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Literature Review on High-Speed Rail and Regional Uneven Development

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Abstract

Many different types of interactions between transportation and land use have been noticed and debated by researchers and the general public because transportation infrastructures have frequently been cited as an important factor in determining spatial structures at diverse levels, including the local, regional, and national levels. Notably, because transportation accessibility has facilitated agglomeration economies, a small number of core areas have benefited from a geographic concentration of industries and consumption. As a result of the unequal distribution of economic resources and capacities, peripheral regions have been subjected to significant challenges, such as an increase in the rate of unemployment. Consequently, transportation can be considered as a global factor that contributes to the promotion of uneven development. A question that is connected to the phenomena is regarding the economic effects of considerable transportation improvements, namely high-speed rail (HSR), on the long-standing uneven development practices. Thus, this study (1) synthesized the manner in which transportation contributed to the creation of uneven development, (2) reviewed empirical findings to determine whether HSR mitigated the long-standing uneven development, and (3) offered future research directions.

Keywords HIgh-Speed Rail, Spatial Structure, Uneven Development, Literature Review
주제어 고속철도, 공간구조, 불균형 발전, 문헌 분석

Ⅰ. Introduction

According to Bertaud (2018), the spatial structure is not defined by urban design and planning that promotes "normative" ideals; rather, it is established by markets that react to price processes. In this regard, transport geographers contend that the cost of transportation is one of the most important factors that contribute to the formation of spatial order. Rodrigue (2020) stated, transportation is among the most essential human activities, and it is a crucial component of the economy and plays a significant role in spatial relations between locations. The improved accessibility from transportation infrastructure improvements can affect the location decisions of households and firms. These spatial arrangements are bound to produce welfare gains to consumers and producers, stemming from their capacity to relocate to where utility level and profit-making capabilities are enhanced. That is, transport infrastructure stimulates efficient spatial patterns of households and businesses, and this increased spatial efficiency can spur economic growth through agglomeration economies (Anas et al., 1998). Beyond the agglomeration economies, Krugman (1991a) observed that concentration of production location in space leads to a core-periphery pattern mainly due to the interaction of increasing returns, transportation costs, and demand. Thus, the agglomerative forces toward the core

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region inevitably introduce uneven development (also called spatial hierarchy). Since the economic and political dominant power is concentrated on the core region, individuals, communities, and firms in the peripheral regions face diverse challenges, including a lack of employment opportunities. Accordingly, high-speed rail (HSR) has the potential to mitigate perpetual uneven development and reverse the cycle of cumulative causation because even minor changes in regional features such as socioeconomic environments, built environments, and transport networks can alter the nature of cumulative regional progress.

Thus, this study reviewed a body of literature on connection between HSR and uneven development, which has not been done by a scholar yet, to (1) synthesize how transportation contributes to the creation of uneven development and general theories surrounding uneven development; (2) review empirical findings to determine whether or not HSR mitigates the long-standing uneven development; and (3) offer future research directions.

Ⅱ. Theoretical Background: Transportation and Spatial Structure

Transportation is implicated in just about everything else, including employment, the environment, climate change, sustainability, national security, inequality, health, education, energy, family life, information, technology, cybersecurity, access to food, and the political process. In addition, transportation is a fundamental component of the environments in which we choose to reside. (Cidell & Prytherch, 2015). In this particular setting, Ullman (1980) recommended that the connectivity between regions and the crucial function of transportation in geography receive a greater amount of focus and consideration. Within the framework of the multidisciplinary study of transportation, the field of transport geography examines topics concerning space, such as location and spatial structures (Gaile & Willmott, 2004). From this point of view, transportation plays an important part in establishing the spatial structures of urban, regional, and global areas (Meng et al., 2021). Therefore, this section highlights the primary features that have been recognized for a significant amount of time in economic theory on the transport geography.

Transportation can help explain why there is a spatial order in the world, which can be explained by the fact that economic resources, activities, and agents are not randomly dispersed (Rodrigue, 2020). When deciding where to locate their businesses, economic agents like individuals and companies take a number of factors into account, including human capital, the features of the surrounding neighborhood, the environmental qualities, the amenities, and the available financial resources (Glaeser & Kahn, 2004). Transportation can have a pivotal role in shaping the spatial structures of an area. Because land is a location-dependent good, there is space for interaction between transportation and land use, which in turn generates spatial structures (Levinson & Krizek, 2018). The competitive advantage of time and money spent on transportation might lead to the development of spatial structures (Stelder, 2005). To go into further detail, transportation involves spatial interactions through the use of the following three concepts: (1) complementarity (supply and demand between interacting locations), (2) intervening opportunities (another location can offer a better alternative as an origin or destination), and (3) transferability (transport infrastructures should support freight, persons, and information being transferred (Ullman, 1980).

