



‘GLOBAL CHENGDU’: AN ANALYSIS OF CHENGDU’S POSITION IN THE GLOBAL ECONOMY

REPORT

to the

City of Chengdu

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Executive summary

The last decades witnessed the rise of an intensely interconnected world in which cities are seen to play an important role. This has led to new policy and research questions focusing on how key cities are positioned in the global economy. Against this backdrop, in this report we:

- (1) present an analysis of Chengdu's connectivity profile in the global economy by making use of the Globalization and World Cities (GaWC) research network's operational database for researching cities at the global scale;
- (2) present a grounded interpretation of this profile based on fieldwork and site visits in Chengdu in August 2018;
- (3) and, drawing on the above, present a set of tailored policy recommendations for strategically enhancing Chengdu's global connectivity.

GaWC's approach to the understanding of cities' position in the global economy is unique in that (1) it is grounded in state-of-the-art scientific research, (2) has been corroborated by earlier policy research for major cities (including Sydney and Abu Dhabi) and global urban stakeholders (including MasterCard and CBRE), (3) advances a unique relational perspective on how cities are positioned and evolve, and (4) combines systematic quantitative analysis (firm network analysis-based examinations of cities in the global economy) with in-depth qualitative analysis (interview-based examinations of how cities fit into the location strategies of global firms).

Using the central importance of producer service firms in the creation of global urban economies, GaWC identifies the work carried out in their office networks across cities as the constituents of a 'world city network'. Producer service firms provide the financial, professional and creative means to facilitate agents in urban economies in their global pursuits. These activities range from resourcing capital, to navigating multiple jurisdictions, to

developing generic marketing strategies. These are largely accomplished through face-to-face meetings requiring work to be carried out in offices across all cities where their clients have important interests. The skyscraper cityscapes that epitomize the world city as place are in fact the 'knowledge factories' that make globalization possible through myriad inter-city communications.

GaWC's quantitative measures of world city network formation draw on an investigation into the office networks of advanced producer service firms across leading cities. Based on detailed and tailored information on the location strategies of 175 service firms across 707 cities in 2016, we generate estimates of knowledge flows between each of these cities using a state-of-the-art network model. These estimates provide the basic research frame to produce analyses of, and comparisons between cities in terms of their overall level of global network connectivity, the key geographical patterns within that connectivity (strategic connectivity with key world cities and the strength of connections with specific world-regions), and the degree of connectivity change in the period 2010-16. Analyses show that Chengdu was ranked 100th in terms of global network connectivity in 2016, which makes it the 7th most connected Chinese city in the world city network, following Hong Kong, Shanghai, Beijing, Taipei, Guangzhou, and Shenzhen. This position is the result of a strong upward momentum since 2010. Although being a world city in the making, the geographical nature of Chengdu's inter-city relations reveals that its status is above all premised on strong connections with Pacific Asian cities. Although this is clearly an asset given the unfolding geographical shift in the global economy towards Pacific Asia, it can be noted that links to European and North American cities (and especially its key world cities) appear relatively underdeveloped. Policy interventions targeted at further developing Chengdu's stature could focus on developing links with major cities in these regions.

These quantitative analyses provide an indispensable background for understanding Chengdu's evolving position in the global economy, but they need to be complemented with an

in-depth understanding of how the city is used and supported by producer service firms in their global and national strategies in order to be useful. To qualify these measures, between August 21st and 23rd we therefore carried out in-depth interviews with four global advanced producer service firms featuring in GaWC's Chengdu operational database and we also met with four Chengdu firms engaged in production activities for export markets, and the Chinese media organization in Chengdu, National Business Daily. These interviews and meetings revealed that 'global Chengdu' is best understood as being at the centre of a Global Functional Mega-City Region (GFMCR) under construction. The city's prime office area itself is a crucial urban node in that globally active producer service firms are spatially clustered in the centre, supporting innovation and business across the GFMCR. Chengdu's rise in advanced producer service connectivity reflects the increasing presence and activity of a cluster of global service providers that facilitate inward investment into Chengdu and city-region economic expansion. Furthermore, the fact that these producer service firms are part of global networks is crucial. It allows them to access specialized global expertise in Chengdu and to tailor innovative global products to meet the needs of companies coming into Chengdu and Chengdu firms that are internationalizing and growing export-oriented businesses.

The point of this report is not to 'prove' or 'celebrate' that Chengdu is a 'world city in the making', a branding to help marketing the city. Rather, it scientifically elaborates on the cursory evidence that the city is increasingly well provided with network externalities as commercial assets within contemporary globalization: its increasing global connectivity enables innovation, foreign inward investment and provides seamless support for export. The general policy recommendation is therefore the need for the addition of a commercial external perspective to how city policy is conceived, which should also include the management of connectivities with other cities as this allows capitalization on, and further expansion of the city's stature in the global economy. The way to respond to this is through (inter-)governmental interventions, ensuring the necessary soft and hard connectivity infrastructure requirements for vibrant inter-city relations, as well as a targeted policy vision

and regulatory strategy to make Chengdu attractive for and operationally connected and open to key urban markets worldwide.

I. Introduction

The last decades witnessed the rise of an intensely interconnected world in which cities are seen to play an important role. In research and policy circles, this often elicits two related, but inconclusive responses. One is to designate a new type of city – ‘world city’ – that has particularly new internal processes that enable globalization. The second is to up-scale existing ideas of ‘national urban hierarchies’ to a new ‘world city hierarchy’. Both approaches tend to have similar outcomes with the identification of cities such as London, New York and Tokyo as the leading cities within globalization, key locales where globalization is being transnationally organized and reproduced. However, such observations often lack the necessary empirical grounding to make them credible.

The key issue is that most research on and policy understandings of world cities are based upon attribute data (i.e. describing world cities as places) to the neglect of using relational data (i.e. showing links between cities). Although an overview of ‘internal’ strengths and areas for improvement certainly helps in elucidating a city’s position in the world, it does not inform how it compares and relates to other cities in terms of how globalization is being transnationally organized and reproduced. The latter requires a very different approach to understanding cities: a relational approach that allows understanding of how leading cities are inter-connected within contemporary globalization.

It is this need to produce an understanding of inter-city relations at the global scale that stimulated the creation of the Globalization and World Cities (GaWC) research network. The starting point in our research is a precise specification of

a 'world city network'. Using the central importance of advanced producer service firms in the creation of global urban economies as put forward in the work of Saskia Sassen, we identify the work carried out in their office networks across cities as the constituents of this world city network. Advanced producer service firms provide the financial, professional and creative means to facilitate agents in urban economies in their global pursuits. These activities range from resourcing capital, to navigating multiple jurisdictions, to developing generic marketing strategies. These are largely accomplished through face-to-face meetings requiring work to be carried out in offices across all cities where their clients have important interests. The skyscraper cityscapes that epitomize the world city as a place are in fact the work centres (the "knowledge factories") that make globalization possible through myriad inter-city communications.

Although producer service firms are but a specific segment of an urban economy, they are – alongside 'hard infrastructures' such as airports – a critical element of the 'soft infrastructures' that allow other agents, firms, and institutions in the urban economy to connect to the global economy. As this cluster of service firms is enabling other businesses to connect across the world's major urban economies, it captures the economic health of a city in general and its capacity to link up with other major cities in particular. Thus, world city network formation can be proxy-ed through systematic investigation into the work carried out in the office networks of advanced producer service firms across leading cities.

Based on mixed-methods research that combines extensive quantitative analysis and intensive qualitative analysis, **GaWC is able to offer a scientifically grounded examination of the inter-city flows of financial, professional and creative knowledges that comprise a city's position in the world city network. In this report, we marshal this approach to explore how Chengdu is positioned within these global inter-city flows and thus hope to provide**

invaluable insight into how key business and policy stakeholders operate in, through and from Chengdu.

In quantitative terms, this entails the use of detailed and tailored information on the location strategies of 175 firms across 707 cities in 2016, leading to a data matrix with 123,725 pieces of information arraying advanced producer service firms (the agents) against cities (where the agents do their work). From this matrix, we generate estimates of knowledge flows (advice, direction, plans, strategies, etc.) between each of these 707 cities using a state-of-the-art network projection model (see Appendix A for model specification and data gathering details, and Appendix B for an overview of cities and firms). These data provide the basic research frame to produce analyses of, and comparisons between cities in terms of their overall level of global network connectivity, the key geographical patterns within that connectivity, and the degree of connectivity change in the period 2000-16 and 2010-16 (see Appendix C for a detailed elaboration of measures). By going beyond the degree of a city's integration into the world city network to consider *how* it is integrated, we delineate specific business assets: the global externalities of Chengdu's city economy put into different contexts, and how all this has changed over the past years.

In qualitative terms, we enrich the quantitative analysis in two respects. We shed light on how global producer service firms are connecting Chengdu to other cities in China and worldwide through everyday activities in their cross-border networks. We also shed light on how these activities are supporting companies in other sectors who wish to inward invest in Chengdu or to internationalize beyond Chengdu and extend their export markets. Qualitative interviews and meetings therefore allow us to identify key real world economic and business drivers of Chengdu's globalization process, firms' requirements to be successful

in investing in and growing in Chengdu, and how the city's environment for business might be enhanced going forward.

Four in-depth interviews, each of up to 1.5 hours duration, with producer service firms in the 2016 quantitative data set for Chengdu and five site visit meetings with firms engaged in advanced knowledge-based business in Chengdu, were conducted. The interviews were designed to provide insights into the processes generating the connectivity and intercity links of Chengdu revealed by quantitative analysis. The resulting 'portraits' of Chengdu provided by the firms are shown in Appendix D-1. A questionnaire which was sent to firms in advance of the interviews to prompt relevant discussion, and which complies with United Kingdom academic research ethics regulations, is included in Appendix D-2. The informal meetings with other firms were contextual in nature, to gather insights into relations between the wider Chengdu economy and the producer services that form the world city network within which Chengdu is globalizing (brief details of the firms visited are provided in Appendix D-3).

The remainder of this report is organized in four main sections. In the first section, we present a brief overview on how to interpret the results of our customized quantitative world city network analyses, followed by an overall summary indication of Chengdu's position in the world city network. The second section frames this position in a comparative perspective. As our research starts from the premise that every city is unique, we need to gain intelligence from comparisons that are not limited to one or two supposed 'similar' or 'leading' cities. Thus our strategy is to have multiple comparisons across measures from different perspectives: (i) 'global-neighbouring cities' (Hong Kong, Shanghai, Beijing and Singapore), (ii) other major Chinese cities. The third section qualifies these findings by arguing, based on the interviews and site meetings, how

Chengdu is increasingly at the centre of a GFMCR, a position enabled by myriad connections with other well-connected world cities in terms of knowledge, expertise, etc. The report is concluded in the final section with an overview of our major findings and their policy implications, as well as proposals for follow-up research to offer a better and more nuanced understanding of Chengdu's position in the global economy in the context of a heavily urbanizing and globalizing GFMCR.

II. Chengdu in the world city network

II.1 Interpretation of GaWC's customized quantitative world city network analysis

Our analysis of the strength, geographies, and changes in relations between cities involves presentation of many tables and figures. To make this report as readable as possible the technical details were relegated to Appendices A-B-C, while here we restrict ourselves to a brief guide to help interpretation of the results; this will ease both seeing broad patterns and trends and appreciating relevant, important details.

Our results cover three complementary aspects of a city's connectivity profile:

1. First, a city's **global network connectivity** measures the degree of its overall integration into the world city network. These measures are shown as a percentage of the most-connected world city (London) to aid interpretation.
2. Second, this global network connectivity can be dissected in different ways. The simplest approach is to distinguish between connectivities to cities in the

same world-region (in Chengdu's case Pacific Asia), which we term **localism**, and connectivities to leading world cities New York and London (NY-LON), which we call **globalism**. The difference between globalism and localism determines what we call a city's **global orientation**. Another way to explore the geographical orientation of a city's relations is to compare their **strength across world regions**. Nine regional groups of cities are defined; in addition to Pacific Asia (cities from Japan to Thailand), these are Eurasia (cities in former Soviet Union states minus Baltic states and plus Mongolia), Europe, Latin America, the Middle East and North Africa, Australasia, Northern America (cities in USA and Canada), Pacific Asia, South Asia (cities from Burma to Pakistan) and Sub-Saharan Africa. The results are standardized so that 'over-connected' relations are positive, average connections are zero, and 'under-connected' relations are negative. Negative values therefore do not signify the absence of connections, but rather these connections being relatively small compared to what might be expected.

3. Third, there is the matter of change, the trajectory of a city's global network connectivity in the world city network. We measure this for the period 2010-16. **Absolute connectivity change** captures the level of change in a city's global network connectivity, with positive values indicating rising levels of global network connectivity and negative values declining levels of global network connectivity. **Relative connectivity change** puts this level of change in the context of overall change. It can be interpreted as a z-score, so that cities scoring ≥ 2 have witnessed exceptional connectivity growth, while cities with a value close to 0 have seen a connectivity change in line with the change in the world city network at large.

II.2 The global position of Chengdu

The initial point to make is that **Chengdu is doing relatively well in the world of contemporary globalization**. It is ranked 100th in terms of global network connectivity, which is on par with cities such as Denver in the United States and Stuttgart in Germany. This is shown in Table 1 where the five cities just above and just below Chengdu are ranked by global network connectivity. **Although not quite in the unique position of cities such as Hong Kong, Shanghai, and Beijing, Chengdu appears to have globally developed beyond its national confines: it is a world city in the making**. Chengdu's connectivity being in line with relatively small cities such as Denver and Stuttgart on the one hand and Kuwait City and Santo Domingo on the other hand can be explained, respectively, by the still relatively larger GDP/capita of countries such as the USA and Germany on the one hand and a 'capital effect' on the other hand where capitals of smaller countries such as Kuwait and Dominican Republic over-perform because these are must-be places for servicing the national market. Although this puts a city such as Chengdu in a disadvantaged position, we believe it should be possible for the city to further boost its connections in light in of its booming Chinese economy and its ongoing expansion in general.

Table 1 Cities ranked close to Chengdu by global network connectivity

Rank	City	GNC%
...
95	Chennai	29.15
96	Stuttgart	29.12
97	Santo Domingo	28.99
98	Rio De Janeiro	28.75
99	Kuwait City	28.60
100	Chengdu	28.25
101	Panama City	28.12

102	Denver	27.99
103	Lahore	27.88
104	Jeddah	27.86
105	Tunis	27.76
...

Table 2 Chengdu's global orientation connectivity range

GNC%	Globalism: link to NYLON	Localism: link to REGION	Global orientation NYLON- REGION
28.25	-0.19	10.40	-10.59

Chengdu's global network connectivity in Table 1 is an overall summary indication of its position in the world city network. Geographically disaggregating this global network connectivity shows that it is above all 'over-linked' to Pacific Asia and 'under-linked' to Europe and North American cities (Figure 2). This suggests that Chengdu is indeed well connected beyond China, but these connections are nonetheless geographically circumscribed to the broader Pacific-Asian region. This is also shown in Table 2 with very strong Localism (connections to Pacific Asia) and less-than-expected Globalism (connections with New York and London), leading to an 'inward-looking connectivity' profile centered on its own world region.

Given that both North America and Europe remain hotspots of economic development in general and urban connectivity in particular, this points to a key element in the geographical nature of its unfulfilled potential in the world city network. Connections to other world regions are roughly in line with expectations, which – coupled with the observation that these regions are relatively less important in global economic terms – do not call for strategic

intervention. Indeed, it is very clear that Chengdu's world-regional orientation does not prioritize the core of the global economy (Northern America, Europe) but on the other hand benefits from the fastest growing region in economic terms (Pacific Asia). Nevertheless, it is clear that the **geographical nature of Chengdu's inter-city relations has potential to be further developed to support world city status, but requires strategic intervention with regards to North America and Europe in general and key world cities in particular.**

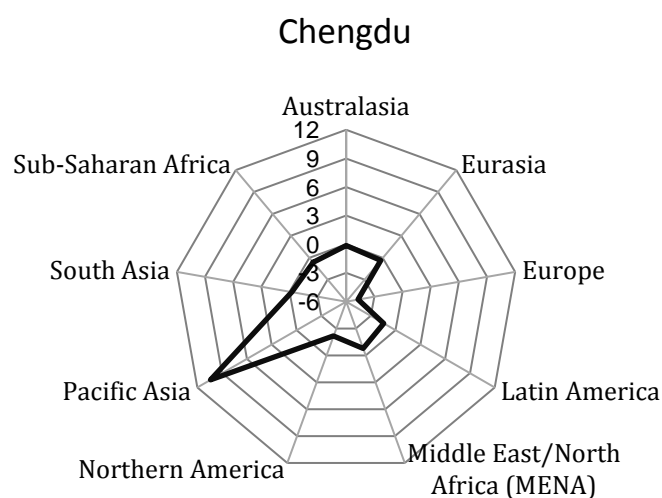


Figure 1 World-regional dimension of Chengdu's inter-city relations

Finally, there is the matter of change, the trajectory of Chengdu's global network connectivity. Table 3 shows that Chengdu's connectivity has appreciable increased over the past six years. It has witnessed exceptional connectivity growth (in statistical terms) and is indeed the city that tops that global ranking.

Table 3 Chengdu's global trajectory connectivity change

Change 2010-16	
Absolute	Relative
12.90	2.52

III. Comparative analyses

The second and more substantive set of the world city network analyses compares Chengdu to other cities; to ease comparison, the Chengdu results will be repeated in tables featuring the other cities.

