Concentration and Decentralization: The New Geography of Freight Distribution in U.S. Metropolitan Areas

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Abstract

This paper examines the suburbanization of warehousing and trucking activity within U.S. metropolitan areas between the 1980s and the present using Gini indices as a measure of concentration. While historical work exists on the relocation of transportation and warehousing activity to suburban locations, there has been little to document the most recent shifts in warehousing and logistics. This research does so via spatial analysis of Economic Census data, finding that while most U.S. metropolitan areas have experienced decentralization in the spatial distribution of freight-related activity, there is also some growth in core counties, indicating that a more complex process is going on than simple suburbanization.

Keywords: freight, distribution, warehousing, suburbanization; Gini coefficient

1.1 Introduction

Warehousing and trucking in the U.S. have shifted from their historical central locations to the suburban fringe over the last few decades due to major changes in the global logistics industry and other factors common to all suburban growth. The need for more space and easier transportation access to road, rail, and air has led to a shift towards intermodal logistics centers which require large amounts of land on the metropolitan fringe, further encouraged by the desire for lower taxes and newer infrastructure. At the national and regional levels, there has been a change in the spatial organization of the freight distribution sector, from the concentration of maritime traffic in fewer but larger ports to a shift towards inland "ports" as the sites of growth in order to alleviate congestion at terminals. At the same time, many metropolitan areas are experiencing dramatic growth along their suburbanizing edges in terms of freight distribution and intermodal activity, signifying an outward shift from the traditional central city.

At least this is the theory. While historical work has been done on the location of transportation and warehousing activity (Eaton 1982, McKinnon 1983), there has been little to document the most recent shifts. In particular, while decentralization has been theorized by a number of different scholars, “empirical studies on the extent of this trend are rare” (Hesse, 2007, p. 6; see also Rodrigue, 2006b). Those that do exist are almost entirely in the context of the consolidation of activity within the European Union (Cabus and Vanhaverbeke, 2003, Hesse, 2004, Riemers, 1998), which is significantly different from the U.S. in terms of urban form and the geography of freight distribution.

This paper provides such an empirical study via spatial analysis of Economic Census data for fifty of the largest metropolitan areas in the U.S. from 1986 to 2005. Gini coefficients expressing the degree of concentration of freight establishments at the county level within metropolitan areas were calculated and followed by multiple regression analyses to explain the results. Based on existing literature, the hypothesis is that decentralization of freight activity at the metropolitan level is occurring nationwide. We would also expect decentralization at the national level, with the Ohio River Valley in particular likely to be growing more rapidly in terms of the number of freight establishments than coastal cities are.

The analysis presented here outlines national trends in the location of warehousing and logistics activity. The results have important implications for transportation planners, showing how the forces driving transportation demand are no longer contained within metropolitan areas as they once were, driven now by national and even global components. But it also points out the importance of considering the factors of individual places, as there are important exceptions to many of these trends. The paper starts with a review of the literature on the geography of freight distribution, followed by an explanation of methods. The results of the data analysis are then presented, first for the number of freight firms and then for their spatial concentration. The conclusion summarizes the implications for policy.

1.2 Literature review

Rodrigue (2006b) is correct to say that transport geographers have neglected not only freight, but freight in the urban context. In particular, as Bowen (2008) has recently observed, the location of warehousing and freight activities within metropolitan areas has been understudied despite recent attention to logistics and distribution. While many transport geographers have an understanding that urban goods distribution is sprawling into exurban areas, there has been little empirical verification of this idea.

