ORIGINAL PAPER

World centralities for political, demographic and market purposes

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Abstract The aim of this paper is to analyse the political, demographic and market centralities of the world through distance-type models. The concept of world centralities to be used is based on the theory of central places. The explanatory variables of the political model are the physical distances between countries. The explanatory variables of the demographic model are the physical distances between countries and the population. The explanatory variables of the market model are the physical distances between countries, their incomes, and an indicator of closeness. The empirical findings have been quite expressive in each case. Interestingly, the world political centre is located between Rome and Athens, the world demographic centre is in the Middle East (mainly its eastern part), and the world market centre is still in the USA, although big emergent countries seem to be closing the gap. The paper shows the potential of the analytical instruments of spatial theory when applied to the world level.

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1 Introduction

In the two decades since the fall of the Berlin Wall, the world has undergone rapid and sweeping changes. Among many other trends, with the globalisation phenomenon, the large, emerging markets such as Brazil, Russia, India and China, i.e. the so-called BRICs, are playing an increasing role in the world economy and financial architecture. It is fair to assert that the outbreak of financial crisis in mid-2007, its further deepening (most notably with the collapse of Lehman Brothers in September 2008) and contamination of the real economy, has indeed accelerated the process. Moreover, it is widely expected that this rise will continue (Wilson and Purushothaman 2003), and there are now more objective bases for this view. As a consequence, after quite a long period of relative stability, the strengths of the long-established group of industrialised countries compared to those of the large, emerging economies has become a matter of intense debate, in particularly as far future developments are concerned.

Major changes have also been characteristic of international flows. It must be underlined that, in contrast with earlier decades, when trade flows concentrated the essential of the world economy, since the late 1980s, the international mobility of factors, considered as irrelevant by most classical and neoclassical economic theorists, has considerably speeded up. This was basically the case of capital movements (in particular, foreign direct investment, which became "the driver of the world economy", Kleinert 2004; Mody 2007). Despite its much slower pace, the movement of people, above all, migrations across countries and regions of the globe, has also significantly increased, compared to previous levels. Thus, the strengthening of these international flows (whatever their nature: trade in goods and services, direct investment, financial operations, mobility of labour) are contributing not only to the increase of interdependence amongst national economies, but also to substantial and rapid changes in the world economic landscape.

Changes induced by political and cultural factors must be highlighted too. Indeed, after the eclipse of the colonial era during the first post-war decades, newly-independent nations in the South and the East, are nowadays becoming increasingly important players on the world political stage. Cultural convergence has been boosted, yet, at the same time, cultural, ethnic, and religious cleavages, that are perhaps no more important than they were in the past (if, we consider, for example, the asymmetrical power in colonial contexts), have become more visible in the day-to-day lives of many citizens around the globe. What does seem clear is that after the first decade of the new century, the world is increasingly open to different configurations, depending on the perspective that we adopt.

Taking into account the broad world changes that we have just briefly described, we feel that it is worthwhile to measure and evaluate such a widespread process, as well as to analyse its implications at several levels. This exercise is needed not only for a better understanding of these changes, but also for preparing an appropriate response to them. With this purpose in mind, in the present paper, using the theoretical concept of centralities, we will investigate, by means of distance models, the locations of the world centralities from different standpoints, raising such questions as whether or not they overlap, in what direction they are moving, which countries and regions are gaining centrality and which are losing it, the role of intermediate regions, etc.

Therefore, starting with the concept of centralities, taken from the field of regional science, particularly in the form of "central places", the aim of this paper is to apply this concept to the political, demographic and market dimensions of the world in the present rapidly evolving conditions. In doing so, we will use distance-type models in order to identify such centralities through a set of explanatory variables. In the political model, the explanatory variable is the physical distance between countries. For the demographic model, the explanatory variables are not only the physical distance between countries, but also their population. In the case of the market model, the explanatory variables are the physical distance between countries, their incomes and an indicator of closeness. More details on these models and their explanatory variables will be set out below.

The paper is organized as follows: in the next section, we make a brief presentation of the relevant literature, developing the basis of the main concepts that will be used, emphasizing the notion of centrality, its content and theoretical evolution, and linking it to the different world levels that will be examined through the distance type models; in the third section, we introduce the models as we have applied them to our core subject, and refer to the main variables that were chosen for our study; in the fourth section, we present and discuss the essential of the empirical findings concerning the three dimensions of world centralities that we have specifically investigated; and in the final section, considering the new evidence arising from our study, some conclusions and recommendations for further research are drawn.

