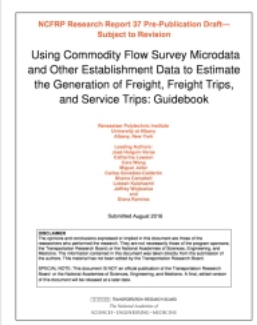

Using Commodity Flow Survey Microdata and Other Establishment Data to Estimate the Generation of Freight, Freight Trips, and Service Trips: Guidebook

DETAILS

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DISCLAIMER

ACKNOWLEDGMENTS

The unique nature of this project—which involved the unprecedented use of the confidential Commodity Flow Survey (CFS) microdata and other confidential data files for freight demand modeling—presented tremendous challenges not typically found in transportation research. The team had to: secure approval to conduct the research, obtain security clearances for all researchers that would use the data, travel to secure Research Data Centers to use the data, follow strict disclosure procedures to release the results, and strictly follow Internal Revenue Service and U.S. Bureau of the Census guidelines for data protection. In following these lengthy and delicate procedures—an absolute necessity to protect the confidentiality of the data—the team was fortunate enough to enjoy the full support of the staff of multiple agencies, who provided invaluable guidance to the team in some cases from the very start of the process in 2010. The team gratefully acknowledges the contributions from: Bureau of Transportation Statistics: Ronald Duych, Rolf Schmitt, Joy Sharp, Michael Sprung, and Edward Strocko; United States Bureau of the Census: Lynn Riggs, James Hinckley, Chester Ford and Scot Dahl; and Census Bureau's Research Data Center: Jonathan Fisher and Shirley H. Liu. Without their support and guidance, the team would not have been able to navigate the complex process of securing access to the confidential data used in the project.

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Executive Summary

This section provides a summary of the work done as part of NCFRP Project 25 "Freight Trip Generation and Land Use" (jointly funded as NCHRP Project 08-80) and NCFRP 25(01) "Estimating Freight Generation Using Commodity Flow Survey Microdata." Throughout the Guidebook 'Phase 1' will refer to NCFRP Project 25 and 'Phase 2' will refer to NCFRP 25(01). The first phase was reported in NCFRP Report 19 (Holguín-Veras et al., 2012). Since then, the work of the previous phase has expanded significantly. Thus, a comprehensive account of the entire project has been captured in this report.

The main objective of NCFRP 25 and NCFRP 25(01) was to study the relationship between freight trip generation and land use "*…to develop a handbook that provides improved freight trip generation rates, or equivalent metrics, for different land use characteristics related to freight facilities and commercial operations to better inform state and local decision-making*." To achieve this objective the research team:

- Used the Commodity Flow Survey (CFS) to estimate 1,409 (342 linear and 1,067 non-linear models) freight production models for entire United States, and separate models for the states of New York, California, Ohio, Texas, and Wyoming for 37 different industry sectors;
- Collected additional establishment-level data in the New York City metropolitan area and in New York State's Capital Region—pooling funds with a SHRP2 C-20 grant "Implementation Assistance Program: Innovative Local Freight Data" to the Capital District Transportation Committee (CDTC) serving the Albany, New York region—about freight trip generation (both production and attraction); added these data to the databases already in the team's possession; and used these data to estimate 62 freight trip production (both linear and non-linear, 31 models each) and 70 freight trip attraction models (both linear and non-linear, 35 models each) for 12 industry sectors;
- Collected data about service trip attraction, using pooled funds with the SHRP2 C-20 grant to the CDTC, and used the data to estimate 118 service trip attraction models (both linear and non-linear, 59 models each)—the first reported in the literature--for 21 industry sectors. (Due to budget constraints, data about service trip production were not collected);
- Collected additional establishment-level data, again pooling funds with the CDTC SHRP2 C-20 grant, about freight generation (both production and attraction) and used these data to estimate 49 freight production (19 linear and 30 non-linear models) and 50 freight attraction models (19 linear and 31 non-linear models) for 11 industry sectors;
- Collected additional establishment-level data, jointly with the CDTC SHRP2 C-20, about the relationship between freight generation and freight trip generation, and used these data to estimate 18 models exploring the relationship between freight production and freight trip production (8 linear and 10 non-linear models), and 20 models exploring the relationship between freight attraction and freight trip attraction (9 linear and 11 non-linear models) for 12 industry sectors;
- Analyzed data and incorporated a set of employment rate models provided by Dr. D. Hartgen that are based on a national sample of freight trip generation from 2008. The data were collected as part of a study to assess the impacts of congestion across the US, with data about shipments received and sent out from 1,000 establishments.
- Consolidated the freight trip generation models in the literature in a database to assist practitioners interested in using the models (http://transp.rpi.edu/~NCFRP25/FTG-Database.rar); and
- Developed the Freight Trip Generation Estimator Software at the ZIP code and 2-digit NAICS code levels for public use (https://coe-sufs.org/wordpress/ncfrp33/appendix/ftg/).

The research identified principles that are central to the development of models that will be able to inform transportation planning and traffic impact analyses. The most important principle is the need to distinguish between freight trip generation (FTG) (i.e., the generation of vehicle-trips), and freight generation (FG) (i.e., the generation of the cargo that is transported by the vehicle-trips). FG is an expression of economic activity performed at a business establishment by which input materials are processed and transformed generating an output that, in most cases, is transported elsewhere for further processing, storage, distribution, or consumption. FTG, in contrast, is the result of the logistic decisions concerning how best to transport the FG in terms of shipment size, frequency of deliveries, and vehicle/mode used. The shipper is able to change shipment size to minimize total logistic costs by transporting more cargo (FG) without proportionally increasing the corresponding number of trips (FTG). Therefore, FTG cannot be generally assumed to be proportional to business size because large establishments could receive larger amounts of cargo without concomitant increases in FTG. This has major implications for FTG modeling, as current modeling practices implicitly assume proportionality between FTG and such business size variables as square footage and employment.

The second key principle is the need to account for service trips, which have been overlooked as a component of commercial vehicle activity. These service trips are generated by technicians, service providers, and the like, who visit an establishment to perform various services. Service trip generation (STG) is the number of service trips generated by a commercial establishment. The STG is comprised of service trip production (STP), which is the number of vehicle-trips leaving the establishment to perform services at other locations. The counterpart of STP is service trip attraction (STA), which is the number of vehicle trips arriving at the establishment to perform a service activity.

As shown, different metrics could be used to measure the transportation activity generated at a given establishment. To simplify the exposition, the term *freight and service activity* (FSA) refers to all activities related to freight and service. The term *metric of freight and service*, or metric of FSA, is used to designate all potential ways to measure the transportation activity generated by the FSA, i.e., FG/FTG/STG.

The final principle is that the accuracy of FG/FTG/STG analyses depend on the following factors:

- the ability of the classification system used in the analyses to group commercial establishments in a set of internally homogeneous classes;
- the ability of the measure of business size used to predict the FG/FTG/STG;
- the ability of the statistical technique used to capture the underlying relations that shape FG/FTG/STG; and,
- the use of disaggregate (establishment-level) models in conjunction with the corresponding aggregation procedure to estimate aggregate values (if needed).

To ensure proper understanding and use of the terms, brief descriptions are provided. A *classification system* is a systematic way to group establishments into pre-defined groupings or classes (e.g. residential, commercial and industrial). A *measure of business size* is the independent variable used to predict FG/FTG/STG, such as square footage of the establishment or total number of employees. The *statistical technique* is the process used to compute the parameters of the models. Among the wide range of approaches available, two techniques were found to be particularly useful: ordinary least squares (regression analysis), and multiple classification analysis. The *aggregation procedure* is the technique used to obtain aggregate values of FG/FTG/STG from the establishment-level estimates produced by a disaggregate model. This routinely overlooked aspect is at the core of many of the problems reported by practitioners when producing FG/FTG/STG forecasts.

As these factors form the backbone of the modeling effort, it is important to discuss their implications:

- **Estimate/use FG/FTG/STG models with classification systems with homogenous classes.** The estimation and use of FG/FTG/STG models works best if the commercial establishments are grouped in classes that are as internally homogeneous as possible. In this case, the variables that measure business size have a better chance of being good predictors of FG/FTG/STG. If the classes group together very different economic activities (i.e., the data for a given class will be very heterogeneous), the ability of business size variables to be a good predictor of FG/FTG/STG will be compromised. Industrial classification systems—such as the Standard Industrial Codes (SIC) and the North-American Industry Classification System (NAICS)—are designed to group together similar economic activities, maximizing the internal homogeneity of each class. By construction, these classification systems are better able to support appropriate modeling of FG/FTG/STG and therefore offer the best alternative for FG/FTG/STG modeling.

  The concern with using land use classification systems in FG/FTG/STG modeling is that they tend to use very aggregate land use classes (e.g., commercial, industrial) that group together disparate sets of economic activities, which undermines the ability of business size to be a good predictor of FG/FTG/STG An exception is the Land Base Classification Standards (LBCS), which classifies land use using five dimensions: the activity (taking place at the establishment), the function (type of enterprise being served), structure type (building characteristics), site development character (physical description of the land), and ownership (e.g., public or private). If the activity dimension contains classes that are defined using an industrial classification system, the resulting classes would be as good as using SIC or NAICS in FG/FTG/STG modeling.
- **Use variables that correctly measure the intensity of FSA as predictors of FG/FTG/STG**. Variables such as square footage and employment differ significantly in ability to be good predictors of FG/FTG/STG. As an example: three establishments of exactly the same square footage may produce different amounts of FG/FTG/STG depending on the intensity and type of the economic activity being performed; and whether or not the establishments are empty, lightly used, or very heavily used. In contrast, variables such as employment are likely to be better explanatory variables because they rise and fall in concert with the level of economic activity. As a result, employment is a better predictor or FG/FTG/STG.
- **Use statistical techniques able to capture the underlying relations that shape FG/FTG/STG.** The ability of shippers and service providers to consolidate cargo and service activities using the same vehicle-trip leads to a situation where FTG cannot be generally assumed to depend on business size. Thus, it is important to statistically determine if a business size variable is a statistically acceptable predictor of FG/FTG/STG. For this reason, the team recommends the use of statistical procedures—such as ordinary least squares (OLS), and spatial econometric techniques—that test the significance of independent variables. These techniques provide a solid way to assess the role played by independent variables. However, they impose a functional form to the model. Multiple classification analysis (MCA) is a very useful technique because it does not impose a functional form, enabling the MCA parameters to freely change without the constraint of the functional form. This feature helps explain why MCA was frequently found to produce models with the best agreement with the data. MCA should only be used in cases where other techniques have already determined that the measure of business size plays a statistically significant role (MCA does not support hypothesis testing).

- **Use establishment-level models with the corresponding aggregation procedure**. As in passenger demand modeling, disaggregate (establishment-level) modeling is the recommended approach when producing FG/FTG/STG forecasts. Disaggregate models are better able to capture the interconnection between FG/FTG/STG and the independent variables. However, disaggregate models do require the use of a suitable aggregation procedure. The research conclusively showed that not using the correct aggregation procedure leads to significant errors in the estimation of FSA. Most notably, the research revealed that the widely used process of obtaining aggregate estimates of FG/FTG/STG by multiplying total employment by a FG/FTG/STG rate per employment is only valid in the minority of cases where the underlying model is one in which FTG is directly proportional to employment. Not following the recommended procedures will lead to estimation errors.

The principles discussed above were tested using statistical estimation technique. To this effect, the research used FG/FTG data from:

- three surveys conducted by the team that collected data from about 1,100 receivers and more than 300 carriers,
- a furniture store chain in the Midwest, and supermarkets in the Puget Sound region and NYC; and,
- the 2007 Commodity Flow Survey (CFS) data.

In those cases where the data were most complete, the team had access to establishment-level variables such as: employment, location, size, revenue, line of business, some trip data (e.g., number of truck trips per day/week, shipment sizes), and land use information. Using the data, the research estimated and assessed the performance of FG/FTG/STG models based on:

- classification systems: both industrial classification systems (i.e., SIC, and NAICS) and land use classification systems (i.e., LBCS, and New York City Zoning Resolution, NYCZR) were tested;
- statistical technique used: ordinary least squares, spatial econometric techniques, and multiple classification analyses were tested;
- aggregation procedure used to obtain aggregate values: the standard aggregation used in practice and the aggregation procedures developed by the team were tested; and
- business size variable used as predictors of FG/FTG: square footage, and employment (where available) were tested.

The comprehensive analyses conducted by the team led to the following insights:

- **Industrial classification systems should be used for FG/FTG/STG modeling, instead of standard land use classification systems.** The research revealed that using industrial classification systems as the foundation for the estimation of FG/FTG models is significantly better than using standard land use classification systems such as the NYCZR, or land use classification systems that can be applied nationally, such as LBCS. The industrial classification systems tended to produce models that were statistically stronger than those obtained using any of the land use classification systems. The best results were found when an economic measure of business size, e.g., employment, was used in combination with an industrial classification system (i.e., two digit SIC codes, or three digit NAICS). The team would expect that using LBCS will produce better models than using the standard land use classification systems (such as NYCZR), particularly if the activ-

ity codes in the LBCS use industrial classification systems (e.g., SIC, NAICS) (Holguín-Veras et al., 2012).

- **Proportionality between FTG/STG and business size happens only in a minority of industry segments.** The research revealed that in 51% of industry segments the FTG is constant and does not depend on business size, indicated by employment; in 31% of cases the FTG model is a function of a constant and a rate that multiplies the establishment's employment; and in the remaining 18% of cases the FTG model is proportional to employment at a constant FTG rate (Holguín-Veras et al., 2011). Similar results were found for STG, where in 66% of the industry sectors the STA is constant; approximately 28% being proportional to employment; and only 6% of the models being a combination of a constant and an FTG rate per employee. Therefore, the fact that the most commonly used approach (the constant trip rate per employee) is correct in only a minority of cases, should be a concern.
- **The models estimated at the establishment level are transferable, though more testing is needed to reach solid conclusions.** The models estimated with New York City data were applied to supermarkets in the Seattle region. The models produced very good estimates of FTG. This is very encouraging, though larger-scale testing is needed to reach definitive conclusions. (Holguín-Veras et al., 2013a).
- **The NCFPR 25 models generally outperform the models previously reported in the literature.** The NCFRP 25 models were compared to the ones in the Institute of Transportation Engineers (ITE)'s Trip Generation Manual (Institute of Transportation Engineers ITE, 2004; Institute of Transportation Engineers, 2008), and the Quick Response Freight Manual (QRFM) (Cambridge Systematics Inc., 1996; Cambridge Systematics, 2007). The results show that the NCFRP 25 models produce more accurate FTG estimates than the corresponding ITE and QFRM models (Holguín-Veras et al., 2013a).
- **Multiple Classification Analysis (MCA) performed better than Ordinary Least Squares (OLS) models.** The research found that, for those industries with FG/FTG/STG dependent on employment, MCA performed better than OLS. This was the case for both industrial and land use classification-based models. Since MCA does not impose a functional form, the parameters can take values that are not restricted by a function (as in OLS). This flexibility increases the ability of MCA to replicate the input data (Lawson et al., 2012).
- **Commodity Flow Survey (CFS) can be efficiently used to estimate freight production (FP) models.** The use of the CFS, in combination with complementary datasets, provides an efficient way to estimate FP models for the entire nation, at various levels of geography. The successful use of the CFS microdata has tremendous implications because the models released—which do not contain commercially sensitive information—can be used to infer FP patterns in between the years that CFS data are collected. The use of the FP models, in conjunction with publicly available data, could enable state DOTs and MPOs to estimate the amount of cargo being produced at their jurisdictions at the ZIP Code level (using the Census Bureau's ZIP Code Business Patterns Database) and lower (if the data are available). These estimates, in turn, will enable planners to monitor changes in cargo flows and implement policies and programs if needed. This approach is significantly better than waiting for the next iteration of the CFS.
- **There are statistically significant differences in FP patterns across the states.** Although the team could not conduct a comprehensive examination of the effects of geography on FP, the limited research used strongly suggests that FP patterns vary from region to region, and frequently from state to state. Thus, using national models, or models from a nearby state, may lead to errors in the estimation of FP. Future research should tackle a comprehensive estimation of FP models to identify state-level differences and commonalities. This research could have important impacts

on future data collection efforts. States with similar FP patterns could pool funds to collect similar data, which will enable them to estimate freight activity very cost effectively.

- **Non-linear models typically provide the best representation of FP patterns**. This is a likely a consequence of scale economies of production, where the larger the establishment, the higher the productivity for a unit of labor. About 76% of the FP models are non-linear. This finding has important implications for modeling, because it implies that the standard aggregation procedures, which simply assume that FP is directly proportional to employment, are incorrect. More sophisticated aggregation procedures must be used. Of all the non-linear models (linear-logarithmic, logarithmic-logarithmic, logarithmic-linear) that were estimated, logarithmic-logarithmic models were found to provide the best agreement to the data.
- **Service trips must be accounted for.** The STA models estimated in the project indicate that most establishments receive between 1-5 trips per week. The largest attractors of service trips on a per-establishment basis, according to the admittedly limited amount of data collected, are the service industries, such as Information (NAICS 51), Finance and Insurance (NAICS 52), Education Services (NAICS 61), Health Care and Social Assistance (NAICS 62), Entertainment (NAICS 71) and Other Services except Public Administration (NAICS 81). Since these establishments represent approximately 55% of the establishments, and 51% of the employment in metropolitan and micropolitan areas in the country, the amount of service trips that they create is very large. Moreover, these service vehicles occupy the curb for extended periods of times (sometimes in the range of hours). As a result, they tend to control a disproportionate portion of the number of spaces allocated to commercial vehicles (both freight and service), making it difficult for freight vehicles to find suitable parking.

The work conducted as part of NCFRP 25 has set the foundation, both empirical and theoretical, for the modern study of FG/FTG/STG. On the empirical front, the work has brought to bear more FG/FTG/STG data than any previous effort. These data include: establishment-level FTG (both production and attraction) data, the CFS freight production data, and newly collected service trip attraction data. These data have led to the estimation of more than 1,700 FG/FTG/STG models covering dozens of industry sectors. On the theoretical front, the research has made a strong case for a redirection of FG/FTG/STG research and practice that emphasizes the economic roots of these activities, and leads to more accurate models that can be seamlessly used in combination with publicly available employment data. The incorporation of these recommendations on traffic impact analyses, traffic engineering, medium/long term demand forecasting exercises, and land use planning will lead to an enhanced understanding of the role of freight and service activity in metropolitan areas, and the transportation needs of these sectors. Policy makers need the more complete picture of freight and service activities (FSA) that these models provide to enact policy and programs that will help these sectors fulfill their economic roles, while producing the minimal amount of negative externalities that impact the economy, the environment, and local communities.