Historically, the location and volume of warehousing and freight distribution have been dependent almost entirely on the population of a metropolitan area. As a result, population growth and freight growth have gone hand in hand (McKinnon, 1983). Generally speaking, most of the factors in the location of warehousing activity are similar to any other industry: "proximity to customers/clients, reasonable real estate costs, access to interstate highways, availability of appropriately skilled workers, and reasonable costs of doing business” (Glasmeier and Kibler, 1996, p. 740). Historically within the U.S., this meant close proximity to the CBD, to other warehouses and industrial facilities, and to the pre-interstate transportation routes of rivers and rail (Eaton, 1982). As cities expanded outward, warehousing facilities have been thought to respond to these same factors. As many cities, especially in the industrial heartland, changed from production to consumption sites, warehousing and distribution facilities were no longer about storing components or exporting final products, but facilitating incoming flows of goods. Recent changes in technology, including containerization and supply chain management, have led firms to consolidate their activities in one place, which generally means a larger footprint (especially as requirements have changed from multi- to single-story buildings) and a correspondingly greater distance from downtown (Glasmeier and Kibler, 1996).

Whether the derived-demand thesis of transportation has been made irrelevant by the globalization of freight activity (Rodrigue, 2006a) or the nature of the derivation has simply changed from producer-driven to distributor-driven (Hesse, 2007), the fact remains that new warehousing and distribution activity is being located in new kinds of places. Rather than congested dockside or central city facilities, new distribution centers are springing up on the outer edges of metropolitan areas while old, centrally-located warehouses are converted to loft-style condos and art galleries. "[T]he activity space of main ports is increasingly becoming relocated to low cost locations reaching far beyond traditional terminal sites and connecting more distant places of their hinterlands" (Hesse and Rodrigue, 2004). Satellite or inland terminals are forming as some functions are split off from existing ports and transferred to less-landlocked locations (Slack, 1999, Notteboom, and Rodrigue 2005), leading to a new type of real estate market to meet the demand for very large parcels with superb transportation access (Hesse, 2004).

However, this conventional wisdom has been largely confirmed through anecdotes or single case studies. Furthermore, many of the studies that do exist focus on logistics *functions* but not *firms*, an important distinction in terms of both landscape and policy (Aoyama et al., 2006). A number of studies have looked at the location of freight-related activities within a single metropolitan area. Sitivanidou's (1996) study of warehouse and distribution establishments within greater Los Angeles found higher rents for properties that were larger, in closer proximity to market and production locations, had better highway and airport access (but not better port or rail access), and were closer to blue-collar workers. These findings echo Glasmeier and Kibler's as outlined above. Similarly, Woudsma et al.'s (2008) model of logistics-related land uses in Calgary found that access to highways and the airport led to more logistics development while access to the central city was irrelevant. Hesse (2004) found that even when a policy existed to encourage concentration of intermodal freight centers within the metropolitan area of Berlin-Brandenburg and thus reduce truck traffic within the central city, its implementation was lacking.

Bowen's (2008) study of warehousing establishments is one of the few to take a big-picture approach. Looking at changes in the number of establishments between 1998 and 2005, he found that counties within MSAs but outside the central county grew faster in percentage terms than either central counties or non-MSA counties. However, growth for suburban counties was only 11.8% as compared to 10.2% and 9.3% for central and non-MSA counties respectively. Furthermore, the number of establishments added in central counties far outweighed suburban or rural counties: roughly four thousand as compared to two thousand and one thousand, respectively. This suggests that the suburbanization of freight is not as straightforward as has been assumed in the literature. Using ordinal indices of accessibility and a sample of 143 metropolitan counties, Bowen found that access to air, highway, and rail led to more warehousing establishments in a county in 1998 while only air and highway access were significant in 2005. Access to rail and port facilities were not significant.

The current study expands on this previous work in a number of ways. First, it looks at fifty of the largest metropolitan areas in the U.S. rather than one, which will help in understanding whether trends that have been identified for single cities are applicable at a larger scale. Second, looking at a twenty-year time period should incorporate many of the significant spatial impacts of trucking and rail deregulation, including the extent to which firms have shifted location. Finally, it documents the extent to which "urban goods sprawl" actually exists across the country, which is of interest to both central cities and suburbs with regards to the importance of investing in new and existing infrastructure to handle freight traffic. The following section explains the methodology that was used to carry out this study, including data sources and analysis.