2 Literature survey

In the beginning of this section, we need to clarify the main concepts to be used in the course of our enquiry. Centrality, under the designation of "central places" was firstly applied to cities and regions (within a country), and their immediate environment, therefore within a relatively limited geographical scope, not at a world or even intermediate level. According to Christaller (1933), centrality was "the capacity conferred on a town or region to offer goods and services to an external population". Later, Castells (1972) defined centrality as "the combination at a given time of economic activities, of political and administrative functions, of social practice, of collective representation which contribute to the control and regulation of the whole structure of the town or region. The centre must group the central economic, political and ideological functions". The satisfaction of these needs presupposes the interconnection of geographical places by transport and telecommunication networks. More recently, Choay (2003) stressed that centrality "depends on the capacity of attraction or diffusion of this element which rests on both the effectiveness and the accessibility of the central pole. The element can be an urban centre, a more specialized polarizing facility (shopping, cultural, financial, administrative centre...). *Accessibility is a major condition.*" (our italics added)

However, the analysis of centralities can also be a major issue in economic and political international studies (Kindleberger 1973, 1996). According to prominent theorists in this area, the world political, financial and economic centres or poles are not, of course, a perfect substitute for the initial meaning of centralities, but their

identification is all the more important, in order to know what are the underlying forces that drive the world, particularly in transitional periods such as the current time, when the location of centralities may be unclear. For example, insofar as it concerns the more sensitive politico-economic concept of hegemonic power and its implications (Kindleberger 1973), be it polarized in one country or in several countries, its use remains controversial and its application is rather complex. Thus, in our paper, by analogy, we will use the concept of centralities, not in the originally narrow geographical sense, within a strict regional science framework, but at the world level and we attempt to measure its market, demographic and political dimensions in the present changing landscape that characterizes the globalization context.

In order to deepen the theoretical understanding of our core subject, we need to observe that the spatial theory consists of proposing a partial explanation as well as prediction possibilities regarding the state and likely evolution of geographical objects/entities, on the basis of knowledge of their situation with respect to other geographical objects. However, there is not yet any general theory of geographical space that could explain the concentration of spacing and spatial structures, in addition to the evolution of spatial systems, relying on knowledge of behaviours in space and of spatial representations. Notwithstanding the peculiar case of almost static geopolitics (Blouet 2001), this is particularly true at the global level of spatial analysis; moreover, historically, several world spatial structures may be recognized during the three last centuries (for example within the context of the so-called "globalization waves"; O'Rourke and Williamson 1999). In these circumstances, to improve our knowledge of how geography is actually organized, consistent subsets of theoretical proposals have nonetheless been gradually enriched. Most of these theories, which attempt to explain the location and distribution of human activities, refer to the major role played by *distance*, which on the one hand strongly impacts on their interactions and on the other hand makes value of places vary in function of their relative geographical situation.

As an example of this procedure, in relation to the spatial theory in the framework of international economics, we have studied the relationships between trade and foreign direct investment in the light of the concept of distance (Cechella et al. 2009). Geographically, it may be accepted that the increase of distance has a negative impact on such flows. It must be added, however, that this effect can be reduced or neutralized by transaction costs stemming from other factors like those emanating from cultural, linguistic and historical proximity, as many recent studies and analyses have shown (Helliwell 1998; Eichengreen and Irwin 1998; Rauch 2001). This is mainly due to "the ability to exchange more information of a less formal kind", as put by Krugman (1995). It also means that we have to ponder the issue of distance from different perspectives rather than exclusively from the physical geography point of view, which is relevant to a more accurate study of world centralities and the way they effectively run. In spite of the relevance of this topic, we will not specifically explore these differences in the present paper. Nonetheless, it is necessary to bear in mind the complexity of the concept of distance: for example, some geographically distant countries may be quite close, from the cultural and linguistic perspectives (Silva 2009).

