (prevalence of EPO patent applications from firms); and state-rescaling opportunities from “infrastructural” policy initiatives (the share of land covered by industrial and technological parks)⁽⁷⁾. All these shifts are expected to contribute to creating Subnational Innovation Spaces (SIS), intended as supra-urban areas entailing different capabilities to innovate and govern innovative activities.

Data are taken as the average of the yearly values between 2006 and 2010 (eleventh five-year plan). Because each measure ranges over a different scale, however, a common standardisation procedure is applied (e.g., Fagerberg et al., 2014). Let be I the set of all the cities i and $j \in I$ a given city. The method adopted transforms each individual value as follows:

$$z_j = 100 \times \frac{x_j - \min_i x_i}{\max_i x_i - \min_i x_i}, \quad (1)$$

where x_j is the original value for the given city j , x_i is the overall distribution of values across cities, and i and z_j are the value obtained from standardisation for the city j . The

⁽⁷⁾ Data on city population and land area are from China Data On Line: <http://chinadataonline.org>

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9 three standardised measures are distributed as $0 \leq z_i \leq 100$, so that they are now
10 comparable.
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13 Obtaining a standardised measure of “infrastructural” policy initiative e_i simply
14 requires replacing values x_i in Equation (1) with the k_i value of km² covered by
15 industrial and technological parks. The white-filled areas in Figure 5 are those regions
16 that do not house listed parks. Thus, the distribution of innovation-related
17 “infrastructures” appears quite sparse. The highest values of e_i are in Shanghai (100)
18 and Beijing (82), scaling down to 50 in Dalian (Liaoning), Wuhan (Hubei) and
19 Nanchang (Jiangxi) and to 35 in Zhengzhou (Henan), Wuhu (Anhui), Guangzhou and
20 Huizhou (Guangdong) and Tianjin.
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33 < *Figure 5 about here* >
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37 Unlike with parks, standardisation requires some additional adjustments to quantify
38 the innovation intensity y_i and S&T system transition t_i . In the first place, measure y_i
39 rests upon the count of patent applications p_i per million inhabitants. The great
40 concentration of patents in a few centres, such as Shenzhen, Beijing and Shanghai,
41 nonetheless biases the overall distribution of values p_i across cities. A solution to reduce
42 skewness is to adjust the procedure in Equation (1) through a logarithmic
43 transformation of values, as follows:
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$$y_j = 100 \times \frac{\log(1 + p_j)}{\log(1 + \max_i p_i)}, \quad (2)$$

where log arguments are augmented, so that $y_i = 0$ corresponds to $\min_i p_i = 0$. These very regions correspond to the white-filled areas in Figure 6, while grey tones are associated with increasing intensities of innovative effort. As is known, the darker-filled regions are concentrated on the eastern coast, with Dongguan (Guangdong), Xiamen (Fujian), Zhuhai (Guangdong), Shanghai and Beijing ranking high on the indicator (above 35) and Shenzhen (Guangdong) ranking highest.

< **Figure 6** about here >

In the case of measure t_i , instead, the first step is calculating the intensity of innovative effort from firms y_i^f and those from the other groups of inventors y_i^r (i.e., public authorities, universities or research institutions and persons). They are obtained by applying Equation (2) to the respective subsets of patents p_i^f and p_i^r . The second step is calculating the difference f_i between these groups as $f_i = y_i^f - y_i^r$. The third step is then standardising f_i as follows:

$$t_j = \begin{cases} 0, & p_j = 0 \\ 100 \times \frac{1 + f_j - \min_i f_i}{1 + \max_i f_i - \min_i f_i}, & p_j > 0 \end{cases}, \quad (3)$$

where both the numerator and denominator are augmented, so that measure t_i is

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9 distributed as $0 \leq t_i \leq 100$, but $t_i = 0$ is assigned to the case of $p_i = y_i = 0$ only. Thus, the
10 white-filled areas in Figure 7 again correspond to those prefectures that did not fill
11 patents at the EPO, while grey becomes darker as the prevalence of firms increases.
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15 Several cities rank high in the indicator (i.e., above the value of 75) and are
16 generally located in the provinces of Guangdong (6), Shandong (11) and Jiangsu (8).
17 Including values between 50 and 75, other provinces, such as Zhejiang and Jiangxi,
18 emerge featuring transition. The cities with a higher prevalence of firm-owned patents t_i
19 often score high in innovative intensity y_i , e.g., Shenzhen and Huizhou (Guangdong),
20 Suzhou (Jiangsu), Weihai (Shandong), Xi'an (Shaanxi) and Qingdao (Shandong).
21
22 Conversely, Shanghai and especially Beijing rank relatively low despite their very high
23 patent counts. This result was expected given the high concentration of universities and
24 public research centres in these areas. Nonetheless, the evidence suggests that at least in
25 part, the transition towards a firm-centred S&T system in China evolved irrespective of
26 the intensity of innovative effort. Therefore, the rough proxy used here probably
27 captures different facts. One is transition in the strict sense, that is, the case in which
28 firms add themselves to pre-existing groups of innovators. Reasonably, it involves cities
29 where the innovative activities grew earlier, just like Beijing and Shanghai. On the other
30 hand, innovative activities started from the very effort of firms in other regions. This is
31 true in the case of Shenzhen, for instance, where the most valuable academic institutions
32 are "subsidiaries" of those from abroad and other cities like, again, Beijing and
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Shanghai (Zhang et al., 2011). Although they diverge, both these cases stress the rising importance of entrepreneurial activities within the Chinese S&T system.

