University of Tsukuba
Graduate School of Humanities and Social Sciences

Master Thesis submitted in partial fulfillment of the requirements to be awarded the degree of Master of Arts

WORLD CITY NETWORK EXPANSION 2000-2004
An appraisal of the determinants of connectivity growth among world cities

By

Renato Aristides Orozco Pereira

(Doctoral Program in International Political Economy)

January, 2007

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DECLARATION

This Research Paper is my original work and has not been presented for a degree in any other University

……

RENATO ARISTIDES OROZCO PEREIRA

This Research Paper has been submitted for examination with our approval as University Supervisors

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PROF. HARALD KLEINSCHMIDT (Second Sub-Advisor)

ABSTRACT

The term *"globalization"* has long been vented indiscriminately everywhere with few being capable to either define or measure it. Cities are said to be at the forefront of the *"works of globalization"* by becoming coordinating centers for the transnational activities of multinational corporations. Ultimately, they become tied up to each other, as those activities require information inputs from different regions of the world.

This thesis uses the advanced corporate service firms' location patterns to measure the linkages between cities. The underlying assumption is that a pair of cities that have an office from the same service firm is more connected to each other than a pair without it. Because social, economical, cultural and political information about the cities flow through the firms' network of branch offices, a highly connected city provides better corporate servicing to businessman wanting to do business elsewhere.

By calculating the total connectivity of each city to the rest of the world, as well as total presence of global service firms within these cities, in the years 2000 and 2004, we produce a measure of the connectivity growth in the period. In a second moment, we use a linear regression model to test hypothesis concerning the determinants of connectivity growth in those cities.

Results show us that connectivity growth in a city, in case of firm's network expansion, display a *"rich-get-rich"* behavior on which well connected cities became even more connected. Furthermore, connectivity growth is responsive to competition, agglomeration economies, infrastructure, trade openness, human capital and the overall economic level of the country. Some of the variables behave differently according to the service firms' sector being analyzed. In particular, we scrutinize the role of human capital as a determinant of connectivity growth in the management and banking sector, and interpret the results as a function of whether the sector is skilled-labor intensive (management) or capital intensive (banking).

Key Words: *World City Network; Connectivity; Globalization; Interlock Network Model; Global City Model; Service Firms.*

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1. **INTRODUCTION**

This research aims at shedding some light on the determinants of connectivity growth among world cities. The assumptions and premises found on the following pages are deeply rooted in a broader, extensive (albeit young), research on world cities. On being so, the results that are found, as well as the interpretations given, should be located into the context of the previous studies of the subject, carried out in twenty or so years of world city research. Trying to locate this research outside this context will make it lose some of its significance, after all, the concepts used here, the hypothesis that were tested and the theoretical implications that were derived, can only be fully understood within the paradigm that was erected in the past. Therefore, I will try, in the following pages, to briefly summarize the origins and main contributions to the world city literature up to today.

1.1 The World City Hypothesis (1986)

The origin of "World Cities Network" is allegedly due to John Friedmann's "*The World City Hypothesis*"[1] (Friedmann, 1986) paper. Although his work was promptly criticized for not having any sound empirical support[2] (Korf, 1987), it became the backbone for much of the research and studies of cities in globalization. His main "hypothesis" is that:

1) *"The form and extent of a city's integration with the world economy and the functions assigned to the city in the new spatial division of labor, will be decisive for any structural changes occurring within it."*(Friedmann, 1995, p.318)

[1] Friedmann, J., 1986, "The World City Hypothesis", Development and Change 17: 69-83.
[2] Korff, R. 1987, "The world city hypothesis – a critique", Development and Change 18(3): 483-95

The participation of the city in the world economy (defined as the direction and volume of transnational capital flows) and the function it is assigned (i.e. functions of finance, management or production) in the new spatial division of labor (a concept akin to Wallerstein's[3] approach, which attribute a specific country to the core, semi-periphery, or periphery) will greatly impact its prospects for any structural change within it.

2) *"Key cities throughout the world are used by global capital as 'basing points' in the spatial organization and articulation of production and markets. The resulting linkages make it possible to arrange world cities into a complex spatial hierarchy."* (Friedmann, 1995, p.319)

Some "key" cities in the world are used as command & control bases for organizing and articulating production and consumption globally. Those "key" cities are termed by him as "world cities", and are arranged into a spatial hierarchy (ranking). By using Wallerstein categorization of countries as "core-countries", "semi-periphery countries" and "periphery countries", Friedmann sustains that world cities will be located only in core and semi-periphery countries, excluding a large portion of the globe from world city formation. He further creates two world city tiers (primary and secondary) into three sub-systems (Asian, American and West European sub-systems)[4].

3) *"The global functions of world cities are directly reflected in the structure and dynamics of their production sectors and employment.* (Friedmann, 1995, p.322)

[3] Wallerstein, I. 1979, "The Capitalist World-Economy". Cambridge: Cambridge University Press
[4] For a summary of Friedmann's original classifications of world cities (1986), please refer to table 1on the annex. For a summary of Friedmann's revised classification (1995), please refer to table 2 on the annex.

The global functions of world cities are related to the structure and dynamics of their productive sectors. Of particular contribution to those functions are corporate headquarters, international finance, transport, communications and business services. World cities also function as centers for the production and dissemination of ideas (information, news, best practices, culture, etc…)

4) *"World cities are major sites for the concentration and accumulation of international capital.* (Friedmann, 1995, p.322)

5) *"World cities are points of destination for large numbers of both domestic and/or international migrants."* (Friedmann, 1995, p.323)

6) *"World city formation brings into focus the major contradictions of industrial capitalism – among them spatial and class polarization."* (Friedmann, 1995, p.324)

World cities create raising inequalities. They are responsible for a widening gap of peripheral economies and rich countries (global scale), bringing interregional inequality in a given country (regional scale) and, by creating a high skilled, highly paid specialized labor and a unskilled, low paid labor within the city, also raise inequality at the metropolitan level (urban scale).

7) *"World city growth generates social costs at rates that tend to exceed the fiscal capacity of the state."* (Friedmann, 1995, p.326)

Finally, world city formation weakens the fiscal capacity of local governments, as they generate social costs related to the mass of lowly paid labor and infrastructural costs related to the upscale needs demanded by the transnational capital.

This first assortment about world cities, although lacking evidential support, motivated a series of other scholars to research deeper into the subject. After all his work was mainly theoretical, and without the empirical evidence, there was still much room for further discoveries to support or discard his views.

One much sought divergence, in particular, was about his locating of cities within a hierarchy (hypothesis number 2), by comparing their attributes (size, GDP/capita, infrastructure, population size, etc.). The problem, it was often said, is that he assumed that those cities are interlinked and the criteria he uses for creating a ranking of cities in this matter is either subjective or related to attributes (as opposed to relations) of cities. Relations in his analysis are assumed instead of observed. (Smith, 1995, p. 294)[5]

If it is the direction and volume of transnational capital flow between cities that matter, how can one propose a city hierarchy based only on their attributes? If there is an inability to measure and observe those relational flows, can we really conceptualize those cities into a "hierarchy" of cities?

1.2 The Global City (1991)

Saskia Sassen contributed with her much acclaimed "*The global city: New York, London, Tokyo*"[6] (Sassen, 1991). Her book tells us how New York, London and Tokyo became command centers of the global economy and what kind of change came with this. Sassen makes her point by using those three cities as case studies in order to create a theoretical

[5] Smith, D and Timberlake, M. 1995 "Conceptualising and Mapping the Structure of the World System's City System". Urban Studies, 32 (2):287-302
[6] Sassen, S. 1991, "The global city: New York, London, Tokyo." Princeton: Princeton University Press

argument on world cities. In a follow-up of her ideas, in "*Cities in a world economy*"[7], she extends her analysis to more cities showing how those have evolved into transnational market "spaces". For her, even though production itself is becoming decentralized into many places in the world, function of command and control of this global production are more and more concentrated only in a few of those global cities.

Sassen defines global cities as those that:

> *"are strategic sites in the global economy because of their concentration of command functions and high-level producer service firms oriented to world markets; more generally, cities with high levels of internationalization in their economy and in their broader social structure*." (Sassen, 1994:154)

She further describes the new functions of those cities in the context of globalization, emphasizing their role as (1) command centres for the organization of the world economy; (2) marketplace for financial and specialized corporate service providers; and (3) centres for the production of innovations. (Sassen, 1991, p. 3-4)[8] (Sassen, 1994, p. 4).

She also describes the mechanisms which allowed cities to acquire those new functions and shows evidence supporting her arguments for the concentration of those on world cities.

As for the mechanisms, she claims that, with the spread of new telecommunication technology, international trade and post-fordist flexible production (different firms, geographically dispersed, became integrated globally in the production of their goods),

[7] Sassen, S. 1994, " Cities in a world economy." London: Pine Forge Press

[8] *"These cities now function in four new ways: first as highly concentrated command posts in the organization of the world economy; second as key locations for finance and specialized service firms, which have replaced manufacturing as the leading economic sectors; third, as sites of production including production of innovations, in these leading industries; and fourth, as markets for the products and innovations produced."* (1991, p. 3-4)

production of goods became dispersed both within and between countries. Geographical dispersion of production activity and enhanced communication possibilities could potentially make cities obsolete, except that she points out that ownership is also becoming increasingly concentrated in few powerful firms which operate globally. In order to produce globally, it is necessary to have the productive system well integrated. Finally, the combination of geographical dispersal of economic activities and system integration generated the need, by large corporations, for activities of command and control of their production / marketing activities. Ultimately, it is on large cities and more even so in global cities, that the appropriate infrastructure and corporate services[9] needed for this command and control activities are found. (Sassen, 1994, p. 18-24)

> *"Under these conditions, the territorial dispersal of economic activity creates a need for expanded central control and management if this dispersal is to occur along with continued economic concentration. This in turn has contributed to the strategic role played by major cities in the world economy today."* (Sassen, 1994, p.24)

Sassen's global city model can thus be summarized as a relation where territorial dispersal of production plants, especially in the international level, raises demand for advanced corporate producer's services (banking, accounting, advertising, management, legal, etc.). Economic globalization has raised the scale and complexity of international transactions, generating the demand for more services which can help activities related to

[9] In her own words: *"I see producer services, and most especially finance and advanced corporate services, as industries producing the organizational commodities necessary for the implementation and management of global economic systems (Sassen 2000: chapters 2-5). Producer services are intermediate outputs, that is, services bought by firms. They cover financial, legal and general management matters, innovation, development, design, communications, wholesale distribution, advertising, cleaning services for firms, security and storage. Central components of the producer services category are a range of industries with mixed business and consumer markets; they are insurance, banking, financial services, real state, legal services, accounting and professional associations."* (Sassen, 2001b, p. 18)

the centralized control functions of firms. As cities are key sites for the production of services for firms, we observe "world city" formation.

> *"At the global level, a key dynamic explaining the place of major cities in the world economy is that they concentrate the infrastructure and the servicing that produce a capability for global control. The latter is essential if geographic dispersal of economic activity – whether factories, offices, or financial markets – is to take place under continued concentration of ownership and profit appropriation. This capability for global control cannot simply be subsumed under the structural aspects of the globalization of economic activity. It needs to be produced. It is insufficient to posit, or take for granted, the awesome power of large corporations.*
>
> *By focusing on the production of this capability, we add a neglected dimension to the familiar issue of the power of large corporations. The emphasis shifts to the practice of global control: the work of producing and reproducing the organization and management of a global production system and a global marketplace for finance, both under conditions of economic concentration. Power is essential in the organization of the world economy, but so is production: the production of those inputs that constitute the capability for global control and the infrastructure of jobs involved in this production. This allows us to focus on cities and on the urban social order associated with these activities."* (Sassen, 1994, p. 76)

As for the evidence supporting her arguments, she uses mostly attribute data from the cities and firms. She makes a case for her claims of geographical dispersion of production and how vast are the number of affiliates of large corporations by showing figures on the number of parent transnational corporations and foreign affiliates by country (1994:21). She exemplifies her argument of increasing concentration of corporate producer's services by showing evidence of location patterns of banks and securities firms (1994:22-23), and of stock market capitalization in cities (1994, p. 23-24).

What distinguishes Sassen's work from Friedmann's is that she explains this "world citiness" process by the economies of agglomeration that pushes command and control functions of the firms to be located (by either locating headquarters or outsourcing those

functions) into the global city. While Friedmann's idea is that the international headquarters of cities will have incentives to be located in the world cities, for Sassen this might not be always the case as many firms may decide to keep their headquarters outside those cities[10] while outsourcing these coordinating functions to advanced corporate service firms (accounting, law, management, banking, advertising, etc.) located on those cities. The fundamental difference is that Sassen considers a world city as the place where coordinating functions are produced. Also, Sassen sees the cities in a system, instead of a hierarchy (1994, pp 47-52). As markets are integrated, overall growth is maximized through growth in all centers, implying no competition among global cities, but division of labor.

Finally, Sassen also points out that the literature on world cities needs to be addressed in a transnational perspective, focusing on the relations between the cities, as opposed to a focus on comparative studies (1994, p.7). She tries to address those when analyzing processes that happen in an integrated way in more than on city, notably when describing processes related to the financial sector in New York, London and Tokyo. But her main contribution was to identify corporate service providers as key facilitators / agents of those processes.

1.3 The Rise of the Network Society (1996)

Manuell Castells, on his "*The Rise of the Network Sociey*"[11] proposes a theoretical meta-narrative, which is often used for conceptualizing world city networks. According to him, *'…our society is constructed around flows: flows of capital, flows of information, flows of*

[10] This notion of multinational corporate headquarters deciding to locate outside global cities was corroborated by the results of empirical studies carried out by Lyons and Salmon (1995).
[11] Castells, M. 1996, "The rise of the network society". Oxford: Blackwell

technology, flows of organizational interaction, flows of images, sounds, and symbols'(1996: 411-12). As flows take such an active role in society, he goes into saying that cities' wealth and power are a consequence of the kind and intensity of flows that passes through them. He proclaims that society is emerged in this new economy, which is informational, global and networked.

> *"It is informational because the productivity and competitiveness of units or agents in this economy (be it firms, regions, or nations) fundamentally depend upon their capacity to generate, process, and apply efficiently knowledge-based information. It is global because the core activities of production, consumption, and circulation, as well as their components (capital, labor, raw materials, management, information, technology, markets) are organized on a global scale, either directly or through a network of linkages between economic agents. It is networked because, under the new historical conditions, productivity is generated through and competition is played out in a global network of interaction between business networks."* (Castells, 1996, p.77)

While those flows can take many different forms, as flows of people, capital, ideas and culture, cities must fulfill some infrastructural requirements (especially those related to microelectronic and telecommunication technology (1996, p.69-70)) to attract those flows. As those infrastructural capabilities are not evenly distributes between cities, it follows that most places can not compete with the most advanced cities and are just excluded from the process altogether.

His book, of course, is not specific to cities, but to a newly formed, globally ranged, "*informational society*", based on networking and brought up through recent technological advances in telecommunication. The logic he describes, notwithstanding, has been often applied, including in his own work, to cities. One of such mechanisms describes how the expansion of the network makes it more attractive for a *wanna-be-member* of the network.

> *"Moreover, when networks diffuse, their growth becomes exponential, as the benefits of being in the network grow exponentially, because of the greater number of connections, and the cost grows in a linear pattern. Besides, the penalty for being outside the network increases with the networks's growth because of the declining number of opportunities in reaching other elements outside the network… a simple mathematical formula showing how the value of a network increases as the square of the number of nodes in the net. The formula is* $V = n^{(n-1)}$ *where n is the number of nodes in the network."* (Castells, 1996, p. 71)

Cities, then, under the rise of a network society, especially when we think about the organization of firms as networks, find it increasingly more profitable to join the network. However, this is not always feasible. For one, they do not have agency power (firms, not cities, decide to organize themselves in networks). Secondly, because they often do not fulfill the infrastructural requirements needed for attracting firms (termed by him as network enterprises) that could enhance their position in the network.

The network enterprise for Castells is a type of model-enterprise, the one with most chances of being successful, in today's economy. It comprises many autonomous parts (firms, suppliers, buyers, etc.) which operate in an integrated way towards a common goal. In this sense, if we assume that Castells is right on his portrayal or modern firms as network enterprises, it is in accordance with Sassen's Global City Model in the sense that control & command functions of this integrated productive system becomes ever complex and expensive with geographical dispersal. Castells argues that the performance of network is dependent on its capacity to communicate between the parts and we can relate this to Sassen's work by arguing that it is the advanced corporate service firms that raise the efficiency of the network by enabling a better flow of communication between the parts.

In his own words, Castells describes the network enterprise as:

> *"To define more precisely the network enterprise, I need to recall my definition of organization: a system of means structured around the purpose of achieving specific goals…On the basis of these conceptual distinctions, I propose what I believe to be a potential useful (non-nominalist) definition of the network enterprise: that specific form of enterprise whose system of means is constituted by the intersection of segments of autonomous systems of goals. Thus, the components of the network are both autonomous and dependent vis-à-vis the network, and may be a part of other goals. The performance of a given network will then depend on two fundamental attributes of the network: its connectedness, that is, its structural ability to facilitate noise-free communication between its components; and its consistency, that is, the extent to which there is a sharing of interests between the network's goals and the goals of its components.*
>
> *… the successful organizations are those able to generate knowledge and process information efficiently; to adapt to the variable geometry of the global economy; to be flexible enough to change their means as rapidly as goals change, under the impact of fast cultural, technological, and institutional change; and to innovate, as innovation becomes the key competitive weapon. These characteristics are indeed features of the new economic system we have analyzed in the preceding chapter. In this sense, the network enterprise makes material the culture of the informational, global economy: it transforms signals into commodities by processing knowledge."* (Castells, 1996, p.187 – 188)

Global cities, for Castells, are those which serve as hubs in this networked flowing and transformation of information, which ultimately generates value. Each place has a defined function.

> *"Therefore, while the analysis of global cities provides the most direct illustration of the place-based orientation of the space of flows in nodes and hubs, this logic is not limited by any means to capital flows. The main dominant processes in our society are articulated in networks that link up different places and assign to each one of them a role and a weight in a hierarchy of wealth generation, information processing, and power making that ultimately conditions the fate of each locale."* (Castells, 1996, p. 445)

Critics to Castells' approach questions the empirical research carried out by him. Quantitatively and qualitatively, his array of evidential support is not very impressing. While the main points of his arguments are in the flows (links) between the cities, he only

uses as empirical resources data on the attribution qualities within the city (nodes). By looking into the nodes but without clear observations about the flows, his evidential support is mispecified. Richard Smith, (Smith, 2003[12]) voices a strong critique of Castells for exaggerating the importance of the network society (pretending to encompass the whole world), being too much technologic deterministic, too much abstract and void of agency (actors are seen as secondary to his analysis).

Far from accepting all of Castells' propositions as true, this research considers his work as a positive related literature to the study of world city networks. By proposing a general meta-framework explaining the mechanisms from which information flows, are appropriated and turned into knowledge in order to generate efficiency, Castells provide the meta-theory on which to locate (and eventually generate the missing evidence and test) world city network researches.

1.4 Global Networks, Linked Cities (2002)

Some interesting contributions about world cities were edited in 2002 in the book "*Global Networks, Linked Cities*"[13]. Being the work of 20 researchers, each one analyzing cities from a different perspective and using different methodologies, the book is a collection of 12 short articles. It brings insights from case studies (Mexico City[14], Hormuz Corridor[15], Sao Paulo[16], Beirut[17], Hong Kong[18], Shanghai[19], Buenos Aires[20] and

[12] Smith, R. 2003, "World city actor-networks" Progress in Human Geography 27 (1): 25-44
[13] Sassen, S. (ed.) 2002, "Global networks, linked cities." Routledge.
[14] Parnreite, C. 2002, "Mexico, The Making of a Global City" in: Sassen, S. (ed.) "Global networks, linked cities." p. 145-182 New York: Routledge.
[15] Keivani R. and Prasa, A. 2002, "The Hormuz Corridor: Building a Cross-Border Region between Iran and the United Arab Emirates" in Sassen, S. (ed.) "Global networks, linked cities." p. 183-208 New York: Routledge.
[16] Schiffer, S. 2002, "Sao Paulo: Articulating a Cross-Border Region" in Sassen, S. (ed.) "Global networks, linked cities.", p. 209-236 New York: Routledge.

Amsterdam[21]) and of some recently proposed methods and perspectives to analyze world city networks. Although the case studies enable us to see if the more general analysis apply to those specific cases and, further on, enable us to see details about world city formation that would otherwise not be detected, it is on the articles with a more general focus which I draw some insights interesting for this paper.

Although the book is composed of many articles, the general common framework that bounds them is the one proposed previously by Sassen's global city model. While production becomes globalized, central functions of firms become more complex and expensive. Firms outsource part of those services by hiring specialized advanced corporate service providers, which have, as a requirement for the kind of operations they perform, branches spread in several other world cities. Those services are seen as a kind of "commodity" that is produced in a more efficient way on world cities, explaining the agglomeration of service firms on those latter.

> *"By central functions I do not only mean headquarters functions; I am referring to all the top-level financial, legal, accounting, managerial, executive, and planning functions necessary to run a corporate organization operating in multiple countries. These central functions are partly embedded in headquarters, but also in good part in what has been called the corporate services complex, that is, the network of financial, legal, accounting, and advertising firms that handle the complexities of operating in more than one national legal system, national accounting system, advertising culture, and so forth and do so under conditions of rapid innovations in all these fields. Such services have become so*

[17] Huybrechts, E. 2002, "Beirut: Building Regional Circuits" in Sassen, S. (ed.) "Global networks, linked cities.", p. 237-248 New York: Routledge.
[18] Meyer, D. 2002, "Hong Kong: Global Capital Exchange" in Sassen, S. (ed.) "Global networks, linked cities.", p. 249-272 New York: Routledge.
[19] Gu, F. and Tang, Z, 2002 "Shanghai: Reconnecting to the Global Economy" in Sassen, S. (ed.) "Global networks, linked cities.", p. 273-308 New York: Routledge.
[20] Ciccolella, P. and Mignaqui, I., 2002 "Buenos Aires: Sociospatial Impacts of the Development of Global City Functions" in Sassen, S. (ed.) "Global networks, linked cities.", p. 309-326 New York: Routledge.
[21] Riemens, P. and Lovink, G, 2002 "Local Networks: Digital City Amsterdam" in Sassen, S. (ed.) "Global networks, linked cities.", p. 327-246 New York: Routledge.

> *specialized and complex that headquarters increasingly buy them from specialized firms rather than produce them in-house. These agglomerations of firms producing central functions for the management and coordination of global economic systems are disproportionately concentrated in an expanding network of global cities. This network represents a strategic factor in the organization of the global economy.*
>
> *These global control and command functions are partly embedded in national corporate structures but also constitute a distinct corporate sub-sector. This sub-sector in each city can be conceived of as part of a network that connects global cities across the globe through firms' affiliates or other representative offices, and through the specialized servicing and management of cross-border transactions."* (Sassen, 2002, p.8)

What the articles on this collection try to enlighten are what and how, within those world cities, is responsible for this enhanced efficiency on producing central function services. Is it the communication infrastructure on those cities? Is it gains of agglomeration? Is it the flow of information that travels between specialized service firms, with branches scattered on several world cities? Does history matter? Did Government intervene? How about the personal network of the dwellers of a city? Or are those and other variables all partly responsible for it?

Linda Garcia[22] thus analyzes the role of communication and information technologies into the locus of economic activities. She claims that we have to analyze what is the technology being deployed and how it is going to be used to make any conclusion as whether it will decentralize of centralize economic activity. Her research is relevant to mine as communication cost is one of the variables I use in the cross-section comparison among world cities, trying to ascertain the determinants of connectivity growth.

[22] Garcia, L., 2002 "The Architecture of Global Networking Technologies" in Sassen, S. (ed.) "Global networks, linked cities.", p. 39 - 70 New York: Routledge.

Of particular relevance is that, on anticipating changes in the networked economy, under her framework, she identified the following major technology advances of communication: increase in network reach; richer and denser information flows; increased network accessibility; more network flexibility; and finally, more network functionality. How will these technologies affect the organization and location of economic activities? She claims that because of over-accessibility of information, firms will need enhanced transnational networking capabilities. "*Thus, as companies spread their corporate boundaries they will need to make far more complex decisions based on information and data that reflect cultural and political disparities"* (Garcia, 2002, p.54).

If that is so, demand for "command & control" commodities (corporate services) from service firms with a wide geographical presence of branch offices will likely increase. Moreover, the agglomeration gains from the cities will also be evermore significative, as the more complex the information, more reflexive and interpretative effort is needed, making demand for face-to-face interactions to rise.

Also on the topic of communication technologies, Stephen Graham[23] shows a relationship between advanced telecommunications network and global cities. By using a survey which ranked competitiveness of a city telecommunication infrastructure[24], he shows that global cities concentrate "*the most communications-intensive elements of all economic sectors and transnational activities within small portions of geographic space"* (Graham, 2002, p.72)

[23] Graham, S., 2002 "Communication Grids: Cities and Infrastructure" in Sassen, S. (ed.) "Global networks, linked cities.", p. 71 – 92 New York: Routledge.

[24] This survey was carried out by the Yankee Group, a U.S telecommunications consultancy, and Communications Week International, and is based on technical assessment of tariffs, choice of networks and availability of services.

As a conclusion, Graham states that:

> *"The activities, functions, and urban dynamics that become concentrated in global city-regions rely intensely on the facilitating attributes of advanced telecommunications for supporting relational complexity, distantiated links, and snowballing interactions, both within and between cities. Such "telereliance" is particularly high in internationally oriented industries with products and services that are little more than telemediated flows of exchange, information, communication, and transaction, backed up also by intense face-to-face contact and supporting electronic coordination."* (Graham, 2002, p.88)

Clearly, telecommunication technology is essential for a world city. Telecommunication competitiveness is thus likely to be a strong determinant of overall connectivity of a city into the global economy. Nevertheless, it should be made clear that this is a necessary condition but not a sufficient. Any town can have fiber optic cables and that doesn't mean that it will become a world city.

Also of interest, was Smith and Timberlake[25] attempt to measure the relations between cities using data on airplane travels between cities. As this paper enter the realm of the empirical papers written on the subject, we will comment more on that in the next session.

The many case-studies presented throughout this book give us very nice intuitive ideas on what works on the making of a world city. Some interesting findings point to the role of business networks (personal, kinship, trust based relationships) in world city formation (the manuscript on Hong Kong[26] is paramount on that); government policies (Shanghai, Buenos Aires); and history (Sao Paulo, Mexico City).

[25] Smith, D. and Timberlake, M. "Hierarchies of Dominance Among World Cities: A Network Approach" in Sassen, S. (ed.) "Global networks, linked cities.", p. 117 – 141 New York: Routledge.
[26] Meyer, D. 2002, "Hong Kong: Global Capital Exchange" in Sassen, S. (ed.) "Global networks, linked cities.", p. 249-272 New York: Routledge.

Finally, one of the articles[27] (Taylor, 2002) proposes a methodology to measure the connections of cities, through service firms, following the framework proposed by Sassen. It relies on the analyses of a sample of London based service firms and their branches location on a sample of cities. They succeed at mapping the global networks of offices and further classify the cities according to their participation in the network. I will work on details of the methodology used in their analysis latter on, as their specification is central on my own work throughout this paper.

1.5 Empirical studies on World City Network

In 1995, yet another book[28] was edited with contributions of several scholars investigating on world cities. Interesting enough, its first article was from Friedmann, reviewing what was done in 10 years of world city research. The article, called "*Where we Stand: a decade of world city research*"[29], after reviewing the recent advances and discoveries in the research scholarship, exposed the main problem up-to-date:

> *"At the top we find the cities that are the subject of Saskia Sassen's researches: the command and control centers of the global economy, New York, London, and Tokyo (Sassen 1991). After that, the going becomes more contentious because* ***we lack unambiguous criteria*** *for assigning particular cities to a specific place in the global system."* (Friedmann, 1995b, p. 23)

After almost 10 years of world city research, the literature still lacked ways of measuring the importance of world cities as global coordinating centers of the world economy. No credible measure of the trans-national flows central to the analysis were identified or

[27] Taylor, P., Walker, D. and Beaversock, J., 2002 "Firms and Their Global Service Network" in Sassen, S. (ed.) "Global networks, linked cities.", p. 93-116 New York: Routledge.
[28] Knox P L and Taylor P J (Eds), 1995 "World Cities in a World System", Cambridge: Cambridge University Press
[29] Friedmann, J., 1995b, "Where we Stand: a decade of world city research" in Knox P L and Taylor P J (Eds) World Cities in a World System, p. 21-47 (Cambridge: CUP)

produced during those period, although some attempts had been already tried. Overall, the world cities theoretical bases were still underspecified and untested. This was also the opinion of Susan Clark about the whole volume while reviewing this book for the *American Political Science Review* (Clark, 1997)[30].

Notwithstanding, in the same volume, Smith and Timberlake[31] suggest that a possible way to conceptualize world cities is as central nodes in economic, social, demographic and information networks, which would allow for the flows to be measured[32] and the network of cities relationships to be mapped. In fact, in the same year they write an empirical paper[33] using airline data as estimates of the way in which 23 cities are linked by the movement of people. The basic problem with their advance, however, is that it measures broad patterns of flow but can not distinguish specific flows within those patterns (to set apart, for example, air travels by businessman, migrants or tourists).

The "evidential problem", in this way, still remained. It was raised again by Short et al.[34] in 1996 and followed by Taylor in 1997[35] and 1999[36]. Short et al., noted the absence of empirical evidence on the literature and proposed five observable indicators of world

[30] Clarke, S., 1997 "World Cities in a World System" (Review), in The American Political Science Review, Vol. 91, No. 1., p.237-238

[31] Smith, D., Timberlake, M., 1995, "Cities in global matrices: toward mapping the world-system's city system" in Knox P L and Taylor P J (Eds) World Cities in a World System, p. 79-97 (Cambridge: CUP)

[32] They build a four-by-three cell conceiving possible flows liable to be measured within a system of cities, classified according to their general form. This table can be found on the annex table 3.

[33] Smith, D and Timberlake, M. 1995b "Conceptualising and Mapping the Structure of the World System's City System". Urban Studies, 32 (2):287-302

[34] Short, J., Kim, Y, Kuss, M and Wells, H., 1996 "The Dirty Little Secret of World City Research". International Journal of Regional and Urban Research 20, 697-717.

[35] Taylor, P. 1997 "Hierarchical tendencies amongst world cities: a global research proposal." Cities 14(6), 323-332

[36] Taylor, P. 1999, "So-called "World Cities": The Evidential Structure within a Literature". Environment and Planning A, 31 (11), p. 1901-1904

city-ness[37], generating the first world city measurement obtained from empirical analysis, although data source was not relational, but based on attributes of the cities.

Taylor, by his turn, identified the problem impeding empirical work as *"a double deficiency of published data being both state-centric and dominated by attribute measurements"*(1997, p.323). As the right specification for doing empirical work on linkages of cities would be flows among those, the fact that most of the data available deal with flows between countries or attributes of cities, does no help for the research[38]. On analyzing the kind of data used so far in the literature (1999), he found out that, even though previous researches on the subject did try to gather empirical evidence (491 pieces of empirical evidence in seven books analyzed), attribute data (436) highly surpassed relational data (55), and not all of the relational data was on cities (only 31), but also about country data. Overall, the amount of city level relational data on those literatures was only 6% of overall empirical evidences presented![39]

Faced with this challenge, rooted on the inexistence of city-level relational data, Taylor's response was an invitation for scholars to join force in order to produce their own relational data (1997). A "*Global Observatory*" (latter renamed as GaWC [40] – *Globalization and World Cities Study Group and Network*) at *Loughborough University*, which would work as a public depository of the data. I will write about the

[37] The indicators were presence of: 1) major financial institutions; 2) corporation headquarters; 3) telecommunications; 4) transportation infrastructures; 5) global cultural events.
[38] One exception would be information on transport and communications, which are usually node oriented (airport to airport or phone code to phone code), but unless one can identify which passengers / phone calls relate to flows related to the activities related to coordination of the global economy (to follow Sassen's theoretical construct), we are bound to get reach nowhere with a large proportion of flows that are not related to those process (like, for example, tourist flows in the air travel data).
[39] For a table summarizing the use of empirical evidence by categories and book, see table 4 in the annex.
[40] Accessible at http://www.lboro.ac.uk/gawc/

accomplishments of the GaWC study group on the production of empirical data for world city research on the next section. It suffice to say by now that GaWC has over 200 research bulletins published by over 130 different researchers in its website, so that a whole range of different empirical approaches are documented there.

Some ways worth mentioning for trying to estimate the world city process were proposed by Beaverstock et al.[41] Their first technique is to, through 'content analysis' of 'business news' published in the main newspaper of each city, obtain a proxy data on the economic relations between the cities. Other technique proposed is through interviewing practitioners in key firms within the city in order to ascertain information about their migration between world cities. Finally, through analysis of the producer service office locations, they create an organizational measure of the relations between world cities.

The first method records place (cities, but also regions) in a sample of business news in each sampled city. Preliminary results (Taylor, 1997) using a sample of the front page of the business section of six American newspapers, analyzed 24 times through 1990 showed consistency with what was expected from intuition (New York was more cited in all newspapers, Miami had more references to latin America, etc.).

