

Permanence of Economic Potential of Cities Based on Sector Development

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Abstract: The paper attempts to answer the following key question: how will a city's world rank change in the face of crisis in its main economic sector? Crisis is defined here as a decline in financial performance in the given sector, which leads to the decline of its constituent firms and corporations on the world economic scene. The World Economic Center Index (WECI) has been created in order to rank cities based on the value of their resident corporations by sector and show their level of stability upon the removal of the most important sector. This provides information on the potential of each analyzed city as well as on its advanced features or area of specialization. Research has shown that nearly half the World Economic Centers are dominated by the financial and materials sectors of the economy. Different sectors dominate different regions of the world. For example, consumer staples and materials were dominant in North America, while information technology and financials were dominant in Europe. In Asia, several sectors tend to dominate the economy. Research has shown that the ability of a principal economic sector to resist economic crisis largely depends on the strength of the command and control function of a city. Finally, a high globalization level of a city is a key determinant of its susceptibility to economic crisis.

Keywords: globalization; economic crisis; world city; world economic center; headquarters

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1 Introduction

Large affluent cities make information readily available, which facilitates teamwork in the realm of science and other technical fields. Easy access to important information is also a key component of a high standard of living for social elites seeking wealth as well as social interactions and an active cultural scene. Cities are home to the headquarters of international corporations, political institutions, media outlets, advanced 'producers' of culture as well as 'consumers' of culture. Urban businesses and organizations generate economic success for cities and surrounding areas by attracting qualified workers and specialists from around the world (Beaverstock and Boardwell, 2000), which is also facilitated by the presence of major airports that help drive globalization processes (Addie, 2014). Large corporations play a spe-

cial accelerating role by creating international linkages and turning cities into world centers. This helps produce an economy based on knowledge (Dorocki and Borowiec, 2012), which further accelerates the process of globalization (Pain, 2008).

Several key factors help determine business location in today's world: 1) information and telecommunications infrastructure, 2) capital markets, 3) business support institutions, 4) availability of educated workers, both technical and academic, as well as research and development facilities, 5) economic climate, 6) history and cultural traditions, and 7) standard of living and quality of life (Płaziak and Szymańska, 2014). The above factors help determine the number of international corporate linkages in a given geographic area. This has been the case on a major scale since the 1990s (Beaverstock *et al.*, 1999). Economic ties between major

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cities increased significantly in the 1990s, frequently via the establishment of affiliates in countries other than the parent country of each given corporation. Globalization has also altered spatial planning efforts on the world scale as well as the regional scale (Lüthi *et al.*, 2010). This process further accelerated in the early 21st century via the evolution of multinational corporations whose revenue reached 3×10^{13} USD (the United States Dollar) in 2012 (Taylor and Csomós, 2012).

Expansion via acquisition is a key part of corporate globalization. A second strategy consists of relocating manufacturing plants and service centers to countries with lower labor costs (Kleibert, 2015). A third strategy consists of opening sales offices in new countries, thus strengthening commercial linkages between cities. One outcome of this strategy is the rising importance of so-called BRICS countries as well as other emerging markets (Liu *et al.*, 2014). All three strategies can be observed in action in central and eastern Europe today and this has been the case with companies in the region since the 1990s (Ravbar, 2009). This has produced an increase in the number of the largest companies and an increase in their financial performance in the region (Raźniak and Winiarczyk-Raźniak, 2015; Raźniak *et al.*, 2015).

2 Theoretical Background

One of the key works in this field of study is that of Hall (1966) who created the theoretical basis for the 'world city' concept. In his view, world cities serve as political centers amassing major government institutions, labor unions, and federations. In addition, world cities are home to the headquarters of major companies that engage in international commerce via seaports, international airports, principal roads, and major railways. World cities also serve as centers of finance via the presence of central banks, insurance companies, and other financial service providers. Other specialized services include major hospitals, legal firms, leading universities, research centers, museums, book and journal publishers, and national libraries. Finally, world cities are home to luxury stores, renowned brands, specialized product providers, as well as entertainment venues such as operas, theaters, concert halls, cinemas, and restaurants (Hall, 1966). In 1966 he identified seven world cities: London, Paris, Moscow, New York, Tokyo as well as the Rhine-Ruhr region in Germany and the

Randstad region in the Netherlands. The world city concept was further developed by Friedmann (1986) who submitted seven hypotheses for further discussion. His hypotheses were strongly rooted in the process of globalization and reflected his view that, '... the global control functions of world cities are directly reflected in the structure and dynamics of their production sectors and employment...' (Friedmann, 1986). He identified nine cities as primary world cities: London, Paris, Rotterdam, Frankfurt, Zurich, New York, Chicago, Los Angeles and Tokyo.

Advanced research work on the 'world city' concept has been led over the last two decades by researchers (Beaverstock *et al.*, 1999; Taylor *et al.*, 2002; Taylor and Aranya, 2008). More recent economic data show London and New York as cities with the strongest international linkages, and also indicate that Asian cities are becoming increasingly important (Derudder *et al.*, 2010; Taylor *et al.*, 2010; Shing *et al.*, 2012; Derudder *et al.*, 2013; Li *et al.*, 2015).

In 2012 London and New York were once again the most internationally linked cities in the world, even called the pair NY-LON (Smith, 2012). Highest category (alpha-type) cities are concentrated in North America, the western Europe, and the eastern Asia (38 out of 45) (Fig. 1). Cities such as Shanghai, and Beijing are actively developing linkages with New York and London (Taylor *et al.*, 2014), and they have also high political global city status (Su *et al.*, 2014). Beijing is also referred to as success city (Timberlake *et al.*, 2014). It is success owes not only capital functions but also the capital market forces (Pan *et al.*, 2015). Also South and eastern Asia reached over 1.4×10^{12} USD of FDI, which is the leader region in the world (Stoddard and Noy, 2015) and reaches large volumes of international trade (Liu and Ng, 2010). Western Europe may be called a pentagonal system (Kincses *et al.*, 2013) and eastern Asia with all world cities ranked alpha++ and alpha+ (except Dubai). Beijing is very strongly linked with cities of the western Pacific, while Shanghai is closely linked with major global cities including London and New York, rather than China's capital city. At the same time, Shanghai is characterized by a higher rate of growth in international connectivity relative to Beijing. The case of Hong Kong is interesting in that this city has lost some of its connectivity with New York and London in favor of stronger ties with Shanghai (Taylor *et al.*, 2014).



