The metropolis in retrospect From the trading metropolis to the global metropolis

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1 Introduction : The metropolis as an enigma

So many phenomena are associated with the term *metropolis* and its derivative *metropolization* that, like Lacour (1999), we may wonder whether this diversity is evidence of just how rich or just how poor the concept is. The concept seems like a black box where each researcher puts its own vision and its personal definition. In such a fuzziness, producing a meaningful definition is indeed a challenge. Stating out an absolute and universal definition is out of the question. No analysis can simultaneously grasp the multiple facets of the metropolis. We rather focus on a single significant dimension of this elusive concept and develop its consequences.

A metropolis is a city, but it is more than a city. Understanding what is a metropolis presupposes that we can point out what makes a metropolis different from an ordinary city. Keep away two wrong tracks. First, in everyday language and even in some scientific work, the term "metropolis" evokes nothing more than a very large city. The vast literature on metropolises and metropolization, especially in Europe over the last 20 years, shows that things are anything but straightforward. Population alone is probably not a necessary condition and obviously not a sufficient condition to characterize a metropolis. A large population has to do with megalopolization, not even with metropolization. Second, an administrative conception was proposed in France by the DATAR in the 1960s. It resulted from the

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will to develop a series of significant regional poles, the so-called *métropoles d'équilibre*, to compensate the crushing dominance of Paris. Neither the political nature nor the regional range of such metropolises do reflect the most original characters of the metropolis. A metropolis cannot be decred.

We aim at characterizing the metropolis by specific functions. Keeping in mind that this is only one aspect of the subject, we rather refer to world economic leading cities and to the functions that make them economic leaders. In this sense, a metropolis looks like a world city, or even a global city at the turn of the century. The metropolis is not just an economic phenomenon. It has a far-reaching effect on social structures. But economic processes are doubtless at the heart of the emergence and the evolution of metropolises.

Most of the recent literature focuses on the novelty of the phenomenon. It is widely claimed that metropolises have emerged since the 1970s in connection with dramatic changes brought about by the recent rise of the service and information economy and by contemporary globalization. But in every urban system, at every period in history, certain cities have stood conspicuously in a leading world economic position. Even in the distant past, a small number of cities have performed functions which are usually associated with present-day metropolises.

The main argument of this paper is that metropolises, as world leading cities, have been around for centuries. The metropolis is an enduring phenomenon. But it is also a changing phenomenon. We do not deny the originality of today's metropolis, but the metropolitan revolution beginning in the 1970s is only one of a series of major changes which have affected metropolis evolution. We must identify both the permanent features of the metropolis and the major discontinuities in its evolution. Given the extent and the complexity of the problem, we will confine our study to European cities, mainly since the Renaissance.

We consider that metropolization is first of all an economic process, but we must acknowledge the role acted by both technologies and institutions in its development. From a permanent functional basis we shall identify, the concrete role of metropolises has evolved as a result from the interplay of technological, institutional and economic changes.

Even if we refute purely technological determinism, there is no denying that these transformations are technology-dependent, as far as the technology determines the set of the possible economic and spatial evolutions, mainly through the costs of production and of interaction – transport and communication. We believe that technological advances and breakthroughs brought about sudden changes in the metropolis, which had long been in preparation.

But technology determines only the domain of realizable economic development and its spatial patterns. Institutions, as "the rules of the game in a society, or the humanly devised constraints that shape human interaction" (North (1990)) favor or discourage exchanges and all forms of interactions

that bring about economic change. Institutions define and limit the set of choice of economic agents and determine the form of economic organizations. They combine with technological conditions to built the framework in which specific economic structures and their spatial patterns develop and give rise to metropolitan functions and forms. In return, these economic and spatial features influence technological and institutional evolutions. In the long term such an interplay produces both permanence and change in the metropolitan characteristics.

The analytical background of this paper combines four domains. First, it deals with the history of Western economic development and especially of European urban change (mainly Bairoch (1985, 1997); Hohenberg and Lees (1995)). Second, it refers to the vast literature about globalization and metropolization based on the primary role of specialized services and information. Third, the major stylized facts are interpreted in terms of the principles of the economic theory of agglomeration (Fujita and Thisse (2002); Huriot and Thisse (2000)). Fourth, as far as possible, these principles are complemented by considering the role of institutions and transaction costs (North (1990)). Indeed, economics of agglomeration provides useful insight because 1/ it models agglomeration processes on the basis of cumulative mechanisms which can be used to understand the emergence and the stability of metropolises, and 2/ it allows us to determine the consequences of changes in the values of technology-dependent parameters such as transport and communication costs. Technological changes largely affect transport and communication costs and release economic agglomeration forces, which leads to the further development or renewal of metropolises. But economics of agglomeration dramatically neglects the active role of institutions because it postulates implicitly they are given.

The next sections are organized as follows.

First of all, in order to identify metropolises past and present, we need some criterion that has been relevant throughout the history of cities. It can be reached by an analysis of the permanence of the main urban high-level economic functions (section 2). Emphasis will be placed on the *functions of coordination* which make certain cities world economic leaders. Given this conceptual basis, we can determine the concrete features of the metropolis at different ages of history and the major changes resulting from the economic and technological transformations of the second millennium (section 3).

This flashback allows us to identify the long-term trends and the most significant changes leading to today's metropolis (section 4).

2 The permanent metropolis

Defining a generic concept of metropolis involves looking for permanent characteristics. The first step of our study consists in identifying these cha-

racteristics by analyzing cities and metropolises both present and past and in synthesizing these characteristics in a simple framework. We surveyed present-day conceptions of the metropolis and historians' descriptions of major cities of the past. Bairoch (1985, 1997), Hall (1997), Hohenberg and Lees (1995), Mumford (1961), Toynbee (1970) and Weber (1947) are drawn on, among others. We also call for the theory of agglomeration and that of transaction costs to derive the most permanent features and processes characterizing both present-day and past metropolises.

This historical inquiry leads to the following conception.

A metropolis is considered as *a city which agglomerates majors functions of coordination of complex activities and which fulfils these functions at a world scale.*

This definition is based on four key concepts related to one another: *agglomeration*, *coordination*, *complexity* and *world scale*. They are the guidelines for the following explanation of the functional nature of the permanent metropolis.