In the pursuit of our research, considering the initial background of the theory of "central places" (Christaller 1933; Lösch 1940), we must highlight the conceptual

principles that shape the economic space: the *market principle*: that maximizes the number of central places (better serving the population) while ensuring the equitable sharing of customers among centres, the *transport principle*: that reduces the cost of transport infrastructure; and the *administrative principle* that avoids overlapping between areas of influence of each centre of the same level. So, this theory is based on a distinction between centres, which are the seats of the supply of goods and services, and peripheries (regions complementing the centre), where demand, i.e. the population using them, resides. The notion of centrality justifies clustering in the same place of production of services at the same level and intended for the population which is scattered in the complementary region (or influence area), whose customers are polarized by the centre. The explanation calls for integration of the central places theory into a more general theory that could be an evolutionary theory on the basis of such clusters. A centre acquires an upper centrality level through the accumulation and increased complexity of its activities if it succeeds in competing with other centres by capturing the initial advantage of a sufficient number of innovations. It is a process that tends to regulate the spacing of centres, in any area where interactions have been taking place during a sufficiently long, continuous time, according to the proximity rule. Furthermore, it is this process which leads to growing inequality in centres' weights. The latter is strengthened through the systematic increase of the realm of spatial interactions caused by the increasing speed of communications, which determines a historical trend toward contraction of physical space and towards widening of the space accessible for interactions.

We feel that the inclusion of the above considerations, based on the foundations of the theory of "central places" and its evolution, is justified insofar as they provide a possible theoretical approach that can be applied to world centralities, i.e, where, with the purpose of working with global available and workable data, we work with countries rather than cities and small regions as happened in the traditional use of the concept. We seek to apply such an approach in three different dimensions: political, demographic and market potential, allowing a better understanding of the present global process and the induced changes in the world structure at these levels.

3 Methods to identify the world central places

The literature refers to various methods to identify centralities (Crucitti et al. 2006) and central places (Eff 2005). The measure that we use for the world political centrality of each country is simply the sum of the distances between that specific country and all the others, the most central country being the one with the lowest results for the political centrality indicator (PC_i). The basic idea is to identify the country where it would cost the least to organise a gathering, with one representative per country, considering only the transportation cost. Obviously, this is a simplification (indeed, beyond distance, other factors like the size of demand also matter for transportation costs), but it takes into account a decisive element and can be represented as follows:

$$PC_i = \sum_j d_{ij}$$

where PC$_i$ = the indicator of political centrality and d_{ij} = distance between country (i) and country (j).

The second measure of centrality proposed in this paper seeks to identify the country where it would cost, in the conditions just described, the least to attract all of the world's population. The world demographic center can be seen for example as a world pilgrimage centre as Rome, Jerusalem or Mecca. The world demographic centre will be the country with the lowest levels of demographic centrality (DC$_i$), which can be calculated by the following formula:

$$DC_i = \sum_j d_{ij} P_j$$

where DC$_i$ = the indicator of demographic centrality; P$_j$ = the population of country (j); and d_{ij} = distance between country (i) and country (j).

The last measure of centrality proposed in this paper tries to identify the country or countries to locate world markets to buy—demand market potential DEP$_i$—or sell—supply market potential SEP$_j$—products. We used the following equations whose elements are detailed afterwards:

$$F_{ij} = k \cdot Y_i^\beta \cdot Y_j^\alpha \cdot \exp(-\delta d_{ij})$$

$$SEP_j = \sum_i F_{ij}$$

$$DEP_i = \sum_j F_{ij}$$

where:

SEP$_j$ = Supply market potential of country j;
DEP$_i$ = Demand market potential of country i;
F$_{ij}$—commercial flows between origin i and destination j;
Y_i—income at the origin;
Y_j—income at the destination;
d_{ij}—distance between the origin i and the destination j;
k, β, α, and δ—are the coefficients of the independent variables estimated in Cechella et al. (2009), based on data from 90 countries on income (Y_i) and commercial flows (F$_{ij}$) in the year 2005.

These are the main equations that we have calculated in our empirical research. They allow us to measure world centralities from the political, demographic and market potential perspectives, using a set of explanatory variables.

4 Empirical findings

In this section, the most significant empirical findings of the study are presented and discussed. We will analyse them through Figs. 1 to 5, which depict the results that we have obtained for the three measures of world centrality: political, demographic

