

Global data matrix

User Guide

This is a 'service values matrix' for 2004. Service values are the intensity of use of a city by an advanced producer service firm. In this matrix the use of 315 cities worldwide by 80 global service firms are described. The service values range from 0 (no presence of a firm in a city) through to 5 (firm's headquarters in a city).

The data can be used for computing global network connectivities of cities or exploring the configuration of the world city network (as defined by the data). This is a replication of data collected in 2000.

For details of data collection and analysis, see Taylor, P J (2004) World City Network: a Global Urban Analysis (Routledge, London)

RESEARCH REPORT

WORLD CITY NETWORK FORMATION: GLOBAL CONNECTIONS AUDIT AND ANALYSIS

Background

This project builds directly upon a previous ESRC project “World city formation in a space of flows” (R000223210). This produced two key outcomes (see Appendix 2 and 5a):

- (i) An interlocking network model of world city network formation was precisely specified. This was an advance on previous world city research because it did not reify cities: global service firms were identified as the network makers. This foregrounds network and mutualities between cities as compared to the dominance of hierarchy and city competition in orthodox urban studies.
- (ii) The model guided data collection and analyses of the world city network. This was an advance on previous world city research because inter-city relations were derived from data on firms. This overcomes the lack of data on flows between cities.

The initial project used the model for a cross-sectional analysis for the year 2000. Using the data for 2000 as the starting point, the basic purpose of this project is to extend the data collection to 2004 to enable network change analyses for 2000 to 2004. Thus the basic research question being asked is: how has the world city network changed through the first five years of the twenty first century?

2. Analysis aim: to investigate changes in the world city network, 2000-04.

Achieved with a little modification due to the data collection problem mentioned above

Objective 2a: to conduct cross-sectional principal components analyses for different years and interpret changes in findings. **This was partially achieved (including a published article) for 2000-01 and 2001-02 as indicated above.**

Objective 2b: to conduct principal components analysis on change data over the five year period. **Achieved. (See Results)**

Objective 2c: to experiment with multidimensional scaling techniques to see whether a suitable visualisation of change can be constructed. **Achieved. (See Results)**

Objective 2d: to explore the data using a variety of other multivariate statistics to see whether they throw any additional light on the dynamics of world city network formation. **Achieved using fuzzy set analysis. (See Results)**

3. Theory aim: to provide a definitive specification of the dynamics of world city network formation. **Achieved in a continuing process running parallel to the empirical work.**

Objective 3a: to incorporate a change dimension into the current tripartite specification. **Achieved through relating the interlocking model to Jacobs (1970; 1984) dynamic city growth theses. (See Outputs)**

Objective 3b: to relate the tripartite specification to other processes and actors (e.g. city competition, states) in a more encompassing model of world city network formation. **Achieved through pioneering a city-centred approach to global governance and global civil society (See Outputs)**

4. Practical aim: to foster external contacts within and beyond academia.

Achieved in general through being part of GaWC as an international network of researchers and practitioners.

Objective 4a: to disseminate ideas and findings through peer reviewed publications and conference presentations. **Achieved. (See Activities and Outputs)**

*Objective 4b: to encourage the GaWC network of researchers within and beyond Loughborough to be involved in analysis and interpretation. **Achieved through GaWC-i (electronic newsletter to c.2000 contacts) and making data available to non-commercial researchers before publication as a GaWC Data Set. (See Outputs)***

*Objective 4c: to maintain contact with the GaWC 100 firms in a reciprocal arrangement of providing and interpreting information. **Here we achieved the objective in a different way. After discussions (especially with Peter Charlton of Clifford Chance, Senior Partner dealing with global strategy for the world's largest law firm) we came to understand that our practice audience were from the cities and not the firms. Thus the objective was achieved in a modified form through dissemination to urban practitioners rather than to service practitioners. Hence the research/practice dialogue has been with urban policy makers. (See Impacts)***