Fig. 1 World cities in 2012

International corporations play an increasingly significant role in the world economy. This evolution of corporations has produced a new concept, that of the 'global city' (Hymer, 1972). This new concept is largely based on the presence of international corporations (Cohen, 1981). Theoretical research on the 'global city' developed throughout the 1980s (Friedmann and Wolff, 1982; Sassen, 1988). According to Sassen (1991), global cities play a strong command and control role as well as serve as global service centers. Today it is the mobility of capital that appears to constitute the most important aspect of globalization. In addition, physical distance is also becoming a less important issue, both in the area of labor mobility and capital mobility. Hence, what appears to be emerging is an international economic system with easy capital flows and increasingly important financial entities (Sassen, 2000).

The functions of large corporations were the subject of research on cities as world command and control centers (Godfrey and Zhou, 1999; Alderson and Beckfield, 2004; Taylor and Csomós, 2012, Csomós and Derudder, 2014a). This concept is the key to understanding cities in the process of globalization. While the geographic distribution of corporate headquarters does show the strength of cities as command and control centers, it is not the only metric of a city in the global urban network (Taylor, 2004). Csomós (2013) used corporate financial data such as revenue, profits, assets, and market value to create a Command Control Index (CCI) for the world's top cities. In 2012 cities with the highest CCI values were Tokyo, New York, London, Beijing, and Paris. However, the highest rate of growth

in terms of the number of headquarters as well as CCI was noted for cities in China.

There are critics of the world city and global city concepts and their link with control in a global world. One view is that, '...it is always just the head office of the 'network' of offices of one independent commercial service firm that is determining all the rankings in his typology of global 'command' centres...' (Smith, 2014). It is also difficult to estimate just how many corporate headquarters are needed in order for a city to be classified as a world city or global city (Smith, 2014). Some researchers note the narrow selection of corporations considered in world/global city analyses and suggest that this may affect final rank (Robinson, 2005). On the other hand, Bassens (2010) believes that an analysis of connectivity in the case of firms in the advanced producer services sector used by the GAWC (Globalization and the World Cities Network, www.lboro.ac.uk) does not provide a complete picture of connectivity in western Asia, as most firms in this sector are located either in Europe or the United States. In addition, a focus on the firms of this sector does not show their impact on the real functions of a city (Parnreiter, 2010). It may also be argued that there exists no ideal typology for cities given all the metrics available today (Raźniak, 2014). It is also likely that there is no city that would be characterized by high values of all available parameters (Sassen, 2009). While there are also some economic indicators that can be used to evaluate city rank (McKinsey Global Institute, 2012; Kearney, 2014), it may be argued that the world city, global city, and command control concepts are optimal at characterizing relationships and city rank

in a global economy. It is also likely that relationships between cities are more stable in time of crisis than relationships between individual corporations (Derudder and Liu, 2013; Liu *et al.*, 2014).

Existing concentrations of the labor force and those of other sectors of the economy strongly affect planned locations of new business facilities. This suggests that existing local conditions are a primary magnet for new industries. While strong sector differentiation may be a magnet for new companies, it does not guarantee the success of these new companies. Yet, employment levels in a given city depend more on current market conditions than local levels of economic development (Henderson *et al.*, 1992). In addition, the local accumulation of top management talent may draw companies to cities instead of rural areas located far away from cities (Becker and Henderson, 2000). Companies that produce goods and services may also take advantage of the accumulation of infrastructure in a given city, along with supporting companies, as well as the presence of highly specialized capital inputs. This helps a city continue to meet or exceed its growth targets and increase its attractiveness to new companies (Krugman, 1991). The current trend is to relocate business support services to smaller urban centers with lower operating costs compared with costs in large cities. At the same time, these corporate support firms continue to serve companies located in large cities (Liao, 2012). The last several decades have seen the emergence of international financial and service centers, which tend to focus the finance and services sectors on a global scale. Globally connected cities form a vast integrated financial system that collaborates and competes internally at the same time, which further helps to strengthen connectivities within itself. Growth in the financial sector in cities such as London, New York, Paris, and Frankfurt is partially associated with their function as global financial centers. The highly developed financial connectivities of these cities may be advantageous in a good economy, but may serve as trigger points in time of crisis, which may help spread financial problems to other cities as well (Sassen, 2011).

An analysis of linkages between cities shows that many are part of the broader process of globalization, which occurs with variable intensity on the world scale. New urban nodes of globally connected business activity are emerging due to globalization (Taylor *et al.*,

2010). Hence, it may be argued that international linkages between cities are a sign of globalization (Beaverstock *et al.*, 2011; Neal, 2013) or a product of globalization (Taylor, 2009).

The concepts known as the 'world city' (GaWC) and the 'global city' (Sassen, 1991) as well as the 'command and control index' (Csomos, 2013) illustrate cities in terms of different metrics, but do not gauge the level of resistance of cities to crises associated with the largest companies performing the command and control function. It also seems that the strength of a city may be reflected in its ability to resist economic crisis events. The concept of world cities mostly reflects cities characterized by a specific function linked with the presence of APS. This excludes cities with little APS, but significant differentiation of other sectors of the economy. According to Sassen (2011), it is global cities with strong financial linkages that spread financial problems around the globe. In this particular case, it is cities with a broad array of sectors that may resist economic crisis better. Hence, it appears that world cities may not be able to handle economic crisis very well after all. For this reason, we are proposing a new concept, which we will call cities that are world economic centers.