III.1 Comparing Chengdu to global-neighbouring cities

We begin by comparing Chengdu to ‘global-neighbouring cities’ Hong Kong, Shanghai, Beijing and Singapore. The concept ‘global-neighbouring cities’ refers to those cities in the same world-region (Pacific Asia) that have reached the upper echelons of the world city network. Table 4 shows Chengdu clearly being quite far removed from these leading cities in these global times: Singapore and Hong Kong now being the 3rd and 4th most connected cities in the global economy (more connected than Tokyo) shows the immense rise of the Pacific Asian economy in general and the prowess of quasi-city-states in which economic and governance frameworks coincide in particular. Alongside Hong Kong, Shanghai and Beijing are the undisputed leading Mainland Chinese cities in terms of global network connectivity (both now firmly in the top 10). However, of major importance here is that the difference between Chengdu and these ‘global-neighbouring cities’ is not just confined to the overall levels of connectivity, but also the nature of that connectivity: these ‘global-neighbouring cities’ are also well-connected within their own region (they have large positive values for Localism) but combine this with relatively strong connections to New York and London. Their global orientation is thus much less inward-looking (perhaps with the exception of Beijing), which again suggests that Chengdu is not only less connected but also lacks connections beyond its own region in general and with key urban markets in particular.

Table 4 Connectivity results: Global-neighbouring cities

'Global Chengdu'	Page 14 of
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City	Rank	GNC%	Globalism: links to NYLON	Localism: links to REGION	Global Orientation: NYLON -REGION
Chengdu	100	28.25	-0.19	10.40	-10.59
Hong Kong	4	74.89	0.49	2.49	-2.00
Shanghai	9	66.96	0.43	4.46	-0.42
Beijing	6	69.18	0.35	5.85	-5.51
Singapore	3	75.40	0.43	1.02	-0.59

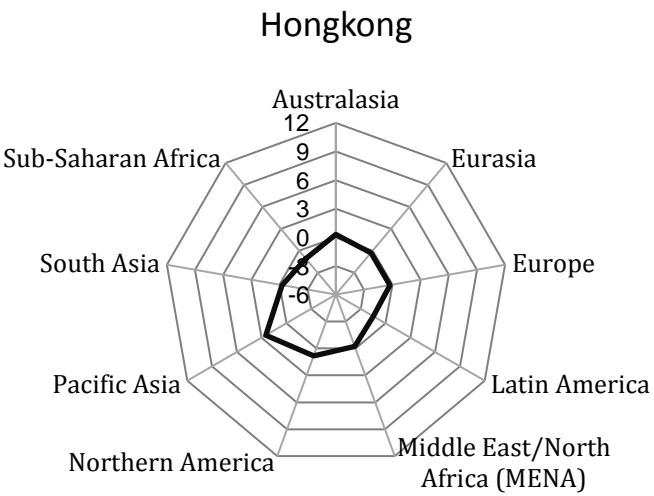
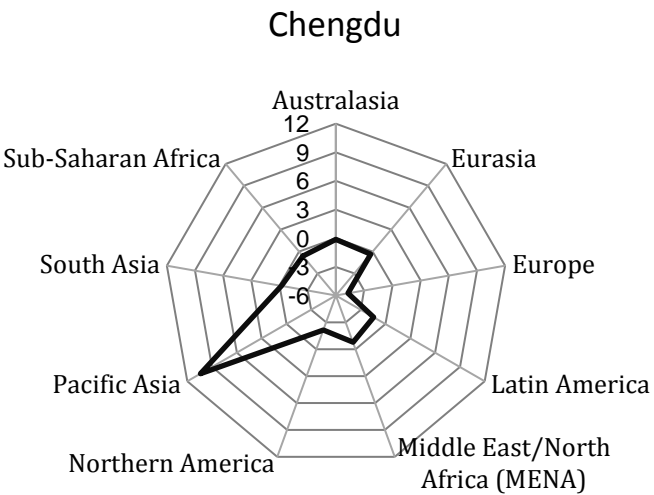
Table 5 shows changes in connectivity and the most notable feature is that, over the period of analysis, Chengdu has clearly caught up with these ‘global neighbouring cities’: although the difference in connectivity remains sizable, Chengdu has become much more and much more rapidly integrated, with only Beijing rivalling its growth momentum. The three Mainland Chinese cities in the table clearly have been catching up with Hong Kong.

Table 5 Connectivity change results: Global-neighbouring cities

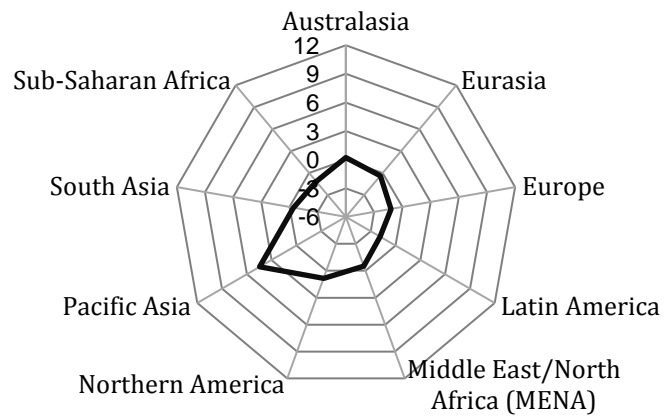
City	Change 2010-16	
	Absolute	Relative
Chengdu	12.90	2.52
Hong Kong	-0.03	-0.25
Shanghai	2.06	0.19
Beijing	8.01	1.52
Singapore	6.44	1.19

In Figure 2 the world-regional analyses of these cities are very revealing with Beijing and Shanghai broadly sharing Chengdu’s profile albeit with slightly stronger connections to North America. Singapore and Hong Kong are not only stronger and more strategically connected with other key world cities, they also have a more balanced connectivity profile. **Overall the key finding is that Chengdu is not only less connected than its ‘global-neighbouring cities’, but also less well connected with Europe, North America and key world cities. However, its connectivity growth has been much more marked than that of**

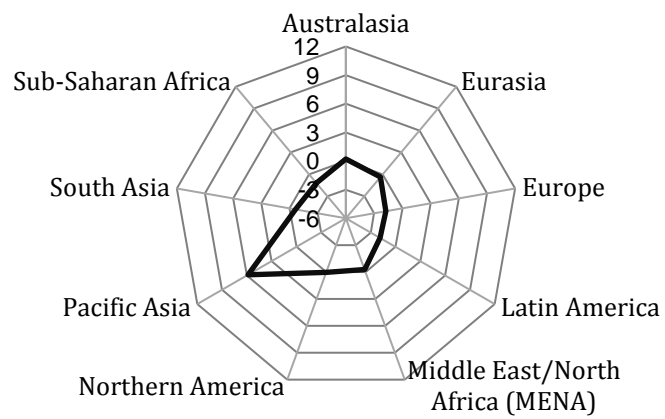
Beijing and Shanghai so that in the years to come the focus can be placed on the nature of its connectivity.



Shanghai



Beijing



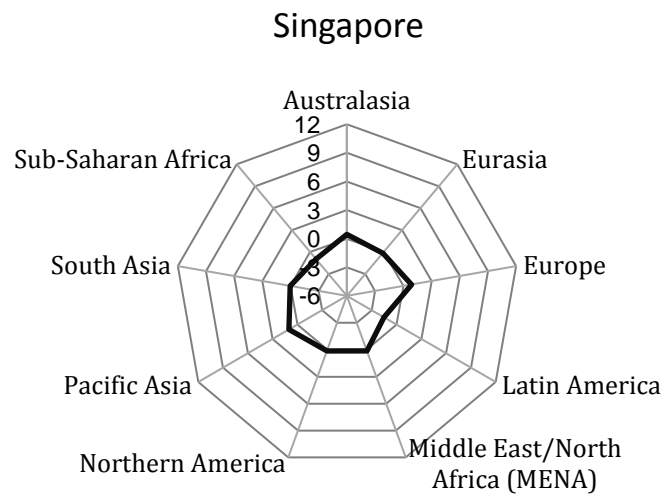


Figure 2 World-regional dimension of inter-city relations

III.2 Comparing Chengdu to other major Chinese cities

Second, we compare Chengdu's connectivity profile with that of other major Chinese cities with a connectivity of >10%. Comparing Chengdu with these other Chinese cities is instructive as a means for providing a global perspective because these are comparable through the putatively similar experiences in China's globalizing space-economy. The superficial parallels between the urban experience of major Chinese cities warrants an assessment of how Chengdu compares to these cities as they have become integrated into the world city network.

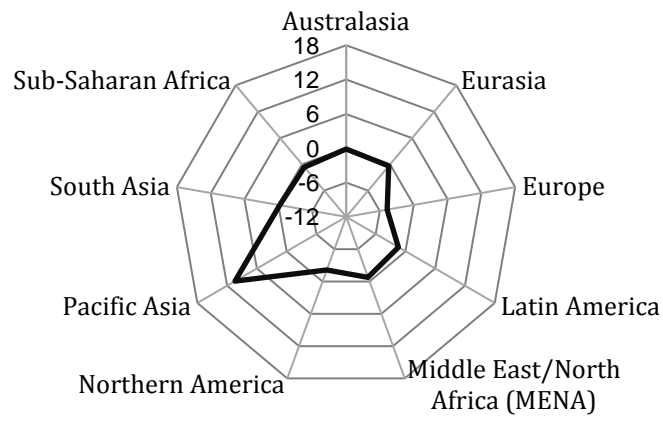
The connectivity results for Chinese cities are shown in Table 6. The first thing to note that is that the key Pearl River Delta cities stand out and do not seem to suffer too much from a shadow effect from their 'global-neighbouring city' Hong Kong: Guangzhou and Shenzhen are clearly more connected than Chengdu and the other major Chinese cities, with the most connected cities being Chengdu,

Tianjin, Nanjing, Hangzhou and Qingdao. In addition, both Guangzhou and Shenzhen have slightly stronger connections with New York and London, making for a more strategically connected profile. That said, Chengdu does rank relatively favourably compared with most of the other major Chinese cities in this context. Each of these cities shares a very similar connectivity profile, with underdeveloped connections with New York and London and strong connections with Pacific Asian cities. This suggests that Chengdu's connectivity profile parallels that of other Chinese cities of roughly the same stature. This is replicated in the radar diagrams, which all look broadly similar.

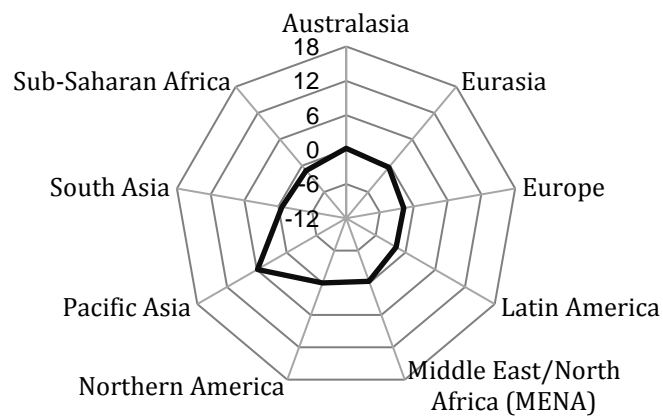
Table 6 Connectivity results: Major Chinese cities

City	Rank	GNC%	Globalism: links to NYLON	Localism: links to REGION	Global Orientation: NYLON -REGION
Chengdu	100	28.25	-0.21	10.40	-10.59
Guangzhou	40	43.27	0.01	6.55	-6.54
Shenzhen	85	32.18	-0.10	11.69	-11.79
Tianjin	113	27.02	-0.16	12.40	-12.57
Nanjing	139	22.87	-0.21	10.99	-11.20
Hangzhou	140	22.81	-0.29	14.42	-14.71
Qingdao	143	22.57	-0.24	14.68	-14.92
Dalian	160	21.19	-0.22	15.66	-15.88
Chongqing	163	20.95	-0.22	16.21	-16.43
Xiamen	171	20.14	-0.19	14.92	-15.11
Wuhan	190	18.84	-0.23	17.80	-18.03
Suzhou	198	18.25	-0.16	17.18	-17.34
Changsha	201	18.05	-0.23	17.27	-17.50
Xi'An	209	17.50	-0.31	16.92	-17.23
Shenyang	213	17.32	-0.21	17.80	-18.00
Jinan	221	16.79	-0.27	18.11	-18.38

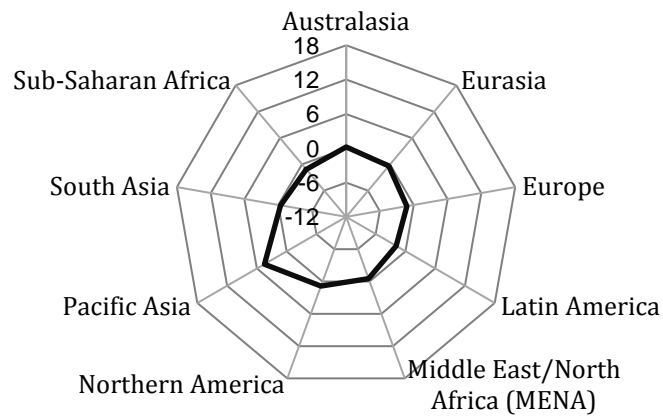
Chengdu



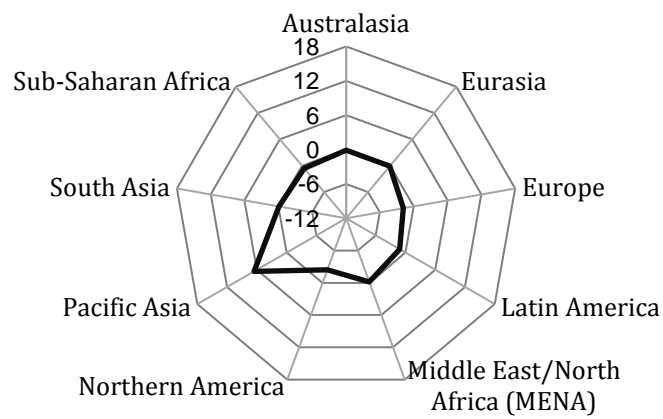
Beijing



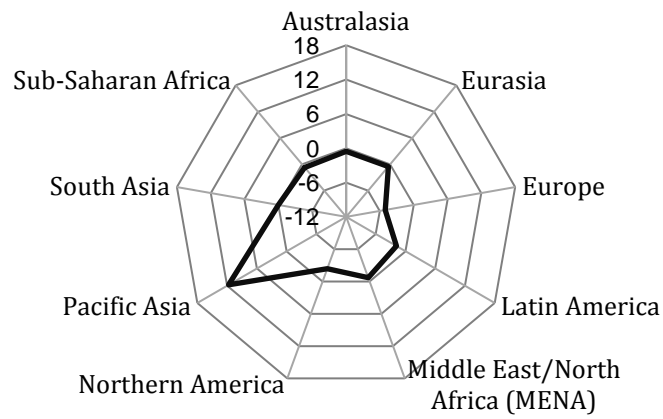
Shanghai



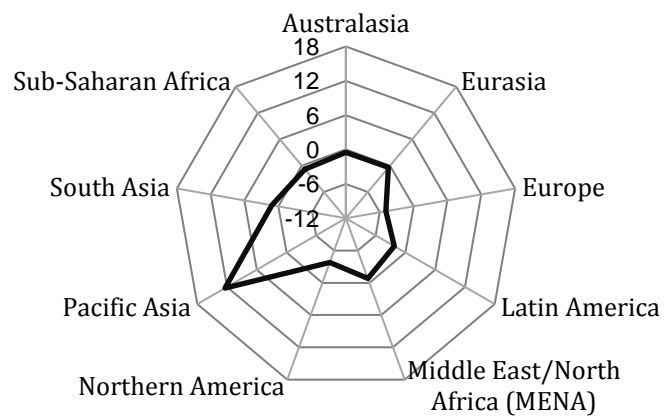
Guangzhou



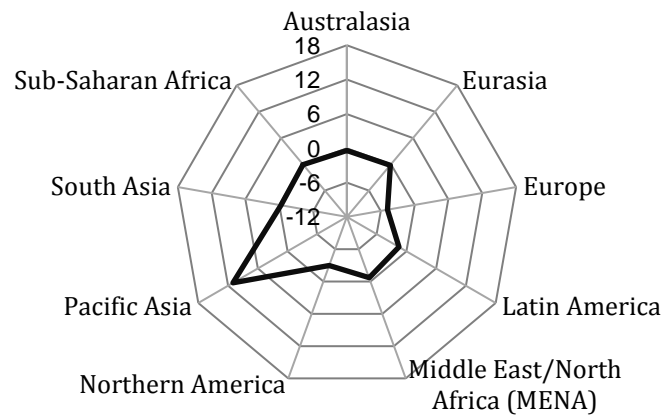
Shenzhen



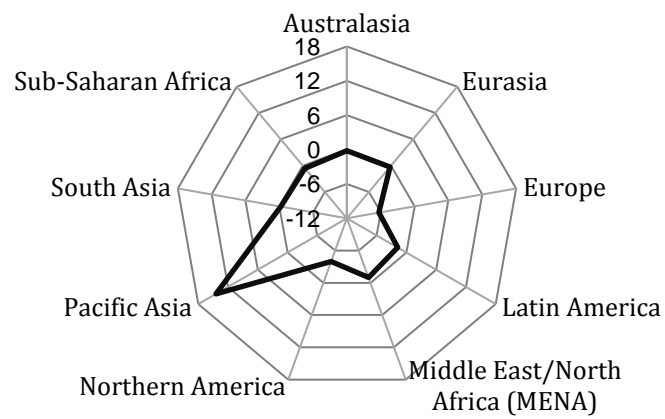
Tianjin



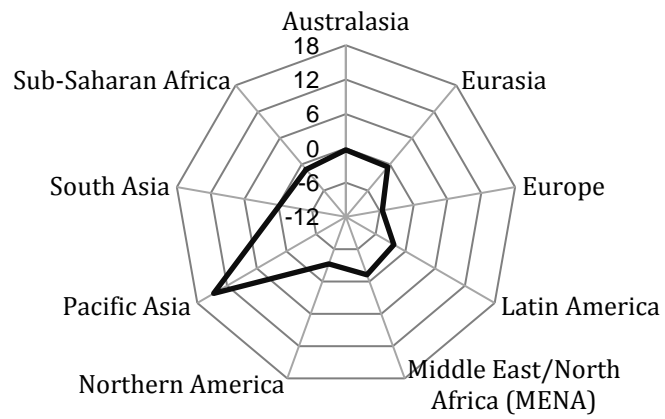
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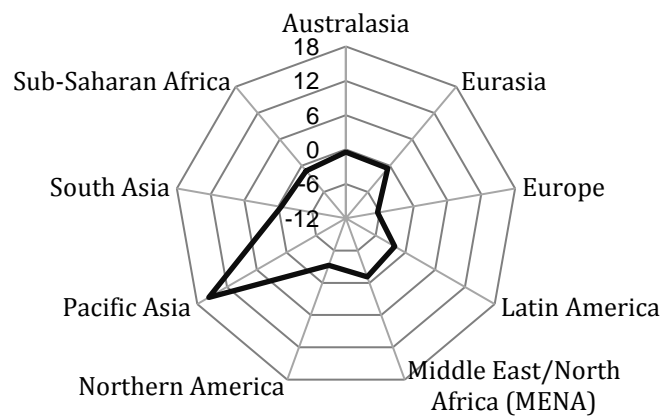
Hangzhou



