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**KNOWLEDGE EXTERNALITIES AND  
GROWTH IN PERIPHERAL REGIONS:  
INTRODUCTORY NOTES**

**Fabiana Santos**

**Marco Crocco**

**Frederico G. Jayme Jr**

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**Fabiana Santos**

Executive Director of Technological Park of Belo Horizonte – Brazil and Associate Researcher at  
Centre of Regional Development and Planning (CEDEPLAR).  
E-mail address: [fabiana@cedeplar.ufmg.br](mailto:fabiana@cedeplar.ufmg.br)

**Marco Crocco**

Associate Professor at Centre of Regional Development and Planning (CEDEPLAR) – Brazil  
E-mail address: [crocco@cedeplar.ufmg.br](mailto:crocco@cedeplar.ufmg.br)

**Frederico G. Jayme Jr**

Associate Professor at Centre of Regional Development and Planning (CEDEPLAR) – Brazil  
E-mail address: [gonzaga@cedeplar.ufmg.br](mailto:gonzaga@cedeplar.ufmg.br)

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## **ABSTRACT**

The aim of this paper is to discuss the idea that knowledge externalities, as discussed in the Endogenous Growth Theory, can be spread over any kind of space. Although this point has already been discussed by some scholars in the heterodox tradition (Nelson, 1998, Martin and Sunley, 1998, among others), we would like to bring into discussion a new perspective that analyses the validity of this assumption in peripheral regions/countries. It will be argued that there are some peripheral structural conditions that constrain the generation, transfer and absorption of knowledge externalities. Above of all, it will be argued that the construction of “space” in the periphery is determinant for the absence of widespread diffusion of this kind of externality. This conclusion implies that the generality of the New Growth Theory is very difficult to be assumed.

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## **INTRODUCTION**

The discussion of externality has assumed a central position since the emergence of the so-called New Endogenous Growth Theory (NGT) theory. In these models, which follow the neoclassical approach to economic growth, the widespread existence of externalities is essential for the appearance of increasing returns at the aggregate level, which offset decreasing returns at the firm level. Among different kind of externalities, the literature has dedicated a significant amount of effort to discuss the knowledge ones (Romer, 1990; Grossman and Helpman, 1991 e Aghion and Howitt, 1992). In these models it is assumed that knowledge externalities can be spread over any kind of space.

The aim of this paper is to discuss and deny the validity of this assumption. Although this point has already been discussed by some scholars in the heterodox tradition (Nelson, 1998, Martin and Sunley, 1998, among others), we would like to bring into discussion a new perspective that analyses the validity of this assumption in peripheral regions/countries. It will be argued that there are some peripheral structural conditions that constrain the generation, transfer and absorption of knowledge externalities. Above of all, it will be argued that the construction of “space” in the periphery is determinant for the absence of widespread diffusion of this kind of externality. This conclusion implies that the generality of the NGT theory is very difficult to be assumed.

### **I. ENDOGENOUS GROWTH THEORY: GENERALITIES**

Endogenous growth theory or New Growth Theory (NGT) argues that increased returns to scale are the key element to explain its theory. It is the outcome of externalities that can arise from specific types of investment: R&D, investment in capital goods and human capital (Romer, 1986, 1990; Jones, 1995). Since technology is the engine of economic growth, in the Romer (1986) version of NGT, ideas play a central role in his model by means of their externalities. It assumes that ideas are public goods, as long as they are nonrivalrous. Therefore, as Jones (1998) highlights, this nonrivalry generates increasing returns to scale and imperfect competition, which is the key to understand the spillovers of ideas in NGT. Some models argued that spending on R&D can generate a sustainable growth rate of output as this type of spending generates more and better, either final and intermediate, goods. The increase in better intermediate goods works to increase the overall productivity of the productive sector (Romer 1990, Grossman and Helpman, 1991 e Aghion and Howitt, 1992).

Other models, like Romer’s (1986), assume that the degree of technological development of an economy is directly related with the amount of capital goods of this economy. So, there is a direct relationship between the amount of capital goods and technological development, as the process of learning by doing operates to increase technological knowledge. When an isolate firm increases its own stock of capital, it is at the same time increasing the stock of capital of the whole economy and the knowledge that has been produced by the use of this new capital good is spillovered for the rest of the economy.