The paper attempts to answer the following key question: how will a city's world rank change in the face of crisis in its main economic sector? Crisis is defined here as a decline in financial performance in the given sector, which leads constituent firms to lose their place on the Forbes Global 2000 list (www.forbes.com). As a result, the sector and its constituent firms lose their ability to serve as command and control elements for a given city. It may be argued that a city with a well-developed command and control function does not necessarily have to be good at managing crises. This is often linked with a narrow sector specialization of a given city or its reliance on a single large company. In both cases, it does appear that unfavorable economic changes caused by an economic crisis will strongly affect cities with undiversified growth drivers. Cities with a single dominant sector or company may experience economic collapse in the event that this one company or sector faces problems. On the other hand, cities with multiple prosperous companies representing multiple sectors will be affected less, as stronger companies and sectors will offset losses experienced by any weaker companies and sectors. Sector differentiation in a city's economy may be de-

scribed using the term 'stork effect'. In time of crisis, when one or more sectors of the economy are faltering, the local economy can stand on its 'other leg' or sectors able to resist economic crisis. These other sectors can help stabilize a city's economy in order to offset instability triggered by other sectors.

The risk associated with excessive specialization was noted in Poland after 1989 when the national economy became weaker and a 'sector focus' became a liability. Many economically developed urban regions in Poland, which had relied on a single company or sector, fell into deep economic recession following major economic change in the country and the lack of market stability that followed 1989. Some of these economically focused cities became economically weak and lost their significance in the national economy. Resistance to crisis may also be gauged in terms of cities' international linkages, as corporate losses in one place may be offset by corporate gains in another place.

3 Methods

Csomós and Derudder (2014b) argue that the command and control function of cities is performed by the 2000 largest companies listed by Forbes Global 2000. In addition, the Command Control Index by Csomós (2013) also assesses the economic rank of a city in a given year based on the financial performance of the companies listed by Forbes Global 2000. In this paper, the largest 2000 companies in the world are used as a basis for a variety of calculations. The World Economic Center Index was created for this purpose and it shows the rank of each given city relative to the value of its resident corporations by sector and can be used to show the stability of each ranked city by excluding selected sectors. This makes it possible to assess the potential of each given city as well as its level of development and specialization. In this paper, cities with at least four sectors are considered, as this is the number of sectors assumed by Csomós in his analysis of cities in the United States (2013). The location of companies was assigned based on the location of their corporate headquarters. The metropolitan area with corporate headquarters also became the spatial unit of choice for researchers working on the 'world city' concept (www.lboro.ac.uk), global city concept (Sassen, 1991), and the command and control index (Csomós, 2013).

In this paper, data for the years 2006 and 2012 obtained from the Forbes Global 2000 list (www.forbes.com) are used, and are aggregated for the metropolitan areas that host each given corporate headquarters (Csomós, 2012, GaWC Data Set 26). The concepts discussed above are based on entire metropolitan areas, although terms such as 'world city' and 'global city' are formally used in many research papers. In addition, the 'world economic center' concept presented in this paper also applies to full metropolitan areas, although the discussion section uses the term 'city'.

Standardized values based on normalized revenue, profit, asset, and market values (x) were calculated for selected sectors (z_s) (Equation 1) in order to compare the relative rank of selected cities. The standardized values were then totaled in order to produce a comprehensive index for corporate headquarters located in each studied city (i) (Equation 2). In summary, the SIP_{HQ} (Synthetic Indicator of Potential HQs- SIP_{HQ}) index measures the market potential of companies headquartered in each studied city.

$$z_s = \sum \frac{x - \frac{\sum_{i=1}^N x_i}{N}}{\sqrt{\frac{\sum_{i=1}^N (x_i - \bar{x})^2}{N}}} \quad (1)$$

$$SIP_{HQ} = \sum_{i=1}^N z_{s_i} \quad (2)$$

where x represents particular values for revenue, profit, asset, and market for selected sectors and city; x_i represents revenue, profit, asset, and market values of sector for selected city i ; N represents the number of cities per sector.

The calculations were performed on data from 2006 and 2012 in order to track changes. In order to see which sector has the most influence on each given city, the value of each studied sector was subtracted from the total standardized for 2012 to show how the standardized total z' would change using the initial value as 100% (Equation 3).

$$z' = \frac{SIP_{HQ} - z_s}{SIP_{HQ}} \times 100\% \quad (3)$$

This calculation indicates which cities possess the strongest specialization (sector) and which sector is the weakest. The lower the overall score (less than 100) following the subtraction of a given sector, the more important the sector for the given city. Conversely, if a sector value is subtracted and the resulting outcome is much higher than 100, then the relative value of this specific sector must be low for the city of interest. Cities characterized by large differences between minimum and maximum values following the subtraction of selected sectors are said to be highly specialized and suffer from inadequate development in selected sectors. Cities characterized by small differences following sector subtraction are said to have developed along multiple sector paths. Only cities with four or more sectors were studied.

An index of stability (IS) was constructed using standardized values and changes in values following sector subtraction (z'). The value of the SIP_{HQ} index was divided by the value of the standard deviation (SD) of values produced by the subtraction of selected sectors (z') (Equation 4).

$$IS = \frac{SIP_{HQ}}{SD_{z'}} \quad (4)$$

The higher the IS value, the higher the value of its constituent sectors, and the greater its stability, which is defined here as a lack of strong specialization. In effect, a city with a high IS value possesses a diverse economy based on many equally developed sectors. The IS index also shows how economic crisis in a principal economic sector can affect the financial performance of a given city.

The last part of the research sought to place cities into development classes using a comprehensive World Economic Center Index (WECI), which was based on the IS value, the number of sectors and the number of corporate headquarters (Equation 5). It was assumed that 50% of the overall score would be assigned to financial performance, which is an indicator of the strength of a company and the balanced and strong development of all sectors. The next component is the number of sectors: a large number of which may stabilize a city's economy in time of crisis when one or more sectors are affected by a downturn. This component was assigned 30% of the overall WECI score. In the event of a merger between two companies with their headquar-

ters located in one city, one corporate headquarters ceases to exist, which would on the surface diminish the strength of a city in terms of the number of corporate headquarters. This is why the number of headquarters is assigned only 20% of the overall WECI score. Given the problems discussed earlier, it appeared necessary to construct a World Economic Center Index that would not only focus on cities' resistance to crisis via the presence of major corporate headquarters and a diversity of economic sectors, but also via the total number of sectors present (even weak sectors) and the total number of corporate headquarters. This type of comprehensive approach will enable a fuller analysis of economic potential, especially in the case of cities with similar levels of economic stability.

$$WECI = \frac{IS \times 50 + S \times 30 + HQ \times 20}{100} \quad (5)$$

where HQ is number of headquarters; S is number of sectors.