There are many different kinds of spatial patterns brought about by transportation. For example, transportation hubs provide a powerful agglomerative force because they are equipped with an effective distribution system, are able to manage greater volumes of traffic, and provide a high frequency of transport services. There is a concentration of specialized industries such as manufacturing and mining since these businesses have a tendency to be concentrated in order to distribute raw resources, labor, and output in an efficient manner. It also involves the concentration of service sectors such as administration and finance in a system of central sites with optimal accessibility to labor or potential consumers. These places have the ability to attract a large number of both.

A book chapter titled "Transportation and Urban Form - Stages in the Spatial Evolution of the American Metropolis" (Muller, 2004) illustrated this connection. It categorized the stages of the evolution of the American metropolis according to improvements in transportation. It outlined the four distinct morphological spatial patterns that emerged over the course of time in the United States: (1) the era of the walking-horsecar (1800–1890), (2) the era of the electric

streetcar (1890–1920), (3) the era of the recreational automobile (1920–1945), and (4) the era of the freeway (1945-present).

Lastly, the question of whether transportation has played an important part in determining spatial structures is a topic of discussion. In relation to this topic, there is a well-known dispute on whether or not the interaction between transportation and land use is becoming weaker. Giuliano (1995) proposed that because metropolitan areas already possessed well-established transportation networks, even significant transportation developments and investments, such as the construction of new stretches of freeway, would only play a minor part in making metropolitan areas more accessible. Although anticipated shifts in land use at the local level do take place, overarching regional trends are not likely to change significantly in the foreseeable future. In addition, Giuliano (1995) stated that when it comes to the locational decisions of households and businesses, the significance of transportation has decreased. This is due to the fact that transportation costs make up a small proportion of expenditures, and flexible work arrangements make businesses more footloose. In addition, because the evolution of land use involves many different aspects, such as transportation, local land-use policies, and overall economic conditions, it is necessary to acknowledge that the potential for improvement of transportation is limited.

Giuliano's arguments were refuted by Cervero and Landis (1995), who argued that transportation developments and investments continue to have a significant impact on channeling land use patterns, urban densities, and property values by combining supportive policies. They made their case by stating that supportive policies allow transportation developments and investments to continue to have this crucial impact. The interaction between transportation and land usage is weaker today, which brings up an interesting topic. Even if there is still significant elasticity in the link between the two, the interaction is weaker today. This is partially due to the skewed price of inexpensive automotive trips. In the United States, people who drive motor vehicles do not pay an appropriate amount for externalities such as parking. Because of this distortion, the interplay between transportation and land use may become less effective.

In addition to the debate, Glaeser and Kohlhase (2004) remarked that even while the costs of transporting commodies are not insignificant, they are still quite low and are continuing to drop. Because the cost of transportation is going down across the board for all modes, it ought to play an increasingly unimportant role in the economy of metropolitan areas, at least in terms of the movement of commodies. For instance, we have watched the slow but steady decline of port cities; the transportation characteristics that made these areas centers of productivity during the era of the streetcar appear to have become irrelevant in more recent times. Additionally, developments in information and communication technology have resulted in a diminishing emphasis on being physically close to one another. The elements will inevitably lead to a decentralization of economic activity, which will, in turn, reduce the requirement for core cities. However, the continued growth of megalopolises and the re-emergence of some central areas suggest that decreased transportation costs and the increasing availability of substitute technologies for face-to-face meetings and physical proximity may not be enough to nullify the benefits of agglomeration economies (Giuliano et al., 2019). More specifically, the decline makes it possible for businesses to become indifferent to their location in terms of how close they are to a market, and it makes it possible for customers to become indifferent to location when it comes to making purchases despite the increased cost of transportation (Mori, 1997). However, this results in intense price rivalry, which forces businesses to find ways to differentiate their offerings in terms of cost in order to remain profitable. Within this framework, securing key locations is essential in order to cut down on travel time to a big number of potential customers. In addition, proximity is still very significant because the benefits of being close to other people tend to stem from reduced expenditures associated with the provision of and acquisition of services, as well as an improvement in the flow of information. In addition, there appears to have been an increase in the cost of moving people, primarily as a result of road delays (Ciccone and Hall, 1993). As a result, there is still a demand for physical proximity as a result of the desire to eliminate the costs of transportation for goods, people, and ideas.

III. Theoretical Background: Transportation and Uneven Development

This section discusses a somewhat different perspective. Instead of asking why a particular industry is concentrated in a particular location, it asks why economic agents end up concentrating in a few core regions, with the remaining regions playing a "periphery" role to the core regions and how transportation influences this spatial hierarchy. Competition across locations is inherently oligopolistic, and economic activities are unevenly distributed across them (Ottaviano & Puga, 1998). Across the globe, economic theories, along with anecdotal and empirical evidence, have observed peaks and troughs in the spatial distribution of economic activities, resources, and competitiveness (Ottaviano & Thisse, 2004). This section provides a general understanding of uneven development and discusses the interaction between transport infrastructure and uneven development.