The second method is based on interviews with the human resource departments of major corporations in order to raise quantitative data on the re-location strategies for high skilled practitioners. A research following this methodology was carried out[42] focusing on the banking industry (Beaverstock, 2005) bearing some interesting results with respect

[41] Beaverstock, J.V., Smith, R.G., Taylor, P.J., Walker, D.R.F and Lorimer, H. 2000, "Globalization and World Cities: Some Measurement Methodologies", Applied Geography, 20 (1), 43-63

[42] Beaverstock, J.V., 2005 "World City Networks 'From Below': International Mobility and Inter-City Relations in the Global Investment Banking Industry", GaWC Research Bulletin 179.

to a career path (to which cities he was most likely to be re-located throughout his carrer) of an executive practitioner. The basic assumption justifying this approach is that international mobility of high skilled workers produces inter-city relations and world city networks 'from bellow'.

Finally, a third method proposed, which has generated a whole range of empirical studies on world city networks, draws on how advanced producer services have set branch offices throughout the world. By collecting data on head and branch office locations, we straightforwardly measure major investments by corporate service firms in offices across cities. Results from empirical studies using this method can be assessed on Taylor's seminal work "*World City Network: A Global Urban Analysis*"[43] and will be more comprehensively reviewed and specified on the next section.

Other researches mimicked this approach based on the location strategies of firms, but without limiting their analysis to corporate service firms and without differentiating for type of firms. A notable scholarship with this perspective is that from Alderson and Beckfield[44] (2004), using the 'Fortune 500' list of multinational companies and their subsidiaries. With this data-set, they produced a directed and valued matrix linking 3692 cities in the world and subsequently employed network analysis to evaluate their position.

Apart from that, many researches tried to estimate relations between cities, concentrating on non-economic transnational flows. Following the methodology of organizational locations, studies have been conducted on inter-linkages of cities relating to non-

[43] Taylor, P.J., 2004 "World City Network – A Global Urban Analysis" London: Routledge
[44] Alderson, A.S. and Beckfield, J. 2004 "Power and position in the world city system". American Journal of Sociology 109, 811-851.

governmental organizations[45], international organizations[46] and media conglomerates[47]. Another approach uses the communication infrastructure[48] (internet backbone) to specify the linkage among cities. Finally, a recent article proposed linkage between cities on the basis of a research output index[49] (analyzing co-authorships of publications from authors in two different cities). All of those different specifications generate interesting analysis and advances our understanding on world cities, showing the similarities and difference of position of cities in several types of different networks.

1.6 World City Network (2004) and the GaWC study group

The main contribution of the GaWC study group was the construction of a data-set and modeling[50] which can be used to measure[51] intercity relations (as conceived by Sassen's Global City Model) and its subsequent analysis. The construction of the data-set was based on the observation of the location of headquarters and branches from advanced corporate service firms from the following sectors: management, accountancy, banking, law, advertising and insurance. This allowed specifying the world city network as an "*interlocking network*" of shared branch offices of service firms within cities, allowing for measuring the global network connectivity of the cities.

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[45] Taylor, P.J. 2005 "New Political Geographies: Global Civil Society and Global Governance through world city networks." Political Geography 24 (6), 703-730

[46] Taylor, P.J. 2005b "Leading World Cities: Empirical Evaluations of Urban Nodes in Multiple Networks" Urban Studies, 42 (9), 1593 – 1608

[47] Kratke, S. and Taylor, P.J. 2004 "A World Geography of Global Media Cities" European Planning Studies 12 (4), 459 – 477.

[48] Townsend, A.M. 2001 "Network Cities and the Global Structure of the Internet" American Behavioral Scientist 44, 1697-1716.

[49] Matthiessen, C.W., Schwarz, A.W., Find, S. 2006 "World Cities of Knowledge: Research Strength, Networks and Nodality" Journal of Knowledge Management, 10 (5), 14-25

[50] Taylor, P.J. 2001 "Specification of the World City Network" Geographical Analysis, 33 (2), 181-194.

[51] Taylor, P.J., Catalano, G. And Walker, D.R.F. 2002 "Measurement of the World City Network" Urban Studies, 39 (13), 2367-2376

The interesting feature about the "*interlocking network*" model is that it follows the main theoretical assumptions of Sassen's theoretical "*Global City Model*". In her model, world cities are centers for the production of advanced services, meant to coordinate the geographically dispersed, yet integrated, production of large multinational corporations. Advanced service providers choose to locate on world cities, by their turn, because of cities' knowledge-rich environment and gains of agglomeration. Also, as they are basically dealing with transnational processes (for example, a law firm might have to provide information on the legal system of a country other than that where his client is primary based), their performance is dependent on its geographical presence in several world cities in order to provide the adequate service for their customers. As the "*interlocking network*" relies basically on the aggregate of the location of service firms networks within cities, it captures well the ideas expressed on the "*Global City Model*".

World city network formation is an outcome of global corporate location decision. In other words, cities do not have agency power in this model. They are simply the locus where firms decide to locate their activities. The "*interlocking network*" specification of the world city network enables it to be seen as a social network. Nodes are actors (firms) and links are social relations (informational exchanges within branches from the same service firm). Cities are then, connected through the links formed by firms within the city.

For a visual example of the "*interlocking network*", dealing with ten cities interconnected by three firms, please refer to the figure 1 at the annex.

With this specification of the world city network, many papers have been written identifying[52], mapping, ranking, performing network analysis and interpreting the results from the total connectivity level and inter-relations patterns of cities. A comprehensive collection can be found either in Taylor (2004) or at the GaWC homepage.

1.7 Conclusion from the literature review and proposal of this research

The literature on World Cities, albeit young, is quite rich on theoretical and empirical contributions. For the sake of this thesis, a major challenge was to delimitate my research within a specific framework and line of thought. The theoretical models presented by Friedmann, Sassen and Castells, although related, are quite different from each other. Likewise, the empirical work based on airplane flow, multinational corporation headquarters and service firm locations, although similarly analyzing world cities, deal with fundamentally different processes within world cities. The first imperative step of this thesis is to select which one of those processes is to be analyzed.

I choose to conduct my research following the theoretical framework of Saskia Sassen's "*Global City Model*" and the measuring techniques of Taylor's "*Interlock Network*". In the previous section I made a point on why the latter is a good specification of the former.

The reason I choose an approach based on corporate service offices locations is because they produce services which are crucial for the transnational economic activity of multinational firms. Hence, the degree on which such services can be found within a city can tell us a lot on the competitiveness (and, in a more abstract way, the world-citiness)

[52] For the GaWC inventory of World Cities, please refer to table 5 in the annex. For a more visual representation of this inventory, refer to figure 2 in the annex.

of a city. Also, as service firms organize themselves in a network of branch offices throughout the world and those branches work together in projects that bear relation to the geographical area in which they are specific located, we can think about a flow of information among them. This flow can take the form of fax, e-mail, letters, re-location of employees, business travel, reports, etc. They have in common the fact that the flow is directed from one office to the other and that they carry information vital to the doing of transnational economic activities such as specific, difficult to find, details about, for example, the tax, legal, cultural, political, managerial system of another region. Choosing service offices locations as the basis of my approach to study world cities allow me to capture both the informational inter-linkage between cities (through firms within cities) as the importance this bears for the city as a center of (command & control functions) production itself.

But, with so much written using this same approach and specification, what can my research add to the literature? My intention is not describing the world city network as this has already been done, as I pointed out extensively in the previous pages. My intention is to shed some light on to the determinants of world city formation. To discover what characteristics from the cities and from the economy of the country in which the city is located causes a city (through the location strategy of the firms) to have a high connectivity (number of links) to the other cities. Does the stock of human capital matters? How important are agglomeration gains? Does the size of the national economy matter? How about trade-openness? Why a given city occupies a certain central or peripheral position in the network? In summary, what can we learn about what makes a

city less or more likely to become connected to the world economy, as specified by the interlocking network model?

2. METHODOLOGY AND DATA-SET

I use Sassen's "*Global City Network*" as a theoretical framework and GaWC's "*Interlock Network*" as a way of providing a specification to this network and calculating the total connectivity (linkages to other cities) from each city in the network. By using a data-set with information on the location and size of 80 service firms in 316 cities, for the year 2000 and 2004, I calculate connectivity growth for each city. As a next step, I use two differently specified sets of linear regressions to test hypothesis on the relation of key variables with connectivity grow.

In this chapter, I present the models above mentioned and the data-set and variables used in my research, as well as some summary statistics

2.1 Global City Network Model

I carry out my analysis under the theoretical framework of Sassen's "*Global City Network*" (Sassen, 2001). In order to refresh the reader's mind, I proceed with a brief summary of her framework:

1) In recent years, there has been a systematic increase in the geographical dispersion of economic activities (Sassen, 2001, xix), even though they are still integrated globally, as those activities are carried out by huge multinational conglomerates.

2) Geographical dispersion of economic activities under a integrated command & control, increases the importance and complexity of corporate "coordinating"

(command & control) of those activities, generating demand for "seamless" corporate servicing (which are increasingly being outsourced). (Sassen, 2001, xx)

3) Corporate service providers agglomerate in a few cities, generating the emergence of "world cities", which specialize in the production of those services.

4) Service providers need to provide a seamless global service, so they seek to build a network of affiliate offices dispersed through the world. (Sassen, 2001, xxi)

My question can be summarized as which cities and why those cities, are the object of this formation of "world city" process.

2.2 The Interlock Network Model

For the specification of world city network, I use the "Interlock Network Model" (Taylor, 2001). The idea behind the interlocking network model is that cities are linked to each other by means of the linkage of the shared firms they have. The main assumption is that a pair of cities sharing the same service firms has more flows between each other than a pair of cities sharing no such firms. Also, we assume that those flows carry out vital information (the legal system, cultural characteristics, key business contacts, and managerial specificities) vital for doing business in that specific place. Below I will present the model in a step-by-step manner, together with a illustrative (thus hypothetical) example of how the model works for 10 cities linked up by 3 companies.

First, we consider a total number of *m* advanced produced firms (3 in our example) located in *n* cities (10 in our example). If a firm "j" is located in a city "i", we code it as

"1" and "0" otherwise. We call those observation as elemental attributes x_{ij} whereas firm j has a presence (1) or not (0) in city j.

This binary observations form a presence matrix, X. In the example bellow, Sakura Bank has an office in Chicago but does not have an office in Frankfurt.

PRESENCE MATRIX X

Firm (j) / City (i)	SAKURA BANK	DRESDEN BANKING GROUP	DELLOITE
Chicago	1	1	0
Frankfurt	0	1	0
Hong Kong	1	0	1
London	1	1	1
Los Angeles	0	0	1
Milan	0	1	0
New York	1	1	1
Paris	0	1	1
Singapore	1	0	1
Tokyo	1	1	1

Apart from the presence of a firm j in a city i, we also have information about the size of the firm, which we call the service value of the firm in a city. We measure those as v_{ij} and form a service value matrix, V. The idea behind this construction is that the larger the office, the more connections it has with other offices in the firm network. Note in the example bellow that the office of Dresden Banking in Frankfurt is larger than that one in Chicago.

SERVICE VALUE MATRIX V

Firm (j) / City (i)	SAKURA BANK	DRESDEN BANKING GROUP	DELLOITE
Chicago	1	2	0
Frankfurt	0	5	0
Hong Kong	1	0	2
London	3	1	3
Los Angeles	0	0	1
Milan	0	1	0
New York	3	3	5
Paris	0	1	1
Singapore	2	0	1
Tokyo	5	2	2

With the Service Value Matrix, V, we can calculate the total advanced producer services in the whole system.

$$S = \sum_i \sum_j v_{ij} \qquad (1)$$

In our example, S = 45

This total advanced producer services, S, can be decomposed into two measures relating to total advanced producer services of the firms and cities, respectively firm service status, F, and site service status, C.

Firm service status:

$$F_j = \sum_i v_{ij} \qquad (2)$$

(Total service value provided by firm F_j)

Site service status:

$$C_i = \sum_i v_{ij} \qquad (3)$$

(Total service value provided by all firms within city C_i)

Following our example, Sakura Bank has a firm service status, $F_{sakura} = 15$ and Chicago has a site service status, $C_{Chicago} = 3$.

SERVICE VALUE MATRIX V WITH FIRM AND SITE SERVICE STATUS

Firm (j) / City (i)	SAKURA BANK	DRESDEN BANKING GROUP	DELLOITE	$C_i = \sum_i v_{ij}$
Chicago	1	2	0	3
Frankfurt	0	5	0	5
Hong Kong	1	0	2	3
London	3	1	3	7
Los Angeles	0	0	1	1
Milan	0	1	0	1
New York	3	3	5	11
Paris	0	1	1	2
Singapore	2	0	1	3
Tokyo	5	2	2	9
$F_j = \sum_i v_{ij}$	15	15	15	

From Matrix V, we can derive a measure for the basic relational element for each pair of cities, linked by the branch offices of a single firm. This are the links between a pair of cities, derived from a shared office of one specific firm, considering also the size of the office in the equation. We will call those as the elemental interlock link, $r_{ab,j}$.

Elemental Interlock link:

$r_{ab,j} = v_{aj}.v_{bj}$ (4)

(Measures the relation between city a and b in terms of firm j)

In our example, the elemental interlock link for Chicago and Frankfurt in terms of Dresden Bank and Sakura Bank is respectively $r_{Chicago\text{-}Frankfurt,Dresden} = 10$; and $r_{Chicago\text{-}Frankfurt,Sakura} = 0$.

The aggregate from the elemental interlock link derived from all the firms is the aggregate city interlock link, r_{ab}.

Aggregate City Interlock link:

$$r_{ab} = \sum_{j} r_{ab,j} \qquad (5)$$

(Measures the relation between city a and b in terms of the sum of all firms j)

In our example, the aggregate city interlock link between Chicago and Frankfurt is the sum of their elemental interlock link in terms of Dresden Bank, Sakura Bank and Delloite, which is $r_{Chicago\text{-}Frankfurt} = 10$. Note that we have two elements here: first, the link generated by the shared office of Dresden Bank; and second, the value of this link (line value), generate by the size of Dresden Bank's office in Chicago and Frankfurt.

Taking one city at a time (egocentric analysis), the sum of the line values can be used to measure the total number of connections of a city with all the others. This is called the situational status of the city, N_a, and is merely the sum of all the links, weighted by their respective line values, binding together the firms within a city with all the other cities. It is, in network analysis terminology, the degree of the city.

Situational Status of the city:

$$N_a = \sum_{\substack{i \\ a \neq i}} r_{ai} \qquad (6)$$

(Sum of all the aggregate city interlock link for a given city "a" and all the other cities)

ELEMENTAL AND AGGREGATE INTERLOCK LINK AND SITUATIONAL STATUS OF CHICAGO

Firm (j) City (i)	SAKURA BANK $r_{ab,Sakura}$ a = Chicago	DRESDEN BANKING $r_{ab,Dresden}$ a = Chicago	DELLOITE $r_{ab,Delloite}$ a = Chicago	Aggregate City Interlock Link $r_{ab} = \sum_j r_{ab,j}$
Chicago	X	X	X	x
Frankfurt	0	10	0	10
Hong Kong	1	0	0	1
London	3	2	0	5
Los Angeles	0	0	0	0
Milan	0	2	0	2
New York	3	6	0	9
Paris	0	2	0	2
Singapore	2	0	0	2
Tokyo	5	4	0	9
SITUATIONAL STATUS OF CHICAGO, $N_a = \sum_i r_{ai}$ $a \neq i$				$N_{Chicaco} = 40$

The situation status of a city, N_a, is a measure of the total amount of connections of this city with all the other cities. For that reason, from here onward I refer to it as "total connectivity" of a city. Those values have central importance in my analysis as it is a measure of how well connected (in the quantitative sense, it does not tell us to whom a city is linked) a city is.

I will employ the change in the total connectivity of cities from 2000 to 2004 as a dependent variable of one of my regression models. Besides, I also use total connectivity of cities in 2000, in the aggregate form and disaggregated by sectors, as independent variables in order to test some hypothesis on world city formation.

2.3 The Hypothesis

My objective is to find the determinants of "world citiness", defined as the degree in which a city is connected to all the other cities through the network formed by advanced corporate service firms.

The determinants I focus in are the following:

- The effect of competition on growth of connectivity. My hypothesis is that growth of connectivity due to a particular sector (e.g. management) will be less in the cities which are already well connected by firm's networks within that same (management) sector as firm's location choice will try to avoid competition with same sector firms.

- The effect of gains from agglomeration on growth of connectivity. My hypothesis is that connectivity growth due to a particular sector (e.g. management) will be higher in the cities which are well connected by firm's network of a different sector (e.g. banking). This happens because those sectors are complementary into the servicing of the large multinational conglomerates and firm's location choice will seek the advantages brought by that complementariness.

- The effect of communication technology within a city on growth of connectivity. My hypothesis is that firms prefer to locate in cities where they can reduce their international communication cost.

- The effect of human capital stock within a city on growth of connectivity. My hypothesis is that firms prefer to locate in cities where they can find highly skilled

human capital and knowledge producing institutions (universities, research centers). By doing this, they would reduce their cost on recruiting and training activities.

- The effect of the countries' GDP on growth of connectivity. My hypothesis is that a country's main city (primary city, defined as being the city with the largest population in a country) will experience larger connectivity growth if its GDP is relatively larger because firms will seek to operate on countries with higher GDP, as this allows for more business opportunities.

- The effect of city population on growth of connectivity. My hypothesis is that firms prefer to locate on the largest cities, to benefit from gains of agglomeration.

- The effect of city quality of life on growth of connectivity. My hypothesis is that firms prefer to locate on cities with a better quality of life, in order to minimize compensation wages for expatriates workers.

- The effect of port infrastructure on growth of connectivity. My hypothesis is that port infrastructure will have no relation with growth of connectivity as the logistic and coordinating operations of an enterprise do not have to be located in the same city.

- The effect of airport infrastructure on growth of connectivity. My hypothesis is that cities with a better airport infrastructure will experience larger connectivity growth as service firms' activities demand a lot of air transportation as face-to-

face contact with clients and partners from other cities is routine in their operations.

- The effect of trade openness on growth of connectivity. My hypothesis is that cities located in countries that are relatively more engaged on international trade will experience more connectivity growth, as international trade transactions raise demand of advanced corporate services, motivating such a firm to locate in cities from those countries.

- The effect of local government affiliation to technical cooperation networks of cities on growth of connectivity. My hypothesis is that no relation will be found, as the former is a political arrangement of local governments and the second captures the economic (command and control) activities within a city.

- The effect of connectivity on growth of connectivity. Is there a "rich-get-rich" phenomenon on world city formation? Will cities that are already well connected become mechanically more connected with the passage of time? My hypothesis is that as the network grows, cities that are already part of the network will automatically become more connected to other cities (the new entrants on the network).

Because the functioning and network structure of each service sector analyzed here (accountancy, management, banking, insurance, advertising and law) are very different from each other, I expect some of the results to differ among sectors. In that case, I will try to explain what causes these differences.

Finally, as analyzing each one of those determinants as drivers of "*world citiness*" with a rigorous approach might be an excessively ambitious endeavor, I focus my interpretations mostly on the mechanisms behind the effect of human capital on world city network formation, notably on the difference among sectors.

2.4 The Data-set

I use the GaWC 100[53] and GaWC 80[54] data sets in my study. The first is a Matrix formed from 100 advanced corporate service firms and 315 cities in the year 2000 and the second is a Matrix formed from 80 advanced corporate service firms in the same 316 cities in the year 2004. Firms were selected based on the criteria that they have offices in at least 15 different cities, including one or more in Northern America, Western Europe and Pacific Asia. Cities comprise capital cities from all but the smallest states plus other cities of economic relevance. For each city, each firm is coded[55] according to its size / presence within the city: 0 – firm is not in the city; 1 – small office; 2 – medium office; 3 – large office; 4 – regional headquarter; and 5 – international headquarter. For more details on criteria for generating the GaWC 100 and GaWC 80 data, refer to Taylor, 2003. For a list with all the firms and cities in the data-set, refer to tables 6 and 7 in the annex.

From the GaWC 100 and GaWC 80 data-set I calculate the following information for each city:

1) Total Connectivity in 2000 (equation 6)

[53] ACKNOWLEDGEMENT: The GaWC 100 data-set was produced by P.J. Taylor and G. Catalano and constitute Data Set 11 of the GaWC Study Group and Network (http://www.lboro.ac.uk/gawc/) publication of inter-city data.
[54] ACKNOWLEDGEMENT: The GaWC 80 data-set was produced by P.J. Taylor who kindly allowed me to use it in this study.
[55] For information on the coding criteria, please visit http://www.lboro.ac.uk/gawc/datasets/da11_4.html

2) Total Connectivity in 2004 (equation 6)

3) Total Connectivity change 2000/2004

4) Site Service Status in 2000 (Equation 3)

5) Site Service Status in 2004 (Equation 3)

6) Site Service Status change 2000/2004

As for my independent variables, I use observations on the following:

Country based variables:

- Air Passenger Traffic (2000)
- Pupil to Teacher Ratio (1997 - 2002)
- Phone Cost (2000-2002)
- Trade / GNP (2002)

City based variables:

- Primary City * GDP (2000)
- City Population (2000 or closest available - UNSYB 2003)
- Quality of Life (2005)
- Affiliation to Metropolis (2006)
- Affiliation to UCLG (2006)
- Top University (2004)
- Container Traffic (2002-2006)

Country dummies variables:

- USA

- UK
- Germany
- China
- India
- Brazil

For summary information, description and data source on those variables please refer to table 8 in the annex.

2.5 The Regression model

In order to test my hypothesis, I use two different linear regression models. The first one employs connectivity change as dependent variable. The second one employs site service status change as dependent variable. Besides that, I also run regressions disaggregating the total connectivity change and total connectivity in 2000 for sectors of advanced service firms (accountancy, management, banking, insurance, advertising and law).

Total connectivity change regression model

$$L_{it} = \beta_1 L_{it-1} + \beta_2 X_{1it-1} + \beta_3 X_{2it-1} + \beta_4 X_{3it} + u$$

Where:

L_{it} is the total connectivity in 2004.

L_{it-1} is the lagged dependent variable, total connectivity in 2000.

X_1 is a column vector consisting of country based variables.

X_2 is a column vector consisting of city based variables.

X_3 is a column vector consisting of country dummy variables.

By using the lagged variable L_{it-1}, I intend to control for the effect of connectivity in the previous period so that my coefficients capture the effect of the independent variables without the undesirable effect of a possible "*rich-get-rich*" (returns to agglomeration) or "*rich-get-poor*" (costs of agglomeration) behavior.

By subtracting L_{it-1} from both sides of the equation, it becomes:

$$L_{it} - L_{it-1} = \beta_1 L_{it-1} - L_{it-1} + \beta_2 X_{1it-1} + \beta_3 X_{2it-1} + \beta_4 X_{3it} + u$$

$$L_{it} - L_{it-1} = (\beta_1 - 1) L_{it-1} + \beta_2 X_{1it-1} + \beta_3 X_{2it-1} + \beta_4 X_{3it} + u$$

Hence, as $L_{it} - L_{it-1}$ is nothing less than the total connectivity change between 2000 and 2004, we can use it as dependent variable. The coefficients of X_1, X_2 and X_3 will remain the same and setting $(\beta_1 - 1) = \delta_1$, we have a more straight interpretation for δ_1 when verifying a *rich-get-rich* or *rich-get-poor* relation of the connectivity.

The new equation reads as:

$$L_{it} - L_{it-1} = \delta_1 L_{it-1} + \beta_2 X_{1it-1} + \beta_3 X_{2it-1} + \beta_4 X_{3it} + u$$

In order to test the robustness of the results and to increase number of observations (some of my independent variables do not have complete observations for all the cities), I use five different specifications for the model.

Disaggregated total connectivity change regression model

In order to search the effect of the presence of rival / non-rival (complementary) firms into firm's network expansion strategy, I disaggregate the previous model into a specific service sector (accountancy, management, banking, insurance, advertising and law). I do that by calculating the connectivity change derived from first of only one sector at a time, and the total connectivity in a city in 2000 derived from firms of a specific sector. This also serves me to find if the previous variables behave equally or not across the service sectors and provide the model with a better specification to check whether the variables remain robust.

My hypothesis is that firms form same sector regard each other as competitors, avoiding to locate in cities which already have a relatively larger concentration of such firms. There may also be a saturation process in which cities with a larger concentration of such firms experience less connectivity growth derived from that sector just because firms that are already located in the city do not need to expand their activities there. In such a case, I expect to find a negative sign in the coefficient of the independent variable "connectivity in 2000" from the same sector as the dependent variable.

Likewise, I also have the hypothesis in which firms from different sectors (for example: banking and management) regard themselves as complementary industries. In such a case, we would see an agglomeration process in which connectivity derived from a sector would seek cities in which the other sectors are relatively concentrated. In such a case, I expect to find a positive sign in the "total connectivity in 2000" from other sector than the one of the dependent variable.

Hence, the regression model for the management sector becomes:

$$L_{it,man} - L_{it-1,man} = \delta_1 L_{it-1,man} + \delta_2 L_{it-1,bank} + \delta_3 L_{it-1,ins} + \delta_4 L_{it-1,acc} + \delta_5 L_{it-1,law} + \delta_1 L_{it-1,adv} + \beta_2 X_{1it-1} + \beta_3 X_{2it-1} + \beta_4 X_{3it} + u$$

Where the subscripts: “man”, “bank”, “ins”, “acc”, “law”, “adv” stands respectively for management, banking, insurance, accountancy, law and advertising.

Site Service Status regression model

The problem of the total connectivity change regression model is that, while informative on showing up the correlations between the variables and total connectivity in the city, it is the composed result of two different processes at the base of connectivity change in the city. The results achieved, in this way, are related to both those processes at the same time, and we do not know exactly which one of them explains the connectivity change. What maybe worse, it is possible that the effect of those processes have different directions, which could cause a statistically significant correlation to appear insignificant or vice-versa.

The way the interlock network is specified, the total connectivity growth of a given city will change when one of the two happen: either a firm decides to open/close/expand/reduce business in that specific city or else a firm that is already located in that city decides to expand/reduce its business elsewhere.

In order to better illustrate my point, I want to remind the following points about the interlock network model and further on show the two types of processes for connectivity change in a diagram.

First, we need to remember the following concepts of the interlock network model:

- Advanced Corporate Service Firms located in a given city are rated from 1 to 5 according to their size and function (this is called service value, v_{ij} and is the basic element found on Service Value Matrix, V (this volume, p. 29)).

- An edge (link, line) is drawn where there are two branches of the same firm in two different cities.

- The line value is the product of the service value of the two firms. This is called elemental interlock link, $r_{ab,j}$.(equation (4), p. 31)

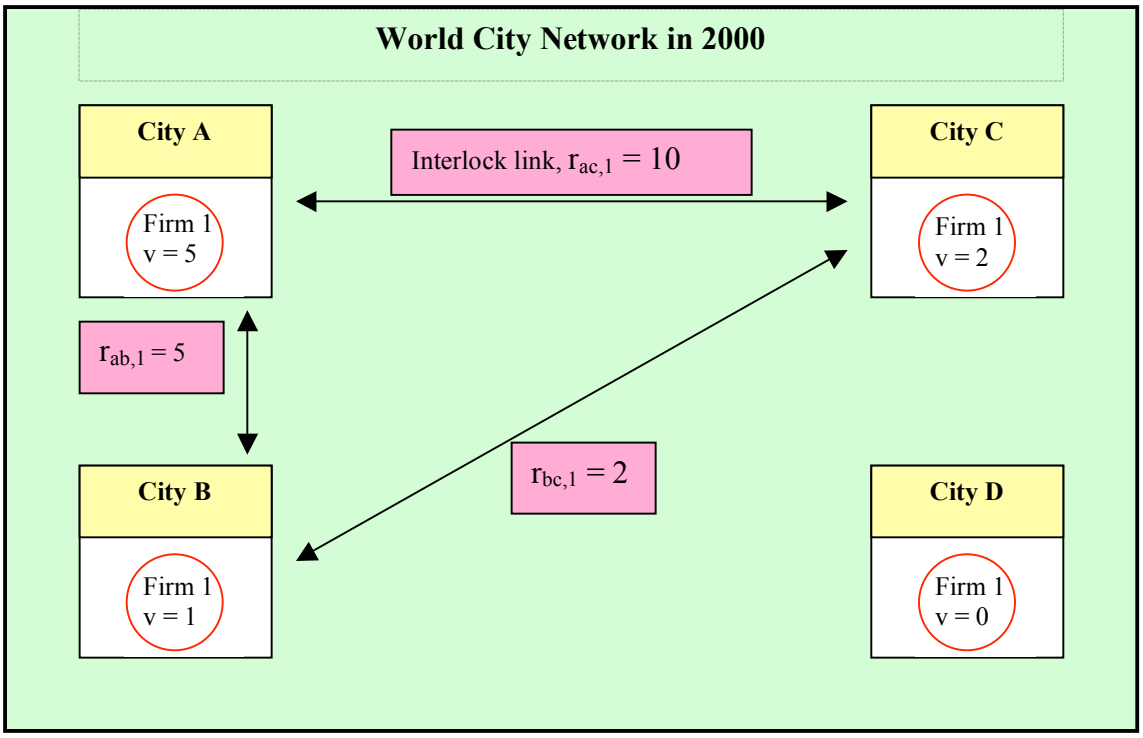
- The total connectivity of a city, N_a is the sum of all line values linking one city to all other cities. (equation (6), p.32)

- The site service status, c_i is the sum of all the service value of the firms within a city.

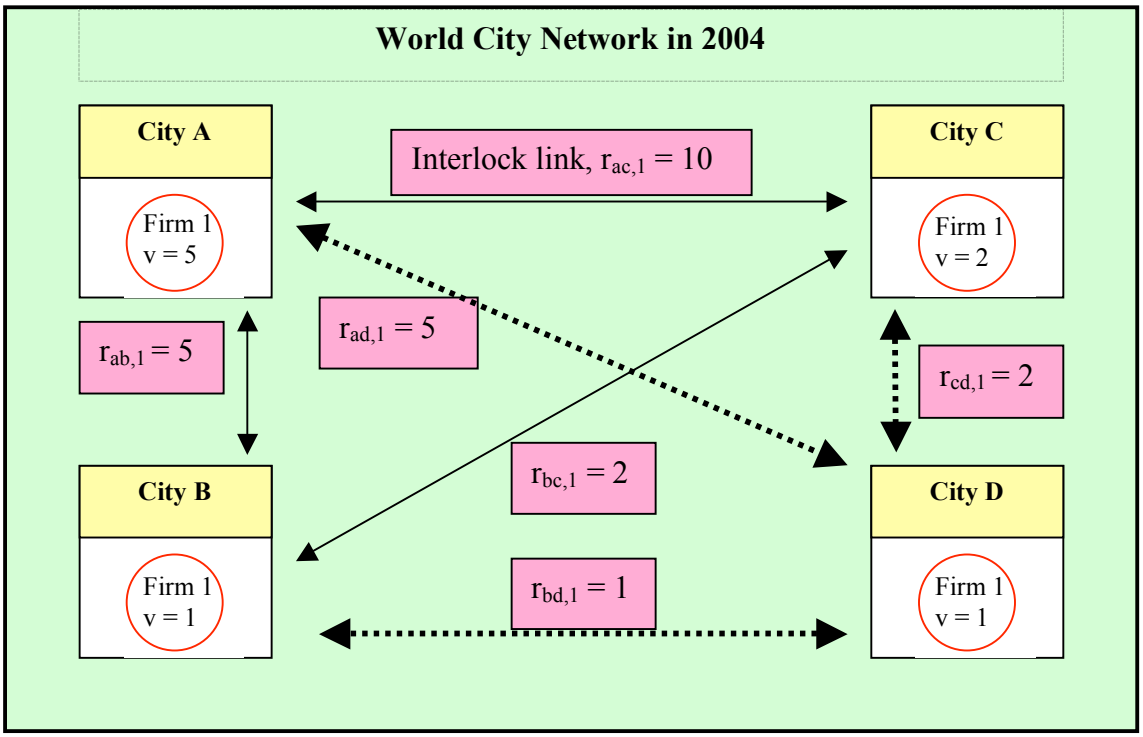
Now, let's suppose that we have a system with 4 cities and 1 firm in 2000.

This firm has its headquarter in City A, so that the service value, $v_{a1} = 5$. As our system has only one firm, the site service status, c_a of City A is also 5. The firm also has a small branch office in City B and a medium sized branch in City C, so that $v_{b1} = c_b = 1$ and $v_{c1} = c_c = 2$. Finally, the firm has no branch office in City D, so that $v_{d1} = c_d = 0$.

Reminding that the elemental interlock link, $r_{ab,j}$ is the product of the service values of a pair of cities, linkage between those cities will be such as seen in the next picture.



Suppose that in 2004, Firm 1 decides to open a small branch (v = 1) in City D. The system will change in the following way (new links in dashed):



Now, if we compute the total connectivity of each city in 2000 and 2004 we will have a clear view of both processes on which total connectivity can change: one due to a firm locating in a given city and other due to the effect of a firms expansion in the system.

Note in the summary box bellow that even though Firm 1 changed its location strategy only in City D, opening a new branch there, we observe a change in total connectivity in all other cities as well.