< **Figure 7** about here >

The three measures obtained are now merged in a synthetic index c_i through a linear combination that attributes the same weight to each measure⁽⁸⁾:

$$c_i = \frac{1}{3}(y_i + t_i + e_i). \quad (4)$$

Then, two additional steps allow the conclusive derivation of an SIS index s_i . The first highlights similarities across bordering cities through a spatial-augmented indicator wc_i defined as:

$$wc_i = \frac{1}{2} \left(c_i + \frac{1}{w_i} \sum_{-i \in W_i} c_{-i} \right), \quad (5)$$

where $-i \in W_i$ are those cities surrounding city i and w_i is the number of cities⁽⁹⁾. The last step is to apply Equation (1) to wc_i to obtain a standardised SIS index s_i .

⁽⁸⁾ Alternative combinatorial devices are available, of course. The solution in Equation (4) is advantageous because it does not force assumptions about the relative impact of the three dimensions considered, which is consistent with the descriptive approach here adopted.

⁽⁹⁾ The elements in W_i are chosen according to the queen contiguity rule. See, for instance, Lee and Yu (2010) for a discussion about contiguity rules.

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The result is the map shown in Figure 8, where four regions clearly stand out. They are all located in the East and, more precisely, near Beijing, Weihai and Yantai (Shandong), Shanghai and Suzhou (Jiangsu), and Shenzhen (Guangdong). These supra-urban areas consist of city-agglomerations forming innovative regions around easily identifiable centres. These centres generally house renowned RIS in China (Fan, 2014 for a survey), which *de facto* serve as seeds of larger SIS. Differently, other regions currently show potential as seeds of SIS. With the exception of Xiamen (Fujian), they are all located in the Central region around cities such as Changsha (Hunan), Nanchang (Jiangxi), Wuhu (Anhui), Wuhan (Hubei) and Zhengzhou (Henan).

< *Figure 8 about here* >

These two groups are at their own stage in state restructuring. The first group is capable of governing complex socio-economic processes at the local level, such as promoting and sponsoring the development of innovative activities. Indeed, since the mid-1990s, cities like Beijing and Shanghai have actually initiated innovation-related “infrastructures” out of state plans. In turn, the second group could probably gain from being further attended by the national government in arranging such socio-economic processes.

Finally, a number of cities emerge as border sites for innovative activities. They

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9 include Chongqing and Chengdu (Sichuan), Dalian and Shenyang (Liaoning),
10 Changchun (Jilin) and Xi'an (Shaanxi), among others. Because these regions are mainly
11 located in the Northeast and West, the ongoing configuring of SIS could be crucial to
12 containing an increase in regional disparities in the near future. Nonetheless, the process
13 of structural change seems to be still weak, and consequently, to remain based on state
14 policymaking. The fact that specific technology-focussed interventions entered the
15 governmental programme of "Developing the Western Region" (Tian, 2004) is thus
16 congruent with the picture here. In other words, a lasting weakness of endogenous
17 development has become entangled in the weakness of state restructuring: bottom-up,
18 local institutions miss opportunities to appropriate a part of the state power, while top-
19 down, state power misses motivations to effectively downscale.
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35 **6 Concluding remarks**

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37 This paper provides insight into the evolution of innovative activities in China during
38 the countrywide reconfiguration of state spaces. Three main facts are presumed to play
39 a part in this process. First, the uneven distribution of innovative activities across
40 regions follows from the path of economic development and transition. This is because
41 when local processes have become robustly self-propelling, they have mostly given rise
42 to an upsurge of innovative activities. It is no wonder that the eleventh five-year plan
43 (2006-2010) specifically noted a trajectory of "upgraded development" for cities in the
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9 Eastern region (Fan, 2006). Second, when local development is self-propelling, it is also
10 embedded. As a consequence, the same socio-economic process can assume diverging
11 configurations across cities. As seen before, this is the case of a transition towards a
12 firm-centred S&T system. This outcome is a target of the “Medium-to-Long-term Plan
13 Outline for Development of National S&T (2006-2020)”, which explicitly notes the
14 goal of transforming China into an “innovation-oriented Country” (Sun and Liu, 2010).
15 Nevertheless, cities can adopt different place-based strategies, such as, for example,
16 promoting academic spin-offs in Beijing and attracting foreign companies in Shanghai
17 (Zhang et al., 2011). Third, the possibility of drawing place-based strategies depends on
18 the downscaling of state power. In turn, cities are capable of designing effective place-
19 based strategies only if local development is self-propelling. This simultaneity
20 reinforces the endogenous dimension of development and makes sense of state rescaling
21 at the same time.
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37 Combined together, these facts are helpful to the understanding of how innovative
38 activities have contributed to shape a multi-scalar geography of state in China. Their
39 city-level overlap actually distinguishes different subnational spaces (SIS), which are
40 expected to be grouped by common steps in both technological upgrading and state
41 downscaling. In fact, state spaces are not “pre-given territorial containers” (Brenner,
42 2004b) and rather emerge from dissimilarities in the practice of governing socio-
43 economic dynamics at different state scales. Thus, various experiences of state rescaling
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9 can coexist with the same country, producing a puzzled developmental picture.