Each metropolis is part of a metropolitan *network* which reflects the intimate link between local and world interactions, or between the concentration of coordination functions and the world range of their interactions. Moreover, metropolitan birth and growth are governed by a *cumulative* process which both favors stability and protects from competition through a sort of shadow effect. It results that the metropolization process is selective and creates segregation between cities.

2.1 Coordination

Coordination is another ill-defined concept. We consider here that *coordination is the set of interactions between economic agents brought into play in the aim of organizing innovation, production, exchange and consumption efficiently.* It may be internal or external to the firm, marketized or not. Internal coordination ensures the efficient running of the firm. It includes the internal managerial activities, which by definition entail non-market interactions. External coordination refers to a vast set of interactions between firms, including cooperation, negotiation, regulation, control, through the market or out of the market. It uses intensively information exchanges, *i.e.* non-market interactions. Externalization of financial, managerial and other high-order services is a major expression of the development of external coordination through market interactions.

When coordination consists of information exchanges, it can generate spatial externalities which have important agglomeration effects (Guillain and Huriot (2001)). When it is marketized, it is the source of transaction costs (North (1990)), which add to transport costs to form total exchange

costs[1] (Behrens (2003)). Even if transaction costs may be considered as non-spatial costs, they have important indirect spatial consequences. Indeed, economic agents aim at minimizing these costs, through the organization of interactions and the choice of locations. One significant example is the externalization of specialized services, what lowers the costs of these services because of scale economies. Insofar as such services are information intensive, they are subject to agglomeration effects which take a large part in the formation of metropolises.

Before focusing on the metropolis, let us point out that the coordination of economic activities is a major function of every city at almost every time in history. The city is part of a network organized for exchanging people, goods, and information, or at least they have been since the Middle Ages (Hohenberg and Lees (1995)). The city is not only an economic organization but an organization regulating the economy (Weber (1947)). The city creates and organizes taxation, finance, credit, industry, jobs and long range trade (Braudel (1979)). Contemporary urban analysis confirms the feature. Ascher (2001) evokes the permanence of the "GIP" system (goods, information, people). The city "provides for the circulation of commodities, money, and information" (Damette (1994)). Metropolis itself is defined by its "ability to attract, organize, filter and spread a complex and ever increasing set of goods, people, and information flows" (Gaschet and Lacour (2002)).

Because the city coordinates activities, it concentrates information and focuses information exchanges. It is true that information is the prime means of every form of coordination, not only coordination of exchanges, but also coordination of research and innovation, of production, of finance, and of all forms of markets, for goods, services, labor, capital and land. Indeed, we can observe a remarkable continuity in the prime role of information, from ancient to contemporary cities. It is largely admitted that the city was essentially a center of exchange and circulation of information, even at the height of industrial expansion in the 19th century (Hohenberg and Lees (1995)).

Thus the coordination of the economy generates transaction costs and is information intensive. It is a permanent function of the city.

2.2 Complexity and world scale

Coordination characterizes the city, whatever its nature. It is a universal urban function. However, it is necessary but not sufficient to characterize a metropolis. The smallest market town is a center for coordinating commodity exchanges. The least regional center is a place of political coordina-

[1] "Transaction costs are the costs arising during a transaction at the stages of finding the transaction partner(s), measuring the valuable attributes of the resources being transferred, devising and negotiating the contractual agreement, monitoring and policing the execution of the agreement and, eventually, assessing contract violations and enforcing the execution in order to protect rights." (Behrens (2003))

tion. Other criteria are required. Complexity and world scale dramatically increase the need for coordination, and are key factors for defining a metropolis. According to our definition,

a city becomes a metropolis if and only if its coordination functions apply to complex activities and operate at a world scale.

Complexity

Complexity can results from two sources. Complexity is produced by the high level of knowledge, skill and know-how entailed and their rapid renewing due to innovation. It is reinforced by combinatory aspects, *i.e.* the necessary combination of a great number of specialized operations, numerous skills and diversified knowledge[2].

More complexity entails more intense interactions between more numerous and diverse skilled agents, more evolutionary and more uncertain interactions. Therefore, complexity of economic operations requires more complex coordination and increases the costs of transacting. Coordination supposes interactions between an increasing number of different specialized and skilled agents, *e.g.* managers, financiers, lawyers, and requires diversified infrastructures, *e.g.* education, transport and communication, and real estate. Contracts are less simple and induce higher costs of measurement (of attributes lumped in the goods or services, of rights that are transferred, ...) and of enforcement (North (1990)). Transaction costs may then become high enough to hamper exchanges (Behrens (2003)). Under these circumstances, transaction costs can be reduced by the setting-up of appropriate institutions including formal and informal rules. New organizations will emerge that can provide complex coordination functions at lower costs. This leads to the development of jobs and firms specialized in high-order services and especially finance and producer services.

To resume the argument, *more complexity creates new needs for coordination and gives rise to firms specialized in high-order services.*

World scale

World scale activities lead to an increasing complexity of economic operations, because they imply interactions with remote and varied agents which do not share the same economic environment, the same culture, the same behavior rules, the same practices. In other words, institutions (in the sense of North) differ. Thus, uncertainty increases, trust vanishes, and operations demand more accurate decision processes, more aid to decision and more control, therefore more complex coordination.

In the remote past, even if commercial interactions were relatively simple, the rudimentary means of transport took a great deal of time and implied high risks, which made long-distance trade rather complex. The

[2] This is close to the conception of knowledge developed by Nelson (1998).

development of this trade increased the need for coordination, entailing the development of new institutions and of a series of high-level, skilled, and information-based activities.

Therefore, the world scale of operations increases their complexity, and reinforces the need for coordination and for specialized high-order services.

2.3 Agglomeration and network

These are the consequences of the increased need for coordination produced by complexity and world scale.

Coordination functions concentrate in cities. The most complex and long range coordination functions concentrate in metropolises. The reasons for such a concentration relate to the key role of information as a source of spatial externalities and to several forms of increasing returns. These are actually the two major sources of agglomeration in the economics of cities (Huriot and Thisse (2000), Fujita and Thisse (2002)). This concentration gives metropolises the form of network nodes where local and world interactions are complementary and reinforce mutually. Such a cumulative process is more probably observed in large and diversified cities and it favors the stability of metropolises.