Before moving on to a more in-depth explanation, it is required to first designate the three key geographical components that make up the whole: the core, the semi-core, and the periphery areas. In order to convey the concepts behind the three regional components, it is also helpful to have a schematic representation of the spatial patterns (Herbert & Thomas, 1997).

For instance, Walter Christaller (1933) established Central Place Theory in order to explain how some locations operate as central places that supply services to the areas surrounding them in the form of a system of hexagons and networks. Taking into account the numerous orders in which settlements can be found, higher-order settlements, such as cities, provide intermediate-order settlements, such as towns, and lower-order settlements, such as villages and hamlets, with specialized goods and services. This framework, when combined with the concept of distance, can be expanded to describe the function of various modes of transportation. For instance, locations that have better access to markets and natural resources are more likely to become core regions because they may exert a higher centrifugal influence on businesses and consumers.

Core regions are traditionally industrialized and possibly post-industrial regions that contain the vast majority of company headquarters and continue to be key market-

places for world production, according to Friedmann and Wolff (1982). The only places you'll find world cities are in the core parts of the world; there, they act as banking and financial capitals, administrative headquarters, ideological control centers, and a host of other important roles. Agglomerative gains, such as improved human capital, go to the core region since it has the authority to "command and control" the periphery regions. In this context, the term "semi-core region" refers to rapidly industrializing places whose economies are nevertheless dependent on the capital and technical knowledge of core regions. As a result of their function in bridging the gap between the core and the periphery markets, they are seen as an intermediate component of the regional structure that lies between the core and the periphery. It's also possible for these places to be newly industrialized regions with median living levels. It is generally accepted that peripheral regions are the sites at which an ongoing process known as the development of underdevelopment can be found. They are not part of the market economy, which leaves them economically disadvantaged, technologically behind, and politically powerless. Core regions often borrow the economic resources and capacities of periphery regions, which puts them in a precarious position, making them susceptible to a variety of problems such as unemployment.

Wallerstein (1974, 1998) is the one who devised the world-system theory, and it is he who seeks to explain the three zones in economic and political geography. According to the theory, the core areas are the districts or states that not only have concentrated wealth, innovation, and economic resources, but also have dense population and a clear identity. This is something that Friedmann and Wolff both pointed out. Because of the financial and economic flows that are directed toward them, the centers foster migration patterns on a regional and international scale. Even economic policies frequently lean toward serving the core regions' best interests. They ultimately become the primary focal points of accumulation. However, when viewed from the perspective of spatial dynamics, the creation of new economic opportunities, in conjunction with incentive governmental policies, has the potential to drive the establishment of new cores (sometimes referred to as new geographies of production) (Stadel, 2009).

The uneven distribution of (1) natural resources and (2)

economic pressures that come from human actions are two possible causes of such spatial imbalances. Both of these causes are the result of human activity. Scholars have recently focused their attention on economic forces that have the potential to generate a substantial permanent imbalance due to the fact that the first plausible cause does not provide a reasonable explanation for what happened following the Industrial Revolution (uneven development). A number of different academics, in an effort to provide answers for the theories, have established their own theories to explain the phenomenon. In detail, regional economic theories of concentration and diffusion attempt to explain the dynamics of the economic growth process and the development of spatial hierarchy (Malizia & Feser, 1999).

The Growth Pole theory, which was created by Perroux (Perroux, 1950a, 1950b), is considered to be one of the most important theories in reference to uneven growth since it places an emphasis on the "dominant influence." The "asymmetrical" power and experience differences between actors are the primary cause of this impact (Meardon, 2001). To put it another way, the primary actors can act as propelling industries and produce growth impulses, which together make up growth poles in the economic space. The theory does not demonstrate spatial hierarchy; but, it does describe exactly how, why, and where growth poles occur, which might be viewed as unequal development. Friedmann (1969) also emphasized the uneven organization and distribution of territorial "power" between the core and periphery. He says that "it is necessary only to point out that core regions possess the means for limiting and controlling the development of their peripheries and for extracting from them the resources that will contribute to their own accelerated growth. This imbalance of power between the core and periphery, which displays a strong tendency to increase over substantial segments of the development path, will naturally lead to social and political tensions. Where these tensions cannot be depressed to tolerable levels, they eventually undermine the stability of the system and its ability to generate further development" (Friedmann, 1969, p. 14).