Calculations can not be performed for a mean sector value of zero. Normalization was performed assuming a normal distribution and without checking for data asymmetry. This is a consideration in data analysis. Strongly skewed distributions should not be normalized. The analysis in the paper is based on customized indicators based on basic statistical methods including the coefficient of variability, standardized values, and the weighted average. These methods are available to most researchers, which make the customized indicators easy to use for most researchers. For example, the index of entropy can be used to analyze the diversity of economic sectors in a city. This index is used to show inequalities in a population and is based on redundancy defined as the absence of randomness in a data sample. The location quotient can also be used to show sector dominance in a city. This particular measure is used to test the level of economic specialization of a city versus a larger geographic area. In this paper, the goal was to measure sector dominance within a city: as opposed to a comparison with other cities.

The studied cities were placed into four categories:

Major World Economic Center (WECI > 10.00): cities that lose a negligible amount of their potential in the event of a crisis in their dominant economic sector and remain dominant centers of command and control.

Midsized World Economic Center (WECI 5.00–9.99):

cities that lose a significant amount of their potential in the event of a crisis in their dominant economic sector and remain dominant centers of command and control.

Minor World Economic Center (WECI 3.00–4.99): cities where crisis in their dominant economic sector strongly impacts their rank, which can lead to a decline in WECI and a gradual transition to a regional or continental role.

Potential World Economic Center (WECI < 2.99): cities characterized by some economic potential, but the dominance of a single sector creates significant instability in the event of a crisis.

4 Results

Rapid increases in city rank based on the indicator used appear to be linked with high specialization levels in production. The largest declines in city rank, following the subtraction of one sector, were noted for: Mexico City (subtraction of the telecommunications sector), Shenzhen (financials), Montreal (information technology), Delhi (utilities), Shanghai (healthcare). The above cities strongly specialize in one sector of their economy,

which leads to a significant index value decrease when that one sector is removed from the index calculation (Fig. 2).

The subtraction of one sector resulted in an increase in overall index value in the case of 18 cities, which is an indication that the subtracted sector is not very valuable (Fig. 3). Cities where the index value increased more than 200% relative to the initial value were Mexico City (subtraction of the industrials sector), Calgary (energy), Montreal (financials), Melbourne (materials) as well as two cities in China: Shenzhen (industrials), and Shanghai (financials). Conversely, cities characterized by the highest level of stability with respect to decreases in index value were Tokyo, Boston, and Delhi. Finally, the smallest fluctuations (less than 20%) between minimum and maximum values following sector subtraction were determined for Monterrey, Kansas City, Geneva, Manila, and Warsaw.

The next part of the study included an analysis of index of stability values (Fig. 4). The same four cities earned the highest index values in this case as well: Tokyo, Paris, London, New York. At the same time, these cities' index values declined the most between 2006 and