Information externalities

We give the term information an extended meaning which includes data as well as all forms of knowledge. Information is a non-rival good and information exchanges are non market interactions which generates externalities (Stigler (1961); Arrow (1974)). These are proximity externalities, for proximity generally makes information exchanges easier and more beneficial (Hägerstrand (1965)). Therefore, information exchanges produce agglomeration forces.

However, the nature and intensity of this agglomeration effect depends on the form of information and on its exchange mode. The distinction between codified and tacit information is central (*e.g.* Foray and Lundvall (1996)). Codified information uses a formal language which requires some form of standardization. Its meaning does not depend on the sender and on the receiver. Therefore it can be transmitted at a distance by communication technologies without loss of meaning. In contrast, tacit information can not be completely standardized because it is complex, and its meaning depends on the context and on the agents who send and receive it. It results that it can hardly be transmitted or exchanged by communication technologies with its complete meaning. Tacit information exchanges require face-to-face contacts.

Coordination of complex activities makes intensive use of tacit information. Moreover, coordination is implemented through the cooperation of

a large set of complementary services which exchange intensively tacit information. This bestows a strategic role on *proximity interactions* in the form of face-to-face contacts. Such interactions generate a cumulative agglomeration process affecting coordination activities.

Given the above definition of the metropolis, such proximity interactions are probably one of the most important factors in the formation of the metropolis. In this agglomeration process, human capital externalities play a key role. As coordination functions develop, the need for skilled labor increases and human capital externalities arise. Human capital, and information processing are mutually reinforcing. Because it facilitates the diffusion of information, the agglomeration of agents benefits the formation of human capital, *i.e.* development and learning, knowledge and innovation. In return, human capital is a factor of agglomeration, insofar as it attracts new high-order activities.

Increasing returns

Increasing returns appear in the coordination activities themselves and in the infrastructures and services they need to interact and develop.

First, they are internal to most high-order services, because of their high specialization and their intensity in human capital. This specialization requires a large market. This is why specialized high-order services appear more probably in large cities.

Second, increasing returns, or fixed costs, are present in transport and communication infrastructures and in certain services such as public services (administration, education) which are intensively used by the different specialized high-order services.

A network of metropolises

The metropolis develops worldwide activities entailing long-distance interactions which extend largely beyond its hinterland. The metropolis interacts mostly with remote cities of similar standing in other hierarchies of central places, in large networks. Even in the late Middle Ages, a system of international cities was established, in which each city was more attuned to the wider world than to its hinterland, at least in one specific activity (Hohenberg and Lees (1995)). In the past as in the 21th century, metropolises are the nodes of *networks* and they are connected to one another through *network interactions.*

Consequently, the development of metropolises gives rise to a network organization which is superposed and even partly substituted to the classical central place or hierarchical organization, at least for the specific functions of metropolises.

A cumulative process

The metropolis is characterized both by intense proximity interactions and by network interactions. These two forms of interactions are mutually reinforcing. Proximity interactions and long-distance interactions in combination are powerful factors of agglomeration and metropolization. Proximity interactions are obviously favorable to spatial concentration. Long-distance interactions give rise to new coordination activities which need proximity; they generate specialized networks into which large diversified cities are the best points of entry. The coexistence of these two types of interaction is an original feature of the metropolis. Moreover, they are mutually reinforcing, so that metropolization entails metropolization and old-established metropolises have a definitive advantage over others. Because they are subject to scale economies, coordination activities appeared only when long-distance interactions develop beyond a certain volume, and they tended naturally to concentrate and to reinforce the metropolitan character of the cities where they developed. Once established, they favored the development of long-distance interactions. This *cumulative* process leads to a lock-in mechanism promoting the stability of the metropolis.

It results that there is a connection between the external role of the metropolis and the nature and internal structure of metropolitan economic activities. External activities involve specific coordination needs. The resulting internal interactions between high-level activities determine a concentration of these activities in the metropolis, and a specific spatial organization of these activities at the intra-urban level, as shown by the permanent presence of specific districts specialized in high-order services.

It results that *proximity interactions and network interactions are interrelated in a cumulative process favoring the stability of the metropolitan system.*

City size and diversity

Apart from the obvious fact that what counts as a large city differs from one period to another (in 1800 a large city had 50 000 inhabitants, today it has 500 000 – Hohenberg (2002)), size alone is not a requisite feature of the metropolis. However, in the most developed parts of the world, a large city size will probably facilitate the development of complexity and long-range interactions, and therefore the rise of the coordination function, because it will more readily concentrate the required human and material resources.

The cumulative process which generates the metropolis appears only above a minimum level of agglomeration forces. Now the intensity of these forces depends on the size and composition of the city. *City size* favors the concentration of coordination functions, essentially because they operate with increasing returns. The concentration of a variety of economic activities, of skilled labor and of long distance transport and communication modes (harbours in the past, airports and communication infrastructures

at present) promotes the rise of high-level activities because they have a better access to resources and to markets there. As a consequence, a large city is able to create new rare activities which in turn increases diversity and thus produces new Jacobs-type agglomeration economies. Furthermore, a minimum size is required for the appearance of specialized public services and infrastructures needed by coordination functions, because of scale economies.

Diversity is generally greater in larger cities. *Diversity* is also a factor of development of the coordination function, because it means the concentration of numerous activities and the complexity of interactions. Moreover, coordination itself implies the interaction between a number of diversified and specialized activities. Besides, diversity may be a condition for metropolitan stability, as we shall see in the following section.

Permanence and stability

The preceding analysis leads to a very simple identification of the permanent metropolis. The main stable characters of the metropolis derive from or are closely connected with one major feature which is the function of coordination of complex economic activities operating at a world scale. A priori stability is favored mainly by diversity and the cumulative character of the metropolization process resulting in a lock-in mechanism. It is worth while to confront this statement to some evidence of the concrete durability of the metropolitan system.