Furthermore, Gunner Myrdal (1957) elaborates on the uneven development practices by presenting cumulative causation theory. Simply put, the theory suggests a "vicious cycle" that creates a cluster of activities and causes regional inequalities. In other words, while core regions exert self-reinforcing advantages, peripheral regions experience the adverse effects (MacKinnon & Cumbers, 2018). Once a region starts to grow due to new industry, supporting industries with various inputs, services, and capabilities move into the region. The expansion of economic capabilities and population creates additional revenues, which, in turn, provides better infrastructures. Myrdal identifies two effects in the process: (1) backwash effects and (2) spread effects. Backwash effects mean that the attractive regions exercise agglomerative power and absorb labor, capital, and resources from surrounding regions. The spread effects mean that areas proximate to the core region enjoy opportunities to supply its growing market. Since the region's pull factors lead to continued economic growth and create perpetual "backward" regions, government intervention is needed to counteract the dynamics behind regional inequalities.

The idea of geographical growth centers was given a theoretical framework by Albert Hirschman (1958), who established the imbalanced growth hypothesis. The crux of his theory is that, while polarization is unavoidable in the early stages of economic expansion in the short term, "trickle-down effects" will eventually begin to level out regional disparities. As a result of this unequal growth, major businesses will eventually relocate to regions that are more underdeveloped and peripheral; hence, it will not be required for the government to intervene in order to restore spatial hierarchy (Friedmann & Weaver, 1979). Also, one interesting theory that implies uneven development is the 'selection effect' and 'sorting effect' (Baldwin & Okubo, 2006). The heterogeneity of enterprises is included into the new framework for economic geography by the theory. The core locations are hypothesized to be those that attract highly productive enterprises, while the periphery regions are predicted to be those that attract firms with lower levels of productivity. Companies with high levels of productivity typically have lower marginal costs, a greater demand for their products, and are able to successfully compete in marketplaces with high levels of competition. To put it another way, the theory suggests that the core regions are magnets for high-productivity enterprises, which in turn boosts the core regions' regional competitiveness and productivity. On the other hand, because less productive businesses are often

hurt by the increasing rivalry in the core region and move to the periphery, the average productivity in the region will invariably decrease.

In addition, path dependency theory is one crucial dimension in uneven development that needs to be elaborated on in this paper. Product-cycle theory mainly presents the "ecological" dynamics of the growth process, which clearly shows the modification of inter-regional development patterns over time (Malizia & Feser, 1999). In product-cycle theory, path dependence is one of its potential outcomes when increasing returns fail, and equilibrium fails to materialize. "Path dependent process or system is one whose outcome evolves as a consequence of the process's or system's own history" (Martin & Sunley, 2006, p. 399). The theory illustrates how path-dependent regional development trajectories can change over time. As a product matures, it becomes standardized, thereby initiating exports to less-developed regions. As a result, the core regions enjoy a development path with sequential phases of positive 'lock-in' (Martin & Sunley, 2006). When the production process is standardized, both more developed and less developed regions can produce the product. Moreover, during the maturing-product phase, the production exceeds consumption in more developed regions. As a result, since firms find locating production in the less developed regions profitable, they move and export back to the more developed region. During these phases, the more developed region, the once-core region, faces a development path in which positive 'lock-in' becomes negative 'lock-in.' However, the once-core regions still have important functions.

Differently, the Marxian school contends that the inherent structure of capitalism causes and sustains the structural inequalities that lead to uneven development patterns. This view is supported by the Marxian school (Smith, 2010; Rubara, 2014). The uneven distribution of "use-value" in space is the systemic result of capitalist development, which can be seen as the uneven growth that occurs under capitalist conditions (Walker, 1978). In particular, the differentiation of space is brought about by rivalry in the capitalist economy, as well as class strife and inequality. Harvey emphasized the importance of understanding the dialectics between territorial and capitalist logic in order to make sense of unequal progress (Harvey, 2003). David Harvey is a prominent figure within the Marxist school of geography.

He is an influential academic who discusses aspects of the production of space within the framework of capitalism, such as uneven geographical development. Das (2017) categorized Harvey's arguments on uneven development in six theses: (1) spatial concentration thesis, (2) spatial dispersal thesis, (3) spatial fix or surplus absorption thesis, (4) uneven geographical development-as-ideology thesis, (5) uneven geographical development and the state connection thesis, and (6) uneven geographical development-associated political thesis. Particularly, the first thesis, the spatial concentration thesis, explains that economic advantages, including decreased travel time and cost, help to generate a few specialized economic regions.