Usually the endogenous growth models assume that there is “a constant or decreasing returns at the level of the individual firm but with positive spin-offs between them”. New growth models have their results depending on the existence of increasing returns to scale, which are derived from the existence of externalities. The latter comes in the form of spillover effects for the economy as a whole: education, invention and learning networks. As the most famous textbook emphasizes:

“One of the main contributions of new growth theory has been to emphasize that ideas are very different from other economic goods. Ideas are nonrivalrous: once an idea is invented, it can be used by one person or by one thousand people, at no additional cost. (...) In particular, the nonrivalry of ideas implies that production will be characterized by increasing returns to scale” (Jones, 1998, p. 86)

In sum: knowledge externalities are the key for understanding increasing returns to scale in NGT.

One important aspect to stress is the fact that NGT does not split with the neoclassical theory of growth. In fact, NGT intends to contribute to a better modelling of growth using the same instruments of the neoclassical framework, such externalities, as well as increase returns in a typical production function with perfect substitutability between labour and capital. While in Solow-Swan model technology is totally exogenous and available, in NGT growth model technological progress is driven by research and development.

## **II. KNOWLEDGE EXTERNALITIES AND THE TRANSFER PROCESS – THE IMPORTANCE OF GEOGRAPHY**

The central point of the argument is the understanding that externalities do not flow over space. For the majority of the types of externalities, especially those related to knowledge, the features of the space surrounding the places of its generation and of its absorption are fundamental, or essential, for its “operationality”. By “operationality” we mean the unpaid side-effects of one producer’s output or input on other producers.

An externality does not exist until the moment that one producer takes the advantage (or disadvantage in the case of a negative externality) of the action of other producer. Until this moment, the mere fact that, for example, one producer spends money in R&D to generate new knowledge does not mean that an externality was created. When other producer uses this new knowledge, without paying for that, on her/his productive process then occurs the transformation of this new knowledge into externality. This means that the uncontrolled outcome of a productive action of one producer only becomes an externality when it has an economic value for other producers.

The point that we would like to stress here is that both the space surrounding the producer that has generated this ‘uncontrolled outcome’ and the space surrounding the producer that uses this outcome are equally fundamental to define the economic value of this ‘uncontrolled outcome’.

Having this comments in mind, we believe that the concept of ‘centrality’ can help to improve our understanding of the ‘externality phenomenon’ in contrast to more simplistic views that completely disregard the underlying conditioning factors for the “externality phenomenon” to take place.

## II.1. Centrality and the Geographical Dimension of the Transfer Process

The regional economics literature has highlighted that the development of a series of activities - particularly services – are essential for the generation, transfer and absorption of knowledge. These activities are directly related to the emergence of urban densities that represent minimum scales for the emergence of external economies stemming from urban agglomerations.<sup>1</sup> This process allows diversification and accessibility of several kinds of services and goods, since they make up the confluence and overlapping of market areas.<sup>2</sup>

The analysis of such a possibility requires the understanding that urbanization may be characterized by two movements: *concentration* and *centralization*. *Concentration* is related to urbanization in cities. *Centralization*, in turn, as Christaller (1966) has shown, consists in the unequal development of urban centres, implying relative concentration of economic activities in large urban centres. Christaller (1966) argues that a large urban centre relies on high-quality, complex, specialized – central – services that provide it with economic higher efficiency than that found in smaller centres. The author's major concern refers to the formation of urban-centre networks as well as the reasons for the existence of different city sizes and its irregular distribution over space. Therefore, the author develops the notion of *central goods and services* and *central place networks*.

The 'centrality' characteristic of a *central place* stems from a region's quality of supply of service, which may have a relationship with high population density and economic activities<sup>3</sup> so as to allow this region to supply central goods and services, such as knowledge intermediaries<sup>4</sup>, wholesale and retail trade, banking, business organizations, administrative services, education and entertainment facilities, etc.. That is to say, a *central place* would play the role of a *locus* of central services for itself and for the immediately neighbouring areas (supplementary region). From this definition of central place, Christaller admits the existence of a *hierarchy of central places*, in accordance to smaller or greater availability of goods and services that need to be centrally localized (central goods and functions). The position of an urban region in the hierarchy of central places is defined by the size of its market area and degree of complexity and essentiality of goods and/or services it provides to its polarised area.