	Statistics of the city in 2000		**Statistics of the city in 2004**	
	Service Status, c_a	T. Connectivity, N_a	Service Status, c_a	T. Connectivity, N_a
CITY A	5	15	5	20
CITY B	1	7	1	8
CITY C	2	12	2	14
CITY D	0	0	1	8

Hence we can conclude that there are two processes related to total connectivity growth in the city.

The first is a function of a change in the service status, c_a, of a city, caused by a change of service value, v, of a firm located inside the city. This process due to a change in **service value**, v, within a city, we will call "SV change effect".

The second one is a function of a change in the rest of the network, in such way that the service status, c_a of (as well as service value, v, inside) the city didn't change at all, but as service status and value changed in other (inter-connected) city changed, the connectivity between those two cities also change. As this process is derived from a change in the **firm's network** outside the city, we will call this process as "FN change effect"

This distinguishing is very important in my analysis because the regression model employed is specified to account for the attributes of the city (and of the country where

the city is located) which could be regarded as an incentive or disincentive for a service firm to locate in that city. The model does not account for determinants of the size nor change in the size of the firm's network.

The site service status regression model intends, them, to capture the determinants of change in service status, c_a, of the city, as this is one of the processes through which total connectivity grows. In order to do so, I use service status, c_a, as dependent variable, capturing exclusively the source of "SV change effect" and expelling from my regression the undesirable effect of "FN change effect"[56].

Site service status regression model:

$$\mathbf{SV_{it} - SV_{it-1} = \delta_1 L_{it-1} + \beta_2 X_{1it-1} + \beta_3 X_{2it-1} + \beta_4 X_{3it} + u}$$

Where:

SV_{it} is the total site service status, c_a, within a city for 2004.

SV_{it-1} is the total site service status, c_a, within a city for 2000.

L_{it-1} is the total connectivity in 2000.

X_1 is a column vector consisting of lagged country based variables.

X_2 is a column vector consisting of lagged city based variables.

X_3 is a column vector consisting of country dummy variables.

Analysis for disaggregated sectors, following the same methodology employed on the *total connectivity change regression model*, is carried out.

[56] For a pie chart showing the share of "SV change effect" and "FN change effect" on total connectivity change between 2000 and 2004 (total and disaggregated values) , please refer to figure 3 in the annex.

2.6 Specification of the Regression Model

On both "*total connectivity change*" and "*site service status*" regression models I use five different specifications to test the robustness of the variables to a different set of controls. My motivation for doing that is threefold. First, some of my data is related to the country level and assigned to cities within those countries. As there is no variation for country level variables on cities within the same country, it doesn't make sense to use them with country dummies in the same regression. Second, not all my variables are complete for all of the cities, causing a significant change in the amount of observations in the regression, depending on the choice of variables. Third, by using the lagged level of connectivity in the city in 2000 I can effectively check / control for a *rich-get-rich* behavior, but I also would like to compare all the cities without this control. Those are the main motivations that led me to exploit the same model within five wide-ranging specifications in my research.

Below, I proceed with a description of each one of the specifications:

(I) The model is not controlled for the lagged level of connectivity in the city in 2000. If there is any effect of the amount of connectivity on future total connectivity and site service status levels in a city (due to gains/loss from agglomeration, aversion to competition or responsiveness to complementarities from other firms, for example), this specification will not capture / control for it.

(II) The model uses country level variables and no country dummies, and the variable "*Quality of Life*", which is incomplete in several cities, is dropped in order to increase the

number of observations. This specification compares cities from countries that have a similar characteristic as captured by country-level variables.

(III) Country dummies are used instead of country-level variables. It allows us to check how the independent variables affect the dependent variable when we compare cities from the same country.

(IV) "*Quality of life*" is dropped in order to increase the number of observations and country-level variables are dropped while country dummies are added. This specification has the largest number of observations.

(V) All variables are used, except country-dummies. This specification has the least number of observations.

Finally, when analyzing the accountancy sector, I add a variable for the weighted presence (service value, v_{ij}, this volume, p. 29) of Arthur Anderson in year 2000. I do so because I believe this can help me to understand how firms' location strategy is responsive to competition. As Arthur Anderson bankrupt in 2002, we could expect that cities in which Arthur Anderson was located in 2000 would observe a total connectivity / site service value growth[57] in the accountancy sector as other firms would be quick to re-locate / expand there in order to best serve the orphaned clients of Arthur Anderson.

[57] Note that my dependent variables (Total Connectivity Change and Site Service Status Change) were calculated without observations derived from Arthur Anderson location patterns.

3. WORLD CITY NETWORK IN 2000

The objective of this section is to describe the World City Network in the year 2000. We have seen previously that connectivity change is due to two mechanisms: Firms Network (FN) change effect; and Service Value (SV) change effect. While the latter is due to change of the firms within a city, the former is due to a much more inertial process: even though the composition of firms within a city remains exactly the same, connectivity might change if those firms networks change outside the city.

The relevance of the present section has much more to do with the *FN change* than to the *SV change* effect. It is the attributes of the cities in terms of total connectivity in 2000 that will define how the city will be affected by the *FN change*. In particular, we can clearly show that more connected cities are more affected *by FN change effect* than by *SV change effect* than less connected cities. With more firms located inside a given city, the probability of a change in the global branch network of a random firm affecting the connectivity level of this city is higher.

The mechanism which explains why *FN change effect* is stronger on well connected cities is easy to understand. Let's suppose that firm *x* experienced a very high expansion on its branches around the world between 2000 and 2004. This expansion will generate *SV effect change* in connectivity in every city that received / lost a new branch office of that firm. Apart from that, there will also be *a FN effect change* in connectivity for every city that already had a branch of that firm in 2000, even though nothing changed in terms of the composition of firms inside those cities. If we compare two cities, one with only one randomly assigned firm and the second with ten randomly assigned firms, the

probability that firm x will have an office in the second city is much higher. Henceforth, we can expect that the second city has a higher probability of experiencing a *FN effect change* due to firm *x*'s expansion. Because of that, *FN effect change* will probably represent a higher share of total change in well connected cities than in less connected[58].

This analysis is important because *FN effect change*, in case of firms' network expansion, generates a "*rich-get-rich*" behavior. When new nodes are attached to the network (through the opening out of offices in new locations), they are automatically connected to the already existing nodes (cities which already possess a branch of the firm that is opening up offices elsewhere), making them even more connected.

We can have a good view of this effect at play by looking to tables 9 and 10 in the annex. In table 9 we can find the mean and total (sum of all the cities) connectivity change and the FN effect connectivity change by sectors. All sectors expanded their firms network between 2000 and 2004 except for banking and insurance (in bold). Table 10 gives us correlation coefficients (all significant to the 1% significance level) between connectivity in 2000 by sector and FN effect connectivity change by sector. All coefficients from sectors that expanded their firms' network have positive sign, while all coefficients from sectors that retracted have negative sign. Those results confirm that connectivity change due to the FN effect will benefit more those cities that are well connected in case of a firms' network expansion.

[58] We can also observe this pattern empirically. Please refer to figure 4, in the annex, for a plot of "share of connectivity change" by kind and total connectivity in 2000, together with correlation's coefficients.

We now know that well-connected nodes are awarded with this *"rich-get-rich*" behavior due to a firms' network expansion[59]. The next question I want to raise is about who were those well-connected cities in the year 2000?

To start with, they were few. By inspecting the histograms (figure 5 in the annex), we can see the distribution of total connectivity and site service status among cities. The overwhelming part of the cities, no matter if we are analyzing the aggregated or disaggregated data, is poorly connected and has very low site service status. Some few cities have intermediate values for total connectivity and site service status. After that, we have an hiatus, where no city occupies this part of the histogram to finally, see London and New York with an above normal degree of total connectivity and site service status.

This composition, together with the enhanced "tail" on the histogram, suggests us that there has been a non-random concentration of connectivity / site service status on some cities while the majority shows much more modesty on their status. Notwithstanding the fact that much of this concentration process is due to the characteristics of the city / country which makes it an interesting place to base their business, there is an ongoing, retro-fed, concentration process due to the rich-get-rich behavior brought by the FN change effect. Cities that were historically well-connected, like New York and London, will automatically became more connected, benefiting from new linkages brought by new entrants (New York and London's based firms opening branches oversea) to the network.

Second, by calculating simple correlations of key city and country based socio-economic variables to the connectivity level of cities in 2000[60], we can have some insights on who

[59] Note that, in case of a firms network retraction, well-connected nodes (cities) will be the ones to lose most connectivity due to the *FN effect change*. In this case, we will observe an inertial "rich-get-poorer" behavior.

are the most connected cities. I calculate the correlations coefficients, as well as their p-value, for the following categories: all cities, capitals, non-capitals, primary cities, non-primary cities, regional clusters (Oceania, Central America, North America, South America, Africa, Asia and Europe) and country clusters (Brazil, India, China, Germany, USA and UK)[61].

The results show us that the most connected cities in the world are also those with the best quality and highest cost of life. They are usually large cities and have the best universities centers (those result are robust to regional and country dummies), enabling local production of skilled human capital.

On analyzing country-level variables, we see that those cities are usually located on countries with high GDP, high GDP per capita and Human Development Indexes. They are located in better educated countries, with a lower pupil to teacher ratio, higher school enrollment and literacy rates. They are located in countries with more internet users and cheaper rates for international phone calls. Finally, well connected capital and primary cities are located in countries with a large population.

Findings from table 11 show us that connectivity is much correlated with socio-economic development, in the broader sense (as captured by the above mentioned socio-economic variables), although in table 12 this relation is not so much evident within regional groups,

[60] The Correlations Coefficients Table can be found the annex, tables 11, 12 and 13.

[61] On applying the above mentioned methodology, we face two main obstacles: city based variables are not always completed for all cities, reducing drastically the number of observations available on those analyses; and country-based variables do not vary within cities from the same country. There is not much we can do about the first obstacle, apart from testing those city-variables with country dummies, to check their robustness. For the second obstacle, it might be interesting to pay an increased attention to the results achieved on the analysis of capital and primary cities, as in those cases only one city from each country is used, providing us with a much clearer view of the correlations than those found for non-capital and non-primary cities.

maybe due to a smaller variations on their country-level statistics within regions, as the correlation found on city-level variables are quite statistically significant.

The conclusion is that the most connected cities in 2000 are also the most developed ones, usually located on the most advanced countries. Those are the cities that will benefit the most from the *FN effect change* on connectivity growth whenever there is a firms' network expansion.

4. DETERMINANTS OF CONNECTIVITY GROWTH AMONG WORLD CITIES

So far, in our quest for discovering the determinants of world city formation, we have been through a contextualization, based on literature review, about the achievements of "world city" research in the last twenty years (this volume, p.1-26). This presented us with the main different ways through which "world citiness" has been thought about, as well as insights (mostly empirically untested) claiming the importance of one or another determinant for world city formation. I proceeded by choosing a theoretical framework (Sassen's Global City Network Model) and specification (Taylor's Interlock Network Model) to generate quantitative data on the connections between cities (this volume, p.27), allowing me to observe the total connectivity of a city towards all others. Next, I test some hypothesis (this volume, p.34) through a set of regression models (vide annex: Regression 1 to 14) and report the results in this chapter.

The most straightforward feature we can extract from the results is how diverse the sectors are among themselves in terms of their determinants. Few of the variables tested seemed to behave in the exact same way in all sectors as an estimator of connectivity growth, although some of them were found to be robust estimators within one or two sectors.

Broadly speaking, we can cluster the independent variables of the models in four distinct categories: lagged total connectivity in 2000 for each sector (management, accountancy, insurance, advertising, banking and law); city-level variables (primary city * GDP, city population, quality of life, affiliation to Metropolis and UCLG, top university and container traffic); country-level variables (air passenger traffic, pupil to teacher ration,

phone cost, trade/GNP); and country dummies (USA, UK, Germany, China, India and Brazil). From those, it was on the *lagged total connectivity* variables that we found most consistency on the behavior of the many sectors analyzed. From the group of city-level variables, we found a clear correlation between *top university* and *primary city*GDP* correlating respectively with total connectivity growth in management and banking sector. Country level variables were also found to be strong predictors of connectivity growth, although results differed according to sectors. Finally, the country-dummy variables also revealed that cities from some countries had a consistent increase / decrease in the connectivity status on the four years analyzed.

Bellow, I will explain the empirical results presented on regression tables 1 to 14 in the annex and provide an economical reason for such changes of connectivity.

4.1 Overall Total Connectivity and Total Site Service Status Change

Inasmuch as each sector seems to function by their own logic, when we carry out our empirical testing for the connectivity (vide regression 1) and site service status (vide regression 8) of the cities in an aggregated way (computing connectivity and service status from all sectors together, instead of only one sector at a time), some very clear (and statistically robust) patterns emerge. This might suggest that those variables could be determinants of city connectivity independent of the particular sector that is being analyzed, although some sectors are clearly more sensitive to a specific determinant than the others.

In this aggregated analysis, country level variables are strong predictors of both total connectivity and site service status growth. We found out that cities located within

countries with a high volume of air passenger traffic, low telephone cost for international calls and relatively more open to trade (trade/GNP) displayed an average higher growth on total connectivity than others.

When we look, however, into specific sectors, this trend is not so uniform. Air passenger traffic remains significant only on the Banking sector (Regression 3 and 10, specifications II and V) and only when lagged connectivity in 2000 is controlled for. Low international telephone call cost remains a statistically significant determinant of total connectivity only for Banking (Reg. 3 and 10) and Insurance (Reg. 6 and 13). Trade/GNP is a predictor for connectivity growth for the Advertising sector (Reg. 5 and 12) and to a lower degree to the Banking sector (Reg. 2 (V), 10 (I, V)) and Management (Reg. 9 (I, V)). For the insurance sector, we found out that Trade/GNP is correlated with connectivity growth (Reg. 6) but this is due to the firm's network expansion (FN change effect, this volume, p.52) instead of firm's decision to expand business in cities from countries with a high trade/GNP ratio (Reg.13).

Although for the remaining sectors, those variables are not statistically significant, the sign of the coefficient is the same as expected (positive for air passenger and trade/GNP and negative for phone cost). The exceptions are the law (Reg. 7 and 14) and accountancy (Reg. 4 and 11) sectors which regressions displays wrong signs for one or more of those variables.

As for the city-level variables, *primary city*GDP*, *city population* and *top university* are statistically significant on the Overall Total Connectivity Growth regression (reg. 1). *City population* and *top university* are not robust to country dummies (reg. 1 (III and IV)).

Also, *top university* does not remain significant on the site service status regression (reg. 8), suggesting that connectivity growth on cities with a better human capital stock may be more of a function of firms network expansion (FN change effect) than of new firms moving to cities with high human capital stock (SV change effect).

When we look, however, into the sector disaggregated results, we see that the only sectors in which *primary city*GDP* seems to be a statistically significant driver of connectivity change is the banking (reg.3 and 10) and insurance (reg. 6 and 13) ones. *City population*, on its turn, follows the same pattern of the overall regression for management, banking and advertising sectors, all of them also not robust to country dummies.

Finally, we found no evidence of "rich-get-rich" behavior on the aggregated regressions, evidenced by the statistically insignificant coefficients of the *own connectivity 2000* variable. Cities from United States on average experienced a drop of connectivity during the period while cities from the United Kingdom became more connected. This seem to be especially true for the banking and insurance sectors.

4.2 Competition and Complementarities as functions of firms' location strategy

When we disaggregated the total connectivity and site service status of a city by the service firm sector, we used a lagged dependent variable for the connectivity of a city within a given sector, in 2000. By doing that, my objective was to check the existence of a possible concentration process. If, after controlling for cities and country variables, cities with a higher connectivity in 2000 experienced a larger growth of connectivity and, specially, of site service status, in the following four years, this would be an evidence of a *rich-get-rich* effect on world city formation. The rationale behind it is that, even though

choosing to expand in a city already full of firms could possibly mean more competition, there are gains of agglomerations to be reaped that makes this a preferred choice for the firm.

This is in agreement to Sassen's (1994) analysis on agglomeration economy. She suggests that because of advanced information technologies, service firms were not expected to concentrate on central cities, as they could do better choosing other location options without the high costs and congestions of major cities. She says that what make those firms decide to locate in those places are the agglomeration economies and innovative environments in it.

> *"A production process takes place in these services that benefits from proximity to other specialized services. This is especially the case in the leading and most innovative sectors of these industries. Complexity and innovation often require multiple highly specialized inputs from several industries. The production of a financial instrument, for example, requires inputs from accounting, advertising, legal services, economic consulting, public relations, design, and printing. The particular characteristics of production explain the centralization of management and servicing functions that has fueled the economic boom of the early and mid-1980s in major cities (...) Producer services, unlike other types of services, are not necessarily dependent on spatial proximity to the consumers – that is, firms served. Rather, economies occur in such specialized firms when they locate close to others that produce key inputs or whose proximity makes possible joint production of certain service offerings. The accounting firm can service its clients at a distance, but the nature of its service depends on proximity to specialists, lawyers, and programmers. Moreover, concentration arises out of the needs and expectations of the people likely to be employed in these new high-skill jobs that tend to be attracted to the amenities and life-styles that large urban centers can offer. Frequently, what is thought of as face-to-face communication is actually a production process that requires multiple simultaneous inputs and feedbacks. At the current stage of technical development, having immediate and simultaneous access to the pertinent experts is still the most effective way to operate, specially when dealing with a highly complex product."*(Sassen, 1994, p. 66)

In order to capture the preference of the firm to locate in a city with agglomeration of other firms and at the same time capture the aversion of firms to locate in a place where they might face more competition, I use the lagged connectivity in 2000 disaggregated by sectors. I expect to find a negative sign for the lagged connectivity in 2000 of firms of the same sector as the one being analyzed, as firms will decide not to locate in cities where rival firms are already serving or that they themselves are already located. Likewise, a positive sign is expected for the lagged connectivity in 2000 of firms of different sector than that being analyzed, as firms will seek gains from agglomeration and complementarities with other non-rival firms (which sometimes even serve the same customers).

This hypothesis is confirmed by the regression results. All disaggregated regressions (reg. 2 to 7 and 9 to 14) have a strongly negative correlation for the *own connectivity 2000* variable, except for law[62] firms. I interpret this being a consequence of both the saturation effect of a city having too much of firms from a specific sector and firms aversion to locate where their competitors are already located.

Also, while avoiding cities with a higher share of competitors, firms seek to locate in cities with a larger share of firms from other sector, as those contribute to create a locale in which knowledge fully circulates, generating gains from agglomeration. This pattern was observed with different degrees of intensity depending on the sector being analyzed and the sector of the lagged variable. A special mention, however, should be done to the banking sector, which was found to be positive statistically significant for all other

[62] Overall, we could not get meaningful results for law firms. Perhaps, this is due to the fact that those firms are the least globalized of all sectors, causing less variation on their location strategy in the period.

sectors (reg.9, 11, 12, 13 and 14) in the site service status model. This is a strong indicative that service firms from other than banking sectors try to locate themselves in cities which are well connected in a global network of banking firms.

Finally, an analysis of Arthur Anderson can also provide us with some clues about these processes. Arthur Anderson was one of the big 5 accountancy firms in the world in 2000 and bankrupt, due to the Enron scandal and the credibility crisis brought about in this event. As total connectivity for cities in 2000 and 2004 were computed without Arthur Anderson, we can expect, under our hypothesis that the location strategy of firms try to avoid competition, so that cities were Arthur Anderson was located in 2000 will experience a higher connectivity growth after Arthur Anderson's demise. Other firms from the accounting sector would be fast to occupy market spaces left empty by Anderson after the bankruptcy. The regression results confirm our hypothesis (reg. 4 and 11). The total connectivity regression model (reg. 4) tell us that those firms located in the same cities as Arthur Anderson used to have an office experienced an increased total connectivity growth, although the site service status regression model (reg. 11) suggests that this growth was more related to those firms expanding abnormally elsewhere (FN effect change) than expansion of their (or other firms that were not located there before) business in cities where Arthur Anderson used to be.

4.3 Country-level variables: telecommunication, trade openness, education and air traffic

Country-level variables serve my research for two purposes: first, it enables me to approximate measures for city's key variables to the city that are unavailable at the city

level; second, it captures the effect of being a city located in a country with those characteristics. The drawback is that while the results can help us to understand why two cities from the same country might have, on average, experienced a different change on their connectivity as compared to other countries with different level on those variables, it does not give us any clue on why those cities might have changed in a different way compared to each other. Preferably, I would like to have those same variables at the city level, but as this was not possible, I choose to carry on the analysis with country-level variables.

Surprisingly, beside the above mentioned problem, they ended up to be quite strong predictors of total connectivity and site service status change. Trade/GNP, for instance, captures the trade openness of a country. This variable was statistically significant on the overall regressions (reg. 1 and 8) and on the specific regressions for the advertising (reg.5 and 12). For the remaining sectors, we could not reject the null hypothesis at the 10% confidence level but the coefficient sign was positive, as expected, with the sole exception of the law sector (reg. 7 and 14) and a few of the specifications on the insurance (reg. 6 (I) and 13 (I)), and accountancy (reg. 11 (II)) sectors.

Telecommunication, captured by the average cost of an international call from the country, was strongly significant for the overall regressions (reg. 1 and 8) and the banking (reg. 2 and 10) insurance (reg. 6 and 13) sectors, preserving the right sign for all the other sectors but the law sector.

Education, captured by the pupil / teacher ratio in the country, was weakly significant on the overall regression for total connectivity (reg. 1) and for the management (reg.2) sector,

but was not significant at all on their total site service status regression model counterpart. This indicates that this significance might be due to FN effect change and not to firms decision to locate on cities from countries with a smaller pupil / teacher ratio in the analyzed period. This variable seems to be a very weak predictor of connectivity change in a city.

Finally, air passenger traffic followed the same line as pupil / teacher ratio. Although we find some significance (reg. 8 and 10), the results are most of the case either statistically insignificant or not robust to a different set of controls, so that we can not reject the null hypothesis.

4.4 Country Dummies

Country dummies were added on the models exclusively to check the robustness of the variables to country dummies. My intention was to see if the pattern of connectivity growth seem on a global scale, was also replicated on a country level. Although pointing out which countries have the cities that experienced a larger connectivity growth is not an objective of this paper, by using country dummies as control variables, I also have estimates on how those performed in terms of connectivity growth.

Overall results show that the greatest losers were American cities (reg. 1 and 8), while British cities seems to have increased their connectivity status. This is in accordance with results from Taylor and Aranya on the rise of UK's Provincial Cities (2006b[63]) and the

[63] Taylor, P.J., Aranya, R. 2006b "Connectivity and City Revival" Town & Country Planning". November.

decline of US cities (2006a[64]). They explain their results for British cities as possibly a consequence of governmental de-centralization and political devolution policy. For the decline of connectivity of the American cities, they claim that far from reflecting a possible economic downturn of American cities, it is more likely to be fruit of the location strategy of American firms to retreat from global competition and concentrate operations domestically.

> *"...there is one specific finding that can be used to make another important point: the relative decline of US cities in our world city connectivity analyses. It must be emphasized that our approach is a one-scale method; we have studied connectivities generated by service firms operating on a global scale. This is just one process within the service sector that is itself just one part of wider economic processes. Thus decline in relative connectivity in our analysis should not be translated simply into economic decline of a city. The US cities illustrate this situation perfectly. As profit-maximizing entities, US producer service firms can choose to concentrate their investments in servicing the richest national service market in the world and with which they are familiar, instead of chasing new clients in unfamiliar lesser markets that constitute the rest of the world-economy. Thus it can make sense not to 'go global' or expand globally in order to be economically successful; in the case of law this is clearly the case (Beaverstock et al 2000b). Hence, our analyses do not indicate economic decline of US cities. (...)"* (Taylor and Aranya, 2006a, p. 7)

On the sector disaggregated analysis, US cities continued to fare badly and UK to do well. Germany presented a systematic decrease of total connectivity and site service status for the advertising sector (reg. 5 and 12). The remaining results, when statistically significant, did not show robustness to different specifications or were weakly correlated (statistically significant at 10% significance level).

[64] Taylor, P.J., Aranya, R. 2006a "A Global 'Urban Roller Coaster'? Connectivity Changes in the World City Network, 2000-04" GaWC Research Bulletin 192. Available at: http://www.lboro.ac.uk/gawc as of December, 2006.

4.5 Human Capital and Financial Power in the Management and Banking Sector

At this point, I would like to take a closer examination on the Management and Banking sector, analyze the empirical results for each one of those sectors, point out the difference and provide an economical explanation for those. My analysis draw on the *total site service status regression model* results (reg. 9 and 10) as this model best captures the location strategy decision of the firms, as compared with the *total connectivity regression model*.

The difference between both sectors is that management firms seems to choose to locate on cities which have a high stock of highly skilled human capital (captured here by the "*top university*" variable, which measures the number of top 500 universities within a city) while the banking sector seem to prefer a location on primary cities from rich countries (as captured by the "*primary city*GDP*" variable) with good telecommunication infrastructure (phone cost).

Although human capital and skilled labor is central to both sectors, the main input for the banking sector is capital and for the management sector is skilled labor. In relative terms between both sectors, we can say that banking is capital intensive and management is skilled labor intensive. As such, management firms' location choice strategy takes into account the characteristics of the city which can be related with an easier access to recruitment or continued training of skilled human capital. The banking sector, however, prioritizes locating in the main cities from countries with high GDP, as they need to be near where money circulates the most. For their operations, it is more important to be on

financial centers, stock markets and trading centers, which will offset their need for recruiting and training skilled labor in those locations.

Human capital is also important for the banking sector although being located at financial and trading centers is even more so. The way the banking sector deals with it may be explained by the findings of Beaverstock[65] (2005), in his analysis of world city network from a micro level instead of a macro level, as the one carried out on my research.

Beaverstock (2005) analyzes international mobility in the global investment banking industry. By analyzing data from the annual reports, firm world wide web sites and interviews with C.E.O's responsible for international human resources in ten global investments banks in 1999/2000, he found that those firm's human resource policy consistently favored labor mobility among the branch firms (as opposed to locally nurturing its own labor force) as an "*efficient mechanism to make the knowledge structures of world city networks*" (Beaverstock, 2005, p. 1). In other words, he found that "*investment banks transfer knowledge and expertise throughout their international office networks by* ***physically moving*** *staff between world city locations*." (Beaverstock, 2005, p. 2, my bold marks)

If that is so, the banking sector would not need to rely on the city's capability of generating this high skilled labor when deciding where to open / expand their networked branches. It can, instead, develop its human capital strengths at the centre and then

[65] Beaverstock, J.V., 2005 "World City Networks 'From Below': International Mobility and Inter-City Relations in the Global Investment Banking Industry", GaWC Research Bulletin 179.

transfer to its overseas units, concentrating their location strategy on the proximity with its clients and in financial and trading centers.

Interesting enough, the air passenger traffic variable is statistically significant on the banking sector regression (reg.10), although it is not significant for the remaining sectors (except for the management sector, for the specification which does not account for the lagged connectivity level – reg. 9 (I)). This might be due, among other things, to the labor mobility strategy employed by the banking sector to cope with its need of highly skilled labor.

We could also argue that it makes more sense for the banking sector to employ this coping strategy than the management sector because of the nature of their activities. While management requires an employee with wide knowledge of local specificities (contacts, knowledge of the suppliers, competitors, customers, etc), an employee of the banking sector need relatively less knowledge on those and more on financial instruments and procedures which are not "place-bound". The management sector requires human capital that is place-bound: they need to rely on local expertise for their doings. The banking sector, however, requires human capital skilled on financial procedures which are, by nature, not place-bound: they can transfer their employees from elsewhere.

5. CONCLUSIONS

My research aimed at shedding some light in the determinants of connectivity growth among cities. In the course of this thesis, I defined connectivity in the grounds of the linkage created by the branch offices network location of global advanced corporate service firms. Further on, I used statistical techniques to advance some hypothesis on the drivers of connectivity growth among cities between 2000 and 2004. My findings identified a "*rich-get-rich*" behavior, on which well connected cities became even more well-connected faced with an expansion of the firms network, and the country and city-level characteristics which are drivers of connectivity growth.

Much is often said about globalization generating a growing economic interdependence among countries through an increasing volume of cross-border transactions of goods and services, capital flow and diffusion of technology. It is also said that large cities participate in this processes by becoming command centres for the transnational activities of corporations. If we accept the idea that world cities are intrinsically linked to globalization, serving as hubs where (legal, cultural, business, etc) information flows, is processed and become central coordinating (service) inputs for multinational corporations, we need to ask how, why and which cities are more likely to serve those functions.

By finding the determinants of connectivity change, our knowledge of which cities (and why those specific cities) will became more integrated in the global economy as command centres is enhanced. The new knowledge can be used to predict which cities will be the emerging coordinating centers by observing their growth trend in terms of those determinants. Above and beyond, it can be used by policy makers and notably

urban planners to draft strategies and urban interventions envisaging raising their prospects of becoming such a center.

Without further due, I present next a synthesis of the main findings of my research:

1. First of all, I identified a "rich-get-rich" behavior, whereas well connected cities became automatically more connected. This is due – and only happens when – there is an expansion in the firms' branch network within a given sector.

2. This effect is partly offset by that of competition (and saturation of the market) within a sector in a given city. I have shown that, holding all other variables constant, firms that are well connected for a given service sector, will display a slower connectivity growth and attract less firms of the same sector as they try to avoid competition and / or do not have an incentive to expand, already having secured its presence in that city.

3. On the other hand, firms respond positively to the presence of non-rival firms in the city. This suggests that a kind of agglomeration economy takes place, on which firms benefit from locating near other (non-rival) firms. This is particularly evident when we observe firms from all sectors but banking locating in cities with a relatively stronger banking sector.

4. Telecommunication infrastructure, trade openness, education and air-traffic levels in a country are determinants of connectivity growth, although different service sectors seem to respond differently to each one of them. Cost of an

international telephone call, in particular, seems to be a stronger predictor of connectivity growth.

5. Skilled human capital formation in a city is a determinant at play for influencing the location strategies of the management sector, but seems to have no impact on the banking sector. My explanation to this pattern is that, even though human capital is important to both sectors, management is skilled labor intensive while banking is capital. Management firms will thus seek to locate in places where it can easily recruit high skilled personal and keep them up-dated through life-long education. Banking, by its turn, needs to locate where capital flows, near financial centers, stock and commodity markets, on the primary cities of the richest countries. It alleviates its need for human capital by physically moving the staff from the center offices (in cities with a high stock of human capital) to the desired locations.

At this moment, I would like to invite the reader to contemplate the implications of this research into real world issues. Much, for example, has been said about the digital divide: how technological innovations of telecommunication are at an increasingly gap between rich and poor countries. Such situation might generate an even larger gap in the world city network system, with high technological cities becoming hyper-connected while others lag behind. On another account, if we see the emergence of clusters of high tech telecommunication in cities within not so advanced countries, we can expect them to attract more global service firms, raise their levels of total connectivity, serving the rest of the country (or region) as a hub for the flow of global (business) information.

The same kind of analysis can be done for the levels of human capital generation (brought up by top rated universities), trade openness and airport infrastructure. After, however, being positioned as a city with the infrastructural attributes necessary for debuting in the world city network, we can expect the city to become increasingly connected, as the forces of agglomeration economy would instigate more service firms to expand into the city.

Surely, there is much more we need to know about world city network formation. I hope this manuscript will add to the literature and to our knowledge on how cities develop into command and control centers for the world economy.

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7. ANNEX

TABLE 1. The World City Hierarchy[a] (Friedmann, 1986, p.22)

Core Countries[b]		Semi-peripheral Countries[b]	
Primary	Secondary	Primary	Secondary
London* I	Brussels* III		
Paris* II	Milan III		
Rotterdam III	Vienna* III		
Frankfurt III	Madrid* III		
Zurich III			Johannesburg III
New York I	Toronto III	Sao Paulo I	Buenos Aires* I
Chicago II	Miami III		Rio de Janeiro I
Los Angeles I	Houston III		Caracas* III
	San Francisco III		Mexico City* I
Tokyo* I	Sydney III	Singapore* III	Hong Kong II
			Taipei* III
			Manila* II
			Bankgok* II
			Seoul* II

Note: * National capital.
Population size categories (recent estimates, referring to metro-region):
I 10-20 million; II 5-10 million; III 1-5 million.

[a] *Selection criteria include:* major financial centre; headquarters for TNCs (including regional headquarters); international institutions; rapid growth of business services sector; important manufacturing centre; major transportation node; population size. Not all criteria were used in every case, but several criteria had to be satisfied before a city could be identified as a world city of a particular rank. No city from a country of the "peasant periphery" was included, though questions might be raised about Bombay. But India, like China, is at the present time only weakly integrated with the world market economy. Also eliminated from consideration were all centrally planned economies which are integrated into the Soviet block and are not part of the capitalist world system.
In principle, it would have been possible to add third and even fourth-order cities to our global hierarchy. This was not done, however, since our primary interest is in the identification of only the most important centres of capitalist accumulation.
[b] *Core countries* are identified accourding to World Bank criteria. They include nineteen so-called industrial market economies. *Semi-peripheral countries* include for the most part upper-middle income countries having a significant measure of industrialization and an economic system based on market exchange.