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11 In China, one of these experiences is the Yangtze River Delta Economic Region
12 (YRD). Established in 1992 around Shanghai, this horizontal cooperative region of
13 fourteen cities represents, on the one hand, an example of an “upgraded” inter-
14 municipality relationship. Cooperation has strengthened over time, until the YRD has
15 become the space for sharing information and human resources, defining common
16 commercial rules and coordinating infrastructural development (Li and Wu, 2012). On
17 the other hand, the same experience also represents an example of “upgraded”
18 development, as show in Figure 8.
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29 The Changsha-Zhuzhou-Xiangtan Economic Cooperation Zone (CZX) is instead
30 one experience of regional development integration among cities that Figure 8 depicts
31 as less pronounced SIS. Differently from the previous case, in fact, CZX represents an
32 important example of a top-down cooperation plan that was initiated by the central
33 government at the end of the 1980s and from which local inter-municipality
34 associations have proceeded (Li and Wu, 2012). Later, other provinces, like Hainan,
35 Hubei and Anhui, started their own “rescaling-through-coordination” reforms,
36 following from the main guidelines that the central government noted in the eleventh
37 five-year plan (1996-2010), especially concerning fiscal decentralisation (Li and Wu,
38 2012).
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51 This wave of reforms also involved a group of “latecomers”, which include, for
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9 instance, Jilin province and broadly correspond to a third level of SIS outlined in Figure
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11 8, i.e., those regions where the clustering of innovative activities was not pronounced
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13 between 1996 and 2010. Thus, the results of technological upgrading and state
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15 downscaling in China are effectively intertwined: innovative activities are taking part in
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17 layering relational interdependencies and bringing path dependence out into local
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19 development (Wei, 2007). In this manner, they contribute to redesigning the geography
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21 of state.
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24 Those regions in which economic development “upgraded” earlier on innovative
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26 activities are the same regions where the state also started restructuring earlier. It was
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28 for historical reasons, as in the case of Beijing and Shanghai, or for explicit state-level
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30 initiatives aiming to launch a transition, as in the case of Shenzhen. Regardless, these
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32 subnational spaces were able to “upgrade” their own development model by making use
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34 of an “up-scaled” administrative power. External factors, like national resources, FDI
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36 inflows and imported technology, were no doubt essential drivers of this “upgrade”.
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38 Nonetheless, an empowered local governance was necessary to embed the descending
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40 socio-economic dynamics in a place-based development model. State restructuring is
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42 thus a means of societal restructuring.
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46 The same shift, however, is easier or smoother when it is based more on indigenous
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48 than imported capabilities. The barriers to change are actually as lower as new socio-
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50 economic dynamics become entangled in more embedded processes. The approach to
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9 urbanisation first evolved, for instance, in Beijing and Shanghai, much as competition
10 had earlier turned into cooperation in the YRDER. In addition, regional development
11 coordination was started by state- or province-level governments elsewhere. Thus,
12 “upgraded” development entails more pressing needs, needs that embedded models
13 seem capable to responding to faster and more spontaneously. Where the experience of
14 “upgraded” development is fresher, the central government has attended the local
15 restructuring process more closely, and should continue doing so.
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24 Unfortunately, the map of SIS does not yet include a number of other regions that
25 frequently exhibit the largest gaps with the “frontiers”. Given the experience gained
26 from successful local tests of “upgraded” development and state restructuring, catching
27 up could be probably be sped up by merging two main steps in one, that is, identifying
28 regional hubs in which to extensively downscale state power to coordinate and
29 encourage the development of wider areas. The first step was in broad terms the
30 “Shenzhen-model” of upscaling in the early-1980s, while the subsequent step is similar
31 to what began around Shenzhen in the Pearl River Delta in 1984 and other cities in
32 second-tier SIS a decade later (Xu, 2008). This last step actually needed a longer time,
33 and there is no doubt that time cannot be easily rescaled.
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48 **References**

49 Akinici G and Crittle J (2008) *Special economic zone: performance, lessons learned*,
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and implication for zone development. Foreign Investment Advisory Service (FIAS) occasional paper, Washington DC.

Brandt L and Thun E (2010) The Fight for the Middle: Upgrading, Competition, and Industrial Development in China. *World Development* 38(11): 1555–1574.

Brandt L, Rawski TG and Sutton J (2008) China's industrial development. In: Brandt L and Rawski TG (eds), *China's Great Economic Transformation: Economics development and growth*, Cambridge UK: Cambridge University Press, pp. 1–26.

Brenner N (2004a) *New State Spaces: Urban Governance and the Rescaling of Statehood*. Cambridge MA: Oxford University Press.

Brenner N (2004b) Urban Governance and the Production of New State Spaces in Western Europe. *Review of International Political Economy* 11(3): 447–488.

Brenner N (2009) Open questions on state rescaling. *Cambridge Journal of Regions, Economy and Society* 2(1): 123–139.

Callaert J, du Plessis M, Growels J, et al. (2011) *Patent statistics at Eurostat: Methods for regionalisation, sector allocation and name harmonisation*. Eurostat, Luxembourg.

Chen C, Chang L and Zhang Y (1995) The role of foreign direct investment in China's post-1978 economic development. *World Development* 23(4): 691–703.