I. Overview of the Guidebook

This Guidebook's primary purpose is to improve freight demand modeling by providing Freight and Service Activity (FSA) models that practitioners and researchers could use to quantify FSA. In doing so, the Guidebook describes the process followed to develop the models, as well as their application. Chapter II describes the relevant key concepts. Chapter III provides background information about urban economies, and urban supply chains to help the reader understand the interconnections between the economic activities and FSA. Chapter IV defines the various metrics that could be used to measure FSA: Freight Generation (FG), Freight Trip Generation (FTG), and Service Trip Generation (STG). Chapter V describes the modeling principles that guided the model development. Chapter VI discusses the modeling methodology. Chapter VII identifies potential applications of FSA models and defines step-by-step processes for the most typical cases. Chapter VIII presents the final models that resulted from the statistical estimation process. Chapter IX presents four illustrative applications of FSA models that differs in terms of the objective of the analysis, geographic scale, and the FSA metric that is estimated. Chapter X lists the references cited in the Guidebook. The Appendices chapter contains the technical details of the models, and descriptive analyses of the data.

II. Key Concepts

This section describes the necessary concepts to characterize the freight transportation system, as well as its relations to the land use system, and to the study of FG/FTG/STG.

The freight system

Characterizing the freight system is challenging because of its multifaceted and highly heterogeneous nature. In fact, it is hard to think of any other component of the transportation system that is more varied. The agents in the freight system exhibit many fundamentally different behaviors and involve more interacting parties than any other component of the transportation system. More importantly, the system is pervasive in modern life, and yet rarely studied. Because of this complexity, it is best to describe the freight system in a systematic fashion by defining the relevant dimensions that characterize it, and discussing each of these dimensions in some detail. The multidimensional nature of the freight system poses a major challenge to simple land use classification systems because it may not be possible to characterize such complexities by a single metric. A formal characterization requires defining the interacting agents within the system, and the links between them.

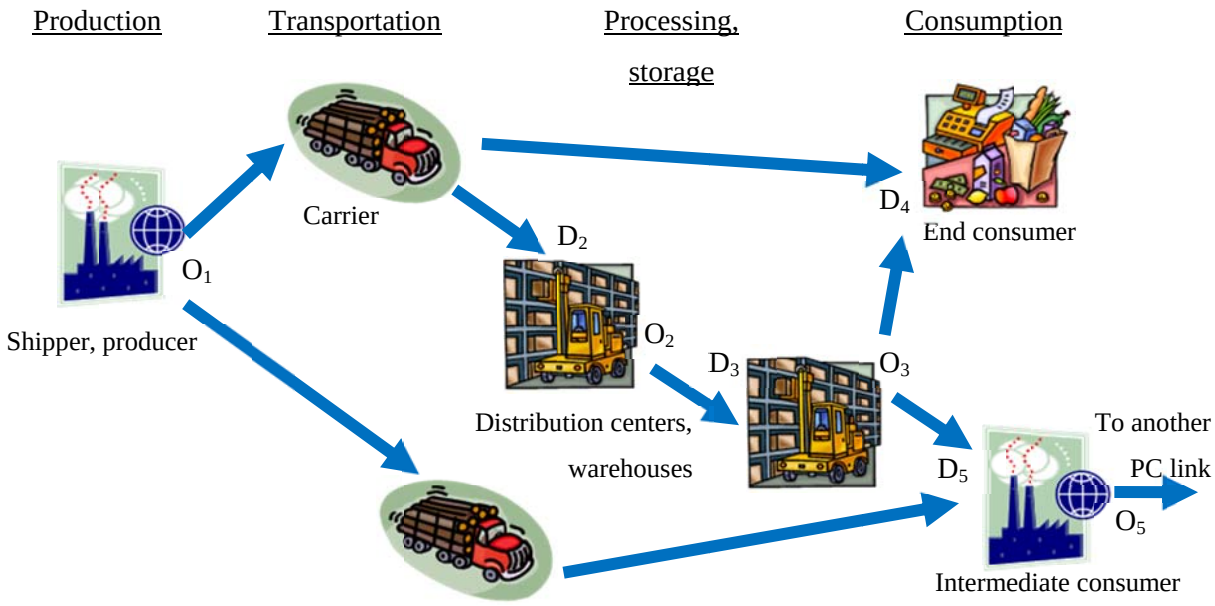
A direct consequence of modern economies is their reliance on complex logistics and freight systems. It is useful to envision the freight system as the physical manifestation of the economy, as in most cases, monetary transactions are accompanied by a commodity flow in the opposite direction. In essence, freight activity is economic activity in motion. The first level of complexity is related to the many agents that influence the generation of freight. So to understand the generation of freight, one must have a basic understanding of the connections among various economic agents.

To decompose the process and facilitate understanding, the concept of a production-consumption (PC) link is useful. A PC link represents the transaction that connects a producer of cargo with the next consumer (which could be the end user, or an intermediate consumer who uses the cargo as an input to another PC link). A schematic of some of the possibilities is outlined in Figure 1, together with the corresponding trip origins and destinations. In essence, a typical supply chain is comprised of many PC links where an economic agent produces/ships freight that other agents process/transform and store, and ultimately deliver to the end/intermediate consumers. Obviously, if the agents are not collocated, transportation has

to take place. This, in turn, is what produces the vehicle-trips that transportation planners and engineers capture as trip origins (O), and trip destinations (D). In simple supply chains, e.g., a farmer who sells produce to the local market, the corresponding PC pattern is straightforward. In complex supply chains, e.g., in the automobile industry, there could be hundreds of PC links corresponding to the various stages of the production process. The multiplicity of possibilities is overwhelming.

Therefore, to understand freight demand, one must study the underlying supply chains that satisfy the needs of the PC links that comprise a production and distribution process. This is because the transportation flows generated as part of those PC links materialize into freight traffic, e.g., truck-trips. The main focus of this research is on locations where the cargo is produced, transformed, stored, or consumed, i.e., the nodes in the transportation network. Understanding the underlying process that determines how much freight is produced or attracted for the key land use classes is the key objective of this project. As a result, the study of the FG and FTG must consider: (1) production sites / shippers; (2) intermediate processing points, including storage; and (3) consumer sites, both end and intermediate.

Figure 1: Production-Consumption (PC) Link



Note: The arrows represent transportation flows, O is a trip origin, D is trip destination, and the numbers represent the physical location of the agents in a trip end.

There are important practical reasons to be comprehensive in the study of FTG. While it is easy to identify generators of freight and truck-trips such as production sites, warehouses, trucking companies, and ports, the role of consumer-oriented businesses (e.g., retail stores) as generators of truck trips is frequently overlooked. While the need to study FTG by service and retail businesses has long been recognized as a key priority (National Cooperative Highway Research Program, 2001), the role of consumer-oriented businesses as generators of truck trips is frequently overlooked. Quite frequently, and particularly in urban areas, small establishments—when taken together—produce more truck trips than any single large generator. As an example, calculations made by the team indicate that the 10,000 restaurants and bars in Manhattan produce more truck traffic than the Port Authority of New York and New Jersey terminals combined.

A number of agents are part of, or involved in freight transportation: shippers, carriers, receivers, third party logistics, freight forwarders, and warehouses/distribution centers, among others. The main agents are:

- **Shippers** are the agents that produce or ship freight.
- **Carriers** are the agents that provide transportation services to the shipper to carry cargo to their respective destinations.
- **Receivers** are the destination agents that receive the cargo sent from the shipper, including intermediate and end consumers.

As a consequence of the individual agents fulfilling their role in each stage, nobody is able to provide a complete picture of the functioning of the entire system. Assembling a coherent description of the whole requires assembling the views provided by the composite parts, i.e. the different agents who may be aware only of those aspects that concern their operation. A summary of the information that each agent is typically aware of is shown in Table 1.

Table 1: Partial Views of the Freight System

Freight generation:	Shippers / Producers	Carriers	Distribution centers / Warehouses	Consumers of cargo (receivers)	Transportation agencies
Amount of cargo	Yes (1)	Yes (1)	Yes (1)	Yes (2)	No
Number of loaded vehicle-trips	Yes (1)	Yes (1)	Yes (1)	Not always	At key links (no distinction between loaded and empty)
Number of empty vehicle-trips	No	Yes (1)	No	No	
Number, frequency, of deliveries	Yes (1)	Yes (1)	Yes (1)	Yes (2)	No
Commodity type	Yes (1)	Not always	Yes (1)	Yes (2)	Only at some ports of entry
Shipment size	Yes (1)	Yes (1)	Yes (1)	Yes (2)	No
Cargo value	Yes (1)	Not always	Not always	Yes (2)	Only at some ports of entry
Land use patterns	Yes (1)	Yes (1)	Yes (1)	Yes (1)	All

Notes: (1): Only of the cargo that they handle. (2): For all the cargo they receive.

The table shows that producers and shippers of cargo are typically aware of the characteristics of the cargo that they receive and/or ship out. However, they do not know much about what happens once the freight vehicles leave their facilities. Carriers know the details of their operations—including the loaded and empty trips produced—though, quite frequently, they are not aware of the attributes of the cargo they transport. They know who they deliver to, though they do not necessarily know who else is delivering to a particular customer. The consumers of the cargo, i.e., the receivers, know the details of the cargo they receive/ship out, though they do not always know how many vehicle-trips have been generated because many of them only observe the number of deliveries (a truck-trip could be used to make multiple deliveries). Transportation agencies have an idea about truck traffic in the network and land use patterns. However, in most cases, they know very little about the freight flows in their jurisdictions.

In summary, none of the agents involved in freight have sufficient information to fully describe what happens in the system as a whole. This has important implications for data collection efforts, as most surveys rely on the information gathered from the participants in the freight activity. The fundamental challenge is how to put that information together into a comprehensive picture of freight generation that is relatively accurate, practical, and conceptually correct. However, from the standpoint of FG and FTG, there should be no doubt that the consumers and producers of the cargo agents are able to provide the most complete view because they have the details of the cargo they receive and/or ship out, and the corresponding delivery frequencies, and shipment sizes. This implies that establishment data—and the models estimated with them—are the most accurate.

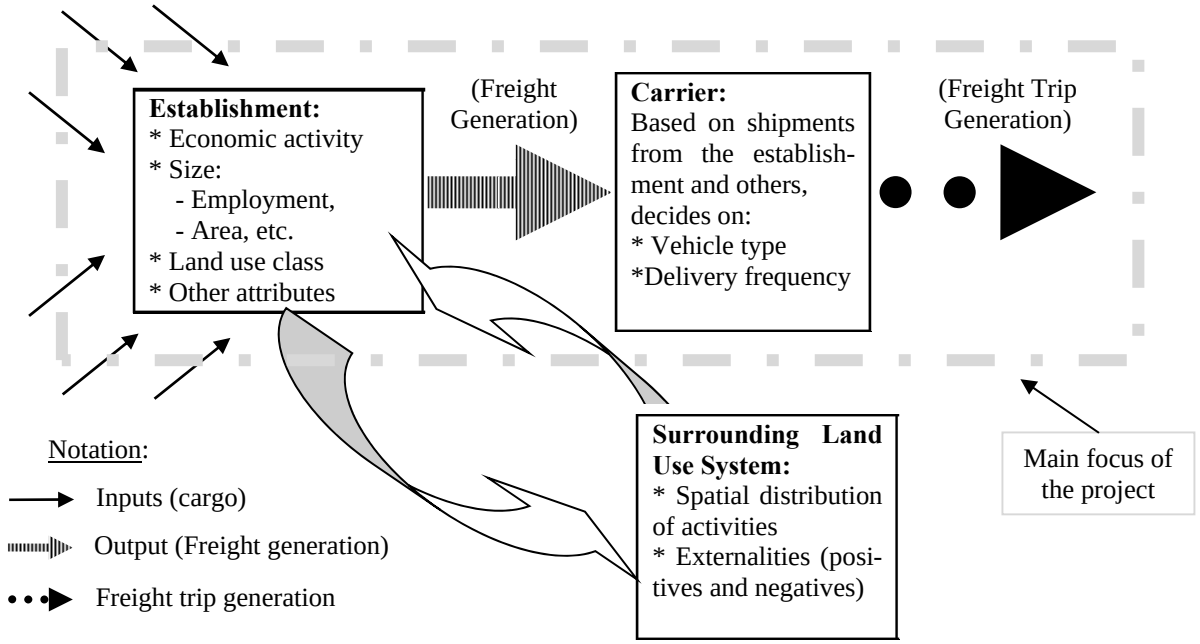
Relationship between the freight system and land use

This section discusses the interconnected relationship between freight activity and land use, building on both empirical evidence and theory. On the one hand, land use patterns could impact FG/FTG/STG patterns, as the different activities generate different amounts of freight-related trips; conversely, the freight system could also have a significant impact on land use, which is typically the case with large developments such as distribution centers, terminals, ports, and intermodal centers, which not only influence the freight flows, but also the geographic patterns of land use surrounding them.

The lack of consensus among professionals with respect to a definition for the term “land use” blurs the connections between freight and “land use”. Although there is some evidence of the application of the Land-Based Classification Standards (LBCS) for freight, the comprehensiveness of the dimensions (e.g., activity, function, structural characteristics, site development character, and ownership) would be very useful for understanding the relationships between the freight system and land use. For example, in studies that use the ITE Manual land use classifications (i.e., primarily structure-based or site descriptors), it should be possible to map these classifications to the LBCS Structure categories, while studies using employment codes (e.g., SIC or NAICS) could be mapped to the LBCS Function categories, and those using land use planning designations could be mapped to the LBCS Activity categories. Each of these dimensions could have a different impact on FG or FTG, making it essential to reclassify various studies’ outcomes.

In describing the connections between the freight system and land use, it is important to distinguish between two separate aspects: (1) how land use at the establishment level influences FTG; and (2) how freight activity and land use interact with each other at the system level. These effects are shown in Figure 2. Although both aspects are important, since the main emphasis of this project is the impact of land use on FTG, the freight/land use connections are not discussed here.

Figure 2: Schematic of Connections between Freight and Land Use



Determining how land-use impacts FG/FTG/STG requires resolving and reconciling the difference of opinions between economic/logistic and transportation literature. The economic/logistic literature suggests that FTG is determined by the FG (in itself the output of an economic process), along with a host of interactions concerning shipment size and total logistics costs. Interestingly, this body of literature barely mentions land use as a factor. The reason seems to be that, in most cases, land use is a constraint to the production process, not an input. From the economic/logistic point of view, the input factors that determine FG and FTG include labor, capital, and other intermediate inputs to the process. In essence, the larger the employment or the capital, the larger the FG (while other factors, as discussed, determine the impact on FTG).

In contrast, the research conducted by the team stresses the importance of separately studying FG as well as FTG. The analyses described in this report indicate that business establishments attract and produce cargo (freight generation, FG) that translates into freight vehicle-trips (freight trip generation, FTG). The amount and nature of the incoming and outgoing FG depends on the type of business, and its size. In contrast, the FTG depends on the corresponding shipment sizes, and the ability of the carriers to consolidate their shipments (e.g., with the shipments of other establishments). Other factors, such as storage capacity constraints, inventory and transportation costs, etc. play a key role in determining shipment sizes, delivery frequencies, and the amount of inventory. In addition to FG and FTG, it is important to consider the service trip generation (STG) at the establishments. These services, associated with the travel of technicians, and the services they provide, are the result of the specialization and interconnectedness of modern economies, where businesses increasingly rely on other businesses for the provision of key services.

This suggests that the establishment's land use is, at best, a proxy for the underlying economic activity being conducted. However, in the absence of detailed information about an establishment's economic characteristics, assuming that FTG depends on general characteristics of land use may just be a pragmatic solution. The weakness of this decision is that various land use classes group together economic sectors with fundamentally different FTG patterns. In essence, the adequacy of land use attributes as explanatory variables depends on how well the land use class matches the FTG patterns of the industry segments that have been included. In cases where there is a good match, land use is likely to be a good predictor. In

contrast, if a land use class groups disparate economic activities, it is unlikely to be a good explanatory variable.

III. Background

This chapter provides basic information about urban and metropolitan economies, urban supply chains, and the generation of FSA. This chapter is intended to help the reader develop a solid understanding of the interconnections between the economy, supply chains, and the generation of FSA.

Urban and Metropolitan Economies

Quantifying the relation between FSA and its independent variables—the primary goal of this research—necessitates a basic understanding of the economic and logistical roots of these activities. The magnitude and extent of FSA is often underestimated. To a great extent, this reflects the natural human tendency to only register phenomena—such as large trucks—that seems discordant with the rest of the environment. The bulk of FSA, which primarily uses small trucks and delivery vans, usually goes unnoticed. Facilities like ports and distribution centers, with high volumes of large trucks, are easily recognized as large generators. In contrast, few people would guess that the food and retail sector in a large city generates traffic volumes several times larger than those at ports and distribution centers. These misperceptions often lead professionals to fail to ensure that FSA needs are properly addressed. This, in turn, creates additional congestion and pollution, and aggravates the negative externalities produced by FSA.

Throughout the Guidebook, the term "freight and service activity" (FSA) denotes all expressions of these activities (e.g., flows of cargo, freight vehicle-trips, service trips). The term "metric of FSA" or simply "FSA metric" refers to the different ways of measuring FSA (e.g., freight generation/ attraction/ production, freight trip generation/ attraction/ production, service trip generation/ attraction/ production).

The economic data about number of establishments and employment provide a good way to get a sense of the true extent of FSA. To this effect, it is useful to classify industry sectors in two groups: Freight Intensive Sectors (FIS) and Non-Freight Intensive Sectors (non-FIS). Generally speaking, in the FIS of the economy, consumption and production of cargo is central to the activity performed by the establishment. Conversely, the non-FIS group are those where production and consumption of cargo are of secondary importance. Table 2 shows the statistics for Metropolitan Statistical Areas (MSAs).

As shown, a large portion of the economy—about 45% of the establishments and half the employment—correspond to FIS. However, this is not the complete story because all sectors of the economy, including the non-FIS, demand freight and services (such as photocopier technicians, plumbers, and the like). The amount of FSA, and the resulting vehicular traffic, is substantial even in non-FIS sectors.