1.3 Methodology

This paper relies on quantitative data to determine the distribution of freight transportation-related activity. Because my interest is in warehousing and logistics-related activity, the main variable used is the number of freight establishments within a county, aggregated to the metropolitan level. The classification system of the U.S. Census groups trucking and warehousing firms together under "freight transportation".[1] Nationwide, about 70% of the establishments classified as Freight Transportation are in the trucking sector and about 12% are in warehousing, although warehousing firms are generally much larger in terms of employees and revenue.

[1] Therefore, the term "freight establishments" in this paper refers not only to warehousing but to trucking, distribution centers, waste disposal, and other kinds of firms as explained below.

1.3.1 Data collection

This paper is part of a larger project investigating the suburbanization of warehousing and distribution activity in the major metropolitan areas of the U.S. The most consistently available data source for this information is the U.S. Economic Census. The Economic Census is taken every five years (in years ending in 2 and 7) and is supplemented with County Business Patterns and ZIP Code Business Patterns taken every year. Unfortunately, ZIP Code Business Patterns do not break down the data by detailed enough economic sectors to separate out information on warehousing. Therefore, the County Business Patterns were used to collect the number of establishments by county for 2005 (the most recent available) and 1986 (the earliest available in digital form)[2]. Data were collected for all 3,140 designated counties and county equivalents in the U.S., and later aggregated into metropolitan areas according to the 2003 U.S. Census designation of core-based statistical areas (CBSAs) as explained below.

County Business Patterns data are gathered by individual establishments, not by firms. A freight company that has multiple locations will therefore be counted multiple times, while a firm with all of its operations in the same place will only be counted once. From a transportation point of view, a company with multiple locations is likely to generate more trips between locations than if its operations were all in one place. Therefore, the

[2] In 1997, the Census Bureau switched from the Standard Industrial Classification system (SIC) to the North American Industrial Classification System (NAICS) in order to make cross-border comparisons with Canada and Mexico easier after the implementation of NAFTA. Based on the bridges established between the two systems by the Census Bureau, adjustments were made to the NAICS data (post-1997) in order to keep them comparable with the SIC data (details available from the author on request).

number of establishments is a more relevant means of measurement than the number of firms. Additionally, alternate forms of data such as employment or payroll are not reliably available at the county level for as specific an economic sector as warehousing[3].

1.3.2 Gini coefficients

The Gini coefficient (sometimes called an index) is one of the most common methods for analyzing the concentration of a phenomenon. Originally used for determining how evenly incomes are distributed across a country (Gini, 1912), it has since been used by transportation geographers to compare concentrations of maritime and air traffic over time and across space (e.g., Reynolds-Feighan, 1998; McCalla, 1999; Notteboom, 2006). The Gini coefficient is a number from 0 to 1, with a higher number indicating greater concentration. In order to calculate the index, observations (in this case, counties within a metropolitan area) are ranked in order from highest to lowest (in this case, by number of freight establishments), then cumulatively added and compared to the curve that would result if all observations contributed equally to the total (which would be the line y=x). This coefficient was calculated for 1986 and 2005 for fifty of the largest metropolitan areas in the U.S.

In calculating Gini coefficients, Core-Based Statistical Area (CBSA) definitions were used. A CBSA consists of one or more metropolitan and micropolitan areas as designated by the U.S. Census. CBSAs are collections of counties ranging in size from one to thirty-three. For purposes of this analysis, of the fifty largest CBSAs, those with

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[3] Bowen (2008) notes that there is a 90% correlation between number of establishments and number of employees for those counties for which full information is available.

fewer than four counties were eliminated (e.g., Miami, Phoenix, and San Diego) because the value of the Gini coefficient is suspect for so few observations[4]. Additional CBSAs were added until a total of fifty was reached.

1.3.3 Regression analysis

Multiple regression analyses were carried out to explain the number of freight establishments, the Gini coefficients, and the change over time of both. Table 1 lists the data used as independent variables for each of these regressions, and they are further explained below. The data were collected or calculated at the CBSA level based on 2003 CBSA definitions. In order to reduce multicollinearity, many of the variables were normalized by population as indicated, and stepwise regressions were used. Examination of the residuals indicated normal distribution of all independent variables. Tables in the following section include only the significant regression results.