*Objective 4d: to invite the GaWC 100 firms to be represented at a one day seminar at the Corporation of London where project results will be presented. **This was achieved in a different way for the reasons given for objective 4c. (In addition our contact in the Corporation left due to ill health 3 years before the end of this project - this was intimated as possibly problematic in a footnote in the application because 'it was a long way ahead'). Nevertheless, this objective has been actively achieved in a modified form through presentations to, and meetings with, urban practitioners in association with spin-off projects. (See Outputs and Impacts)***

Methods

This project claimed no originality in methods: it replicated the data collection and analysis of the initial project for 2000 (see Appendix 2). This relies heavily on the web sites of advanced producer service firms to provide information on their

global office networks, supplemented on a few occasions by firm's internal directories. The idea is to produce a service values matrix of *cities x firms* where the value of each cell indicates the importance of a city to a firm in the provision of its services to clients. Because firms used web sites to proclaim their globalization in order to attract clients and to recruit young professionals, it was found in the initial project that information on location of offices across the world was given, commonly with extra details for some offices with additional functions. In this way data for 100 firms across 315 cities was collected. Of course, the information varied greatly from firm to firm so that a uniform coding of service values was devised ranging from 0 to 5 (see Appendix 2b for allocating service values). The resulting 100 x315 service values matrix proved to be very successful in describing the world city network in 2000 (Taylor 2004) and forms the foundation data for this change project.

The initial idea was to recreate the service values matrix every year so that change could be directly monitored on a year-to-year basis. However, in the first year it was soon appreciated that replicating the methodology in the three month allocated to data collection was not feasible. The task of checking for changes in service values across all firms and cities was beyond research time resources allocated. Thus the methodology was modified to measure change in another way while retaining the spirit of the original purpose. Again using the scavenger method with a focus on firms' websites, all indications of change in office networks were recorded by comparing to the previous year's websites in the project archive. The data collected was evidence of change in the circumstances of an office. This was measured binomially as either expansion or retraction and worked very well for change from 2000-01: 1074 changes were identified and analysed, and the results were published (Taylor, Catalano and Gane 2003). Basically we found that at the beginning of a turndown in the economic cycle, global service firms were still expanding overall, the ratio of expansion to retractions was 2.12, but there was a tendency to consolidate where services

were already strong (e.g. major world cities) while disengaging where they were already weak (e.g. sub-Saharan Africa).

This new methodology was repeated for 2001-02. On this occasion 1527 changes were recorded and some of the results are shown in Table 1 (all tables are shown in Appendix 3) where they are compared to 2000-01 results. Ratios of expansions to retractions are used to measure change; overall the ratio declined from 2.12 to 1.48 indicating continuing but reduced expansion. The results in Table 1 are credible: ratios are greatly reduced in nearly all categories but certain findings stand out (e.g. the effective elimination of the world city advantage over other cities, the demise of advertising and insurance but with law and accounting 'holding up' (bad economic times are good employment times for lawyers and accountants), and the 'flattened' regional geography). But this year we decided not to publish the results because we were not satisfied that the data was a true and accurate record. Our change period was at the depth of a world economic downturn and there were several high profile events that our data was not fully picking up, for instance, the dispersal of services after the destruction of the World Trade Center in New York, the banking collapse in Argentina, and the collapse of Andersen accountants in the wake of the Enron scandal. It was always accepted that the methodology produced a broad-brush picture of global services but these examples were symptomatic of a basic limitation of method that was not foreseen. Quite simply, websites are not locales for negative stories. Firms use them to promote their wares and, as noted above, for advanced producer services they flaunt their globality. This means our data collection method works well at times when expansion dominates – which is the norm for the services we are dealing with – but the method is problematic in more severe phases of economic downturn, such as 2001-02. This is not to say that we cannot find retractions – we identified 615 examples in 2002-01 – but that we under-estimate them.