Table 2: Establishment and Employment Totals for Macro and Micro MSAs (2013)

NAICS	Description	Establishments		Employment	
		Number	%	Number	%
Freight Intensive Sectors (FIS)					
11	Agriculture, Forestry, Fishing and Hunting	15,614	0.22%	142,779	0.12%
21	Mining, Quarrying, and Oil and Gas Extraction	21,929	0.31%	543,042	0.46%
22	Utilities	14,643	0.21%	616,818	0.52%
23	Construction	613,873	8.72%	6,240,668	5.25%
31-33	Manufacturing	271,633	3.86%	10,606,778	8.93%
42	Wholesale Trade	397,026	5.64%	6,301,619	5.31%
44-45	Retail Trade	990,533	14.07%	16,475,243	13.87%
48-49	Transport and Warehousing	195,853	2.78%	4,276,935	3.60%
72	Accommodation and Food Services	633,191	9.00%	13,494,478	11.36%
	Sub-Total	3,154,295	44.81%	58,698,360	49.42%
non-Freight Intensive Sectors (non-FIS)					
51	Information	127,025	1.80%	3,288,869	2.77%
52	Finance and Insurance	442,269	6.28%	6,120,740	5.15%
53	Real Estate and Rental and Leasing	344,711	4.90%	2,477,859	2.09%
54	Professional, Scientific, and Technical Services	840,912	11.95%	8,981,245	7.56%
55	Management of Companies and Enterprises	51,283	0.73%	2,797,857	2.36%
56	Administrative and Support and Waste Management and Remediation Services	377,025	5.36%	8,313,055	7.00%
61	Educational Services	95,136	1.35%	2,815,497	2.37%
62	Health Care and Social Assistance	801,554	11.39%	16,973,023	14.29%
71	Arts, Entertainment, and Recreation	119,354	1.70%	2,246,428	1.89%
81	Other Services (except Public Administration)	685,506	9.74%	6,066,754	5.11%
	Sub-Total	3,884,775	55.19%	60,081,327	50.58%
	Total of FIS + non-FIS	7,039,070	100.00%	118,779,687	100.00%
Unclassified		11,043		35,485	
Totals		7,050,113		118,815,172	

The role of transportation policy is to ensure that public resources are allocated in a way that maximizes economic welfare. The allocation of public resources, such as curb space, must balance the needs of the various users of transportation networks, and their contributions to the economy and society. Reasonably accurate estimates of FSA—of the kind that could be produced with the Guidebook models—provide transportation professionals with crucial information about the geographic location of major FSA centers, their contributions to congestion and pollution, and their public space needs. With this information, policy makers can work to ensure the FSA activity is performed in the most efficient manner.

The economic and environmental impacts of improvements to FSA are tremendous. The various industry sectors in metropolitan economies play different roles (and/or interact) with international trade, manufacturing, local distribution of supplies, and service activities. The large facilities associated with international trade—airports, ports, intermodal complexes—the most visible of these activities, provide economic and physical linkages between international and local supply chains and economies. Manufacturing activities are essential for metropolitan economies. It is estimated that the 100 largest metropolitan areas are the origin or destination for 80% of the cargo transported in the US, with a total value of $16.2 trillion (Tomer and Kane, 2014). Manufacturing sites have a different freight and freight vehicle-trips profile than, for instance retail stores, as these sites tend to receive and ship out large shipments of goods, usually by large trucks. In terms of total freight traffic, however, the manufacturing sector's contribution is relatively small in mid-size and large metropolitan areas, though it undoubtedly generates a large portion of the total cargo volume and weight transported. Urban deliveries and service activities fulfill the role of the capillary system in a body by ensuring that all corners of the metropolitan economy are adequately sourced. In doing so, they produce vast amounts of FSA trips that are several times larger than the amounts produced by manufacturing, and large facilities like ports and airports. About 40 % of the total correspond to deliveries to establishment in the food and retail sectors. In most cases, deliveries to urban areas are made using delivery vans and small trucks that typically represent 80% to 90% of the total freight traffic. These trips deliver small shipments, with a relatively high frequency, because most commercial establishments in urban areas tend to have little or no storage space. These establishments produce additional FSA in the form of waste and "reverse logistics" of returns and exchanges.

IV. The Generation of Freight, Freight Trips, and Service Trips

In contrast to the sprawling nature of supply chains, which could encompass multiple levels of geography: city, region, nation, and international, FSA is easily observed at the (local) establishment level. At this level, FSA arrives to perform an activity, and leaves to perform activities elsewhere. In accordance with the transportation planning nomenclature, this generation activity is decomposed into a process of Attraction (the flows that arrive to perform an activity at the establishment), and a process of Production (the flows that depart from the establishment to perform an activity at a different location). These important concepts are defined next.

The various expressions of FSA can be measured by different metrics:

- **Freight Generation (FG)** is the amount of cargo—typically measured in units of weight such as pounds/day, tons/day—generated by a commercial establishment. The FG is the summation of:
    - **Freight Attraction (FA)** is the amount of cargo that is brought to the establishment to be processed, stored, or sold to customers. Most establishments receive supplies.
    - **Freight Production (FP)** is the amount of cargo sent out of the establishment for use at another establishment. Typically, establishments that sell final products to consumers have FP = 0. Establishments that conduct intermediate processing activities have FP > 0.

- **Freight Trip Generation (FTG)** is the number of freight vehicle trips generated by a commercial establishment. The FTG is the sum of:
    - **Freight Trip Attraction (FTA)** is the number of freight vehicle trips arriving at the establishment to transport the FA. Most establishments receive freight vehicle-trips. Delivering supplies to an establishment will create two vehicle trips (inbound and outbound).
    - **Freight Trip Production (FTP)** is the number of freight vehicle trips that depart from the establishment to transport cargo to other destinations. Establishments that do not have FP, will not generate FTP. In most cases, picking up a shipment from an establishment will necessitate two vehicle trips (inbound and outbound).
- **Service Trip Generation (STG)** is the number of service trips generated by a commercial establishment. As in the previous cases, STG is the summation of:
    - **Service Trip Attraction (STA)** is the number of vehicle trips that arrive at the establishment to perform a service activity. Most establishments receive service trips. As before, performing a service will create two vehicle trips (inbound and outbound).
    - **Service Trip Production (STP)** is the number of vehicle trips that depart from the establishment to perform a service at other locations. Typically, only establishments in service sectors will perform service trips.

Generation by Industry Sectors

The vast majority of the industry sectors found in urban economies create FG, FTG, or STG, though they do so in different amounts. Table 3 shows qualitative estimates of the amounts of FG, FTG, and STG that are produced by the various industry segments.

Table 3: Typical Contributions to FG, FTG, and STG by Industry Sectors

NAICS	Description	Freight Generation (FG)	Freight Trip Generation (FTG)	Service Trip Generation (STG)
Freight Intensive Sectors (FIS)				
11	Agriculture, Forestry, Fishing and Hunting	+++	+	+
21	Mining, Quarrying, and Oil and Gas Extraction	+++	+	+
22	Utilities	++	+	+
23	Construction	+++	+	+
31-33	Manufacturing	++	++	+
42	Wholesale Trade	++	+++	++
44-45	Retail Trade	++	+++	++
48-49	Transport and Warehousing	++	++	++
72	Accommodation and Food Services	++	+++	++
non-Freight Intensive Sectors (non-FIS)				
51	Information	+	+	++
52	Finance and Insurance	+	+	++
53	Real Estate and Rental and Leasing	+	+	++
54	Professional, Scientific, and Technical Services	+	+	+++
55	Management of Companies and Enterprises	+	+	++
56	Administrative, Waste Management…	+	+	++
61	Educational Services	+	+	++
62	Health Care and Social Assistance	+	+	++
71	Arts, Entertainment, and Recreation	+	+	++
81	Other Services (except Public Administration)	+	+	++

Note: (+++) = major contributor, (++) = mid-level contributor, (+) = small contributor

The table includes all possible industry sectors, though not all of them are likely to be present in metropolitan areas. In general terms, FIS create the bulk of FG and FTG, while non-FIS—particularly those in service sectors—create the bulk of STG. Regrettably, there are not much data about service trips in metropolitan areas. The STA models in the Guidebook are the first ones in the published literature.

As shown, the primary sectors in terms of FG are Agriculture, Forestry, Fishing and Hunting (NAICS 11), Mining, Quarrying, and Oil and Gas Extraction (NAICS 21), and Construction (NAICS 23), which dominate the generation of cargo. These are followed by Utilities (NAICS 22), Manufacturing (NAICS 31-33), Wholesale Trade (NAICS 42), Retail Trade (NAICS 44-45), Transportation and Warehousing (NAICS 48-49), and Accommodation and Food Services (NAICS 72), all of which are mid-level contributors to cargo generation. In terms of FTG, the rank order is radically different, as the vast majority of the trips are created by Retail Trade (NAICS 44-45), Wholesale Trade (NAICS 42), and Accommodation and Food Services (NAICS 72). As mentioned, the bulk of STG trips are created by the service sectors.

V. Modeling Principles

The modeling approach adopted in this Guidebook is a major improvement over traditional approaches. It has solid conceptual foundations, and more importantly, produces estimates that are more accurate than alternative methodologies. See Holguín-Veras et al. (2013a) for a comparison. However, this does not mean that these models are perfect, far from it. The reason is that FSA is the result of complex interactions between the economic factors that determine the production and consumption of freight and services, and a host of logistical decisions. These interactions cannot be captured by simple models, such as the ones in this Guidebook. The research conducted by team members confirms this assertion.

Sánchez-Díaz et al. (2014) used advanced econometric techniques to estimate two sets of models. The first group considered traditional independent variables—such as employment and other establishment attributes—while the second set considered spatial variables such as proximity to similar businesses and large population centers. The difference in the explanatory power of the models was remarkable. The coefficients of determination (R^2) in the traditional models—in the range of 0.10-0.20—jump to 0.76-0.94 with the inclusion of spatial variables and the use of spatial econometrics. The use of these variables—spatial proxies of the determinants of economic activity—leads to models that provide a better explanation of FSA. However, using spatial econometric techniques and spatially defined independent variables is beyond the reach of most practitioners. There is also the issue of data availability. In applications such as site impact analysis and freight demand forecasts, it is not possible to even guess the values that spatially defined variables are likely to take. Simpler, though admittedly less accurate, models are needed. These considerations led the team to estimate the simplest—yet conceptually valid—models using employment as the sole independent variable because employment is an expression of the economy (represented by number of employees) and data about employment at different levels are publically available, making easier for practitioners to apply the models. These models have numerous advantages as they:

- Could use the employment estimates produced by federal agencies, such as the Census Bureau, to estimate FSA at a fine level of detail.
- Establish a direct connection with the Commodity Flow Survey (CFS), an underused resource that could be further exploited for transportation modeling purposes.

The analyses conducted by the team led to the conclusion that the Guidebook models should also be:

- **Establishment-level (disaggregate) models.** Estimating FSA at the establishment level leads to more accurate models because there is a more direct connection between FSA and employment.

Importantly, these estimates can then be aggregated to larger levels of geography (e.g., city block, ZIP code, transportation analysis zones or TAZ) using suitable aggregation procedures.

- **Economic based.** Instead of using variables like square footage, that do not measure the intensity of the activity performed at the establishment, the models use employment, which correctly measure the intensity of the use of space, which leads to better forecasts of FSA.
- **Applicable to any land use classification system.** The models' disaggregate and economic-based nature allow their use irrespective of how the land use classes are defined. This enhances model transferability, because land use classes change from city to city, while the FSA for an industry sector is significantly more stable across the country.

These features are discussed in more detail next.

Establishment-Level (Disaggregate) Models

The Guidebook models are based on the fundamental principle that, for a model to adequately predict transportation demand, it must correctly capture the underlying processes that generate the demand. In the case of FSA, these processes—economic and logistical in nature—take place at the establishment level. This emphasis reflects transportation modeling experience, which unambiguously shows that disaggregate models are better able to correctly capture the determinants of transportation demand. These models are very efficient because they: (1) require smaller samples than their aggregate counterparts, (2) establish a direct connection between the attributes of the establishment and the measure of FSA that is being estimated, and (3) could be aggregated to any level of geography.

Economic Based Nature of the Models

The Guidebook models are "economic-based," as they use economic variables to estimate FG, FTG, and STG. For the following reasons, this enables the models to produce better estimates of FSA, and increases their ability to work well in different land use patterns:

- The amount of cargo consumed and produced at an establishment are the inputs and outputs of an economic process. For that reason, employment and the industry sector are better predictors of FSA than variables like square footage, which denotes little about the activity taking place at the establishment. See Holguín-Veras et al. (2013a).
- The economic nature of the models allow for a differentiation between FG and FTG. This is significant because, while FG is the output of an economic process, FTG is the output of such logistical decisions concerning frequency of deliveries and shipment sizes. As a result, there is no one-to-one correlation between FG and FTG because increasing shipment sizes could allow carriers to transport larger amounts of FG without necessarily increasing FTG. This distinction provides a more nuanced view of how operational or policy changes might alter freight activity.

Given the economic nature of the models, it is important to use a formal economic classification system of industrial activities. Using these systems improves model quality because the establishments within a group share common characteristics, which reduces the internal variability of the data in that group. The classification system used here is the North America Industrial Classification System (NAICS) because:

- It enables direct use of official statistics—particularly employment—that are regularly released by agencies such as the Census Bureau and the Bureau of Transportation Statistics.
- It provides a comprehensive classification of all the economic activities that can take place in the formal economy, including in freight intensive and service sectors.

Applicability to Various Land Use Configurations

A key principle that guided model development was the desire for the resulting models to be applicable irrespective of the prevailing land use patterns. This was accomplished by estimating models that do not use land use variables. To this effect, the team exploited the disaggregated and economic nature of the models. Instead of estimating FSA models based on land use patterns, the team estimated the models by industry sectors. This decision is advantageous in multiple ways because:

- **The FSA generation patterns by industry sector are more stable than those associated with land use.** While land use patterns could radically change from city to city, the patterns of FSA are largely determined by industry-wide practices and regulations, which reduces variability.
- **Industry-based FSA models can be folded into any land use pattern.** Since land use ordinance regulates the economic activities that are possible at any given zone, FSA models by industry sector can easily be mixed so that they replicate any land use pattern.

Essentially, there is no doubt that a city block in a highly dense commercial area in a large city is likely to generate a different level of FSA compared to a city block in a mid-size or small city. However, close examination of the FSA generation patterns at the establishment-level reveals that these patterns are relatively similar. This is because the establishments in the same line of business tend to use similar technologies and operational practices. True, there are differences in FSA on account of land use values, proximity to arterials, and other local factors (Sánchez-Díaz et al., 2014). However, for practical purposes, the assumption that FSA patterns are the same for all establishments in the same industry sector is reasonable. The differences in FSA patterns that are observed beyond the establishment-level, such as the level of city block and buildings, are likely to be the result of the role played by factors, such as the density of commercial establishments, the mix of industry sectors present in the area, and the logistical adjustments made by vendors to deliver supplies to environments of various densities.

VI. Modeling Methodology

This chapter provides a succinct overview of the models used in the Guidebook, the data required, the aggregation procedures that could be used to obtain estimates of FSA for conglomerates of commercial establishments (e.g., city block, transportation analysis zones). Limitations are also discussed.

Model Typology

To facilitate their use in data-constrained application environments, the Guidebook models are designed to be as simple as practically possible, using employment as the sole variable. The Guidebook models capture a wide range of FSA patterns. The first group of models are econometric in nature and were estimated using statistical techniques to ensure that the resulting parameters meet a minimum threshold of significance. The second group of models are FTG rates as a function of employment that are not statistically estimated.

Econometric models

These models express FSA as a statistical function of employment. The estimation process typically starts with a general form that is sequentially reduced, by eliminating the parameters that are not significant or are not conceptually valid. At the end of the process, if an acceptable model is found, there are statistical assurances that the final model is statistically acceptable. The econometric models in the Guidebook are statistically significant and conceptually valid. The models fall into two major families: linear and non-linear. The functional forms of the models are described next.

Linear models:

These models are variants of the linear model shown next:

$$f_i = \alpha + \beta E_i \quad (1)$$

Where:

f_i = FSA metric for establishment i E_i = employment at establishment i

Three different linear model types are used in the Guidebook:

- **Constant (model type C)**: In these cases the FSA metric does not depend on the establishment employment.

$$f_i = \alpha \quad (2)$$

- **Employment Rate (model type ER)**: These cases correspond to situations where the FSA metric bears a direct relation to establishment employment.

$$f_i = \beta E_i \quad (3)$$

- **Constant and Employment Rate (model type C-ER)**: These industry sectors with this model type exhibit FSA with both a constant and an employment term.

$$f_i = \alpha + \beta E_i \quad (4)$$

Non-linear models:

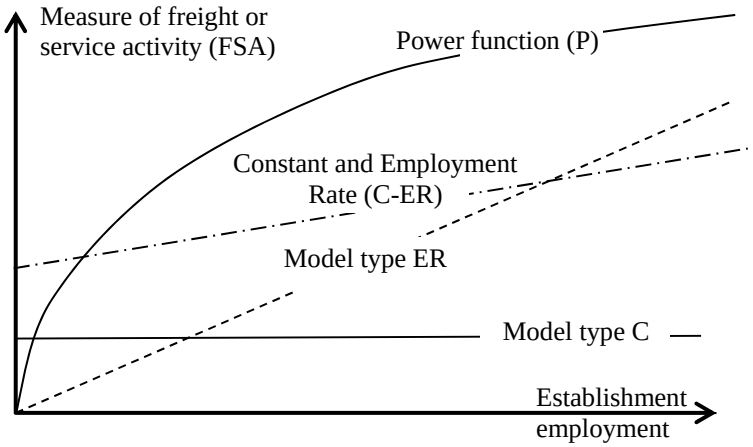
Although there are many potential non-linear forms, the team decided to use a power function of the kind shown below because: (1) it is very flexible and able to accommodate various data patterns; and (2) it is consistent with the Economic Order Quantity (EOQ) model, which is a good approximation for the ordering behavior of commercial establishments. It is worthy to mention that the EOQ model predicts that, irrespective of transportation and inventory costs, the frequency of orders (which is the FTG) is a function of the square root of the demand. This result provides a theoretical value that could be used to check the validity of the models estimated in the Guidebook.

- **Power function (model type P)**: In these cases the FSA in question increases as a power function of the establishment employment.

$$f_i = \phi E_i^{\gamma} \quad (5)$$

Graphically, these model types can be represented as in Figure 3.