Bairoch (1985) considers that the stability of the urban system is a constant of urban history, strongly marked in a given geographical area and in a civilization system, but often observed at a still larger spatial scale. The large size and the diversification of cities are important factors of their permanence. Hohenberg and Lees (1995) clearly show that cities with one dominant activity have been less stable metropolises than more diversified cities. The latter were very often cities with significant coordination functions. However, the dominant long-distance trade centers of the pre-industrial era were rather unstable. Throughout this long period, cities at the top of central place hierarchies were more durable than the nodes of large networks (Hohenberg (2002)), because the latter were relatively specialized. This is the case of the trading metropolises of the pre-industrial era as well as of the first industrial cities. From the 15th to the 18th centuries, the center of gravity of the international trade network shifted from Southern Europe (Italy) to South-Western Europe (Spain and Portugal) and finally to North-Eastern Europe (Netherlands and then England). Generally, large cities were also more stable than smaller ones. Hohenberg and Lees (1995) propose a comparison of the ranks of the main European cities in 1750, 1850 and 1950. They remark on the relative stability of the ranks of the large cities, despite the major breaks of two industrial revolutions that mark this period. However, we observe that only eight cities keep their place in the top twenty of the hierarchy over the entire period. Still more

importantly, changes affect smaller cities. But with few exceptions, the main capitals and multifunctional cities invariably dominate the hierarchy : London, Paris, Naples, Vienna, Moscow, Madrid, Berlin, and Hamburg. The most enduring metropolises combine political, industrial and service activities. Agulhon *et al* (1998) confirm this phenomenon in 19th century France : the largest cities are still the most stable. However, the phenomenon is much more pronounced in France than in either England or Germany.

2.4 The dynamics of change

The metropolis is fundamentally the result of an ongoing process. Ability to change and capacity to act on and react to technological, economic and institutional conditions play a major part in this process. This process applies to every period of important change, as we shall see later. This capacity to change is the condition of the long-term stability and permanence of the metropolis. Understanding the changing metropolis is knowing how it interacts with a changing environment.

Metropolization is a recurrent process by which certain cities change their organization to manage the coordination of complex and long range economic operations in relation to changing technological, economic and institutional conditions. Coordination functions are a permanent feature of the metropolis. But, depending on the period, they apply in diverse contexts and relate to different activities, being implemented in various ways. They vary with the prevailing organization of production, the technical regimes, specially the means of transportation, and the dominant institutions, *i.e.* the rules of games of the society, especially in the economic field. But *the causation runs both ways* : institutions change incrementally in response to the development of coordination functions; metropolization results from and favors technological progress and economic evolution towards complexity and world scale.

Three main stages are classically distinguished, punctuated by radical changes : the pre-industrial period, the industrial period (including the two industrial revolutions), and the post-industrial period. This is an oversimplification but there is a broad consensus on these three periods.

From one period to another, the metropolis reflects changes in its environment. But the movement is irregular. During each change, the form and the characters of the metropolis vary with the new context – mainly the new structures and organization of production, including regulating institutions, and with new technological conditions – especially advances in means of transport and communication. It is usual to stress the role of the resulting diminishing costs of exchange in the reshaping of economic and spatial organization. But transaction costs take also an important part in the changes affecting metropolises. They are far from being negligeable (North (1990)), and they can even be higher than the strict transport costs. Still more remarkable, they can considerably increase when transport costs di-

minish (Behrens (2003)). The reason is that decreasing transport costs lead to an expansion of the market which, as Adam Smith already said, favors the specialization and the division of labor. This results in an increasing complexity of economic operations, and therefore in an increasing need for coordination and in higher transaction costs. This process affects indirectly but noticeably the development of metropolises, particularly at the end of the 20th century.

At any stage, the world dimension of the metropolis is essential. However, this dimension has dramatically changed in the post-industrial economy with the globalization process. A global economy is not only a world economy. It entails something new, that will be pointed out further.

Remark that at any period, the term world designates "*terrae cognitea*", "the known part of the earth", that part with which interactions are practicable and implemented. The concept of "économie-monde" (Braudel (1979)) is a good illustration of this idea for the period from the 15th to the 18th century. The "économie-monde" is dominated by a "ville-monde" which is the archetype of the metropolis we want to identify.

3 The changing metropolis : from the trading metropolis to the manufacturing metropolis

We consider that two breaks in metropolitan transformations were the most decisive steps towards the contemporary metropolis. The first one occurred around the 1870s, a couple of decades after the decrease in inter-urban transport costs and the simultaneous development of increasing returns. It was also a result of the sizeable fall in intra-urban transport costs. The second one related to the considerable fall in information diffusion costs from the 1970s on, but also to the continuous increase of transaction costs resulting of the new needs for coordination engendered by globalization. These changes in costs are closely linked to the agglomeration processes. In particular they helped modify the internal organization of the metropolis and its role as a network node, giving increasing weight to high-order services and extending their external influence.

In section 3, we deal only with the pre-industrial period (3.1.) and the industrial period (3.2.), and with their role in the emergence of the trading metropolis and of the manufacturing metropolis. The post-industrial period and the resulting contemporary global metropolis are the subject of section (4.).

3.1 The pre-industrial period : The trading metropolis

This stage extends from the late Middle Ages to the 18th century. Industrial production is carried out in small individual units and entails no or only low increasing returns.

We shall see that despite serious impediments to urban growth, certain cities show evidence of metropolitan features, especially those specialized in long-distance trade.

Constraints on metropolitan development

During the pre-industrial stage, economy was embedded in technical and institutional constraints that limited metropolis emergence and expansion.

First, the high costs of transport were the main impediment to urban growth. Bairoch (1985) states convincingly that high transport costs limited the area of foodstuff supplying for the city subsistence and thus the number of inhabitants of the city. Now the weak yields of agriculture made necessary to import foodstuffs from remote areas and this reinforces the constraint on city size. As a consequence, the most urbanized regions were also the most prosperous agricultural regions. At the same time, intra-urban transport was difficult and the city was mainly pedestrian-oriented. The spatial extent of the city was restricted by "the distance people could walk to work, shops, and social recreational activities" (Yeates and Garner (1980)). This implied small urban size and high densities.