Through cumulative causation mechanisms, spatial concentration leads to an uneven regional concentration of wealth, power, and influence. The spatial dispersal thesis argues that centrifugal forces such as traffic congestion and increased land value limit continuous concentration, contrary to cumulative causation theory, which is not an especially Marxian perspective. Harvey states that "the near elimination of transport costs and times as a factor in location decisions permits capital to explore differential profit opportunities in widely disparate places … Regional specializations and divisions of labor become even more marked because small differences in costs (such as local taxes) translate into higher profits for capital" (Harvey, 2014, p. 148). The quotation is a key point in the Marxian framework because it suggests that capital mobility is primarily about the imperative for the system to reproduce in the context of competition and declining profits. The spatial fix thesis states that even if capital wants to flow freely in space and time, the production of new landscapes still requires the development of new physical infrastructures. This is the case even if capital wants to freely circulate in space and time. Increased capital mobility and an intensification of capitalist spatial penetration are both results of increased regional interconnectivity through transportation and communication infrastructure (Walker, 1978). However, because of the required budgets for the infrastructures, capital is fixed in the core regions, at least in terms of the built environment. This means that only core regions can enjoy a development path with sequential phases of positive 'lock-in,' which in turn means that only core regions can enjoy a positive 'lock-in' situation (Martin & Sunley, 2006). Once a specific

amount of capital has been secured within the core regions, it will no longer be free to transfer to other areas. The inequitable development practices that already existed are then preserved until there is a crisis. Although the movement of capital is necessary to satisfy requirements, this process invariably results in the destruction and devaluation of "once" core regions, which in turn creates tensions between geographical areas.

The relationship between transportation and uneven development has received a far smaller amount of attention from researchers. According to the central place hypothesis, all regional systems feature a well-established spatial hierarchy, with a select few cores serving as the primary nodes. Within the context of such an illustration of the spatial organization, transportation is of utmost significance due to the fact that it establishes the travel cost, the level of accessibility, and the distance between locations (Rodrigue, 2020). In addition, it is general knowledge that the rates of transportation, the length of the journey, and the degree of accessibility differ from one place to the next (Hay, 1973). Because of these geographical differences, different locations may have varying degrees of economic capability. Because core regions often have superior economic capacities in terms of transportation, it is believed that transportation is a component that promotes polarization and uneven growth. This is due to the fact that core regions typically have better transportation. Specifically, in order to take advantage of economies of scale, the production of manufactured items will take place at a condensed number of locations (Krugman, 1991b). If all other factors remain the same, the sites that have a reasonably high demand in the immediate area will be given preference. This is due to the fact that manufacturing near one's primary market reduces the amount of money spent on transportation. After that, service will be provided to other places for these strategically positioned sites. For example, areas that have a high accumulation of flows and transport infrastructures, such as maritime shipping and air freight distribution, have the potential to become major nodes in the spatial organization that structures an environment that encourages the geographical concentration of economic activity. In other words, the process of economic development is uneven, with the core benefiting first because they can seek the provision of services and products in a cost-effective manner, while the periphery

eventually becomes absorbed in a system of flows. This is because the core can seek the provision of services and products in a manner that is efficient. In addition, Krugman (1992, 1999) centered his attention on the connection between the cost of transportation and the geographical differences that occur when exchanging items. He suggested that the endogeneity of transportation costs plays a significant role in the development of the manufacturing belt and that this role is vital. The fall in the cost of transportation entails advantages that reinforce themselves and encourages the concentration of population in a few places. To be more specific, as the cost of transportation continues to fall, regions that have dense railroad or highway networks connecting regions have a competitive edge over other regions when trading products, which ultimately leads to regional differentiation. As the costs of transportation continue to fall, businesses aim to either secure their positions in "still" core regions or establish "new" core regions that are more lucrative.

IV. Connection between High-Speed Rail and Uneven Development

One question that is connected to this topic is the following: what kinds of economic repercussions would semi-peripheral and peripheral areas experience as a direct result of large transportation improvements, namely high-speed rail (HSR)? According to Fujita and Thisse (1996), economic geography contains a phenomenon known as the multiplicity of equilibrium. This phenomenon states that even minute shifts in regional characteristics, such as socioeconomic environments, built environments, and transport networks, can alter the nature of a cumulative and self-reinforcing process that occurs in regions. In this perspective, HSR has the potential to bring about regional economic growth not only in core regions, but also in semi-core and peripheral regions as a result of greatly increased accessibility and decreased time-space distances (Chen et al., 2019). It is possible for it to bring up two theoretical assertions on the effects that it has on the economy: (1) to ameliorate or restructure unequal development, and (2) to intensify regional hierarchies (also called the straw effect) (Zhang et al., 2019). This section analyzes and summarizes the empirical research that has been published.