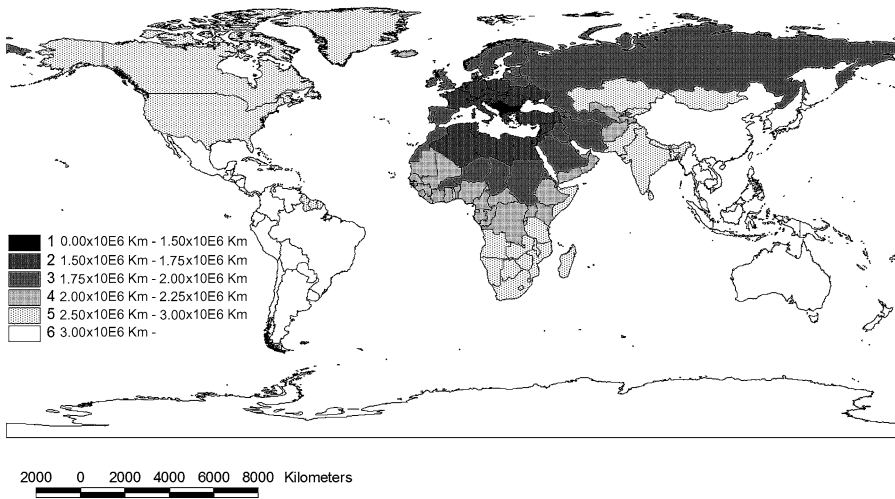## World Centre for Country Representatives

Fig. 1 World political centrality

and market potential. In the figures shown, increasing world centrality is represented in bold, and centrality will diminish when numbers increase from 1 to 6 (except in Fig. 5).

Based on the measure of political centrality proposed above, Fig. 1 reveals that the most central place to establish the Headquarters of the United Nations is not New York, as is the present case, but Albania, located in the Balkans, which is interestingly half-way between Rome and Athens. At the same time, very important world regions like Eastern Asia (including China and Japan) or Latin America appear relatively peripheral from this particular perspective. Of course, the political centrality would have been quite different if political boundaries were not what they are. In any event, for the short-term purpose of establishing the location for the Headquarters of the United Nations or any other world organization with country representatives, the exercise carried out emphasizes that "the total distance that has to be travelled if one representative of any country had to meet at a particular point" is not the only factor that influences the location of world organizations of countries but the attractiveness of Geneva (World Health Organization, World Trade Organization), Rome (Food and Agriculture Organization) all of them with considerable political centrality, illustrates the relevance of accessibility of country representatives for the location of world organizations.

Figure 2 shows another interesting outcome by highlighting the crucial importance of Afghanistan and Pakistan and, from the demographic perspective, the remote character of the United States, Brazil, South Africa and Australia. As in the previous case, the estimated result as far as the world centrality is concerned is pretty clear; it is true, however, that if distances were appraised by sea, the resulting centralities would be different. Nevertheless, for centralities based on population, certainly a good distance measure is the direct connection by air. Moreover, benefiting from their location at a
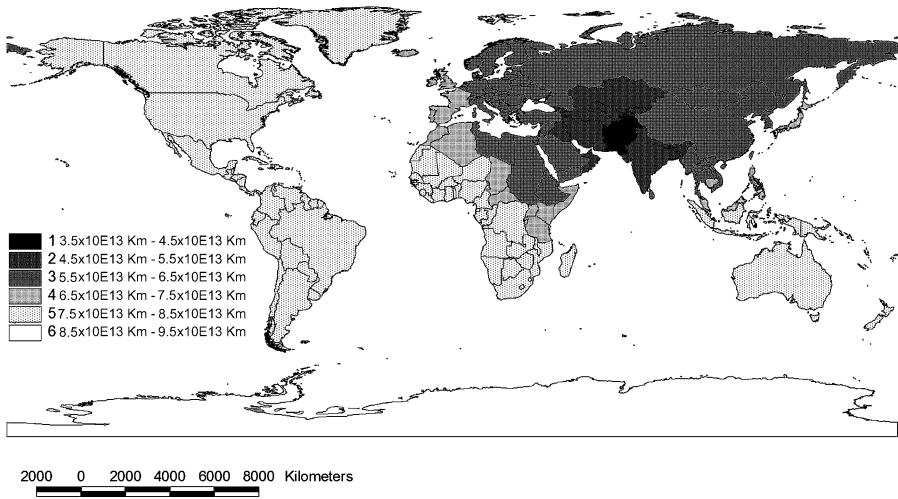
World Centre for Population Gathering

Fig. 2 World demographic centrality

world level between highly populated regions like Europe and East and South Asia, it is compelling to note the remarkable centrality of relatively depopulated areas such as the Gulf States, which is robustly revealed by these calculations.