TABLE 2. Spatial articulations 30 world cities (Friedmann, 1995, p.24)

1. **Global financial articulations**
   # London* A (also national articulation)
   # New York A
   # Tokyo* A (also multinational articulation: SE Asia)

2. **Multinational articulations**
   # Miami C (Caribbean, Latin America)
   # Los Angeles A (Pacific Rim)
   # Frankfurt C (western Europe)
   # Amsterdam C or Randstad B
   Singapore* C (SE Asia)

3. **Important national articulations (1989 GDP>$200 billion)**
   # Paris* B
   # Zurich C
   Madrid* C
   Mexico City* A
   Sao Paulo A
   Seoul* A
   # Sydney B

4. **Subnational/regional articulations**
   Osaka-Kobe (Kansai region) B
   # San Francisco C
   # Seattle C
   # Houston C
   # Chicago B
   # Boston C
   # Vancouver C
   # Toronto C
   Montreal C
   Hong Kong (Pearl river delta) B
   # Milano C
   Lyon C
   Barcelona C
   # Munich C
   # Dusseldorf-Cologne-Essen-Dortmund (Rhine-Ruhr region) B

Population (1980s):
A 10-20 million
B 5-10 million
C 1-5 million
* national capital
# major immigration target

TABLE 3. Conceptualizing inter-city linkages: a typology (Smith and Timberlake, 1995, p.86)

Function	**Form**		
	Human	**Material**	**Information**
Economic	Labour, managers, lawyers, consultants	Capital, commodities	Business phone calls, faxes, telex messages, technology transfer, advertisements
Political	Troops, diplomats, social workers	Military hardware, foreign aid	Treaties, political threats
Cultural	Exchange students, dance troupes, rock concerts, theatre	Paintings, sculpture, artefacts	Feature films, videos, phono albums (CD's)
Social reproduction	Families, Red Cross, community organizers	Remittances, foreign aid	Post cards, nigh phone calls

TABLE 4. An Evidential Structure of World City Literature (Taylor, 1999, p.1904)

EVIDENCE	**SOURCE**							
SUBJECT:	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**ALL**
Cities	46	16	17	102	4	16	66	267
States	30	17	3	51	61	12	50	224
Ratio	1.53	0.94	5.67	2.00	0.07	1.33	1.32	1.19
TYPE								
Relational	10	4	5	11	4	10	11	55
Attribute	66	29	15	142	61	18	105	436
Ratio	0.15	0.15	0.33	0.08	0.07	0.56	0.10	0.13

Key to sources: A = Sassen (1991); B = Sassen (1994); C = Knox and Taylor (1995); D = Brotchie et al. (1995); E = Castells (1996); F = Graham and Marvin (1996); G = Lo and Yeung (1998)

FIGURE 1. Example of the Interlocking Network (Taylor, 2001, p. 194)

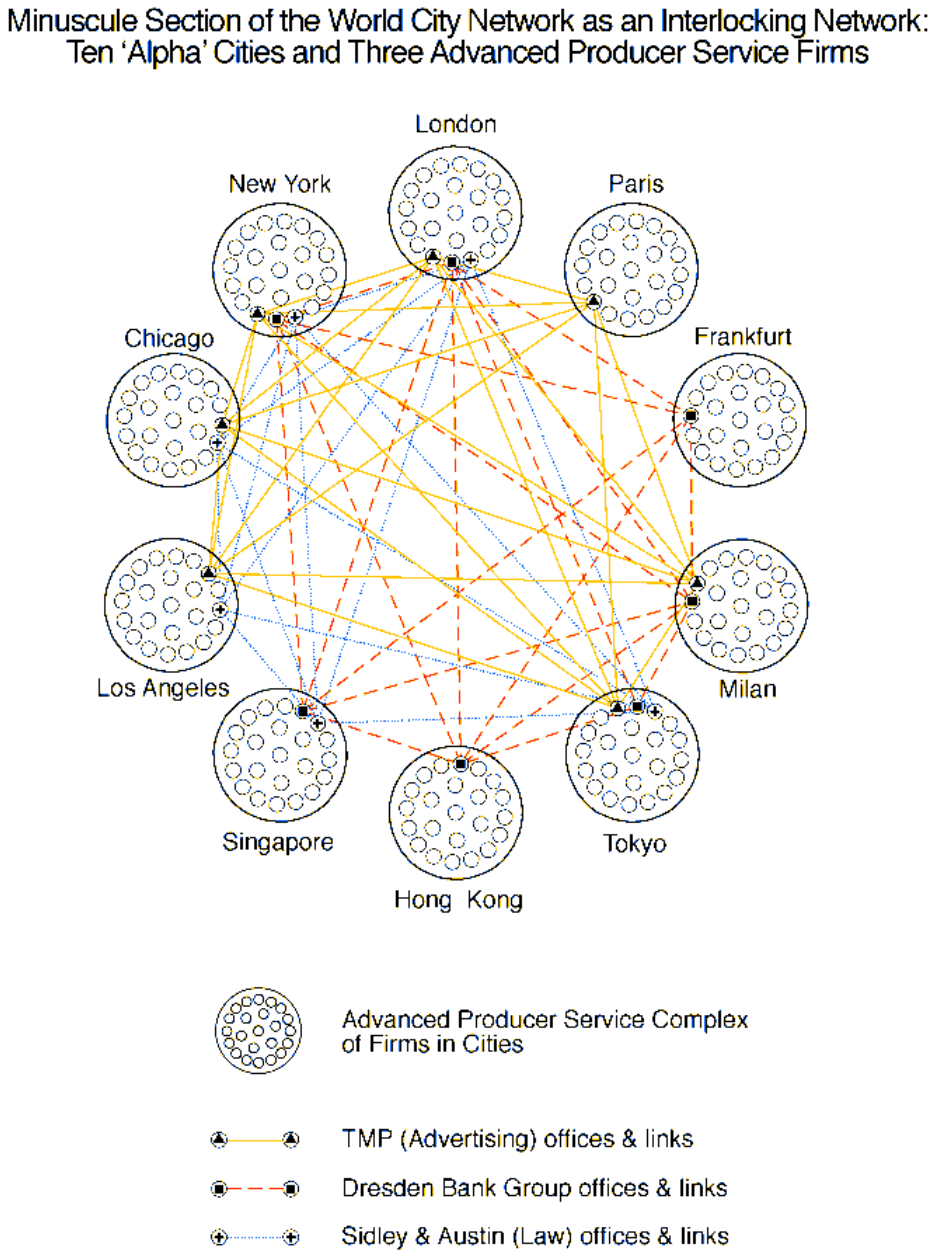


TABLE 5. The GaWC Inventory of World Cities (Beaverstock et al., 1999, p.457)

Cities are ordered in terms of world city-ness with values ranging from 1-12

A. ALPHA WORLD CITIES

12: London, Paris, New York, Tokyo

10: Chicago, Frankfurt, Hong Kong, Los Angeles, Milan, Singapore

B. BETA WORLD CITIES

9: San Francisco, Sydney, Toronto, Zurich

8: Brussels, Madrid, Mexico City, Sao Paulo

7: Moscow, Seoul

C. GAMMA WORLD CITIES

6: Amsterdam, Boston, Caracas, Dallas, Dusseldorf, Geneva, Houston, Jakarta, Johannesburg, Melbourne, Osaka, Prague, Santiago, Taipei, Washington

5: Bangkok, Beijing, Montreal, Rome, Stockholm, Warsaw

4: Atlanta, Barcelona, Berlin, Buenos Aires, Budapest, Copenhagen, Hamburg, Istanbul, Kuala Lumpur, Manila, Miami, Minneapolis, Munich, Shanghai

D. EVIDENCE OF WORLD CITY FORMATION

Di Relatively strong evidence

3: Athens, Auckland, Dublin, Helsinki, Luxembourg, Lyon, Mumbai, New Delhi, Philadelphia, Rio de Janeiro, Vienna

Dii Some evidence

2: Abu Dhabi, Almaty, Birmingham, Bogota, Bratislava, Brisbane, Bucharest, Cairo, Cleveland, Cologne, Detroit, Dubai, Ho Chi Minh City, Kiev, Lima, Lisbon, Manchester, Montevideo, Oslo, Rotterdam, Riyadh, Seattle, Stuttgart, The Hague, Vancouver

Diii Minimal evidence

1: Adelaide, Antwerp, Arhus, Baltimore, Bangalore, Bologna, Brasilia, Calgary, Cape Town, Colombo, Columbus, Dresden, Edinburgh, Genoa, Glasgow, Gothenburg, Guangzhou, Hanoi, Kansas City, Leeds, Lille, Marseille, Richmond, St. Petersburg, Tashkent, Tehran, Tijuana, Turin, Utrecht, Wellington

Definitions

World city-ness values produced by scoring 3 for prime centre status, 2 for major centre status, and 1 for minor centre status.
For rationale of divisions into classes of city, see text.

FIGURE 2. Pictogram of the GaWC Inventory of World Cities (Beaverstock et al., 1999, p.458)

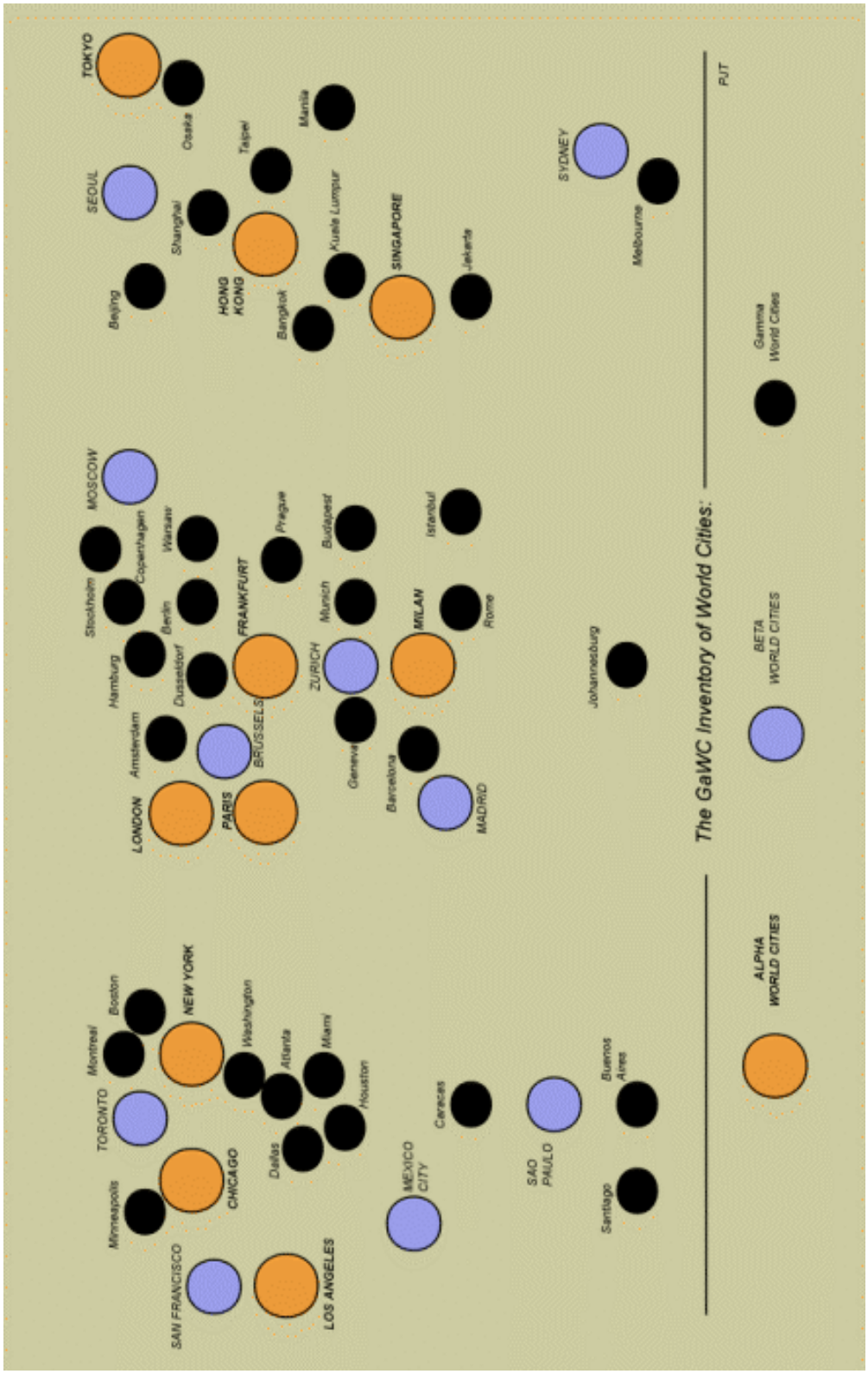


TABLE 6. List of Cities in the GaWC 100 data-set

Abidjan	Buffalo	Guangzhou	Lisbon	Osaka
Abu Dhabi	Bulawayo	Guatemala	Liverpool	Oslo
Accra	Cairo	Guayaquil	Ljubljana	Ottawa
Addis Ababa	Calcutta	Hamburg	Lome	Palermo
Adelaide	Calgary	Hamilton	London	Palo Alto
Ahmadabad	Canberra	Hannover	Los Angeles	Panama City
Alexandria	Cape Town	Hanoi	Luanda	Paris
Algiers	Caracas	Harare	Lucknow	Penang
Almaty	Cardiff	Hartford	Lusaka	Perth
Amman	Casablanca	Havana	Luxembourg	Philadelphia
Amsterdam	Charlotte	Helsinki	Lyon	Phoenix
Ankara	Chennai	Ho Chi Minh	Macau	Pittsburgh
Antwerp	Chicago	City	Madrid	Plymouth
Arhus	Christchurch	Hobart	Mainz	Port Louis
Asuncion	Cincinnati	Hong Kong	Malacca	Port Moresby
Athens	Cleveland	Honolulu	Malmo	Port Of Spain
Atlanta	Cologne	Houston	Managua	Port-Au-
Auckland	Colombo	Hyderabad	Manama	Prince
Baghdad	Columbus	Indianapolis	Manaus	Portland
Baku	Conakry	Islamabad	Manchester	Porto Alegre
Baltimore	Copenhagen	Istanbul	Manila	Prague
Bandar Seri	Cuidad Juarez	Jaipur	Mannheim	Pretoria
Begawan	Curitaba	Jakarta	Maputu	Pusan
Bandung	Dakar	Jeddah	Marseille	Pyongyang
Bangalore	Dalian	Jerusalem	Medan	Quebec
Bangkok	Dallas	Johannesburg	Medellin	Quito
Barcelona	Damascus	Kabul	Melbourne	Rabat
Basel	Dar Es	Kampala	Mexico City	Rawalpindi
Batam	Salaam	Kansas City	Miami	Refice
Beijing	Denver	Karachi	Milan	Reykjavik
Beirut	Detroit	Kawasaki	Minneapolis	Richmond
Belfast	Dhaka	Khartoum	Minsk	Riga
Belgrade	Djibouti	Kiev	Mombasa	Rio De
Belo	Doha	Kingston	Monrovia	Janeiro
Horizonte	Dortmund	Kinshasa	Monterrey	Riyadh
Bergen	Doula	Kobe	Montevideo	Rochester
Berlin	Dresden	Krakow	Montreal	Rome
Bern	Dubai	Kuala	Moscow	Rotterdam
Bilbao	Dublin	Lumpur	Mumbai	Ruwi
Birmingham	Durban	Kuwait	Munich	Sacramento
Bogoto	Dusseldorf	Kyoto	Nagoya	Salvador
Bologna	Edinburgh	La Paz	Nairobi	San Diego
Bonn	Edmonton	Labuan	Nanjing	San Francisco
Bordeaux	Essen	Lagos	Naples	San Jose (CA)
Boston	Frankfurt	Lahore	Nassau	San Jose (CR)
Bratislava	Freetown	Las Vegas	New Delhi	San Salvador
Brasilia	Gaborone	Lausanne	New Orleans	Sanaa
Brazzaville	Geneva	Leeds	New York	Santiago
Brisbane	Genoa	Leipzig	Newcastle	Santo
Bristol	Georgetown	Liege	Nicosia	Domingo
Brussels	Glasgow	Lille	Norwich	Sao Paulo
Bucharest	Gothenburg	Lima	Nottingham	Sarajevo
Budapest	Grenoble	Limassol	Nuremberg	Seattle
Buenos Aires	Guadalajara	Linz	Omaha	Seoul

Seville	Stuttgart	The Hague	Utrecht	Winnipeg
Shanghai	Suva	Tianjin	Valencia	Xiamen
Sheffield	Sydney	Tijuana	Vancouver	Yangon
Shenzhen	Taipei	Tirana	Venice	Yaonde
Singapore	Tallinn	Tokyo	Vienna	Yerevan
Sofia	Tampa	Toronto	Vilnius	Yokohama
Southampton	Tashkent	Trieste	Warsaw	Zagreb
St Louis	Tbilisi	Tripoli	Washington	Zurich
St Petersburg	Tegucigalpa	Tunis	Wellington	
Stockholm	Tehran	Turin	Wilmington	
Strasbourg	Tel Aviv	Ulan Bator	Windhoek	

TABLE 7. List of Firms in the GaWC 100 data-set

ACCOUNTANCY

Ernst & Young
Arthur Andersen**
Macintyre Sträter
International (MSI)*
IGAF: International Group of Accounting Firms
AGN International
BDO International*
Grant Thornton International
Horwath International
KPMG
Summit International + Baker Tilly
RSM International*
Moores Rowland International*
HLB International*
Moore Stephens International Network
Nexia International
PKF International*
Fiducial International*
PricewaterhouseCoopers

ADVERTISING

Impiric
TMP Worldwide
Hakuhodo Inc.
Draft Worldwide
Young &Rubicam Inc.*
D'Arcy Masius Benton & Bowles*
FCB
Saatchi & Saatchi*
Ogilvy & Mather Worldwide Inc.
BBDO Worldwide
McCann-Erickson WorldGroup*
J Walter Thompson
Euro RSCG
CMG. Carlson Marketing Group
Asatsu DK

BANKING/FINANCE

WestLB (Westdeutsche Landesbank Girozentrale)
Dresdner Bank
Commerzbank
Deutsche Bank
Chase Hambrecht & Quist*
BNP Paribas
ABN-AMRO Holding NV
Credit Suisse First Boston
Rabobank International*
UBS AG
ING Bank
Barclays
Fuji Bank
Bayerische HypoVereinsbank
Bayerische Landesbank Girozentrale
SDI (Sakura+Dellsher Bank)*
Sumitomo Bank
Sanwa
J. P. Morgan*
Bank of Tokyo-Mitsubishi
Dai-Ichi Kangyo Bank*
HSBC
CitiGroup (Citibank + SSBCiti Asset Management)*

INSURANCE

Allianz Group
Skandia Group
Chubb Group
Prudential
Reliance Group Holdings*
Winterthur
Fortis
CGNU
Liberty Mutual
Royal and Sun Alliance
Lloyd's

LAW

Latham and Watkins
Morgan Lewis
Baker and McKenzie
Clifford Chance
Jones Day
Freshfields Bruckhaus Deringer
Allen and Overy
Dorsey and Whitney
Linklaters–Alliance
White and Case
Cameron McKenna
Morrison and Foerster LLP
Lovells Boesebeck Droste
Skadden, Arps, Slate, Meagher, and Flom LLP
Sidley and Austin
Coudert Brothers

MANAGEMENT CONSULTANCY

Towers Perrin
Logica Consulting
Watson Wyatt Worldwide
Sema Group
CSC
Hewitt Associates
IBM*
Mercer Management Consulting
Boston Consulting Group*
Deloitte Touche Tohmatsu
Booze, Allen & Hamilton
A.T. Kearney
McKinsey & Company
Bain & Company
Compass
Andersen Consulting
Cap Gemini Consulting

Note:

* Firms that were dropped from the analysis because data collected in 2004 was considered unfit for comparision purposes.

** Arthur Anderson bankrupted in 2002 due to the Enron scadall . As change of connectivity of cities due to Arthur Anderson demisse was not a result of Arthur Anderson's location strategy, I dropped it from my analysis.

Table 8. Description and summary statistics of variables

Summary of the Variables

Total Connectivity - 2000							
Variable	**Description**	**# Obs**	**Mean**	**Std. Dev.**	**Min.**	**Max**	**Source**
Connect2000b	Gross Connectivity for 315 cities vs. 80 firms in 2000.	315	9349	7523.98	0	46580	Own calculations[66] based on GaWC 100[67]
ConnectACC2000b	Gross Connectivity of 315 cities vs. 10 accountancy firms in 2000	315	3674	1969.892	0	11909	
ConnectMAN2000	Gross Connectivity for 315 cities vs. 15 management firms in 2000.	315	809	1098.424	0	5819	
ConnectINS2000	Gross Connectivity for 315 cities vs. 10 insurance firms in 2000.	315	933	999.2767	0	6330	
ConnectADV2000	Gross Connectivity for 315 cities vs. 11 advertising firms in 2000.	315	1104	1295.01	0	7604	
ConnectBANK2000	Gross Connectivity for 315 cities vs. 18 banking firms in 2000	315	2609	2610.688	0	13200	
ConnectLAW2000	Gross Connectivity for 315 cities vs. 16 law firms in 2000.	315	217	498.0541	0	3589	

[66] Calculation was done with aid of *Data Tool 2*: **Macro for Calculating Connectivities** (max 1100 cities x 255 firms)
(R. Aranya)
Available at: http://www.lboro.ac.uk/gawc/data.html .

[67] The GaWC 100 were produced by P.J. Taylor and constitute Data Set 12 of the GaWC Study Group and Network (**http://www.lboro.ac.uk/gawc/**) publication of inter-city data.

Total Connectivity - 2004							
Variable	**Description**	**# Obs**	**Mean**	**Std. Dev.**	**Min.**	**Max**	**Source**
Connec2004	Gross Connectivity for 315 cities vs. 80 firms in 2004.	315	10018	8192	0	51308	Own calculations based on GaWC 80[68]
ConnectACC2004	Gross Connectivity of 315 cities vs. 10 accountancy firms in 2004	315	4224	2553	0	14033	
ConnectMAN2004	Gross Connectivity for 315 cities vs. 15 management firms in 2004.	315	1535	1385	0	8035	
ConnectINS2004	Gross Connectivity for 315 cities vs. 10 insurance firms in 2004.	315	563	738	0	5151	
Connect ADV2004	Gross Connectivity for 315 cities vs. 11 advertising firms in 2004.	315	1186	1475	0	8278	
ConnectBANK2004	Gross Connectivity for 315 cities vs. 18 banking firms in 2004	315	2231	2434	0	13465	
ConnectLAW2004	Gross Connectivity for 315 cities vs. 16 law firms in 2004.	315	277	613	0	3976	

[68] The GaWC 80 were produced by P.J. Taylor and kindly sent through e-mail after requested

Total Connectivity Change – 2000/2004							
Variable	**Description**	**# Obs**	**Mean**	**Std. Dev.**	**Min.**	**Max**	**Source**
Connectgrowth	Connectivity change between 2000 and 2004.	315	669	1870	-4362	5020	Own calculations based on GaWC 80[69]
ConnectgrowthACC	"ACC" – only accountancy firms were analyzed.	315	550	1273	-2986	4000	
ConnectgrowthMAN	"MAN" – only management firms were analyzed.	315	725	629	-686	2327	
ConnectgrowthINS	"INS" – only insurance firms were analyzed.	315	-370	460	-1922	672	
Connect growthADV	"ADV" – only advertising firms were analyzed.	315	81	464	-1353	2340	
ConnectgrowthBANK	"BANK" – only banking firms were analyzed.	315	-378	905	-2703	4146	
ConnectgrowthLAW	"LAW" – only law firms were analyzed.	315	59	184	-422	1026	

[69] The GaWC 80 were produced by P.J. Taylor and kindly sent through e-mail after requested

Site Service Status Change – 2000/2004							
Variable	**Description**	**# Obs**	**Mean**	**Std. Dev.**	**Min.**	**Max**	**Source**
SVgrowth	Site Service Status change between 2000 and 2004.	315	2	8	-18	38	Own calculations based on GaWC 80 and GaWC 100 data-sets
SVgrowthACC	"ACC" – only accountancy firms were analyzed.	315	1.5	3.5	-6	13	
SVgrowthMAN	"MAN" – only management firms were analyzed.	315	1.3	2.7	-5	10	
SVgrowthINS	"INS" – only insurance firms were analyzed.	315	-0.8	2.3	-9	8	
SVgrowthADV	"ADV" – only advertising firms were analyzed.	315	0.4	2.1	-5	12	
SVgrowthBANK	"BANK" – only banking firms were analyzed.	315	-0.8	3.9	-13	22	
SVgrowthLAW	"LAW" – only law firms were analyzed.	315	0.35	2.1	-6	14	

Country Based Variables							
Variable	**Description**	**# Obs**	**Mean**	**Std. Dev.**	**Min.**	**Max**	**Source**
Air Passenger Traffic	Air transport, passengers carried - 2000	302	2.26e+07	4.52e+07	19000	6.63e+08	The World Bank – World Development Indicators 2004 5.9 Transport infrastructure p.286
teachratio	Pupil-teacher ratio, primary – latest available data 1997/2002	293	22.37806	10.34483	8.4428	65.94022	The World Bank – World Development Indicators 2004 2.10 Education inputs p. 74
Phonecost	Telephone average cost of call to US (US$ per three minutes) - latest data available 1997/2002	301	2.804186	2.08338	.2786	13.947	The World Bank – World Development Indicators 2004
Trade / GNP	Trade (% of GDP) – 2000	299	67	38	21	293	The World Bank – World Development Indicators 2004 6.1 Integration with the global economy p.308

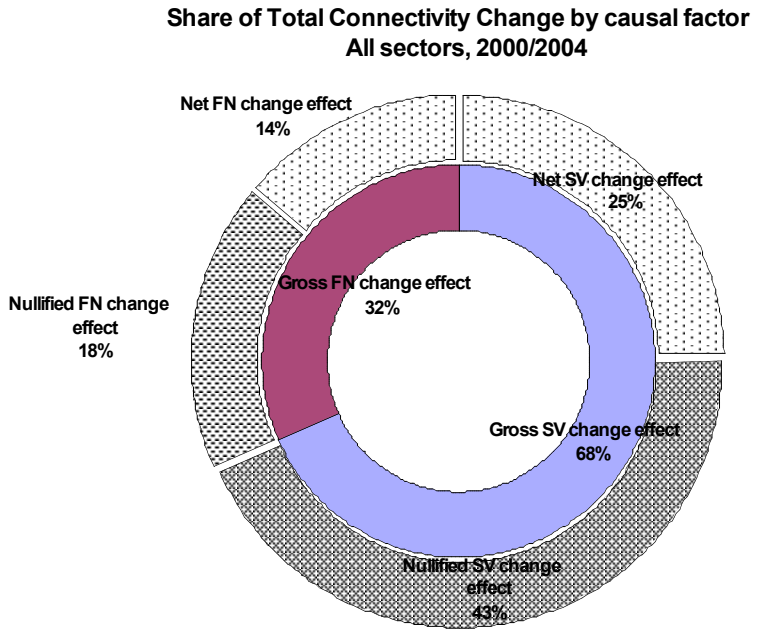
City Based Variables							
Variable	**Description**	**# Obs**	**Mean**	**Std. Dev.**	**Min.**	**Max**	**Source**
GDP	GDP Current Price in 2000	307	1776	3225	.553	9816	International Monetary Fund World Economic Outlook Database, April 2006 http://www.imf.org/external/pubs/ft/weo/2006/01/data/index.htm
Primcity*GDP	Interaction between GDP Current Price in 2000 and a dummy for whether the city is a primary city (the city with the highest population within the country) (1) or not (0).	307	110	657	0	9816	
City Population	City population using total metropolitan population and, where this is not available, city population. (per 100,000) (closest available year to 2000)	310	21.80	29.34	.00969 (Hamilton Bermuda)	194.9 (Mexico City)	United Nations Statistics Division - Demographic Yearbook 2003: Population of capital cities and cities of 100 000 and more inhabitants: latest available year Available at: http://unstats.un.org/unsd/demographic/sconcerns/densurb/densurb2.htm#DYB (August, 2006)
Quallife2005	Index for Quality of Life in the city for the year 2005	180	78.4	21.8	14.5	108	Mercer Index for Quality of Life, 2005 and 2006 Mercer Human Resource Consulting, Quality of Life Press Release, 14th March 2005 (www.mercerhr.com)
Affiliation to Metropolis	Affiliation to the "Metropolis" network of Local Governments in 2006	315	.2095	.4076	0	1	Metropolis home page[70]
Affiliation to UCLG	Affiliation to the "UCLG" network of Local Governments in 2006	315	.2476	.4323	0	1	United Cities and Local Governments (UCLG) home page[71]
Top University	Quantity of universities ranked as top 500 located in the city.	315	0.4	1.04	0	10	Ranking from Institute of Higher Education, Shanghai Jiao Tong University[72].
Container Traffic	Container Traffic in the port (TEUs, 000s)	270	754.1	2535	0	21984	American Association of Ports Authorities[73] and various website from cities port authorities

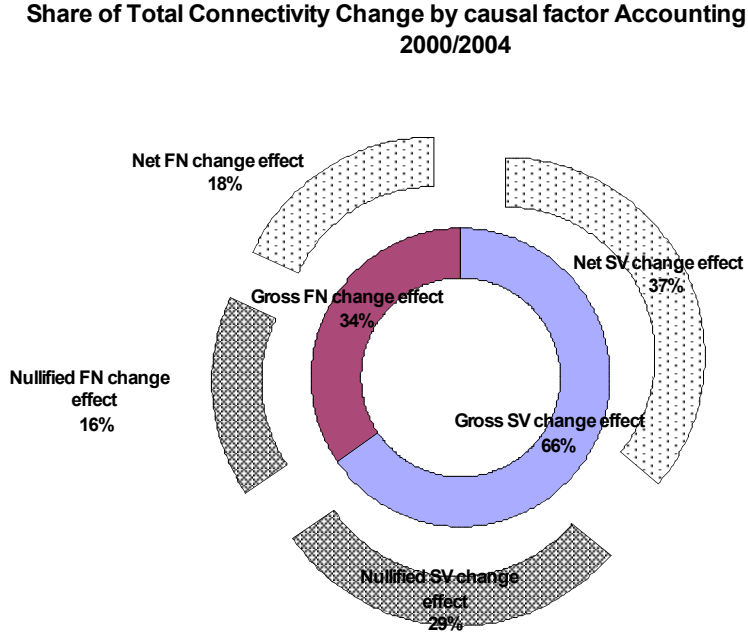
[70] http://www.citymayors.com/gratis/metropolis.html (as of September, 2006)
[71] http://www.cities-localgovernments.org/uclg/index.asp (as of September, 2006)
[72] Available at: http://ed.sjtu.edu.cn/rank/2004/top500list.htm
(as of September, 2006)
[73] http://www.aapa-ports.org/pdf/WORLD_PORT_RANKINGS_2004.xls
http://www.aapa-ports.org/pdf/CONTAINER_CENTRAL_SOUTH_AMERICA.xls
http://people.hofstra.edu/geotrans/eng/gallery/Container%20Ports.xls (as of September, 2006)

Country Dummies Variables							
Variable	**Description**	**# Obs**	**Mean**	**Std. Dev.**	**Min.**	**Max**	**Source**
USA	Cities located in USA	40	(a) 12146 (b) 67	(a) 8298 (b) 1634	(a) 2346 (b) -4129	(a) 45465 (b) 5020	Own calculations based on GaWC 80 and GaWC 100 data-sets
UK	Cities located in UK	13	(a) 9262 (b) 1913	(a) 11387 (b) 1810	(a) 3796 (b) -1203	(a) 46580 (b) 4728	
Germany	Cities located in Germany	16	(a) 10733 (b) 404	(a) 7212 (b) 1938	(a) 2938 (b) -2945	(a) 25943 (b) 2957	
China	Cities located in China	10	(a) 10770 (b) 1184	(a) 10477 (b) 2120.	(a) 1814 (b) -2490	(a) 33731 (b) 3765	
India	Cities located in India	9	(a) 8654 (b) 817	(a) 7655 (b) 1746	(a) 0 (b) -2842	(a) 21698 (b) 2771	
Brazil	Cities located in Brazil	9	(a) 7958 (b) 571	(a) 7155 (b) 1940	(a) 1655 (b) -1888	(a) 25033 (b) 3574	

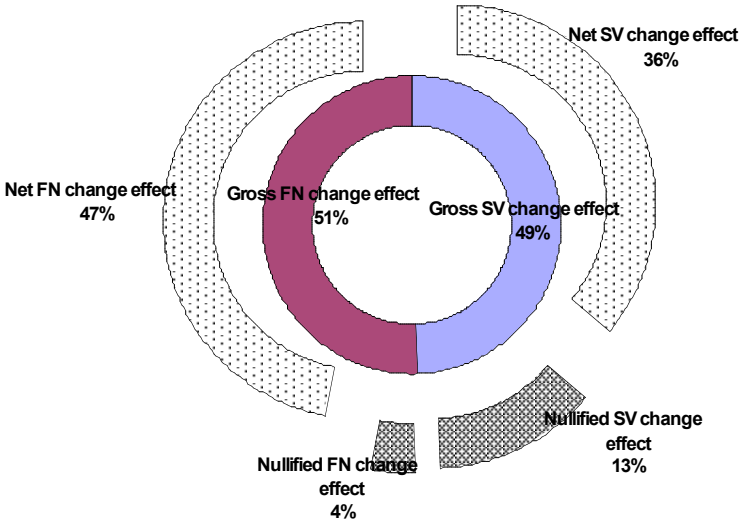
Note: Mean, Standard Deviation, Minimum and Maximum Values are related to (a) Total Connectivity in 2000 and (b) Total Connectivity changes for the dummy population.