Figure 3: Econometric Forms Estimated in the Guidebook



As shown in Chapter VII, no single model type is always the best (though the power model is the one that most frequently provided the best fit). Assuming a specific form, like one in the ER model, could lead to major estimation errors if it is applied to an industry sector with a different FSA pattern. For instance, if an analyst uses a FTG rate per employment to estimate the FTG of establishments for which the actual FSA pattern follows the C pattern, it will underestimate the FTG for small establishments and overestimate the FSA for large establishment. See Holguín-Veras et al. (2011) for an in-depth discussion.

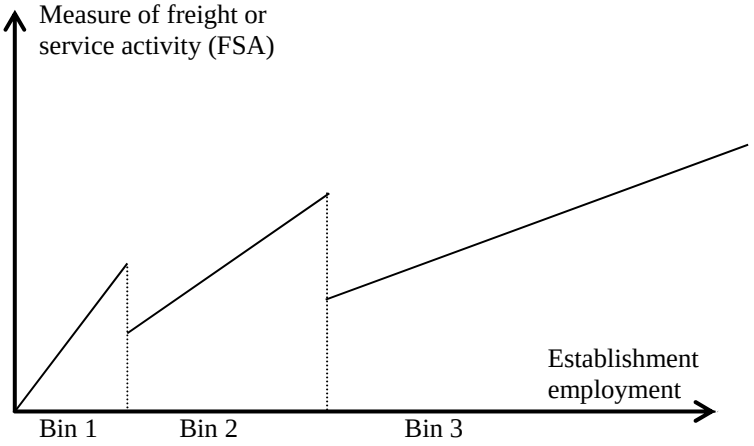
FTG Rates by Employment Bin (Model Type ER-EB)

The ER-EB models are a more general version of the constant FTG rate model that mitigate the problem caused by the use of a constant FTG rate by computing FTG rates by employment bins. However, the computation of the rates by employment bins leads to the undesirable characteristic of discontinuities in the FSA estimates at the points where the FTG rates change values. Not accounting for these discontinuities could lead to unreasonable results. See Figure 4. Mathematically, the ER-EB is expressed as:

$$f_i = \beta_{l_i} E_i \tag{6}$$

Where the parameter β_{l_i} is the one that corresponds to the employment bin (l) for establishment i.

Figure 4: FTG Rates by Employment Bin



Aggregation Procedures

In most applications, transportation professionals are interested in estimates of FSA for conglomerates of users, such as those within a city block, a corridor, a ZIP code, or a TAZ. For instance, a city engineer interested in determining the parking spaces needed to accommodate deliveries to a downtown city block, needs to estimate the total number of deliveries generated by that city block. Obtaining these aggregate estimates requires the use of an aggregation procedure that uses the disaggregate-level estimates to compute the aggregate values of the FSA metric. This section provides a summary of key aggregation procedures, their advantages and disadvantages, and recommended uses. For a complete discussion see Holguín-Veras et al. (2011). The techniques discussed are classified into two major cases, when: (1) establishment level data are available; and (2) only aggregate data are available.

Case 1: Establishment Level Data are Available

Establishment level data to estimate the models are available, and could be used to estimate the levels of FSA for the establishments in the data.

Complete Enumeration

Recommended use: This technique is well suited for cases in which there are data for all of the establishments of interest, and the number of establishments is relatively small. This technique is applicable to both linear and non-linear models.

This is probably the simplest of all aggregation procedures. It only requires: (1) applying the model that corresponds to the establishment's industry sector to obtain the establishment-level values; and (2) adding up the establishment-level estimates of FSA. Mathematically, the aggregated FSA, F, is equal to the summation of the values for the different establishments, f_i:

$$F = \sum_{i=1}^{n} f_i \tag{7}$$

Where: F = Aggregate generation of a metric of FSA E_i = employment at establishment i

f_i = FSA metric for establishment i

These calculations are straightforward and could be performed with a typical spreadsheet.

Sample Estimation

Recommended use: This technique is very useful when: (1) there are no complete data for the establishment in the study area; or (2) when the number of establishments is very large. This technique is applicable to both linear and non-linear models.

In this technique, a sample of establishments—representing the population of establishments under study—is used to estimate the average value of FSA being studied. Once this average is available, the aggregate number is obtained by multiplying the average by the total number of establishments.

Mathematically:

$$\bar{f} = \frac{\sum_{i=1}^{n} f_i}{n} \tag{8}$$

$$F = N\bar{f} \tag{9}$$

Where: F = Aggregate generation of a FSA metric E_i = employment at establishment i

f_i = FSA metric for establishment i $\bar{f}$ = Average FSA for small sample

N = Total number of establishments in study area

The accuracy of this procedure depends on how representative the small sample is. If the sample is representative of the population, the procedure will provide solid estimates of the overall level of FSA.

Case 2: Only Aggregate Data Are Available

Recommended use: These techniques are very useful when: (1) aggregate data by industry sector are available; and (2) the establishment-level models are linear. This technique only applies to linear models.

The aggregation procedures discussed before work if the establishment level data are available. There are cases, however, when only aggregated data are available. Notable examples of these cases include:

- **Official employment statistics**: Most of the publicly available economic data are released at an aggregate level, for confidentiality reasons. The employment data released by the Census Bureau, for instance, are only disclosed by ZIP code or county, e.g., (U.S. Census Bureau, 2013).
- **Planning Forecasts at MPO levels**: In most cases, for practical reasons, the forecasts of economic activity are only made at the aggregate level e.g., by Transportation Analysis Zones. In most cases, it is not technically possible to produce disaggregated forecasts at the establishment level.

Fortunately, the linear models in the Guidebook can be used to compute the aggregate FSA if the aggregate data contain the number of establishments and total employment by industry sector. In this case, the resulting estimates of FSA will be exactly the same as if they were produced with the disaggregate data. In all cases the aggregation procedure must be the one that correspond to the disaggregate model that is used. See Holguín-Veras et al. (2011). Since the models in the Guidebook are by industry sector, the aggregation procedure must be performed industry sector by industry sector. Each model type requires a different aggregation procedure. The easiest way to illustrate this is to obtain the aggregation formulas.

The formulas to be used are as follows:

Constant (model type C)

In this case, the metric of FSA at the establishment level is constant. Mathematically:

$$f_i = \alpha \tag{10}$$

Replacing equation (10) in (7) and taking α out of the summation term:

$$F = \sum_{i=1}^{n} \alpha = n\alpha \tag{11}$$

This implies that, if the FSA at the establishment level is constant, the correct way to estimate the aggregate metric FSA is to multiply the unit value of FSA, α, by the number of establishments.

Employment Rate (model type ER)

This case could be represented as in equation (12), where β is a constant FTG rate per employee.

$$f_i = \beta E_i \tag{12}$$

Replacing equation (12) in (7) and taking β out of the summation term:

$$F = \sum_{i=1}^{n} \beta E_i = \beta \sum_{i=1}^{n} E_i = \beta E^* \tag{13}$$

This means that, if the underlying FSA pattern is proportional to employment, the total FSA could be obtained as the multiplication of the total employment (E^*) times the FSA rate.

In the case of the FTG Rates by Employment Bin (type ER-EB), the aggregation formula becomes:

$$F = \sum_{l=1}^{L} \beta_l \, E_l^* \tag{14}$$

Where: β_l is the employment rate for employment bin *l*, *L* is the number of bins, and E_l^* is the total employment in employment bin *l*. (It should be noted that the total estimate of FSA is susceptible to be affected by the discontinuities illustrated in Figure 2.)

Constant and Employment Rate (model type C-ER)

In this case, the FSA at the establishment level has an intercept and a term that depends on employment. Mathematically:

$$f_i = \alpha + \beta E_i \tag{15}$$

The total is then:

$$F = \sum_{i=1}^{n} (\alpha + \beta E_i) = n\alpha + \beta \sum_{i=1}^{n} E_i = n\alpha + \beta E_i^* \tag{16}$$

The correct way to obtain the total FSA is to multiply the total number of establishments by the constant FSA term plus the total employment times the FSA rate. Case C-ER is a mix of cases C and ER.

Data used

The Guidebook models enjoy an empirical support that is significantly more substantial than its predecessor's (Holguín-Veras et al., 2012). Since the publication of the original NCHRP Report 739/NCFRP Report 19 report, the team collected data and secured access to additional data sources, most notably the Commodity Flow Survey (CFS) microdata. The data used to produce the Guidebook come from: (1) the 2007 Commodity Flow Survey microdata; (2) an establishment survey conducted by the Hartgen Group; and (3) establishment surveys conducted by the team. The data used are summarized in Table 4.

Table 4: Data Sources Used in Guidebook

Description of the data collected	2007 Commodity Flow Survey	2008 Hartgen Group Survey	RPI Establishment Surveys		
			2006 NYSDOT	2011 USDOT	2015 NCFRP / SHRP C-20
Freight Attraction (FA)					✓
Freight Production (FP)	✓				✓
Freight Generation (FG=FA+FP)					
Freight Trip Attraction (FTA)			✓	✓	✓
Freight Trip Production (FTP)			✓	✓	✓
Freight Trip Generation (FTG=FTA+FTP)		✓			
Service Trip Attraction (STA)					✓
Service Trip Production (STP)					
Service Trip Generation (STG=STA+STP)					
Number of observations	100,000	1,000	691	263	450

As shown, the 2007 Commodity Flow Survey microdata only contains freight production data, on account of its shipper-based nature. The 2008 survey from the Hartgen Group collected data about shipments received and sent out from 1,000 establishments in the United States. Finally, the RPI establishment surveys include about 1,400 observations data about freight attraction and production, freight trip attraction and production, and service trip attraction. These data sources are further discussed next.

The Commodity Flow Survey (CFS) is the most important source of freight demand data in the country, and one of the oldest data collection programs in transportation. The CFS collects data on the movement of goods in the 50 states of the United States and the District of Columbia. The establishments selected are asked to provide data on shipments sent during one week for each quarter. The CFS provides information on commodities shipped, their value, weight, and mode of transportation, and origin and destination of shipments. The main focus is on shipments sent by domestic establishments in manufacturing, wholesale, mining, and other selected industries. It excludes crude petroleum and natural gas extraction, farms, service industries, government establishments, imports (until shipment reaches first domestic shipper), and trans-border shipments (Fowler, 2001; Bureau of Transportation Statistics, 2008). According to federal law governing Census Bureau reports, the data collected cannot be disclosed in any way or form that permits identification of individual firms or establishments. To protect the confidentiality of the data, the team used the CFS microdata, complemented these with other data sources, and estimated freight production models at a secured Census Bureau facility. The Guidebook models were subject to a rigorous disclosure procedure to ensure that no confidential information is inadvertently disclosed.

A separate set of models was generously provided by Dr. David T. Hartgen, from the Hartgen Group. The data used to estimate the models were collected in 2008 (Hartgen et al., 2014), as part of a study to assess the impacts of congestion on employers across the US. Approximately 1,000 companies were surveyed in all states except Alaska and Hawaii. The respondents were asked about the number of shipments sent or received per week at their establishments, mode of transport, and percent of deliveries affected by local congestion (Clark & Chase Research Inc., 2008). These models are different in several respects to the rest of the models included in the Guidebook. First, they estimate the summation of FTA and FTP, as opposed to separately estimating FTA and FTP as the other models do. There are issues with the ER-EB models. First, aggregating FTA and FTP could lead to errors because FTA and FTP do not always follow the same pattern. Second, the models assume that FTG increases with employment, which is not always the case. In spite of these issues, the models are a pragmatic way to estimate FTG that is otherwise consistent with the rest of the models in the Guidebook.

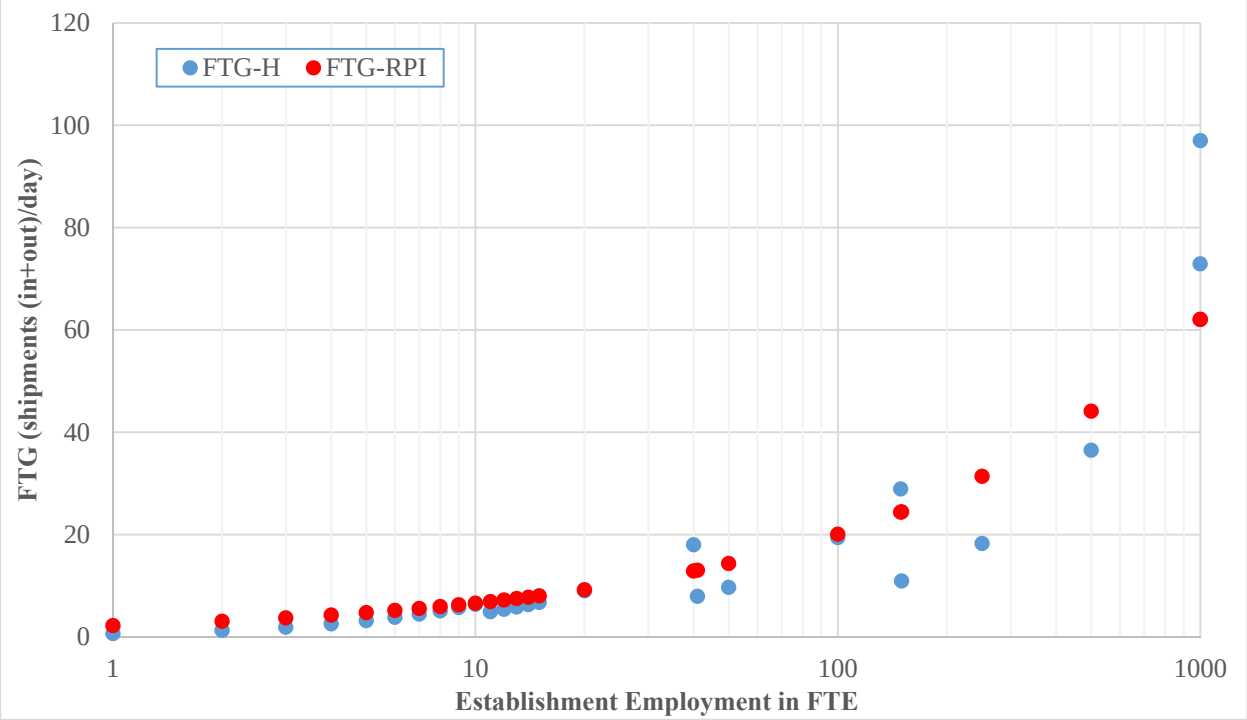
The third source of data are three datasets collected by RPI using establishment surveys. The first dataset—assembled in 2006 as a part of a project conducted for the New York State Department of Transportation (NYSDOT)—was used to estimate the models in NCHRP Report 739 / NCFRP Report 19: Freight Trip Generation and Land Use (Holguín-Veras et al., 2012). In that effort, disaggregated data were collected at the establishment level through two surveys targeting carriers and receivers. The questionnaire inquired about company attributes and operational and FTG patterns. The receiver sample was selected from receivers in Manhattan with more than five employees, while selected carriers had at least 25 employees, and were based in New York and New Jersey. The data collection process resulted in a sample for the Manhattan and Brooklyn receivers with 362 observations and a sample of New York and New Jersey carriers comprised of 339 observations (Holguín-Veras et al., 2012). The second dataset came from an establishment survey that was part of a project funded by the United States Department of Transportation (USDOT). The survey was conducted in 2011, and included sections that inquired about deliveries and shipments received, and current operations. These sections included questions concerning the number of deliveries received, shipment size, type of good(s) received, number of vendors, and number of employees. Data were collected from 263 receivers in Manhattan (Holguín-Veras et al., 2013b). The third and most recent dataset is based on an establishment survey—specifically designed to collect data about FSA—conducted in 2015 using a modified version of the survey instrument from Holguín-Veras et al. (2012). This data collection effort was co-funded by NCFRP and the second Strategic Highway Research Program (SHRP C-20) “Freight Demand Modeling and Data Improvement” project. The survey targeted

establishments in the New York City (NYC) metropolitan area and the New York State Capital Region. It had three sections containing questions to collect data on deliveries received and shipments sent out, service trips, and current operations and flexibility. The deliveries and shipment section included questions pertaining to number of deliveries received, number of shipments sent out, typical size and weight of deliveries and shipments, vehicle type used for both deliveries and shipments, type of products received and shipped, and who transports the deliveries and shipments. The current operations and flexibility section surveyed the respondents on the number of employees, both full and part-time; fleet owned; and other operations-related questions. The service trip section inquired about the number of service trips received, type of vehicle used, most common types of planned and emergency service trips, and percentage of planned and emergency service trips that occur during regular business hours and those that take place during off-hours (7pm-6am). It is important to note that the NCFRP / SHRP C-20 effort originally did not plan to collect data about service trips. However, recognizing the importance of these data, the team decided to include questions about service trip attraction. Regrettably, budget constraints prevented collecting data about service trip production. Data were collected from 450 respondents, 280 from the NYC metropolitan area, and 170 from the New York State Capital Region (CR).

The research approach adopted to produce the Guidebook has produced remarkably consistent results. Figure 5 shows a comparison of the "all sectors" models estimated by the Hartgen Group and the ones estimated for the Guidebook. Since the former models use FTG from a nationwide survey, they provide an external test to the models estimated for the Guidebook. These "all-sectors" models can be interpreted as representing a "generic" establishment. They could be very useful to produce rough estimates of FTG.

As shown, there is a very good agreement between both models throughout the entire range of employment. However, as highlighted earlier, the discontinuities in the estimates of the ER-EB model are quite significant and must be properly accounted for to ensure sensible results. The largest difference occurs for the highest values of employment, which may be due to the presence of outliers in the data used to estimate the ER-EB models.

Figure 5: Comparison of FTG Estimates (All Sectors)



Limitations

Although the Guidebook models are a significant step forward, offering some of the best models available, they have some limitations. Among them:

- **Lack of geographic diversity in the estimation data.** The data used to estimate FTG and STG comes primarily from the Northeast United States (the exception are the ER-EB models). Although the "all-sectors" models produce results that are consistent with each other, there are no data that could be used to assess the transferability of the industry sector models.
- **Type of data collected.** The only effort that collected a full complement of data, using a formal FSA generation survey, is the one of 2015. The other projects only collected basic data. Since the models were estimated with the pooled data, only the basic variables common to all datasets could be used. As a result, the full potential of the 2015 data could not be realized.
- **Lack of data about service trip production and freight attraction.** As shown in Table 4, no data exist for freight attraction and service trip production. Collecting data to fill these gaps would complement the data collected by the CFS and this project, enabling a more comprehensive modeling of freight and service activity.
- **Sparsity of data from large establishments.** The data collected by the team contains a very small number of establishments with more than 100 employees. This could be an issue because the FSA patterns at these establishments may be different than those at smaller establishments.
- **Low explanatory power.** The decision to use relatively simple models based on employment lowers the explanatory power of the models, because other relevant variables are left out. Although the Guidebook models are practical and adequate for most applications, they are not necessarily the best ones. For applications where more accurate estimates are needed, models like the ones estimated by Sánchez-Díaz et al. (2014) are better.