As the dependent variables, WHFIRMS05 and WHFIRMZ8605 indicate the number of warehousing and freight establishments within the CBSA in 2005 and the change from 1986 to 2005, respectively. Both are taken from County Business Patterns. The Gini coefficient for each CBSA, calculated by the author, is coded as GINI05, with GINIZ8605 representing the difference between 1986 and 2005. For the independent variables, population in each year, population change, and density are represented by POP86, POP05, POPZ8605, and POPDEN, taken from U.S. Census estimates. The total

[4] Linear regression confirmed that of the metropolitan areas chosen, neither the number of counties nor the number of smaller metropolitan areas within a CBSA significantly affected the resulting Gini coefficients.

number of firms in a CBSA is coded as FIRMS86 and FIRMS05, with FIRMSZ8605 as the difference, taken from County Business Patterns. Median household income is coded as INCOME, taken from the Census for the year 2000. The two transportation variables HWYCAP and RRCAP were calculated using ArcMap with the total mileage of U.S. interstate highways or railroads within a CBSA divided by population, with data coming from the National Atlas. The CONTAINER variable was calculated according to a gravity model where the number of containers handled in 2005 at each container port was divided by the square of the distance between the CBSA centroid and each port[5], with the highest resulting value being used. The ENPLANE variable was calculated as the total of all enplanements at airports within the CBSA, based on FAA data. Finally, two independent variables were used to capture characteristics of urban areas: INCORP, the year a central city was incorporated, and CENTDIST, the straight-line direction to the geographical center of the U.S.[6]

1.4 The decentralization of U.S. freight transportation

There are two different components to the results. First, I examine the number of freight establishments in fifty of the largest metropolitan areas across the U.S. and how those numbers have changed over the last twenty years. In which metropolitan areas has the greatest growth occurred, and has the spatial distribution across the country changed?

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[5] Data on ports were taken from the U.S. Army Corps of Engineers' U.S. Waterway Data, including coastal, Great Lakes, and inland ports. There are a total of 9,638 port facilities included in this dataset.

[6] While a variable for market area was considered in terms of the amount of population within a 500-mile radius, this gave unequal weight to cities such as Albany or Syracuse that are within a relatively short distance of a major population center but are unlikely to have large amounts of warehousing activity because of their peripheral location.

Second, I move to the regional scale and look at the Gini indices for those same fifty metropolitan areas. To what extent is freight activity spatially concentrated in central counties? Has deconcentration occurred over the past twenty years, and if so, what might explain it?

1.4.1 The changing geography of freight activity across the U.S.

Figure 1 shows the spatial distribution of freight establishments per capita in the fifty selected metropolitan areas in the U.S. in 1986 and in 2005, using the same break points for both time periods. A simple linear regression indicates that 98% of the variation in number of establishments can be explained by variation in population, so per capita data were used instead. In the mid-1980s, warehousing and distribution activity was fairly randomly distributed, though somewhat concentrated in the West Coast and Midwest. By 2005, there is a strong pattern of Midwestern distribution centers emerging, plus the Pacific Northwest and Piedmont regions to a lesser extent. The trend towards inland ports is clearly visible here.

Table 2 shows the results of multiple regressions carried out to explain the spatial distribution of establishments in 2005. Because many of the explanatory variables correlate highly with population, they were transformed into per capita variables as listed in Table 1. For the number of freight establishments per capita, there were only two significant variables: miles of railway in the metropolitan area per capita, and percentage growth in freight establishments. Cities like Chicago or Kansas City that enjoy high levels of railroad access, as well as cities with a higher rate of growth in freight firms such as Memphis or Oklahoma City, ended up with a higher number of freight firms per capita.