FIGURE 3. Share of "SV Change Effect" and "FN Change Effect" on Total Connectivity Change 2000/2004

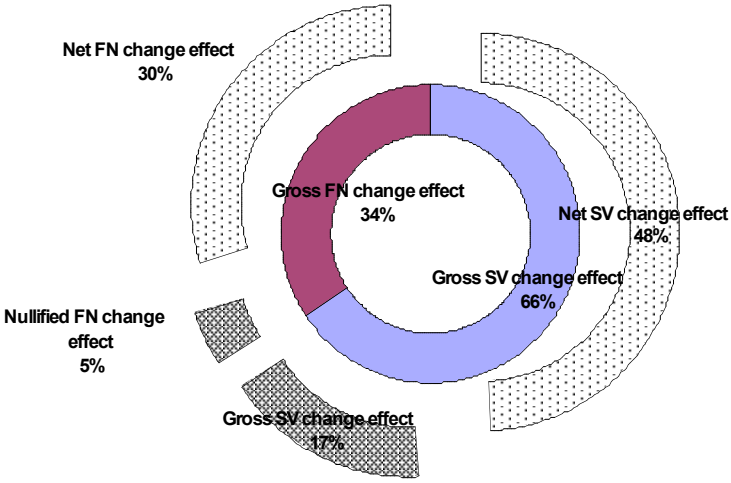




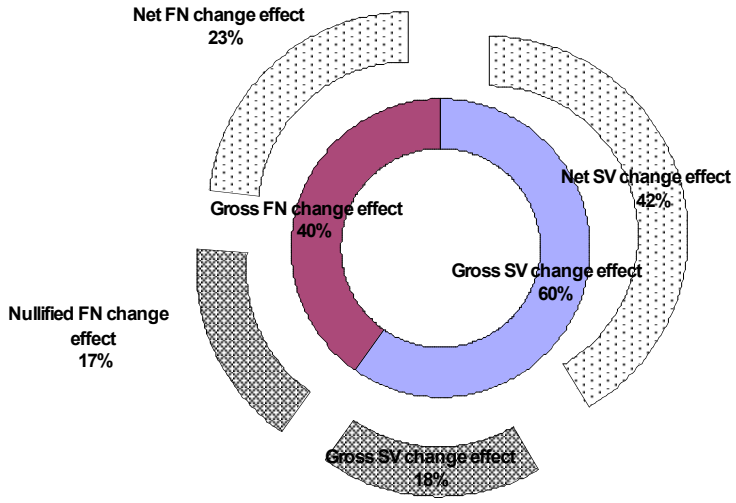
Share of Total Connectivity Change by causal factor
Management sector, 2000/2004



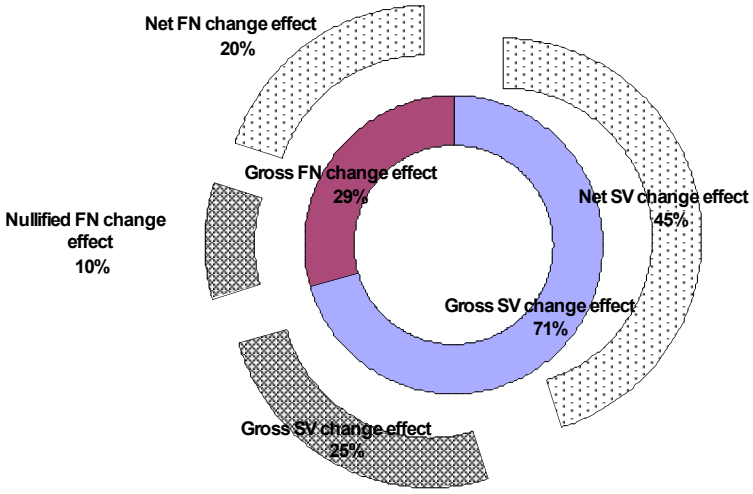
Share of Total Connectivity Change by causal factor
Insurance sector, 2000/2004



Share of Total Connectivity Change by causal factor
Advertising sector, 2000/2004



Share of Total Connectivity Change by causal factor
Banking sector, 2000/2004



Share of Total Connectivity Change by causal factor
Law sector, 2000/2004

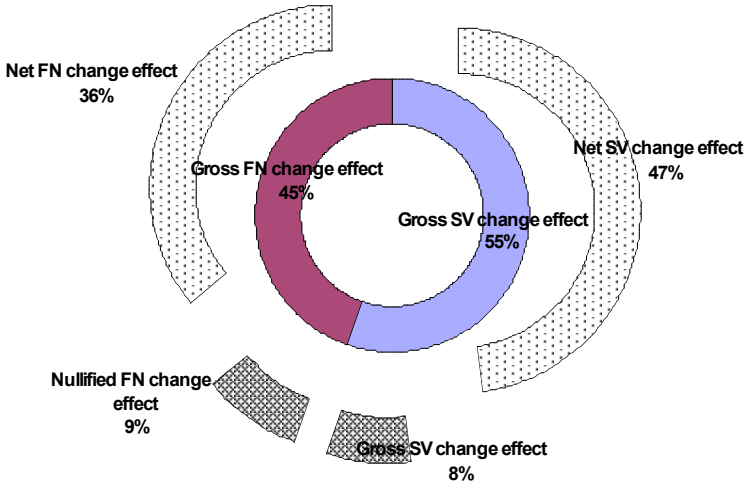
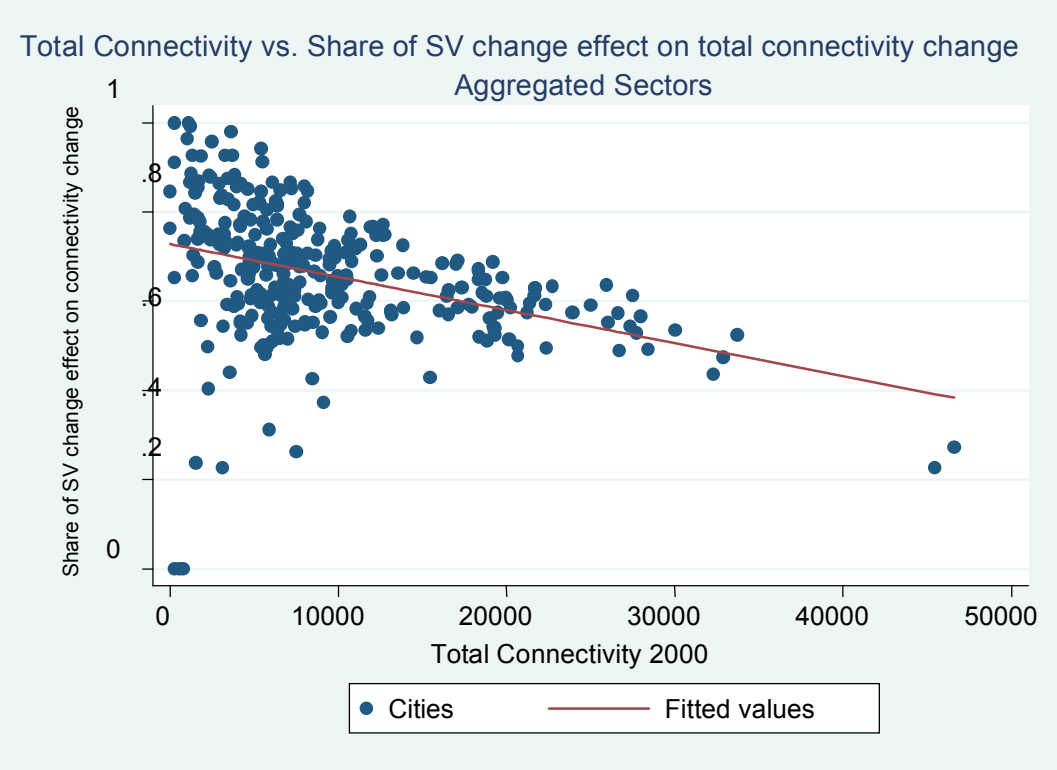
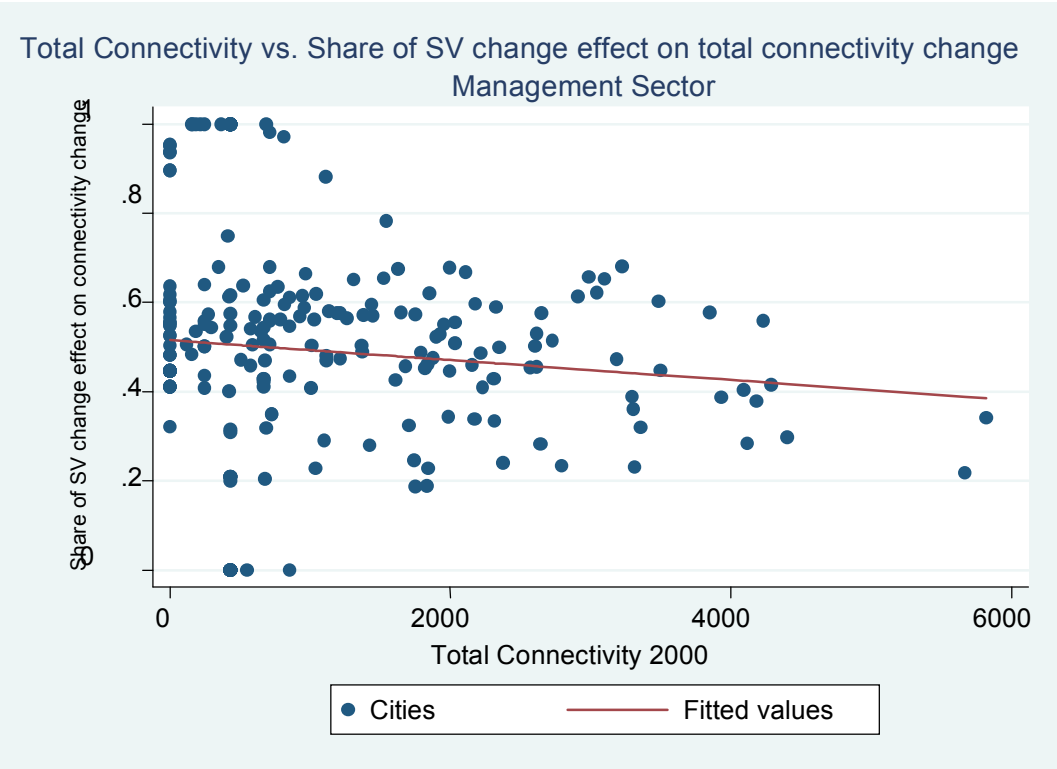


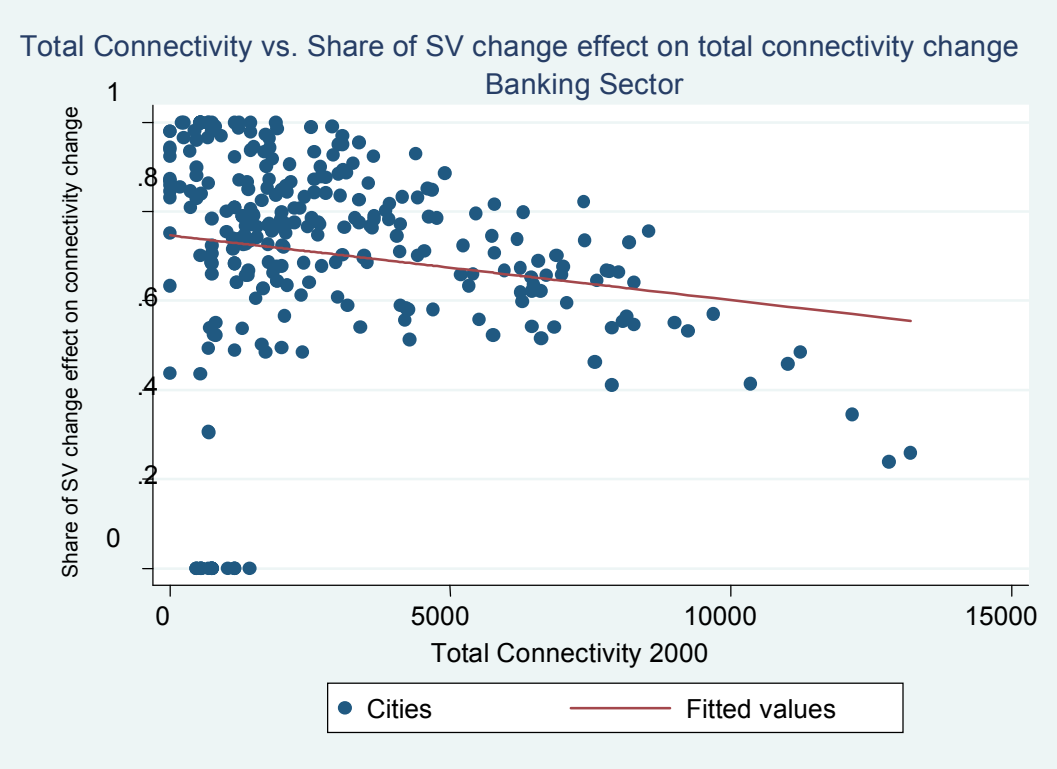
FIGURE 4. Plot of Share of "SV Change Effect" and "Total Connectivity in 2000"



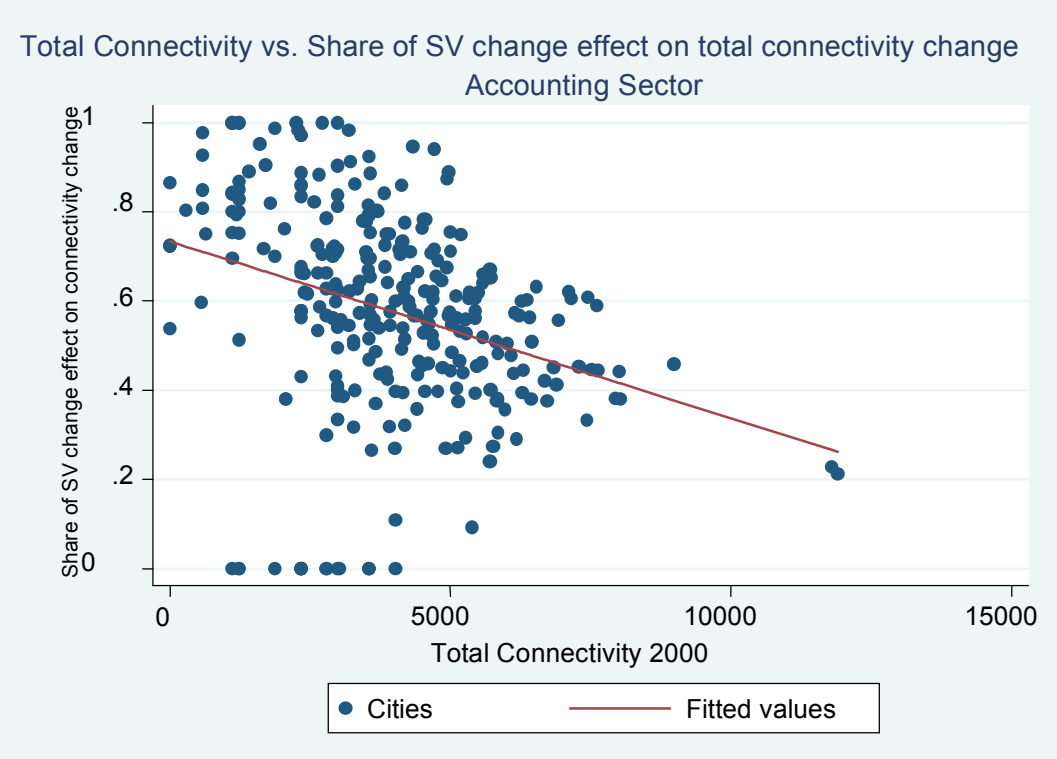
Correlation Coefficient = -0.3791



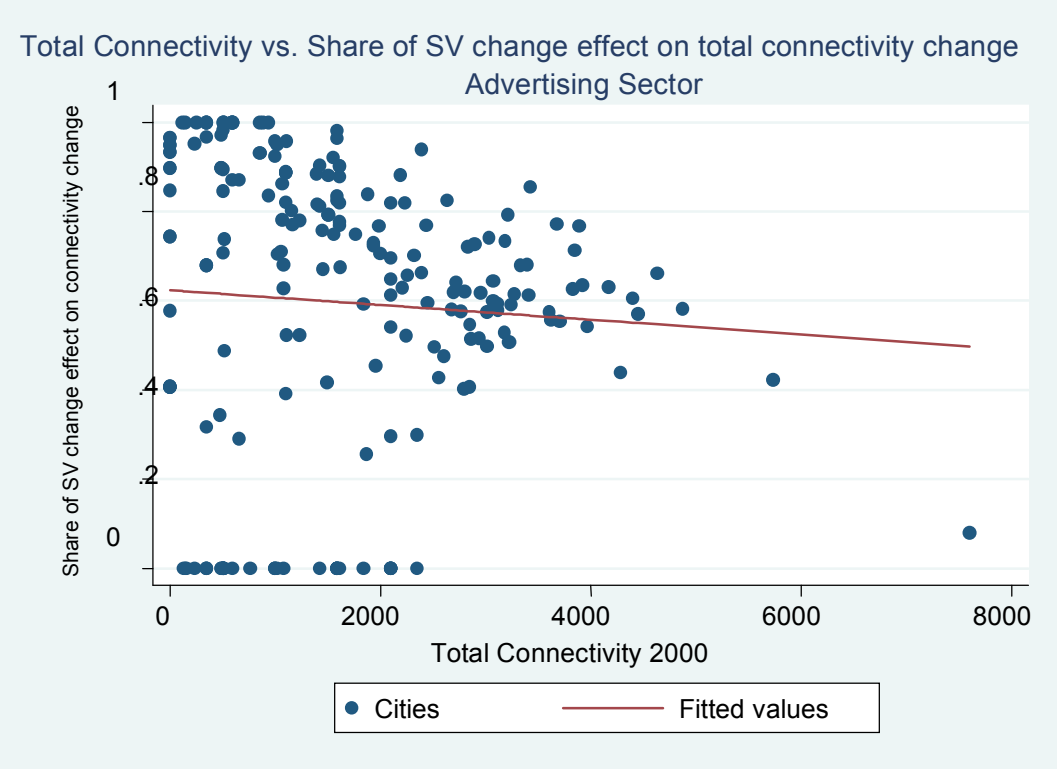
Correlation Coefficient = -0.1017



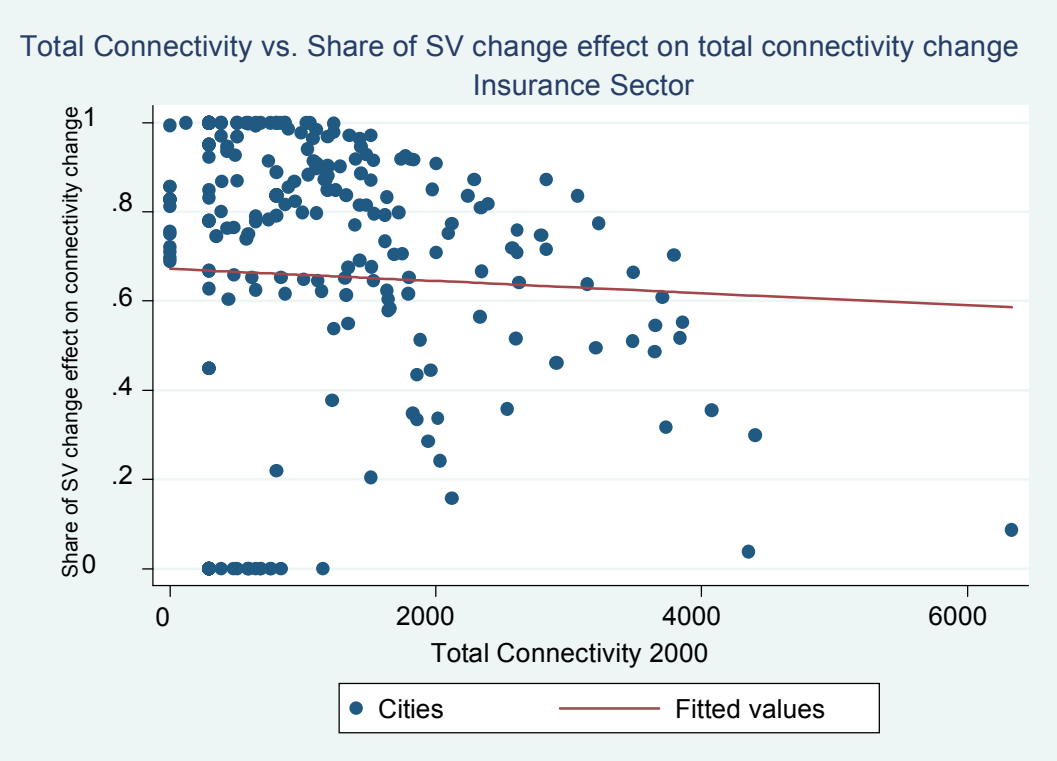
Correlation Coefficient = -0.1561



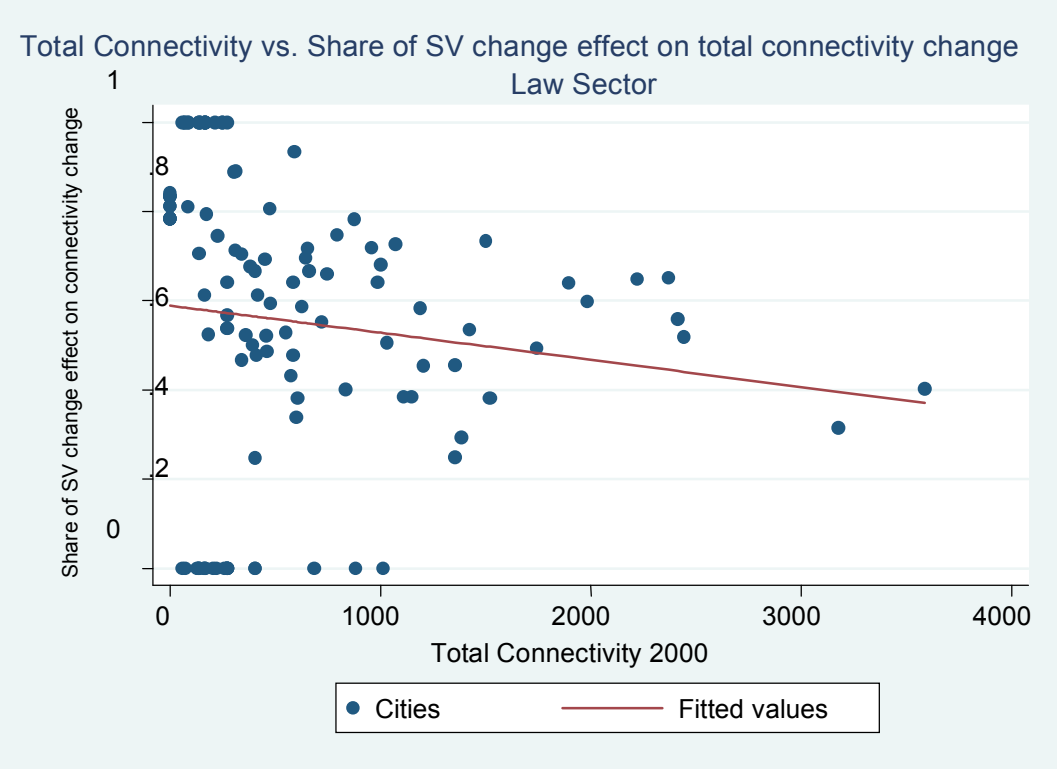
Correlation Coefficient = -0.3140



Correlation Coefficient = -0.0639



Correlation Coefficient = -0.0396



Correlation Coefficient = -0.1253

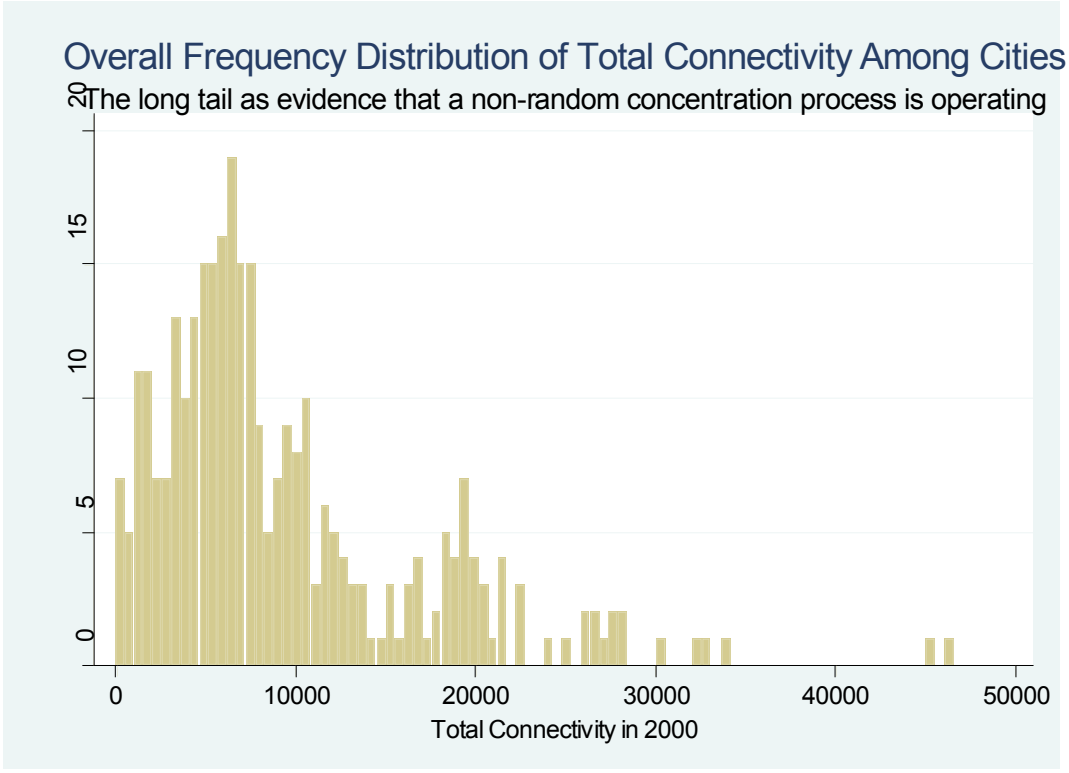
TABLE 9. Summary Table for Total Connectivity Change and "FN" Effect Change

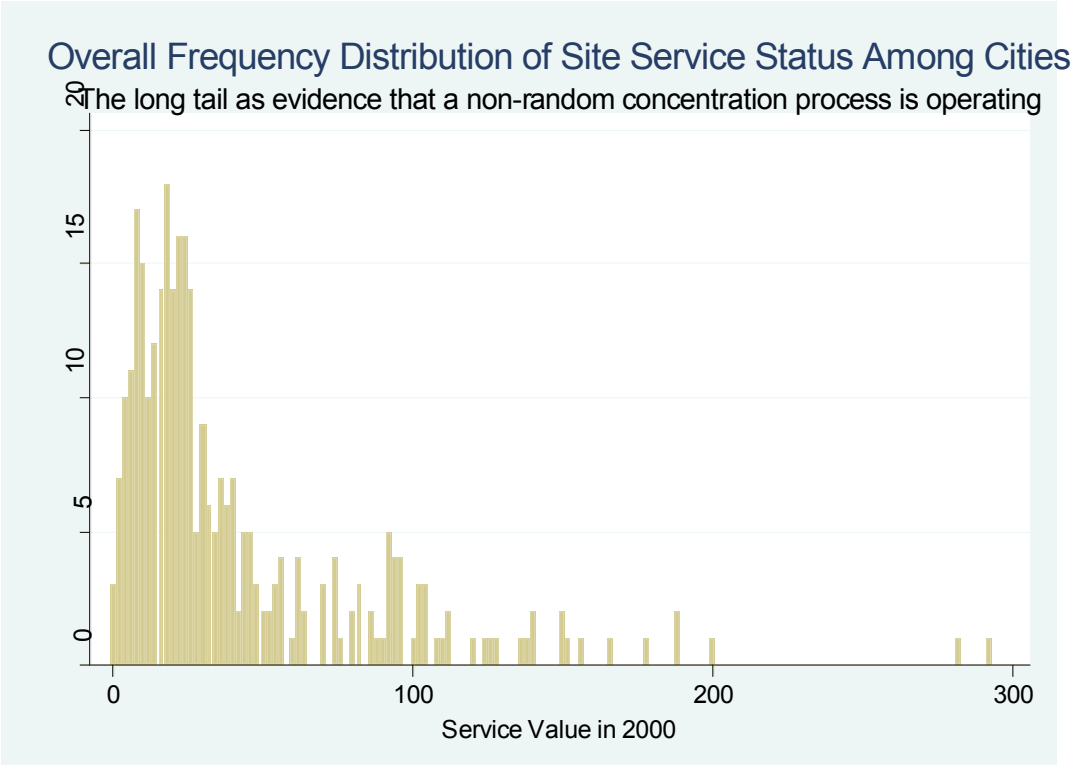
VARIABLE	MEAN CHANGE	STD. DEVIATION	TOTAL OF ALL CHANGE
Total Connectivity Change	669	1870	210976
T. Connectivity Change (Management)	725	629	228634
T. Connectivity Change (Banking)	**-378**	**905**	**-119114**
T. Connectivity Change (Accounting)	550	1273	173418
T. Connectivity Change (Advertising)	81	464	25776
T. Connectivity Change (Insurance)	**-370**	**460**	**-116572**
T. Connectivity Change (Law)	59	184	18834
FN Connectivity Change	891	826	280952
FN Effect Change (Management)	513	360	161650
FN Effect Change (Banking)	**-53**	**308**	**-16798**
FN Effect Change (Accounting)	463	487	146084
FN Effect Change (Advertising)	74	170	23364
FN Effect Change (Insurance)	**-140**	**251**	**-44244**
FN Effect Change (Law)	34	77	10896

TABLE 10. Correlation Coefficients between Total Connectivity in 2000 and "FN" Effect Change

SECTOR	CORRELATION COEFFICIENT	P-VALUE
GENERAL	0.5753*	0.0000
MANAGEMENT	0.5308*	0.0000
BANKING	**-0.3517***	**0.0000**
ACCOUNTING	0.6638*	0.0000
ADVERTISING	0.5750*	0.0000
INSURANCE	**-0.5353***	**0.0000**
LAW	0.8504*	0.0000

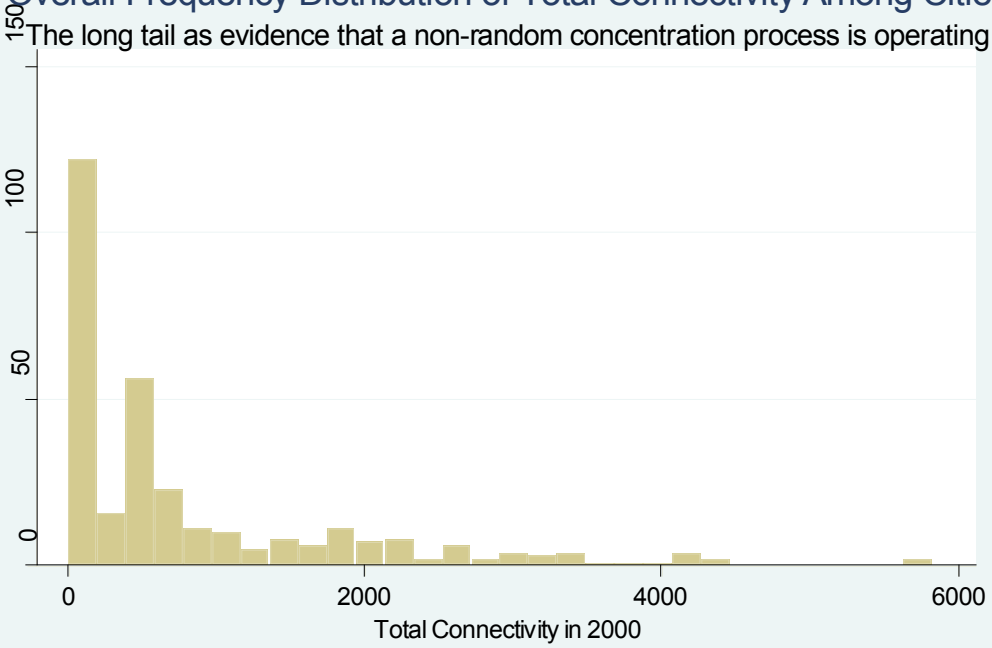
FIGURE 5. Distribution of Total Connectivity and Site Service Status among Cities