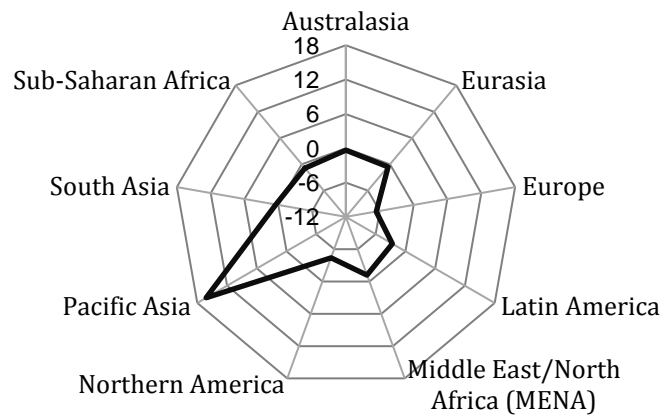
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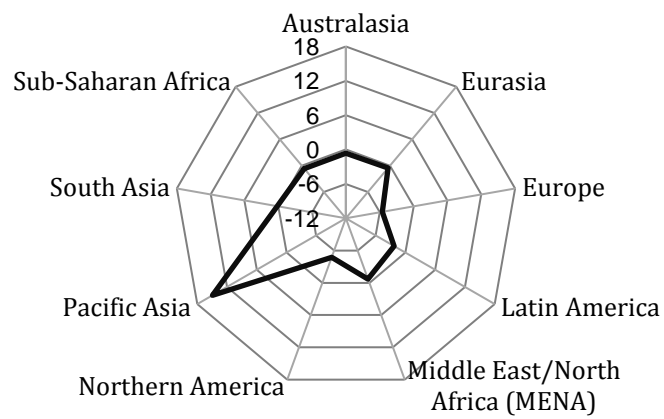
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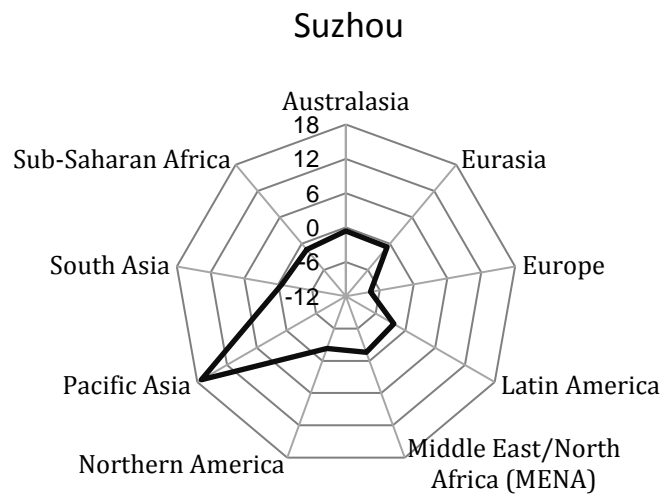
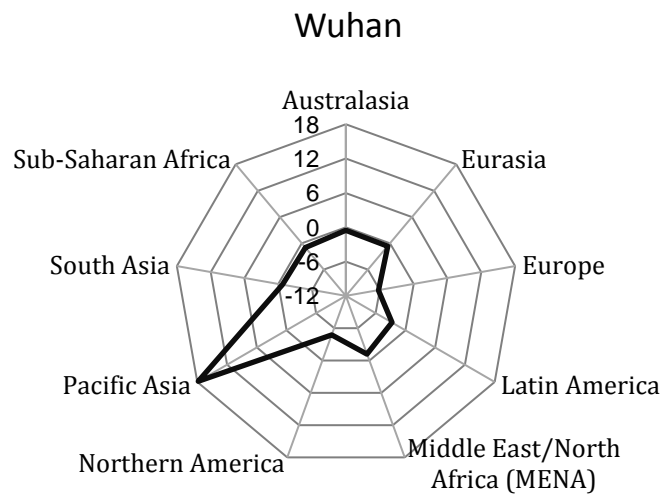


Chongqing

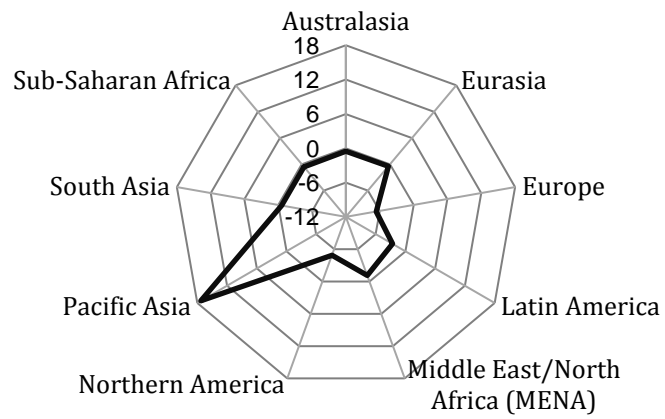


Xiamen

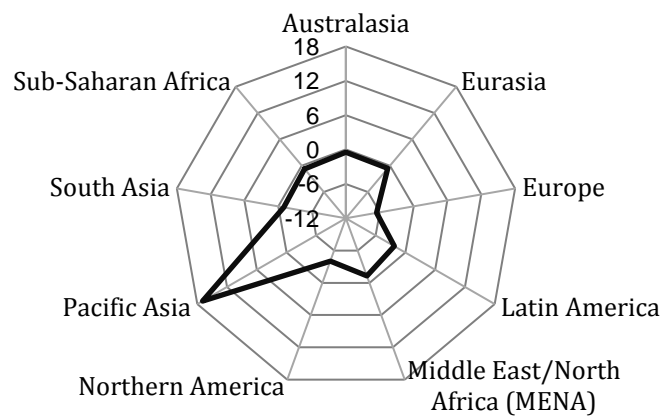




Changsha



Xi'An



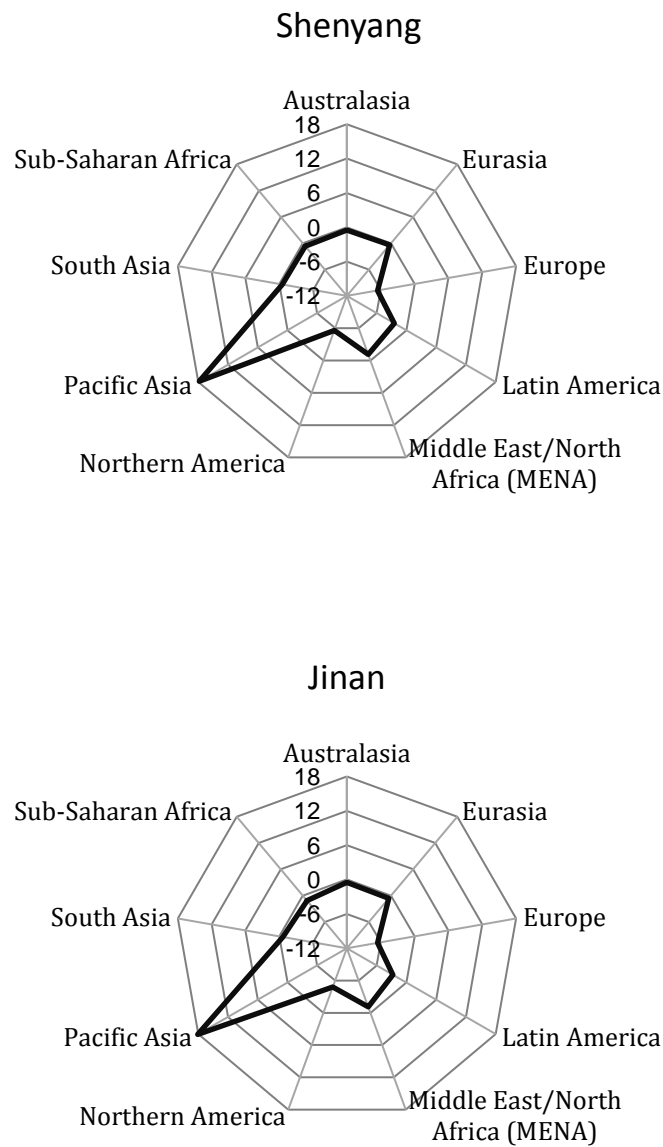


Figure 3 World-regional dimension of inter-city relations

Perhaps unsurprisingly, an analysis of change measures shows an upward trend for all of the Chinese cities in the analysis. However, as already suggested above this is really where Chengdu stands out as no other city has gained as much connectivity in the period 2010-6 – its slightly higher ranking in 2016 than that of other Chinese cities is indeed a reflection of that growth momentum as it did not have that stature in 2010. The growth momentum of major cities in the Pearl

River Delta has slightly stalled, but Guangzhou and Shenzhen remain hotspots of connectivity and the gap between these cities and Chengdu (and other Chinese cities) remains sizable.

Table 7 Connectivity change results: Major Chinese cities

City	Change 2010-16	
	Absolute	Relative
Chengdu	12.90	2.52
Beijing	8.01	1.52
Shanghai	2.06	0.19
Guangzhou	6.81	1.20
Shenzhen	4.08	0.56
Tianjin	7.77	1.38
Nanjing	7.52	1.31
Hangzhou	8.26	1.48
Qingdao	7.94	1.40
Dalian	7.21	1.24
Chongqing	9.88	1.83
Xiamen	10.58	1.99
Wuhan	8.64	1.55
Suzhou	7.78	1.36
Changsha	11.06	2.09
Xi'An	6.52	1.08
Shenyang	8.18	1.45
Jinan	9.80	1.81

The conclusion is straightforward. **In comparison with Chinese cities, Chengdu is less connected than leading Pearl River Delta cities such as Guangzhou and Shenzhen, but slightly more connected than other Chinese cities. Most of the Chinese cities share a similar connectivity profile with strong Pacific Asian links, and with room for becoming more connected to European and North American cities in general and the leading cities in these regions in particular. All of these cities show an upward trajectory, with Chengdu doing better than most other Chinese cities since 2010.**

IV. Qualitative analysis

The results from the qualitative research help to explain the results from the quantitative analysis and importantly they provide insights into the processes underpinning the changing position of Chengdu in the world city network. Five observations can be made.

A first observation is that Chengdu's advanced producer service network connectivity matters. The quantitative analysis found that since 2010, although most Chinese cities analyzed show an upward connectivity trajectory, Chengdu is doing better than most (see III.2). Furthermore, it found that Chengdu's connectivity growth has been much more marked than that of China's leading global cities, Beijing and Shanghai (see III.1).

The qualitative results illustrate how the surge of development of Chengdu's knowledge-based advanced industrial base since 2010, has been attracting in service sector firms with global networks, supplying to producers, financial and linked services and increasing the city's connectivity as a global service centre. This process was described by a bank as the development of an ecosystem which is characterized by synergies, for example, "in the high-tech/technology sector where there are big data centres, more students and employees are crowding into the ecosystem". We were told that, if banks are first encouraged to come, "the rest will follow and the entire eco-system will develop and flourish, all flooding into the city." Government understanding of industry clustering drivers is therefore important "for the promotion of investment and for the whole

ecosystem to flourish, with banking, legal and consultancy firms, and everyone covering a place.”

Therefore an important take-away from the qualitative interviews is that the growth of Chengdu as a global city requires government understanding of the local economy as a complex ecosystem in a highly interconnected world city network.

A second observation is that Chengdu’s strong Pacific Asian links (see III.2), reflect that, as for most Chinese cities, Chengdu’s growth is fed by the good global connectivity of its ‘global-neighbouring cities’. In relation to real estate inward investment which is critically important in creating the infrastructure for business:

“... when looking at international flows, Singapore is almost always the first to get into the market. In Chengdu, the first large-scale international investment in real estate is Capital Land. Singapore goes in first and once established, Tokyo and United States investors may follow.”

A bank explained that:

“All of the bank’s products are designed and managed centrally at group level, which could be Hong Kong or Singapore, where the financial markets are advanced and open, legally and financially. The network provides the platform for internationalization because the bank is able to use those parts of its network to provide innovative products that help domestic company clients to expand overseas.”

Within China, the bank's Chinese mainland–Hong Kong network is seen as “very advantageous”:

“A lot of Hong Kong revenues originate from China because when many corporates decide to expand abroad, the first destination in the region will always be Hong Kong. More than 50% of the entire central group revenue entry is in North Greater China (China, Hong Kong, Taiwan, Korea and Japan). So the collaboration between China and Hong Kong has been very good in that respect.”

Network links with ‘global-neighbouring cities’ within China and Pacific Asia generated by producer service firms illustrate that proximity still plays a part in the promotion of Chengdu’s economic growth. A further example is access to skilled people, for example, in legal services we learned that although “most of the graduates the office recruits in Chengdu are from top local universities... many graduates have studied overseas and then come to Chengdu for work and increasingly graduates are coming to Chengdu from famous universities in Beijing or Shanghai, even if they were not locals originally.”

Similarly, in consultancy, a firm described how for junior staff, it has many talented graduates from top local universities in Chengdu. However, “some junior staff are sent to cities such as Shanghai for training in their first year and senior management come from offices in Shanghai or Hong Kong.” Even for senior staff, access to expertise in ‘global-neighbouring cities’ matters: “For each team, there are several partners and a partner in Shanghai usually travels to Chengdu several times a year to communicate with clients and instruct the local team.”

Furthermore, expertise in 'global-neighbouring cities' is imbued with knowledge gained in leading world cities. However, geographic proximity benefits work conducted in Chengdu despite the use of communications by Internet and phone.

In consultancy:

"The tax partner based in Chengdu worked for several years in other big cities such as Beijing, Shanghai, London and New York to gain knowledge of international tax principles and other specific areas. The technology team partner has a base in Hong Kong and may travel to Chengdu two or three times a year, also communicating often through the Internet or by phone."

Chengdu's strong links to its 'global-neighbouring cities' should therefore not be interpreted, negatively, as 'over-localization' because these close relations are critically important for the city's growth and for the healthy functioning of the Chinese city network.

A third observation is that although the benefits of strong local links are clear, development of Chengdu's links with North America and Europe and other key world cities matters (see II.2. III.1, III.2). All four producer service firms interviewed stressed at length how critical their global networks are for doing business in Chengdu in support of local economic growth. This is such an important observation that an array of evidence from the interview results is presented here. In banking we were told that having a presence:

"... in four world regions: Africa, the Middle East, Asia and America. [The bank's] international office network and organization allow the bank to trade cross-border in consistency with China's 'belt and road' vision, with about 70% of its network of countries strongly matched, (Russia/Eastern Europe where the bank does not have a network, being the exception)."

“There is a programme to ensure the availability of all products anywhere and a match with local needs. In whichever markets in whichever countries, local product managers feed back to the centre on any necessary deviations required to localize and use products locally, and all solutions are documented and tracked centrally.”

“When a customer wants to expand to another country, the bank can support that by combining network centrality and locality, communication and feedback to ensure that superior products are suited to the market. For mergers and acquisitions in overseas markets, the bank often knows the tax, legal and political sensitivities in both local markets because it has experience in many markets.”

In legal services networks, cross-border links between firms through alliances, help to overcome the barrier of different jurisdictions:

“Dacheng doesn’t have offices in Pakistan but it has a network, a legal alliance which allows it conduct local work in jurisdictions where it is not allowed to have an office. Where language would be an obstacle to conduct legal consulting, the firm works with the local office to help clients there. So Dacheng benefits hugely from Dentons global network. Last year, more than 1,000 partners met in the office in Toronto for the firm’s annual meeting which is held in different office each year so that partners from different offices intermix. Last year the meeting was so large that it was held in an exhibition centre.”

Global networks benefit producers expanding overseas:

“Companies with global business requirements like to approach legal firms like Dacheng because they know it has a global network and that will help them a lot. So they ask the firm to put together a team of lawyers globally, for example, a team with five lawyers in Chengdu and five lawyers in London which takes instructions from the client locally in Chengdu and overseas. A benefit for the client is that it doesn’t need to communicate with different lawyers from different jurisdictions.”

Mobility of senior people between cities in the network reinforces and strengthens the network and services provided:

“Dacheng is putting continuous effort into interacting with other offices through the network, giving the firm in Chengdu a better understanding of practices elsewhere and how teams work on different transactions. Movement of senior leaders allows better understanding and cooperation in the network.”

In consultancy services, “with the Government, the firm considers how its professional expertise can speed up innovation, or help start-ups to grow quickly, for example, by introducing them to big companies through its network.”

“The global network is advantageous in Chengdu. For example, last year, a client who wanted to invest in Spain and buy a company needed to know about Spanish tax policies. The local office connected them with PWC in Spain through the network and the Spanish team gave the local team details of Spanish local tax policies and the sub-cities the client could apply for.”