For percentage growth in freight establishments, two variables produced significant results: percentage growth in all firms, and an inverse relationship with median household income[7]. The first result is expected from the strong correlation between population and freight activity. The latter result is also not surprising: given the low-skill nature of most freight-related jobs, they would be expected to locate in cities where low wages predominate, all other factors being equal. As cities in the interior of the U.S. tend to have lower wages than those on the coasts, this further confirms the shift towards inland locations. Median household income can also serve as a proxy for the costs of other factors of production besides labor, including land, energy, and materials. Albuquerque, Memphis, and Oklahoma City all exemplify these trends, with relatively high growth in all firms including freight firms and relatively low per capita income.

In terms of freight establishments per capita, one city in particular stands out. Chicago has significantly more than one would expect based on a simple regression model, largely due to its high connectivity via rail and interstate networks. In terms of percentage growth, it is not at all exceptional, with change in establishments almost directly proportional to change in population. However, when it comes to the *number* of freight establishments added in the past twenty years, Chicago is literally off the charts (Figure

[7] Percentage growth in population was also significant, but as this variable is highly correlated with percentage growth in firms, it was removed from the equation.

2). While most cities have a tight connection between increasing numbers of people and increasing numbers of warehouses, Chicago added nearly three times the number for freight establishments as one would expect. Given that the percentage increase *was* proportional, this reaffirms Chicago's traditional strength in freight transportation. It also suggests more dramatic changes in the landscape here than elsewhere: if proportionately more firms are being added, where are they going within the metropolitan area? The following section explores this question in more detail across the fifty cities in the study.

1.4.2 Spatial concentration of warehousing within regions

One way to look at the changing landscape of freight activity is to see where the greatest change is occurring within metropolitan areas (with very few exceptions, "change" means "growth".) In most cities, the greatest numerical and percentage growth is occurring in a suburban county (Table 3). These cities range from regional centers such as Albany or Greensboro to major metropolitan areas such as Chicago or New York. However, there are also cities where the largest number of establishments was added in the central county, although it was a suburban county that experienced the highest percentage growth. These are medium-sized cities in the South and West, among the fastest-growing in the country in terms of population and businesses but with physically large counties so that suburban-style growth might be taking place within the centermost county. Finally, a handful of metropolitan areas experienced the most growth in both numerical and percentage terms in their central county. It is difficult to generalize across these locations; individual factors such as relative county size in the San Francisco-Oakland

CBSA or the presence of a military base converted to a logistics center in Columbus or Sacramento explain these outliers.

Table 3 suggests that the common understanding about freight activity dispersing to the suburbs is correct. This can be further tested by calculating Gini coefficients. The methodology section above explained the calculation and meaning of the Gini index or coefficient; recall that the higher the index, the more concentrated the activity. Figure 3 maps the values of the index in 1986 and 2005, as well as the changes over time. In the earlier year, we can see that metro areas with warehousing activity most heavily concentrated in the central county are located in the middle third of the country, with the most decentralized cities in the Northeast. By 2005, with the same classification breaks in place, nearly all cities have decentralized to some extent, with Texas cities still the most spatially concentrated. The third map shows that Denver experienced the greatest decentralization, with only three cities centralizing to a small extent (San Francisco-Oakland, where the centralization is actually occurring in Alameda County; Columbus, OH; and Hartford, CT). Table 4 shows the Gini coefficients for all fifty metropolitan areas, sorted by the amount of decentralization over time.

Table 5 attempts to explain the decentralization of warehousing activity within metropolitan areas. With the Gini coefficient in 2005 as the dependent variable, the best model produced an R^2 of 0.685 with five significant variables: percentage growth in population, total firms and freight firms per capita (albeit with opposite signs), highways per capita, and population density. The faster-growing and less dense the city, the more spatially concentrated warehousing activity is within the central county, probably because these tend to be relatively young cities where multiple nuclei of economic activity haven't yet had time to develop. The same explanation holds for the significant relationship between the number of highway miles and the concentration of firms in the central county. Cities with a high number of firms per capita are more likely to have freight activity dispersed throughout their region, which also fits with the multiple nuclei thesis. On the other hand, cities with a relatively high number of freight firms per capita are more likely to have those firms concentrated in the central county, suggesting that if a metropolitan area's function is as a warehousing or distribution center, that activity is spatially concentrated.