The remaining figures provide a basis for analysis of world centralities at the market level from different perspectives. Figure 3 shows the results of world market centrality based on the concept of Supply Market Potential of each country (their ability to sell). It is clear that nowadays, there is no one single major market centre, but three—the United States, Europe and Japan. This result is still similar to what was common knowledge in the past two or three decades, the so-called *Triad Power* (Ohmae 1985). Nevertheless, as was mentioned earlier, the world is rapidly changing, and if we assume that in the future, the income per capita will be the same in every country (Fig. 4), then there will be a world market centrality in China and India, and a few other second-level centres in the United States, Nigeria, Pakistan, Indonesia, Brazil, Congo, Ethiopia, Iran, Turkey, North-Western Europe and South-East Asia. For example, in view of the fact that in 2009, China overtook Germany as the main world exporter we must recognise that major changes are occurring in relation to the "old" Triad. So, our hypothesis is not unlikely in the coming decades, since the world is already undergoing a significant process of economic and technological catching up, particularly in emerging countries. This means that even if an equalisation of income per capita among the countries of the world is not predictable as such, many of them may improve their position in the medium term (as was clearly the case in the last decade), perhaps even overtaking the previous leaders. Additionally, it is important to note that the main assets in such a vast process of global improvement (income, technology, finance, etc.), besides geographic centrality, is population, notably under the perspective of human capital creation.
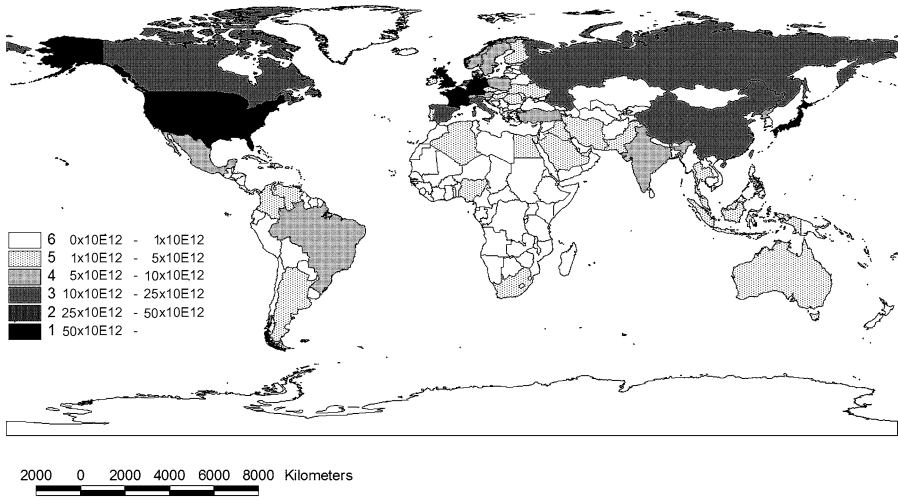
World Economic Centres of Today

6	0x10E12	- 1x10E12
5	1x10E12	- 5x10E12
4	5x10E12	- 10x10E12
3	10x10E12	- 25x10E12
2	25x10E12	- 50x10E12
1	50x10E12	-

2000   0   2000 4000 6000 8000 Kilometers

Fig. 3 World market centralities of today

World Economic Centres of Tomorrow

6	0x10E12	- 1x10E12
5	1x10E12	- 5x10E12
4	5x10E12	- 10x10E12
3	10x10E12	- 25x10E12
2	25x10E12	- 50x10E12
1	50x10E12	-

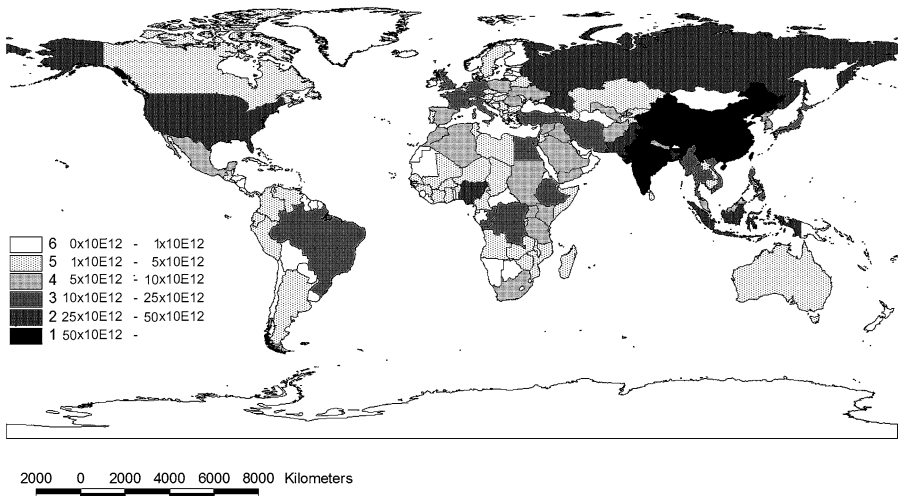2000   0   2000 4000 6000 8000 Kilometers