One body of empirical studies contends that the periphery stands to gain from the development of HSR as a result of improvements in accessibility to non-local markets and core regions brought about by the construction of transit infrastructure. In the short term, HSR increases accessibility and connectivity between regions (Ortega et al., 2012; Shaw et al., 2014; Kim & Sultana, 2015). This directly contributes to a reduction in the amount of time spent commuting, a reduction in the amount of time spent traveling for business, an improvement in product and material delivery, and an increase in industrial productivity (Wetwitoo & Kato, 2017). Long term, it has the potential to restructure regional hierarchy since it has the ability to expand consumer and worker markets, modify patterns of land use, and boost the possibility for economic competitiveness. It may be beneficial for businesses and individuals to locate on the peripheral since they are able to reap the agglomeration benefits of core regions without having to bear the economic and social expenses of those core regions. In other words, HSR has the potential to offer a wide range of geographic possibilities via enhancing market integration. Therefore, politicians and transportation agencies take into consideration this mitigating role in order to facilitate the economic expansion of cities on the periphery by connecting them to megacities.

Another perspective on this connection is provided by New Economic Geography (Krugman, 1998), which suggests that HSR has the potential to rebalance the relationship between centrifugal and centripetal pressures. Because of this, the two forces work together in a way that is both simultaneous and dynamic. To put it another way, HSR has the potential to produce what is known as the redistribution effect. To be more specific, the centrifugal force, which is also known as the generative and agglomerative force, has the ability to concentrate economic resources and activities in core locations (Shaw et al., 2014). However, centripetal forces have the potential to counteract the effects of agglomeration, which are also known as diffusion effects. Rising property values, traffic congestion, and the cost of living may encourage businesses and households to relocate from core regions to semi-core or peripheral regions that are involved in HSR networks (Zheng & Kahn, 2013). Zhang et al. (2020) discovered that between the years 2007 and 2017, gradual progress was made toward achieving a balanced level of economic development at the national level. It is interesting to note that even though they saw beneficial benefits on leveling off regional disparities in development at the provincial level, those positive effects diminished as the amount of land covered by HSR did. Additionally, Chen and Haynes (2017) discovered that regional economic imbalance in China has shrunk as a result of the growth of HSR. As a result of the territorial accessibility and locational advantages that were reshaped by HSR, it is reasonable to anticipate that it will cause a distribution of population and economic capabilities from core regions to the periphery, as well as further stimulate economic interaction and prosperity in regions that are involved in the transit network (Tsai et al., 2020).

A body of previous literature suggests that high-speed rail networks may drive the so-called siphon effect as well as stimulate spatial disparity. The decrease in travel costs and the amount of time required for inter-regional transportation can potentially strengthen the agglomeration pressures that are directed toward core regions and lessen the dispersion forces that are directed toward periphery regions. In a nutshell, high-speed rail has the potential to bring about two distinct types of spatial inequality: regional uneven development (1) between regions involved in the HSR network and others, and (2) between core and surrounding regions where both are included in the transportation network. The first body of literature, which has illustrated intensification of uneven development between regions involved in the HSR network and others, conducted research that compared the core to the regions immediately surrounding it (Meijers et al., 2012). Companies are able to serve markets that are further away when the expenses of transportation are reduced. In this scenario, the connectivity across regions A, B, and C provided by HSR drives enterprises in regions D and E to compete against one another in a harsh environment. Companies are becoming more aware of the potential benefits of relocating to core regions that are participating in HSR networks due to the existence of agglomeration economies. As a direct consequence of this, peripheral regions suffer a decline in their economic capacities and levels of competitiveness, whilst core regions continue to build upon their existing strengths. Meng et al. (2018) conducted an empirical study to explore the influence of high-speed rail on the allocation of economic resources at the county level in China. When compared to

counties that did not have access to HSR services, they discovered that overall, high-speed rail contributed to the economic expansion of regions that were already equipped with HSR stations (the average promotion effect on regional GDP was 14%). Counties that were fewer than 110 kilometers away from HSR stations saw slower economic growth, while counties that were more than 110 kilometers away from HSR stations did not see any influence on the allocation of economic resources. Yin et al. (2015) came to the conclusion that high-speed rail can present new economic disadvantages to cities that are not served by HSR networks while simultaneously introducing new locational advantages for cities that are connected to high-speed rail. The findings led the researchers to the conclusion that HSR could even cause serious polarizing effects. Qin (2017) offered empirical evidence on how high-speed rail altered urban peripheral patterns in China. He discovered that counties without HSR stations faced lower GDP and GDP per capita than those counties that did have HSR infrastructures. The findings suggested that there is a growing discrepancy between the core and peripheral regions as a result of the growth of HSR. Before and after the High Speed Rail (HSR) development in Europe, Spiekermann and Wegener (1994) developed the space-time map. They contrasted it with the first map in order to demonstrate how the compression of time and space affects the redistribution of economic resources. They brought out the fact that high-speed rail simply connected major cities, whilst other locations whose accessibility was significantly reduced became new periphery territories. Sasaki et al. (1997) conducted research in Japan to investigate the effects of high-speed rail's (HSR) spatial dispersion on economic activity and population. They came to the conclusion that the degree of dispersion from a few core places did not increase significantly to the point where it could resolve excessive agglomeration. Tsai et al. (2020) evaluated the distributional impact of HSR in Taiwan in terms of population and employment at multiple levels and scales of spatial organization. According to the findings, municipalities that participated in HSR networks saw an increase in both their population and employment levels. In addition, the location of HSR stations in either urban or suburban areas played a significant part in the successful recruitment of people to live there. The second body of literature, which has illustrated intensification of uneven