Philadelphia illustrates this explanation for spatial concentration, with the lowest Gini coefficient in 2005 and relatively high-density with low population growth and low highway miles per capita. In fact, Philadelphia is one of the few metropolitan areas where the central county does *not* have the largest number of freight establishments in the metropolitan area. This is largely due to rapid growth in distribution centers near the cities of Allentown, Reading, and Lancaster, each about an hour's drive to the west along a corridor that parallels the congested coastal freeways. On the other hand, Dallas-Fort Worth has approximately the same population, but with much lower density and total firms per capita, and with more freeway miles and freight firms per capita. Despite having two central cities in the metroplex and intermodal centers such as Alliance Airport and BNSF's main rail yard in Fort Worth, because freight firms as measured by the

Economic Census are mostly trucking companies, the Gini coefficients indicate that they remain heavily concentrated in Dallas County.

In explaining the change over the two decades in the Gini coefficient, two variables were significant: the Gini index at the start of the time period and the number of firms per capita in the region, both of which had a negative sign. In other words, cities with a high number of total firms per capita were more likely to experience a deconcentration of freight firms, which as above fits with a multiple nuclei model of urban growth. Chicago and Cincinnati are typical examples of this, with intermodal centers spread across multiple states and transportation hubs. Additionally, the more concentrated a city's freight establishments were at the beginning of the twenty-year time period, the more likely they were to disperse over time. Denver is the strongest example of this trend, where the general outward growth of the city has been heightened by the new airport and the associated distribution centers east of the central city.

There are some exceptions to this trend: Figure 4 shows a cluster of four cities with much less deconcentration than would be expected given their high initial Gini indices. This cluster includes the three Texas cities of Houston, Dallas-Fort Worth, and San Antonio; and Memphis, which has FedEx's main hub within its central county. At the other extreme, Philadelphia was already considerably deconcentrated, perhaps from being in the shadow of New York and Baltimore-Washington, and so did not experience much more dispersion. Texas therefore seems to be the exception to the rule that metropolitan areas with their freight establishments more heavily concentrated in the central county experienced greater dispersion of those firms over the past twenty years.

1.5 Conclusion

The purpose of this paper is to see if empirical justification exists for two trends commonly accepted in the transportation literature: the move towards inland distribution centers and the suburbanization of freight activity. Both trends were confirmed to a large extent through a combination of mapping, calculating Gini coefficients, and multiple regression analysis. Nevertheless, there are significant exceptions in a number of metropolitan areas, highlighting the importance of case studies and local factors.

As freight traffic has both increased in volume and become more international in scope, it has concentrated in fewer ports and gateways. As those gateways have become congested, shippers have begun to move towards inland ports and distribution centers to free up dockside space for maritime activities. Mapping the location of freight establishments per capita for fifty of the largest U.S. cities confirms that there is a shift in the last twenty years towards concentrating freight activity in the Ohio and Missouri River valleys. Highways, rail, and inland waterways, though themselves not always significant predictors of the number of freight establishments within a metropolitan area, are therefore of considerable importance both in these Midwestern cities and in the coastal gateways they are connected to.

Secondly, as containerization and high levels of throughput have led to the need for single-story distribution centers spread over hundreds of thousands of square feet, freight distribution activity has moved out from its traditional central-city location to suburban sites. Of the fifty cities analyzed here, only four did *not* experience a decentralization of freight activity over the last twenty years as measured via Gini coefficients, confirming this suburbanization. On the other hand, in many metropolitan areas, the largest number of freight establishments was actually added in the central county. Furthermore, metropolitan areas with fast-growing populations, many miles of interstate highway, and large numbers of freight establishments per capita are more likely to have those establishments concentrated in their central county.