Second, the guilds and other similar organizations of citizen, controlled the entry of workers in the city and ensured regulation functions. They guaranteed the quality of the production, the supplying and price of foodstuffs and the stability of manufacturing and trade (Weber (1947)). They also controlled mobility, loans, external trade and raw material imports. They excluded competition and were reluctant to innovation (Bairoch (1997)), so that they guaranteed the stagnation of most cities and the relative rarity of the emergence of large metropolises. This archaic coordination system is partly responsible of the decline of numerous cities in the 16th century. New firms located intentionally in new places, away from the influence of such organizations (Weber (1947)).

The pre-industrial production

Let us only recall the main features. During the pre-industrial era, the share of agriculture in total employment was approximately between 75 % and 80 % and the value of agricultural production was much higher than the value of industrial production. Industry was closely linked to the agricultural sector because of the need for raw materials and also because of the intensive use of the agricultural manpower and the dispersion of industrial activity in the rural areas (Piuz (1997)). Another reason for this dispersion was the quasi-absence of increasing returns. Production did not use much fixed

capital and it was carried out in small individual units. If we add the high costs of carrying people and goods and the high costs of communication, we have all the ingredients for a large dispersion of production, as it is theoretically established by economics of agglomeration (Krugman (1991)).

Finally, in a context of relative economic and technological stagnation, the weakness of fixed capital maintains because profits are reinvested in land or real estate rather than in industrial production, and thus stagnation persists.

Trading as an agglomeration force

Even so a spatial division of labor arose between the city and its surroundings which became more marked during the proto-industrial period. The city became increasingly specialized in activities which were intensive in skilled labor (Hohenberg and Lees (1995)). So, the city produced craft goods such as clothes and silk products which required know-how, while its hinterland supplied it with food and raw materials and produced less elaborate goods. As a consequence of this spatial division of labor, local trade concentrated exchanges between the city and the surrounding country. For Cantillon (1755) as well as for Thünen ((1826; see also Hall (1966) and Huriot (1994)), the city was seen as the center where manufactured goods were exchanged for foodstuffs and raw materials.

Even if the pre-industrial city is an important place of production, it is widely admitted that the most significant urban function was trade[3]. All the pre-industrial cities were more or less *trading cities. Trading was probably the strongest agglomeration force.* Cities were the places where supply and demand of agricultural products and city-produced goods come physically face-to-face and thus the places where prices were set (Huriot and Perreur (1992)). Thus concentration of trade in cities was a means of reducing transport costs between sellers and buyers and of reducing transaction costs by improving the organization of trade and providing better information.

But among trading activities, long-distance trade was the most influential on the emergence of metropolises.

Long distance trade as a metropolization factor

In this context, two groups of cities gained a dominant position in the national or international economy : specialized cities and capital cities. They acquired unequally the major characteristics of the metropolis.

Above all the development of long distance trade allowed a number of specialized cities to acquire specific features of the metropolis and to develop a true international influence. It is that kind of metropolis which Braudel (1979) termed "*ville-monde*" (world-cities) between 15th and 18th century.

[3] The city also had an important ecclesiastic function (Toynbee (1970)). It was not completely separated from the trading one; for example, pilgrims, who were also merchants, initiated or enhanced the trading role of the city.

The long distance trade was quantitatively not important. It involved luxury goods mostly, and then only in small amounts. However, it was of strategic importance and it brought about the development of associated activities and of new economic and legal institutions reducing transaction costs. Along with its associated activities, it was significant in shaping the metropolization process. Two series of features are worthy of note.

First, this trading activity generated long distance interactions. The long distance trading cities interacted with a vast geographical area. They both attracted and diffused. They were coordination centers of international trade. They were organized in a large-scale network system and they traded more with other similar cities than with their immediate vicinity (Hohenberg and Lees (1995)). Besides, movement by traders allowed information to spread around the world.

Second, long distance trade was risky and stimulated the emergence of complex and specialized activities and coordination functions subject to increasing returns. The long distance trading cities operated as true business centers. In addition to trading activities, they were the focus for financial activities such as exchange transactions, bank lending, financial consultancy and other service activities such as legal consultations, accounting, insurance, which were essential in coordinating commercial activities.

Both features are essential to the nature of a metropolis which both concentrates complex coordination functions and interacts in world network structures : they determined the emergence of *trading metropolises.*

However, because their role was essentially restricted to the luxury goods trade, they dominated a small part of economic activity and have hardly generated any sustainable agglomeration process, which was probably one of the causes of their long-term instability.

Capital cities and metropolization

Other cities had a dominant position and could be candidates to metropolization : the large *capital cities.* They fulfilled mainly political, administrative, religious, defensive functions and the associated coordination functions, but they were also trading cities. Thus, their activities were diversified and services ever present. A large population was not a sufficient condition for a city to be a capital. Such cities were distinguished functionally by their position in the system of central places (Hohenberg (2002)). The capital city exerted its influence over its near hinterland and at the national level. It did not necessarily develop long range economic activities outside the borders and it might keep out of international networks. It was clearly a coordinating city but not ever a metropolis[4].

To resume, *the pre-industrial period gave rise mainly to the trading metropolis, coordination functions of which were clearly driven by long-*

[4] Even today, a number of "capital cities" do not reach the status of metropolis, *e.g.* in developing countries, or in Central and Eastern European Countries, because they lack at least one of the criteria adopted previously.

distance trade. It gained a world dimension and concentrated the highest-order services such as financial or law services.

3.2 The industrial era and the manufacturing metropolis

This period extends from the end of the 18th century to the first part of the 20th century. It was essentially marked by the two industrial revolutions, which were preceded and permitted by the agricultural revolution. Until then the spread of intensive farming practices and the commercialization of agricultural products were slow. Progress led to an increase in agricultural productivity, which subsequently enabled food to be provided for the growing urban population, releasing the work force for industry and promoting the formation of capital. Besides, progress in agricultural technology led to an important increase of the demand for manufactured products that was an important incentive to industrialization. The causation was both ways and determined a cumulative effect (Bairoch (1997)).

Regarding the metropolis, we can identify a transitional period which ends in the 1870s, when a new typical form of metropolis emerged : the manufacturing metropolis.