Some of these limitations reflect the opportunistic nature of the data collection process used in the Guidebook, whereby surveys originally intended for a different purpose were extended to collect data about FSA. Although a pragmatic way to collect data that otherwise would not have been collected, such an ad-hoc process cannot replace a comprehensive data collection program. The latter is needed to improve the empirical foundations of FSA modeling throughout the country.

VII. How to Apply the Models

This chapter provides the reader with actionable information about how to use the Guidebook models. It describes potential uses of the Guidebook models, and summarizes the various steps to apply them in the context of practical applications.

Practical Uses of the Models (When to Use What) and Recommended Practices

The Guidebook models can help provide answers to a number of important questions pertaining to FSA at several levels of transportation decision making. Table 5 shows a sample of potential applications, together with the type of models that could help provide the information needed.

Table 5: Practical Uses of the Models

Description	Freight Trip Generation			Service Trip Generation			Freight Generation		
	FTA	FTP	FTG	STA	STP	STG	FA	FP	FG
Traffic Impact Analysis	✓	✓	✓	✓	✓	✓			
Number of parking spaces needed by freight vehicles *	✓	✓	✓						
Number of parking spaces needed by service vehicles *				✓	✓	✓			
Number of parking spaces needed by commercial vehicles *	✓	✓	✓	✓	✓	✓			
Analysis of trends in freight activity *	✓	✓	✓						
Analysis of trends in FSA *	✓	✓	✓	✓	✓	✓			
Estimation of freight trip generation *	✓	✓	✓						
Estimation of service traffic generation *				✓	✓	✓			
Estimation of freight generation *							✓	✓	✓

Note: (*) These analyses can be conducted at any level of geography.

Typical Applications

The application of the models is similar to that of traditional trip generation models, only the independent variables are different. When discussing the various cases, the term metric of FSA, or FSA metric, is used to designate all possibilities (FG, FTG, STG). Essentially, using the models requires:

- Assembling the data needed for the type of establishments involved.
- Running the corresponding models.
- Aggregating the results (if the estimates are for a conglomerate of users).

The most common applications could be categorized on the basis of the number of establishments, and the type of data available to quantify FSA. In terms of number of establishments, there are two cases:

- **Single commercial establishment**: In this case, the analyst is interested in quantifying the FSA for a single commercial unit, e.g., a restaurant. It should be noted that commercial developments, such as malls, typically house multiple establishments (see next case).
- **Conglomerate of commercial establishments:** Here, the interest is on estimating FSA for groups of commercial establishments such as a commercial center, a commercial street, a neighborhood, a ZIP code, or a TAZ. In these cases, the FSA is the summation of the FSA taking place at the establishment level.

In terms of data availability, there are two cases:

- **Establishment-Level Data Are Available**: In this case, estimates of the industry sector and the number of employees for each establishment are available. This is the case, for instance, where the establishments are already in operation and the analyst is interested in quantifying FSA to determine how many parking spaces should be allocated to FSA. The data required are the establishments' industry sectors, and the corresponding numbers of employees.
- **Only Aggregate Data are Available**: This is the case of official employment statistics that are only released as aggregate numbers, e.g., the ZIP Code Business Pattern Database, and in planning applications where it is usually not possible to forecast establishment level estimates of employment. The aggregate data required are, for each industry sector of interest, the number of establishments and number of employees.

The various combinations are shown in Table 6.

Table 6: Outline of Estimation Process for Typical Application Cases

	Type of Data Available	
Number of Establishments	**Establishment-Level Data Are Available**	**Only Aggregate Data Are Available**
Single	**CASE 1: Single Establishment** - Decide on the desired metric(s) of FSA - Select the model(s) of interest for the establishment's industry sector - Run the model(s) with the establishment data Applicability: Linear and non-linear models	(This case is the same as CASE 1)
Multiple	**CASE 2: Complete Enumeration** - Decide on the desired metric(s) of FSA - Run model(s) with data for each establishment - Aggregate results Applicability: Linear and non-linear models **CASE 3: Sample Estimation** - Decide on the desired metric(s) of FSA - Run the model(s) with the data for each establishment in the sample - Compute mean values of FSA - Expand results to entire population Applicability: Linear and non-linear models	**CASE 4: Only Aggregate Data** - Decide on the desired metric(s) of FSA For each industry sector: - Select the correct aggregation procedure - Apply the aggregation procedure to obtain aggregate results Applicability: Only linear models

Data Inputs

The Guidebook models only need two inputs: the establishment's employment in Full-Time-Equivalents (FTE) and the industry sector. The FTE is the summation of the number of full-time employees plus 0.45 times the number of part-time employees, as shown below. In cases where no data are available, the FTE for comparable establishments from the same industry sector and size could be used.

$$\text{FTE} = \text{Number of full-time employees} + (\text{Number of part-time employees}) \times 0.45 \quad (17)$$

The industry sector is establishment's the two-digit or a three-digit NAICS. Generally speaking, the models at the three-digit level (if available) are more precise than the ones at two-digits. Whenever possible, three-digit models should be used. It should be noted that the two-digit NAICS models represent wide ranges of economic activities. For this reason, two-digit models could be useful in cases where the type of economic activity to be performed at a given location is not known with certainty.

Model Outputs

The Guidebook models were estimated with data collected from the demand generators, i.e., the ones that create the need for vehicle-trips. In doing so, the Guidebook models decompose the generation of the demand from the generation of the FSA traffic, a standard practice in passenger transportation modeling. There are multiple reasons to decompose the problem. To start, it leads to models that are more realistic and flexible, and thus better able to capture the nuanced behaviors observed in real life. This is because while the demand generation is the manifestation of the economic process conducted at the establishment, the generation of vehicle-trips is the result of the logistics of the distribution. An establishment—even though it generates the same amount of shipments—could generate different amounts of vehicle-trips depending on its location: if the establishment is located in an isolated area, each delivery made by a vendor may require a vehicle-trip; if the establishment is close to similar businesses, the establishment will generate less vehicle-trips because the vendors may be able to consolidate deliveries to various businesses. These behaviors can only be explained if the generation of demand is treated separately from the gen-

eration of vehicular traffic. Moreover, collecting the data that the demand generator could accurately provide leads to data of better quality that could be linked directly to the establishment attributes. A manager of a store could provide very solid information about the numbers of deliveries they receive, the amount of cargo received, or the number of service calls in a week. However, the manager may not necessarily know how many vehicle-trips these activities actually produced. The decisions about the vehicle-trips are made by someone else, either the vendor of the supplies of the carrier.

As a result, the demand estimates must be complemented with a separate model—albeit a simplified one—to convert demand (measured in deliveries/day, shipments out/day, service calls/day, or pounds/day) into vehicle-trips. Ideally, these models ought to provide a reasonable approximation to the decision rules that vendors and carries use to determine the vehicle-trips needed. Estimating these models, or conversion factors, is not trivial as they are likely to depend on multiple factors, including: the degree of competition among the vendors (the more competition, the more difficult to consolidate trips), the density of the destinations to be visited (the lower the density, the more difficult to consolidate trips), the urgency of the activity to be performed (the more urgent, the more difficult to consolidate trips), among others. Regrettably, it was not possible to collect data to study these effects. Further research is needed.

In order to gain insight into the practical range of conversion factors, the team conducted informal interviews with carriers. The suggested values, together with the units of the outputs produced by the different types of models are shown in Table 7. The use of the conversion factors, ϕ_A and ϕ_P, deserve discussion. To facilitate understanding, the cases where separate models exist for attractions and productions are discussed first. Then, the case where there is only a single generation model is discussed.

Separate models for attractions and productions are available

This is the case of the models estimated for the Guidebook, i.e., the FTA, FTP, STA, and FP models. The most distinguishing feature of these models is that separate conversion factors could be used.

FTA: Conversion factor between deliveries/day to vehicle-trips/day. This factor accounts for the fact that a vehicle-trip could be used to make multiple deliveries. This is standard practice for parcel carriers, USPS, and courier services, as they are able to consolidate deliveries on account of the scale of the operations. However, notwithstanding the large size of these operations, the reality is that they only transport a small portion of the total cargo. According to the CFS, parcel / USPS/ couriers transport 2% of the total ton-miles and 0.4% of the tons transported by truck-only modes. The carriers interviewed indicated that, because of stiff competition, it is very difficult to make multiple deliveries from the same location. This suggests that the conversion factor, ϕ_A, should be close to 1.

Table 7: Summary of Output Units and Conversion Factors

Metric of Freight and Service Activity (FSA)	Output unit	Conversion Factor to Vehicle-Trips (multiply by)
Freight Trip Generation (FTG) (HARTGEN)	shipments/day	$(\gamma_A \phi_A + \gamma_P \phi_P)$
Freight Trip Attraction (FTA)	deliveries/day	ϕ_A = 1.00
Freight Trip Production (FTP)	shipments/day	ϕ_P = 0.5
Service Trip Generation (STG)	-	-
Service Trip Attraction (STA)	service calls/day	ϕ_A = 1.00
Service Trip Production (STP)	-	-
Freight Generation (FG) (RPI)	-	-
Freight Attraction (FA)	pounds/day	Table 20, 21
Freight Production (FP)	pounds/day	Table 22, 23

Note: ϕ_A and ϕ_P are the conversion factors for attractions and productions of the various metrics of FSA. γ_A and γ_P are the ratios of attractions and productions with respect to the total generation.

FTP: Conversion between shipments/day to vehicle-trips/day. This factor takes into account that shipments going out of an establishment can be consolidated to reduce transportation costs. The interviews conduct that this form of consolidation is relatively frequent. The team's best estimate is that a conversion of factor ϕ_P = ½ (2 shipments out = 1 vehicle-trip) is appropriate. Obviously, in the case of establishments that rely on parcel carriers, the conversion factor could be even smaller.

STP: Conversion between service calls/day to vehicle-trips/day. This factor takes into account that a vehicle making service calls could do more than one service call from the same location. This case resembles that of FTA in that, generally speaking, it is difficult to consolidate service calls. For this reason, a conversion factor of, ϕ_A = 1 is suggested.

FP: Conversion between pounds/day to vehicle-trips/day. The outputs of the FP models are in units of pounds/day, so they must be converted into vehicle-trips/day. This process is straightforward in the case of large shipments that required full-truck-loads though it is extremely complex for less-than-truckloads shipments, which are the vast majority in metropolitan areas. The team attempted to estimate statistical relations for the latter case using the RPI 2015 survey, which collected both FG and FTG data. The results were not encouraging. As shown in Tables 20 - 23, although being statistically significant the models have low explanatory power. Additional research is needed to develop better ways to estimate FTG from FG for the case of less-than-truckload shipments that is the norm in metropolitan areas.

Only a generation model (attractions plus productions) is available

In the case of the ER-EB models, which combine attraction and production in a single estimate, the conversion between shipments and vehicle-trips must account for the relative importance of attractions vis-à-vis productions. This could be done with this formula:

$$\phi_G = \left(\gamma_A \phi_A + \gamma_P \phi_P\right) \quad (18)$$

Where: ϕ_A and ϕ_P are the conversion factors for attractions and productions; γ_A and γ_P are the ratios of attractions and productions with respect to the total generation.

In a city where attractions represent 60% of the total generation and productions the other 40%, and ϕ_A =1 and ϕ_P = 0.5, the corresponding value of ϕ_G will be equal to 0.8 (0.6x1 + 0.4x0.5). Multiplying the total generation by ϕ_G will estimate the corresponding number of vehicle-trips.

It is important to acknowledge that the conversion factors presented here could be significantly improved. Future research should focus on improving the conversion factors presented. Collecting data that account for the logistical decisions regarding the relations between shipments and vehicle-trips would complement FSA modeling. This should be a priority.

Step-by-Step Process

Table 8 provides an easy way to find the models desired. As shown, the rows contain the various metrics of FSA, while the columns represent the type of models (linear or non-linear). The cells in the table represent the numbers of the tables that contain the models.

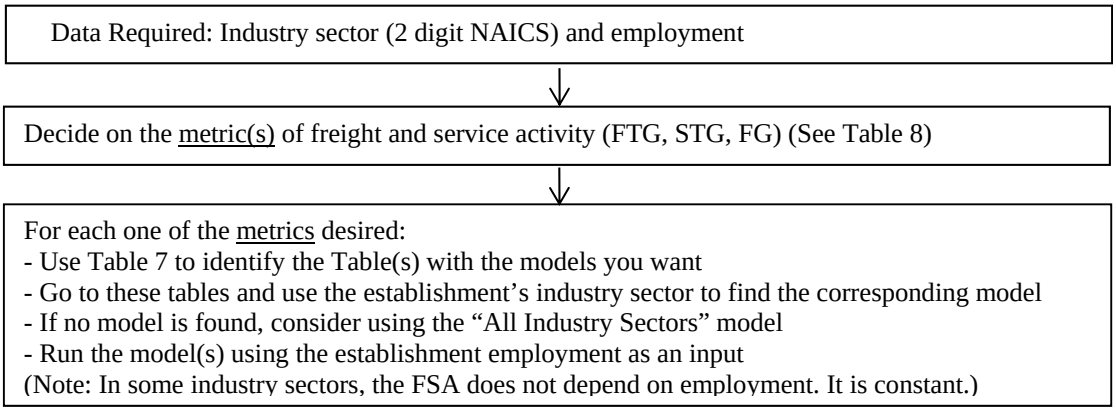
Table 8: Tables Where Models Can be Found

(FSA)	Linear	Non-Linear
Freight Trip Generation (FTG) (HARTGEN)	Table 13	-
Freight Trip Attraction (FTA)	Table 9	Table 10
Freight Trip Production (FTP)	Table 11	Table 12
Service Trip Generation (STG)	-	-
Service Trip Attraction (STA)	Table 14	Table 15
Service Trip Production (STP)	-	-
Freight Generation (FG) (RPI)	-	-
Freight Attraction (FA)	Table 16	Table 17
Freight Production (FP)	Table 18	Table 19
FTG as function of FG (RPI)	-	-
FTA as function of FA	Table 20	Table 21
FTP as function of FP	Table 22	Table 23
Freight Generation (FG) (CFS 2007)	-	-
Freight Attraction (FA)	-	-
Freight Production (FP)	Tables 24-27(NY), 40-43(CA), 56-59(TX), 72-75(WY), 88-91(OH), 104-107(US)	Tables 28-39(NY), 44-55(CA), 60-71(TX), 76-87(WY), 92-103(OH), 108-119(US)

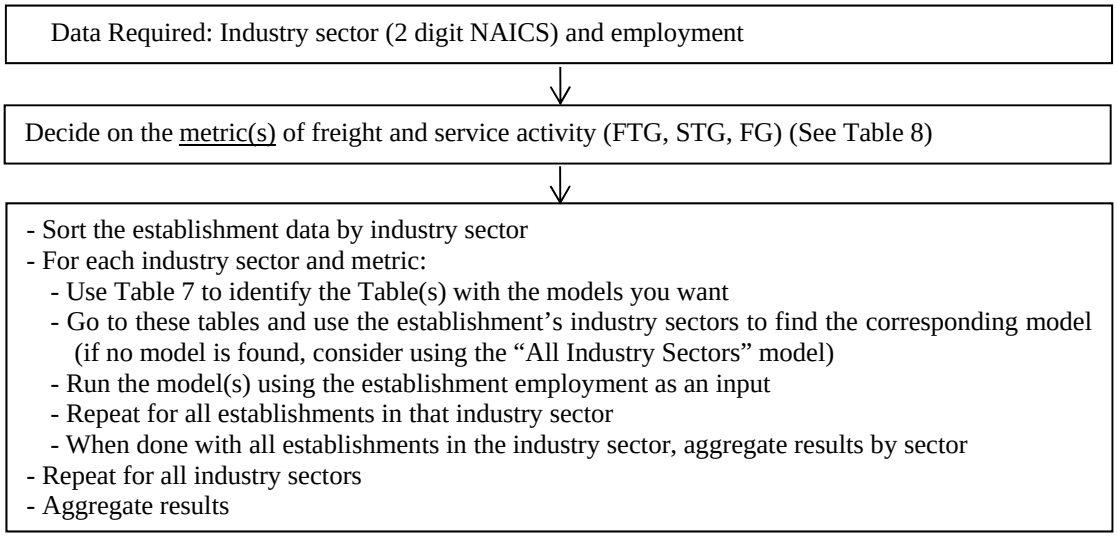
Note: The FP models estimated with the CFS 2007 for the states of California, Ohio, Texas, Wyoming, and the entire US, were submitted for disclosure in November 2015. These models were estimated, in linear and non-linear forms, for 2 and 3 digits NAICS, and "all modes" and "road" modes. The models will be included in the Guidebook as soon as their disclosure is approved.

The flowcharts provide a detailed process to help practitioners use the Guidebook models to quantify FSA. The discussion starts with the cases where the disaggregate data are available, followed by the applications where only aggregate data are available.