It is widely recognised in the literature on regional economics that 'centrality' is essential to the appearance of externalities that are derived from the diversification of the industrial structure. This point is particularly emphasized by Jacobs (1966) through the concept of *economic reciprocating system*. It is defined as the process of diversification of the productive system associated with the introduction of new kinds of products in different kinds of sectors, made possible by the development

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<sup>1</sup> As Lemos says, it is important here to distinguish a city from an urban center. "The concept of city involves a geographic-population idea, while by 'urban' or 'urbanization', we understand the formation process – capitalist – of a 'complex of services'" (Lemos 1989, p. 216).

<sup>2</sup> Market areas is defined here both in the Weberian sense (Weber, 1929), i.e. the locus where several economic transactions occur, and the Löschian sense (Lösch, 1954), a localized space whose property is the accessibility to a given service.

<sup>3</sup> It is important to note that the concept of centrality has not to be confused with the concept of urbanization. Although it is possible to argue that there is some relationship between both concepts, the idea of centrality implies the supply of special kind of services, usually more sophisticated. A region with a large population without this kind of service will have a lower degree of centrality than another region with less population but with the supply of more sophisticated services, specially the productive ones.

<sup>4</sup> Knowledge intermediaries will be discussed in more detail later.



of the exportation sector. This process allows the urban region to increase its economic performance as it increases its exports of goods and service. This will attract diversified firms to the region, thereby working to increase the agglomeration externalities of the local and, hence, making the region even more attractive to other business activities and people. Moreover, as a urban region moves (upwards) in the hierarchy (and thus becomes of higher centrality order) it displaces other region(s). This is a process that, left to its own course, will increase regional disparities and turn the space more fragmented or fractured.

What has been argued here is that the concept of centrality is fundamental for the occurrence of some forms of externalities, especially knowledge spillovers and the transfer process. These kinds of externalities are present in many neoclassical models of endogenous growth as those analyzed above. The importance of centrality to the occurrence of these kinds of externalities can be visualized from the discussion of two special features: a knowledge demand and the existence of knowledge-intermediaries.

First of all, it is worthwhile noticing that in the majority of the studies on knowledge spillovers the role of knowledge demand is usually overlooked. As pointed out by Howells (2002, p. 879), this is a result of the fact of these studies assumes a “traditional ‘public good’ notion of knowledge and its costless characteristics [...]. On this basis, demand in a sense need not be considered, since knowledge would somehow permeate to those who needed it”. Taking this fact into account, one can argue that for a knowledge spillover to become an externality it is necessary the existence of some economic activities that use it in the productive processes. In others words, it is necessary the existence of an economic opportunity to the application in the productive process of this new knowledge.<sup>5</sup> This can equally happen in areas that show a significant degree of specialization – as conceptualised by the Marshallian industrial districts, *clusters*, or Italian industrial districts – or in areas that encompass several clusters (i.e., have a highly diversified productive structure). However, it is possible to assume that in areas with diversified productive structures, due to a high degree of centrality, the opportunities for the use of that new knowledge are bigger than in places of lower ranking and thus, knowledge spillovers will in fact occur and become an important externality of the place.

Knowledge-intermediaries, in turn, can be defined as *conduits of knowledge-transfer* and, hence, significantly contribute to the emergence and diffusion of knowledge externalities. It can take both a formal form - like specialist service design, research, engineering and consultancy firms - and an informal form - like membership in a learning society or industry association, the attendance at conferences and workshops. The existence of these *conduits* is directly associated with the degree of centrality of a specific region, as the latter is determined by the supply of more sophisticated, complex and central goods and services. That is to say, a place that can supply those types of services is a central place of a higher rank. In this sense, it is possible to argue that the higher the centrality the easier is the emergence of knowledge externalities.

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<sup>5</sup> It is important to note that this knowledge demand can assume two forms. First it can appear in the form of a market for knowledge, implying the existence of some transaction process, like the purchase of a catalogue or a scientific book, the hiring of qualified personnel, and research agreements or contract R&D. Secondly, it can take place in non-market terms, like informal trading and reciprocal knowledge sharing via joint-ventures operations (Howells 2002).

From what has been said so far, one can assert that the more central places exist within an economic territory, a country for example, and the higher their rank the easier becomes for the knowledge externality to spread around this economy and to impact positively its performance. In other words, the spatial dimension of knowledge demand has impacts on the scale of knowledge spillovers. The size of knowledge demand in the local of its generation and the existence of knowledge-intermediaries can determine whether a knowledge spillover will be lost (undiscovered) or ignored and in what extension. The neoclassical new endogenous growth models seem to assume that every economic space has a sufficient number of central places for the effect of knowledge externalities to generate increasing returns in aggregate to compensate the diminishing returns on the firms' levels. In other words, there is an assumption of non-segmented space in new endogenous growth theories.