It is therefore important to consider the impacts of increased freight activity not only on the suburbanizing fringe, but on existing central city locations. As inner-city railyards are modified to become intermodal yards, established neighborhoods will have to deal with increasing volumes of truck and train traffic. Additionally, in light of growing concern over the reliability and maintenance of urban infrastructure, it is clear that demand for that infrastructure on the part of the freight industry is continuing to grow. Investing in existing infrastructure while minimizing the impacts on local communities is therefore vital to keeping the U.S. freight industry in motion.

List of Figures

Table 1. Variables collected for analysis. Source: U.S. Census, U.S. Bureau of Transportation Statistics, calculations by author.

Description	Variable
Number of warehousing firms in 1986 and 2005, change over time, and per capita	WHFIRMS86, WHFIRMS05, WHZ8605; WHCAP05
Gini coefficient and change over time	GINI1986, GINI2005, GINIZ8605
Population in 1986 and 2005 and change over time	POP85, POP05, POPZ8505
Population density	POPDEN2000
Total number of firms in 1986 and 2005, change over time, and per capita	FIRMS86, FIRMS05, FIRMSZ8605, FIRMSPER8605, FIRMCAP05
Median household income in 2005	INCOME
Miles of interstate highways per capita	HWYCAP
Miles of railroad track per capita	RRCAP
Container port index	CONTAINER
Enplanements at all metropolitan passenger airports	ENPLANE
Distance from the population center of the U.S.	CENTDIST
Year central city was incorporated	INCORP

Table 2. Regression results for warehousing firms and change in firms. Calculations by author.

	R^2	Standardized coefficients	t	Significance
Warehousing firms per capita, 2005	0.375			
RRCAP		0.610	7.861	0.000
WHPER8605		0.266	2.258	0.029
Warehousing firms, percent change	0.593			
FIRMSPER8605		0.789	8.189	0.000
INCOME		-0.317	-3.294	0.002

Table 3. Location of warehousing and distribution growth by county, 1986-2005.

Calculations by author.

Metropolitan Area	Central co. growth in #s	Central co. growth in %	Suburban co. growth in #s	Suburban co. growth in %
Suburban county leads in both numbers and percentage				
Albany, NY	42	35%	112	55%
Atlanta, GA	132	57%	1383	178%
Birmingham, AL	54	20%	144	79%
Boston, MA	31	6%	502	43%
Chicago, IL	853	52%	1832	160%
Cincinnati, OH	-9	-3%	293	101%
Cleveland, OH	100	22%	391	79%
Dallas-Ft. Worth, TX	371	52%	836	129%
Dayton, OH	34	19%	131	85%
Denver, CO	100	53%	497	124%
Detroit, MI	230	38%	619	95%
Grand Rapids, MI	95	54%	186	112%
Greensboro, NC	108	68%	297	119%
Indianapolis, IN	202	69%	400	130%
Kansas City, MO	70	25%	330	80%
Los Angeles, CA	1309	61%	1441	96%
Louisville, KY	78	34%	176	75%
Milwaukee, WI	71	22%	176	52%
Mpls.-St. Paul, MN	108	40%	748	91%
Nashville, TN	76	31%	268	131%
New Orleans, LA	-5	-3%	64	12%
New York, NY*	243	15%	1373	27%
Oklahoma City, OK	141	62%	200	200%
Omaha, NE	48	20%	276	134%
Orlando, FL	339	170%	242	218%
Philadelphia, PA	-17	7%	666	51%
Pittsburgh, PA	9	2%	17	3%
Portland, OR	17	5%	435	124%
Providence, RI	113	62%	188	75%
Richmond, VA	72	44%	228	115%
Rochester, NY	45	26%	76%	58%
Seattle, WA	208	37%	495	125%
St. Louis, MO	216	51%	388	67%
Syracuse, NY	24	13%	43	56%
Tampa, FL	296	110%	362	191%
Washington, DC	46	10%	1244	92%
Central county leads in numbers, suburban counties lead in percentage				
Albuquerque, NM	147	125%	64	256%