In real estate services:

“The firm has a management system across the whole Greater China business and globally, linking Chengdu clients worldwide. Part of the role of the team is to link businesses in Greater China and Taipei with the rest of the firm’s consulting businesses. Chengdu is growing quickly and is very keen to draw on global experience and learn how lessons can be applied to Chengdu. So for example, the firm works with the New York, London and Hong Kong offices to provide background on how the industry is changing and on how technology is improving in London to contextualize that for its local clients in Chengdu.”

“Outbound international investment benefits from the firm putting together a team. For example, for a Chengdu company doing a lot of tourist projects in Katmandu, the firm has a team of two or three people from Chengdu, who understand how the client’s business model works in China and put them in touch with three people from the New Delhi office covering Katmandu who understand the local market. A project manager from Hong Kong who has dealt with the cross culture panel is put in to facilitate the communication. So several people from three different localities bring to bear a particular set of expertise. The firm looks at the stream of business and developments using its global expertise all across the world.”

Through their networks, global producer service suppliers have access to global expertise and to products that can be localized to meet the needs in Chengdu of MNCs and companies starting up new operations overseas. Without the presence of global service networks in Chengdu, the wider city region would lack access to inward foreign investment and distant markets.

A fourth observation is that placing focus on the *nature* of Chengdu's connectivity in the years to come matters (see III.1). Chengdu is undergoing a process of globalization associated with the growth of its advanced industries and supported by advanced global producer service networks. The qualitative evidence from interviews indicates that the nature of Chengdu's connectivity in these networks is that it represents synergistic inward and outward investment flows. Connectivity in global producer service networks supports *inward* investment into Chengdu and *outward* business activities of export-oriented local producers. In real estate services we were told that "the firm, which has been in China for 20 years, has an important role in bringing people, concepts and ideas to Chengdu and supporting companies going out of Chengdu."

For this same firm:

"The Chinese financial sector is very important in the firm's office groups. So for example, a Chengdu counterpart in Shanghai talks to someone in Belgium and someone in America, so you have a global specialization in areas that particularly interest the client in Chengdu. MNCs have upgraded their office to a western hub and local companies are expanding in different major cities in China and occupying more space in Chengdu to serve local people."

"Education is one of the firm's biggest areas. It puts UK schools together with Chinese developers to help them to establish campuses internationally, drawing on its education team working with Malaysia, UAE and China offices to bring UK schools together with Chinese partners. For example, it works with an investment group based in Chengdu to bring an international school to Chengdu. The UK team understands the priority of the school and the Chengdu office works with Chinese business and then together they work through the financial

and education and asset management sides of the business with a law firm to work out the details of the contract. Health care is another big area.”

From a banking perspective:

“The Chengdu Government is doing a lot to promote foreign inward investment. For example, the Beijing and Hong Kong governments are coming to Chengdu for foreign investment. There is a lot of growth with 200 of World Fortune 500 companies in Chengdu, Bell, Intel, and many other high-end manufactures, and that helps the bank to position itself locally and globally on account of its network overseas. The bank is able to help to set up trade that could be in Hong Kong, Singapore, or elsewhere, and that assists in cash management for a local entity that is trying to grow abroad, providing an international perspective, including for SMEs.

At the same time, global producer services are also working with Chengdu government bodies to collaborate on ways to accelerate this dual inward-outward economic expansion dynamic and to govern growth more effectively. In consultancy services we heard that:

“The firm is helping many enterprises and negotiating with the Government on their behalf if they have disputes concerning regulatory environment and tax. At the same time, the Government is a client of the firm for organizational planning, industrial analysis and planning for the city from the district level. And the Government supports firms like PWC, for example, in accessing potential clients. The firm uses its expertise, such as industrial understanding of companies which may invest in Chengdu, to help the Government better plan the industry chain for the city. The firm may also contribute to policy making to improve targeting and leveraging its relationships with clients serviced directly and nearer to the

market, and understanding of their needs, requests and what will be most helpful.”

“With the Government, the firm considers how its professional expertise can speed up innovation, or help start-ups to grow quickly, for example, by introducing them to big companies through its network. In Chengdu, the firm cooperates with the Government bodies, such as the new economy department focusing on unicorn companies and other innovation areas such as big data and health care, and providing professional services such as auditing, and guiding them to train companies and grow up quickly.”

In consequence, for a global real estate network servicing property occupiers and investors, “Chengdu is very much a global market. Suddenly, all the firm’s competitors are in Chengdu and are getting into the consulting space.”

Qualitative evidence illustrates that Chengdu’s rising connectivity reflects a synergistic relationship between local advanced industry development and crowding in of talent, inward investors, and global producer services able to support inward and outward business flows.

A fifth observation is that Chengdu’s spatial and regulatory environments for business matter. First, the qualitative research indicates that the nature of Chengdu’s global network connectivity is underpinned by synergistic GFMCR spatial relations.

On the one hand, global connectivity in producer service networks requires physical clustering of global service suppliers in Chengdu. A real estate firm explained that:

“The firm’s Chengdu office is almost in the prime occupancy area. That is driven by the transactional side of business who want to be close to the landlord, close to the talent and doing the deals in the primary office base. In Hong Kong, its professional services sit in a cluster with architects, designers, local government and the financial sector.”

On the other hand, this clustering of producer services networks, unlocks inward and outward economic production channels and increases value-added for advanced knowledge-based industries across the wider GFMCR. From a real estate perspective:

“Tianfu new city is focusing on high-tech and new materials R&D and manufacturing, IT and new economy companies incubation, which will drive further development and enhance people, capital, technologies, and connectivity with other cities.”

Further Government and producer services support for innovative advanced industry start-ups and SMEs, such as in biotechnology, high-end equipment manufacturing and new generation information technology in Chengdu’s Tianfu New Area can be expected to increase Chengdu’s ‘outward-looking’ connectivity profile as internationalizing and export-oriented companies seek the support overseas of clustered service providers with global networks able to localize products, advice and solutions in any country. The fact that no other Chinese city has gained as much connectivity as Chengdu in the period 2010-16 (see III.1),

reflects an association between the growth of producer service networks presence in Chengdu and the development of Tianfu.

Second, the qualitative research indicates that recent central government initiatives should benefit Chengdu however to capitalize on new connectivity opportunities, regulatory barriers must be attended to.

The interviews suggest that the 'Belt and Road' initiative, national high speed rail, the pan-Asia railway to Southeast Asia, and the second Chengdu airport, should be helpful in fostering an outward-looking economic mindset and links to developed and emerging markets. For example in legal services we were told that:

"Since China introduced the Belt and Road initiative, many of the firm's local clients have been incentivized to expand overseas and many projects have emerged in this area in Chengdu during the past two years. For example, because Sichuan is rich in hydropower resources, a client with related management and technology in constructing and managing hydropower projects is now branching out overseas where there is a need for hydropower for example, in Africa."

The 'Greater Bay Area' initiative is likely to be important in strengthening Chengdu's links with 'global-neighbouring cities', for example in banking, collaboration between Chengdu and Hong Kong means that "the bank is excited by the Greater Bay Area Hong Kong, Macaw, Taiwan/Thailand, Shenzhen initiative." However for Chengdu to exploit the future economic growth opportunities that these policy initiatives present, diligent but agile regulatory governance will be needed to support the city's openness to inward and outward

investment flows important for economic vibrancy as noted strongly in the following banking insight:

“Chengdu internationalization has increased in recent years and the bank expects this trend to continue subject to the Government’s approach and persistency, for example, in ensuring that financial regulation promotes this activity. If certain financial regulations are too stringent, it is very difficult for the bank to conduct those transactions and it may have to stop engaging in some activities that support internationalization. It is important for Government to understand that banks are participating and developing innovative products in whole eco-systems. The legal, consultancy etc., firms are all coming into Chengdu now, however, the Government must promote investment oriented policies to attract more of these corporates.”

Smart localization of global producer service know-how in advising innovative start-ups and SME’s wishing to grow, can help to control risk. For example, in bank lending:

“In Chengdu, the bank is doing much better than any other foreign banks in lending to SMEs because it has a very good selling product pool (the Business Instalment Loan). While other banks can copy the products, they can’t copy how the bank measures viability and risk based on its international network experience.”

Relevant for the Chengdu findings, a recent global study led by Professor Pain for the Urban Land Institute which has offices in Washington, D.C., Hong Kong, London and Frankfurt, and the New Climate Economy Coalition for Urban Transitions, found that compact city development, global producer services connectivity, innovation and a green environment, are positively correlated with

returns on real estate investment. On the other hand, the study found that transportation of carbon and other emissions generated by motorized traffic in GFMCRs and an adverse regulatory environment for business, constitute potential investment risks (<https://europe.uli.org/supporting-smart-urban-development-successful-investing-density/>).

Two recommendations follow from the fifth observation. First, Chengdu-Sichuan institutional coordination is needed to encourage clustered city inward investment by producer service providers with a global presence together with synergistic wider GFMCR innovative advanced industry development in a green environment with good air quality. Second, commercially informed inter-governmental collaboration is needed to confront regulatory barriers to inward and outward investment flows that are needed to boost Chengdu's connectivity and growth going forward.

V. Conclusions

Chengdu is a world city in the making. In this report, we detailed this appraisal by looking at (1) the strength, geography, and changes of its worldwide inter-city relations and (2) interpreting these figures by drawing on site visit meetings and interviews with advanced producer service firms in Chengdu. Our overall conclusion is straightforward: all the evidence points towards Chengdu increasingly becoming provided with network externalities as commercial assets within contemporary globalization. Although obviously not quite comparable to 'global-neighbouring cities' such as Singapore, Hong Kong, Shanghai, and Beijing, Chengdu is within the category of China's cities that have globally developed beyond their national confines and that have a relatively stable trajectory of

growing connectivity, and this is being supported by links with its 'global-neighbouring cities'. Other key findings include:

- Chengdu has been experiencing remarkable connectivity growth over the last couple of years, no other city in the world (let alone in China) has seen this level of growth momentum in recent years. The geography of Chengdu's inter-city relations has potential to be further developed to support its world city status, and this requires strategic intervention with regards to North America and Europe in general and key world cities in particular.
- In comparison with Chinese cities, Chengdu is less connected than leading Pearl River Delta cities such as Guangzhou and Shenzhen, but slightly more connected than other Chinese cities. Most of the Chinese cities show an upward trajectory, but as mentioned Chengdu has been gaining connectivity much faster than other Chinese cities.
- Within China, Chengdu stands out as a dynamic site of organic economic growth and internationalization. Ongoing government support for advanced knowledge-based industries, including innovative start-ups and SMEs in Tianfu New Area, can be expected to increase Chengdu's GFMCR connectivity as foreign investors and global producer service providers flood into Chengdu.
- In order to exploit this future economic expansion, government coordinated and agile thinking is needed in GFMCR spatial and economic planning and in reviewing regulatory mechanisms that put a brake on healthy inward and outward investment flows.

There is no single path towards world city formation: successful cities can be very different and that enables them to complement one another's growth

processes. This implies that neither global-neighbouring cities nor other leading world cities should be seen as ‘examples to follow’ or as economic rivals for Chengdu, but rather as alternative constellations of global practices. In this context, the point of this report has not been to ‘prove’, in some sense, that Chengdu is a ‘world city’, a branding to help marketing the city. Such is hardly needed. What we have been advocating and showing is that success within globalization requires adaptive city policy making, with a focus on **the interaction between functional city-region inward and outward commercial relations**. Obviously a city government has territorial jurisdiction over the place over which it governs, but the situation is different for network connectivities based as they are on relations beyond a city’s areal jurisdiction. The ways to respond to this can be diverse, and focus on both the development of hard infrastructures (e.g. connecting the city via air transport connectivity), soft infrastructures (e.g. positioning in the global economy through making the city ‘known’ in the broadest sense of that word), and through national and international inter-governmental collaborations between cities, based on commercial economic insights. However, assets from inter-city relations are directly the business of commerce and only indirectly the business of government. But this does not mean government is ineffectual in helping harness these external assets. Beyond ensuring the necessary requirements for vibrant inter-city relations as set out above, the Chengdu Municipal Government could identify and operationalize two key roles:

(A) **Monitoring external assets.** This involves keeping a record of changes in the organizational structures and market and production network geographies of all firms carrying out business beyond the city. This will provide a continuous picture of the economic ecosystem and

rhythm of the city as it deepens its links to the global economy. This is necessary to keep on top of how the city is faring as a world city.

(B) **Evaluating economic changes.** This involves changes in a city's base economy – firms moving in, expanding or declining in and beyond the city – being constantly assessed in terms of their effect on the city's internal and external assets. In terms of the firms used in the analyses above it is obviously better to encourage a multi-city service firm rather than a single city firm and firms in each of the producer service sectors needed to support GFMCR inward investment and internationalization.

Given that an operationalization of such a perspective and role requires in-depth and evidenced-based understanding, we conclude by spelling out a number of pertinent issues that could enhance the Guangzhou Municipal Government's understanding of its position in the global economy. Because gathering data and acting upon this understanding is something only a city government can properly do: its scope is beyond the capacity of any of the individual firms in the city. Two pertinent follow-up researches are:

- In this report, we have shown that Chengdu is relatively under-connected to New York and London, arguably the world's two most connected cities. A more detailed analysis could reveal a much wider array of major urban markets to target, and propose concrete measures to boost that connectivity. This could take the form of a detailed analysis of the strength of Chengdu's connections with, say, the 50 most connected cities in the global economy, and an ad hoc examination of which of these warrant strategic focus in terms of the development and nature of connections.

- Site meetings with producers in the wider GFMCR and in-depth interviews with service firms located in the city, have shown how important their synergistic relationships are to promote the further growth of a vibrant advanced economic ecosystem. To be healthy and sustainable, future growth relies on strengthening the global relations of Chengdu that are generated through inward investment by business networks with cross-border inflows of people and talent, and outward connections of internationalizing local firms with expanding export markets. Research on how government policies can nurture this dynamically evolving ecosystem, should explore how public-private sector collaboration and risk management can make the regulatory environment compatible with present active government support for business and infrastructure development.

Appendix A: model and data

Over roughly the last decade there have been a number of scientific efforts to measure and map world city networks. In this Appendix we specify the GaWC approach to measuring and mapping world city networks. This clarifies our take on key questions such as ‘how are cities connected to each other?’ and ‘how can a city’s connections be measured?’

Specification requires identification of the agencies that create the world city network. In the first section, we explain why one particular agent is chosen as the key instrument for our specification: advanced producer services firms. This choice leads to a discussion of our model in the second section, which essentially specifies the world city network as the aggregated work flows in the office networks of advanced producer services firms. Specification of this network model stipulates what information and data are required to describe and measure such a network, and this is the subject matter of the third section.

Advanced producer services firms and world city network formation

Cities are the basic economic entities for creating new wealth and stimulating development. However, cities do not of themselves create economies. Economic actors forge the economic links that tie cities together in networks; this leads to a consideration of which agents make cities and their networks. The makers of cities are, of course, multifarious. Many contemporary world cities clearly bear the mark of their makers: cultural agency has created Los Angeles as a world media city; political agency has created Geneva as an international institutional city; and economic agency has created Hong Kong as an international financial centre. Of course, the leading world cities are the result of all three of these (and

many more) agencies creating 'well-rounded' world cities. London and New York are archetypical in this respect: both are very important media, political and financial centres and much else besides – in fact they simply cannot be ignored or bypassed by agents pursuing global strategies.

Following Sassen (2001), the agents we concentrate upon are advanced producer service providers. Producer services are intermediate inputs to further production activities that are sold to other firms. They are typically tailored products that often reflect a 'contracting out' of services with a high knowledge content. Examples are services in the realm of accountancy, legal issues, management consultancy, etc. Although producer services firms are found across cities worldwide, some cities now function as the main operational platforms for those services firms that are instrumental in the organisation of the world economy. These service firms have emerged out of three inter-related processes.

First, globalization of economic activity in general implies that to keep an important client, a service provider will have to provide services where their client wants to be serviced worldwide. Obviously a major multinational company would not want to deal with, say, a different accountancy firm in every country it did business in. Second, as service firms move from following their clients across the world to developing their own global strategies to win new business, they have become concerned to protect their own brand name. Providing a direct service under one brand allows for global quality control and a seamless worldwide service for the client. Third, the combining of communications with computers has created a new information technology environment that meant services could be more easily organized on a multi-office basis across the world.

Against the backdrop of the rapid growth, specialisation, internationalization and agglomeration of producer service firms, 'world cities' have emerged as key sites for the production of service innovations in the global economy. **We treat cities as service centers, and use this starting point to specify a world city network of interconnected global service centers.**

The strategies and trajectories of the globalization of service industries are inevitably messier than this brief discussion suggests: both the how and the why of this globalization are in reality very complex. Firms use combinations of 'organic' office openings, mergers and acquisitions, and alliances as they globalize. This diversity then leads to different types of integration and spatial economies in the office networks of service firms, which in turn depend on corporate culture and the nature of the new market in question. However, regardless of the complex reasons for, and the precise forms under which service firms have 'gone global', the end result is the emergence of global service firms. These firms are the key agents in our specification of the world city network.

The interlocking network model

We develop a network model in which advanced producer services firms are recognized as the prime agents of world city network formation. Figure A.1 has been constructed to aid description of the formal specification of our network model. It depicts a minuscule part of the world city network as an interlocking structure: 10 cities and three advanced producer service firms. This example will be used in what follows to provide concrete results at different stages of the specification; the results should be treated as strictly illustrative for the

measures we report upon and not as meaningful findings about the world city network.