Chien S-S (2008) The Isomorphism of Local Development Policy: A Case Study of the Formation and Transformation of National Development Zones in Post-Mao

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51
52
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58
59
60
- Jiangsu, China. *Urban Studies* 45(2): 273–294.
- Chien S-S and Gordon I (2008) Territorial Competition in China and the West. *Regional Studies*, Routledge 42(1): 31–49.
- Chung H (2007) The Change in China's State Governance and its Effects upon Urban Scale. *Environment and Planning A* 39(4): 789–809.
- Cooke P, Gomez Uranga M and Etxebarria G (1997) Regional innovation systems: Institutional and organisational dimensions. *Research Policy* 26(4-5): 475–491.
- Cooke P, Uranga MG and Etxebarria G (1998) Regional systems of innovation: an evolutionary perspective. *Environment and Planning A* 30(9): 1563–1584.
- Cooke P, De Laurentis C, Tödting F, et al. (2007) *Regional Knowledge Economies: Markets, Clusters and Innovation*. London: Edward Elgar Publishing.
- Crescenzi R, Rodriguez-Pose A and Storper M (2012) The territorial dynamics of innovation in China and India. *Journal of Economic Geography* 12(5): 1055–1085.
- Dernis H and Guellec D (2001) Using Patent Counts for Cross-Country Comparisons of Technology Output. *STI Review* 27(Special Issue on New Science and Technology Indicators): 129–146.
- Fagerberg J, Feldman MP and Srholec M (2014) Technological dynamics and social capability: US states and European nations. *Journal of Economic Geography* 14(2): 313–337.
- Fan C (2006) China's Eleventh Five-Year Plan (2006–2010): From 'Getting Rich First'

1
2
3
4
5
6
7
8
9 to 'Common Prosperity'. *Eurasian Geography and Economics*, Taylor & Francis
10 Group.

11
12 Fan P (2014) Innovation in China. *Journal of Economic Surveys* 28(4): 725–745.

13
14 Fu X (2008) Foreign Direct Investment, Absorptive Capacity and Regional Innovation
15 Capabilities: Evidence from China. *Oxford Development Studies*, Routledge 36(1):
16 89–110.

17
18 Fu X, Pietrobelli C and Soete L (2011) The Role of Foreign Technology and Indigenous
19 Innovation in the Emerging Economies: Technological Change and Catching-up.
20 *World Development* 39(7): 1204–1212.

21
22 Gabriele A (2010) The Role of the State in China's Industrial Development: A
23 Reassessment. *Comparative Economic Studies* 52(3): 325–350.

24
25 Griliches Z (1990) Patent Statistics as Economic Indicators: A Survey. *Journal of*
26 *Economic Literature* 28(4): 1661–1707.

27
28 Guan J and Liu S (2005) Comparing regional innovative capacities of PR China based
29 on data analysis of the national patents. *International Journal of Technology*
30 *Management* 32(3-4): 225–245.

31
32 Heilmann S (2008) Policy Experimentation in China's Economic Rise. *Studies in*
33 *Comparative International Development* 43(1): 1–26.

34
35 Heilmann S, Shih L and Hofem A (2013) National Planning and Local Technology
36 Zones: Experimental Governance in China's Torch Programme. *The China*