Austin, TX	156	106%	125	227%
Charlotte, NC	250	113%	207	144%
Greenville, SC	104	85%	68	99%
Houston, TX	551	62%	293	138%
Jacksonville, FL	362	150%	108	177%
Memphis, TN	307	98%	139	240%
San Antonio, TX	252	82%	111	227%
Tulsa, OK	134	67%	85	115%
Suburban counties lead in numbers, central county leads in percentage				
Raleigh-Durham, NC	173	123%	176	121%
San Fran.-Oakland, CA	126	23%	137	8%
Central county leads in both				
Columbus, OH	303	103	152	88%
Hartford, CT	127	63%	32	34%
Sacramento, CA	185	66%	129%	56%

*All five counties within the city of New York were combined for the central county figure.

Table 4. Gini coefficients for warehousing and distribution firms, 1986-2005.

Calculations by author.

City	***1986***	***2005***	***Change***	***City***	***1986***	***2005***	***Change***
Denver	0.79	0.60	-0.19	Seattle	0.61	0.55	-0.06
Portland, OR	0.55	0.42	-0.13	Syracuse	0.48	0.42	-0.06
Birmingham	0.61	0.50	-0.11	Dallas-Ft. W.	0.76	0.71	-0.05
Cincinnati	0.74	0.63	-0.11	Los Angeles	0.47	0.42	-0.05
Cleveland	0.50	0.39	-0.11	Orlando	0.54	0.49	-0.05
Detroit	0.59	0.48	-0.11	Rochester, NY	0.51	0.46	-0.05
Wash., DC	0.58	0.47	-0.11	Houston	0.80	0.76	-0.04
Mpls-St. Paul	0.52	0.42	-0.10	Louisville	0.66	0.62	-0.04
New Orleans	0.53	0.43	-0.10	Raleigh-Durham	0.54	0.50	-0.04
Atlanta	0.68	0.59	-0.09	Sacramento	0.56	0.52	-0.04
Dayton	0.47	0.38	-0.09	Albany	0.39	0.36	-0.03
Oklahoma City	0.64	0.55	-0.09	Memphis	0.76	0.73	-0.03
Tampa	0.44	0.35	-0.09	Milwaukee	0.41	0.38	-0.03
Chicago	0.72	0.64	-0.08	Philadelphia	0.27	0.24	-0.03
Kansas City	0.66	0.58	-0.08	Providence	0.51	0.48	-0.03
Boston	0.44	0.37	-0.07	St. Louis	0.64	0.61	-0.03
Greensboro, NC	0.51	0.44	-0.07	Charlotte	0.49	0.47	-0.02
Omaha	0.59	0.52	-0.07	Greenville, SC	0.53	0.51	-0.02
Albuquerque	0.60	0.54	-0.06	Jacksonville	0.64	0.62	-0.02
Austin	0.61	0.55	-0.06	New York	0.43	0.41	-0.02
Grand Rapids	0.55	0.49	-0.06	Tulsa	0.68	0.66	-0.02
Indianapolis	0.57	0.51	-0.06	Pittsburgh	0.40	0.40	0.00
Nashville	0.67	0.61	-0.06	Columbus	0.60	0.61	0.01
Richmond	0.64	0.58	-0.06	San Francisco	0.41	0.42	0.01
San Antonio	0.78	0.72	-0.06	Hartford	0.45	0.47	0.02

Table 5. Regression results for Gini coefficients and change over time. Calculations by author.

	R^2	Standardized coefficients	t	Significance
Gini coefficient, 2005	0.469			
POPPER8505		0.352	3.044	0.004
FIRMCAP05		-0.322	-2.721	0.009
WHCAP05		0.235	1.902	0.064
HWYS		0.403	3.165	0.003
POPDEN2000		-0.343	-2.387	0.021
Gini coefficient change	0.184			
GINI1986		-0.388	-2.872	0.006
FIRMCAP05		-0.285	-2.109	0.040

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