CASE 1: Single Establishment—Establishment-Level Data Available for All—Linear/Non-Linear Models



CASE 2: Multiple Establishments—Establishment-Level Data Available for All—Linear/Non-Linear Models



CASE 3: Multiple Establishments—Establishment-Level Data Available for a Sample—Linear/Non-Linear Models

Data Required: Industry sector (2 digit NAICS) and employment

↓

Decide on the metric(s) of freight and service activity (FTG, STG, FG) (See Table 8)

↓

- For the establishments in the sample
- Sort the establishment data by industry sector
- Count the number of establishments in each industry sector. If there are more than 20 establishments per industry sector, the analysis could be done by industry sector. If not, regroup the data in clusters of industry sectors with more than 20 observations each. When creating these groups, try to ensure that they include similar economic activities.
- For each industry sector (or clusters of) and metric(s):
  - Use Table 7 to identify the Table(s) with the models you want
  - Go to these tables and use the establishment's industry sector to find the corresponding model (if no model is found, consider using the "All Industry Sectors" model)
  - Run the model(s) using the establishment employment as an input
  - Repeat for all establishments in that industry sector
  - When done with all establishments in the industry sector, aggregate results by sector and compute a mean and standard deviation
- Repeat for all industry sectors (or clusters of)
- To obtain aggregate results, multiply the number of observations in the entire population by the average values obtained from the sample
- If a grand total is needed (all industry sectors), add the values for all industry sectors

CASE 4: Multiple Establishments—Only Aggregate Data Are Available—Linear Models

Data Required: Industry sector (2 digit NAICS) and employment

↓

Decide on the metric(s) of freight and service activity (FTG, STG, FG) (See Table 8)

↓

- For each industry sector and metric of freight and service activity:
- Identify the type of model: Constant (C), Employment Rate (ER), or Combination of Constant and Employment Rate (C-ER)
  - For model type C:
    The aggregate value of the metric of interest =
    (The value of the constant)x(Number of establishments in the industry sector)
  - For model type ER:
    The aggregate value of the metric of interest =
    (The employment rate)x(Total Employment in the industry sector)
  - For model type C-ER:
    The aggregate value of the metric of interest =
    (The value of the constant)x(Number of establishments in the industry sector) + (The employment rate)x(Total Employment in the industry sector)
  - For model type ER-EB:
    FTG = (FTG rate for bin 1)x(Total Employment in the industry sector and bin 1) +
    (FTG rate for bin 2)x(Total Employment in the industry sector and bin 2) +
    (FTG rate for bin 3)x(Total Employment in the industry sector and bin 3)
  - Repeat for all industry sectors
- If a grand total is needed (all industry sectors), add the values for all industry sectors

VIII. Freight, Freight Trip, and Service Trip Generation Models

This chapter shows the final models selected by the team and technical notes for the benefit of users.

Technical Note #1: About interpretation of R^2

In analyzing the statistical results, the reader must be aware of the limitations of the R^2 statistic as goodness of fit measure. For a linear model with a constant term, the R^2 is calculated as:

$$R^2 = 1 - \frac{\sum_i (y_i - \hat{y}_i)^2}{\sum_i (y_i - \bar{y})^2} \quad (19)$$

Essentially, the R^2 measures the model's goodness of fit compared to the reference model with only a constant term. It turns out that, for conceptual reasons, many of the Guidebook models cannot have a constant term. This is the case of the FG models (no establishment with zero employment can generate cargo), and the models that estimate FTG as a function of FG (no establishment with zero employment can generate freight trips). The lack of a constant in the model requires the use of another metric of R^2.

For models without a constant term, the R^2 is computed (as in most statistical packages):

$$R_0^{\ 2} = 1 - \frac{\sum_i (y_i - \hat{y}_i)^2}{\sum_i y_i^{\ 2}} \quad (20)$$

This revised metric computes the model's goodness of fit compared to a reference model with noise only. As $\sum_i y_i^2$ is typically much larger than $\sum_i (y_i - \bar{y})^2$, R_0^2 is often higher than the R^2 with a constant term. Therefore, the removal of a constant term often artificially increases the value of R^2. The implication is that R_0^2 and R^2 are not comparable metrics. Using other statistical measures is in order.

Technical Note #2: About Bias Correction in Non-Linear Models

It should be noted that when running the nonlinear models for FTG, STG and FG, exponential transformation is needed. And in order to adjust for bias caused by the transformation, an additional S^2 term should be included in the calculation so that:

$$f_i = e^{\alpha + \frac{S^2}{2}} \times E_i^{\beta} \quad (21)$$

To facilitate the use of the models, the $e^{\alpha + \frac{S^2}{2}}$ term has been computed and reported in the tables as:

$$\alpha^* = e^{\alpha + \frac{S^2}{2}} \quad (22)$$

Thus, the mathematical model to be used in the calculations is:

$$f_i = \alpha^* \times E_i^{\beta} \quad (23)$$

Technical Note #3: About Statistical Significance and Conceptual Validity of the Models

The team has attempted to ensure that the Guidebook models are statistically significant and conceptually valid. In the case of the ER-EB models, the team only presented the rates with a more than five observations; and added a column with the type of model econometrically found to be the best. The ER-EB model should only be used in cases where the ER model type has been confirmed by the data.

Freight Trip Generation (FTG) Models (RPI)

Freight Trip Attraction (FTA in deliveries/day) Linear Models (RPI)

$$FTA_i = \alpha + \beta E_i \quad (24)$$

Table 9: Freight Trip Attraction (FTA) Linear Models

NYC and CR - FTA [deliveries/day]							
NAICS	Description	α	β	Obs.	Employment		
					Min.	Mean	Max.
23	Construction	2.132	0.059	66	3	28	201
31-33	**Manufacturing**	**1.427**	**0.087**	**202**	**1**	**41**	**350**
31	Food, Beverage, Tobacco, Textile, Apparel	1.825	0.032	54	2	39	200
32	Wood, Paper, Chemical, Plastics, Nonmetals	-	0.153	65	2	38	300
33	Metal, Machinery, Electronic, Furniture & Misc.	2.276	0.075	83	1	44	350
42	Wholesale Trade	3.669	0.081	227	1	20	200
44-45	**Retail Trade**	**2.756**	**0.118**	**259**	**1**	**17**	**173**
44	Motor Vehicle, Furniture, Electronics, Clothing	2.793	0.143	180	1	18	173
45	Sporting Goods, Hobby, Book, & Music Stores	3.375	-	79	1	15	98
48	Modal Transportation & Support Activities	10.157	-	14	3	36	151
72	Accommodation and Food	1.918	0.070	102	3	27	180
All	**All Freight Intensive Sectors (FIS)**	**3.061**	**0.079**	**872**	**1**	**26**	**350**

NYC - FTA [deliveries/day]							
NAICS	Description	α	β	Obs.	Employment		
					Min.	Mean	Max.
23	Construction	2.168	0.059	57	3	30	201
31-33	**Manufacturing**	**1.144**	**0.096**	**166**	**1**	**41**	**350**
31	Food, Beverage, Tobacco, Textile, Apparel	1.705	0.035	49	2	37	200
32	Wood, Paper, Chemical, Plastics, Nonmetals	-	0.157	50	2	42	300
33	Metal, Machinery, Electronic, Furniture & Misc.	2.056	0.082	67	1	43	350
42	Wholesale Trade	3.910	0.079	198	1	21	200
44-45	**Retail Trade**	**2.871**	**0.117**	**232**	**1**	**17**	**173**
44	Motor Vehicle, Furniture, Electronics, Clothing	2.970	0.144	158	1	19	173
45	Sporting Goods, Hobby, Book, & Music Stores	3.400	-	74	1	15	98
48	Modal Transportation & Support Activities	11.291	-	11	3	39	151
72	Accommodation and Food	2.081	0.069	95	3	28	180
All	**All Freight Intensive Sectors (FIS)**	**3.072**	**0.078**	**760**	**1**	**26**	**350**

CR - FTA [deliveries/day]							
NAICS	Description	α	β	Obs.	Employment		
					Min.	Mean	Max.
23	Construction	2.789	-	9	4	16	40
31-33	**Manufacturing**	**2.674**	**0.043**	**36**	**3**	**38**	**300**
31	Food, Beverage, Tobacco, Textile, Apparel	3.400	-	5	6	51	175
32	Wood, Paper, Chemical, Plastics, Nonmetals	3.315	-	15	3	22	70
33	Metal, Machinery, Electronic, Furniture & Misc.	-	0.070	16	5	48	300
42	Wholesale Trade	3.282	-	29	2	12	53
44-45	**Retail Trade**	**1.905**	**0.113**	**27**	**1**	**14**	**50**
44	Motor Vehicle, Furniture, Electronics, Clothing	2.042	0.105	22	1	15	50
45	Sporting Goods, Hobby, Book, & Music Stores	-	0.262	5	3	10	26
72	Accommodation and Food	1.141	-	7	4	15	51
All	**All Freight Intensive Sectors (FIS)**	**2.932**	**0.093**	**112**	**1**	**26**	**350**

Freight Trip Attraction (FTA in deliveries/day) Non-Linear Models (RPI)

$$FTA_i = \alpha^* \times E_i^{\beta} \quad (25)$$

Table 10: Freight Trip Attraction (FTA) Non-Linear Models

NYC and CR - Ln (FTA) [deliveries/day]							
NAICS	Description	α*	β	Obs.	Employment		
					Min.	Mean	Max.
23	Construction	1.565	0.275	66	3	28	201
31-33	**Manufacturing**	**0.858**	**0.499**	**202**	**1**	**41**	**350**
31	Food, Beverage, Tobacco, Textile, Apparel	1.169	0.298	54	2	39	200
32	Wood, Paper, Chemical, Plastics, Nonmetals	0.517	0.603	65	2	38	300
33	Metal, Machinery, Electronic, Furniture & Misc.	0.803	0.540	83	1	44	350
42	Wholesale Trade	1.142	0.539	227	1	20	200
44-45	**Retail Trade**	**1.580**	**0.427**	**259**	**1**	**17**	**173**
44	Motor Vehicle, Furniture, Electronics, Clothing	1.571	0.465	180	1	18	173
45	Sporting Goods, Hobby, Book, & Music Stores	1.541	0.316	79	1	15	98
48	Modal Transportation & Support Activities	2.463	0.470	14	3	36	151
72	Accommodation and Food	0.918	0.477	102	3	27	180
All	**All Freight Intensive Sectors (FIS)**	**1.389**	**0.428**	**872**	**1**	**26**	**350**

NYC - Ln (FTA) [deliveries/day]							
NAICS	Description	α*	β	Obs.	Employment		
					Min.	Mean	Max.
23	Construction	1.574	0.280	57	3	30	201
31-33	**Manufacturing**	**0.870**	**0.495**	**166**	**1**	**41**	**350**
31	Food, Beverage, Tobacco, Textile, Apparel	1.183	0.292	49	2	37	200
32	Wood, Paper, Chemical, Plastics, Nonmetals	0.767	0.606	50	2	42	300
33	Metal, Machinery, Electronic, Furniture & Misc.	0.801	0.540	67	1	43	350
42	Wholesale Trade	1.182	0.538	198	1	21	200
44-45	**Retail Trade**	**1.592**	**0.431**	**232**	**1**	**17**	**173**
44	Motor Vehicle, Furniture, Electronics, Clothing	1.566	0.477	158	1	19	173
45	Sporting Goods, Hobby, Book, & Music Stores	1.568	0.307	74	1	15	98
48	Modal Transportation & Support Activities	3.154	0.448	11	3	39	151
72	Accommodation and Food	1.449	0.342	95	3	28	180
All	**All Freight Intensive Sectors (FIS)**	**1.607**	**0.380**	**760**	**1**	**26**	**350**

CR - Ln (FTA) [deliveries/day]							
NAICS	Description	α*	β	Obs.	Employment		
					Min.	Mean	Max.
23	Construction	1.576	0.230	9	4	16	40
31-33	**Manufacturing**	**1.544**	**0.332**	**36**	**3**	**38**	**300**
31	Food, Beverage, Tobacco, Textile, Apparel	1.033	0.346	5	6	51	175
32	Wood, Paper, Chemical, Plastics, Nonmetals	1.585	0.304	15	3	22	70
33	Metal, Machinery, Electronic, Furniture & Misc.	1.769	0.345	16	5	48	300
42	Wholesale Trade	1.511	0.338	29	2	12	53
44-45	**Retail Trade**	**1.494**	**0.386**	**27**	**1**	**14**	**50**
44	Motor Vehicle, Furniture, Electronics, Clothing	1.590	0.372	22	1	15	50
45	Sporting Goods, Hobby, Book, & Music Stores	1.163	0.467	5	3	10	26
72	Accommodation and Food	0.335	0.521	7	4	15	51
All	**All Freight Intensive Sectors (FIS)**	**0.749**	**0.639**	**112**	**1**	**22**	**300**

Freight Trip Production (FTP in shipments/day) Linear Models (RPI)

$$FTP_i = \alpha + \beta E_i \quad (26)$$

Table 11: Freight Trip Production (FTP) Linear Models

NYC and CR - FTP [shipments/day]							
NAICS	Description	α	β	Obs.	Employment		
					Min	Mean	Max
23	Construction	-	0.092	20	6	39	201
31-33	**Manufacturing**	**5.321**	**0.063**	**96**	**1**	**51**	**350**
31	Food, Beverage, Tobacco, Textile, Apparel	-	0.117	18	2	43	150
32	Wood, Paper, Chemical, Plastics, Nonmetals	5.511	0.135	36	2	45	300
33	Metal, Machinery, Electronic, Furniture & Misc.	5.769	0.021	42	1	59	350
42	Wholesale Trade	6.455	-	68	2	22	200
44-45	**Retail Trade**	**2.314**	**0.242**	**63**	**1**	**15**	**94**
44	Motor Vehicle, Furniture, Electronics, Clothing	-	0.321	42	1	15	77
45	Sporting Goods, Hobby, Book, & Music Stores	3.956	0.179	21	2	15	94
48	Modal Transportation & Support Activities	8.500	-	8	9	53	151
72	Accommodation and Food	-	0.114	12	5	35	159
All	**All Freight Intensive Sectors (FIS)**	**3.800**	**0.085**	**268**	**1**	**33**	**350**

NYC - FTP [shipments/day]							
NAICS	Description	α	β	Obs.	Employment		
					Min	Mean	Max
23	Construction	-	0.091	17	3	34	250
31-33	**Manufacturing**	**5.441**	**0.065**	**69**	**1**	**41**	**300**
31	Food, Beverage, Tobacco, Textile, Apparel	-	0.110	15	2	47	200
32	Wood, Paper, Chemical, Plastics, Nonmetals	7.394	0.126	24	2	61	300
33	Metal, Machinery, Electronic, Furniture & Misc.	6.612	-	30	1	81	400
42	Wholesale Trade	6.021	-	44	1	21	200
44-45	**Retail Trade**	**-**	**0.279**	**51**	**1**	**17**	**173**
44	Motor Vehicle, Furniture, Electronics, Clothing	-	0.295	32	1	20	202
45	Sporting Goods, Hobby, Book, & Music Stores	3.490	0.186	19	1	15	98
48	Modal Transportation & Support Activities	7.667	-	6	3	39	151
72	Accommodation and Food	-	0.115	11	3	28	180
All	**All Freight Intensive Sectors (FIS)**	**3.386**	**0.087**	**199**	**1**	**28**	**400**

CR - FTP [shipments/day]							
NAICS	Description	α	β	Obs.	Employment		
					Min	Mean	Max
31-33	**Manufacturing**	**5.181**	**0.048**	**27**	**3**	**38**	**300**
32	Wood, Paper, Chemical, Plastics, Nonmetals	2.564	0.140	12	3	22	70
33	Metal, Machinery, Electronic, Furniture & Misc.	6.041	0.037	12	5	48	300
42	Wholesale Trade	7.250	-	24	2	12	53
44-45	**Retail Trade**	**-**	**0.432**	**12**	**1**	**14**	**50**
44	Motor Vehicle, Furniture, Electronics, Clothing	-	0.418	10	1	15	50
All	**All Freight Intensive Sectors (FIS)**	**5.189**	**0.090**	**69**	**1**	**22**	**300**

Freight Trip Production (FTP in shipments/day) Non-Linear Models (RPI)

$$FTP_i = \alpha^* \times E_i^{\beta} \quad (27)$$

Table 12: Freight Trip Production (FTP) Non-Linear Models

NYC and CR - Ln (FTP) [shipments/day]							
NAICS	Description	α*	β	Obs.	Employment		
					Min.	Mean	Max.
23	Construction	0.276	0.896	20	6	39	201
31-33	**Manufacturing**	**2.111**	**0.445**	**96**	**1**	**51**	**350**
31	Food, Beverage, Tobacco, Textile, Apparel	1.581	0.369	18	2	43	150
32	Wood, Paper, Chemical, Plastics, Nonmetals	2.201	0.572	36	2	45	300
33	Metal, Machinery, Electronic, Furniture & Misc.	2.133	0.385	42	1	59	350
42	Wholesale Trade	6.804	-	68	2	22	200
44-45	**Retail Trade**	**0.966**	**0.737**	**63**	**1**	**15**	**94**
44	Motor Vehicle, Furniture, Electronics, Clothing	0.806	0.762	42	1	15	77
45	Sporting Goods, Hobby, Book, & Music Stores	1.689	0.603	21	2	15	94
48	Modal Transportation & Support Activities	9.714	-	8	9	53	151
72	Accommodation and Food	0.508	0.706	12	5	35	159
All	**All Freight Intensive Sectors (FIS)**	**1.348**	**0.544**	**268**	**1**	**33**	**350**

NYC - Ln (FTP) [shipments/day]							
NAICS	Description	α*	β	Obs.	Employment		
					Min.	Mean	Max.
23	Construction	0.378	0.639	17	3	34	250
31-33	**Manufacturing**	**1.946**	**0.446**	**69**	**1**	**41**	**300**
31	Food, Beverage, Tobacco, Textile, Apparel	1.607	0.337	15	2	47	200
32	Wood, Paper, Chemical, Plastics, Nonmetals	2.030	0.608	24	2	61	300
33	Metal, Machinery, Electronic, Furniture & Misc.	1.782	0.379	30	1	81	400
42	Wholesale Trade	6.286	-	44	1	21	200
44-45	**Retail Trade**	**1.854**	**0.702**	**51**	**1**	**17**	**173**
44	Motor Vehicle, Furniture, Electronics, Clothing	1.959	0.404	32	1	20	202
45	Sporting Goods, Hobby, Book, & Music Stores	1.651	0.583	19	1	15	98
48	Modal Transportation & Support Activities	1.717	0.413	6	3	39	151
72	Accommodation and Food	1.468	0.421	11	3	28	180
All	**All Freight Intensive Sectors (FIS)**	**1.122**	**0.557**	**199**	**1**	**28**	**400**

CR - Ln (FTP) [shipments/day]							
NAICS	Description	α*	β	Obs.	Employment		
					Min.	Mean	Max.
31-33	**Manufacturing**	**2.690**	**0.442**	**27**	**3**	**38**	**300**
32	Wood, Paper, Chemical, Plastics, Nonmetals	2.623	0.466	12	3	22	70
33	Metal, Machinery, Electronic, Furniture & Misc.	3.661	0.403	12	5	48	300
42	Wholesale Trade	2.007	0.644	24	2	12	53
44-45	**Retail Trade**	**1.504**	**0.653**	**12**	**1**	**14**	**50**
44	Motor Vehicle, Furniture, Electronics, Clothing	1.415	0.628	10	1	15	50
All	**All Freight Intensive Sectors (FIS)**	**2.659**	**0.499**	**69**	**1**	**22**	**300**