## **II.2. Knowledge Spillovers and 'Absorptive Capabilities'**

Another feature that is essential for the outcome of a spending in R&D (or from a learning by doing process) to be transformed into externality is the capacity of this outcome to be incorporated by other producers. This capacity, in its own turn, depends on two aspects: the way this outcome is divulged and the capability of other producers to understand and absorb it.

The first aspect is related to the channels of transmission of knowledge, especially the technological one, inside a society. To be spread to the whole economy, knowledge diffusion requires that channels of communication among agents be perfect, in a sense that once a specific knowledge is generated it can be passed easily and quickly. However, this assumption does not take into account the concept of *knowledge base*. This concept is related to the characteristics of the knowledge used in an innovation. According to Dosi (1988: 224), various sorts of pieces of non-excludable knowledge are used in the solution of most technological problems: universal versus specific; public versus private; and articulated versus tacit.

Universal knowledge refers to knowledge that has a large applicable understanding, based on principles that are well known and pervasive, whilst specific knowledge means that particular to some activities. Moreover, there is that knowledge that is public in the sense that it is available in scientific and technical publications as opposed to knowledge that is private because it is protected by laws (patents). Moreover, in the case of public or codified knowledge it is necessary that the access to this new knowledge be equally distributed over sectors and regions, which implies the existence of homogeneous access to this knowledge. This implies the existence of a uniform distribution of universities, colleges and research centres, which can educate people to deal with new technologies. It also requires the widespread existence of libraries, bookshops, and technological assistance.

Finally, some sorts of knowledge are well articulated and for the most part are written down in manuals, books and so on. In contrast, there is also that kind of knowledge that is tacit, meaning that it comes from an inarticulated experience and practice. Given the relevance of tacit knowledge to our discussion, we think that a further analysis of this concept is worthwhile.

The concept of tacit knowledge has been synthesized by Polanyi (1958; 1967) in the following statement: “*We can know more than we can tell*” (1967: 4; italics in original). Basically, the meaning of tacit knowledge can be understood when we realize that we can recognize the face of our neighbours without being able to explain how we recognise the face. In others words, “perception is determined in terms of the way it is integrated into the overall pattern” (Nonaka and Takeuchi 1999: 216). Polanyi argues that knowledge acquisition is “the outcome of an active shaping of experience performed in the pursuit of knowledge” (Polanyi 1967: 6).

Polanyi stresses the importance of experience, self-involvement and commitment to the understanding of tacit knowledge when he identifies tacit knowing as indwelling. As pointed out by Nonaka and Takeuchi:

To know something is to create its image or pattern by tacitly integrating particulars. In order to understand the pattern as a meaningful whole, it is necessary to integrate one’s body with the particulars. Thus, indwelling breaks the traditional dichotomies between mind and body, reason and emotion, subject and object, and knower and known. Therefore, scientific objectivity is not a sole source of knowledge. Much of our knowledge is the fruit of our own purposeful endeavours in dealing with the world.

(Nonaka and Takeuchi 1995: 60).

While explicit knowledge can be expressed in a systematic and formal way in the form of hard data, scientific formulae, codified procedures or universal principals, tacit knowledge, as Polanyi has pointed out, is highly personal and hard to formalise. In this case, proximity or contact face to face is a necessary condition for its diffusion.

From the previous discussion, it is possible to argue that the diffusion of tacit knowledge requires proximity (geographical and cognitive), in a way that allows a network to be constructed, like in the Marshallian industrial districts. As tacit knowledge is not expressed in a formal code, its transmission is based on the share of cultural values, informal codes, routines, or in other words the share of institutions in a broad sense<sup>6</sup> (formal and informal). These institutions are geographically localized, giving the transfer process of tacit knowledge a strong local dimension. Moreover, even codified knowledge requires tacit knowledge to be learned. In the words of Howells (2002, p. 876)

... tacit knowledge, situation and locational context do play a significant role in the use and spread of *codified* knowledge. Thus, although codified knowledge may be more ubiquitous and accessible, its interpretation and assimilation are still influenced by geography.