The transitional stage : the consequences of the first industrial revolution

This was the era of coal and the steam engine. Successive innovations altered the manufacturing structure and promoted large-scale production. So, large factories developed during this time and their organization changed with the use of machinery. The need for capital assets was considerable and with the resulting high fixed costs, production became subject to *increasing returns*. Because of the still high costs of transport, industry expanded in highly specialized cities near to the sources of energy and mining. Nevertheless, an industrialization movement in the old urban centers arose but was less marked.

With the development of the railroads around 1840-1850, depending on the country in question, *transport costs decreased* especially between cities, leading to the more rapid spread of innovation and to economic growth. Industry returned to the cities and factories could be located away from sources of coal. Big, new factories were set up on the outskirts of large cities. In France, from 1850 to 1911, the fastest urban growth was in coal mining cities and industrial suburbs (Agulhon *et al* (1998)).

Due to the combination of the scale economies in production and the decreasing transport costs, markets expanded and mass production developed. Greater needs for coordination related to the production and sale of products resulted in the rise of service activities. With the development of commercial bureaucracy, which is clearly a feature of the 19th century

(Mumford (1961)) and consequently with the increasing needs for information, many tertiary occupations developed such as clerical work, accountancy, and consultancy. These activities were naturally located in the large cities or more exactly in cities which already had metropolitan features, because of a skilled labor force and diversified activities, and they in turn fostered the development of the metropolis.

This period is a stage of great technological and economic transformations but, regarding the metropolis, it can be considered as a *transitional period, combining old and new features.*

On the one hand, cities and metropolises had still pre-industrial characteristics. They covered generally small areas and population densities were high and getting higher. Because of the high costs of transport within the city, even large cities were still "walking cities" (Pinol (1991)). Land use was not specialized although, for example, finance was concentrated in one small district in New-York.

On the other hand, the metropolis was more an more organized on the basis of the large firms and of its needs for coordination, what induced a diversification of its activities. These transformations were the necessary conditions of the development of the manufacturing metropolis in the 1870s.

Indeed, the rapid decline in transport costs, associated with the development of increasing returns in production, was beneficial to agglomeration and to the power of metropolises. Basic results in economic geography tell us that, all things being equal, a sufficient fall in transport costs can stimulate the agglomeration of economic activities. Moreover, transaction costs rise because of the increasing complexity of the economy and the expansion of markets. But, due to the weak differentiation of products, complexity still remains relatively low compared to actual complexity, so that the increase of transaction costs did not compensate the fall of transport costs and that firms where able to internalize most of the services they needed (Behrens (2003)). Therefore it is not unreasonable to suppose that the effect was beneficial to agglomeration. We know that this effect is explained by the fact that low transport costs release agglomeration forces. People, consumers or producers, can more readily take advantage of increasing returns and proximity externalities of different kinds because their localization is less restrained by transport (Fujita and Thisse (2002)).

The second stage : a new technical regime, a new economic organization

At the end of the century, new changes induced and permitted the development of the manufacturing metropolis.

Two major features characterized this period, which begins in 1870s. The first was the discovery and development of electricity and of the internal combustion engine, *i.e.* the second industrial revolution, which was followed by a series of crucial inventions. The second was the substantial change in

the firm as an organization, mainly because of new capital requirements. These changes set up an industrial regime which remained dominant till the 1970s.

Two technological consequences of the second industrial revolution will retain our attention.

One of the most obvious effects of the second revolution was the fall in intra-urban transport costs, thanks to a rapid and continuous progress in transportation. After the 1850s, the first main alternatives to walking were horsecar and railroad. During the 1880-1920 period, the advent of the electric streetcar and the development of the rapid transit (especially subway) strongly influenced the metropolization process and the city structure by changing drastically interaction costs.

These costs, the costs of treatment and diffusion of information, and more generally the costs of coordination, were also affected by more discrete but highly significant inventions like stenography, the typewriter, the lift and the telephone, and by innovations in printing and reproduction processes. Such advances gave progressively rise to a new office-organization (Moss (1987)).

Whatever the importance of these changes, they did not act alone. They went along with the consequences of the first revolution and with new changes in institutions (the definition of property rights) and consequently in the organization of firms.

Production and trade had long been carried out by individual firms for the most part. In the 1860s, *i.e.* before the second industrial revolution, the first limited liability companies were formed. Owners of capital and managers were no longer necessarily the same people. Responsibilities were shared between two groups. Strategic choices about the method and the level of production and commercialization were in the hands of the new capitalists, who were in general financiers, whereas manufacturing was in the hands of the manufacturers.

These changes gave rise to new interactions between production, commerce, and finance, making coordination more complex. This implied further expansion of services and mainly of bureaucracy and finance. The strategic role of finance in economic activities resulted in a new development of the coordination function of metropolises. From the second part of the 19th century, the center of gravity of industry was no longer to be found in workshops but in offices (Hall (1966)).

These changes reinforced the role of the metropolis in the economy and determined the new form of the metropolis : the manufacturing metropolis.

The manufacturing metropolis

Before the second half of the 19th century, urban spread was long limited by the use of primitive, expensive and slow means of transportation. Due to the advances in transport, people could move more quickly and at less

expense. Mass transport came into being and permitted the beginning of urban spread and population suburbanization, a process which is continuing nowadays, even if it takes different forms. This movement led to the separation of the place of residence and the place of work. The metropolis expanded and its spatial pattern changed. The suburbs grew also with the new migrants coming principally from rural areas (Pinol (1961)) and the central district gradually specialized in services. The specialization of land use emerged with the residential zone and the central business district. The spatial restructuring of the metropolis also resulted from the new needs for coordination. The rise of the bureaucracy generates increased needs for information. Advertising business, investment trusts, finance and insurance companies develop. The diffusion of information became essential. Consequently, the service activities necessary for the new organization of production became more concentrated in the metropolis. The various innovations and inventions resulting from the second industrial revolution were key factors allowing coordination functions to be concentrated in the metropolitan central district (Moss (1987)).

Finally, *the manufacturing metropolis can be defined as the place of concentration of production and of the means of coordination of production.* It resulted primarily from the changes in transport and communication costs and from the emerging new economic organization. Its spatial organization changed radically with the rise of suburbanization of the population and the concentration of employment in the center of the city.

