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Comparison of major air freight network hubs in the U.S. and China

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ABSTRACT

The increase in global economic connectivity spurred by ties between Chinese manufacturing and a global market, particularly in high value low weight goods, pushed establishment of air cargo networks. These remain under-examined but impactful particularly for second and third tier metropolitan hub cities. This research looks at the air freight connections within China, a major rapidly developing trade center, and use of the aerotropolis concept to accelerate growth in the lagging inland region. References are made to FedEx and UPS networks within their U.S. headquarter region and in China to note differences in political economic contexts and China's adaptation of developed world models. The theoretical framework includes global production networks strategically coupled by transport logistics linked to aerotropolis type development. Data comes from government aviation and transportation sources, research analyses, corporate and industry reports, and interviews with Chinese officials. Focus falls particularly on Zhengzhou, capital of Henan Province in central China and the country's first airport-centered economic zone. The conclusion finds that Chinese hub cities more closely correspond to major manufacturing and population centers and central policy directives for development dispersion.

1. Introduction

Commodity flows through air freight centers constitute an economically notable aspect of globalization. The trade-off of higher cost for faster speed favors high-value, technology-infused, low weight air cargo such as computer and medical goods, as well as time-sensitive items such as clothing and biological shipments (Ensign, 2014). Air cargo transport systems nevertheless remain under-examined in both theory and case studies (Bowen, 2004, 2012; Hesse and Rodrigue, 2006). The following study considers China's creation of an Airport Economic Zone at Zhengzhou (ZAEZ), capital of central Henan Province, as an experimental zone for an air cargo production and logistics-based economy. The pattern of leading U.S.-headquartered cargo companies FedEx and UPS is referenced as is the aerotropolis model of urban airport-centered development since both are central to Zhengzhou's aspirations (The Economist, 2015; personal communications, Zhengzhou development officials 2015).

This study hypothesizes that the locations of major air cargo integrators reflect development strategies in places targeted for transit-oriented activities as a tool to drive growth, particularly in lagging inland regions. Utilization of hub cities to strategically couple local economic strengths (particular products or services) within their related global production network (GPN) illustrates the further assertion that despite spatial pattern similarities, differences in air freight networks arise from the roles played by individuals and companies in the U.S. compared to the role of governments in China. This allows China to speedily implement ideas and examples from the U.S. to improve hub modernization and connectivity to these networks whose spatial fragmentation drives the restructuring of China's air freight network (Hui et al., 2004). At China's current stage as a rapidly developing economy, government policies accelerate the speed of integration by encouraging targeted foreign direct investment (FDI) to enhance export trade, strategically coupling local firms with global integrators, suppliers and markets (Mackinnon, 2012, 2013).

Networks globalize and accelerate the development trajectory of areas with a well-integrated intermodal transportation infrastructure location conducive to distribution functions, particularly in a nation's interior region. These cities frequently function as cross-docking sites where goods are sorted and redirected to various destinations via land-based infrastructure connected to a regional airport. Spreading development into less prosperous

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regions expands spatial and policy impacts of air freight network locations. Hubs may be supplemented by functioning within a larger scale aerotropolis: "a new urban form where cities are built around airports speedily connecting time-sensitive suppliers, manufacturers, distributors, and business people to distant customers, clients, and marketplaces" (Kasarda, 2013; aerotropolis.com).

China seeks to geographically spread the benefits of its manufacturing prowess by building new facilities for shipping cargo by air, rail and roadways linked to global as well as domestic markets. Placing the country's first aerotropolis-centered economic zone in central China forms an integral part of the country's continuing geographic strategy of initially developing the east coast, followed by the western and now the central regions (Fan, 1995). Airfreight network locations assist urban economic growth based on a variety of similar factors including the established relationship between air cargo volume, GDP per capita, and growth in higher skill producer services (Oster et al., 1997; Bowen and Leinbach, 2003; Kay, 2004; Kasarda and Green, 2005; Alkaabi and Debbage, 2011). The exact relationship defies measurement due to data suppression at many sites, but one study of four FedEx hub metropolitan areas calculated the multiplier effect of an air freight hub to be around 1:3 (Oster et al., 1997). This is less than the multiplier for manufacturing but still notable, particularly in areas seeking to establish a new economic base or build higher skill level extensions of the existing base.