This contrast to the conventional view of neoclassical endogenous growth models, which assume that knowledge is a “public good” (and, hence, non-excludable and nonrivalrous) that can *flow* freely, without any costs and frictions, between individuals (or firms) (Howells 2002). Another form of knowledge prized by these models is that knowledge embodied in goods (notably capital goods). In

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<sup>6</sup> See in this regard the concept of “relational proximity” as found in Amin and Cohendat (1999, 2000).

this case, *flow* of knowledge (spillover effects) rather than *sharing* of knowledge is made possible by (free) trade relations<sup>7</sup> (Park, 1995; Coe and Helpman, 1995).

The discussion above indicates that the diffusion of knowledge externality is strongly influenced by the quantity and the quality of channels of communication of scientific knowledge and by the degree of proximity between the ‘producers’ and the ‘users’ of this knowledge.

Another important basic feature for knowledge to be transformed into externality is the capacity of potential users to understand and incorporate in their productive processes this knowledge, which depends on their absorptive capability. According to this approach, knowledge is not a good that anyone can pick up on the shelf. The introduction of a new piece of knowledge is surrounded by what has been labelled “dynamic uncertainties” (Camagni, 1991). As put forward by Lawson (1999), these uncertainties would be related to: (1) information complexity and difficulty in identifying useful information, what requires a “*searching function*”; (2) the problem of *ex ante* inspection of the qualitative characteristics of inputs, equipment, etc., what requires a “*screening function*”; (3) the difficulty in processing available information, what requires a “*transcoding function*”; and (4) the difficulty in assessing the results of actions taken both by the firms’ and other agents in their relationship (competitors, suppliers, etc.), what requires a “*coordination mechanism*.” The firm capabilities to deal with these uncertainties will vary among sectors, size and location, meaning that the absorption’s potential of an externality will vary over space.

One can summarize the discussion above saying that whether or not an ‘uncontrolled outcome’ resulting from a learning or R&D process will be transformed into a widespread externality (i.e. knowledge spillover), will depend upon the existence of a system of innovation. In Lundvall (1992, p.2) words,

... a system of innovation is constituted by elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge and that a national [regional, local] system encompasses elements and relationships, either located within or rooted inside borders of a nation [regional, local] state.

This definition makes it clear that a system of innovation is both a social system and is spatially defined, “including all parts and aspects of the economic structure and the institutional set-up affecting learning as well as searching and exploring – the productive system, the marketing system and the system of finance present themselves as sub-system in which learning takes place” (Lundvall 1992, p. 12).

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<sup>7</sup> Although it should be recognized that international trade plays a central role in spillover effects between countries, it is debatable, as the discussion above has shown, whether all features of knowledge can be embodied in goods. In this regard it is important to consider that for some types of knowledge the transfer process is via non-market mechanism. Moreover, it must be considered that underlying structures for the successful absorption of these spillovers are required (as captured by the concepts of national system of innovations, social and absorptive capabilities).

### **II.3. Bringing Back the “Space” – Knowledge and Geography**

Taking this theoretical discussion into account, it is possible to argue that some neoclassical new endogenous growth models assume the existence of both well distributed central places and well organized national system of innovation as a natural feature of all economies. This is an assumption necessary to make their theory a general one, capable of being applied in any space. Our argument is that this is a highly unsatisfactory approach, to the extent that, in our view, *territory* is as social space that goes beyond its physical geographical endowments. This means that it is impossible to analyze a specific space without understanding its conventions, values, rules and institutional arrangements that define its social forms of production. This means that history is an essential feature of every space and defines its social forms of production. In this sense it is impossible to assume that central places and national system of innovations are ubiquitous of the space.

One can assume for theoretical purposes that, in general, space in developed countries is more homogenous (that is, the urban hierarchy is less fragmented or more horizontal than vertical), due to some similar features of its development. Developed countries show a degree of urbanization, income distribution and a system of innovation that, although not identical, can be assumed to be very similar. Moreover, it can be assumed that the spaces in developed countries are endowed with those conditions necessary to the occurrence of externalities derived from knowledge. That is, in developed countries there exists a balanced distribution of central places and a system of innovation that work to facilitate the generation, diffusion and absorption of knowledge externalities.

However, this homogeneity of space is not found in peripheral countries in comparison with the developed ones. Moreover, this lack of homogeneity is likely to happen within peripheral countries as it will be discussed next.