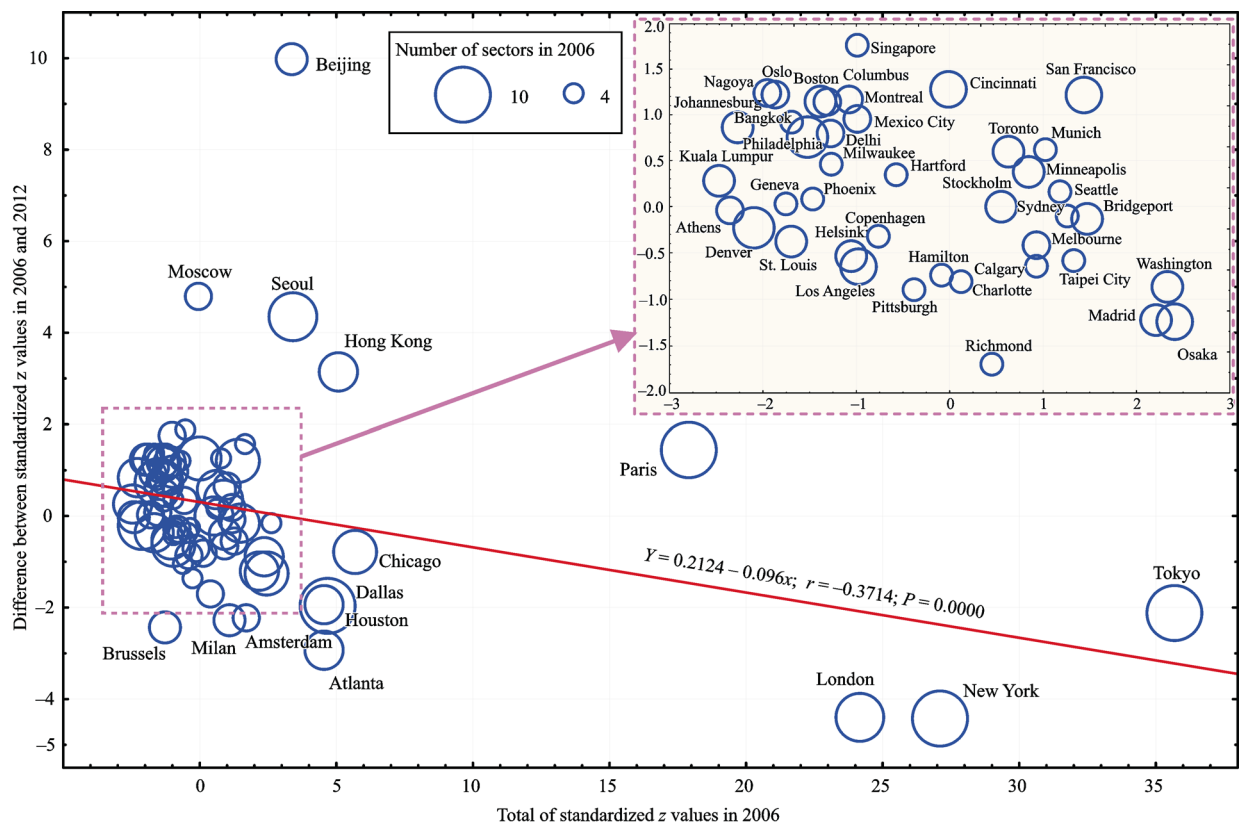


Fig. 2 Differences in city potential in 2006 and 2012

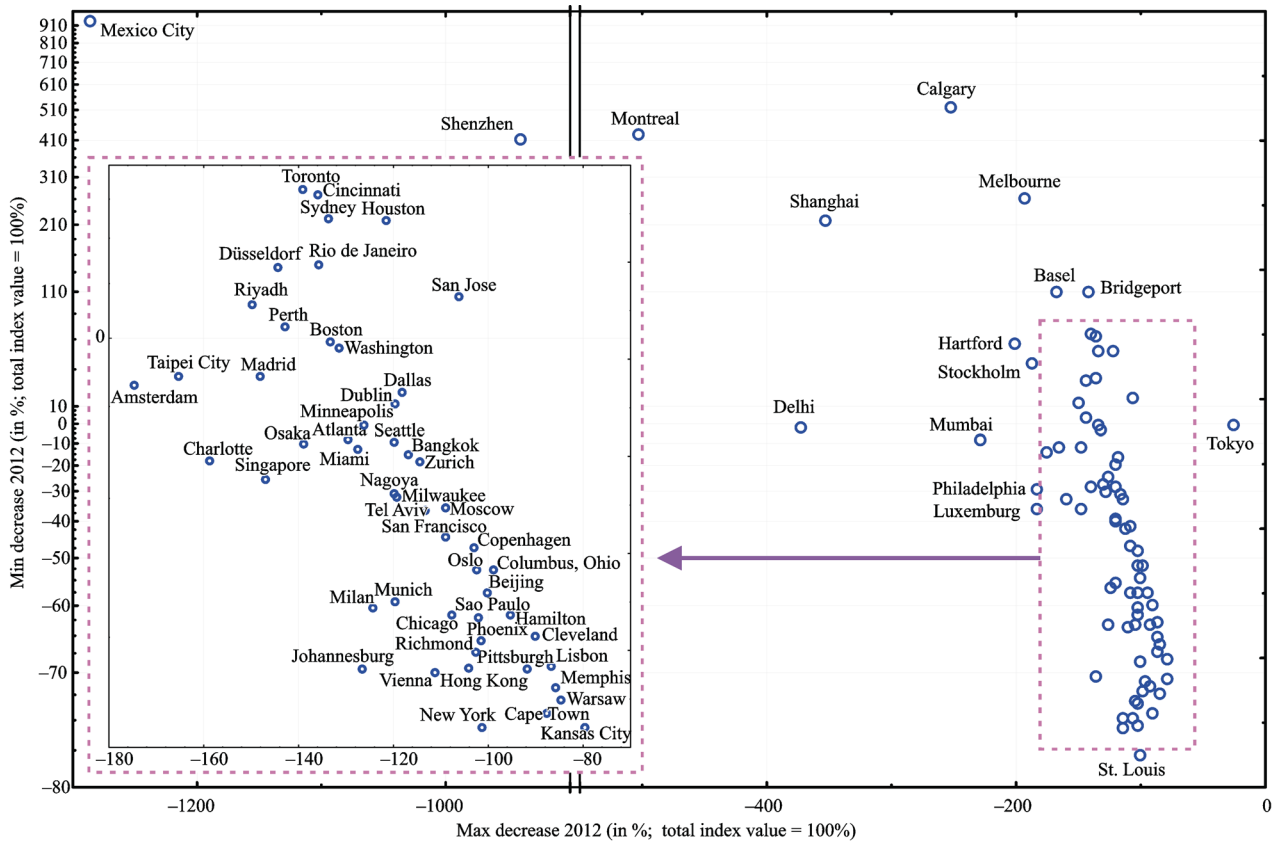


Fig. 3 Largest and smallest changes in index value following single sector subtraction