development between core and surrounding regions where both are included in the transportation network, investigated the differences and similarities between core regions and regions that are part of the HSR network. The findings have been contradictory; although some publications have proven that regions A or C will rob region B of its economic resources and activity, other papers have showed that there will be dispersion or spillover effects. Ureña et al. (2009) looked at how high-speed rail created new economic opportunities for intermediate cities between France and Spain. On the one hand, this research was conducted in Spain and France. According to the findings of the case study, intermediate cities attracted middle-level businesses, technical consulting firms, congresses, tourists, and various types of seminars and exhibitions as a result of increased accessibility between major metropolitan areas and the influence of HSR passengers. On the other hand, Jiao et al. (2020) discovered that the benefits of high-speed rail on the economies of core cities and the cities that surround them were large and favorable. To put it another way, cities that are geographically closer to their respective metropolitan centers have the potential to experience more noticeable economic benefits, whilst cities that are further away from the centers tend to suffer less obvious economic consequences (Chen et al., 2019). Wetwitto and Kato (2017) also discovered that the effect size of high-speed rail (HSR) on economic productivity was larger in regions that had HSR stations located within a 150-200 kilometer radius of the largest cities than it was in other regions. This was the case despite the fact that the effect size of HSR on economic productivity was the same in both groups of regions. It is interesting to note that the influence of HSR was diminishing with time, which may suggest that as further HSR networks were constructed in the underdeveloped regions, the marginal impact on economic production was less prominent than it had been in the past. According to the findings of a study that was carried out by Diao (2018), the accessibility benefits of HSR were not dispersed uniformly over space in China. More specifically, cities in the eastern area benefited more from HSR than other cities in periphery regions. In addition, the study discovered that in comparison to smaller cities, HSR cities with higher populations witnessed a more significant increase in the investment of fixed assets. The impact of high-speed rail on the spatial dynamics of China's

knowledge-intensive economy was the primary point of emphasis for Wang et al. (2020). They discovered a statistically significant and favorably correlated relationship between the frequency of HSR service and the expansion, concentration, and specialization of KE employment at the national level. Additionally, a beneficial impact was seen in the prosperous eastern region, although the effect was only slight in the regions with lower levels of development (central and western regions).

A handful of research have pointed to the fact that the effects of HSR on regional hierarchy are marginal. For example, in Vickerman's (2015) research, intermediate cities in Europe were investigated to see whether high-speed rail (TEN-T) stimulated regional economic growth. According to the findings of the study, the growth of transportation did not help to ameliorate the uneven development of the region because its economic consequences were much more muted. Although some cities are able to take use of these new prospects, many others are unable to do so due to the fact that HSR stations are often situated in remote areas that have weak connections to local transportation networks and are far from urban centers. In light of the fact that the transportation infrastructure did not automatically bring about economic benefits, they came to the conclusion that HSR could merely serve as an alternative in situations where other modes of transportation, such as airplanes and automobiles, are not suitable for traveling a certain distance between 200 and 600 kilometers.

One critical aspect of HSR impact is the consideration of space heterogeneity. A body of studies has subdivided the effects of HSR on regional economic growth from heterogeneous spaces. The New Economic Geography helps understand the influence of transport cost mechanisms on the core-periphery dynamic. However, this theory relies heavily on the hypothesis of homogeneous space, which is unrealistic (Sheppard, 2008). In this context, few studies have attempted to introduce non-homogeneous space based on the New Economic Geography theory to explain how HSR influences the economic growth paths of regions differently. The hypothesis allows to examine different opportunities in different cities and distinguish agglomeration and spillover effects. Most empirical studies have supported that HSR development can have spatial selective effects on generating and redistributing economic activities. Under the hypothesis