The manufacturing metropolis is a special case of the monocentric city in the Fujita-Ogawa's models. It is well known that in such a model, if communication costs between firms are high and commuting costs low, then firms are agglomerated in the center and households are located in the periphery. Remind that if the commuting costs are very high, the city is "integrated", *i.e.* firms and residences are uniformly distributed in urban space, which is a rough image of the pre-industrial pattern.

Again, conditions have changed in the second half of the 20th century.

4 The global metropolis

A new form of metropolis emerges since the 1970s in connection with both the transformation of production structures affecting the post-industrial economy, especially the rise of high-order services, and the rapid and dramatic changes in communication technologies.

Contemporary metropolises, or global metropolises generally involve new forms of urban growth, along with more recent and striking changes in the form and the role of cities in developed countries. Again, metropolization does not affect all cities.

We consider that the term singles out today's large cities which play a major role in the technical and economic changes characterizing the post-industrial economy, and succeed in developing efficient and leading coordination functions at a global scale (Bourdeau-Lepage and Huriot (2002)). This implies large changes in the spatial structure and the economic role of the metropolis. But these changes were prepared by the two industrial revolutions and were made possible largely by the new communication technologies.

We shall first identify the major technical and economic changes resulting in the post-industrial economy, by focusing on what seems to be definitive breaks with the past (4.1.). Then we shall try to characterize what is really new in the post-industrial global metropolis, in terms of its coordination role and of its internal spatial restructuring (4.2.).

4.1 The emerging post-industrial economy

Industry remains an important sector in all economies, even if it is no longer dominant in cities. The post-industrial economy emerges and is most visible in global metropolises, in relation to their coordination function.

The changes in production structures and processes

Production is increasingly *intangible*, meaning that services are becoming the main activity. Also in manufacturing activities, even in agricultural production, information exchange and processing are increasingly significant compared with the direct processing of goods. Services were present in cities for centuries. What is new is the rapid rise in high-order producer services.

Production becomes more *personalized*, not only in manufacturing with the rapidly increasing diversification of products (up to 32,000 varieties of the same basic product in a Japanese firm) but even more so in services. This contrasts radically with the preceding Fordist period. Diversification involves more complex production and enhances the need for coordination, *i.e.* the rise of high-order services. The extreme diversification and specialization of these services requires co-production and new needs for coordination.

Production is increasingly *global*, owing to the expansion of markets, to the fall in transport and communication costs, to the opening-up of borders, and to deregulation, and in close connection with the new global division of labor. Globalization is the process of integration of production, exchange and consumption on a global scale; coordination and its associated services are being integrated throughout the world (Sykora (1995)).

The global economy differs from the world economy. This is not simply a generalization of the "*économies mondes*" defined by Braudel in the pre-industrial economy, or of the international economy of the first half of

the 20th century. Thanks to information technologies, the global economy operates in real time at a planetary scale (Castells (1996)).

Globalization is made possible by new technologies, and in return it requires specific coordination means which make intensive use of information, so that it enhances the progress of communication technologies. Actually, globalization implies world-wide dispersion of production. This is another factor of complexity and another source of the increasing need for coordination. Headquarters controlling plants or other establishments operating in a number of distant countries, with different cultures and different laws, need more information and specialized producer services.

Transaction costs and the organization of production

All these trends reinforce the development and the strategic role of coordination activities, which are intensive in skilled labor and information and which entails strongly increasing transaction costs. Thus we reach the situation where transaction costs tend to increase more rapidly than transport costs decrease, so that the total trading costs increase. In such a situation, firms' profitability can be seriously affected. "What is therefore needed is a sector able to absorb and transform those costs in order for the other sectors to break even" (Behrens (2003)).

This is the prime source of the movement of externalization of high-order services. The complexity of these services imply that they are produced with increasing returns, so that they are less costly if each of them is externalized and produced in one large specialized firm than if each firm produces at a small scale every service it needs. The externalization of high-order services and their coordination functions is then able to slow down the excessive increase of transaction costs.

To sum up, *the complexity of economic interactions and the expansion of markets resulting from the product differentiation and from globalization lead to the rapid increase of external high-order services which is determinant in the actual growth, composition and form of the global metropolis.*

The changes in production structures and processes would not have been possible without the informational revolution. It have permitted the explosion of high-order services responding to the dramatic increase of the needs for coordination; it have been the necessary condition of globalization; it can also be seen as a means for slowing down the increase of transaction costs.

The revolution in information technologies

While the costs of transporting goods continue to decline, direct or opportunity commuting costs remain high, and *the costs of exchanging and processing information have collapsed* because of advances in communication technologies. The progress in information and communication technologies is a transformation comparable to the industrial revolution (Castells

(1996)). It has even been compared with the invention of writing. It gives information a dominant, strategic role across the entire range of economic activities. It contributes to radical change in the structures and workings of the economy, of cities, and especially global metropolises.

The strategic role of information is not new, as we have seen. But its extension and its primacy are new. We have moved on from an industrial economy where the strategic role was played by energy and raw materials, to an economy were the capacity to process information becomes the main productive force (Castells (1996)). Moreover, information itself is part of a cumulative process where information influences technologies and technologies influence information. Information is no longer only in the service of economic activities, but also in the service of information.

It should be recalled that the fall in the cost of exchanging information by the new technologies relates only to marginal cost. Communication infrastructures are rather large and expensive and they yield increasing returns. This greatly affects the form of global metropolises.

But above all, we must remind that the revolution is partial. It does not affect directly tacit information and does not lower the needs for face-to-face contacts, which are nowadays a major agglomeration force and a prime principle of metropolization. Direct face-to-face contacts, far from declining, develop as a result of the new technologies. It has been established (Gaspar and Glaeser (1998); Guillain and Huriot (2001)) that the complementarity between tacit information (exchanged by face-to-face contacts) and codified information (diffused by information technologies) gives rise to new behaviors, new interactions, and new needs for information.

4.2 The global metropolis

Despite the progress in information technologies, cities, and especially metropolises, continue to grow and to extend their economic influence (Leamer and Storper, (2001)). The new organization of production, the increasing needs for coordination and the explosion of externalized high-order services entail new forms of metropolitan concentration. Technological progress and the related change in communication costs have brought about new spatial patterns. Three features characterize the emergence of global metropolis: the metropolitan concentration of high-order activities, the modifications of the internal city structures and the domination of global metropolises in a network system.