This was a threat to the project. We dealt with it as follows. First, we did not know what the situation would be in a final census year, 2004, and therefore we used the 2003 data collection period to explore other means of collecting the necessary data. This was largely experimental and it was not intended to produce 2002-03 data. The emphasis was to ensure good data could be produced for 2004 so that 2000-04 comparisons would be doable. The approach that was explored was to use trade magazines to trace what was happening to our firms. This worked to a reasonable degree but proved to be much more time consuming than the original method of data collection. The conclusion was that this method worked when combined with firms' websites to produce reasonable data. However, if forced to use the revised method in 2004, it would impinge on much of the time allocated to analyses. As it happened, the downturn was not as deep as expected and, by 2004, the economy was as buoyant as in 2000. Thus the original data collection method could be used to produce a new firms x cities matrix of service values for 2004.

Of course, this does not mean that replicating the data collection five years on was not without its problems. Data gathering for the second round of analysis in 2004 was faced with a specific problem that illustrates the dynamic nature of the global economy. Of the 100 advanced producer service firms from 2000, 2 firms were liquidated completely, 5 firms had to be deleted because of mergers with other firms in the data, and 2 firms were excluded because of the low quality of data on their 2004 web pages. This resulted in a new list of 91 firms for 2004. However, even after these deletions, we were unsure of the comparability of new data with old data for 11 other firms. Basically firm reorganization meant that information available for the two dates was quite different for these particular firms. Since we wish to be sure that measurement of differences between 2000 and 2004 represent economic geography change rather than 'data availability change', a smaller set of 80 firms is identified for 2004. We have probably been over zealous in removing some firms for which we have both 2000 and 2004 data

but this is to err on the right side: overall we think any bias resulting from the changes is minimal.

This data preparation took longer than originally allocated and impinged on time for writing up the data analysis.

Results

The results consist of new city-centred geographies appropriate to the twenty first century. They are both theoretically important – how ‘external externalities’ relate to city economic growth - and practically relevant – how the ‘external network’ can be incorporated into place-based policy. No equivalent spatial analysis of change in globalization is available. Results take three forms: changes in city connectivities, changes in network configuration, and conceptual extension of the network-making model of cities.

Changing city connectivities in the world city network

The change measures for cities analysis has been written up (Taylor and Aranya 2006) and the paper is provided with this report. The ‘headline’ result is that there are few changes among the major world cities; Figure 1 (all figures are shown in Appendix 4) shows a stable top 20 in terms of global network connectivity with 18 cities common to both lists. However, a key feature of this research is to go beyond the major cities and therefore the important analysis is of the statistical distribution of standardised changes in connectivity for all 315 cities. Since change is ubiquitous we interpret stability not as an outcome (‘no change’) but as a process. This process is change as myriad *small* forces that generate a normal distribution. Deviations from such a distribution of changes are interpreted as *large* forces that are distorting the normal pattern. The latter are systematic biases in change patterns that can be statistically tested and evaluated. They represent forces that are not reproducing the normal distribution and therefore can be interpreted as reflecting exceptional change.

The distribution is shown in Figure 2 which shows several distortions from a normal distribution, notably a bi-modal centre and a stepped negative slope including a third mode. The contrast in shape between the negative and positive slopes suggest that larger forces creating systematic biases are constraining effects on city change whereas there are no major systematic causes for positive change leaving it subject to myriad small effects relating to individual cities. One example of the former appears to be the 44 US cities in the data that are conspicuous by the absence from the 'hole' in the middle of the distribution but are well represented in the 'third mode'. Of course, this observation is just suggestive: we cannot know empirically which particular cities are 'absent' from the middle of the distribution due to systematic biases, or distinguish between those cities in the third mode that are the result of systematic bias and those cities which would be located due to small non-systematic forces. However we can test for biases using different categories of city.