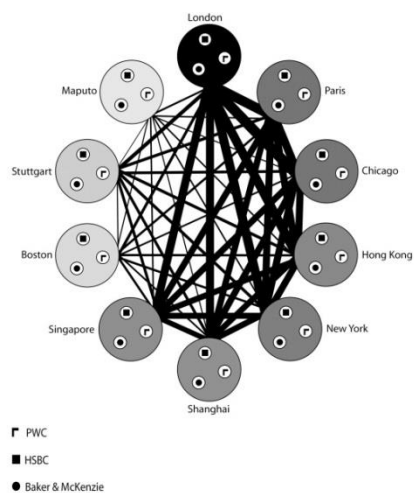
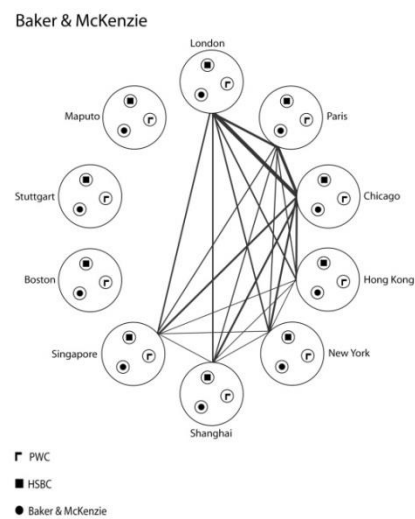
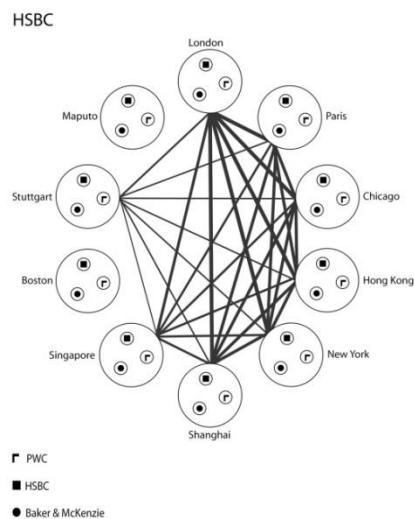
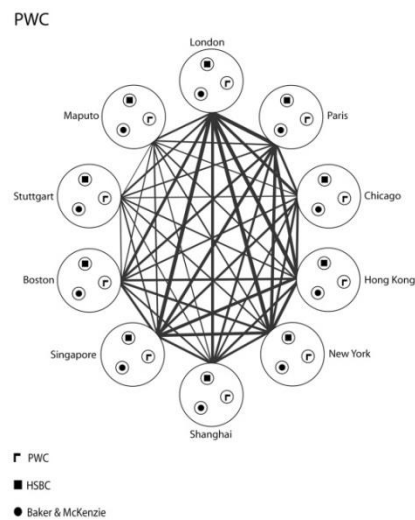
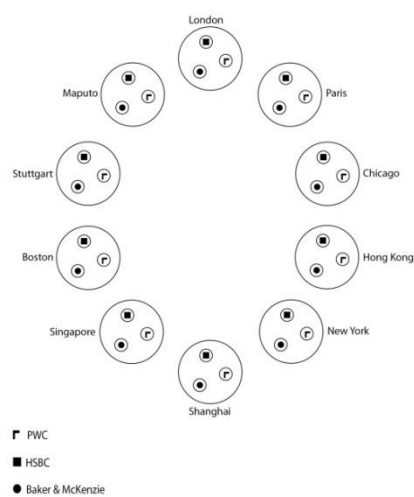


Figure A.1 Construction of the world city network as an interlocking network

A universe of m advanced producer service firms located in n world cities is defined. The elemental measure is a service value V_{ij} with information on the importance of the presence of firm j in city i . These observations can be arrayed as a $m \times n$ service value matrix V . For illustrative purposes, a small data set is used with sizes presented as simple integers ranging from 0 to 5, with larger values indicating a more important presence of firm j in city i . Table A.1, using the same firms and cities as Figure A.1, shows V as an actual 10-city \times 3-firm service value matrix.

A first and very straightforward measure of a city's position would be its total level of services, which we will term a city's service status C_i :

$$C_i = \sum_j V_{ij} \quad (1)$$

The set of sums is given in Table A.1. London and Maputo have the highest and lowest city service status with values of 14 and 2, respectively. A city's site service status C_i is a straightforward measure of world city status, but it is in a way also an inadequate one. To be fair, C_i gives a snapshot of the accumulated expertise that enables cities to enjoy an advantage in certain aspects of business services. But such an audit would not provide an understanding of what cities do with their past and present assets, and what it puts together with them: world cities are not only important simply because of the size and magnitude of the resources at their disposal. Rather, they are above all important because of the practices employed by the financial and business professionals distributed in the corporate networks that flow through their business centres. Thus we need to convert V so that it gives us insight into the interaction between cities through firms rather than simply taking stock of firms' presences in cities.

Table A.1 Example of a service value matrix V

City	PwC	HSBC	Baker & McKenzie	C_i
London	5	5	4	14
Paris	4	4	3	11
Chicago	3	4	5	12
Hong Kong	4	4	2	10
New York	4	4	2	10
Shanghai	3	4	2	9
Singapore	4	3	2	9
Boston	3	0	0	3
Stuttgart	2	2	0	4
Maputo	2	0	0	2

The crux of the interlocking network model function is the definition of city-dyad connectivity CDC_{a-b} between cities a and b for each pair of cities and firms based on V :

$$CDC_{a-b} = \sum_j V_{ai} \cdot V_{bj} \quad a \neq b \quad (2)$$

The conjecture behind conceiving CDC_{a-b} as a surrogate for actual flows of inter-firm information and knowledge between cities is that the more important the office, the more connections there will be with other offices in a firm's network: larger offices have the capacity to create more potential interaction.

Table A.2 shows how R is constructed. Calculations are based on the illustrative example provided in Table A.1. The table shows the basic relational elements for each of the three firms for each pair of cities $CDC_{a-b,j}$ and aggregated city interlocks CDC_{a-b} across all three firms. Equation (2) allows measurement of how well a city-pair is interconnected, and represents the individual cells in our newly constructed relational matrix.

For each city there are n-1 such links, so that a city's overall connectivity – which we will term ‘global network connectivity’ GNC_a – can simply be calculated by aggregating all possible links:

$$GNC_a = \sum_b CDC_{a-b} = \sum_{bj} V_{aj} \cdot V_{bj} \quad a \neq b \quad (3)$$

Table A.2 Example of construction of relational matrix R of city interactions (based on data in Table A.1)

	London	Paris	Chicago	Hong Kong	New York	Shanghai	Singapore	Boston	Stuttgart	Maputo
PWC										
London	0	20	15	20	20	15	20	15	10	10
Paris	20	0	12	16	16	12	16	12	8	8
Chicago	15	12	0	12	12	9	12	9	6	6
Hong Kong	20	16	12	0	16	12	16	12	8	8
New York	20	16	12	16	0	12	16	12	8	8
Shanghai	15	12	9	12	12	0	12	9	6	6
Singapore	20	16	12	16	16	12	0	12	8	8
Boston	15	12	9	12	12	9	12	0	6	6
Stuttgart	10	8	6	8	8	6	8	6	0	4
Maputo	10	8	6	8	8	6	8	6	4	0
HSBC										
London	0	20	20	20	20	20	15	0	10	0
Paris	20	0	16	16	16	16	12	0	8	0
Chicago	20	16	0	16	16	16	12	0	8	0
Hong Kong	20	16	16	0	16	16	12	0	8	0
New York	20	16	16	16	0	16	12	0	8	0
Shanghai	20	16	16	16	16	0	12	0	8	0
Singapore	15	12	12	12	12	12	0	0	6	0
Boston	0	0	0	0	0	0	0	0	0	0
Stuttgart	10	8	8	8	8	8	6	0	0	0
Maputo	0	0	0	0	0	0	0	0	0	0
Baker & McKenzie										
London	0	12	20	8	8	8	8	0	0	0
Paris	12	0	15	6	6	6	6	0	0	0
Chicago	20	15	0	10	10	10	10	0	0	0
Hong Kong	8	6	10	0	4	4	4	0	0	0

New York	8	6	10	4	0	4	4	0	0	0
Shanghai	8	6	10	4	4	0	4	0	0	0
Singapore	8	6	10	4	4	4	0	0	0	0
Boston	0	0	0	0	0	0	0	0	0	0
Stuttgart	0	0	0	0	0	0	0	0	0	0
Maputo	0	0	0	0	0	0	0	0	0	0
All 3 firms										
London	0	52	55	48	48	43	43	15	20	10
Paris	52	0	43	38	38	34	34	12	16	8
Chicago	55	43	0	38	38	35	34	9	14	6
Hong Kong	48	38	38	0	36	32	32	12	16	8
New York	48	38	38	36	0	32	32	12	16	8
Shanghai	43	34	35	32	32	0	28	9	14	6
Singapore	43	34	34	32	32	28	0	12	14	8
Boston	15	12	9	12	12	9	12	0	6	6
Stuttgart	20	16	14	16	16	14	14	6	0	4
Maputo	10	8	6	8	8	6	8	6	4	0

Table A.3 gives global network connectivities for our illustrative example. The table also features cities' site service status to show that, although related, C and GNC, are not the same measure. For instance, despite having a larger site service status C, Chicago has a smaller connectivity GNC than Paris. Similarly, New York and Singapore have a larger connectivity GNC than Hong Kong and Shanghai, respectively, in spite of having the same site service status C. In the case of Chicago versus Paris, this difference is due to the uneven connectivity within the networks of PriceWaterhouseCoopers and Baker & McKenzie: the PriceWaterhouseCoopers network has, amongst other things, more offices than Baker & McKenzie. This leads to more options for city networking. Paris assumes a more important role in the PriceWaterhouseCoopers office network than in the Baker & McKenzie, while the obverse is true for Chicago. In aggregate, this results in larger connectivities for Paris than Chicago, in spite of the latter city having a larger accumulated level of expertise and servicing at the level of the city itself. By applying and using our network model, we thus move from a vision

in which cities are conceptualised as mere clusters of capabilities and resources to a vision in which cities are conceptualised as nodes in networks of capabilities and resources.

Table A.3: Example of GNC of cities (based on data in Table A.1 and calculations in Table A.2)

City	C	GNC
London	14	334
Paris	11	275
Chicago	12	272
Hong Kong	10	248
New York	10	260
Shanghai	9	233
Singapore	9	237
Boston	3	93
Stuttgart	4	120
Maputo	2	64

Creating data to describe the world city network

The service matrix V in Table A.1 clarifies what data are required to describe the world city network. We need (i) to identify a set of global service firms, (ii) to select a set of cities, and (iii) to find or derive service values that show the importance of each city to the service office network of each firm. The argument proceeds in two stages. First, the process of gathering the appropriate information is described. Second, the conversion of this multifarious information into comparable data across firms is described. The data are produced by devising a uniform scale of service value that is then applied separately to the specific information gathered on each firm. The end-result is a data matrix of the services values of global services firms across world cities to describe and analyze the world city network in the year 2016.

Advanced producer service firms provide knowledge-based (expert/profession/creative) services to other corporations to facilitate their business activities. In such a situation, a 'global presence' is an integral part of the firm's public marketing policies. For instance, new potential clients from around the world will want to know the geographical range of the services on offer. Hence among producer service firms, locational strategy is perforce quite transparent. An integral part of the showcasing of the geographical range of the services on offer is that their websites provide an option to select 'location' giving addresses of offices. This often comes with a world map of their distribution to emphasis their global presence. Advantage is taken of this geographical transparency for information gathering.

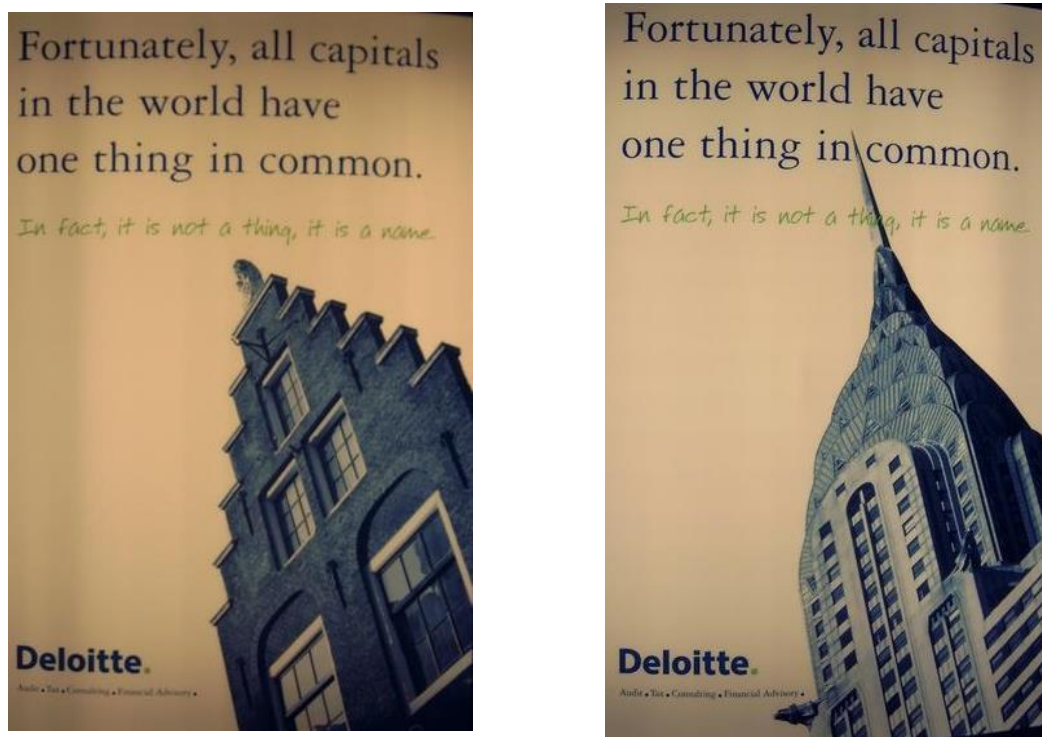


Figure A.2 Deloitte advertisements at Amsterdam Schiphol Airport (2004, author)

We collected information on the presence of 175 firms (see Appendix C): 75 financial services firms, 25 management consultancy firms, 25 advertising firms,

25 law firms, and 25 accountancy firms. The information on the location strategies of these firms was gathered between July 2016 and September 2016. Firms were selected based on sectoral rankings for 2016, which tended to be based upon 2015 data. We selected financial services firms from BrandFinance's Top 500 financial services and insurance companies', which is based on a benchmark study of the strength, risk and future potential of financial services firms; accountancy firms were chosen from World Accounting Intelligence's ranking, which is based on an analysis of aggregated company revenues; advertising agencies were selected based on Brandirectory's analysis of the valuable brands in the advertising sector; law firms were selected based on Chambers' ranking of leading corporate law firms; and management consultancy firms were selected from Vault Management & Strategy Consulting's Survey, which ranks firms in terms of their 'prestige' based on a large survey of professionals. For each sector, the top-ranked firms were chosen, and we also identified substitute firms (i.e. ranked just below 75 and 25) to cover for situations where a firm had disappeared (e.g. been taken over) during the actual data collection.

To select cities, we used a number of overlapping criteria. In addition to the cities that featured in earlier key publications in this scientific literature, we also included all cities with a population of more than 1.5 million inhabitants in 2010; all capital cities of states with a population of more than one million, and every city with a headquarter office of one of our selected firms. This led to the selection of 707 cities (see Appendix C).

Assigning service values to city/firm-combinations was based on an in-depth analysis of all possible relevant available information, firm by firm, from their websites, supplemented by material from any other sources available such as

annual reports and internal directories. For each firm, two types of information have been gathered. First, information about the size of a firm's presence in a city is obtained. Ideally, information on the number of professional practitioners listed as working in the firm's office in a given city is needed. Such information is widely available for law firms but is relatively uncommon in other sectors. Here other information has to be used such as the number of offices the firm has in a city. Second, the extra-locational functions of a firm's office in a city are recorded. Headquarter functions are the obvious example but other features like subsidiary HQs and regional offices are recorded. Any information that informs these two features of a firm's presence in a city is collected in this method of information gathering. The end result is that for each of the 175 firms, information is available to create service values in each of 707 cities.

In conversion from information to data there is always a tension between keeping as much of the original material as possible and creating a credible ordering that accommodates all degrees of information across cases. In this exercise, there is very detailed information for some firms and much less for others. This tension is resolved here by devising a relatively simple scoring system to accommodate the multifarious information gathered. A six-point service value scale is used where two levels are automatically given: obviously 0 is scored where there is no presence of a firm in a city, and 5 is scored for the city that houses a firm's headquarters. Hence decision making on scoring focuses upon allocating the middle four scores (1, 2, 3, and 4) to describe the service value of a firm in a city. This means that for each firm three boundary lines have to be specified: between 1 and 2, 2 and 3, and 3 and 4.

The basic strategy of allocation is to begin with the assumption that all cities with a non-HQ presence of a firm score 2. This score represents the 'typical'

service level for the given firm in a city. To determine this requires inspection of the distribution of information across all cities for that firm. To alter this score there has to be a specific reason. For instance, a city where contact with a firm's office is referred elsewhere (i.e. to another office of the firm in a different city) will be allocated a service value score reduced to 1. In other firms where there is full information on numbers of practitioners, a city with an office showing very few (perhaps none) professional practitioners would also score 1. The point is that the boundary between 1 and 2 will differ across firms depending on information available. The same is true of the other boundaries. Generally, the boundary between 2 and 3 has been based upon size factors, and that between 3 and 4 on extra-territorial factors. For instance, exceptionally large offices with many practitioners will lead to a city scoring 3 while location of regional headquarters will lead to a city scoring 4. In practice, size and extra-locational information have been mixed where possible in deciding on the boundaries for each firm. The end result is the service value matrix V, a 707x175 data array with v_{ij} ranging from 0 to 5. Feeding these data into equations (1-3) and the formulas outlined in Appendix B is the evidential basis on which this report is based.