- 1
2
3
4
5
6
7
8
9 *Quarterly* 216: 896–919.
- 10 Hu AG (2007) Technology parks and regional economic growth in China. *Research*
11 *Policy* 36(1): 76–87.
- 12
13 Hu AG and Jefferson GH (2009) A great wall of patents: What is behind China’s recent
14 patent explosion? *Journal of Development Economics* 90(1): 57–68.
- 15
16 Hu X (2006) Evolution and prospect of China’s regional planning. *Acta Geographica*
17 *Sinica* 61(6).
- 18
19 Huang C, Amorim C, Spinoglio M, et al. (2004) Organization, programme and
20 structure: an analysis of the Chinese innovation policy framework. *R&D*
21 *Management* 34(4): 367–387.
- 22
23 Jessop B (2002) *The Future of the Capitalistic State*. Cambridge UK: Polity Press.
- 24
25 Keller W (2004) International Technology Diffusion. *Journal of Economic Literature*
26 42(3): 752–782.
- 27
28 Lee L and Yu J (2010) Some recent developments in spatial panel data models.
29 *Regional Science and Urban Economics*, Elsevier B.V. 40(5): 255–271.
- 30
31 Leydesdorff L (2006) ‘While a Storm is Raging on the Open Sea’: Regional
32 Development in a Knowledge-based Economy. *The Journal of Technology*
33 *Transfer* 31(1): 189–203.
- 34
35 Li W and Putterman L (2008) Reforming China’s SOEs: An Overview. *Comparative*
36 *Economic Studies*, Nature Publishing Group 50(3): 353–380.
- 37
38
39
40
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50
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3
4
5
6
7
8
9 Li X (2009) China's regional innovation capacity in transition: An empirical approach.
10
11 *Research Policy* 38(2): 338–357.
12
13 Li X (2012) Behind the recent surge of Chinese patenting: An institutional view.
14
15 *Research Policy* 41(1): 236–249.
16
17 Li Y and Wu F (2012) The transformation of regional governance in China: The
18
19 rescaling of statehood. *Progress in Planning* 78(2): 55–99.
20
21 Lin JY and Wang Y (2012) China's integration with the world: Development as a
22
23 process of learning and industrial upgrading. *China Economic Policy Review* 1(1):
24
25 1–33.
26
27
28
29 Liu F and Sun Y (2009) A comparison of the spatial distribution of innovative activities
30
31 in China and the U.S. *Technological Forecasting and Social Change* 76(6): 797–
32
33 805.
34
35 Liu F, Simon DF, Sun Y, et al. (2011) China's innovation policies: Evolution,
36
37 institutional structure, and trajectory. *Research Policy* 40(7): 917–931.
38
39 Liu X and White S (2001) An exploration into regional variation in innovative activity
40
41 in China. *International Journal of Technology Management* 21(1-2): 114–129.
42
43
44 Lu LYY and Liu JS (2004) R&D in China: An empirical study of Taiwanese IT
45
46 companies. *R and D Management* 34(4): 453–465.
47
48
49 Motohashi K and Yun X (2007) China's innovation system reform and growing
50
51 industry and science linkages. *Research Policy* 36(8): 1251–1260.
52
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3
4
5
6
7
8
9 Naughton B (2007) *The Chinese Economy: Transitions and Growth*. Cambridge MA:
10 MIT Press.
11
12 Nelson RR and Sampat BN (2001) Making sense of institutions as a factor shaping
13 economic performance. *Journal of Economic Behavior & Organization* 44(1): 31–
14
15 54.
16
17
18
19 North DC (1990) *Institutions, Institutional Change and Economic Performance*.
20 Cambridge MA: Cambridge University Press.
21
22
23
24 OECD (2008) *OECD Reviews of Innovation Policy: China 2008*. Paris: OECD
25
26 Publishing.
27
28
29 OECD (2009) *OECD Patent Statistics Manual*. Paris: OECD Publishing.
30
31 Sun Y and Liu F (2010) A regional perspective on the structural transformation of
32
33 China's national innovation system since 1999. *Technological Forecasting and*
34
35 *Social Change* 77(8): 1311–1321.
36
37
38 Tian Q (2004) China develops its west: motivation, strategy and prospect. *Journal of*
39
40 *Contemporary China* 13(41): 611–636.
41
42
43 Wei YHD (2007) Regional Development in China: Transitional Institutions, Embedded
44
45 Globalization, and Hybrid Economies. *Eurasian Geography and Economics*,
46
47 Routledge 48(1): 16–36.
48
49
50 Wong K-Y (1987) China's Special Economic Zone Experiment: An Appraisal.
51
52 *Geografiska Annaler. Series B, Human Geography* 69(1): 27.
53
54
55
56
57
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2
3
4
5
6
7
8
9 Wu F (2000) The Global and Local Dimensions of Place-making: Remaking Shanghai
10 as a World City. *Urban Studies* 37(8): 1359–1377.
11
12
13 Wu F (2003) The (Post-) Socialist Entrepreneurial City as a State Project: Shanghai's
14 Reglobalisation in Question. *Urban Studies* 40(9): 1673–1698.
15
16
17 Wu F and Phelps NA (2008) From Suburbia to Post-Suburbia in China? Aspects of the
18 Transformation of the Beijing and Shanghai Global City Regions. *Built*
19 *Environment* 34(4): 464–481.
20
21
22
23
24 Xu J (2008) Governing city-regions in China: Theoretical issues and perspectives for
25 regional strategic planning. *Town Planning Review* 79(2-3): 157–186.
26
27
28
29 Yeh AG and Wu F (1999) The transformation of the urban planning system in China
30 from a centrally-planned to transitional economy. *Progress in Planning* 51(3):
31 167–252.
32
33
34
35 Zeng DZ (2010) How Do Special Economic Zones and Industrial Clusters Drive
36 China's Rapid Growth? In: Zeng DZ (ed.), *Building Engines for Growth and*
37 *Competitiveness in China: Experience with Special Economic Zones and Industrial*
38 *Clusters*, Washington DC: The World Bank, pp. 1–54.
39
40
41
42
43
44 Zhang F, Cooke P and Wu F (2011) State-sponsored Research and Development: A
45 Case Study of China's Biotechnology. *Regional Studies* 45(5): 575–595.
46
47
48
49 Zhang R, Sun K, Delgado MS, et al. (2012) Productivity in China's high technology
50 industry: Regional heterogeneity and R&D. *Technological Forecasting and Social*
51
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Change 79(1): 127–141.

Zhou Y (2005) The making of an innovative region from a centrally planned economy: institutional evolution in Zhongguancun Science Park in Beijing. *Environment and Planning A* 37(6): 1113–1134.