Fig. 4 World market centralities of tomorrow

Finally, in Fig. 5, the relation between Supply Market Potential and Demand Market Potential is presented. The countries with higher indicators are those which will profit more from increased accessibility, whereas those with lower indicators are those which could gain from some degree of trade barriers. Remarkably, those relative indicators are similar for the Market Potentials of today and tomorrow. Figure 5

Relation Between Supply and Demand Potential

Legend:
- 0 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1
- 1 - 1.1
- 1.1 - 1.2

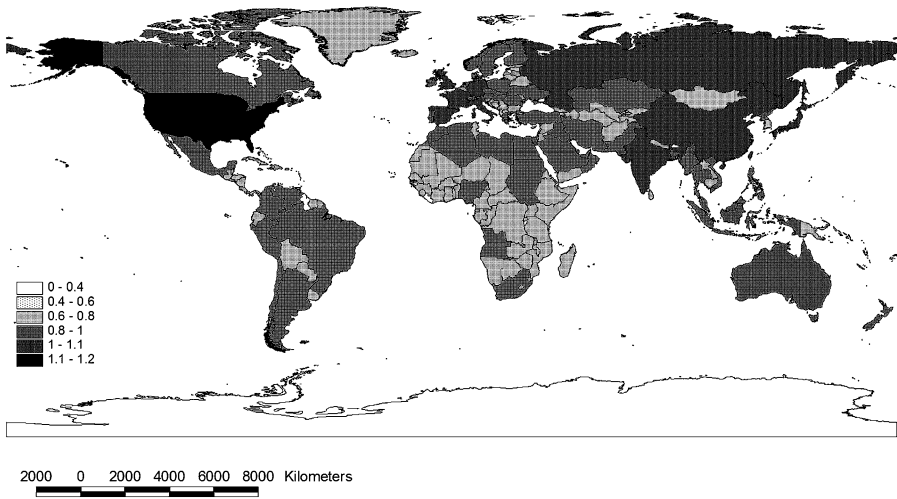2000   0   2000 4000 6000 8000 Kilometers

Fig. 5 Relation between supply and demand potentials

also highlights another geography, this time in which the United States shows an interesting potential that results both from its dimension and relative remoteness.

The results of our research on world centralities through distance models show that they may not correspond to what is actual or usually expected. Moreover, in spite of their clarity, the measures evidence that the different levels that we have considered may not necessarily overlap. On the contrary, the degrees of centrality are relatively well-defined throughout the world. Most importantly, if we look at future prospects, particularly from the point of view of market centrality, the world landscape appears quite different from what was common during the last decades of the 20th century, when this level played a key role in the ranking of world centralities. In any case, market centralities tend to be more decentralised, with more than one pole, than political and demographic centralities.

5 Concluding remarks

Our research has shown that world centralities could differ radically from those to which we are accustomed. An outline of the findings is provided after each central-ity exercise, and without any profound speculation, the conclusions are, firstly, that the world political centre appears to be Albania rather than New York. Secondly, the world pilgrimage centre would probably shift from such traditional places as Rome, Jerusalem or Mecca to much more central places such as Kabul, Dubai or Goa. Thirdly, there is not one market centre but many, and of different levels, and this is quite changeable depending on the dynamics, movements of human capital and their associated environmental capacity.

On the basis of this research, it is worthwhile to note that the traditional concepts and analytical instruments of the spatial theory, like central places, physical distances and gravitational models, can be quite appropriate for making interesting analysis not only about how the world centralities could be structured for several purposes, but also how this can evolve with changes in the main factors that influence them like distance attrition, population distribution and income distribution. As mentioned above, the issue distance/proximity is complex and there are other ways to measure distance instead of the strictly physical point of view. However, in the light of the present situation in the world, even further studies on the basis of the same methodology used in this paper (including its application to other levels) may be quite elucidatory in respect to highlight the distance resilience that influence the geography of the coming changes, particularly if the trend towards global economic levelling persists.

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