Freight Trip Generation (FTG) Models (HARTGEN)

Freight Trip Generation (FTG in vehicles/day) Rates (HARTGEN)

Where: $f_i = \beta_{l_i} E_i$ (28)

Table 13: Freight Trip Generation (FTG) Rates (2 digit NAICS and SICs)

Freight Trips Rates per Employee at 2-digit SIC level										
SIC 2 Dig.	NAICS	Description	Employment Range					Avg. Rate	Obs.	RPI Model
			1-10	11-40	41-149	150-999	1000+			
13	21, 23	Mining-Oil and Gas						0.097	6	ER,C-ER,P
15	23	Construction-Building	0.295					0.255	22	ER,C-ER,P
16	23	Construction-Heavy		0.297				0.206	12	ER,C-ER,P
17	23, 56	Construction-Special	0.308	0.644	0.378			0.510	35	ER,C-ER,P
20	31	Manufacturing-Food					0.020	0.124	17	ER,C-ER,P
24	32, 33	Manufacturing-Wood						0.154	7	C-ER,P
25	33	Manufacturing-Furniture						0.052	5	C-ER,P
27	32, 51	Manufacturing-Printing, Publishing		0.575		0.039		0.380	15	C-ER,P
30	31-33	Manufacturing-Rubber and Plastic						0.884	5	ER,C-ER,P
33	32, 33	Manufacturing-Primary Metals						0.127	5	C-ER,P
34	32, 33	Manufacturing-Fabricated Metals		0.358	0.298			0.317	18	C-ER,P
35	33	Manufacturing-Industrial Equipment			1.775			1.149	12	C-ER,P
36	33	Manufacturing-Electronic Equipment						0.117	7	C-ER,P
37	33, 54	Manufacturing-Transportation Equip.						0.249	7	C-ER,P
38	33	Manufacturing-Measuring Equip.						2.092	6	C-ER,P
39	33	Manufacturing-Miscellaneous						0.664	10	C-ER,P
41	48,62	Transportation-Local Passenger						0.028	7	C,P
42	48, 49	Transportation- Freight & Warehouse						1.341	13	C,P
47	48, 54	Transportation Services						0.051	6	C,P
48	48, 51	Communications-Telephone, Radio, etc.						0.225	6	C,P
49	48, 49	Transportation-Electic, Gas, Sanitation						0.045	6	C,P
50	42, 44	Wholesale Trade-Durable Goods	1.117	0.382	0.270	0.027	0.021	0.542	47	C-ER, P
51	42, 44	Wholesale Trade-Non-Durable Goods	1.030		0.075	0.211	0.124	0.911	34	C,C-ER,P
52	44	Retail-Building Materials, Hardware		0.509		0.070		0.264	19	C-ER, P
53	45	Retail-General Merchandise Stores				0.015		0.078	17	C,P
54	44, 45	Retail-Food Stores			0.050			0.071	10	C-ER, P
55	44	Retail-Automotive and Gasoline Dealers		0.311	0.090			0.279	17	C-ER, P
56	31, 44	Retail-Apparel and Accessory						0.617	6	C-ER, P
57	33, 44	Retail-Home Furniture, Equipment Store		0.067		0.022		0.215	18	C-ER, P
58	71, 72	Retail-Eating and Drining Places		0.057	0.053			0.159	15	C-ER, P
59	44, 45	Retail-Miscellaneous		0.233				0.344	13	C-ER, P
60	52	Finance-Depository Institutions						0.084	12	-
61	52	Finance-Non-Depository Institutions	0.183					0.114	8	-
62	52	Finance-Commodity Brokers, Dealers						0.588	10	-
64	52	Finance-Insurance Agents, Brokers				0.014		0.067	11	-
65	53, 54	Real Estate	0.404	0.364				0.342	24	-
67	52, 53	Finance-Holding & Other Investment						0.088	6	-
70	72	Services-Hotels, Camps and Lodging				0.042	0.017	0.041	29	C-ER, P
73	54, 56	Services-Business	0.439	0.133	0.086	0.158		0.223	49	-
76	44, 81	Services-Miscellaneous Repair						1.067	6	C-ER, P
79	48, 71	Services-Amusement and Recreation	0.435				0.030	0.219	18	C,P
80	54, 62	Services-Health	0.135	0.102	0.042	0.101	0.018	0.056	162	-
81	54	Services-Legal						0.300	6	-
82	51, 61	Services-Education			0.032	0.030	0.007	0.028	86	-
83	62, 81	Services-Social	0.347		0.027			0.171	27	-
87	23, 54	Services-Engineering, Research	1.515	0.129	0.117	0.089		0.359	43	ER,C-ER,P
91	92	Public Administration-Executive				0.017		0.846	12	-
99	-	Non-Classified Establishments	0.403		0.052			0.156	17	-
Total		**All Establishments**	**0.638**	**0.450**	**0.194**	**0.073**	**0.097**	**0.313**	**949**	**-**

Service Trip Generation (STG) Models (RPI)

Service Trip Attraction (STA in service calls/day) Linear Models (RPI)

$$STA_i = \alpha + \beta E_i \quad (29)$$

Table 14: Service Trip Attraction (STA) Linear Models

NYC and CR - STA [trips/day]							
NAICS	Description	α	β	Obs.	Employment		
					Min.	Mean	Max.
23	Construction	-	4.07E-03	9	9	55	201
31-33	**Manufacturing**	**0.236**	**-**	**47**	**3**	**68**	**309**
31	Food, Beverage, Tobacco, Textile, Apparel	0.197	-	6	28	104	184
32	Wood, paper, chemical, plastics, nonmetals	0.251	-	23	3	48	223
33	Metal, machinery, electronic, furniture & misc.	0.230	-	18	5	82	309
42	Wholesale	0.304	-	31	2	46	355
44-45	**Retail Trade**	**-**	**0.010**	**21**	**1**	**38**	**202**
44	Motor vehicle, furniture, electronics, clothing	-	0.012	16	1	39	202
45	Sporting goods, hobby, book, & music stores	0.174	-	6	3	35	91
48	Modal Transportation & Support Activities	-	9.30E-03	7	8	37	100
51	Information	0.595	-	20	2	142	900
52	Finance and Insurance	0.850	-	13	5	707	4000
53	Real Estate	-	9.23E-04	11	6	93	405
54	Professional and Technical Services	0.391	7.99E-04	22	1	181	2000
56	Administrative and Waste Services	0.291	-	22	4	86	523
61	Education Services	0.439	-	15	5	68	177
62	Health Care and Social Assistance	1.179	-	14	11	136	500
71	Entertainment	0.763	-	14	3	62	300
72	Accommodation and Food Services	-	0.022	16	4	28	79
81	Other Services (except Public Admin)	0.571	-	7	31	114	305
All	**All Sectors - Weighted**	**0.408**	**1.09E-03**	**260**	**1**	**111**	**4000**

NYC - STA [trips/day]							
NAICS	Description	α	β	Obs.	Employment		
					Min.	Mean	Max.
23	Construction	-	3.92E-03	6	12	72	201
31-33	**Manufacturing**	**0.251**	**-**	**29**	**3**	**89**	**309**
31	Food, Beverage, Tobacco, Textile, Apparel	0.167	-	3	100	142	184
32	Wood, paper, chemical, plastics, nonmetals	0.233	-	15	3	61	223
33	Metal, machinery, electronic, furniture & misc.	0.298	-	11	12	115	309
42	Wholesale	0.266	-	13	10	92	355
44-45	**Retail Trade**	**0.248**	**-**	**13**	**11**	**52**	**125**
44	Motor vehicle, furniture, electronics, clothing	0.295	-	10	11	48	125
45	Sporting goods, hobby, book, & music stores	0.091	-	3	45	68	91
48	Modal Transportation & Support Activities	-	9.25E-03	6	8	42	100
51	Information	0.804	-	13	15	209	900
52	Finance and Insurance	0.428	3.22E-04	10	15	844	4000
53	Real Estate	-	9.15E-04	7	17	137	405
54	Professional, Sci, and Tech Services	-	1.10E-03	7	65	514	2000
56	Administrative and Waste Services	0.393	-	11	40	159	523
61	Education Services	-	2.77E-03	11	10	84	177
62	Health Care and Social Assistance	1.126	-	9	40	152	500
71	Entertainment	0.879	-	12	13	75	300
72	Accommodation and Food Services	-	0.017	12	6	32	79
81	Other Services (except Public Admin)	0.571	-	7	31	114	305
All	**All Sectors - Weighted**	**0.42**	**4.10E-04**	**156**	**3**	**167**	**4000**

Table 14 (cont.): Service Trip Attraction (STA) Linear Models

CR - STA [trips/day]							
NAICS	Description	α	β	Obs.	Employment		
					Min.	Mean	Max.
23	Construction	0.258	-	3	9	21	40
31-33	**Manufacturing**	**0.212**	**-**	**18**	**3**	**36**	**175**
31	Food, Beverage, Tobacco, Textile, Apparel	0.227	-	3	28	78	175
32	Wood, paper, chemical, plastics, nonmetals	0.284	-	8	3	25	70
33	Metal, machinery, electronic, furniture & misc.	0.123	-	7	5	30	85
42	Wholesale	-	0.021	18	2	13	53
44-45	**Retail Trade**	**-**	**0.018**	**11**	**1**	**25**	**202**
44	Motor vehicle, furniture, electronics, clothing	-	0.018	8	1	30	202
45	Sporting goods, hobby, book, & music stores	-	0.017	3	3	13	26
51	Information	-	0.013	7	2	18	60
53	Real Estate	0.080	-	4	6	16	41
54	Professional, Sci, and Tech Services	0.500	-	16	1	26	103
56	Administrative and Waste Services	0.190	-	11	4	20	82
61	Education Services	-	0.036	4	5	25	76
62	Health Care and Social Assistance	0.466	8.53E-03	4	11	105	373
72	Accommodation and Food Services	-	0.054	4	4	17	51
All	**All Sectors - Weighted**	**0.184**	**0.012**	**104**	**1**	**26**	**373**

Service Trip Attraction (STA in service calls/day) Non-Linear Models (RPI)

$$STA_i = \alpha^* \times E_i^{\beta} \quad (30)$$

Table 15: Service Trip Attraction (STA) Non-Linear Models

NYC and CR - Ln (STA) [trips/day]							
NAICS	Description	α*	β	Obs.	Employment		
					Min.	Mean	Max.
23	Construction	0.309	-	9	9	55	201
31-33	**Manufacturing**	**0.100**	**0.233**	**45**	**3**	**68**	**309**
31	Food, Beverage, Tobacco, Textile, Apparel	0.222	-	6	28	104	184
32	Wood, Paper, Chemical, Plastics, Nonmetals	0.256	-	23	3	48	223
33	Metal, Machinery, Electronic, Furniture & Misc.	0.058	0.347	18	5	82	309
42	Wholesale	0.134	0.263	31	2	46	355
44-45	**Retail Trade**	**0.270**	**-**	**24**	**1**	**38**	**202**
44	Motor Vehicle, Furniture, Electronics, Clothing	0.312	-	18	1	39	202
45	Sporting Goods, Hobby, Book, & Music Stores	0.197	-	6	3	35	91
48	Modal Transportation & Support Activities	0.007	1.073	7	8	37	100
51	Information	0.044	0.582	20	2	142	900
52	Finance and Insurance	1.173	-	13	5	707	4000
53	Real Estate	0.279	-	12	6	93	405
54	Professional and Technical Services	0.635	-	23	1	181	2000
56	Administrative and Waste Services	0.077	0.362	21	4	86	523
61	Education Services	0.450	-	15	5	68	177
62	Health Care and Social Assistance	1.632	-	14	11	136	500
71	Entertainment	1.003	-	14	3	62	300
72	Accommodation and Food Services	0.080	0.697	16	4	28	79
81	Other Services (except Public Admin)	0.596	-	7	31	114	305
All	**All sectors - Weighted**	**0.137**	**0.362**	**260**	**1**	**111**	**4000**

NYC - Ln (STA) [trips/day]							
NAICS	Description	α*	β	Obs.	Employment		
					Min.	Mean	Max.
23	Construction	0.326	-	6	12	72	201
31-33	**Manufacturing**	**0.259**	**-**	**29**	3	89	309
31	Food, Beverage, Tobacco, Textile, Apparel	0.201	-	3	100	142	184
32	Wood, Paper, Chemical, Plastics, Nonmetals	0.247	-	15	3	61	223
33	Metal, Machinery, Electronic, Furniture & Misc.	0.322	-	11	12	115	309
42	Wholesale	0.302	-	13	10	92	355
44-45	**Retail Trade**	**0.254**	**-**	**13**	**11**	**52**	**125**
44	Motor Vehicle, Furniture, Electronics, Clothing	0.339	-	10	11	48	125
45	Sporting Goods, Hobby, Book, & Music Stores	0.099	-	3	45	68	91
48	Modal Transportation & Support Activities	0.003	1.278	6	8	42	100
51	Information	0.887	-	13	15	209	900
52	Finance and Insurance	0.897	-	11	15	844	4000
53	Real Estate	0.012	0.567	7	17	137	405
54	Professional, Sci, and Tech Services	0.884		7	65	514	2000
56	Administrative and Waste Services	0.460		11	40	159	523
61	Education Services	0.021	0.592	11	10	84	177
62	Health Care and Social Assistance	1.689	-	9	40	152	500
71	Entertainment	1.220	-	12	13	75	300
72	Accommodation and Food Services	0.640	-	13	6	32	79
81	Other Services (except Public Admin)	0.596	-	7	31	114	305
All	**All sectors - Weighted**	**0.518**	**-**	**171**	**3**	**167**	**4000**

Table 15 (cont.): Service Trip Attraction (STA) Non-Linear Models

CR - Ln (STA) [trips/day]							
NAICS	Description	α*	β	Obs.	Employment		
					Min.	Mean	Max.
23	Construction	0.359	-	3	9	21	40
31-33	**Manufacturing**	**0.206**	**-**	**18**	**3**	**36**	**175**
31	Food, Beverage, Tobacco, Textile, Apparel	0.304	-	3	28	78	175
32	Wood, Paper, Chemical, Plastics, Nonmetals	0.298	-	8	3	25	70
33	Metal, Machinery, Electronic, Furniture & Misc.	0.036	0.433	7	5	30	85
42	Wholesale	0.050	0.742	18	2	13	53
44-45	**Retail Trade**	**0.020**	**0.973**	**11**	**1**	**25**	**202**
44	Motor Vehicle, Furniture, Electronics, Clothing	0.018	0.960	8	1	30	202
45	Sporting Goods, Hobby, Book, & Music Stores	0.374	-	3	3	13	26
51	Information	0.026	0.749	7	2	18	60
53	Real Estate	0.082	-	4	6	16	41
54	Professional, Sci, and Tech Services	0.556	-	16	1	26	103
56	Administrative and Waste Services	0.183	-	11	4	20	82
61	Education Services	0.036	1.198	4	5	25	76
62	Health Care and Social Assistance	0.111	0.602	4	11	105	373
72	Accommodation and Food Services	0.016	1.546	4	4	17	51
All	**All sectors - Weighted**	**0.037**	**0.846**	**104**	**1**	**26**	**373**

Freight Generation (FG) Models (RPI)

Freight Attraction (FA in pounds/day) Linear Models (RPI)

$$FA_i = \beta E_i \quad (31)$$

Table 16: Freight Attraction (FA) Linear Models

NYC and CR - FA [pounds/day]						
NAICS	Description	β	Obs.	Employment		
				Min.	Mean	Max.
31-33	**Manufacturing**	**46.492**	**75**	**2**	**82**	**607**
31	Food, Beverage, Tobacco, Textile, Apparel	109.978	9	10	99	200
33	Metal, Machinery, Electronic, Furniture & Misc.	25.427	33	2	106	607
42	Wholesale Trade	431.221	48	2	38	355
44-45	**Retail Trade**	**74.999**	**44**	**3**	**38**	**202**
44	Motor Vehicle, Furniture, Electronics, Clothing	100.519	34	3	36	202
72	Accommodation and Food	8.853	28	4	36	180

NYC - FA [pounds/day]						
NAICS	Description	β	Obs.	Employment		
				Min.	Mean	Max.
31-33	**Manufacturing**	**42.723**	**46**	**2**	**110**	**607**
31	Food, Beverage, Tobacco, Textile, Apparel	137.905	5	10	129	200
42	Wholesale Trade	351.038	21	10	72	355
44-45	**Retail Trade**	**60.822**	**19**	**3**	**68**	**202**
44	Motor Vehicle, Furniture, Electronics, Clothing	87.484	14	3	64	202
72	Accommodation and Food	8.135	24	5	38	180

CR - FA [pounds/day]						
NAICS	Description	β	Obs.	Employment		
				Min.	Mean	Max.
23	Construction	153.338	8	4	16	40
32	Manufacturing - Wood, Paper, Chemical, Plastics, Nonmetals	818.186	12	3	23	70
42	Wholesale Trade	3089.543	27	2	12	53
44-45	**Retail Trade**	**299.423**	**25**	**3**	**15**	**50**
44	Motor Vehicle, Furniture, Electronics, Clothing	248.448	20	3	16	50
72	Accommodation and Food	26.734	4	4	20	51

Freight Attraction (FA in pounds/day) Non-Linear Models (RPI)

$$FA_i = \alpha^* \times E_i^{\beta} \quad (32)$$

Table 17: Freight Attraction (FA) Non-Linear Models

NYC and CR - Ln (FA) [pounds/day]							
NAICS	Description	α*	β	Obs.	Employment		
					Min.	Mean	Max.
23	Construction	50.149	1.626536	24	4	78	810
31-33	**Manufacturing**	**887.901**	**0.962**	**75**	**2**	**82**	**607**
31	Food, Beverage, Tobacco, Textile, Apparel	68.341	1.645	9	10	99	200
32	Wood, paper, chemical, plastics, nonmetals	4274.540	0.982	34	3	54	300
33	Metal, machinery, electronic, furniture & misc.	87.103	1.029	33	2	106	607
42	Wholesale Trade	11500.090	0.802	48	2	38	355
44-45	**Retail Trade**	**267.898**	**1.886**	**44**	**3**	**38**	**202**
44	Motor vehicle, furniture, electronics, clothing	1266.153	0.733	34	3	36	202
72	Accommodation and Food	21.716	1.69	28	4	36	180
All	**All Freight Intensive Sectors (FIS)**	**4420.138**	**0.452**	**233**	**2**	**59**	**810**