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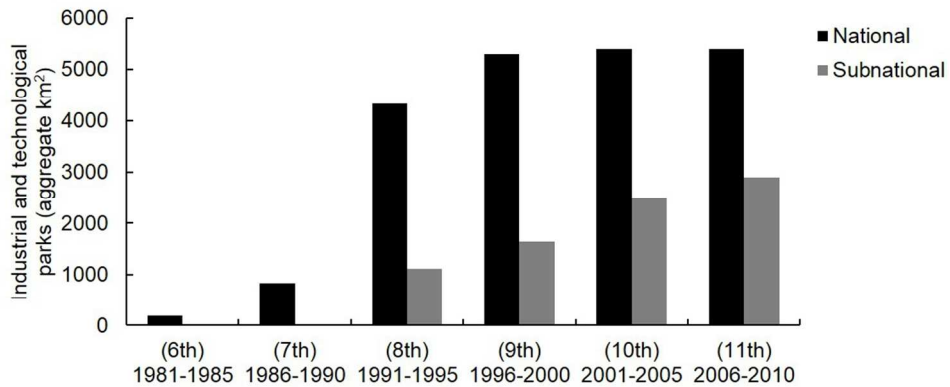


Figure 1. Industrial and technological parks: endowment by state scale (km²) and five-year planning period. China, 1980-2010. Source: authors' arrangement from HKTDC Research and CK. 199x80mm (150 x 150 DPI)

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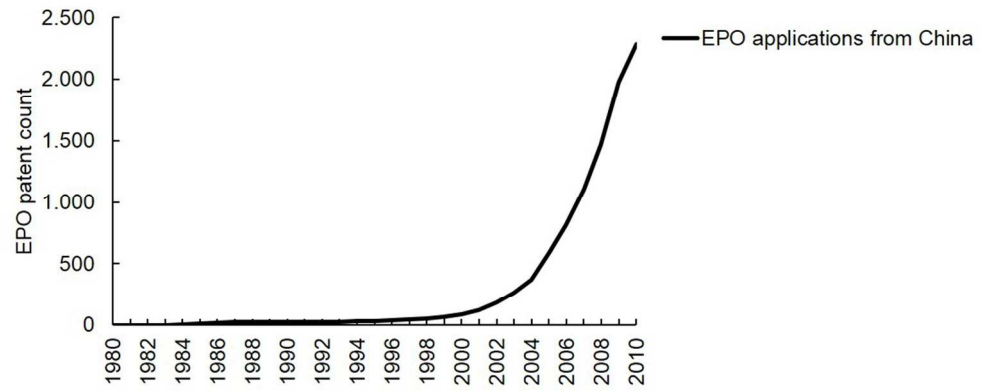


Figure 2. Patent application to the European Patent Office: count (five-year average). Chinese applicants, 1980-2010. Source: authors' arrangement from the OECD, REGPAT database, January 2014. 199x79mm (150 x 150 DPI)

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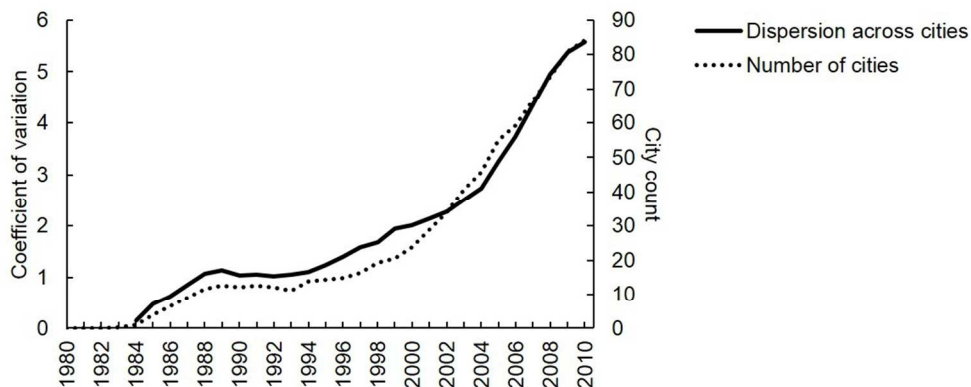


Figure 3. Patent applications to the European Patent Office across prefectures: coefficient of variation (left axis, five-year average) and number of involved prefectures (right axis, five-year average). Chinese applicants, 1980-2010. Source: authors' arrangement from the OECD, REGPAT database, January 2014. 199x80mm (150 x 150 DPI)

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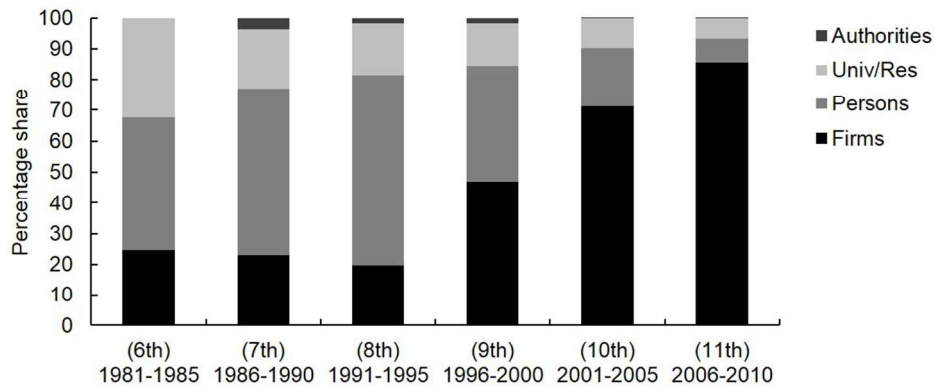