Appendix B-1: List of cities

City	Country	City	Country
Aba	Nigeria	Antalya	Turkey
Aberdeen	UK	Antananarivo	Madagascar
Abidjan	Cote d'Ivoire	Antwerp	Belgium
Abu Dhabi	UAE	Arbil	Iraq
Abuja	Nigeria	Arhus	Denmark
Acapulco	Mexico	Asanol	India
Accra	Ghana	Ashkhabad	Turkmenistan
Adana	Turkey	Asmara	Eritrea
Addis Ababa	Ethiopia	Asuncion	Paraguay
Adelaide	Australia	Athens	Greece
Agadir	Morocco	Atlanta	US
Āgra	India	Auckland	New Zealand
Aguascalientes	Mexico	Aurangābād	India
Ahmedabad	India	Austin	US
Ahvāz	Iran	Baghdad	Iraq
Akita	Japan	Baku	Azerbaijan
Al-Baṣrah	Iraq	Baltimore	US
Albuquerque	US	Bamako	Mali
Alexandria	Egypt	Bandar Lampung	Indonesia
Algiers	Algeria	Bandar Seri Begawan	Brunei
Aligarh	India	Bandung	Indonesia
Allahābād	India	Bangalore	India
Allentown	US	Bangkok	Thailand
Al-Madīnah	Saudi Arabia	Bangui	Central African Rep.
Almaty	Kazakstan	Baoding	China
Al-Mawṣil	Iraq	Baoji	China
Amman	Jordan	Baotou	China
Amritsar	India	Barcelona	Spain
Amsterdam	Netherlands	Bareilly	India
Anchorage	US	Barquisimeto	Venezuela
Angeles	Philippines	Barranquilla	Colombia
Ankara	Turkey	Basel	Switzerland
Anshan	China	Batam	Indonesia
Battle Creek	US	Brussels	Belgium
Beijing	China	Bucaramanga	Colombia

City	Country	City	Country
Beirut	Lebanon	Bucharest	Romania
Belem	Brazil	Budapest	Hungary
Belfast	UK	Buenos Aires	Argentina
Belgrade	Serbia	Buffalo (NY)	US
Belo Horizonte	Brazil	Bulawayo	Zimbabwe
Bengbu	China	Bursa	Turkey
Benin City	Nigeria	Cairo	Egypt
Bentonville	US	Calcutta	India
Benxi	China	Calgary	Canada
Bergen	Norway	Cali	Colombia
Berlin	Germany	Campinas	Brazil
Bern	Switzerland	Canberra	Australia
Bhilai	India	Cangnan	China
Bhopāl	India	Cape Town	South Africa
Bhubaneswar	India	Caracas	Venezuela
Bilbao	Spain	Cardiff	UK
Birmingham (UK)	UK	Cartagena	Colombia
Birmingham (US)	US	Casablanca	Morocco
Bishkek	Kyrgyzstan	Cebu	Philippines
Bissau	Guinea-Bissau	Chandigarh	India
Blantyre	Malawi	Changchun	China
Bogota	Colombia	Changsha	China
Bologna	Italy	Changshu	China
Bonn	Germany	Changwon	Korea (South)
Bordeaux	France	Changzhou	China
Boston	US	Charleston	US
Brasilia	Brazil	Charlotte (US)	US
Bratislava	Slovakia	Chattanooga	US
Brazzaville	R Congo	Chelyabinsk	Russia
Bremen	Germany	Chengdu	China
Brisbane	Australia	Chennai	India
Bristol	UK	Chiba	Japan
Chicago	US	Danbury	US
Chifeng	China	Daqing	China
Chihuahua	Mexico	Dar Es Salaam	Tanzania
Chisinau	Moldova	Datong	China
Chittagong	Bangladesh	Davao	Philippines

City	Country	City	Country
Chonburi	Thailand	Dehradun	India
Chongqing	China	Denpasar	Indonesia
Christchurch	New Zealand	Denver	US
Cincinnati	US	Des Moines	US
Ciudad Juarez	Mexico	Detroit	US
Cixi	China	Dhaka	Bangladesh
Clermont-Ferrand	France	Dhanbād	India
Cleveland	US	Dili	East Timor
Cochabamba	Bolivia	Djibouti	Djibouti
Cochin	India	Dnipropétrovs'k	Ukraine
Coimbatore	India	Doha	Qatar
Cologne	Germany	Donetsk	Ukraine
Colombo	Sri Lanka	Dortmund	Germany
Columbus (Ohio)	US	Douala	Cameroon
Conakry	Guinea	Dresden	Germany
Copenhagen	Denmark	Dubai	UAE
Cordoba	Argentina	Dublin	Ireland
Cotonou	Benin	Duisburg	Germany
Cuernavaca	Mexico	Durban	South Africa
Curitiba	Brazil	Dushanbe	Tajikistan
Daegu	Korea (South)	Düsseldorf	Germany
Daejeon	Korea	Edinburgh	UK
Dakar	Senegal	Edmonton	Canada
Dalian	China	El Paso	US
Dallas	US	Essen	Germany
Damascus	Syria	Faisalabad	Pakistan
Dammam	Saudi Arabia	Fès	Morocco
Florence	Italy	Hamamatsu	Japan
Fortaleza	Brazil	Hamburg	Germany
Frankfurt	Germany	Hamilton	Bermuda
Freetown	Sierra Leone	Hangzhou	China
Fuji	Japan	Hannover	Germany
Fukuoka	Japan	Hanoi	Vietnam
Fuzhou	China	Harare	Zimbabwe
Gaborone	Botswana	Harbin	China
Gaza	Palestine	Harrisburg	US
Gaziantep	Turkey	Hartford(Connecticut)	US

City	Country	City	Country
Geneva	Switzerland	Havana	Cuba
Genoa	Italy	Hefei	China
George Town	Malaysia	Heidelberg	Germany
Georgetown (Guy.)	Guyana	Helsinki	Finland
Georgetown(Cayman)	Cayman Islands	Hengyang	China
Glasgow	UK	Hiroshima	Japan
Goiania	Brazil	Ho Chi Minh City	Vietnam
Göteborg	Sweden	Hobart	Australia
Graz	Austria	Hohhot	China
Greensboro	US	Hong Kong	China
Grenoble	France	Honolulu	US
Guadalajara	Mexico	Houston	US
Guangzhou	China	Hsinchu City	China
Guatemala City	Guatemala	Huai'an	China
Guayaquil	Ecuador	Huaibei	China
Guilin	China	Huainan	China
Guiyang	China	Hubli-Dhārwar	India
Gujranwala	Pakistan	Huizhou	China
Guwahāti	India	Hyderabad	India
Gwalior	India	Hyderabad	Pakistan
Gwangju	Korea	Ibadan	Nigeria
Haifa	Israel	Incheon	Korea
Haikou	China	Indianapolis	US
Ḥalab	Syria	Indore	India
Halifax	Canada	Isfahan	Iran
Handan	China	Islamabad	Pakistan
Istanbul	Turkey	Kharkov	Ukraine
Izmir	Turkey	Khartoum	Sudan
Jabalpur	India	Khulna	Bangladesh
Jacksonville	US	Kiev	Ukraine
Jaipur	India	Kigali	Rwanda
Jakarta	Indonesia	Kingston	Canada
Jalandhar	India	Kingston	Jamaica
Jamshedpur	India	Kinshasa	DR Congo
Jeddah	Saudi Arabia	Kirkūk	Iraq
Jerusalem	Israel	Kitakyushu	Japan
Jiangyin	China	Kobe	Japan

City	Country	City	Country
Jiaozuo	China	Konya	Turkey
Jilin	China	Kotā	India
Jinan	China	Krakow	Poland
Jinzhou	China	Krasnoyarsk	Russia
João Pessoa	Brazil	Kuala Lumpur	Malaysia
Jodhpur	India	Kumamoto	Japan
Johannesburg	South Africa	Kumasi	Ghana
Johor Bahru	Malaysia	Kunming	China
Kabul	Afghanistan	Kuwait City	Kuwait
Kaduna	Nigeria	Kyoto	Japan
Kaifeng	China	La Paz	Bolivia
Kampala	Uganda	Labuan	Malaysia
Kano	Nigeria	Lagos	Nigeria
Kānpur	India	Lahore	Pakistan
Kansas City	US	Lanzhou	China
Kaohsiung	China	Las Vegas	US
Karachi	Pakistan	Lausanne	Switzerland
Karlsruhe	Germany	Leeds	UK
Kathmandu	Nepal	Leicester	UK
Katowice	Poland	Leipzig	Germany
Kawasaki	Japan	Leon	Mexico
Kayseri	Turkey	Leverkusen	Germany
Kazan	Russia	Lianyungang	China
Libreville	Gabon	Madurai	India
Liege	Belgium	Maiduguri	Nigeria
Lille	France	Mainz	Germany
Lilongwe	Malawi	Makassar	Indonesia
Lima	Peru	Makkah	Saudi Arabia
Limassol	Cyprus	Malabo	Equatorial Guinea
Linyi	China	Malacca	Malaysia
Linz	Austria	Málaga	Spain
Lisbon	Portugal	Malang	Indonesia
Little Rock (Arkansas)	US	Malmö	Sweden
Liuzhou	China	Managua	Nicaragua
Liverpool	UK	Manama	Bahrain
Ljubljana	Slovenia	Manaus	Brazil
Lodz	Poland	Manchester	UK

City	Country	City	Country
Lomé	Togo	Mandalay	Myanmar
London	UK	Manila	Philippines
Los Angeles	US	Mannheim	Germany
Louisville	US	Maoming	China
Luanda	Angola	Maputo	Mozambique
Lubumbashi	Congo (Dem. Rep.)	Maracaibo	Venezuela
Lucknow	India	Maracay	Venezuela
Ludhiāna	India	Marrakech	Morocco
Ludwigshafen	Germany	Marseille	France
Luoyang	China	Maseru	Lesotho
Lusaka	Zambia	Mashhad	Iran
Luxembourg	Luxembourg	Mbabane	Swaziland
Lyon	France	Mbuji-Mayi	Congo (Dem. Rep.)
Ma'anshan	China	McAllen	US
Macao	China	Medan	Indonesia
Maceió	Brazil	Medellin	Colombia
Madison (Wisconsin)	US	Meerut	India
Madrid	Spain	Melbourne	Australia
Melbourne (US)	US	Naples	Italy
Memphis (Tennessee)	US	Nāshik	India
Mendoza	Argentina	Nashville (Tennessee)	US
Mérida	Mexico	Nassau	Bahamas
Mexicali	Mexico	Natal	Brazil
Mexico City	Mexico	N'Djamena	Chad
Miami	US	New Delhi	India
Mianyang	China	New Orleans	US
Milan	Italy	New York	US
Milwaukee	US	Newcastle	UK
Minneapolis	US	Niamey	Niger
Minsk	Belarus	Nice	France
Mogadishu	Somalia	Nicosia	Cyprus
Mombasa	Kenya	Ningbo	China
Monrovia	Liberia	Nizhny Novgorod	Russia
Monterrey	Mexico	Norfolk (Virginia)	US
Montevideo	Uruguay	Norwich	UK
Montpellier	France	Nottingham	UK
Montreal	Canada	Nouakchott	Mauritania

City	Country	City	Country
Morādābād	India	Novosibirsk	Russia
Moscow	Russia	Nürnberg	Germany
Multan	Pakistan	Odessa	Ukraine
Mumbai	India	Okayama	Japan
Munich	Germany	Oklahoma City	US
Muscat	Oman	Omaha (Nebraska)	US
Mysore	India	Omsk	Russia
Nagoya	Japan	Onitsha	Nigeria
Nāgpur	India	Oran	Algeria
Naha	Japan	Orlando	US
Nairobi	Kenya	Osaka	Japan
Nanchang	China	Oslo	Norway
Nanchong	China	Ottawa	Canada
Nanjing	China	Ouagadougou	Burkina
Nanning	China	Palembang	Indonesia
Nantes	France	Palermo	Italy
Nantong	China	Palo Alto	US
Nanyang	China	Panama City	Panama
Paramaribo	Surinam	Pretoria	South Africa
Paris	France	Providence(Rhode Island)	US
Patna	India	Puebla	Mexico
Pekanbaru	Indonesia	Pune	India
Penang	Malaysia	Pusan	Korea
Peoria	US	Putian	China
Perm	Russia	Pyongyang	Korea
Perth	Australia	Qingdao	China
Peshawar	Pakistan	Qingyuan	China
Philadelphia	US	Qinhuangdao	China
Phnom Penh	Cambodia	Qiqihar	China
Phoenix	US	Qom	Iran
Pittsburgh (Pennsylvania)	US	Quebec	Canada
Plymouth	UK	Queretaro	Mexico
Podgorica	Montenegro	Quetta	Pakistan
Pombal	Portugal	Quito	Ecuador
Port Elizabeth	South Africa	Rabat	Morocco
Port Harcourt	Nigeria	Rājkot	India
Port Louis	Mauritius	Raleigh (US)	US

City	Country	City	Country
Port Moresby	Papua New Guinea	Ranchi	India
Port of Spain	Trinidad and Tobago	Rawalpindi	Pakistan
Port-Au-Prince	Haiti	Rayong	Thailand
Portland	US	Recife	Brazil
Porto	Portugal	Reykjavik	Iceland
Porto Alegre	Brazil	Richmond (Virginia)	US
Porto Novo	Benin	Riga	Latvia
Poznan	Poland	Rio De Janeiro	Brazil
Prague	Czech Republic	Riyadh	Saudi Arabia
Rizhao	China	Saratov	Russia
Rochester (NY)	US	Saskatoon	Canada
Rome	Italy	Seattle	US
Rosario	Argentina	Semarang	Indonesia
Rostov-on-Don	Russia	Sendai	Japan
Rotterdam	Netherlands	Seoul	Korea
Ruhrgebiet	Germany	Serang	Indonesia
Sacramento	US	Seville	Spain
Sakai	Japan	Shanghai	China
Salem	India	Shantou	China
Salt Lake City	US	Sheffield	UK
Salvador	Brazil	Shenyang	China
Samara	Russia	Shenzhen	China
San Antonio	US	Shijiazhuang	China
San Diego	US	Shīrāz	Iran
San Francisco	US	Shizuoka	Japan
San Jose	Costa Rica	Singapore	Singapore
San Jose (Ca)	US	Skopje	Macedonia
San Juan	Puerto Rico	Sofia	Bulgaria
San Luis Potosí	Mexico	Solāpur	India
San Pedro Sula	Honduras	Southampton	UK
San Salvador	El Salvador	Srīnagar	India
Sanaa	Yemen	St Louis	US
Sandviken	Sweden	St Petersburg	Russia
Santa Cruz	Bolivia	Stockholm	Sweden
Santiago	Chile	Stockton	US
Santo Domingo	Dominican Rep.	Strasbourg	France
Santos	Brazil	Stuttgart	Germany

City	Country	City	Country
São Luís	Brazil	Surabaya	Indonesia
Sao Paulo	Brazil	Surakarta	Indonesia
Sapporo	Japan	Sūrat	India
Sarajevo	Bosnia and Herzegovina	Surgut	Russia
Sūsah	Tunisia	Toronto	Canada
Suva	Fiji	Torreón	Mexico
Suzhou	China	Toulouse	France
Swindon	UK	Toyama	Japan
Sydney	Australia	Trieste	Italy
Tabrīz	Iran	Tripoli	Libya
Tai'an	China	Trivandrum	India
Tainan	Taiwan (Rep. of China)	Tucson	US
Taipei	China	Tulsa	US
Taiyuan	China	Tunis	Tunisia
Taizhong	Taiwan (Rep. of China)	Turin	Italy
Taizhou	China	Ufa	Russia
Takamatsu	Japan	Ulan Bator	Mongolia
Tallinn	Estonia	Ulsan	Korea
Tampa	US	Urumqi	China
Tangshan	China	Utrecht	Netherlands
Taoyuan	Taiwan (Rep. of China)	Vadodara	India
Tashkent	Uzbekistan	Valencia (Sp.)	Spain
Tbilisi	Georgia	Valencia (Ve.)	Venezuela
Tegucigalpa	Honduras	Valparaíso	Chile
Tehran	Iran	Vancouver	Canada
Tel Aviv	Israel	Vārānasi	India
Teresina	Brazil	Venice	Italy
The Hague	Netherlands	Victoria	Seychelles
Thimphu	Bhutan	Vienna	Austria
Tianjin	China	Vientiane	Laos
Tijuana	Mexico	Vijayawāda	India
Tirana	Albania	Vilnius	Lithuania
Tiruchirāppalli	India	Virginia Beach	US
Tiruppūr	India	Visākhapatnam	India
Tokyo	Japan	Vitoria	Brazil
Toluca	Mexico	Vladivostok	Russia

City	Country	City	Country
Volgograd	Russia	Yancheng	China
Voronež	Russia	Yangon	Myanmar
Wanzhou	China	Yangzhou	China
Warsaw	Poland	Yantai	China
Washington	US	Yaonde	Cameroon
Weifang	China	Yekaterinburg	Russia
Wellington	New Zealand	Yerevan	Armenia
Wenzhou	China	Yichang	China
Windhoek	Namibia	Yinchuan	China
Winnipeg	Canada	Yiwu	China
Winston-Salem	UK	Yogyakarta	Indonesia
Wolfsburg	Germany	Yokohama	Japan
Wroclaw	Poland	Zagreb	Croatia
Wuhan	China	Zamboanga	Philippines
Wuhu	China	Zhangjiakou	China
Wuxi	China	Zhanjiang	China
Xiamen	China	Zhengzhou	China
Xi'An	China	Zhenjiang	China
Xiangtan	China	Zhuhai	China
Xiangyang	China	Zhuzhou	China
Xingtai	China	Zibo	China
Xining	China	Zunyi	China
Xinxiang	China	Zurich	Switzerland
Xuzhou	China		

Appendix B-2: List of firms

Firms (Finance)	
ABN Amro	Halifax
Agricultural Bank of China	HSBC
ANZ	ICBC
Banco do Brasil	Industrial Bank Co.
Bank of America	ING
Bank of China	Itaú
Bank of Communications	J.P. Morgan
Bank of Montreal	KB Financial Group

Firms (Finance)	
Barclays	KBC
BB&T	Lloyds Bank
BBVA	Macquarie
BNP Paribas	Merrill Lynch
BNY Mellon	Mizuho Financial Group
Bradesco	Morgan Stanley
Caixa	MUFG
Capital One	nab
Chase	Nationwide Building Society
China CITIC Bank	NatWest
China Construction Bank	Nomura
China Everbright Bank	Nordea
China Merchants Bank	OCBC Bank
China Minsheng Bank	Ping An Bank
CIBC	PNC
Citi	Rabobank
Commonwealth Bank of Australia	RBS
Crédit Agricole	Royal Bank of Canada
Crédit Mutuel	Santander
Credit Suisse	Sberbank
Danske Bank	Scotiabank
DBS	Shanghai Pudong Development Bank
Deutsche Bank	Shinhan Financial Group
DNB	SMFG
Goldman Sachs	Société Générale
Standard Chartered	UBS
State Bank of India	UniCredit
Svenska Handelsbanken	Wells Fargo
TD Bank Group	Westpac
U.S. Bancorp	

Firms (Management consultancy)	
A.T. Kearney	Oliver Wyman
Accenture	Parthenon-EY
Alvarez & Marsal	Point B
Analysis Group, Inc.	Roland Berger Strategy Consultants
Bain & Company	ScottMadden Management consultants

ClearView Healthcare Partners	Strategy&, part of the PwC network
Cornerstone Research	The Boston Consulting Group, Inc.
Eagle Hill Consulting	The Brattle Group
Edgeworth Economics	The Bridgespan Group
Insight Sourcing Group	The Cambridge Group
Kurt Salmon	The Chartis Group
L.E.K. Consulting	ZS Associates
McKinsey & Company	

Firms (Accountancy)	
AGN International	KPMG
Allinial Global (formerly ARAF)	Kreston International
Baker Tilly International	LEA GLOBAL
BDO	Mazars
BKR International	Moore Stephens International
Crowe Horwath International	Morison International
Deloitte	Nexia International
DFK International	PKF International
Ernst & Young	Praxity
GGI Geneva Group International	PrimeGlobal
Grant Thornton International	PwC
HLB International	RSM
IAPA	

Appendix C: Equations

Appendix A discussed our approach to measuring and mapping world city networks. The world city network was specified as the aggregated workflows in the office networks of advanced producer services firms. The specification of this interlocking network model led to measures of (1) the strength of the relation between any pair of cities (city-dyad connectivity CDC_{a-b}), and (2) the overall connectivity of a city (global network connectivity GNC_a). However, additional measures of connectivity can be identified within the same spirit. These additional measures are employed in the different tables in the report, and in this Appendix we review them in the order in which they appear in the different tables and figures.