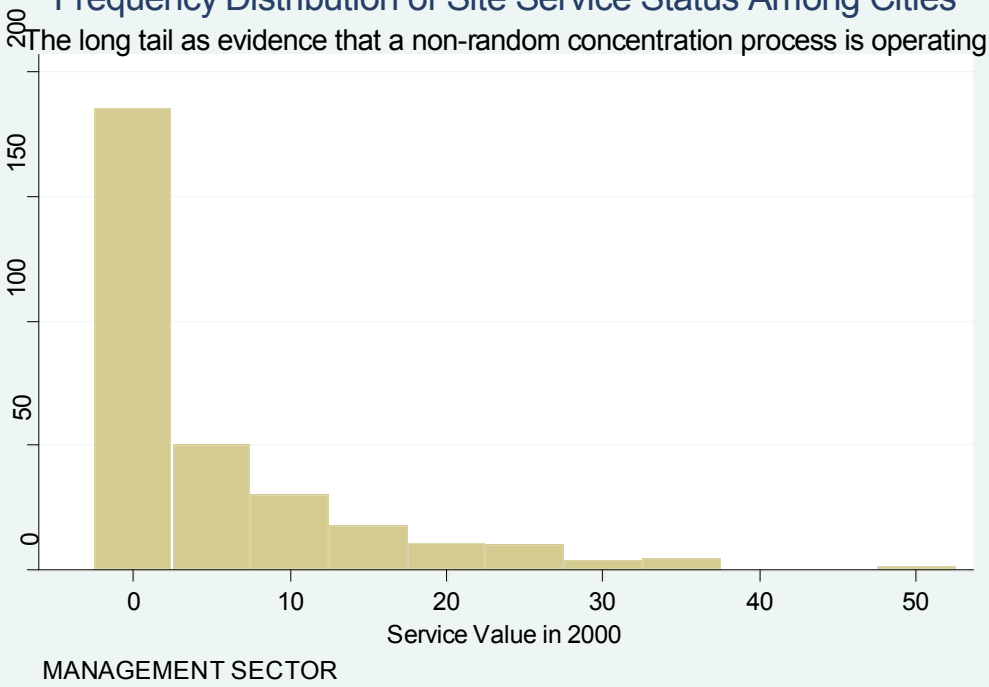
Overall Frequency Distribution of Total Connectivity Among Cities

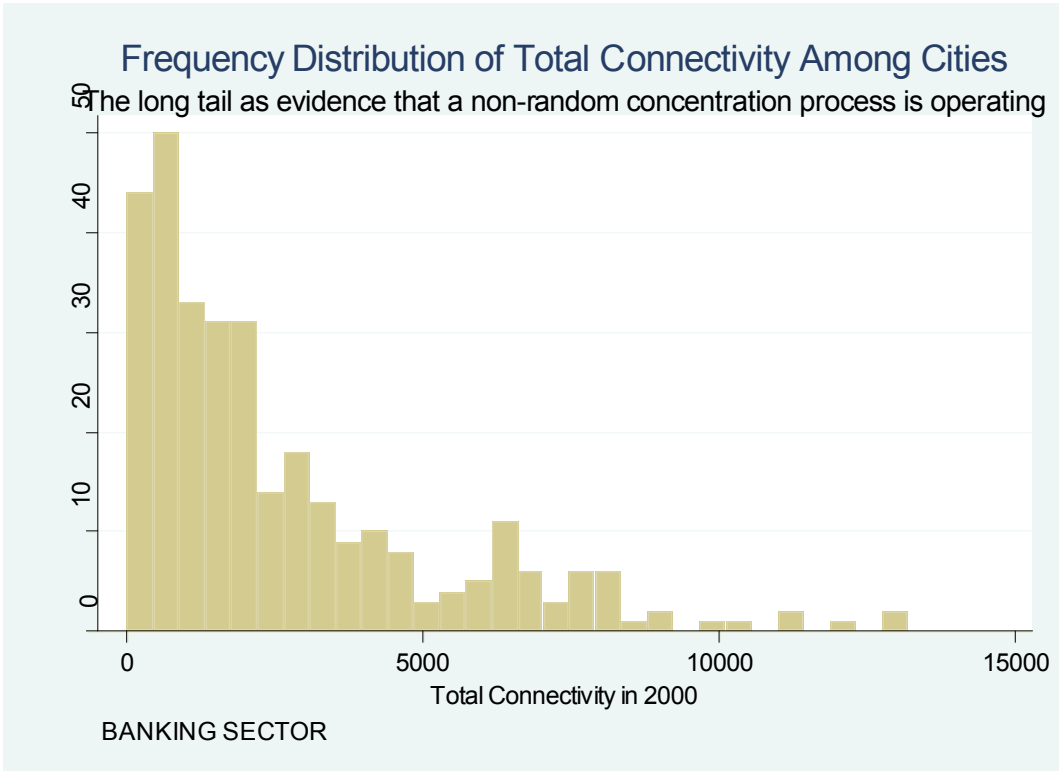
The long tail as evidence that a non-random concentration process is operating

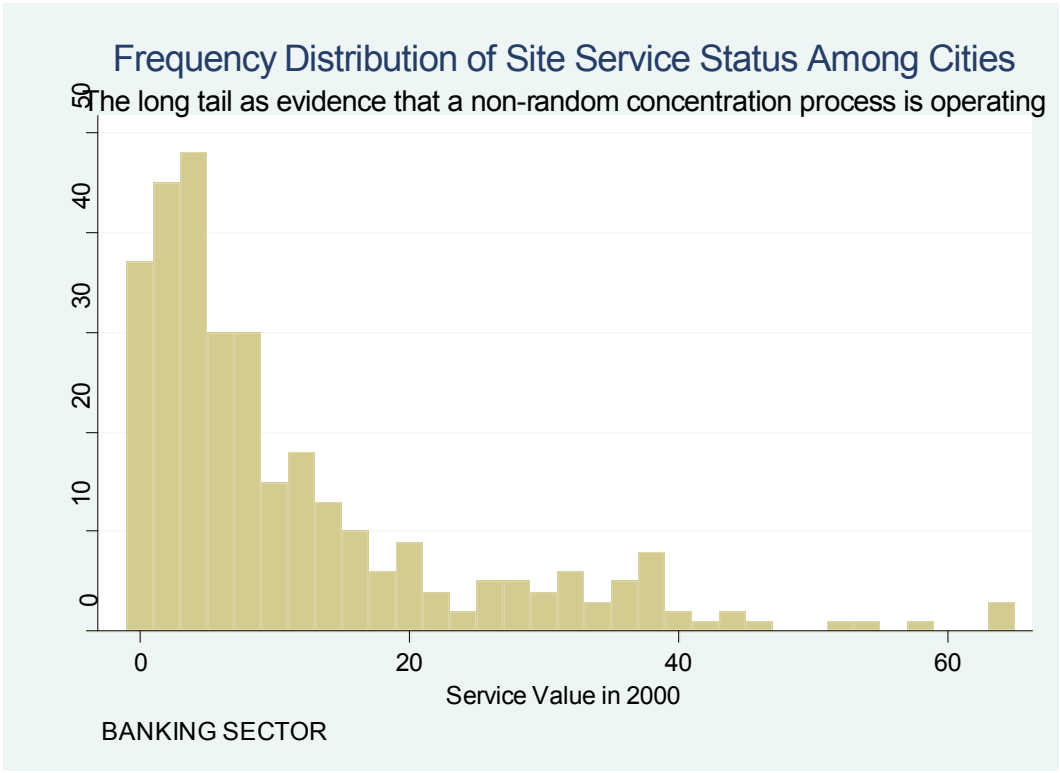


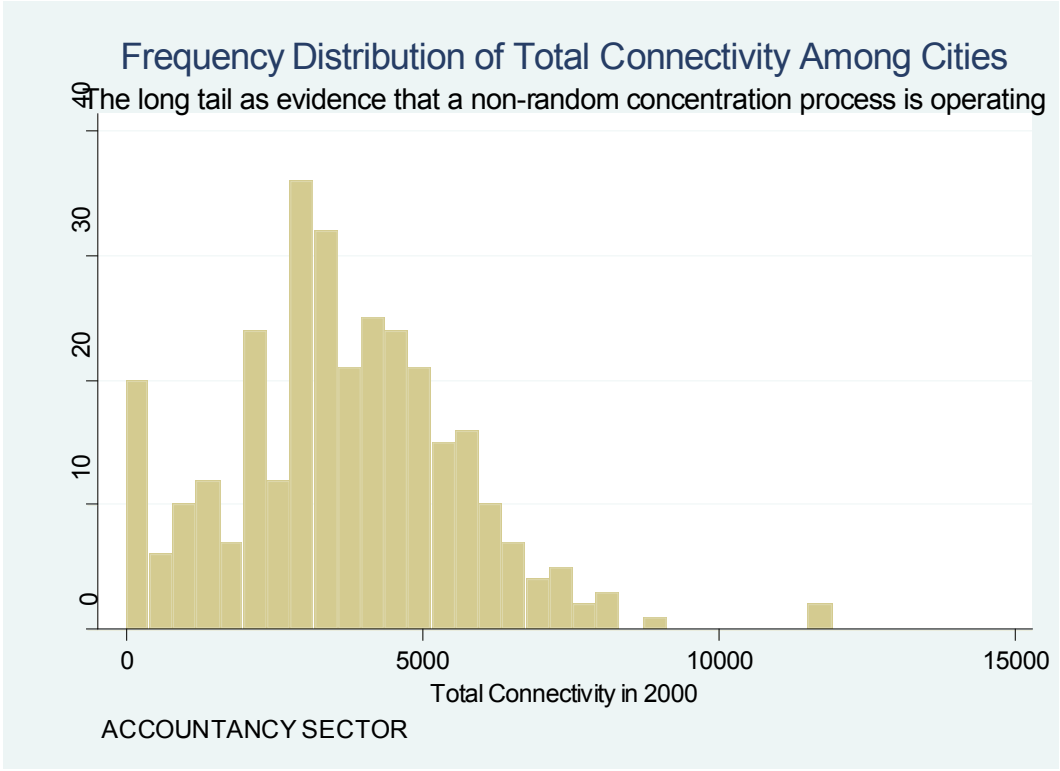
Frequency Distribution of Site Service Status Among Cities

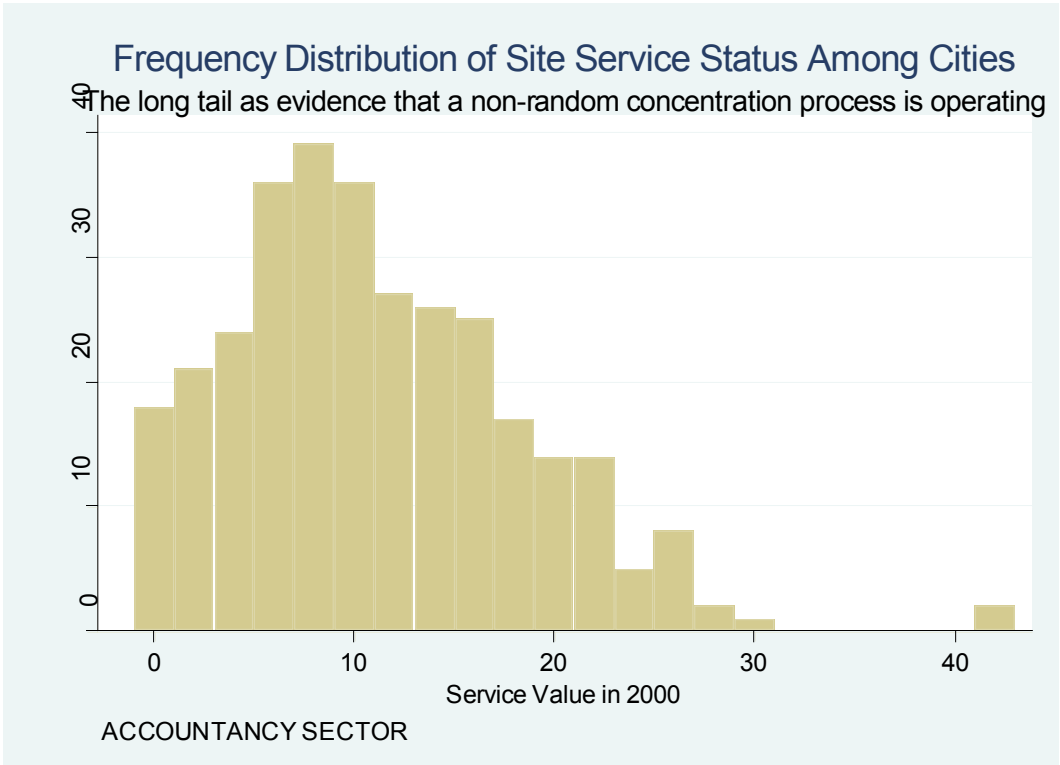
The long tail as evidence that a non-random concentration process is operating

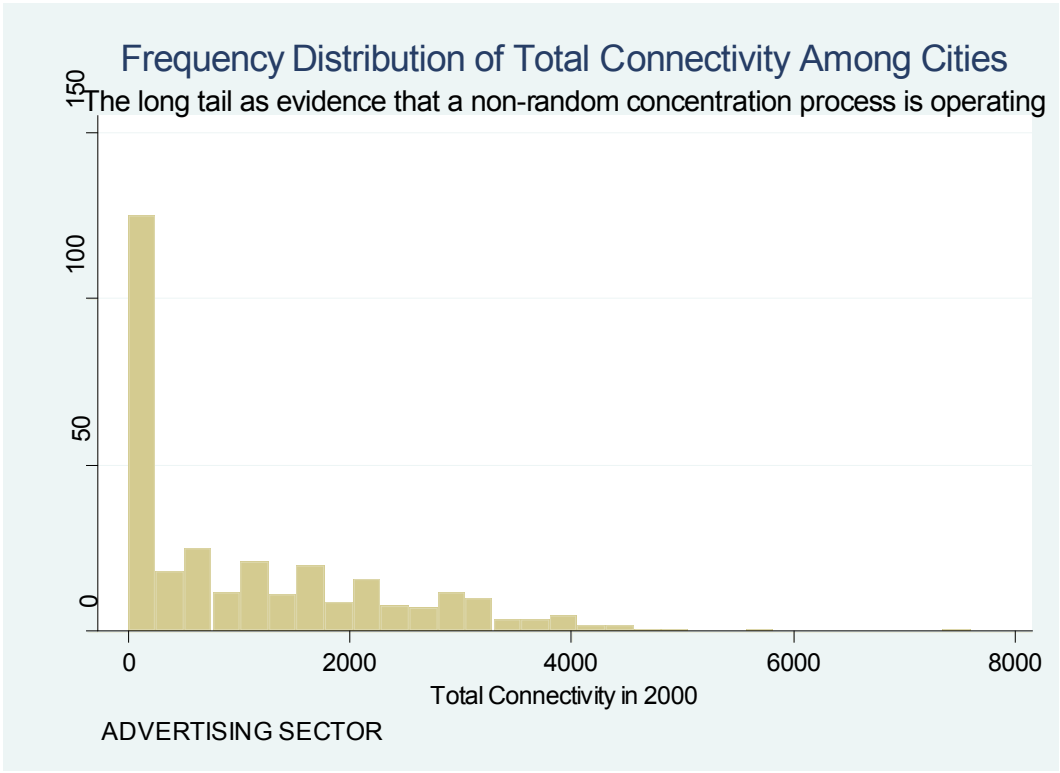


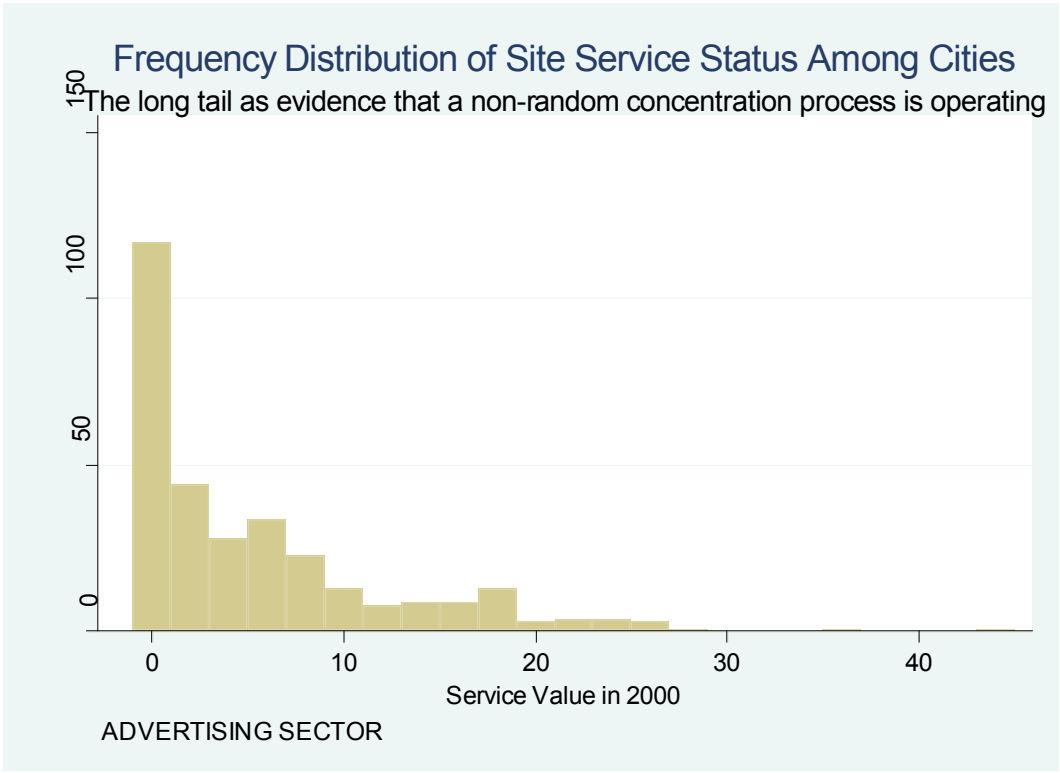

Frequency Distribution of Total Connectivity Among Cities
The long tail as evidence that a non-random concentration process is operating
0
10
20
30
40
50
0
5000
10000
15000
Total Connectivity in 2000
BANKING SECTOR


Frequency Distribution of Site Service Status Among Cities
The long tail as evidence that a non-random concentration process is operating
0
10
20
30
40
50
0
20
40
60
Service Value in 2000
BANKING SECTOR


Frequency Distribution of Total Connectivity Among Cities
The long tail as evidence that a non-random concentration process is operating
0
10
20
30
40
0
5000
10000
15000
Total Connectivity in 2000
ACCOUNTANCY SECTOR

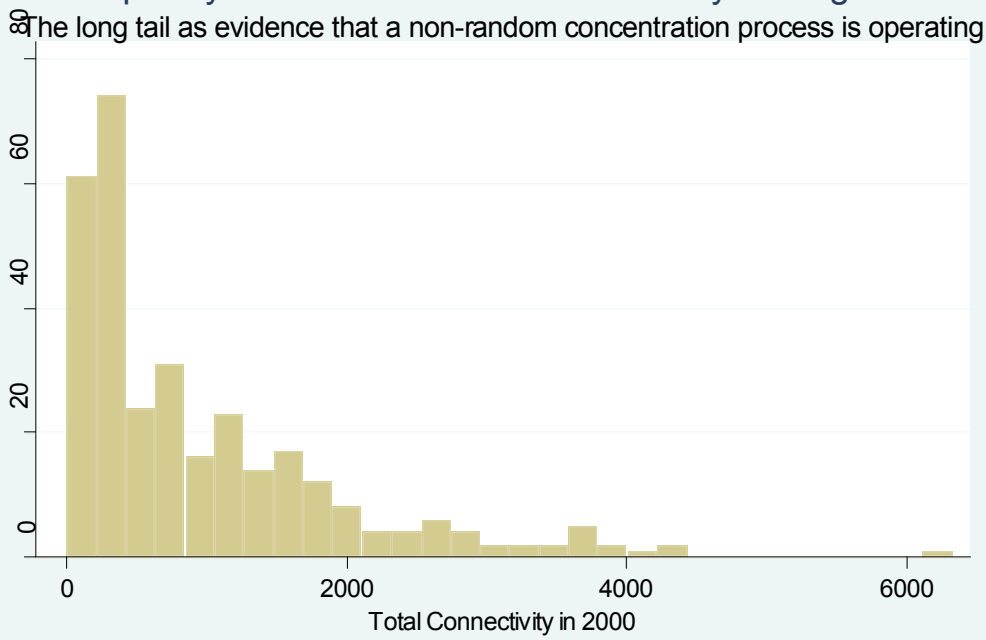

Frequency Distribution of Site Service Status Among Cities
The long tail as evidence that a non-random concentration process is operating
0
10
20
30
40
0
10
20
30
40
Service Value in 2000
ACCOUNTANCY SECTOR


Frequency Distribution of Total Connectivity Among Cities
The long tail as evidence that a non-random concentration process is operating
150
100
50
0
0
2000
4000
6000
8000
Total Connectivity in 2000
ADVERTISING SECTOR


Frequency Distribution of Site Service Status Among Cities
The long tail as evidence that a non-random concentration process is operating
150
100
50
0
0
10
20
30
40
Service Value in 2000
ADVERTISING SECTOR

Frequency Distribution of Total Connectivity Among Cities

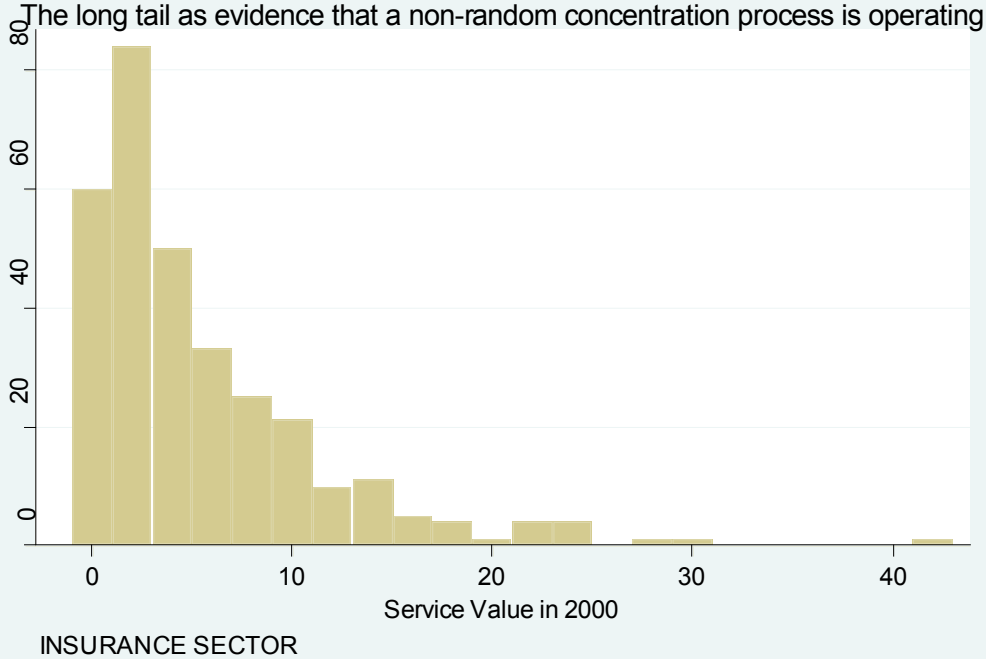
The long tail as evidence that a non-random concentration process is operating



INSURANCE SECTOR

Frequency Distribution of Site Service Status Among Cities

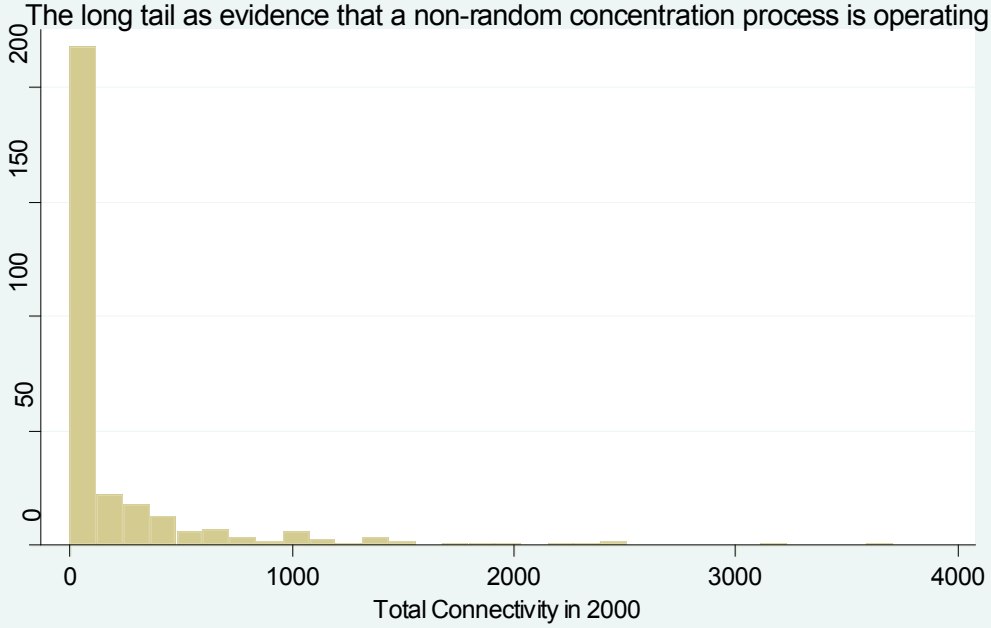
The long tail as evidence that a non-random concentration process is operating



INSURANCE SECTOR

Frequency Distribution of Total Connectivity Among Cities

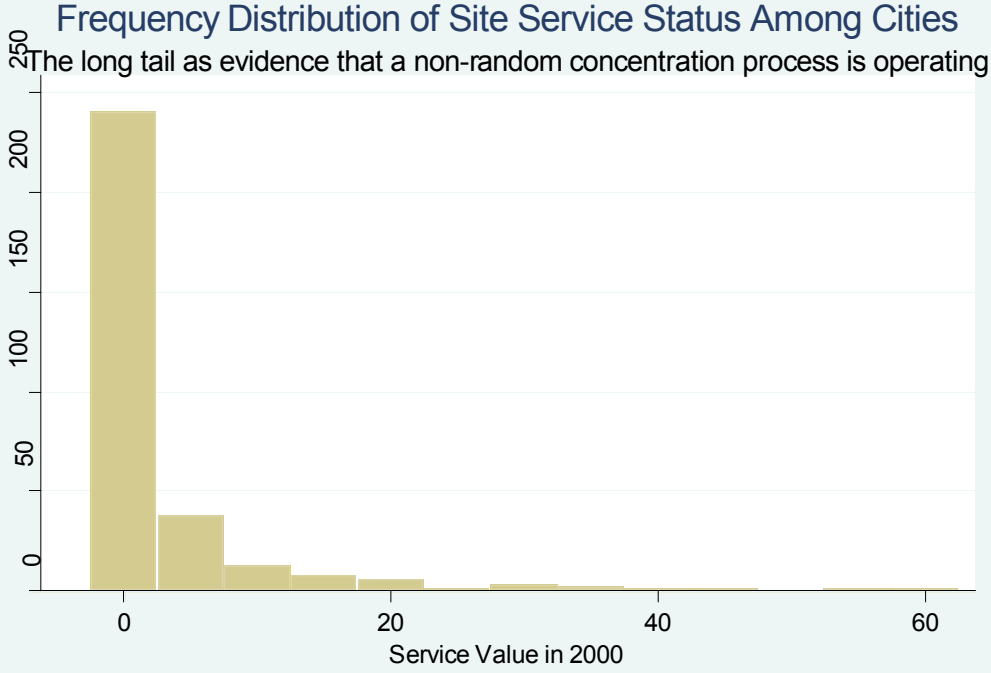
The long tail as evidence that a non-random concentration process is operating



LAW SECTOR

Frequency Distribution of Site Service Status Among Cities

The long tail as evidence that a non-random concentration process is operating



LAW SECTOR

TABLE 11. Correlations Coefficients between variables and Total Connectivity of a city in 2000

	VARIABLES	All Cities	Capital	Non Capital	Primary City	Non Primary City
City Level Variable	Quality of Life (2005)	0.5849* 0.0000 180	0.6831* 0.0000 109	0.3820* 0.0010 71	0.7138* 0.0000 111	0.3954* 0.0008 69
	Cost of Life (2005)	0.4447* 0.0000 139	0.5014* 0.0000 78	0.3641* 0.0039 61	0.4820* 0.0000 84	0.3450* 0.0099 55
	Top University (2004)	0.6424* 0.0000 315	0.6930* 0.0000 136	0.6147* 0.0000 179	0.7350* 0.0000 132	0.5515* 0.0000 183
	City Population (2000)	0.5016* 0.0000 310	0.4477* 0.0000 135	0.5549* 0.0000 175	0.5324* 0.0000 131	0.4234* 0.0000 179
Country Level Variables	GDP Current Price (2000)	0.1484* 0.0092 307	0.2296* 0.0086 130	0.2316* 0.0019 177	0.5375* 0.0000 125	0.2908* 0.0001 182
	GDP PPP 2000	0.2670* 0.0000 307	0.4845* 0.0000 130	0.2428* 0.0011 177	0.5721* 0.0000 125	0.2954* 0.0001 182
	HDI 2000	0.2539* 0.0001 248	0.5292* 0.0000 95	0.1608* 0.0471 153	0.5612* 0.0000 89	0.2236* 0.0046 159
	Pupil to Teacher Ratio (2000)	-0.1917* 0.0014 277	-0.3598* 0.0001 110		-0.3478* 0.0003 105	
	School enrollment, tertiary, (% gross) closest available to 2000	0.2316* 0.0000 312	0.4740* 0.0000 133		0.4547* 0.0000 129	
	Literacy rate - closest available to 2000	0.2379* 0.0008 197	0.3500* 0.0006 93		0.2968* 0.0047 89	0.2300* 0.0166 108
	Internet users (per 1,000 people) - closest available to 2000	0.2030* 0.0003 313	0.4963* 0.0000 134		0.5074* 0.0000 130	
	Cost of International Call - closest available to 2000		-0.2175* 0.0161 122		-0.2494* 0.0065 118	
	Total Population of the country (2000)		0.1994* 0.0204 135		0.2126* 0.0148 131	
	Technicians in R& D (per million people) - closest available to 2000		0.2479 0.0606 58			

Note: p-value in parentheses. Number of observations is shown bellow the p-value.
*Numbers with a * are statistically significant at 5% significance level.*
Only correlations up to 10% significance level are shown.

TABLE 12. Correlation Analysis between variables and Total Connectivity of a city in 2000 (Regional Approach)

	VARIABLES	Oceania	Central America	North America	South America	Africa	Asia	Europe
City Level Variables	Quality of Life (2005)	0.7883* 0.0352 7	0.9166* 0.0005 9			0.6892* 0.0001 26	0.5003* 0.0003 49	0.5121* 0.0001 50
	Cost of Life (2005)	0.8861* 0.0079 7		0.8226* 0.0000 23			0.4432* 0.0060 37	0.5714* 0.0001 44
	Top University (2004)	0.5650 0.0701 11		0.6729* 0.0000 52	0.7753* 0.0001 20	0.3827* 0.0194 37	0.5811* 0.0000 78	0.6542* 0.0000 104
	City Population (2000)	0.8825* 0.0007 10		0.7675* 0.0000 51	0.7980* 0.0001 18	0.3704* 0.0240 37	0.5004* 0.0000 77	0.5417* 0.0000 104
	Average Travel Time from home to work			0.9021* 0.0009 9				
Country Level Variables	GDP Current Price (2000)					0.4564* 0.0051 36		
	GDP PPP 2000					0.2864 0.0904 36	0.2058 0.0786 74	
	Pupil to Teacher Ratio (2000)		0.5596 0.0735 11					
	Literacy rate - closest available to 2000				0.4925* 0.0322 19			
	Internet users (per 1,000 people) - closest available to 2000					0.4101* 0.0117 37	0.2876* 0.0112 77	
	Cost of International Call - closest available to 2000		-0.5644 0.0559 12					
	Total Population of the country (2000)					0.3531* 0.0321 37		

Note: p-value in parentheses. Number of observations is shown bellow the p-value.
*Numbers with a * are statistically significant at 5% significance level.*
Only correlations up to 10% significance level are shown.

TABLE 13. Correlation Analysis between variables and Total Connectivity of a city in 2000 (Country Approach)

	VARIABLES	Brazil	India	China	Germany	USA	UK
City Level Variables	Quality of Life (2005)			0.9467* 0.0042 6	0.6981 0.0811 7		
	Cost of Life (2005)		0.9282 0.0718 4	0.9449* 0.0045 6	0.8776* 0.0216 6	0.8852* 0.0000 17	
	Top University (2004)	0.9603* 0.0000 9		0.9221* 0.0001 10	0.4938 0.0519 16	0.7188* 0.0000 40	0.9879* 0.0000 13
	City Population (2000)	0.9571* 0.0002 8	0.9370* 0.0002 9	0.5774 0.0805 10	0.4896 0.0542 16	0.9190* 0.0000 39	0.9888* 0.0000 13
	Average Travel Time from home to work					0.9194* 0.0005 9	0.9501* 0.0499 4

Note: p-value in parentheses. Number of observations is shown bellow the p-value.
*Numbers with a * are statistically significant at 5% significance level.*
Only correlations up to 10% significance level are shown.