Using observations such as the one above to supplement suggestions as to reasons for urban change to be found in the literature, 13 hypotheses framed as categories of cities were tested using a simple binomial analysis of positive and negative change. The results are shown in Table 2. Significant results are shown as follows: there are five positive biases identified (capital cities, Western European cities, Pacific Asian cities, East European cities, and 'greater' Middle East cities) and two negative biases (US cities and Sub-Saharan cities). Note that this ratio of 5:2 in favour of positive bias is not compatible with the previous discussion of the statistical distribution of changes. However, when these binomial results are subjected to a multivariate analysis (multiple regression) all the positive biases drop out of the equation leaving just two statistically significant negative biases: it seems being a US city generates a bias lowering changing connectivity by 12% of a standard deviation, and being a sub-Saharan African city by 9% of a standard deviation. These results are interpreted as follows.

- Global service firms are not expanding their office networks in the US as much as they are in other parts of the world. This is largely because in the US market for services is the most developed in the world and opportunities for expansion are less than in other countries. Hence this result is NOT reporting a weakness of US cities in the world economy, to do so is to treat globalization as an outcome rather than an ongoing process. The processes that are globalization of services began to a large degree in US cities from whence subsequent growth has spread to non-US cities. Hence in the five year period studied here, on the whole US city connectivities have not expanded as much as other cities. This exceptional feature of US cities is discussed further for 2000 by Taylor and Lang (2004) and is detailed for advertising in Taylor (2006a).
- The relative decline of Sub-Saharan cities was identified in the early change analysis (Taylor, Catalano and Gane 2003) and is confirmed here for the whole period.

These two systematic biases are not the main finding however. The key finding is that the regression model that identified biases itself only accounted for 6% of the total variation in the statistical distribution. Thus our main conclusion is that generally the changes in connectivity for 2000-04 are the result of myriad small forces as expected in a normal distribution model. This is counter to the emphasis on the inherent instability of cities in relentless global competition that is commonly asserted.

One other paper on changes in connectivities is in an advanced stage of preparation and this relates to UK cities. Our results show that the claim of 'recovery' for UK provincial cities is supported. Figure 3 and Table 3 show how well UK cities are doing within the 315 cities worldwide. This result is proving to be of particular interest to practitioners.

Changing configurations of the world city network

For the configuration studies, analyses have been completed and results interpreted but papers have yet to be written. Here I present results tables and initial interpretation of findings of change since the equivalent 2000 analyses (chapter 7 in Taylor 2004, and Appendix 5b and 5c). Because the services values matrix gets sparse as cities are less well connected in configuration analyses we use a selection of the cities. For most studies of the 2000 data we included cities with at least one fifth of the highest connectivity (i.e. 20% of London's score). This gave a roster of 123 cities so that the matrix analysed was 123 cities x 100 firms. Using this criterion for 2004 produces 134 cities for 2004. Further, we use 91 firms for these separate 2004 analyses because with this method it is best to use all firms for which we have information: a 134 cities x 91 firms matrix.

The principal components analysis for the 2000 matrix produced a clear pattern of five dominant components that was termed 'the primary structure of the data'. Essentially the same structure is shown for the 2004 data despite the differences in cities and firms noted above. The results are shown in Table 4 where loadings on cities are listed for all cities above 0.40. As can be seen this is not a principal components analysis where labelling is a problem. The cities fall into five obvious categories: outer cities (both outer European and 'third world' cities), European cities, Pacific Asian cities, US cities and British/Commonwealth cities. This analysis is based upon correlations between the service mixes of firms to be found in cities. The very regional outcome of the analysis shows that the patterns of global service firms' provisions show geographical concentrations. This result is a mixture of two processes. First, and most important, globalization of services has not extended to elimination of the origins of firms so that there is still a 'local' effect: for instance, US cities are still dominated by US service firms' provision. Second, some firms' global strategies have distinctive regional emphases: for instance the Pacific Asian city concentrations include Japanese banks and

advertising agencies but also US and European firms attracted specifically to the growing markets in the region.