The starting point for all of these measures is our universe of advanced producer service firms located in world cities, with as elemental measure the service value V_{ij} with information on the importance of the presence of firm j in city i .

Global Network Connectivity

A city's Global Network Connectivity GNC_a is calculated by aggregating all its city-dyads CDC_{a-b} across all firms:

$$GNC_a = \sum_b CDC_{a-b} = \sum_{bj} V_{aj} \cdot V_{bj} \quad a \neq b \quad (1)$$

These measures are often hard to interpret on their own terms, as they depend on the number of firms and cities in the data. To make them more readily interpretable, we convert them into proportions of the maximum value so that

values range from unity to zero. It is this more easily interpreted form of global network connectivity that is used in the report.

However, information on city-dyads CDC_{a-b} can also be combined into different indicators. First, we examine the geography of city-dyads by looking at their distribution across world regions. Second, we assess the relative balance between a city's connections with first-tier world cities (which we term 'Globalism') and its connections within cities within the same world region (which we term 'Localism'). Combining the Globalism and Localism scores produces insight into the Global Orientation of a city's connectivity.

Regional dimension of Global Network Connectivity

To examine the overall geographical tendencies within city-dyads, we can dissect their comparative strength at the world-regional level. To this end, we identify nine world-regions, i.e.: Europe, Eurasia, Sub-Saharan Arica, the Middle East and North Africa (MENA), Australasia, Pacific Asia, South Asia, Northern America, and Latin America.

The strength of city a 's connections WR_a with cities located in a given world region WR is calculated as follows:

$$WR_a = 100 * \left(\frac{\sum_{i=1}^{WR} CDC_{a-i}}{\sum_{i=1}^{707} CDC_{a-i}} - \frac{\sum_{i=1}^{WR} GNC_i}{\sum_{i=1}^{707} GNC_i} \right) \quad (2)$$

The first part of the formula calculates the proportion of connectivity represented by city a 's connections CDC_{a-i} with cities located in world region WR ; the second part calculates the proportion of connectivity represented by world

region WR in the world city network at large. A positive value of WR_a therefore implies that city a has, on average, relatively strong connections with cities located in that world region; a negative value of WR_a implies that city a has, on average, relatively weak connections with cities located in a world region. The larger the absolute value of WR_a , the stronger the tendency. Calculating equation 2 for all nine world regions produces a comparative overview of the regional tendencies that are present in a city's global network connectivity. These values are shown on radar diagrams, with values close to the centre representing weak connections and values at the fringes representing strong connections.

Globalism, Localism, and Global Orientation

Another take on the geography of city-dyads is to contrast the relative strength of a city's local connections (its 'Localism') – more narrowly defined here as connections within its own world region – with the relative strength of its connections with leading world cities New York and London ('Globalism'). Globalism and Localism provide interesting windows into the distribution of city-dyads in their own right, but can also be combined into a single measure gauging the balance between both through the concept of 'Global Orientation': in cases where Globalism is stronger than Localism, a city's connections tend to be focused on the leading dyad in the global economy rather than on cities in its own region.

Operationalizing 'Globalism' as the relative strength of a city's connections with New York and London (NYLON), and 'Localism' as the relative strength of a city's local connections within its own world-region leads to the following equations:

$$Globalism_a = 100 * \left(\frac{\sum_{i=1}^{NYLON} CDC_{a-i}}{\sum_{i=1}^{707} CDC_{a-i}} - \frac{\sum_{i=1}^{NYLON} GNC_i}{\sum_{i=1}^{707} GNC_i} \right) \quad (3)$$

$$Localism_a = 100 * \left(\frac{\sum_{i=1}^{Cities\ in\ the\ same\ WR} CDC_{a-i}}{\sum_{i=1}^{707} CDC_{a-i}} - \frac{\sum_{i=1}^{Cities\ in\ the\ same\ WR} GNC_i}{\sum_{i=1}^{707} GNC_i} \right) \quad (4)$$

The interpretation of the results of these measures is similar to the one presented in the world-regional example: a positive value for $Globalism_a$ implies that city a has on average relatively strong connections with NYLON; a positive value for $Localism_a$ implies that city a has on average relatively strong connections with cities located within the same world-region. In addition, the larger the absolute value, the stronger the tendency. Both measures can then be combined to gauge the Global Orientation of city a 's connections:

$$Global\ Orientation_a = Globalism_a - Localism_a \quad (5)$$

A positive value for Global Orientation suggests that a city is more strongly connected to New York and London than to cities in its own world-region; a negative value implies that a city is more strongly connected to cities in its own world-region than to New York and London. The larger the value, the stronger the tendency.

Connectivity change

GaWC has been engaged in world city network analysis since 2000, with data gatherings carried out in 2000, 2004, 2008, 2010, 2013, and 2016. Having

different snapshots of the world city network allows analyzing the trajectories of cities, and this is the subject matter of a final set of measures focusing on change.

Although the premises underlying the various data gatherings have not changed, the overarching framework for choosing firms and cities has been revised and improved over time. For example, the selection criteria for the inclusion of firms and cities were markedly different. For example, in 2000 a total of 100 firms were identified in six sectors: 18 in accountancy, 15 in advertising, 23 in banking/finance, 11 in insurance, 16 in law, and 17 in management consultancy. Meanwhile, a total of 315 cities were selected so that a 315 cities x 100 firms' service value matrix was created.

Over the years, both the number of cities and firms and the inclusion criteria have been revised. We now use a predefined number of firms from each sector (e.g. 75 in financial services and 25 in law), selected via independent rankings of their importance as discussed in Appendix A. This new framework has put the data collection on a new and sounder footing: results are more statistically robust given the large number of leading firms from each sector, while the larger number of cities ensures a more balanced coverage of potential world cities. In this report we focus on changes in global network connectivity in the period 2000-16 (the whole period of data collection) and 2010-16 (post-financial crisis). In the below, we will focus on the example of 2000-16 change, but the rationale is exactly the same for assessing 2010-16 change.

The simplest way to examine change would be to look at shifting ranks. However, inter-city relations are not a simple zero-sum game with 'winners' and 'losers'. A

better way to start looking at a city's connectivity change is therefore simply calculating the level of change in a city's global network connectivity

$$\text{Absolute GNC change}_{a,00-16} = \text{GNC}_{a,16} - \text{GNC}_{a,00} \quad (6)$$

Positive values indicate rising levels of global network connectivity, negative values declining levels of global network connectivity. However, change is much more than a matter of rising/declining levels of global network connectivity, as evidenced by the near-general growth in connectivity (i.e. globalization) we find in our data. We therefore developed a methodology that allows for a more nuanced assessment of relative change in the world city network.

One of the limitations of simply looking at changing levels of connectivity, presented as percentages is the possible underestimation of change at the higher ends of the scale. This problem consists of two components: (1) a measurement problem in that higher ranked cities have less leeway to increase their connectivity because they are nearer the limit of the measurement scale (i.e. a city with a global network connectivity of 95% can only increase its connectivity with 5%, while London simply cannot) and (ii) a conceptual problem in that the markets of higher ranked cities are closer to saturation in that they have less leeway to acquire more/larger/more important offices (i.e. a city where all major service firms have a major office can hardly become more important in the office networks of these firms). In addition, there is also a third practical problem of an altered balance of firms across sectors since 2000 – the proportionally larger number of law firms in 2016 may imply that cities with a relatively large number of law firms appears to have become more connected on account of this. Ideally,

these three problems need to be controlled for in a relative measure of connectivity when comparing connectivity change across cities.

Our solution consists of three consecutive standardizations that remove each of these problems. First, the practical issue of the different service mix is dealt with by adjusting the calculation of connectivities in 2000 so that the same 'service mix' is used as in 2016. Second, the measurement problem of the closed number system is tackled by generating standardized measures of connectivity change producing an open number sequence pivoting on zero. And third, the conceptual issue of possible market saturation in cities that were already well connected in 2000 is addressed by using the standardized residuals from a linear regression between our standardized measures of connectivity change and global network connectivity in 2000. In other words, relative measures of global network connectivity change measures can be understood as the actual level of change after accounting for the possible underestimation of change in major service centers because of small, but statistically significant processes of market saturation. This triple transformation produces a standard normal distribution in that its average is 0, its standard deviation equals 1, while statistical testing shows that this distribution can be considered to be a normal distribution. As a consequence, our measure of change can be interpreted as a z-score. For example, cities with an absolute value of Relative GNC Change ≥ 2 have witnessed exceptional connectivity change, while cities with a value close to 0 have seen a connectivity change in line with the change in the distribution at large. We emphasize that results need to be interpreted as a relative measure vis-à-vis the entire distribution: in the face of the overall rise of connectivity in the world city network, a low-ranked city in 2000 that has been gaining in connectivity in recent years can have a negative value if other cities in the

distribution have – on average – been gaining more connectivity. This measure therefore complements rather than supplants Absolute GNC Change.

Appendix D-1: Producer Service Portraits of Chengdu

Standard Chartered

The bank's Chengdu office opened in 1994. Listed in three markets, India, Hong Kong, and London, the bank has been in China since 1858 with its first branch is in the prestigious Shanghai Bund. Its domestic Chinese business has expanded since the bank received its RMB license in 2007 and it now has branches in four regions of China. Regional head offices are located in the east, Shanghai, northeast, Beijing, southeast, Shenzhen, and Southwest, Chengdu. The Chengdu Branch Manager is therefore also the Regional General Manager for four cities in western China, Chongqing, Xi'an, Kunming and Wuhan, in addition to Chengdu where the office in the Times Square international financial centre, is where corporate business is based.

The bank has five products, corporate finance, transactions, financial markets, retail, and wealth management, and is particularly strong in four world regions: Africa, the Middle East, Asia and America. Its international office network and organization allow the bank to trade cross-border in consistency with China's 'belt and road' vision, with about 70% of its network of countries strongly matched, (Russia/Eastern Europe where the bank does not have a network, being the exception).

China's coastal cities boom has slowly come inland and to western China and Chengdu is prominent in this growth with many companies going national, increasing the corporate banking market.

All of the bank's products are designed and managed centrally at group level, which could be Hong Kong or Singapore, where the financial markets are advanced and open, legally and financially. The network provides the platform for internationalization because the bank is able to use those parts of its network to provide innovative products that help domestic company clients to expand overseas. There is a programme to ensure the availability of all products anywhere and a match with local needs. In whichever markets in whichever countries, local product managers feed back to the centre on any necessary deviations required to localize and use products locally, and all solutions are documented and tracked centrally.

Because the bank is governed not only by local regulations but by UK regulations as an incorporated English bank, it must fulfill all the US and EU sanctions and therefore may be less flexible than some Chinese banks. However, this is advantageous in many situations due to the consistency of and similarities between its products. When a customer wants to expand to another country, the bank can support that by combining network centrality and locality, communication and feedback to ensure that superior products are suited to the market. For mergers and acquisitions in overseas markets, the bank often knows the tax, legal and political sensitivities in both local markets because it has experience in many markets.

Chengdu internationalization has increased in recent years and the bank expects this trend to continue subject to the Government's approach and persistency, for example, in ensuring that financial regulation promotes this activity. If certain financial regulations are too stringent, it is very difficult for the bank to conduct those transactions and it may have to stop engaging in some activities that

support internationalization. It is important for Government to understand that banks are participating and developing innovative products in whole eco-systems. The legal, consultancy etc., firms are all coming into Chengdu now, however, the Government must promote investment oriented policies to attract more of these corporates. The first step should be encouraging the banks to come, the rest will follow and the entire eco-system will develop and flourish, all flooding into the city. But this all depends on how willing the Government is to promote direct foreign investment, or foreign investment that comes from other cities. China is more complex than other countries because its geographical mass is even bigger than that of Europe which has many countries. In China, every province has its own strategies which may focus on different industries that constitute the complex eco-system as a whole.

For example, in the high-tech/technology sector where there are big data centres, more students and employees are crowding into the ecosystem, so all the Chinese companies are there. Government understanding of industry clustering drivers is therefore needed for the promotion of investment and for the whole ecosystem to flourish with banking, legal and consultancy firms, and everyone covering a place. The bank cooperates and discusses these issues and the tools it needs to do more scoping of transactions, ensure that it doesn't cross the regulation red line and manages potentially risk for novel activities.

The Chengdu Government is doing a lot to promote foreign inward investment. For example, the Beijing and Hong Kong governments are coming to Chengdu for foreign investment. There is a lot of growth with 200 of World Fortune 500 companies in Chengdu, Bell, Intel, and many other high-end manufactures, and

that helps the bank to position itself locally and globally on account of its network overseas. The bank is able to help to set up trade that could be in Hong Kong, Singapore, or elsewhere, and that assists in cash management for a local entity that is trying to grow abroad, providing an international perspective, including for SMEs. In Chengdu, the bank is doing much better than any other foreign banks in lending to SMEs because it has a very good selling product pool (the Business Instalment Loan). While other banks can copy the products, they can't copy how the bank measures viability and risk based on its international network experience.

The bank's Chinese mainland-Hong Kong network is very advantageous. A lot of Hong Kong revenues originate from China because when many corporates decide to expand abroad, the first destination in the region will always be Hong Kong. More than 50% of the entire central group revenue entry is in North Greater China (China, Hong Kong, Taiwan, Korea and Japan). So the collaboration between China and Hong Kong has been very good in that respect and the bank is excited by the Greater Bay Area Hong Kong, Macaw, Taiwan/Thailand, Shenzhen initiative.

Dacheng/Dentons

Globally, the English name of the firm is Dentons and the Chinese name is Dacheng. The firm is in 60 countries with 147 locations and 7,600 lawyers, 3,800 of which are in China. Its practices cover corporate, M&A, securities and capital markets, private equity and investment funds, state-owned enterprise, international trade, intellectual property and technology, foreign direct investment, banking and finance, outbound investment, real estate and

construction, tax, employment and labour, litigation and dispute, mining, energy and natural resources.

Prior to the combination of the two firms in November 2015, Dacheng was the biggest law firm in China with its headquarters in Beijing established in 1992 and 44 branches throughout China. The office in Chengdu was founded in 2001, and now has about 200 professional and 15 supporting staff such as in the HR and finance departments. When the two firms combined, Dentons was one of the leading law firms globally, with offices in Europe, South America and Asia, and in mainland China, in Beijing and Shanghai. Due to both the strong reputation of both firms in the market, both names were retained after their combination.

There is no substantial difference between the services for law firms in China but there are many differences with offices in other jurisdictions such as New York, Singapore and other developed markets due to different legal systems, regulatory requirements and professional levels. For example, in developed legal systems, offices are normally stricter in recruiting lawyers based on their practicing area, they invest more in infrastructures of the firm, branding, marketing activities and office buildings etc., and they have a higher percentage of supporting staff.

Since China introduced the Belt and Road initiative, many of the firm's local clients have been incentivized to expand overseas and many projects have emerged in this area in Chengdu during the past two years. For example, because Sichuan is rich in hydropower resources, a client with related management and technology in constructing and managing hydropower projects is now branching out overseas where there is a need for hydropower for example, in Africa close to

Pakistan. Dacheng doesn't have offices in Pakistan but it has a network, a legal alliance which allows it conduct local work in jurisdictions where it is not allowed to have an office. Where language would be an obstacle to conduct legal consulting, the firm works with the local office to help clients there. So Dacheng benefits hugely from Dentons global network. Last year, more than 1,000 partners met in the office in Toronto for the firm's annual meeting which is held in different office each year so that partners from different offices intermix. Last year the meeting was so large that it was held in an exhibition centre.