Regression 1. Robust Linear Regression for Overall Connectivity Growth

Dependent Variable: Connectivity Growth	(I)	Beta Coef.	(II)	Beta Coef.	(III)	Beta Coef.	(IV)	Beta Coef.	(V)	Beta Coef.
OWN CONNECTIVITY 2000			-0.004 (-0.17)	-0.02	*0.03* *(0.78)*	*0.11*	*0.04* *(1.51)*	*0.15*	-0.01 (-0.16)	-0.02
*PRIMARY CITY * GDP*	0.09 (0.78)	*0.04*	0.25 (2.49)**	*0.10*	*0.25* *(2.22)***	*0.11*	*0.29* *(2.71)****	*0.11*	0.09 (0.78)	0.04
CITY POPULATION	18.20 (3.98)***	*0.34*	13.99 (2.53)**	*0.25*	*6.37* *(1.12)*	*0.11*	*2.74* *(0.53)*	*0.05*	18.73 (3.41)***	0.35
QUALITY OF LIFE	-7 (-0.5)	*-0.06*			*19* *(1.67)**	*0.20*			-6 (-0.4)	-0.06
AFFILIATION TO METROPOLIS	290 (0.79)	*0.06*	194 (0.64)	*0.04*	*-60* *(-0.16)*	*-0.01*	*-63* *(-0.2)*	*-0.01*	302 (0.81)	0.07
AFFILIATION TO UCLG	24.72 (0.07)	*0.01*	106.45 (0.36)	*0.03*	*-83.39* *(-0.21)*	*-0.02*	*132.65* *(0.46)*	*0.03*	28.65 (0.08)	0.01
TOP UNIVERSITY	246.80 (2.69)***	*0.22*	187.33 (1.91)*	*0.15*	*119.05* *(1.08)*	*0.10*	*137.12* *(1.41)*	*0.10*	258.42 (2.31)**	*0.23*
CONTAINER TRAFFIC	-0.03 (-0.43)	*-0.03*	-0.10 (-1.6)	*-0.10*	*0.03* *(0.62)*	*0.04*	*0.02* *(0.31)*	*0.02*	-0.03 (-0.42)	-0.03
AIR PASSENGER TRAFFIC	6.97 (1.12)	*0.09*	5.98 (1.23)	*0.08*					6.65 (1.04)	0.08
PUPIL TO TEACHER RATIO	-33.44 (-1.81)*	*-0.16*	-19.76 (-1.54)	*-0.10*					-33.52 (-1.81)*	-0.16
PHONE COST	-329.74 (-4.17)***	*-0.33*	-191.33 (-2.99)***	*-0.21*					-331.80 (-4.06)***	-0.33
TRADE / GNP	12.27 (2.7)***	*0.22*	7.41 (1.85)*	*0.14*					12.45 (2.76)***	0.23
USA DUMMY					*-1935* *(-4.08)****	*-0.31*	*-986* *(-3.05)****	*-0.19*		
UK DUMMY					*836* *(1.9)**	*0.05*	*1056* *(2.23)***	*0.11*		
GERMANY DUMMY					*-578* *(-0.79)*	*-0.06*	*-423* *(-0.9)*	*-0.05*		
CHINA DUMMY					*-138* *(-0.17)*	*-0.01*	*-301* *(-0.44)*	*-0.03*		
INDIA DUMMY					*174* *(0.17)*	*0.01*	*46* *(0.07)*	*0.00*		
BRAZIL DUMMY					1157 (1.41)	0.09	110 (0.18)	0.01		
Constant	1235 (0.79)	.	540 (0.93)	.	-1067 (-1.34)	.	199 (1.03)	.	1204 (0.77)	.
Observations	121		220		153		260		121	
R-squared	0.3738		0.2111		0.2376		0.1474		0.3739	

Regression 2. Robust Linear Regression for Connectivity Growth in the Management Sector

Dependent Variable: Con. Growth (MAN)	(I)	Beta Coef.	(II)	Beta Coef.	(III)	Beta Coef.	(IV)	Beta Coef.	(V)	Beta Coef.
OWN CONNECTIVITY 2000			-0.27 (-3.61)***	-0.48	*-0.32 (-3.27)****	*-0.64*	*-0.29 (-4)****	*-0.53*	-0.25 (-2.34)**	-0.50
CONNECTIVITY ACC 2000			0.15 (5.8)***	*0.51*	*0.09 (2.42)***	*0.35*	*0.16 (6.69)****	*0.58*	0.10 (2.13)**	0.35
CONNECTIVITY INS 2000			0.22 (3.56)***	*0.36*	*0.20 (2.41)***	*0.36*	*0.21 (3.24)****	*0.35*	0.16 (1.81)***	0.29
CONNECTIVITY ADV 2000			-0.06 (-1.17)	*-0.13*	*-0.08 (-1.39)*	*-0.18*	*-0.08 (-1.51)*	*-0.16*	-0.07 (-1.1)	-0.15
CONNECTIVITY BANK 2000			-0.01 (-0.24)	*-0.03*	*0.03 (0.76)*	*0.13*	*-0.01 (-0.18)*	*-0.03*	0.04 (0.9)	0.17
CONNECTIVITY LAW 2000			0.01 (0.09)	*0.01*	*0.10 (0.76)*	*0.09*	*0.09 (0.8)*	*0.07*	-0.002 (-0.02)	-0.002
*PRIMARY CITY * GDP*	0.07 (1.34)	0.10	0.04 (0.95)	*0.05*	*0.08 (1.58)*	*0.11*	*0.04 (0.86)*	*0.04*	0.06 (1.07)	0.10
CITY POPULATION	3.05 (1.91)*	*0.18*	2.57 (1.91)**	*0.14*	*0.47 (0.24)*	*0.03*	*-0.29 (-0.2)*	*-0.01*	2.23 (1.28)	0.13
QUALITY OF LIFE	7.13 (1.8)*	*0.22*			*9.69 (2.31)***	*0.32*			5.21 (1.04)	0.16
AFFILIATION TO METROPOLIS	82 (0.81)	*0.06*	-13 (-0.15)	*-0.01*	*23 (0.23)*	*0.02*	*-20 (-0.24)*	*-0.01*	6.3 (0.06)	0.004
AFFILIATION TO UCLG	-119 (-1.1)	*-0.09*	-41 (-0.51)	*-0.03*	*23 (0.2)*	*0.02*	*83 (0.98)*	*0.06*	-110 (-1.02)	-0.08
TOP UNIVERSITY	45 (1.08)	*0.13*	51.88 (1.16)	*0.12*	*46.22 (1.01)*	*0.13*	*86.54 (2.11)***	*0.20*	37.34 (0.61)	*0.11*
CONTAINER TRAFFIC	-0.01 (-0.52)	*-0.03*	-0.04 (-3.05)***	*-0.12*	*-0.02 (-1.25)*	*-0.07*	*-0.02 (-1.51)*	*-0.06*	-0.03 (-1.6)	-0.10
AIR PASSENGER TRAFFIC	4.00 (1.73)*	*0.16*	2.69 (1.34)	*0.12*					3.38 (0.96)	0.14
PUPIL TO TEACHER RATIO	-10.56 (-1.91)*	*-0.17*	-11.42 (-2.7)***	*-0.18*					-9.15 (-1.66)*	-0.14
PHONE COST	-22 (-0.88)	*-0.07*	-9.66 (-0.5)	*-0.03*					-20.53 (-0.72)	-0.07
TRADE / GNP	1.34 (0.81)	*0.08*	0.05 (0.04)	*0.00*					0.22 (0.13)	0.01
USA DUMMY					*134 (0.6)*	*0.07*	*122 (0.95)*	*0.07*		
UK DUMMY					*405 (1.71)**	*0.07*	*32 (0.17)*	*0.01*		
GERMANY DUMMY					*34 (0.19)*	*0.01*	*55 (0.38)*	*0.02*		
CHINA DUMMY					*172 (0.65)*	*0.05*	*162 (0.98)*	*0.05*		
INDIA DUMMY					*388 (1.19)*	*0.10*	*286 (1.41)*	*0.08*		
BRAZIL DUMMY					168 (0.57)	0.04	63 (0.3)	0.02		
Constant	210 (0.49)	.	382 (1.63)	.	-434 (-1.85)*	.	67 (0.84)	.	87 (0.21)	.
Observations	121		220		153		260		121	

Regression 3. Robust Linear Regression for Connectivity Growth in the Banking Sector

Dependent Variable: Con. Growth (BANK)	(I)	Beta Coef.	(II)	Beta Coef.	(III)	Beta Coef.	(IV)	Beta Coef.	(V)	Beta Coef.
OWN CONNECTIVITY 2000			-0.35 (-7.08)***	-1.09	*-0.27* *(-4.51)****	*-0.88*	*-0.31* *(-6.14)****	*-0.98*	-0.31 (-5.29)***	-1.03
CONNECTIVITY ACC 2000			0.03 (0.71)	*0.07*	*0.08* *(1.31)*	*0.20*	*0.05* *(1.39)*	*0.14*	0.09 (1.19)	0.22
CONNECTIVITY MAN 2000			0.13 (1.19)	*0.18*	*0.32* *(2.15)***	*0.45*	*0.25* *(2.09)***	*0.33*	0.12 (0.89)	0.18
CONNECTIVITY INS 2000			0.29 (3.2)***	*0.35*	*0.11* *(0.86)*	*0.15*	*0.25* *(2.75)****	*0.30*	0.18 (1.42)	0.24
CONNECTIVITY ADV 2000			-0.05 (-0.58)	*-0.08*	*-0.12* *(-1)*	*-0.18*	*-0.10* *(-1.04)*	*-0.15*	-0.05 (-0.51)	-0.08
CONNECTIVITY LAW 2000			0.12 (0.65)	*0.07*	*-0.05* *(-0.25)*	*-0.04*	*0.07* *(0.41)*	*0.04*	-0.01 (-0.03)	-0.01
*PRIMARY CITY * GDP*	0.051 (0.76)	0.1	0.13 (2.5)**	*0.12*	*0.17* *(2.72)****	*0.17*	*0.18* *(3.19)****	*0.15*	0.10 (1.6)	0.11
CITY POPULATION	2.68 (0.82)	*0.12*	8.72 (3.67)***	*0.34*	*5.78* *(2.11)***	*0.23*	*3.79* *(1.42)*	*0.14*	9.07 (3.66)***	0.40
QUALITY OF LIFE	5.27 (0.9)	*0.12*			*5.99* *(1.23)*	*0.14*			5.26 (0.77)	0.12
AFFILIATION TO METROPOLIS	-74 (-0.4)	*-0.04*	192 (1.44)	*0.09*	*-32* *(-0.21)*	*-0.02*	*59* *(0.48)*	*0.03*	233 (1.3)	0.12
AFFILIATION TO UCLG	13 (0.07)	*0.01*	-85 (-0.72)	*-0.04*	*-105* *(-0.62)*	*-0.05*	*-49* *(-0.42)*	*-0.03*	-8 (-0.05)	-0.004
TOP UNIVERSITY	-38 (-0.76)	*-0.08*	1.35 (0.03)	*0.00*	*-68* *(-1.16)*	*-0.13*	*-35* *(-0.65)*	*-0.06*	13.1 (0.23)	*0.03*
CONTAINER TRAFFIC	0.01 (0.28)	*0.03*	-0.01 (-0.53)	*-0.03*	*0.06* *(2.42)***	*0.17*	*0.04* *(1.35)*	*0.11*	0.02 (0.71)	0.04
AIR PASSENGER TRAFFIC	0.29 (0.1)	*0.01*	5.94 (2.78)**	*0.19*					5.66 (1.57)	0.17
PUPIL TO TEACHER RATIO	7.12 (0.73)	*0.08*	1.36 (0.25)	*0.02*					8.33 (1.06)	0.10
PHONE COST	-118 (-3.18)***	*-0.27*	-91 (-3.66)***	*-0.21*					-132 (-3.9)***	-0.31
TRADE / GNP	2.79 (1.31)	*0.12*	3.10 (1.58)	*0.13*					6.64 (3.16)***	0.28
USA DUMMY					*-917* *(-3.3)****	*-0.33*	*-460* *(-2.72)****	*-0.19*		
UK DUMMY					*1139* *(3.94)****	*0.14*	*788* *(6.19)****	*0.18*		
GERMANY DUMMY					*14* *(0.05)*	*0.003*	*27* *(0.16)*	*0.008*		
CHINA DUMMY					*-336* *(-1.3)*	*-0.07*	*114* *(0.41)*	*0.02*		
INDIA DUMMY					*-485* *(-0.87)*	*-0.09*	*261* *(0.75)*	*0.06*		
BRAZIL DUMMY					581 (3.23)***	0.10	316 (1.9)*	0.06		
Constant	-1164 (-1.78)*	.	-326 (-1.19)	.	-794 (-2.47)**	.	-265 (-2.64)***	.	-1369 (-2.11)**	.
Observations	121		220		153		260		121	
R-squared	0.1087		0.3617		0.3289		0.3263		0.3713	
Adjusted R2	0.0188		0.3113		0.2330		0.2760		0.2675	
Note: absolute t-values in parentheses.										
*Numbers with ***, ** and * are statistically significant at 1%, 5% and 10% significance level respectively.*										

Regression 4. Robust Linear Regression for Connectivity Growth in the Accountancy Sector

Dependent Variable: Con. Growth (ACC)	(I)	Beta Coef.	(II)	Beta Coef.	(III)	Beta Coef.	(IV)	Beta Coef.	(V)	Beta Coef.
OWN CONNECTIVITY 2000			-0.31 (-3.99)***	-0.52	-0.36 (-3.83)***	-0.69	-0.27 (-3.49)***	-0.47	-0.46 (-4.59)***	-0.80
CONNECTIVITY MAN 2000			-0.13 (-0.83)	-0.12	-0.06 (-0.36)	-0.07	-0.09 (-0.6)	-0.08	-0.13 (-0.63)	-0.13
CONNECTIVITY INS 2000			0.27 (1.78)*	0.21	-0.14 (-0.82)	-0.13	0.22 (1.45)	0.17	-0.09 (-0.51)	-0.08
CONNECTIVITY ADV 2000			0.39 (3.29)***	0.41	0.38 (2.71)***	0.42	0.39 (3.18)***	0.40	0.42 (3.09)***	0.45
CONNECTIVITY BANK 2000			0.09 (1.3)	0.19	0.18 (2.75)***	0.43	0.10 (1.57)	0.21	0.20 (2.97)***	0.46
CONNECTIVITY LAW 2000			0.05 (0.17)	0.02	0.19 (0.73)	0.10	0.06 (0.24)	0.02	0.09 (0.34)	0.05
ARTHUR ANDERSON 2000	166.57 (0.99)	0.13	203.10 (1.67)*	0.17	380.17 (2.65)***	0.32	204.96 (1.82)***	0.17	299.13 (1.76)*	0.24
*PRIMARY CITY * GDP*	0.0 (-0.38)	0.0	0.05 (0.48)	0.03	-0.05 (-0.61)	-0.04	0.02 (0.19)	0.01	-0.07 (-0.85)	-0.06
CITY POPULATION	8.04 (2.05)**	0.24	1.44 (0.39)	0.04	2.75 (0.69)	0.08	0.87 (0.26)	0.02	5.89 (1.42)	0.18
QUALITY OF LIFE	-9.24 (-1.08)	-0.14			11.75 (1.47)	0.20			1.67 (0.18)	0.03
AFFILIATION TO METROPOLIS	249.12 (0.89)	0.09	-91.76 (-0.42)	-0.03	-139.12 (-0.56)	-0.05	-165.03 (-0.8)	-0.05	-54.66 (-0.2)	-0.02
AFFILIATION TO UCLG	-153.58 (-0.66)	-0.06	159.45 (0.8)	0.06	0.75 (0)	0.00	156.61 (0.79)	0.05	84.02 (0.33)	0.03
TOP UNIVERSITY	151.40 (1.88)***	0.22	54.46 (0.63)	0.06	62.16 (0.8)	0.09	11.60 (0.15)	0.01	189.92 (2.01)**	0.27
CONTAINER TRAFFIC	-0.04 (-1.06)	-0.07	-0.07 (-2.02)**	-0.11	-0.01 (-0.55)	-0.03	-0.02 (-0.61)	-0.03	-0.05 (-1.01)	-0.09
AIR PASSENGER TRAFFIC	-0.32 (-0.07)	-0.01	-1.09 (-0.29)	-0.02					-8.18 (-1.67)*	-0.17
PUPIL TO TEACHER RATIO	-19.16 (-1.16)	-0.15	-10.72 (-1.05)	-0.08					-22.07 (-1.53)	-0.17
PHONE COST	-124.19 (-2.14)**	-0.20	-50.70 (-1.18)	-0.08					-121.36 (-2.13)**	-0.19
TRADE / GNP	3.87 (1.23)	0.11	1.14 (0.46)	0.03					2.03 (0.62)	0.06
USA DUMMY					-702.32 (-2.56)**	-0.18	-211.37 (-0.9)	-0.06		
UK DUMMY					-303.19 (-0.75)	-0.03	241.53 (0.62)	0.04		
GERMANY DUMMY					-394.68 (-0.58)	-0.07	91.07 (0.23)	0.02		
CHINA DUMMY					-842.35 (-2.23)**	-0.12	-757.93 (-2.17)**	-0.10		
INDIA DUMMY					-454.49 (-0.86)	-0.06	-517.05 (-1.46)	-0.07		
BRAZIL DUMMY					306.01 (0.73)	0.04	-297.72 (-0.75)	-0.04		
Constant	1483.13 (1.37)	.	1077.01 (2.33)	.	1.30 (0)	.	656.60 (3.82)***	.	1774.96 (1.68)*	.
Observations	121		220		153		260		121	

Regression 5. Robust Linear Regression for Connectivity Growth in the Advertising Sector

Dependent Variable: Con. Growth (ADV)	(I)	Beta Coef.	(II)	Beta Coef.	(III)	Beta Coef.	(IV)	Beta Coef.	(V)	Beta Coef.
OWN CONNECTIVITY 2000			-0.11 (-1.92)*	-0.28	*-0.13 (-2.28)***	*-0.32*	*-0.15 (-3.31)****	*-0.40*	-0.04 (-0.59)	-0.11
CONNECTIVITY ACC 2000			0.01 (0.33)	*0.03*	*0.00 (-0.12)*	*-0.02*	*0.01 (0.58)*	*0.05*	-0.01 (-0.38)	-0.05
CONNECTIVITY MAN 2000			0.11 (1.46)	*0.24*	*0.14 (1.61)*	*0.32*	*0.12 (1.91)**	*0.28*	0.15 (1.49)	0.34
CONNECTIVITY INS 2000			-0.09 (-1.18)	*-0.18*	*-0.01 (-0.15)*	*-0.03*	*-0.08 (-1.3)*	*-0.17*	-0.06 (-0.56)	-0.12
CONNECTIVITY BANK 2000			0.08 (3.38)***	*0.43*	*0.07 (2.51)***	*0.37*	*0.09 (4.2)****	*0.51*	0.07 (2.41)**	0.36
CONNECTIVITY LAW 2000			-0.03 (-0.27)	*-0.03*	*0.15 (1.18)*	*0.17*	*0.08 (0.9)*	*0.09*	-0.09 (-0.74)	-0.10
*PRIMARY CITY * GDP*	-0.04 (-0.98)	-0.1	0.01 (0.23)	*0.01*	*0.02 (0.36)*	*0.03*	*0.02 (0.62)*	*0.03*	-0.02 (-0.52)	-0.04
CITY POPULATION	5.24 (3.46)***	*0.36*	2.58 (1.79)*	*0.17*	*-0.49 (-0.25)*	*-0.03*	*0.34 (0.23)*	*0.02*	2.69 (1.45)	0.18
QUALITY OF LIFE	-3.95 (-1.28)	*-0.14*			*-3.30 (-1.15)*	*-0.13*			-7.31 (-1.91)*	-0.25
AFFILIATION TO METROPOLIS	26.27 (0.25)	*0.02*	16.91 (0.19)	*0.01*	*24.83 (0.21)*	*0.02*	*23.43 (0.25)*	*0.02*	-15.53 (-0.13)	-0.01
AFFILIATION TO UCLG	191.24 (1.82)*	*0.16*	181.61 (2.51)**	*0.16*	*89.23 (0.77)*	*0.07*	*65.60 (0.95)*	*0.06*	148.97 (1.18)	0.12
TOP UNIVERSITY	82.39 (2.39)**	*0.27*	12.69 (0.31)	*0.04*	*-16.87 (-0.37)*	*-0.05*	*-15.59 (-0.42)*	*-0.05*	32.33 (0.65)	*0.11*
CONTAINER TRAFFIC	-0.02 (-0.86)	*-0.07*	-0.01 (-0.87)	*-0.06*	*0.01 (0.57)*	*0.03*	*0.00 (0.05)*	*0.00*	-0.01 (-0.45)	-0.04
AIR PASSENGER TRAFFIC	2.86 (1.57)	*0.13*	1.29 (1.21)	*0.07*					2.92 (1.44)	0.14
PUPIL TO TEACHER RATIO	-2.46 (-0.53)	*-0.04*	3.64 (1.07)	*0.07*					-3.06 (-0.63)	-0.05
PHONE COST	-24.48 (-0.95)	*-0.09*	-20.38 (-1.19)	*-0.08*					-24.95 (-0.89)	-0.09
TRADE / GNP	4.86 (3.14)***	*0.32*	2.89 (2.76)***	*0.20*					3.87 (2.62)***	0.25
USA DUMMY					*-351.96 (-2)***	*-0.21*	*-347.83 (-3.63)****	*-0.26*		
UK DUMMY					*-274.57 (-1.75)**	*-0.06*	*6.09 (0.07)*	*0.00*		
GERMANY DUMMY					*-440.21 (-1.9)***	*-0.17*	*-335.06 (-3.01)****	*-0.17*		
CHINA DUMMY					*140.18 (0.67)*	*0.05*	*18.70 (0.13)*	*0.01*		
INDIA DUMMY					*544.13 (2.62)****	*0.16*	*119.39 (0.69)*	*0.04*		
BRAZIL DUMMY					0.23 (0)	0.00	15.13 (0.16)	0.01		
Constant	-64.30 (-0.22)	.	-413.02 (-2.73)***	.	250.61 (1.32)	.	-51.00 (-0.76)	.	231.41 (0.7)	.
Observations	121		220		153		260		121	

Regression 6. Robust Linear Regression for Connectivity Growth in the Insurance Sector

Dependent Variable: Con. Growth (INS)	(I)	Beta Coef.	(II)	Beta Coef.	(III)	Beta Coef.	(IV)	Beta Coef.	(V)	Beta Coef.
OWN CONNECTIVITY 2000			-0.60 (-15.46)***	-1.29	*-0.60* *(-11.81)****	*-1.42*	*-0.61* *(-17.2)****	*-1.31*	-0.57 (-10.07)***	-1.35
CONNECTIVITY ACC 2000			-0.03 (-1.87)*	*-0.12*	*-0.01* *(-0.7)*	*-0.07*	*-0.01* *(-0.48)*	*-0.03*	-0.02 (-0.6)	-0.07
CONNECTIVITY MAN 2000			0.07 (1.55)	*0.17*	*0.12* *(1.74)**	*0.30*	*0.12* *(2.48)***	*0.28*	0.07 (1.06)	0.19
CONNECTIVITY ADV 2000			0.06 (2.33)**	*0.16*	*0.04* *(1.12)*	*0.12*	*0.03* *(1.27)*	*0.10*	0.06 (1.73)*	0.17
CONNECTIVITY BANK 2000			0.05 (2.46)**	*0.27*	*0.05* *(2.26)***	*0.27*	*0.05* *(2.7)****	*0.27*	0.04 (1.46)	0.22
CONNECTIVITY LAW 2000			0.15 (1.6)	*0.17*	*0.11* *(1.28)*	*0.14*	*0.13* *(1.58)*	*0.14*	0.11 (1.09)	0.14
*PRIMARY CITY * GDP*	0.1 (2.57)**	0.2	0.02 (0.64)	*0.03*	*0.06* *(2.66)****	*0.12*	*0.04* *(1.64)*	*0.06*	0.02 (0.77)	0.04
CITY POPULATION	-3.20 (-2.88)***	*-0.25*	-0.58 (-0.64)	*-0.04*	*-0.76* *(-0.72)*	*-0.06*	*-0.94* *(-1.05)*	*-0.06*	-0.78 (-0.66)	-0.06
QUALITY OF LIFE	-10.29 (-3.51)***	*-0.41*			*2.64* *(1.39)*	*0.11*			-0.63 (-0.22)	-0.03
AFFILIATION TO METROPOLIS	12.55 (0.13)	*0.01*	93.67 (1.81)*	*0.08*	*107.60* *(1.82)**	*0.10*	*77.85* *(1.61)*	*0.07*	139.70 (2.12)**	0.13
AFFILIATION TO UCLG	0.53 (0.01)	*0.00*	-88.47 (-1.99)**	*-0.08*	*-92.04* *(-1.31)*	*-0.09*	*-132.76* *(-2.94)****	*-0.12*	-47.90 (-0.69)	-0.04
TOP UNIVERSITY	-70.09 (-2.43)**	*-0.26*	40.98 (1.75)*	*0.13*	*-4.49* *(-0.23)*	*-0.02*	*14.75* *(0.8)*	*0.04*	38.95 (1.29)	*0.15*
CONTAINER TRAFFIC	0.01 (0.49)	*0.05*	0.03 (1.58)	*0.11*	*0.01* *(0.5)*	*0.04*	*0.01* *(0.61)*	*0.03*	0.04 (1.58)	0.16
AIR PASSENGER TRAFFIC	1.63 (0.93)	*0.09*	-0.67 (-0.7)	*-0.04*					0.13 (0.07)	0.01
PUPIL TO TEACHER RATIO	-0.51 (-0.1)	*-0.01*	0.33 (0.16)	*0.01*					-0.03 (-0.01)	0.00
PHONE COST	-50.56 (-2.27)**	*-0.21*	-28.42 (-2.81)***	*-0.12*					-37.25 (-2.42)**	-0.15
TRADE / GNP	-0.56 (-0.58)	*-0.04*	1.25 (1.94)*	*0.09*					1.79 (1.93)*	0.13
USA DUMMY					*-242.70* *(-2.87)****	*-0.16*	*-191.52* *(-3.33)****	*-0.15*		
UK DUMMY					*577.46* *(3.41)****	*0.13*	*121.89* *(1.22)*	*0.05*		
GERMANY DUMMY					*-196.83* *(-0.97)*	*-0.08*	*-143.22* *(-1.65)*	*-0.07*		
CHINA DUMMY					*73.13* *(0.43)*	*0.03*	*33.74* *(0.32)*	*0.01*		
INDIA DUMMY					*-74.73* *(-0.43)*	*-0.02*	*-69.86* *(-0.88)*	*-0.03*		
BRAZIL DUMMY					-57.93 (-0.31)	-0.02	-84.64 (-0.9)	-0.03		
Constant	749.63 (2.09)**	.	-25.55 (-0.23)	.	-210.34 (-1.89)*	.	-18.84 (-0.55)	.	-59.58 (-0.22)	.
Observations	121		220		153		260		121	
R-squared	0.2957		0.7094		0.6772		0.7039		0.6800	
Adjusted R2	0.2246		0.6865		0.6311		0.6818		0.6272	
Note: absolute t-values in parentheses.										
*Numbers with ***, ** and * are statistically significant at 1%, 5% and 10% significance level respectively.*										

Regression 7. Robust Linear Regression for Connectivity Growth in the Law Sector

Dependent Variable: Con. Growth (LAW)	(I)	Beta Coef.	(II)	Beta Coef.	(III)	Beta Coef.	(IV)	Beta Coef.	(V)	Beta Coef.
OWN CONNECTIVITY 2000			0.05	0.14	*0.04*	*0.11*	*0.06*	*0.15*	0.01	0.03
			(1.02)		*(0.74)*		*(1.16)*		(0.18)	
CONNECTIVITY ACC 2000			-0.02	*-0.19*	*-0.02*	*-0.20*	*-0.01*	*-0.13*	-0.03	-0.28
			(-1.98)**		*(-1.48)*		*(-1.37)*		(-1.66)	
CONNECTIVITY MAN 2000			0.06	*0.31*	*0.07*	*0.39*	*0.05*	*0.26*	0.08	0.43
			(2.12)**		*(2.1)***		*(1.63)*		(2.39)**	
CONNECTIVITY INS 2000					*0.01*	*0.07*	*0.02*	*0.10*	0.01	0.04
					(0.45)		*(0.9)*		(0.26)	
CONNECTIVITY ADV 2000			0.02	*0.13*	*0.01*	*0.03*	*0.01*	*0.07*	0.02	0.10
			(1.19)		*(0.28)*		*(0.68)*		(0.75)	
CONNECTIVITY BANK 2000			0.02	*0.26*	*0.02*	*0.25*	*0.02*	*0.21*	0.03	0.35
			(1.81)*		*(1.43)*		*(1.4)*		(2.18)**	
*PRIMARY CITY * GDP*	-0.02	-0.1	-0.02	*-0.08*	*-0.01*	*-0.03*	*-0.01*	*-0.05*	-0.01	-0.06
	(-0.79)		(-0.89)		*(-0.37)*		*(-0.6)*		(-0.56)	
CITY POPULATION	1.19	*0.19*	-0.36	*-0.06*	*-0.26*	*-0.04*	*-0.30*	*-0.05*	-0.62	-0.10
	(1.8)*		(-0.57)		*(-0.44)*		*(-0.56)*		(-0.81)	
QUALITY OF LIFE	2.25	*0.18*			*0.74*	*0.07*			-0.09	-0.01
	(1.72)*				*(0.8)*				(-0.06)	
AFFILIATION TO METROPOLIS	8.57	*0.02*	-18	*-0.04*	*-41*	*-0.08*	*-27*	*-0.06*	-39	-0.07
	(0.2)		(-0.52)		*(-1)*		*(-0.85)*		(-0.79)	
AFFILIATION TO UCLG	95	*0.18*	56	*0.12*	*49*	*0.10*	*36*	*0.08*	92	0.17
	(1.73)*		(1.69)*		*(1.14)*		*(1.23)*		(1.82)*	
TOP UNIVERSITY	44	*0.33*	9	*0.06*	*7.8*	*0.06*	*12.4*	*0.09*	-0.36	*0.00*
	(3)***		(0.58)		*(0.43)*		*(0.9)*		(-0.02)	
CONTAINER TRAFFIC	0.01	*0.09*	0.01	*0.09*	*-0.001*	*-0.01*	*0.000*	*0.00*	0.01	0.11
	(0.63)		(0.79)		*(-0.13)*		*(0.06)*		(0.8)	
AIR PASSENGER TRAFFIC	0.36	*0.04*	0.27	*0.04*					0.65	0.07
	(0.37)		(0.54)						(0.6)	
PUPIL TO TEACHER RATIO	-2.11	*-0.09*	-1.44	*-0.07*					-2.30	-0.09
	(-0.99)		(-1.3)						(-1.09)	
PHONE COST	10.39	*0.09*	8.28	*0.08*					12.20	0.10
	(0.94)		(1.27)						(1.1)	
TRADE / GNP	0.34	*0.05*	-0.47	*-0.08*					-0.46	-0.07
	(0.56)		(-1.21)						(-0.81)	
USA DUMMY					*-86*	*-0.12*	*-25*	*-0.04*		
					(-1.4)		*(-0.69)*			
UK DUMMY					*-180*	*-0.09*	*-36*	*-0.03*		
					(-1.34)		*(-0.99)*			
GERMANY DUMMY					*-107*	*-0.10*	*-64*	*-0.08*		
					(-1.33)		*(-1.69)**			
CHINA DUMMY					*258*	*0.20*	*157*	*0.14*		
					(1.64)		*(1.56)*			
INDIA DUMMY					*-56*	*-0.04*	*-20*	*-0.02*		
					(-0.84)		*(-0.55)*			
BRAZIL DUMMY					-26	-0.02	49	0.04		
					(-0.28)		(0.83)			
Constant	-198.40	.	28.71	.	-45.76	.	-8.51	.	41.85	.
	(-1.33)		(0.5)		(-0.83)		(-0.46)		(0.28)	
Observations	121		220		153		260		121	

Regression 8. Robust Linear Regression for Overall Total Site Service Status Growth