Figure 4. Patent applications to the European Patent Office: main applicant groups by five-year planning period (percentage share). Chinese applicants, 1980-2010. Source: authors' arrangement from the OECD, REGPAT database, January 2014.
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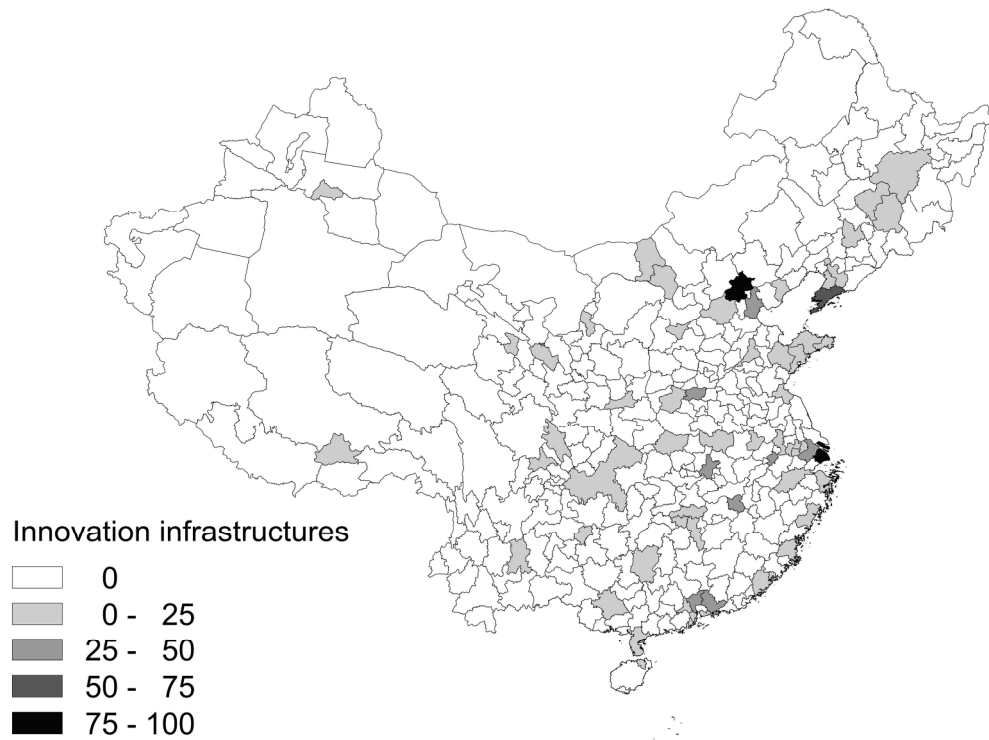


Figure 5. Endowment of innovation infrastructures. Chinese prefectures, 2006-2010. Source: authors' arrangement from HKTDC Research, CK and China Data On Line.
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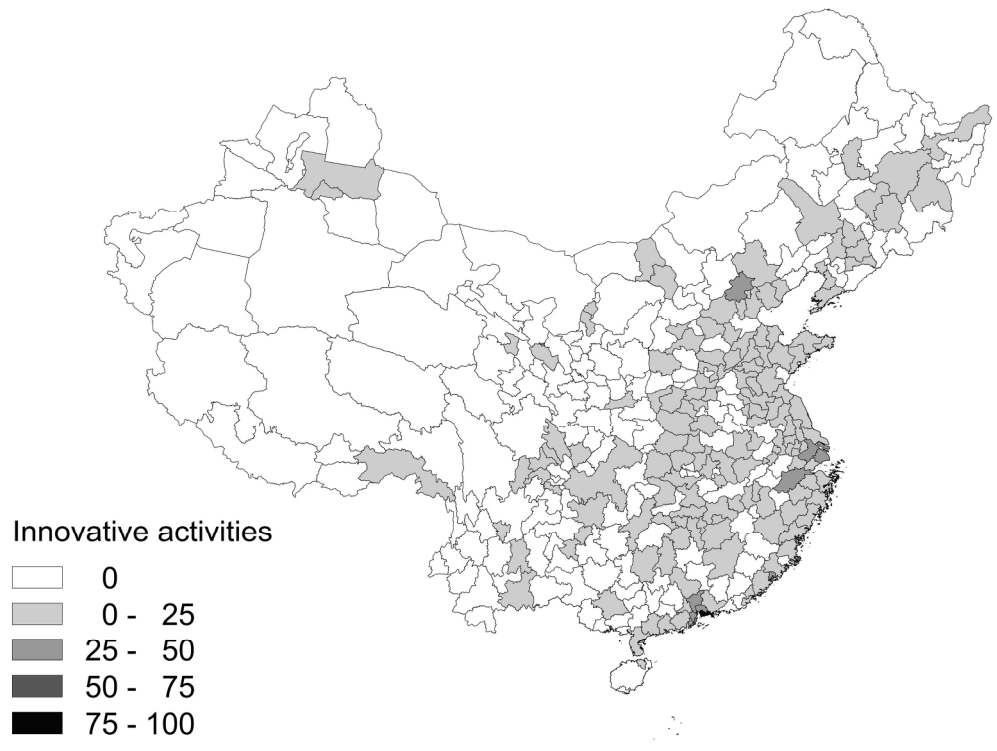