U.S. network examples noted in this research are related to FedEx's international corporate headquarters in Memphis, Tennessee or UPS′ operational headquarters in Louisville, Kentucky, which is separate from the corporate headquarters in Atlanta, Georgia. China's globally-linked hubs include Shanghai-Pudong (with a new national FedEx hub) and Guangzhou on the east coast. Zhengzhou, capital of Henan province, exemplifies the next-stage push to develop inner China's central region. As in the U.S. air freight centers, this location is well served by rail and road networks but located inland from major shipping ports. The following sections set out the basic data used and the theoretical lens of global production networks enhancing regional development through strategic coupling with air cargo transit networks and aerotropolis development. A concluding discussion summarizes contributions from considering China's move to utilize integrator hubs in order to accelerate regional development.

2. Materials and method

Differences in the data available by various sources often complicate comparisons of countries when diverse items are measured, with varying degrees of transparency. The U.S. air freight network is largely served by FedEx and UPS, the world's two largest air freight carriers (Jermy, 2014). Chinese air cargo data is available for cities but not for separate companies, which tends to support the earlier assertion that companies drive growth in the U.S. but government bodies are the important factor in China. We therefore utilize figures from a range of sources. Numerous ZAEZ development officials were interviewed and studies gathered during two trips in 2015. These are referenced as personal communications.

Comparison of air freight traffic in major carrier cities at five year intervals from 2004 through 2014 shows the rise in prominence of Asian centers, with Hong Kong taking over from FedEx center Memphis since the Chinese port serves as a major entry point for three global carriers (Table 1). Two main advantages contribute to the success of Hong Kong (Fu, 2013). Hong Kong is an important bridge connecting Europe and America with other Asian countries due to its central location in Asian-Pacific region. Second, nearby manufacturing centers in the Pearl River Delta ensure the supply of air cargo. Hong Kong is not included in the following Tables and Figures reflecting predominantly Chinese government-driven domestic development.

Table 1
Top world airports in the U.S. and China based on global air cargo carried, 2004–2014.

City	2004 Rank	2009 Rank	2014 Rank	%Change, 13–14
Hong Kong	2	1	1	2.3
Memphis	1	2	2	4.0
Shanghai	14	3	3	8.6
Anchorage	4	6	5	−0.7
Louisville	12	7	7	2.7
Miami	9	12	12	5.1
Beijing	26	14	14	2.0
Los Angeles	6	13	15	2.3
Guangzhou	NA	21	18	11.0
Chicago	13	19	19	9.9
Additional China only ranking				
Shenzhen	4	4	4	5.5
Chengdu	5	5	5	8.7
Hangzhou	8	7	6	8.3
Zhengzhou	25	20	7	44.9

Source: Airports Council International, http://aci.aero; www.transtats.bts.gov; Civil Aviation Administration of China, http://www.caac.gov.cn/I1/K3/201504/t20150403_73469.html.

Rapid growth of the new Pudong airport in Shanghai propelled it to a steady third (from 14th) place. While FedEx hub Anchorage outranks UPS center Louisville, larger cargo airplane size permits longer flight times between refueling and will impact Anchorage's trans-continental centrality as a collection and distribution hub, shown in the negative percent change (Bowen, 2012). U.S. air cargo hub cities frequently differ from busy air passenger sites. Over the decade Beijing soared from 26th place to outrank Los Angeles, as did south China manufacturing center Guangzhou. Shenzhen and Hangzhou play supplementary roles as sub centers in the Pearl and Yangtze River deltas. Chengdu, west China's leader, was fifth in national rankings since 2004. As an emerging hub in central China, Zhengzhou considerably raised its position from 25th in 2004 to 7th in 2014, with an annual growth rate of over 40%.

A rapidly developing country with strong global oceanic trade and rail shipping links but relatively weak domestic highway and air accessibility, China works to extend infrastructure ties to inland areas and promote locational efficiency. Hong Kong SAR serves as the Asian regional hub for the three main global airfreight companies of FedEx, UPS, and DHL. Nearby Guangzhou and Shenzhen replaced the Philippines as Asia/China centers in the first decade of this century, capitalizing on proximity to Hong Kong and the manufacturing 'global factory' concentration in the Pearl River Delta. Overall, China's hub city distribution exhibits major strength in established east coast cities, plus the rise of Zhengzhou in the central region.

3. Strategically coupling global production network s and aerotropolis development

Air cargo pathways in the global network of distribution encourage regional economic development by connecting suppliers, producers, and consumers (Coe et al., 2004). The framework of global production networks (GPN) links actors to consequent economic impacts on contingent regions that their activities shape and integrate (Sturgeon, 2000; Henderson et al., 2002). However, this picture critically downplays the role of goods transporters. Holes in the research literature need to be spanned by examining the strategic coupling of firms and regional development, network dynamics, globalization, and transportation arrangements along

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