### **III. EXTERNALITIES AND PERIPHERAL SPACES**

The major question to be answered is “What would be the conditions in force in peripheral ‘spaces’ that impair knowledge externalities to be generated, diffused and absorbed by economic agents located in this space?”

The answer is necessarily related to the need of amplifying the analytical range of studies of knowledge externalities so as to embed peculiarities associated with the peripheral condition of the country and that of the location itself (internally related to the country). We believe that peripheral development constraints may provide elements for the understanding of the potentialities and limits to the spill over of knowledge externalities. In what follows two aspects related to these constraints are discussed: the construction of capabilities and urban spaces in peripheral countries.

### III.1. Capabilities and the Transferability of Knowledge

First of all, it is important to make it clear that in our view peripheral countries do not innovate in the sense of being capable of shifting the frontiers of knowledge - an attribute of the core. Rather, peripheral countries do invest in knowledge acquisition effort, that is, to acquire, master and, sometimes, improve upon existing knowledge, borrowed from the core.

The fact that knowledge is not a “free, public good” and, relatedly, that the appropriation and transfer processes are not automatic, passive and costless - but rather require minimum social capabilities and active actions to absorb and process it – imply that the “non-excludability” and “high mobility” of knowledge assumptions that sustain endogenous growth models’ knowledge spillover effects are hard to accept for peripheral countries. This is because a place’s (country or region of a country) social and technological capabilities together with the whole set of institutions (summarised by the concept of systems of innovation) that support the building and development of its capabilities are fundamental to determine whether or not it will be capable of benefiting from the externalities of existing (borrowed) knowledge.

Evolutionary *catching up* models (including the concept of systems of innovation) in conjunction with Cepal’s contributions on the problems of generation of technical progress in the context of core-periphery relations are helpful to the understanding of the reasons why widespread knowledge externalities, which is necessary to generate endogenous growth, are not always possible and, accordingly, why it is so difficult for a peripheral country to become an innovation-generating space.<sup>8</sup>

Evolutionary *catching up* models based on technological diffusion have already shown that latecomer countries benefit from positive externalities of access to technologies coming from leader countries at the technological frontier, provided that they meet the threshold precondition of the so-called “minimal social absorption capacity” (Abramovitz, 1986)<sup>9</sup>. Countries below a threshold level would be excluded from the benefits of knowledge spillovers and, hence, from the opportunities brought about by technological *catching-up*. As technologies are becoming increasingly more demanding in terms of the capabilities they require to be adopted, the periphery will be always in a disadvantaged position to the extent that structural factors are difficult to change and the process of knowledge transfer does not have any in-built forces to reverse cumulative causation.

In fact, the incomplete character of peripheral systems of innovation (which captures the institutional dimension of peripheral development) helps to explain why capabilities are underdeveloped (Albuquerque, 2000). As Albuquerque (2000) maintains “incomplete national innovation systems”, are characterised by: a) scientific and technological infrastructure of a relatively small scale; b) atrophy of the “T” in the binomial S&T; c) distribution of R&D spending skewed towards the public sector, which leads to the atrophy of the “D” in the binomial R&D owing to the

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<sup>8</sup> We are not saying that it is impossible for a latecomer country to climb the technological ladder, as the cases of Japan, Germany and more recently East Asian countries such as Korea, Taiwan and Singapore seem to prove. These cases indicate that purposeful State action is sine qua non to determine the outcomes of the catching up. This partly explains the difference between Latin American and East Asian achievements in the catching up process.

<sup>9</sup> In other words, a minimum level of basic social capital, such as the physical infrastructure (telecommunications, transports and electricity networks) and an organized education and health system).

small presence of the private sector; d) significant inter-sectoral heterogeneity of technological development favouring sectors based on natural resources, where former state companies are concentrated.