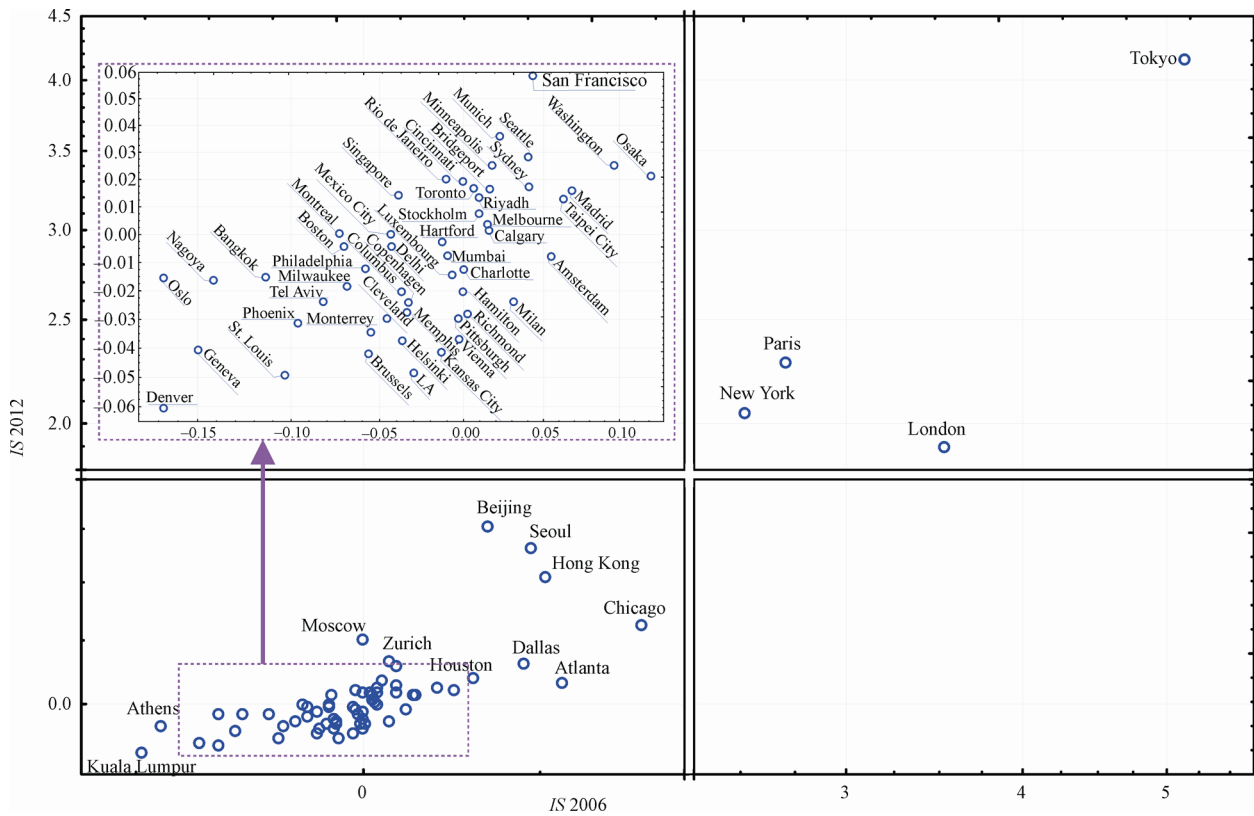


Fig. 4 Stability index for the years 2006 and 2012

2012. The largest declines were experienced by London at -1.63 and Tokyo at -0.97 . Other cities experienced growth of more than 0.09 in the same time period: Johannesburg, Kuala Lumpur, Oslo, Beijing, Athens, Bern, Nagoya, Berlin, Baltimore, Geneva, San Jose, Denver, Moscow, Bangkok.

The highest WECE index values (10 or higher) were assigned to Tokyo, New York, London, and Paris (Fig. 5). However, all four cities experienced a decrease in WECE between 2006 and 2012. Tokyo and London experienced the largest decline in index value. The next group consists of cities with a high index value (10 or higher), which experienced increases in index value relative to 2006: Seoul, Hong Kong, Beijing (> 6 points). Cities that were not in the lead experienced growth of more than 2 points in the same time period: Mumbai, Delhi, Moscow, Riyadh. High WECE values (more than 5 points) are also noted for major world cities such as Chicago, Dallas, Houston, Los Angeles, Osaka, Toronto, Taipei, San Francisco, and Washington D.C. However, most cities on this list experienced a marked decline in index value (espe-

cially Osaka) in the period 2006–2012.

Other cities characterized by similar WECE index values (~ 3 points) experienced either small declines in index value or small gains. The largest gains in this group (~ 1 point) were experienced by Rio de Janeiro, Vienna, and Munich. The largest declines (~ 2 points) were noted for Hamilton (Canada) and Cincinnati (USA). In summary, cities in Asia, the eastern Europe, and South America made the largest gains in the period 2006–2012, while cities in North America and western Europe experienced the largest declines in index value. Some cities possessed too few sectors to be considered for the 2006 index. By 2012 San Jose had more than 6 points, while Shanghai, Sao Paulo, and Dublin had 5 points each. The lowest WECE values (less than 2 points) were assigned to cities just entering the ranking system: Perth (Australia) and Warsaw. A total of 14 new cities appeared on the WECE list in 2012 relative to 2006. Most of the new cities are found in developing regions of the world including two cities in China: Shanghai and Shenzhen.