Preliminary comparison with the 2000 analysis is made in Table 4 where the top 10 cities for each year's analysis are listed in rank order. The similarities in structure across the five components for each year are clear to see but the details vary appreciably. Three changes are particularly interesting. For US cities the component in 2000 was dominated by lesser cities, in 2004 there is a more even pattern of city levels shown. For the European cities the extreme dominance by German cities is removed to provide a geographically more balanced pattern covering central, eastern and southern Europe. Finally the main difference is in British/Commonwealth component where British cities now dominate. The latter can be related to the increased connectivities of British cities previously reported in the network change analysis.

In conclusion, it can be said that this configuration study of world cities as global service centres shows that the same primary structure exists but it is by no means a static or fixed structure.

It was found in analyses of the 2000 data that whereas principal components analysis was particularly useful for providing a general taxonomy of cities in globalization, fuzzy set analysis was more sensitive to strata of cities in terms of their connectivities. Thus, whereas London and New York do not feature in the PCA results (Table 5), they form their own 'global city' category, the centre of the world economy, in the initial fuzzy set analysis. Replicating this analysis for the 2004 data produces similar but interestingly different results. Of the 22 global urban arenas generated, here I concentrate on just the top 10 in 2004. In Table 6, six arenas are shown that correspond to arenas in the 2000 analysis. London and New York continue to define their own arena but the other five arenas become much sharper in definition: Arena B becomes the second tier arena; Arena C is consolidated as the arena of other leading European cities; Arena D is

consolidated as the arena of major northern American cities; the Pacific Asian Arena H now incorporates the leading Chinese cities; Arena I moves from being eastern European to central European with omission of former Soviet cities; and Arena J is consolidated as the arena of other leading US cities. The four new arenas are presented in Table 7 in terms of their structure: cities with membership levels above 0.7 are deemed cluster nuclei, other members are cities with membership between 0.3 and 0.7, if they are not members of other arenas they are 'singular', otherwise they are 'hybrid'. All four arenas to emerge in the early twenty first century are very interesting. Arena F is a cluster of leading Latin American cities with Miami as hybrid; Arena G picks out Beijing and Shanghai as a cluster separate from the rest of Pacific Asia with important non-Asian hybrids; Arena K identifies a southern European cluster; and Arena J a trans-continental cluster of major 'third world' cities separate from the leading cities of Pacific Asia and Latin America.

In conclusion, an initial interpretation of the fuzzy set results suggests that the configuration of cities in globalization are becoming more precise and unambiguous as the processes we are studying further develop in the early years of the twenty first century.

Value added: new applications of the interlocking network model

Running parallel to the empirical work I have been developing the conceptual range of the inter-city modelling discussed above. This has taken three forms.

1. Developing an argument that the inter-locking model is a generic process of city network production, separate from central place theory. This relates to bringing the ideas of Jane Jacobs back to centre stage (Appendix 5e; Taylor 2006b is provided with this report).
2. Extending the model to other networkers using cities in globalization to provide a city-centred interpretation of processes towards global civil society and global governance (Appendix 5d).

3. Extending the model to polycentric mega-regions to show how service corporations are structuring large urban regions. This was at the heart of the POLYNET project, see Impacts below and Appendix 5f.

Activities

This research has been reported as follows.

A To academic audiences

1. Dedicated **two-day conference** on my work on inter-city relations held in **Ghent** (January 2005), sponsored by the Francqui Foundation and Ghent University. Presenters included Roberto Camagni (Milan), Denise Pumain (Paris) and Saskia Sassen (Chicago)
2. Post-doc workshops in **Belgium** (2004 in Brussels, Ghent and Leuven) and **Ireland** (2005 in Maynooth and Limerick)
3. In project workshops (POLYNET) in **Paris** (2004) and **Heidelberg** (2005) to research teams from Amsterdam, Brussels, Dortmund, Dublin, Heidelberg, London, Paris, and Zurich
4. In project development workshops in **Buenos Aires** (2005, funded by UNESCO/Ford Foundation), in **Ghent** (2004, funded by Francqui Foundation) and **Lugano** (2006, funded by Virginia Tech)
5. Invited series of lectures at **Mexico City** (2003) and **Rio de Janeiro** (2005)
6. Individual invited lectures: **Brussels** (2004), **Cambridge** (2003), **Ghent** (2004), **Liege** (2004), **Leuven** (2004), **Miami** (2006), **New York** (2005), and **Oulu** (2006)
7. Invited conference presentations at **Berlin** (2001, European History conference), at **Cologne** (2005, North Rhine Westphalia Regional Planning conference); at **Copenhagen** (2004, Political Science