One may ponder that in view of the growth of integrated production systems, with facilities at different levels of technological complexity, the need for building local capabilities in peripheral countries is reduced. However, one must consider the importance of “technological isolation effect”, associated with limited spillover effects to the peripheral host country. As it is well known, technological effort in R&D - which by, its own nature, demands a significant locational indivisibility - is ultimately concentrated in TNCs’ parent countries (the core). Conversely, TNCs transfer those simpler technologies which only require the efficient use of the capabilities existing in these countries. In fact, they have no interest in investing to create more advanced capabilities in peripheral countries. Thus, subsidiary firms located in peripheral countries would perform simpler strategic functions (basically manufacturing), fundamentally requiring operational capabilities. In this regard, the conjunction of an information- and knowledge-poor environment of the subsidiaries’ site in a peripheral country with subsidiaries’ dependence on knowledge transfers from the parent may create a “technological isolation effect”, to borrow Howell’s (2001) words, characterised by “little information and knowledge interaction with its local environment”. This means that the potential of learning, the scope for technological upgrading, and knowledge spillovers are considerably limited. In other words, the construction of capabilities of peripheral countries based on the transfer of knowledge produces an environment that does not facilitate the widespread generation of the knowledge externalities as assumed by the neoclassical endogenous growth. There are, therefore, important institutional constraints at work that check endogenous growth models’ pretence of being a general theory equally applicable to peripheral and core countries.

### **III. 2. The construction of centralities in the periphery**

Another element to be considered in a broader analysis would be that related to the constitution of a peripheral urban space endowed with a complex service network, necessary to the generation, transfer and absorption of knowledge. As shown above, this is a process that is directly related to the construction of central places inside a region. This construction, in its turn, implies the centralization and concentration of services over the space. In the words of Lemos, “urban concentration and centralization are nothing but the major way through which capitalism accelerates the market area growth, in order to guarantee the productivity development of the tertiary sector” (Lemos 1989 - pp. 293-4).

Such processes give rise to unequal development not only among countries but also among regions of a country, determining the emergence of polarizing regions and polarized regions. In order to understand this process of unequal regional development, it is necessary to understand that this process is essentially constrained by a country’s income dimension and the inequality of its distribution in space: the greater the income spatial distribution, the greater the possibility of the emergence of several central places. In this way, compared with core countries and given the dimension and inequality of income distribution in peripheral countries, one may expect that the

possibility of emergence of central places is naturally smaller in the latter. This would be the factor explaining the existence of a number of *incomplete* urban nuclei, in the sense that they are not able to embed a complex service sector as well as few *complete* urban agglomerations in the periphery. Moreover, the gap – in terms of the quality of the services supplied – among these few *complete* urban agglomerations and those many *incomplete* urban nuclei is very large.

Associated with the previously aspect of small urban density, it is also relevant to take into account that, in peripheral conditions, the urban nucleus surroundings is usually that of subsistence (meaning that the diversification and quality of services and goods is low as well as the level of income) when the region is lagged in the national context. In this case, the tertiary concentration and centralization does not follow a territorially contiguous urban hierarchy, and a strong segmentation of such a hierarchy in the regional surroundings occurs, mainly by the absence of medium-sized urban centres which would be able to absorb complementary industrial activities sustained by the supply of services in the urban centre pole. This means that there is a low productive complementariness between the pole and its vicinity and that the social immersion (backward and forward linkages) is very weak.

Thus, the small service diversification and quality - especially in the case of those modern ones, which function as knowledge-intermediaries and inputs - and the strong segmentation of urban space are unable to feed and sustain knowledge externalities. This feature of peripheral countries / regions is a constraint to the widespread occurrence of increasing returns as theorised by the proponents of endogenous growth theory (Romer 1990, Grossman and Helpman, 1991, Aghion and Howitt, 1992, among others).

#### **IV. FINAL REMARKS**

In this paper we have discussed one hypothesis that is fundamental in the neoclassical's endogenous growth theory. In these models it has been assumed that knowledge externalities can be spread over any kind of space. The heterodox literature has already challenged this assumption (Nelson, 1998; Martin and Sunley, 1998, among others). Even among geographers this assumption has been denied (Feldman, 1994). Most of this literature has argued that knowledge spillovers are geographically confined and are related to the amount of knowledge-generating inputs. Our argument goes further in two dimensions. First, we have argued that one important element of this geographical constraint to the generation and diffusion of these knowledge externalities is the degree of *centrality* shown by a region. It is the centrality characteristic that facilitates both the knowledge-generating inputs and knowledge-intermediaries (the *conduits of knowledge-transfer*). Moreover, local capabilities are also fundamental for absorption of knowledge externalities. In the same way, these local capabilities are geographically constrained and their building is influenced by the degree of centrality.

Second, we have argued that both the construction of local capabilities and *centrality* have structural constraints in peripheral countries. These structural constraints impose serious problems to the neoclassical's endogenous growth theory assumption that knowledge externalities are easily widespread diffused over the space. Taking together, these arguments make it very difficult to accept the generality of the NGT theory.



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