Modelling the shifting command and control function of cities through a gravity model based bidimensional regression analysis

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Since the mid-1980s, it has become common to demonstrate the current economic globalization through the lens of cities. Command and control, provided by multinational corporations (MNCs), is an important component of both the world city hypothesis (Friedmann, 1986) and the global city concept (Sassen, 1991). Command and control function is often determined on the basis of the location of headquarters or the economic performance (e.g. revenues) of the leading MNCs (Godfrey and Zhou, 1999; Alderson and Beckfield, 2004; Taylor and Csomós, 2012; Csomós, 2013).

In this analysis we model the influence of 277 major cities of the global economy on the economic space, from 2006 to 2014. Cities can be regarded as major cities if they have a significant command and control function, i.e. they host powerful MNCs as measured by revenues (revenues are indicated by Forbes "The Global 2000" 2006 and 2014). We use a bidimensional regression analysis based on a gravity model to describe the global economic spatial structure (for more information on the model, see Tóth et al., 2014). The grid is fitted to the coordinate system of the dependent form and its interpolated modified position makes it possible to further generalise the information about the points of the regression. The black arrows show the direction of movement and the grid shading refers to the nature of the distortion. Areas indicated with white refer to concentration and to movements in the same directions (convergence), which can be considered to be the most important gravitational centres.

We find three significant economic zones in the global economic space: Northern America, Western Europe and East Asia.
Northern America: Several economic centres (with the principal role of New York) can be found on the East Coast of the United States, however cities on the West Coast host an increasing number of large corporations. The command and control function of cities in California (especially San Jose and San Francisco) has grown significantly in the past few years, which resulted in a massive convergence in the economic space from the East Coast to the West Coast.

Western Europe: The centre of the Western European economic space can be detected in the Munich–Stuttgart–Frankfurt am Main triangle and there are also some outstanding economic islands like Amsterdam and London. In 2006, the Western European cities gravitated towards the economy of the United States, however this effect became much weaker by 2014. Furthermore, the centre of the European economic space has become gradually more dominant. This process is clearly expressed by the entirely different gravity zones between the East Coast of the United States (indicated by dark grey) and the United Kingdom (indicated by white). Cities in Northern Europe and Central Europe gravitate towards the centre zone, as well as most cities in North Africa and Russia.

East Asia: A new economic space has been forming in East Asia. Japan still has an important role in the economy of the region; however a more significant zone has emerged in East China with Shanghai and Beijing in the centre. Seoul as an economic island lies between East China (Beijing) and Japan (Tokyo), but it seems to be closer to the Chinese economy. Several major cities in India (e.g. Delhi, Kolkata) and Southeast Asia (e.g. Bangkok, Manila, Jakarta, and Singapore) gravitate towards the East Chinese economic space.

South America with Rio de Janeiro and Sao Paulo in the centre, South Africa with the primary role of Johannesburg, and Australia with Sydney and Melbourne in the centre remain neutral in the global economic space.

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Software: ArcGIS, Darcy 2.0 (http://thema.univ-fcomte.fr/production/logiciels/16-categories-en-francais/cat-productions-fr/cat-logiciels-fr/294-art-darcy), Adobe Photoshop CC