Figure 6. Intensity of innovative activities. Chinese prefectures, 2006-2010. Source: authors' arrangement from OECD, REGPAT database, January 2014 and China Data On Line.
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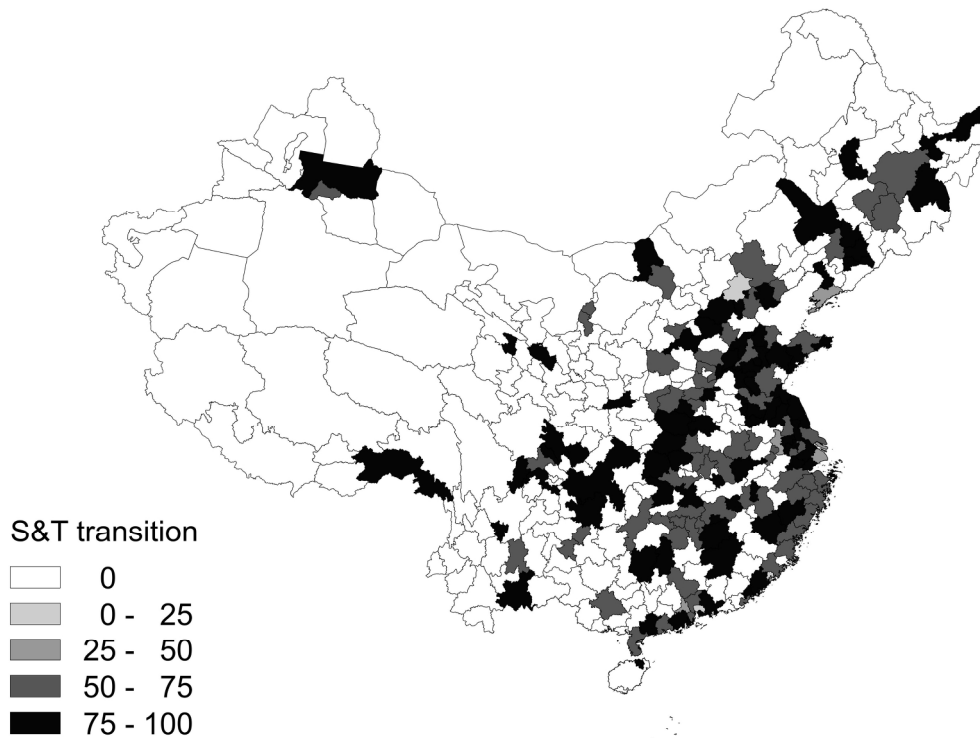


Figure 7. Transition of S&T model. Chinese prefectures, 2006-2010. Source: authors' arrangement from OECD, REGPAT database, January 2014 and China Data On Line.
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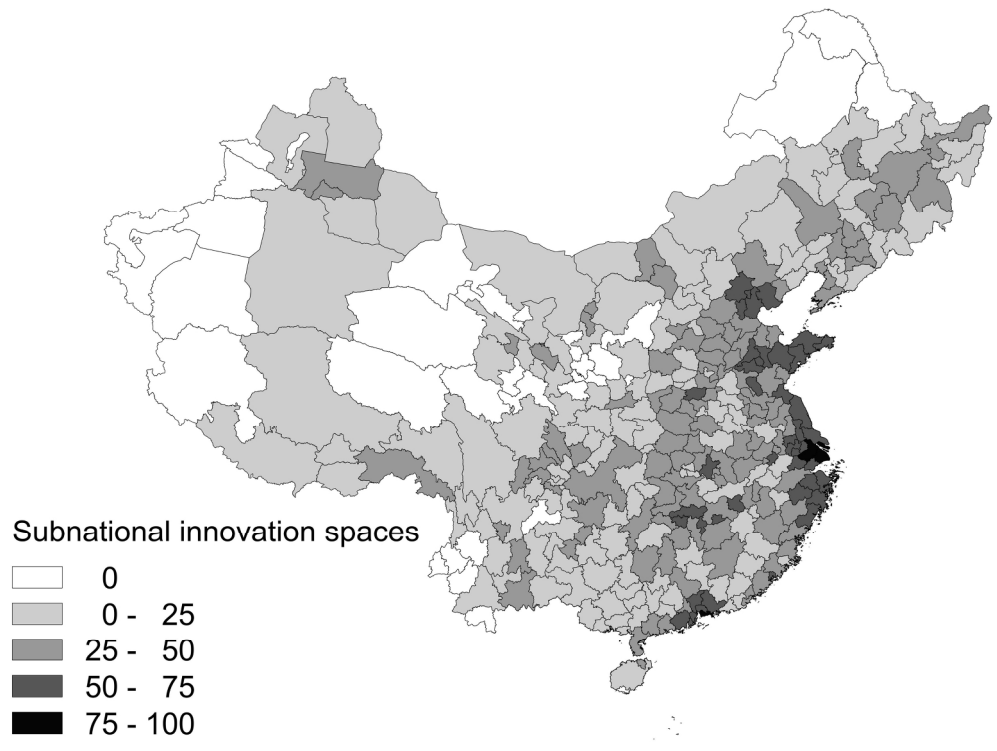


Figure 8. Index for subnational innovation spaces: unweighted linear combination of endowment of innovation infrastructures, intensity of innovative activities and transition of S&T model (spatial augmentation according to queen contiguity). Chinese prefectures, 2006-2010. Source: authors' arrangement from HKTDC Research, CK, OECD, REGPAT database, January 2014 and China Data On Line. 105x78mm (600 x 600 DPI)

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