In terms of incoming work, many international firms want FDI in Chengdu and Dacheng will provide legal services appropriate for their business operation. Chengdu was once less developed compared to Beijing and Shanghai, especially in the service industry, so many investment companies sent legal support from Shanghai and Beijing lawyers. But now, the Dacheng team has become increasingly strong so that more and more clients who need a law service in Chengdu trust the local office to provide it. Dacheng also provides legal services to and cooperates with many service providers in Chengdu, an important example being banking and also accounting firms. Companies with global business requirements like to approach legal firms like Dacheng because they know it has a global network and that will help them a lot. So they ask the firm to put together a team of lawyers globally, for example, a team with five lawyers in Chengdu and five lawyers in London which takes instructions from the client locally in Chengdu and overseas. A benefit for the client is that it doesn't need to communicate with different lawyers from different jurisdictions.

Dacheng is putting continuous effort into interacting with other offices through the network, giving the firm in Chengdu a better understanding of practices

elsewhere and how teams work on different transactions. Movement of senior leaders allows better understanding and cooperation in the network. Most of the graduates the office recruits in Chengdu are from top local universities.

Furthermore, many graduates have studied overseas and then come to Chengdu for work and increasingly graduates are coming to Chengdu from famous universities in Beijing or Shanghai, even if they were not locals originally. Some of them have said that the reason is because they believe there are more opportunities in emerging cities like Chengdu. Chengdu also has a very good reputation for its relaxing lifestyle, however that is less likely to be a relevant influence in law firm recruitment. The main factors are likely to be that the living cost is lower in Chengdu and there is good potential in this new market.

Legal services are related to regulation and policy changes, and a change of policies can bring huge potential opportunities in legal service markets. For example, in 2008, there was a release of new contract law and there were big changes compared to previous labour law regulations. After that, legal services for labour law were booming, because international firms needed to review all the previous law regulations and practice. So the firm mainly makes changes based on external changes and conditions. When foreign firms invest into China, the regulation is not very sophisticated yet. Regulation may be strict, but the firm can let clients know whether there is a difference between regulation and practice, and how flexible it can be. In terms of legislation, based on China's legal system, most substantial legislations are at central government level and the scope for local government is very limited. Nevertheless, certain investment incentives could help to attract investment. Regarding legislation, which is complex, the advice of experienced practitioners is required.

Chengdu has progressed hugely in recent years and it will become a global city due to its abundant resources. It has the foundation of education and technology, many parks and, most important, a strong professional services industry which is attracting international companies and top talent.

PWC

Around the world, the firm's network is in 158 countries with more than 236,000 people who are committed to delivering quality global services in audit and assurance, advisory and consulting, and tax services. In China, there are more than 23 offices, such as in Beijing, Shanghai and now in Chengdu. In the China mainland, Hong Kong and Macau network, there are over 850 partners and over 22,000 people providing services in diversified areas. The Chengdu office was opened 2015 and its services include audit and assurance, tax and technology to program software to help clients handle tax, etc., automatically. The assurance service centre in Chengdu has more than 800 people supporting front work, connecting to people or doing financial work.

The firm has always focused on technology and innovation. An innovation centre was built last year in Shanghai and others will be built, for example in Chongqing. With the Government, the firm considers how its professional expertise can speed up innovation, or help startups to grow quickly, for example, by introducing them to big companies through its network. In Chengdu, the firm cooperates with the Government bodies, such as the new economy department focusing on unicorn companies and other innovation areas such as big data and health care, and providing professional services such as auditing, and guiding them to train companies and grow up quickly. The innovation centre will also explore high potential business in Chengdu and Chongqing through the network.

The technology service team is established in only three cities in China, Hong Kong, Shanghai and Chengdu. Since being established in Chengdu, it is expanding very quickly because there are many IT engineers and experts, for example, at the high tech park in the south of Chengdu. There are many software companies and the firm has employees from several companies such as Tencent, IBM, etc. Technology is very important for consulting industries and the strategy is to improve auditing and consulting using technology. It is used for programming to help clients and provide more automation in accounting tax, saving labour force and avoiding mistakes. For example, a finance robot can help record financing information and do the repeat work, and help the engineers.

Many of the firm's clients have many stores across China and the world. They need to hire many employees, for example, they need to hire an accountant in each store, so the labour cost will be very high. Now the firm can directly give them an accounting system to help them to do calculations very quickly and have fewer employees. PWC in Chengdu just has audit and assurance, and a tax service right now but it will expand the advisory and consulting service. It helps government bodies, such as Chengdu Bureau of Commerce and Chengdu Free Trade Zone. It performed as a third party to evaluate their creation scores and what was needed to improve them in the future. It also cooperates with other bodies to give them strategy planning and other services, such as research, to give them the background on the companies they want to interview or visit.

The firm has around 20 to 30 people in each part of the service, audit and assurance, and tax as well as the technology service. For junior staff, it has many talented graduates from top local universities in Chengdu. Some junior staff are sent to cities such as Shanghai for training in their first year and senior

management come from offices in Shanghai or Hong Kong. For each team, there are several partners and a partner in Shanghai usually travels to Chengdu several times a year to communicate with clients and instruct the local team. The tax partner based in Chengdu worked for several years in other big cities such as Beijing, Shanghai, London and New York to gain knowledge of international tax principles and other specific areas. The technology team partner has a base in Hong Kong and may travel to Chengdu two or three times a year, also communicating often through the Internet or by phone.

The global network is advantageous in Chengdu. For example, last year, a client who wanted to invest in Spain and buy a company needed to know about Spanish tax policies. The local office connected them with PWC in Spain through the network and the Spanish team gave the local team details of Spanish local tax policies and the sub-cities the client could apply for. Chengdu is interesting in China because it is more diversified. The firm is helping many enterprises and negotiating with the Government on their behalf if they have disputes concerning regulatory environment and tax. At the same time, the government is a client of the firm for organizational planning, industrial analysis and planning for the city from the district level. And the Government supports firms like PWC, for example, in accessing potential clients. The firm uses its expertise, such as industrial understanding of companies which may invest in Chengdu, to help the government better plan the industry chain for the city. The firm may also contribute to policy making to improve targeting and leveraging its relationships with clients serviced directly and nearer to the market, and understanding of their needs, requests and what will be most helpful.

The other Big Four are the firm's main competitors in Chengdu - KPMG, EY and Deloitte - which have been in Chengdu for more than 10 years. Most of the time, PWC doesn't directly compete with local firms because its market targets are quite different. Clients of smaller companies may not care about professional service for cost reasons. The firm's service is more specific to a certain problem as opposed to a series of relevant answers provided by local consulting firms. In 2015, there were just four people and now there are 80 people. So the first change was the firm became more famous in Chengdu and then the service expanded and more people are being hired, some coming from PWC offices in other cities such as Hong Kong. Revenue has also grown very fast with a growth rate of more than 50%.

PWC regards Chengdu as a potential booming point in China and as the headquarters office of the West of China, also cooperating with other offices in China about technology and tax projects. The market is new, changing and developing statistically, and that will help the firm to develop cities like Chongqing, Xi'an and other cities of the western region of China. The professional level of clients from different parts of cities differs, so to solve problems, each office needs to spend more effort to deal with it. PWC China really supports the Chengdu office because it sees it as a potential city for the firm's growth.

DTZ/Cushman & Wakefield

Founded in New York in 1917, Cushman & Wakefield's business is now global. Its predecessor firm, DTZ, was founded in Birmingham, England, in 1784. Its services include planning, design and build, marketing, sales and leasing, retail, office, residential, industrial and logistics consultancy and agency, property and

facilities management, asset solutions, and project and building consultancy, and disposal and acquisitions investment and valuation advice. The firm which has been in China for 20 years has an important role in bringing people, concepts and ideas to Chengdu and supporting companies going out of Chengdu.

In 2017-18, 67 graduates were recruited into the consulting business, and of those, 31 were international graduates. Finding staff is very difficult in third-tier cities so if you try to run a business in Qingdao or Shenyang it is very hard to find the appropriate staff. If a firm gets a big project in Qingdao, it gets staff from Beijing or Shanghai or Hong Kong because that is where the market is bigger and the talented people are. There are around 150 people in the Chengdu office, mainly from Sichuan, with varied educational backgrounds including bachelor and masters' degrees in international relations, architecture, planning, finance, financial investment, marketing, real estate research, land resource management, geography, transportation economics and electronic engineering. 10 years ago, it was quite difficult to hire people in Chengdu but the market is rising and the firm is hiring a lot of graduates with an international background and diverse expertise, for example, doctors and architects. Chengdu is one of the most attractive cities in China for new Chinese graduates because of the lower living costs, more relaxed lifestyle compared to Shanghai and Beijing, and the living environment and future fast development. For example, Tianfu New Area is focusing on high-tech and new materials R&D and manufacturing, IT and new economy companies incubation, which will drive further development and enhance people, capital, technologies, and connectivity with other cities.

Chengdu is very much a global market. Suddenly, all the firm's competitors are in Chengdu and are getting into the consulting space although there are still a lot of

opportunities in Shanghai, Beijing etc. The firm has a management system across the whole Greater China business and globally, linking Chengdu clients worldwide. Part of the role of the team is to link businesses in Greater China and Taipei with the rest of the firm's consulting businesses. Chengdu is growing quickly and is very keen to draw on global experience and learn how lessons can be applied to Chengdu. So for example, the firm works with the New York, London and Hong Kong offices to provide background on how the industry is changing and on how technology is improving in London to contextualize that for its local clients in Chengdu. Similarly, it tries to use that experience within China, for example, many clients in Chengdu and Chongqing want to know what happens in Shanghai and Beijing, because that national context is relevant in terms of doing something similar in Chengdu. The firm's Chengdu office is almost in the prime occupancy area. That is driven by the transactional side of business who want to be close to the landlord, close to the talent and doing the deals in the primary office base. In Hong Kong, its professional services sit in a cluster with architects, designers, local government and the financial sector.

With regard to, international investment in real estate in China roughly 60% is essentially domestic investment that has been recycled. Foreign funds are focusing on Beijing and Shanghai because the market is much bigger than that of Chengdu and there is a better taxation rate. So most of the deal volume is domestic but when looking at international flows, Singapore is almost always the first to get into the market. In Chengdu, the first large-scale international investment in real estate is Capital Land. Singapore goes in first and once established, Tokyo and United States investors may follow. Originally development was expansion from the first city ring to the second ring and the third ring. But right now after the expansion to the third ring, the city

government is trying to develop other dispersed areas or new areas and for new towns, so it cannot be the same as the previous expansion. There has to be some specialism, for example, education, health care, or new technology and publishing requires a bigger area for the city to do the expansion. This growth was driven by the city government having the policies to drive businesses there.

Outbound international investment benefits from the firm putting together a team. For example, for a Chengdu company doing a lot of tourist projects in Katmandu, the firm has a team of two or three people from Chengdu, who understand how the client's business model works in China and put them in touch with three people from the New Delhi office covering Katmandu who understand the local market. A project manager from Hong Kong who has dealt with the cross culture panel is put in to facilitate the communication. So several people from three different localities bring to bear a particular set of expertise. The firm looks at the stream of business and developments using its global expertise all across the world. The Chinese financial sector is very important in the firm's office groups. So for example, a Chengdu counterpart in Shanghai talks to someone in Belgium and someone in America, so you have a global specialization in areas that particularly interest the client in Chengdu. MNCs have upgraded their office to a western hub and local companies are expanding in different major cities in China and occupying more space in Chengdu to serve local people.

Education is one of the firm's biggest areas. It puts UK schools together with Chinese developers to help them to establish campuses internationally, drawing on its education team working with Malaysia, UAE and China offices to bring UK schools together with Chinese partners. For example, it works with an

investment group based in Chengdu to bring an international school to Chengdu. The UK team understands the priority of the school and the Chengdu office works with Chinese business and then together they work through the financial and education and asset management sides of the business with a law firm to work out the details of the contract. Health care is another big area. It starts with retirement housing and residential, moving into hospitals with big clients. All the big corporates in US hospital groups are looking really aggressive in China, sometimes independently, and sometimes incorporated with Chinese insurance groups or Singapore companies. There is a mismatch between enormous demand and little local knowledge.

The missing piece for the firm in Chengdu is the old DTZ business in America. So we usually work very closely with South East Asian DTZ, UK DTZ and a little with the Middle East and Africa, but America is the missing piece since a couple of years ago. So for example for health care, 70-80% of the investors are from outside the United States. In the same model, the firm works with the hotel groups to bring hotel and entertainment projects into China. New business in China is general aviation, logistics, pilot training, etc. A military airport changes to a civilian airport and runs both passenger and cargo services. General aviation is something really new, and this is again what the firm takes on and is what it understands globally, how China can bring in and face new opportunities, replicate some areas of the rest world, and this has been very active for two to three years.

And this is what has always happened, the firm has a new business come along, like general aviation, and China may go out for a general aviation network. It is continually revisiting what it is doing in an exaggerated space, and looking at

how you capitalize on that opportunity, and prepare for getting that built in China in 2021 or 2022. That is part of the reason the firm looks to its international experience. When it first did general aviation, it may have really needed to keep to two projects a year all around the world until it really understood what it needed to do. This happens in China because there get to being 25 projects a year for three years and then that will be the end of the business. The business model is do one in Rio, one in Johannesburg, and one in Poland. We can draw on our experience, but because what happens in China is constantly changing, we can't necessarily replicate models. A similar thing happened randomly because a client in China asked us to do project in Nigeria and since then the firm has done about 13 projects in Africa with the team in Johannesburg, and this is increasing around Sub-Saharan Africa with small teams in around 13 countries. Ethiopia has a state-led, government with an export-oriented development model and the Chinese group can understand this and take this back to the start to see what works in Chengdu based on the Ethiopia experience. In the last three to four years in particular, the team has started noticing the experience going around, with people saying can you help us understand what worked in China.

Appendix D-2: Interview Questionnaire

CHENGDU RESEARCH PROJECT

Research Questions

1. a) What is the name and the location of your company in Chengdu?
b) What is your current position and role in the company?
c) What was the business experience of the company's founder and what in your view are the reasons for its success story?
2. a) What business is your company currently engaged in?
b) For how many years or months has your company currently been engaged in this business?
c) What previous other business(es) not already discussed has your company has been engaged in?
d) What in your view are the main reasons for any change(s) in your company's business?
3. a) Does your company have any locations in other cities in China and/or in any other countries?
b) If the company has locations in other cities, how does it's business operations and staff in Chengdu differ, if at all, from its operations and staff in other cities?
c) Do you see that changing in the future?
d) What in your view are the main factors and types of support that have contributed to the company's growth and development?
4. a) How many employees and with which skills and expertise are currently working at your company in Chengdu and (if relevant) in the company in other cities and countries?
b) Do you see that changing in the future?
5. a) What if any are your views on the value-added for companies doing business in Chengdu of the city's connectedness to the local and global networks of 'financial and business service' suppliers located in Chengdu and/or other cities in China and internationally?
b) Are there any particular financial and business services suppliers located in Chengdu and/or other cities in China and internationally that in

your view are particularly important for the success of firms/producers doing business in Chengdu?

6. Is there any other information about how Chengdu is developing as a Chinese global city or about the role of financial and business services in Chengdu that are particularly important in this regard that has not already been covered in this interview?

Many thanks for your participation in this research.

Appendix D-3: Producer Insights into Chengdu

Business site visits were with:

XGIMI Screenless Projection, Tianfu New Area

XGIMI Screenless Projection, located in the Tianfu Software Park has a founder from Chengdu and started up in Chengdu in 2013. It has three production centres in Chengdu that benefit from local support, for example, low interest banking, skills available in Chengdu universities, the size of the China market and collaborations, for example, with Japan. International skills are available at the firm's United States Silicon Valley production centre, which also provides access to the US market.

FUHUARISK, Tianfu New Area

FUHUARISK is a new start-up company in Chengdu with investment and non-investment wings. Chengdu is the 'back office' of China for the financial risk market, however people are attracted to Chengdu for its work-life advantages. Chengdu is good for start-ups due to good government support such as low-cost premises. The financial mathematical model for risk management requires constant innovation. Founder experience in Shanghai and other developed cities, for example, the United States, is advantageous. Post-docs with relevant skills working for the firm for experience, are from Chengdu.

Railway Transit Base, South Tianfu New Area

The China Railway Rolling Stock Transit Industrial Park is making Chengdu an important rail transit industrial centre and an export base for rail transit equipment for the overland interconnecting infrastructure corridors to Belt and Road countries and for servicing the Yangtze River Economic Belt. Production and the assembly line have a large space requirement that is met at the firm's Tianfu New Area location.

Tencent, Tianfu 3rd Street, Chengdu

Founded in 1998 and with locations in Shenzhen, Beijing, Shanghai, Guangzhou and Chengdu, Tencent is a Chinese multinational investment holding conglomerate and a leading provider of Internet-related services and products, including social media, entertainment and gaming, artificial intelligence and technology in China and globally. The firm's Chengdu location reflects its role as a media services provider.

National Business Daily

Ten years ago, NBD set up its headquarters in Chengdu and has since grown into one of China's top financial omni-media. Its backbone is the combination of its English-language news website, its mobile app in traditional Chinese aimed at countries and regions along the Belt and Road, and its social media accounts on Twitter, Facebook and YouTube. NBD has formed collaborations with renowned financial media. As a news media company, NBD has over 50 million daily active users/readers in 205 countries and regions. It positions itself as a mainstream international financial media, focusing on the development of news content in general and technology and industrial development in particular. Recently, it

opened its first overseas branch in Silicon Valley. This is considered to be a first step for NBD in the building of a news network that will cover North America and the Asia-Pacific region, and should **b**ecome an important platform for enterprises located in Chengdu to go global.