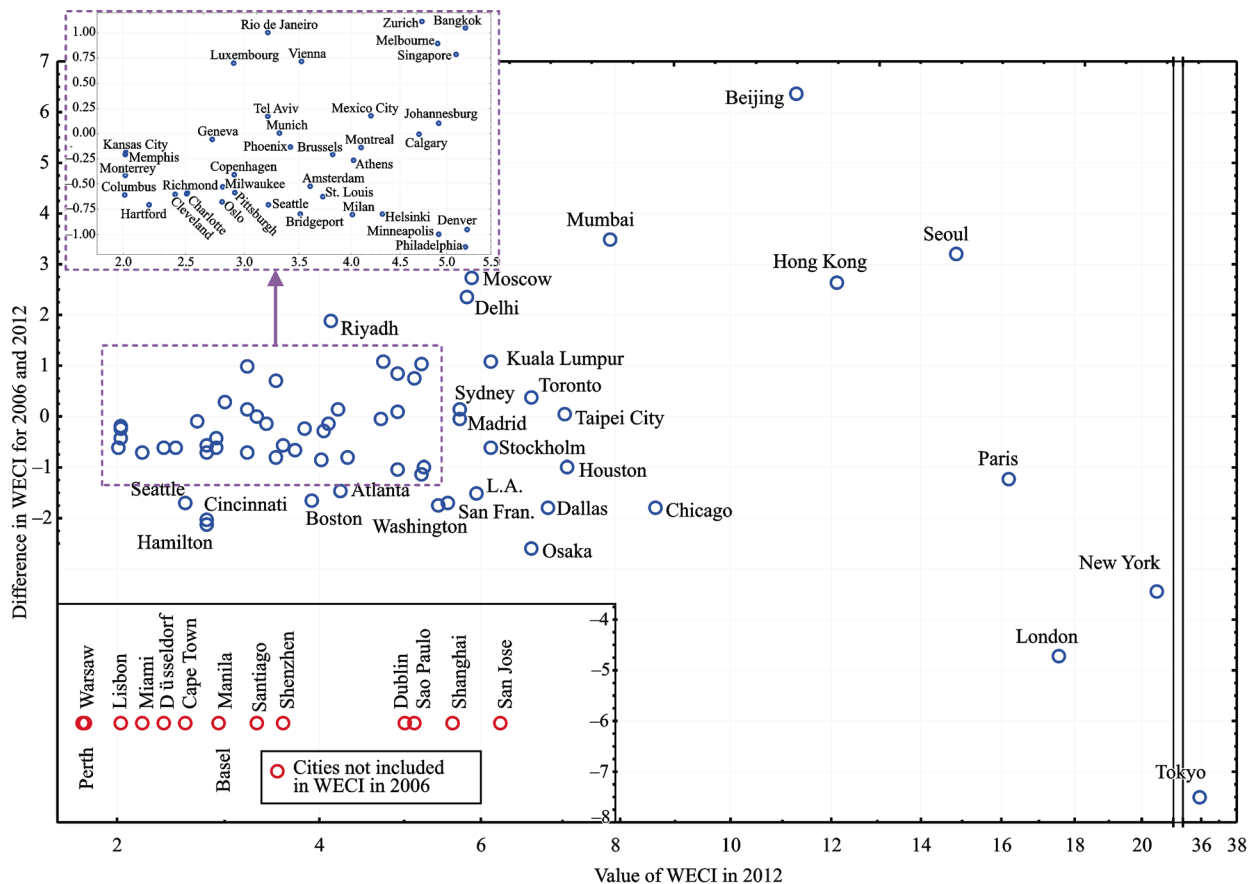


Fig. 5 WECE index values for 2012 and differences with 2006

A total of 56 World Economic Centers have been identified including 7 major centers (WEC > 10), 24 midsize centers (WEC 5–9.99), and 25 minor centers (WEC 3–4.99). The largest numbers of major centers are found in the eastern Asia (4 cities): Tokyo (35.88), Seoul (14.83), Hong Kong (12.10), Beijing (11.25). London (17.55) and Paris (16.14) are the only two European major centers. There are eight midsize and another two minor centers located in Asia, while three are located in China (Shanghai, Shenzhen, Taipei). Both midsize types in North America include ten centers each. In this context, centers and cities are used as synonyms. Europe includes fewer cities in these categories: four midsize centers and another eight minor centers. There are no major centers in other parts of the world, while Sydney and Sao Paulo are designated midsize centers (Fig. 6).

The financial sector was the most influential component in the case of 14 cities (25% of all WEC cities). The materials sector was the second most influential component-dominant in the case of 13 cities (23.2%). Consumer discretionary spending was also a vital sector generating substantial declines in index value (9 cities, 16.1% of all WEC cities). Other key sectors were healthcare and industrials with 8 WEC cities each (14.3% of all WEC cities). In the case of major centers,

information technology was a key sector in the case of four cities (London, Paris, Hong Kong, Beijing). The midsize center type was not dominated by any single sector. Consumer discretionary spending and healthcare were dominant in five cities, while materials in four cities. The financial sector was dominant in eight minor cities, while the materials sector was dominant in only five cases. Each part of the world is dominated by a different sector. For example, the dominant sectors in Europe are financials (6 cities) and information technology (3 cities). Materials (5 cities) are a dominant sector in North America, as are consumer staples (4 cities). No single sector is really dominant in Asia—financials and information technologies were key sectors in three Asian cities each. The situation in Chinese cities is very advantageous (WEC cities: Beijing, Shanghai, Hong Kong, Shenzhen, Taipei), with as many as four dominant sectors. Only the information technology sector is dominant in two cities (Beijing, Hong Kong), while healthcare is the key sector in Shanghai, financials in Shenzhen, and consumer discretionary spending in Taipei. It may be concluded that Asian cities are not only characterized by multiple linkages across the world, but are also quite resistant to crisis in their principal sector. American cities are also quite resistant to crisis in their principal sector. European cities are the

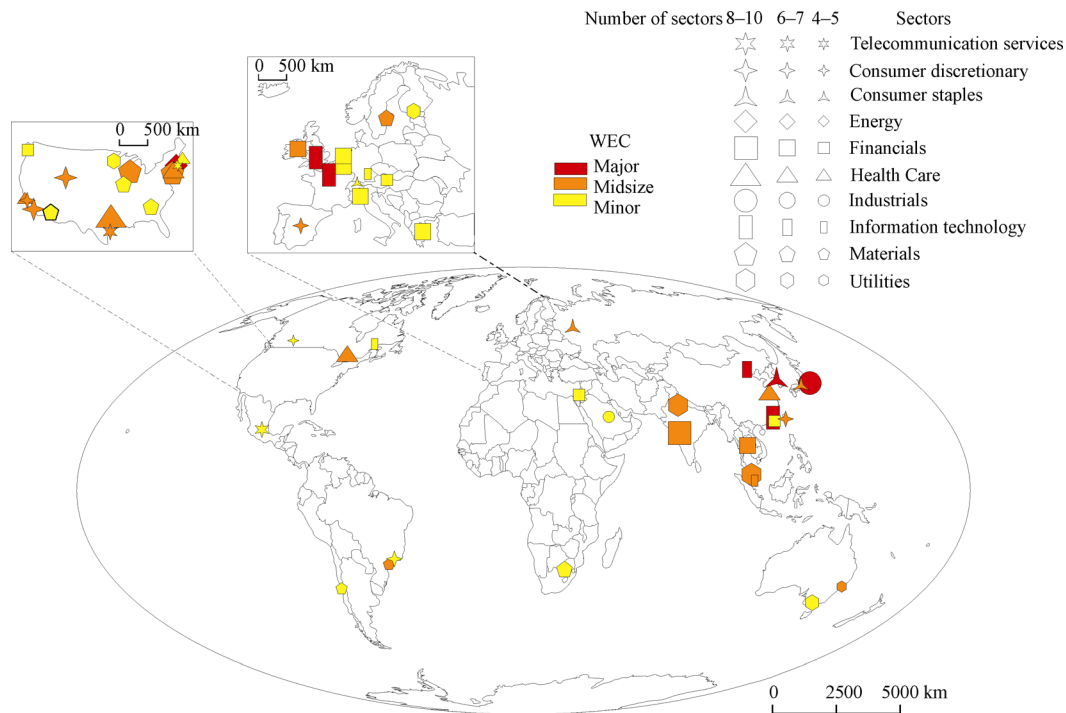


Fig. 6 World economic centers in 2012

least resistant to crisis. Nearly half of WEC cities (48.2%) were dominated by financials and materials. The financial sector and information technology sector were usually dominant in Europe, while the materials and consumer staples sectors were dominant across North America. In Asia, many sectors were dominant. This may be important in the case when crisis impacts many different sectors and Asian cities are better prepared for this type of situation than cities in Europe and North America.