The concentration of coordination activities

Coordination activities are intangible, personalized, global, and information-intensive. They are concentrated more in global metropolises than are other functions, so that global metropolises contain the major part of the high-order functions of the whole country. What is new is not so much this

concentration, but rather the nature of what is concentrated and the actual concentration process.

The nature of coordination activities results from what has been said of the post-industrial economy and the information revolution. If financial and business sectors are permanent components of metropolitan activities, their role has changed radically (Ansidei (2001); Gehrig (2000); Sassen (2000), (2001)). They significantly increased their weight in the global economy and still more markedly in the economy of global metropolises. Even financial services are subject to high increasing returns. Compounded by the substantial need for tacit information exchanges, this results in a huge concentration of world finance in a small number of cities. Alongside this, we also observe a certain dispersion of secondary financial centers, due to the need for localized tacit information (Gehrig (2000)). However, agreements between financial centers periodically reinforce concentration.

The process of concentration results from the new organization of information exchanges. Recall the distinction between tacit and codified information. Only the latter can be transferred using the new technologies. The former requires face-to-face contacts. This creates an informational dualism and thus an organizational and spatial dualism between coordination functions and execution functions. The result is that the need for centrality of the latter vanishes while the concentration of the former becomes even more intense. This boosts the concentration of coordination functions in global metropolises.

Moreover, high-order services operate with increasing returns, because they are highly specialized and also because they use intensively information technologies which require high fixed costs. It results that these services locate where there is a large market and where large informational infrastructures are present, *i.e.* in global metropolises, which attracts new activities and generates a new form of cumulative urban growth.

The spatial composition of global metropolises

Whenever it concentrates very specific functions, the global metropolis renews its spatial pattern. For the same reasons as before, the internal composition of global metropolises is itself more and more selective.

Despite substantial differences, large cities in developed countries share a number of common trends including multipolarization and specialization of poles (Anas *et al* (1998)). Coordination functions have a key role in this restructuring. These functions are not only concentrated mostly in metropolises, they are also concentrated mostly in privileged districts within those cities.

Improvements in informational and communications technologies allow and even encourage a functional split in office activities. This promotes the progressive relocation of the less complex functions of office activities (back offices) in the suburbs (Ota and Fujita (1993)). These functions do

not generally require frequent and direct face-to-face contacts, so that lower suburban land costs and better accessibility become major location criteria. Thus the new information technologies appear as a major cause of the concentration of the highest level functions, and of the deconcentration of the most routine services.

This new office suburbanization has two consequences. First it facilitates the maintenance of the most specialized parts of high-order services (front offices) in the center. Second, it creates new specialized clusters in the metropolitan periphery. These new clusters differ from the main center. Most empirical studies in Europe confirm this claim. Central and peripheral poles of activities are not substitutes but rather complements. When the new poles generate sufficient and appropriate externalities, they can attract front offices. When these functions decentralize, it is frequently only toward the very near periphery as in the Paris Region and in most large French cities (Huriot (2004)). This decentralization of high-order activities is more significant in the United States and in a number of Canadian cities. Nevertheless, the CBD generally remains the most important pole, at least in relative terms, for these activities. In any case, the CBD retains economic power and most complex coordination functions in developing specific competence in a limited number of activities requiring high skills, like FIRE (Finance, Insurance and Real Estate) services, legal or managerial services.

Finally, these processes increase the concentration of the coordination functions and the specialization of urban activity clusters.

Global metropolises and global networks

Global metropolises are organized on a network basis. What is new is not the existence, and even the prevalence of the network system. What is new results from the character of the global informational economy. Networks are global and connect the nodes together instantly. Coordination itself becomes global and instantaneous. On the part of global metropolises, the divorce with the central place system, which began long ago, is now largely completed. The network of global metropolises relies on networks of firms, financial networks, even cultural networks. The metropolis is the node of a large number of more or less specialized networks. It plays a coordinating role within each of these functional networks and between these networks. The nodes interact mainly by means of the new information technologies and brief business trips. Communication infrastructures and rapid transport nodes (high speed train stations and airports) are the privileged points of entry into the global economy. Their high fixed costs entail their metropolitan localization. Their presence in a city reinforces the concentration of high-level functions, especially of coordination functions.

In a few words, the global metropolis is characterized by a new specialization : global coordination of the economy and by a new structure : the specialized multipolarization, which leaves the center the primary coordina-

tion role. It is a double selective process, affecting only a small number of cities through a small number of activities, the highest-order services.

5 Conclusions : permanence and change

As Bairoch (1985) said, every discontinuity in a process of evolution is in practice only an acceleration of a continuous movement.

The continuous movement consists in 1/ the slow growth and diversification and 2/ the ever increasing spatial influence of leading cities. This movement preserves what we have defined as the permanent character of the metropolis, namely its coordination role. It is itself progressively more diverse, more complex and spatially extended. The breaks are caused by variations in production, transportation and transaction costs induced by technical and institutional breakthroughs, which accelerate the mechanisms of agglomeration and diversification, and enhance the strategic role of coordination.

In consequence, our historical detour allows us to refine the widely held idea that the contemporary metropolis is an entirely new phenomenon. The structure and organization of this metropolis are new : they define the global metropolis. They are closely connected to the informational revolution and the related globalization. But the foundations of the metropolis are ancient. Even before the first industrial revolution, a number of cities exercised important coordination functions involving high-level activities and long-distance interactions. The main historical breaks have brought about 1/ the extension of these functions to new sectors of activity, 2/ the complete renewal of their structure and organization and 3/ their spatial expansion.

Even the spatial structure of large cities is not entirely new. Multipolarization is recent, but not suburbanization, which began back in the industrial period and is a near permanent feature of urban growth.

However this historical detour presents a number of limits. Our historical vision of urban development is over-simplified. There is not just one kind of pre-industrial city, not just one sort of industrial city. Furthermore, the post-industrial global metropolis is an over general concept. This is why, along with these reflections on the concept of metropolis, we are conducting case studies and comparative analyses of contemporary metropolization in order to evaluate the different forms of the process (for example, Bourdeau-Lepage (2002); Bourdeau-Lepage and Huriot (2002a, 2002b)).

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