conference), at **London** (2005, RGS-IBG conference), at **Riverside** (2003, PEWS, American Sociological Association), and at **Vienna** (2003, Urban Studies conference). I will be presenting at the **Shanghai** Social Science conference in September.

8. Final results were presented at the Association of American Geographers conference in **Chicago** (2006). This was the only presentation where costs were paid for through the project.

B. To practitioners

1. Meeting at **HM Treasury** to discuss UK financial services in the world city network (2003)
2. Presentation to **Finanz Platz Frankfurt** (2002)
3. Participation in, and keynote address to, 'First Tuesday' seminar, sponsored by **Finanz Platz, Zurich** (2003)
4. Day meeting with Peter Preston (**Clifford Chance**) on the occasion of his delivering the 2003 GaWC Lecture
5. Day meeting with Alan Freeman (**London Economic Unit, GLA**) on the occasion of his delivering the 2005 GaWC Lecture
6. Presentation of inter-locking network analysis results to stakeholders at Lille (**INTERREG III**) 2004
7. Launch of POLYNET book (Hall and Pain 2006) includes important discussions on inter-locking model with **ODPM representatives** (May 2006)
8. Day meeting with Paul Hildreth (**ODPM advisor**) on possible UK POLYNET project follow up (June 2006)
9. I have accepted the position as 'international advisor' on the "**Global Milan**" project sponsored by a consortium of northern Italian local governments

(Note the transfer of effort from service practitioners to city practitioners in the course of the project.)

Outputs

1. This project and associated research has been a major platform for the continuing success of **GaWC** (Globalization and World Cities Study Group and Network) centred on a website (www.lboro.ac.uk/gawc) recently referred to as 'outstanding', 'brilliantly organised', 'invaluable' and 'immensely useful' by Brenner and Keil (2006, p. 12).
2. There are many publications of papers (referred to above, see Appendix 1, 6) all available as **GaWC Research Bulletins** plus two '**state of the art**' books (Taylor 2004; Taylor, Derudder, Saey, and Witlox 2006) and, of course, the **new data sets**.

Impacts

1. The model and methodology were applied in the POLYNET project (funded under INTERREG IIB, see Hall and Pain 2006) that has produced interest from the new **Department of Communities and Local Government** (Paul Hildreth). We are exploring a new UK project with this department.
2. Outside the UK, the work has drawn interest in the USA leading to projects for the **Brookings Institution** (Taylor and Lang 2005). The model is currently being used in projects in **Belgium, Brazil, Sweden, Norway** and **Italy**.

Future Research Priorities

1. Given the difficulties of replicating the 2000 empirical work in 2004, it is not considered feasible to do this again for 2009 (10 year change). A new

approach, compatible with the original, will need to be developed to monitor changes in cities in globalization.

2. The possibilities of using the model as a generic process of city network development and integrating further with Jacobs' ideas is an immediate priority. A project is currently under consideration for funding by the Leverhulme Trust
3. Exploring particular processes through qualitative methodology applied to one service to better understand the processes using qualitative methods. The Sloan Foundation is funding such a project on the globalization of advertising.
4. To explore how the model might be better integrated into urban policy making. It is in this area that we plan a new ESRC project application.

APPENDIX TO RESEARCH REPORT

- 1. References**
- 2. The interlocking network model**
- 3. Tables**
- 4. Figures**
- 5. Annotated bibliography of interlocking network model
publications from 2001**

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