5 World Economic Centers Versus Other City Concepts

There is no ideal ranking system and every system can be criticized for its choice of measures. The number of metrics can be altered and the choice of metrics is also debatable. Each system sheds light on a different angle of cities in our world. Table 1 compares several ranking systems: world cities index, global cities index, command control index. The purpose of this paper was to

evaluate whether cities considered very important by leading researchers can effectively handle crisis events.

The general pattern is that cities that are strongly resistant to crisis in their principal sector rank lower in the world cities index versus the WEC index (Table 1). The leader in the WEC index, Tokyo, is characterized by relatively few international linkages relative to its potential (ranked 7th in the world cities index). The case of San Jose is even more extreme –139 ranks lower in the world cities index relative to the WEC index. Osaka and Houston are two other extreme examples –128 ranks lower and 56 ranks lower, respectively. On the other hand, both indexes rank New York, Paris, and Los Angeles the same. Few cities in the top 20 possess a higher rank in the World Economic Center Index than that in terms of international linkages (London, Moscow, Hong Kong). In summary, cities characterized by a high WEC index value are also characterized by fewer international linkages.

A comparison of WEC and global city values shows that cities in Asia (Hong Kong, Beijing, Mumbai, Kuala

Table 1 World economic centers versus other concepts and city rankings

City/rank	Rank in this work	World cities (GaWC)	Difference in rank ¹	Global city (Sassen, 2009)	Difference in rank ¹	Command Control Index (CCI) (Csomós, 2013)	Difference in rank ¹
Tokyo	1	7	-6	3	-2	1	0
New York	2	2	0	2	0	2	0
London	3	1	2	1	2	3	0
Paris	4	4	0	7	-3	5	-1
Seoul	5	24	-19	9	-4	6	-1
Hong Kong	6	3	3	6	0	10	-4
Beijing	7	8	-1	57	-50	4	3
Chicago	8	11	-3	5	3	14	-6
Mumbai	9	12	-3	48	-39	22	-13
Houston	10	66	-56	34	-24	16	-6
Taipei City	11	41	-30	22	-11	36	-25
Dallas	12	53	-41	35	-23	11	1
Osaka	13	141	-128	19	-6	37	-24
Toronto	14	17	-3	13	1	15	-1
San Jose	15	154	-139	-	-	7	8
Kuala Lumpur	16	22	-6	50	-34	58	-42
Stockholm	17	43	-26	16	1	21	-4
Los Angeles	18	18	0	17	1	39	-21
Moscow	19	14	5	51	-32	9	10
Delhi	20	35	-15	61	-41	54	-34

Note: 1 difference in rank relative to the World Economic Center rank

Lumpur, Delhi) are quite resistant to crisis. Despite the increasing competitiveness of the Chinese economy and other economies in the region (Ni *et al.*, 2014), differences in rank are quite large in case of Beijing ranked 7th in the WEC index and 57th in the global city index. But in case of Hong Kong there are no differences in WEC index rank and global city rank (both rankings 6th). On the other hand, leading global cities such as Tokyo, New York, and London are also top-ranked in the WEC index. Of the top 20 cities, only London, Toronto, Stockholm, and Los Angeles were ranked slightly higher in the global city index.

The crisis resistance level of cities is closest to their Command and Control Index value. The first three cities in both indexes held the same place in each index. As in the case of the global city index, the largest differences between CCI and WEC were noted for Asian cities such as Kuala Lumpur, Taipei, Osaka, and Delhi. On the other hand, in the case of Hong Kong and Beijing, these differences are small. Hong Kong The influence of these cities on the global economy is relatively small, but they are expected to weather a crisis quite well, should one occur. The cities of Moscow and Beijing are rapidly increasing their number of international linkages (Derudder *et al.*, 2010) and are characterized by a high Command and Control Index. Yet, the two cities are ranked lower in the WEC index.

6 Conclusions

In summary, cities most resistant to economic crisis are Tokyo, New York, London, and Paris. WECI varies substantially across the world. Asian cities are quite resistant to crisis in their main economic sector, while American cities are good at managing a crisis. European cities are the least resistant to economic crisis. Almost half of the world economic centers that were analyzed in this paper featured the financial and materials sectors as their two dominant sectors. However, sector dominance does vary based on continent. North American cities are dominated by the materials and consumer staples sectors. European cities are dominated by the financial and information technology sectors. No dominant sectors of the economy have been identified in world economic centers in Asia. This fact may become relevant in the event that multiple economic sectors suffer recession at the same time, in which case Asian cities would be af-

ected less than their counterparts in Europe and North America.

Researchers such as Taylor *et al.* (2014) argue that cities in China are more resistant to economic crisis than, for example, Dubai, due to broader international linkages. The results of our study support this conclusion. The larger number of sectors in Chinese cities helps them resist economic crisis. This is especially true of Beijing, Shanghai, Hong Kong, Shenzhen, and Taipei. At the same time, differences in the dominant sector from city to city in China help the country as a whole resist economic crisis in a given one sector, which cannot be said of the European or American economies.

It may be argued that the crisis resistance level of a principal economic sector is most dependent on the influence exerted by a city on the global economy (CCI) and its global rank. On the other hand, strong international linkages (world city rank) do not assure resistance to economic crisis. Hence, cities characterized by extensive linkages are globalized cities ('open cities'), while cities with fewer linkages are less globalized ('closed cities'). We can say that globalization negatively impacts cities in times of crisis (except for top cities), while less globalized cities fare better.

One way to help prevent the negative outcomes of an economic crisis is to diversify the economy of each given city or region as much as possible. In the event that one or more sectors experience the effects of economic crisis, a city can then rely on its more 'resistant' economic sectors to support its economy.

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