Dependent Variable: SV Change	(I)	Beta Coef.	(II)	Beta Coef.	(III)	Beta Coef.	(IV)	Beta Coef.	(V)	Beta Coef.
CONNECTIVITY IN 2000			0.0001	0.0648	*0.0002*	*0.1692*	*0.0002*	*0.2120*	0.0001	0.0820
			(0.61)		*(1.33)*		*(2.24)***		(0.57)	
*PRIMARY CITY * GDP*	-0.0002	-0.0234	0.0004	*0.0392*	*0.0012*	*0.1194*	*0.0014*	*0.1172*	-0.0003	-0.0267
	(-0.34)		(0.55)		*(1.94)**		*(1.65)**		(-0.4)	
CITY POPULATION	0.072	*0.280*	0.055	*0.216*	*0.008*	*0.030*	*0.001*	*0.003*	0.063	0.245
	(2.7)***		(1.97)**		*(0.3)*		*(0.03)*		(2.09)**	
QUALITY OF LIFE	-0.01	*-0.02*			*0.06*	*0.12*			-0.02	-0.05
	(-0.13)				*(1.02)*				(-0.34)	
AFFILIATION TO METROPOLIS	0.37	*0.02*	-0.03	*0.00*	*-0.50*	*-0.02*	*-0.26*	*-0.01*	0.18	0.01
	(0.2)		(-0.02)		*(-0.28)*		*(-0.17)*		(0.1)	
AFFILIATION TO UCLG	2.38	*0.11*	1.47	*0.08*	*1.47*	*0.07*	*1.30*	*0.07*	2.31	0.11
	(1.23)		(1.06)		*(0.77)*		*(1)*		(1.18)	
TOP UNIVERSITY	1.15	*0.22*	0.72	*0.13*	*1.26*	*0.07*	*1.12*	*0.07*	0.95	*0.18*
	(2.3)**		(1.31)		*(0.52)*		*(0.91)*		(1.5)	
CONTAINER TRAFFIC	0.0005	*0.0964*	-0.0001	*-0.0119*	*0.0004*	*0.1080*	*0.0002*	*0.0633*	0.0004	0.0932
	(0.64)		(-0.09)		*(1.25)*		*(0.73)*		(0.61)	
AIR PASSENGER TRAFFIC	0.07	*0.19*	0.05	*0.15*					0.08	0.21
	(1.91)*		(2.1)**						(2)**	
PUPIL TO TEACHER RATIO	-0.04	*-0.04*	-0.02	*-0.03*					-0.04	-0.04
	(-0.46)		(-0.41)						(-0.42)	
PHONE COST	-1.24	*-0.26*	-0.63	*-0.15*					-1.20	-0.25
	(-3.09)***		(-2.11)**						(-2.89)***	
TRADE / GNP	0.07	*0.28*	0.04	*0.16*					0.07	0.27
	(3.13)***		(1.81)**						(3.01)***	
USA DUMMY					*-9.22*	*-0.32*	*-4.46*	*-0.20*		
					*(-4.12)****		*(-2.98)****			
UK DUMMY					*6.63*	*0.08*	*4.17*	*0.10*		
					*(2.87)****		*(2.56)***			
GERMANY DUMMY					*-1.05*	*-0.02*	*-1.36*	*-0.04*		
					(-0.3)		*(-0.73)*			
CHINA DUMMY					*6.80*	*0.13*	*4.71*	*0.10*		
					(1.21)		*(1.2)*			
INDIA DUMMY					*3.13*	*0.05*	*2.06*	*0.05*		
					(0.67)		*(0.76)*			
BRAZIL DUMMY					1.01	0.02	0.03	0.00		
					(0.29)		(0.01)			
Constant	-2.7535	.	-2.2347	.	-4.8458	.	-1.0887	.	-2.2961	.
	(-0.37)		(-0.78)		(-1.38)		(-1.37)		(-0.31)	
Observations	121		220		153		260		121	
R-squared	0.35		0.20		0.27		0.18		0.35	

Regression 9. Robust Linear Regression for Total Site Service Status Growth in the Management Sector

Dependent Variable: SV. Change (MAN)	(I)	Beta Coef.	(II)	Beta Coef.	(III)	Beta Coef.	(IV)	Beta Coef.	(V)	Beta Coef.
OWN CONNECTIVITY 2000			-0.002 (-5.88)***	-0.93	*-0.002* *(-5.12)****	*-0.96*	*-0.002* *(-6.29)****	*-0.90*	-0.002 (-4.57)***	-0.95
CONNECTIVITY ACC 2000			0.0004 (3.64)***	*0.34*	*0.0003* *(1.86)**	*0.24*	*0.0005* *(4.72)****	*0.43*	0.0003 (1.4)	0.22
CONNECTIVITY INS 2000			0.0006 (1.66)*	*0.21*	*0.0005* *(1.08)*	*0.19*	*0.0007* *(2.05)***	*0.25*	0.00002 (0.04)	0.01
CONNECTIVITY ADV 2000			-0.0002 (-0.54)	*-0.07*	*-0.0003* *(-0.89)*	*-0.13*	*-0.0003* *(-1.1)*	*-0.14*	0.00001 (0.02)	0.00
CONNECTIVITY BANK 2000			0.0003 (1.63)	*0.28*	*0.0004* *(2.05)***	*0.42*	*0.0003* *(1.59)*	*0.26*	0.0005 (2.04)**	0.44
CONNECTIVITY LAW 2000			0.0001 (0.08)	*0.01*	*-0.0002* *(-0.2)*	*-0.03*	*0.0002* *(0.37)*	*0.04*	-0.0002 (-0.27)	-0.05
*PRIMARY CITY * GDP*	-0.0002 (-0.74)	-0.08	-0.0003 (-1.09)	*-0.08*	*-0.00003* *(-0.1)*	*-0.01*	*-0.0001* *(-0.4)*	*-0.03*	-0.0005 (-1.38)	-0.14
CITY POPULATION	0.02 (1.88)*	*0.22*	0.02 (2.61)***	*0.26*	*0.01* *(0.53)*	*0.07*	*0.004* *(0.38)*	*0.04*	0.02 (2.52)**	0.30
QUALITY OF LIFE	-0.004 (-0.18)	*-0.02*			*0.03* *(1.87)**	*0.22*			0.03 (1.11)	0.16
AFFILIATION TO METROPOLIS	0.14 (0.21)	*0.02*	-0.56 (-1.24)	*-0.08*	*-0.20* *(-0.4)*	*-0.03*	*-0.31* *(-0.75)*	*-0.05*	-0.32 (-0.56)	-0.05
AFFILIATION TO UCLG	-0.42 (-0.7)	*-0.06*	0.10 (0.26)	*0.02*	*0.35* *(0.62)*	*0.05*	*0.51* *(1.3)*	*0.08*	-0.17 (-0.3)	-0.02
TOP UNIVERSITY	0.17 (0.68)	*0.10*	0.52 (2.23)**	*0.27*	*0.52* *(1.92)**	*0.29*	*0.53* *(2.43)***	*0.27*	0.70 (2.15)**	*0.41*
CONTAINER TRAFFIC	0.00 (1.15)	*0.11*	0.00 (-0.78)	*-0.06*	*0.00* *(-0.71)*	*-0.05*	*0.00* *(-1.14)*	*-0.07*	0.00 (0.2)	0.02
AIR PASSENGER TRAFFIC	0.04 (2.81)***	*0.34*	0.01 (1.47)	*0.14*					0.02 (1.08)	0.17
PUPIL TO TEACHER RATIO	-0.01 (-0.42)	*-0.04*	-0.03 (-1.52)	*-0.10*					-0.01 (-0.49)	-0.04
PHONE COST	-0.10 (-0.82)	*-0.06*	0.004 (0.05)	*0.00*					-0.07 (-0.52)	-0.05
TRADE / GNP	0.02 (2.23)**	*0.23*	0.01 (1.25)	*0.10*					0.02 (2.12)**	0.21
USA DUMMY					*-0.18* *(-0.17)*	*-0.02*	*0.11* *(0.19)*	*0.01*		
UK DUMMY					*4.64* *(4.18)****	*0.17*	*0.67* *(0.71)*	*0.05*		
GERMANY DUMMY					*0.49* *(0.42)*	*0.03*	*0.14* *(0.2)*	*0.01*		
CHINA DUMMY					*3.93* *(3)****	*0.23*	*3.07* *(3.23)****	*0.19*		
INDIA DUMMY					*1.93* *(1.31)*	*0.10*	*1.67* *(1.85)**	*0.11*		
BRAZIL DUMMY					0.47 (0.32)	0.02	0.04 (0.05)	0.00		
Constant	-0.74 (-0.35)	.	-0.76 (-0.69)	.	-2.78 (-2.77)***	.	-0.97 (-3.15)***	.	-3.70 (-1.81)*	.
Observations	121		220		153		260		121	
R-squared	0.23		0.30		0.38		0.29		0.40	
Adjusted R2	0.15		0.25		0.30		0.23		0.30	

Note: absolute t-values in parentheses.
*Numbers with ***, ** and * are statistically significant at 1%, 5% and 10% significance level respectively.*

Regression 10. Robust Linear Regression for Total Site Service Status Growth in the Banking Sector

Dependent Variable: SV Change (BANK)	(I)	Beta Coef.	(II)	Beta Coef.	(III)	Beta Coef.	(IV)	Beta Coef.	(V)	Beta Coef.
OWN CONNECTIVITY 2000			*-0.0011* *(-4.71)****	*-0.87*	*-0.0008* *(-2.84)****	*-0.60*	*-0.0010* *(-4.01)****	*-0.73*	-0.0010 (-3.46)***	-0.74
CONNECTIVITY ACC 2000			*0.00* *(0.78)*	*0.08*	*0.00* *(1.53)*	*0.23*	*0.0002* *(1.39)*	*0.15*	0.00 (1.31)	0.24
CONNECTIVITY MAN 2000			*0.0005* *(0.98)*	*0.16*	*0.0016* *(2.21)**	*0.49*	*0.0011* *(2.05)**	*0.35*	0.0004 (0.6)	0.14
CONNECTIVITY INS 2000			*0.0013* *(3.07)****	*0.38*	*0.0005* *(0.76)*	*0.13*	*0.0009* *(2.27)**	*0.26*	0.0010 (1.75)*	0.30
CONNECTIVITY ADV 2000			*-0.0001* *(-0.26)*	*-0.04*	*-0.0005* *(-0.86)*	*-0.17*	*-0.0003* *(-0.73)*	*-0.13*	-0.0001 (-0.27)	-0.05
CONNECTIVITY LAW 2000			*0.0005* *(0.55)*	*0.08*	*-0.0005* *(-0.5)*	*-0.08*	*0.0005* *(0.5)*	*0.07*	-0.0002 (-0.23)	-0.04
*PRIMARY CITY * GDP*	0.0007 (1.86)*	0.17	*0.00094* *(3.54)****	*0.21*	*0.00117* *(3.66)****	*0.26*	*0.0012* *(4.01)****	*0.23*	0.0008 (2.54)**	0.22
CITY POPULATION	0.01 (0.85)	*0.12*	*0.026* *(2.38)**	*0.24*	*0.012* *(0.9)*	*0.10*	*0.01* *(0.61)*	*0.06*	0.02 (1.98)*	0.24
QUALITY OF LIFE	0.03 (1.11)	*0.14*			*0.01* *(0.26)*	*0.03*			0.01 (0.26)	0.04
AFFILIATION TO METROPOLIS	-0.10 (-0.12)	*-0.01*	*0.75* *(1.2)*	*0.09*	*-0.12* *(-0.17)*	*-0.01*	*0.39* *(0.67)*	*0.04*	0.73 (0.89)	0.09
AFFILIATION TO UCLG	0.50 (0.66)	*0.06*	*0.04* *(0.07)*	*0.00*	*-0.26* *(-0.34)*	*-0.03*	*-0.08* *(-0.15)*	*-0.01*	0.37 (0.45)	0.04
TOP UNIVERSITY	0.08 (0.3)	*0.04*	*-0.02* *(-0.07)*	*-0.01*	*-0.30* *(-0.99)*	*-0.12*	*-0.26* *(-0.98)*	*-0.10*	0.07 (0.24)	*0.03*
CONTAINER TRAFFIC	0.00 (0.1)	*0.01*	*0.00* *(-0.53)*	*-0.04*	*0.00031* *(1.91)**	*0.19*	*0.00* *(1.18)*	*0.12*	0.00 (0.06)	0.01
AIR PASSENGER TRAFFIC	0.01 (0.42)	*0.03*	*0.020* *(2.12)**	*0.15*					0.030 (1.8)*	0.20
PUPIL TO TEACHER RATIO	0.04 (1.07)	*0.11*	*0.03* *(1.16)*	*0.07*					0.05 (1.26)	0.12
PHONE COST	-0.51 (-3.43)***	*-0.27*	*-0.35* *(-3.16)****	*-0.20*					-0.53 (-3.67)***	-0.28
TRADE / GNP	0.02 (1.84)*	*0.18*	*0.013* *(1.32)*	*0.13*					0.029 (2.78)***	0.28
USA DUMMY					*-4.06* *(-3.59)****	*-0.32*	*-1.95* *(-2.76)****	*-0.19*		
UK DUMMY					*5.40* *(2.51)**	*0.15*	*2.61* *(4.03)****	*0.14*		
GERMANY DUMMY					*0.64* *(0.4)*	*0.03*	*-0.60* *(-0.66)*	*-0.04*		
CHINA DUMMY					*-1.50* *(-1.01)*	*-0.06*	*0.28* *(0.21)*	*0.01*		
INDIA DUMMY					*-2.53* *(-0.98)*	*-0.10*	*0.77* *(0.53)*	*0.04*		
BRAZIL DUMMY					1.39 (1.39)	0.05	0.97 (1.26)	0.05		
Constant	-5.31 (-1.89)*	.	-1.98 (-1.55)	.	-1.97 (-1.37)	.	-1.04 (-2.24)**	.	-5.23 (-1.76)*	.
Observations	121		220		153		260		121	
R-squared	0.19		0.25		0.27		0.22		0.32	
Adjusted R2	0.11		0.19		0.17		0.16		0.21	

Note: absolute t-values in parentheses.
*Numbers with ***, ** and * are statistically significant at 1%, 5% and 10% significance level respectively.*

Regression 11. Robust Linear Regression for Total Site Service Status Growth in the Accountancy Sector

Dependent Variable: SVGrowthb (ACC)	(I)	Beta Coef.	(II)	Beta Coef.	(III)	Beta Coef.	(IV)	Beta Coef.	(V)	Beta Coef.
OWN CONNECTIVITY IN 2000			-0.0008 (-3.4)***	-0.46	*-0.0012 (-4.47)****	*-0.79*	*-0.0007 (-3.26)****	*-0.45*	-0.0015 (-4.91)***	-0.87
CONNECTIVITY MAN 2000			-0.0005 (-1.08)	*-0.17*	*-0.0006 (-1.04)*	*-0.21*	*-0.0006 (-1.37)*	*-0.20*	-0.0008 (-1.12)	-0.26
CONNECTIVITY INS 2000			0.0005 (1.06)	*0.14*	*-0.0005 (-0.91)*	*-0.16*	*0.0005 (1.14)*	*0.14*	-0.0006 (-1.08)	-0.20
CONNECTIVITY ADV 2000			0.0008 (2.04)**	*0.28*	*0.001 (2.37)**	*0.38*	*0.001 (2.19)**	*0.30*	0.001 (2.86)***	0.41
CONNECTIVITY BANK 2000			0.0004 (1.79)*	*0.29*	*0.0006 (2.74)****	*0.48*	*0.0004 (1.73)**	*0.27*	0.0007 (3.47)***	0.58
CONNECTIVITY LAW 2000			0.0003 (0.3)	*0.04*	*0.0008 (0.95)*	*0.14*	*0.0004 (0.44)*	*0.05*	0.0006 (0.63)	0.10
*PRIMARY CITY * GDP*	-0.0004 (-1.33)	-0.10	-0.0002 (-0.46)	*-0.04*	*-0.0005 (-1.98)**	*-0.14*	*-0.0003 (-0.83)*	*-0.07*	-0.0006 (-1.83)*	-0.15
CITY POPULATION	0.02 (1.56)	*0.19*	0.001 (0.13)	*0.01*	*0.01 (0.96)*	*0.12*	*0.005 (0.43)*	*0.04*	0.02 (1.35)	0.18
QUALITY OF LIFE	-0.01 (-0.48)	*-0.07*			*0.05 (2.07)**	*0.27*			0.04 (1.39)	0.20
AFFILIATION TO METROPOLIS	0.57 (0.66)	*0.07*	-0.56 (-0.82)	*-0.06*	*-0.54 (-0.77)*	*-0.07*	*-0.69 (-1.13)*	*-0.08*	-0.35 (-0.43)	-0.04
AFFILIATION TO UCLG	-0.17 (-0.23)	*-0.02*	0.49 (0.83)	*0.06*	*0.42 (0.57)*	*0.05*	*0.61 (1.07)*	*0.08*	0.64 (0.81)	0.08
TOP UNIVERSITY	0.22 (0.8)	*0.11*	0.09 (0.34)	*0.04*	*0.27 (1.19)*	*0.13*	*0.09 (0.38)*	*0.04*	0.49 (1.64)	*0.25*
CONTAINER TRAFFIC	-0.0001 (-0.74)	*-0.06*	-0.0002 (-2.07)**	*-0.11*	*-0.00002 (-0.27)*	*-0.02*	*-0.00004 (-0.42)*	*-0.02*	-0.0001 (-0.86)	-0.07
AIR PASSENGER TRAFFIC	0.01 (0.83)	*0.10*	-0.0001 (-0.01)	*0.00*					-0.02 (-1.18)	-0.14
PUPIL TO TEACHER RATIO	-0.03 (-0.66)	*-0.09*	-0.03 (-0.99)	*-0.08*					-0.03 (-0.8)	-0.09
PHONE COST	-0.24 (-1.3)	*-0.13*	-0.10 (-0.74)	*-0.06*					-0.25 (-1.36)	-0.14
TRADE / GNP	0.01 (1.07)	*0.11*	0.00 (-0.03)	*0.00*					0.01 (0.57)	0.06
USA DUMMY					*-1.69 (-2.01)**	*-0.15*	*-0.03 (-0.04)*	*0.00*		
UK DUMMY					*-2.93 (-2.47)**	*-0.09*	*-0.06 (-0.05)*	*0.00*		
GERMANY DUMMY					*0.32 (0.15)*	*0.02*	*1.27 (1.09)*	*0.09*		
CHINA DUMMY					*-2.49 (-1.97)**	*-0.12*	*-2.27 (-2.22)**	*-0.11*		
INDIA DUMMY					*-0.25 (-0.15)*	*-0.01*	*-1.25 (-1.14)*	*-0.07*		
BRAZIL DUMMY					-0.18 (-0.15)	-0.01	-1.02 (-0.96)	-0.05		
ARTHUR ANDERSON IN 2000	0.30 (0.6)	0.08	0.50 (1.5)	0.15	1.01 (2.5)**	0.29	0.50 (1.64)	0.15	0.81 (1.64)	0.22
Constant	2.313114 (0.68)	.	3.307518 (2.33)**	.	-.3104742 (-0.23)	.	2.082434 (4.53)***	.	2.1069 (0.66)	.
Observations	121		220		153		260		121	

Regression 12. Robust Linear Regression for Total Site Service Status Growth in the Advertising Sector

Dependent Variable: SV. Growth (ADV)	(I)	Beta Coef.	(II)	Beta Coef.	(III)	Beta Coef.	(IV)	Beta Coef.	(V)	Beta Coef.
OWN CONNECTIVITY 2000			-0.0005 (-1.82)*	-0.28	*-0.0005* *(-2.23)***	*-0.30*	*-0.00062* *(-3.09)****	*-0.38*	-0.0002 (-0.48)	-0.09
CONNECTIVITY ACC 2000			0.0000 (0.38)	*0.03*	*-0.0001* *(-0.46)*	*-0.07*	*0.0000* *(0.51)*	*0.05*	0.00 (-0.59)	-0.08
CONNECTIVITY MAN 2000			0.0004 (1.33)	*0.23*	*0.0003* *(0.72)*	*0.16*	*0.00045* *(1.5)*	*0.23*	0.0004 (0.9)	0.22
CONNECTIVITY INS 2000			-0.0004 (-1.24)	*-0.19*	*-0.0001* *(-0.26)*	*-0.06*	*-0.00042* *(-1.47)*	*-0.19*	-0.0003 (-0.69)	-0.16
CONNECTIVITY BANK 2000			0.0004 (3.67)***	*0.51*	*0.0004* *(2.64)****	*0.46*	*0.0005* *(4.49)****	*0.59*	0.0004 (2.89)***	0.49
CONNECTIVITY LAW 2000			-0.0005 (-0.86)	*-0.12*	*0.00* *(0.96)*	*0.17*	*0.00* *(0.26)*	*0.03*	-0.0007 (-1.01)	-0.17
*PRIMARY CITY * GDP*	-0.0002 (-1.25)	-0.10	0.000002 (0.01)	*0.00*	*0.00002* *(0.11)*	*0.01*	*0.0001* *(0.33)*	*0.02*	-0.0002 (-0.8)	-0.06
CITY POPULATION	0.025 (3.4)***	*0.37*	0.012 (1.71)*	*0.18*	*0.00* *(-0.09)*	*-0.01*	*0.00* *(0.1)*	*0.01*	0.01 (1.63)	0.21
QUALITY OF LIFE	-0.01 (-0.9)	*-0.10*			*0.00* *(-0.29)*	*-0.03*			-0.02 (-1.3)	-0.17
AFFILIATION TO METROPOLIS	-0.25 (-0.5)	*-0.04*	-0.23 (-0.54)	*-0.04*	*0.07* *(0.13)*	*0.01*	*0.06* *(0.13)*	*0.01*	-0.51 (-0.86)	-0.09
AFFILIATION TO UCLG	0.90 (1.82)*	*0.16*	0.76 (2.3)**	*0.15*	*0.73* *(1.27)*	*0.13*	*0.42* *(1.26)*	*0.08*	0.74 (1.22)	0.13
TOP UNIVERSITY	0.33 (2.34)**	*0.23*	0.08 (0.42)	*0.05*	*-0.13* *(-0.57)*	*-0.09*	*-0.11* *(-0.61)*	*-0.07*	0.21 (0.96)	*0.15*
CONTAINER TRAFFIC	0.00 (-0.34)	*-0.03*	0.00 (-0.54)	*-0.04*	*0.0001* *(1.77)**	*0.12*	*0.0001* *(1.03)*	*0.07*	0.00 (-0.1)	-0.01
AIR PASSENGER TRAFFIC	0.00 (0.43)	*0.04*	0.00 (-0.25)	*-0.02*					0.00 (-0.05)	0.00
PUPIL TO TEACHER RATIO	-0.01 (-0.25)	*-0.02*	0.01 (0.96)	*0.06*					-0.01 (-0.56)	-0.05
PHONE COST	-0.10 (-0.92)	*-0.08*	-0.09 (-1.18)	*-0.08*					-0.10 (-0.86)	-0.08
TRADE / GNP	0.024 (3.06)***	*0.35*	0.014 (2.68)***	*0.21*					0.02 (2.78)***	0.28
USA DUMMY					*-0.71* *(-1.11)*	*-0.09*	*-0.93* *(-2.43)***	*-0.15*		
UK DUMMY					*-0.79* *(-1.04)*	*-0.04*	*0.29* *(0.7)*	*0.03*		
GERMANY DUMMY					*-3.28* *(-2.44)***	*-0.27*	*-1.96* *(-3.2)****	*-0.22*		
CHINA DUMMY					*-1.05* *(-1.23)*	*-0.07*	*-0.85* *(-1.5)*	*-0.07*		
INDIA DUMMY					*3.00* *(3.14)****	*0.19*	*0.83* *(0.95)*	*0.07*		
BRAZIL DUMMY					-1.67 (-1.8)*	-0.11	-0.79 (-1.37)	-0.06		
Constant	-0.71 (-0.46)	.	-1.66 (-2.48)**	.	0.55 (0.7)	.	-0.23 (-0.81)	.	0.38 (0.25)	.
Observations	121		220		153		260		121	
R-squared	0.25		0.26		0.29		0.25		0.31	
Adjusted R2	0.18		0.21		0.19		0.19		0.20	
Note: absolute t-values in parentheses. *Numbers with ***, ** and * are statistically significant at 1%, 5% and 10% significance level respectively.*										

Regression 13. Robust Linear Regression for Total Site Service Status Growth in the Insurance Sector

Dependent Variable: SV Growth (INS)	(I)	Beta Coef.	(II)	Beta Coef.	(III)	Beta Coef.	(IV)	Beta Coef.	(V)	Beta Coef.
OWN CONNECTIVITY 2000			*-0.0021* *(-7.68)****	*-0.89*	*-0.0025* *(-6.37)****	*-1.13*	*-0.0023* *(-8.42)****	*-0.96*	-0.0021 (-5.32)***	-0.94
CONNECTIVITY ACC 2000			*-0.0003* *(-2.47)***	*-0.24*	*-0.0003* *(-1.6)*	*-0.24*	*-0.0001* *(-1.42)*	*-0.13*	-0.0003 (-1.42)	-0.25
CONNECTIVITY MAN 2000			*0.0004* *(1.07)*	*0.20*	*0.0010* *(1.84)**	*0.48*	*0.0008* *(1.92)***	*0.36*	0.0006 (1.17)	0.31
CONNECTIVITY ADV 2000			*0.0004* *(2.1)***	*0.23*	*0.0004* *(1.74)**	*0.23*	*0.0004* *(2.07)***	*0.22*	0.00 (1.41)	0.20
CONNECTIVITY BANK 2000			*0.0004* *(2.43)***	*0.40*	*0.0003* *(2.04)***	*0.38*	*0.0003* *(2.2)***	*0.35*	0.0003 (1.71)*	0.38
CONNECTIVITY LAW 2000			*0.00* *(0.96)*	*0.13*	*0.00* *(0.59)*	*0.09*	*0.00* *(0.71)*	*0.08*	0.00 (0.67)	0.13
*PRIMARY CITY * GDP*	0.00039 (1.75)*	0.15	*0.00006* *(0.32)*	*0.02*	*0.00042* *(2.22)***	*0.15*	*0.0002* *(1.09)*	*0.06*	0.0002 (0.66)	0.06
CITY POPULATION	-0.01 (-1.13)	*-0.18*	*-0.009* *(-0.91)*	*-0.12*	*-0.012* *(-0.97)*	*-0.16*	*-0.01* *(-1.23)*	*-0.16*	-0.01 (-1.01)	-0.18
QUALITY OF LIFE	-0.02 (-1.58)	*-0.19*			*0.03* *(1.93)**	*0.22*			0.00 (0.16)	0.02
AFFILIATION TO METROPOLIS	0.38 (0.69)	*0.06*	*0.36* *(0.89)*	*0.06*	*0.52* *(1.13)*	*0.09*	*0.36* *(0.97)*	*0.06*	0.55 (1.08)	0.09
AFFILIATION TO UCLG	0.55 (0.99)	*0.10*	*-0.08* *(-0.24)*	*-0.01*	*-0.07* *(-0.13)*	*-0.01*	*-0.37* *(-1.09)*	*-0.07*	0.41 (0.78)	0.07
TOP UNIVERSITY	-0.12 (-0.81)	*-0.08*	*0.17* *(0.98)*	*0.11*	*-0.14* *(-0.98)*	*-0.10*	*0.08* *(0.54)*	*0.05*	0.08 (0.36)	*0.06*
CONTAINER TRAFFIC	0.00 (1.01)	*0.17*	*0.00* *(1.27)*	*0.15*	*0.000* *(0.36)*	*0.04*	*0.00* *(0.37)*	*0.03*	0.00 (1.55)	0.25
AIR PASSENGER TRAFFIC	0.00 (0.11)	*0.01*	*-0.007* *(-0.93)*	*-0.08*					-0.006 (-0.37)	-0.06
PUPIL TO TEACHER RATIO	-0.01 (-0.41)	*-0.04*	*-0.01* *(-0.74)*	*-0.04*					-0.01 (-0.48)	-0.04
PHONE COST	-0.42 (-3.1)***	*-0.32*	*-0.27* *(-3.25)****	*-0.23*					-0.36 (-2.82)***	-0.28
TRADE / GNP	0.00 (-0.41)	*-0.03*	*0.000* *(0.09)*	*0.01*					0.002 (0.28)	0.03
USA DUMMY					*-1.58* *(-2.39)***	*-0.20*	*-0.99* *(-2.15)***	*-0.15*		
UK DUMMY					*4.48* *(5.58)****	*0.20*	*1.39* *(2)***	*0.11*		
GERMANY DUMMY					*-0.82* *(-0.61)*	*-0.07*	*-0.49* *(-0.83)*	*-0.05*		
CHINA DUMMY					*1.42* *(0.92)*	*0.10*	*0.82* *(0.91)*	*0.06*		
INDIA DUMMY					*-0.52* *(-0.35)*	*-0.03*	*-0.47* *(-0.68)*	*-0.04*		
BRAZIL DUMMY					0.38 (0.3)	0.02	0.16 (0.24)	0.01		
Constant	3.12 (1.59)	.	1.41 (1.67)*	.	-1.44 (-1.72)*	.	0.20 (0.76)	.	1.32 (0.7)	.
Observations	121		220		153		260		121	
R-squared	0.15		0.34		0.33		0.33		0.34	
Adjusted R2	0.07		0.29		0.23		0.28		0.23	

Note: absolute t-values in parentheses.
*Numbers with ***, ** and * are statistically significant at 1%, 5% and 10% significance level respectively.*

Regression 14. Robust Linear Regression for Total Site Service Status Growth in the Law Sector

Dependent Variable: SV.Growth (LAW)	(I)	Beta Coef.	(II)	Beta Coef.	(III)	Beta Coef.	(IV)	Beta Coef.	(V)	Beta Coef.
OWN CONNECTIVITY 2000			-0.0003 (-0.41)	-0.07	*-0.0006 (-0.83)*	*-0.14*	*-0.00027 (-0.42)*	*-0.06*	-0.0009 (-1.11)	-0.20
CONNECTIVITY ACC 2000			-0.0002 (-2.41)**	*-0.23*	*-0.0002 (-1.11)*	*-0.17*	*-0.0001 (-1.34)*	*-0.13*	-0.0004 (-1.68)*	-0.30
CONNECTIVITY MAN 2000			0.0003 (0.78)	*0.14*	*0.0004 (0.98)*	*0.20*	*0.00027 (0.79)*	*0.14*	0.0005 (1.02)	0.21
CONNECTIVITY INS 2000			0.0002 (0.47)	*0.08*	*0.0003 (0.7)*	*0.14*	*0.00017 (0.53)*	*0.08*	0.0004 (0.68)	0.15
CONNECTIVITY ADV 2000			0.0002 (1.29)	*0.14*	*0.00 (0.28)*	*0.03*	*0.00 (0.6)*	*0.06*	0.00 (1.01)	0.14
CONNECTIVITY BANK 2000			0.0003 (2.06)**	*0.34*	*0.0003 (1.56)*	*0.32*	*0.0003 (1.76)**	*0.30*	0.0004 (2.1)**	0.40
*PRIMARY CITY * GDP*	-0.0004 (-1.13)	-0.13	-0.0003 (-0.91)	*-0.10*	*-0.0001 (-0.42)*	*-0.04*	*-0.0002 (-0.58)*	*-0.06*	-0.0003 (-0.74)	-0.09
CITY POPULATION	0.009 (1)	*0.12*	-0.005 (-0.55)	*-0.07*	*-0.01 (-0.81)*	*-0.08*	*-0.01 (-0.78)*	*-0.08*	-0.01 (-0.78)	-0.11
QUALITY OF LIFE	0.01 (0.79)	*0.10*			*0.00 (0.12)*	*0.01*			-0.01 (-0.35)	-0.05
AFFILIATION TO METROPOLIS	-0.32 (-0.64)	*-0.05*	-0.52 (-1.26)	*-0.09*	*-0.74 (-1.54)*	*-0.13*	*-0.49 (-1.27)*	*-0.09*	-0.90 (-1.54)	-0.14
AFFILIATION TO UCLG	1.02 (1.43)	*0.16*	0.57 (1.33)	*0.11*	*0.50 (0.85)*	*0.08*	*0.31 (0.83)*	*0.06*	1.03 (1.5)	0.16
TOP UNIVERSITY	0.41 (1.75)*	*0.26*	0.19 (0.85)	*0.12*	*0.23 (0.91)*	*0.15*	*0.24 (1.24)*	*0.15*	0.15 (0.5)	*0.09*
CONTAINER TRAFFIC	0.00 (0.72)	*0.14*	0.00 (0.84)	*0.12*	*0.00 (0.09)*	*0.01*	*0.00 (0.33)*	*0.04*	0.00 (0.68)	0.13
AIR PASSENGER TRAFFIC	0.01 (0.76)	*0.09*	0.00 (0.54)	*0.04*					0.01 (0.63)	0.09
PUPIL TO TEACHER RATIO	-0.01 (-0.56)	*-0.05*	-0.01 (-1.01)	*-0.06*					-0.03 (-1.02)	-0.10
PHONE COST	0.13 (0.87)	*0.09*	0.10 (1.08)	*0.09*					0.14 (0.88)	0.10
TRADE / GNP	0.00 (0.36)	*0.03*	-0.01 (-1)	*-0.08*					0.00 (-0.6)	-0.06
USA DUMMY					*-0.93 (-0.91)*	*-0.11*	*-0.30 (-0.53)*	*-0.05*		
UK DUMMY					*-1.42 (-1.08)*	*-0.06*	*-0.27 (-0.74)*	*-0.02*		
GERMANY DUMMY					*-0.76 (-0.65)*	*-0.06*	*-0.66 (-1.24)*	*-0.07*		
CHINA DUMMY					*4.05 (1.69)**	*0.27*	*2.46 (1.63)*	*0.19*		
INDIA DUMMY					*-0.33 (-0.42)*	*-0.02*	*0.01 (0.02)*	*0.00*		
BRAZIL DUMMY					-0.01 (-0.01)	0.00	0.50 (1.11)	0.04		
Constant	-1.81 (-1.01)	.	0.19 (0.26)	.	-0.26 (-0.4)	.	-0.20 (-0.89)	.	0.88 (0.47)	.
Observations	121		220		153		260		121	