of non-homogeneous space, Jia et al. (2017) found that overall, HSR in China positively influenced economic growth and reshaped spatial hierarchies. More importantly, the effect is different based on different HSR lines. The Beijing-Guangzhou line positively impacted the GDP per capita of HSR cities, which in turn increased regional economic disparity. However, the Beijing-Shanghai line negatively affected the GDP per capita of HSR cities and reduced the gap between HSR cities and non-HSR cities. A study conducted by Huang and Xu (2021) revealed that HSR impact on economic growth showed significant spatial heterogeneity; that is, while the positive impact was observed in the western regions of China, inhibitory effects were found in the eastern regions. A research team also evaluated the performance of HSR stations as an economic development strategy (Kim et al., 2018). The node-place index suggested that underperforming HSR stations were generally remote from urban centers and showed weak integration with local transportation modes. The results implied that a spatial economic hierarchy is unlikely to be restructured without carefully considering varying station locations' different conditions and contexts. Under the right conditions such as proximity to the core regions, proximity to urban centers, local transportation accessibility, and economic capabilities to integrate into the economy of nearby core regions, region B can achieve economic growth due to HSR development (Garmendia et al., 2012). Moreover, Willigers and van Wee (2011) suggested that HSR development along with other attractive characteristics such as economic structure, leisure facilities, airports, planning interventions, and availability of affordable land affect decisions to relocate firms and households to semi-core or peripheral regions. Therefore, the results suggest that HSR development with existing high regional economic competitiveness has a combined effect on generating more economic growth. Existing economic regional conditions can play a significant role in creating new spatial hierarchies.

V. Conclusion

This review paper attempted to (1) synthesize how transportation contributes to the creation of uneven development and general theories surrounding uneven development; (2) review empirical findings to determine whether

or not HSR mitigates the long-standing uneven development; and (3) offer future research directions. The main finding is that there are two conflicting viewpoints on whether HSR promotes the economic growth of periphery regions. Specifically, one research stream has suggested that HSR can facilitate economic convergence because it can improve accessibility and connectivity across regions, develop market potential and integration, and foster economic exchange between core and periphery regions. However, a general body of research has shown that due to HSR-reshaped territorial accessibility and locational advantages, HSR tends to favor core regions and harm peripheral regions (also called the straw effect). HSR allows core regions to attract factors of production and consumption such as skilled labor, additional economic investments, and amenities. In contrast, peripheral regions may merely become dormitory affiliations of the core regions and lose economic vitality (Wang et al., 2020).

Although there is a growing research interest in the impact of HSR on the spatial hierarchy (Chen & Hall, 2012; Diao, 2018), some limitations need to be addressed in future research. To begin, in terms of research areas, not a single one of the studies has carried out a case study in the setting of the United States. This is due to the fact that suitable HSR service has not yet been built in terms of travel speed. However, additional research needs to be done using this case study in order to determine whether or not the Acela network that links Washington, D.C. and Boston can be classified as a HSR network. The case of the United States can be especially fascinating since the research can provide an answer to the question of whether or not the direct economic effects of new transportation infrastructures can be significant in economies that are already developed. Because existing transportation networks have reached their full potential, the accessibility, travel times, and costs will not be greatly altered by newly constructed infrastructure (Giuliano, 1995) To be more specific, the value of these lowered expenses must be greater than the cost of relocation in order for there to be a relocation following a generalized drop in travel costs. There is a little probability that increased connection capacity will result in significant savings in travel costs in a well-developed network such as those found in the majority of current metropolitan areas. This is true even in major cities. Therefore, additional research is required to

investigate whether or not high-speed rail has a major impact on economic growth in developed economies such as the United States. Second, when heterogeneous space is taken into consideration, it is possible to identify numerous prospective future study topics. Additional research is required to investigate the implications of high-speed rail on the reorganization of regional economic hierarchy from the viewpoints of different stages of regional development. To be more specific, the magnitude of the economic effect could change depending on these variations. For instance, the effect of HSR on economic growth may be seen in places that are currently undergoing favorable forms of development. Third, there is a limited understanding of the economic impact at the disaggregated level in terms of the many types of industrial sectors. For instance, some service businesses located in smaller cities may achieve higher economic outcomes, despite the fact that the aggregate level of economic growth may not be particularly noteworthy (Albalate & Fageda, 2016) Therefore, additional study is required in the future to investigate the locational choice of enterprises from the standpoint of unequal development. The fourth step is to provide answers to further specific inquiries. For example, what kinds of extra policies are going to be most effective in bringing about the goals of increased economic growth? Despite the fact that HSR has the potential to be a significant engine of economic expansion, it can also facilitate economic progress, particularly in more developed economies (Meijers et al., 2012). Thus, additional research is necessary to add to the existing body of literature in order to gain a better understanding of several factors that are included in the complex dynamics of regional economic development. These factors include the other economic capabilities of the region, as well as political and institutional conditions. Is the construction of expressways and high-speed railroads more productive than the construction of other highways and trains when the same amount of investment is made in each project? In addition, does the presence of HSR networks important for growth performance? If not, does the degree of service provided by the transportation infrastructure, including its frequency and speed, make a difference? In addition, any future empirical research needs to make a distinction between the short-term and the long-term consequences on the economy (Chen et al., 2019). In empirical investigations, these prob-

lems have not been well addressed, which is an oversight that could have very severe repercussions.

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