NYC - Ln (FA) [pounds/day]							
NAICS	Description	α*	β	Obs.	Employment		
					Min.	Mean	Max.
23	Construction	58.930	1.484038	16	5	109	810
31-33	**Manufacturing**	**1523.358**	**0.929**	**46**	**2**	**110**	**607**
31	Food, Beverage, Tobacco, Textile, Apparel	218.448	1.615	5	10	129	200
32	Wood, paper, chemical, plastics, nonmetals	441.517	1.867	21	3	71	300
33	Metal, machinery, electronic, furniture & misc.	158.637	1.031	20	2	145	607
44-45	**Retail Trade**	**88.038**	**1.496**	**19**	**3**	**68**	**202**
44	Motor vehicle, furniture, electronics, clothing	80.449	1.559	14	3	64	202
45	Sporting goods, hobby, book, & music stores	251.826	1.342	5	30	80	200
72	Accommodation and Food	26.272	1.64	24	5	38	180
All	**All Freight Intensive Sectors (FIS)**	**2522.368**	**0.532**	**136**	**2**	**81**	**810**

CR - Ln (FA) [pounds/day]							
NAICS	Description	α*	β	Obs.	Employment		
					Min.	Mean	Max.
23	Construction	7.986	2.270933	8	4	16	40
31-33	**Manufacturing**	**289.956**	**1.180**	**29**	**3**	**39**	**300**
31	Food, Beverage, Tobacco, Textile, Apparel	56.714	1.701	4	13	62	175
32	Wood, paper, chemical, plastics, nonmetals	9.348	2.664	12	3	23	70
33	Metal, machinery, electronic, furniture & misc.	61.151	0.947	13	5	47	300
42	Wholesale Trade	5219.031	1.304	27	2	12	53
44-45	**Retail Trade**	**49.681**	**2.64**	**25**	**3**	**15**	**50**
44	Motor vehicle, furniture, electronics, clothing	261.045	1.169	20	3	16	50
45	Sporting goods, hobby, book, & music stores	73.831	3.96	5	3	10	26
72	Accommodation and Food	5.736	2.091	4	4	20	51
All	**All Freight Intensive Sectors (FIS)**	**1625.239**	**0.913**	**97**	**2**	**29**	**700**

Freight Production (FP in pounds/day) Linear Models (RPI)

$$FP_i = \beta E_i \quad (33)$$

Table 18: Freight Production (FP) Linear Models

NYC and CR - FP [pounds/day]						
NAICS	Description	β	Obs.	Employment		
				Min.	Mean	Max.
31-33	**Manufacturing**	**41.065**	**67**	**2**	**83**	**607**
31	Food, Beverage, Tobacco, Textile, Apparel	216.084	7	13	84	184
32	Wood, Paper, Chemical, Plastics, Nonmetals	119.151	31	3	54	300
33	Metal, Machinery, Electronic, Furniture & Misc.	9.993	29	2	54	607
44-45	**Retail Trade**	**46.849**	**25**	**3**	**35**	**200**
44	Motor Vehicle, Furniture, Electronics, Clothing	91.439	20	3	31	125
72	Accommodation and Food	1.855	9	6	30	100

NYC - FP [pounds/day]						
NAICS	Description	β	Obs.	Employment		
				Min.	Mean	Max.
31-33	**Manufacturing**	**35.817**	**38**	**2**	**121**	**607**
31	Food, Beverage, Tobacco, Textile, Apparel	212.291	4	80	128	184
32	Wood, Paper, Chemical, Plastics, Nonmetals	88.971	17	3	82	300
42	Wholesale Trade	229.101	18	10	79	355
72	Accommodation and Food	1.867	8	6	31	100

CR - FP [pounds/day]						
NAICS	Description	β	Obs.	Employment		
				Min.	Mean	Max.
23	Construction	16.302	3	9	14	20
31-33	**Manufacturing**	**97.083**	**29**	**3**	**33**	**300**
32	Wood, Paper, Chemical, Plastics, Nonmetals	698.234	14	3	21	70
42	Wholesale Trade	4442.041	25	2	12	53
44-45	**Retail Trade**	**158.223**	**16**	**4**	**16**	**50**
44	Motor Vehicle, Furniture, Electronics, Clothing	125.219	13	4	18	50
45	Sporting Goods, Hobby, Book, & Music Stores	1588.257	3	6	7	9

Freight Production (FP in pounds/day) Non-Linear Models (RPI)

$$FP_i = \alpha^* \times E_i^{\beta} \quad (34)$$

Table 19: Freight Production (FP) Non-Linear Models

NYC and CR - Ln (FP) [pounds/day]							
NAICS	Description	α*	β	Obs.	Employment		
					Min.	Mean	Max.
23	Construction	4.922	1.06	12	9	47	201
31-33	**Manufacturing**	**5389.032**	**0.57**	**67**	**2**	**83**	**607**
31	Food, Beverage, Tobacco, Textile, Apparel	19.284	1.92	7	13	84	184
32	Wood, paper, chemical, plastics, nonmetals	771.387	2.19	31	3	54	300
33	Metal, machinery, electronic, furniture &	10.255	1.37	29	2	54	607
42	Wholesale Trade	14746.320	0.67	43	2	40	355
44-45	**Retail Trade**	**656.278**	**1.64**	**25**	**3**	**35**	**200**
44	Motor vehicle, furniture, electronics, clothing	43.384	1.70	20	3	31	125
72	Accommodation and Food	5.995	0.69	9	6	30	100
All	**All Freight Intensive Sectors (FIS)**	**3561.123**	**0.65**	**167**	**2**	**61**	**700**

NYC - Ln (FP) [pounds/day]							
NAICS	Description	α*	β	Obs.	Employment		
					Min.	Mean	Max.
23	Construction	2.331	0.93	9	10	58	201
31-33	**Manufacturing**	358.596	1.64	38	2	121	607
31	Food, Beverage, Tobacco, Textile, Apparel	19.404	1.84	4	80	128	184
32	Wood, paper, chemical, plastics, nonmetals	7144.925	1.98	17	3	82	300
33	Metal, machinery, electronic, furniture &	7.500	1.32	17	2	160	607
42	Wholesale Trade	142.334	1.91	18	10	79	355
44-45	**Retail Trade**	**1002.841**	**1.20**	**9**	**3**	**69**	**200**
44	Motor vehicle, furniture, electronics, clothing	636.783	1.47	7	3	54	125
72	Accommodation and Food	6.927	0.65	8	6	31	100
All	**All Freight Intensive Sectors (FIS)**	**128.220**	**1.11**	**90**	**2**	**87**	**607**

CR - Ln (FP) [pounds/day]							
NAICS	Description	α*	β	Obs.	Employment		
					Min.	Mean	Max.
23	Construction	3.355	1.89	3	9	14	20
31-33	**Manufacturing**	**1387.964**	**0.977**	**29**	**3**	**33**	**300**
31	Food, Beverage, Tobacco, Textile, Apparel	46.372	2.16	3	13	24	31
32	Wood, paper, chemical, plastics, nonmetals	495.567	1.35	14	3	21	70
33	Metal, machinery, electronic, furniture &	18.054	1.48	12	5	49	300
42	Wholesale Trade	5126.014	1.39	25	2	12	53
44-45	**Retail Trade**	**93.912**	**2.24**	**16**	**4**	**16**	**50**
44	Motor vehicle, furniture, electronics, clothing	10.087	1.93	13	4	18	50
45	Sporting goods, hobby, book, & music	3.016	4.64	3	6	7	9
All	**All Freight Intensive Sectors (FIS)**	**3592.825**	**0.70**	**77**	**2**	**31**	**700**

Freight Trip Generation as a function of Freight Generation (RPI)

Freight Trip Attraction (vehicle-trips/day) as a function of Freight Attraction (pounds/day) - Linear Models (RPI)

$$FTA_i = \lambda FA_i \quad (35)$$

Table 20: Relationship between Freight Attraction and Freight Trip Attraction Linear Models

NYC and CR - FTA [deliveries/day]						
NAICS	Description	λ	Obs.	Employment		
				Min	Mean	Max
23	Construction	4.24E-04	22	4	37	201
31-33	**Manufacturing**	**1.86E-04**	**67**	**2**	**63**	**350**
31	Food, Beverage, Tobacco, Textile, Apparel	4.11E-04	8	10	93	200
33	Metal, Machinery, Electronic, Furniture & Misc.	6.90E-04	28	2	69	350
44-45	**Retail Trade**	**3.81E-04**	**38**	**3**	**25**	**125**
44	Motor Vehicle, Furniture, Electronics, Clothing	5.55E-04	29	3	24	125
48	Modal Transportation & Support Activities	8.40E-05	10	7	46	151
72	Accommodation and Food	3.66E-03	28	4	36	180
All	**All Freight Intensive Sectors (FIS)**	**3.15E-05**	**213**	**2**	**42**	**350**

Freight Trip Attraction (vehicle-trips/day) as a function of Freight Attraction (pounds/day) - Non-Linear Models (RPI)

$$FTA_i = \alpha^* \times FA_i^{\lambda} \quad (36)$$

Table 21: Relationship between Freight Attraction and Freight Trip Attraction Non-Linear Models

NYC and CR - Ln (FTA) [deliveries/day]							
NAICS	Description	α*	λ	Obs.	Employment		
					Min.	Mean	Max.
23	Construction	1.439	0.184	22	4	37	201
31-33	**Manufacturing**	**1.899**	**0.215**	**67**	**2**	**63**	**350**
31	Food, Beverage, Tobacco, Textile, Apparel	1.343	0.207	8	10	93	200
32	Wood, paper, chemical, plastics, nonmetals	2.034	0.180	31	3	50	300
33	Metal, machinery, electronic, furniture & misc.	1.810	0.272	28	2	69	350
44-45	**Retail Trade**	**1.751**	**0.196**	**38**	**3**	**25**	**125**
44	Sporting goods, hobby, book, & music stores	1.665	0.208	29	3	24	125
45	Modal Transportation & Support Activities	2.161	0.170	9	3	28	91
48	Modal Transportation & Support Activities	1.227	0.227	10	7	46	151
72	Accommodation and Food	1.632	0.193	28	4	36	180
All	**All Freight Intensive Sectors (FIS)**	**1.731**	**0.194**	**213**	**2**	**42**	**350**

Freight Trip Production (vehicles/day) as a function of Freight Production (pounds/day) - Linear Models (RPI)

$$FTP_i = \lambda FP_i \quad (37)$$

Table 22: Relationship between Freight Production and Freight Trip Production Linear Models

NYC and CR - FTP [shipments/day]						
NAICS	Description	λ	Obs.	Employment		
				Min	Mean	Max
31-33	**Manufacturing**	**5.10E-04**	**56**	**2**	**59**	**350**
31	Food, Beverage, Tobacco, Textile, Apparel	1.93E-03	6	13	73	184
32	Wood, Paper, Chemical, Plastics, Nonmetals	3.36E-04	27	3	45	300
33	Metal, Machinery, Electronic, Furniture & Misc.	9.68E-04	23	2	72	350
42	Wholesale Trade	8.45E-05	30	2	32	200
44-45	**Retail Trade**	**7.22E-04**	**13**	**3**	**18**	**50**
48	Modal Transportation & Support Activities	1.55E-04	6	9	66	151
All	**All Freight Intensive Sectors (FIS)**	**1.02E-04**	**123**	**2**	**46**	**350**

Freight Trip Production (vehicles/day) as a function of Freight Production (pounds/day) - Non-Linear Models (RPI)

$$FTP_i = \alpha^* \times FP_i^{\lambda} \quad (38)$$

Table 23: Freight Trip Production as a function of Freight Production - Non-Linear Models (RPI)

NYC and CR - Ln (FTP) [shipments/day]							
NAICS	Description	α*	λ	Obs.	Employment		
					Min.	Mean	Max.
31-33	**Manufacturing**	**7.838**	**0.129**	**56**	**2**	**59**	**350**
31	Food, Beverage, Tobacco, Textile, Apparel	2.193	0.347	6	13	73	184
32	Wood, Paper, Chemical, Plastics, Nonmetals	3.236	0.231	27	3	45	300
33	Metal, Machinery, Electronic, Furniture & Misc.	2.926	0.280	23	2	72	350
42	Wholesale Trade	1.583	0.235	30	2	32	200
44-45	**Retail Trade**	**2.438**	**0.293**	**13**	**3**	**18**	**50**
44	Motor Vehicle, Furniture, Electronics, Clothing	2.248	0.319	10	3	17	50
48	Modal Transportation & Support Activities	1.274	0.240	6	9	66	151
72	Accommodation and Food	1.683	0.398	7	6	32	100
All	**All Freight Intensive Sectors (FIS)**	**4.915**	**0.160**	**123**	**2**	**46**	**350**

Freight Production (FP) Models (CFS 2007)

Freight Production (in pounds/year) 2-digit NAICS–All Modes–Linear Models-NY (CFS)

$$FP_i = \beta E_i \quad (39)$$

Table 24: Freight Production (FP) 2-Digit NAICS- All Modes-Linear Models - (CFS)

CFS - New York - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Mining	26,126,448	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	876,226	180
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	62,289	470
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	48,081	540
42	Wholesale Trade	565,253	985
45	Sporting Goods, Hobby, Books & Music	266,125	80
49	Postal Service, Couriers & Messengers, Warehousing & Storage	838,638	30
51	Information	39,166	40
55	Management of Companies and Enterprises	231,546	35

Freight Production (in pounds/year) 3-digit NAICS–All Modes–Linear Models-NY (CFS)

$$FP_i = \beta E_i \quad (40)$$

Table 25: Freight Production (FP) 3 digit NAICS -All Modes- Linear Models - (CFS)

CFS - New York - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (except Oil and Gas)	26,126,448	65
311	Food Manufacturing	736,479	100
312	Beverage and Tobacco Product Manufacturing	2,178,828	25
313	Textile Mills	35,721	15
314	Textile Product Mills	39,006	15
315	Apparel Manufacturing	5,359	20
321	Wood Product Manufacturing	652,905	60
322	Paper Manufacturing	703,119	60
323	Printing and Related Support Activities	332,054	55
324	Petroleum and Coal Products Manufacturing	17,085,653	20
325	Chemical Manufacturing	17,968	100
326	Plastics and Rubber Products Manufacturing	144,649	90
327	Nonmetallic Mineral Product Manufacturing	1,074,852	90
331	Primary Metal Manufacturing	628,500	40
332	Fabricated Metal Product Manufacturing	60,080	125
333	Machinery Manufacturing	40,849	95
334	Computer and Electronic Product	1,669	70
335	Electrical Equipment, Appliance, and Component Manufacturing	10,610	30
336	Transportation Equipment Manufacturing	109,445	50
337	Furniture and Related Product Manufacturing	27,090	50
339	Miscellaneous Manufacturing	6,579	80
423	Merchant Wholesalers, Durable Goods	240,429	545
424	Merchant Wholesalers, Nondurable Goods	723,241	440
454	Nonstore Retailers	266,125	80
493	Warehousing and Storage	838,638	30
511	Publishing Industries (except Internet)	39,166	40
551	Management of Companies and Enterprises	231,546	30

Freight Production (in pounds/year) 2-digit NAICS–Road Modes–Linear Models-NY (CFS)

$$FP_i = \beta E_i \quad (41)$$

Table 26: Freight Production (FP) 2-Digit NAICS- Road Modes-Linear Models - (CFS)

CFS - New York - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Mining	25,335,647	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	856,281	180
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	53,399	470
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	37,748	540
42	Wholesale Trade	548,908	985
45	Sporting Goods, Hobby, Books & Music Stores	255,977	80
51	Information	39,140	40
55	Management of Companies and Enterprises	231,297	30

Freight Production (in pounds/year) 3-digit NAICS–Road Modes–Linear Models-NY (CFS)

$$FP_i = \beta E_i \quad (42)$$

Table 27: Freight Production (FP) 3 Digit NAICS -Road Modes- Linear Models - (CFS)

CFS - New York - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (except Oil and Gas)	25,335,647	65
311	Food Manufacturing	722,970	100
312	Beverage and Tobacco Product Manufacturing	2,115,619	25
314	Textile Product Mills	38,337	15
321	Wood Product Manufacturing	640,232	60
322	Paper Manufacturing	591,017	60
323	Printing and Related Support Activities	323,522	55
325	Chemical Manufacturing	11,948	100
327	Nonmetallic Mineral Product Manufacturing	1,044,915	90
331	Primary Metal Manufacturing	520,289	40
332	Fabricated Metal Product Manufacturing	59,649	125
333	Machinery Manufacturing	35,581	95
335	Electrical Equipment, Appliance, and Component Manufacturing	10,050	30
336	Transportation Equipment Manufacturing	76,299	50
337	Furniture and Related Product Manufacturing	26,976	50
423	Merchant Wholesalers, Durable Goods	206,510	545
424	Merchant Wholesalers, Nondurable Goods	715,443	440
454	Nonstore Retailers	255,977	80
511	Publishing Industries (except Internet)	39,140	40
551	Management of Companies and Enterprises	231,297	30

Freight Production (in pounds/year) 2-digit NAICS -All Modes- Non-Linear Models – New York - (CFS)

Lin-Log Model:

$FP_i = \beta * Ln(E_i)$; Where Ln is the natural logarithmic (43)

Table 28: Freight Production (FP) 2-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - New York - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Mining	246,867,379	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	16,281,311	180
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	20,645,218	470
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	2,401,143	540
42	Wholesale Trade	8,529,135	985
45	Sporting Goods, Hobby, Books & Music	6,315,305	80
49	Postal Service, Couriers & Messengers, Warehousing & Storage	25,309,371	30
51	Information	1,594,972	40
55	Management of Companies and Enterprises	10,991,421	35

Log-Log Model:

$FP_i = \alpha^* \times E_i^{\beta}$ (44)

Table 29: Freight Production (FP) 2-Digit NAICS- All Modes- Non-Linear Models-(CFS)

CFS - New York - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	1.70E+08	1.28	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	224,173	1.40	180
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	25,650,878	1.12	470
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	14,200	1.35	540
42	Wholesale Trade	6,143,087	1.06	985
45	Sporting Goods, Hobby, Books & Music Stores	8,661,789	1.144	80
49	Postal Service, Couriers & Messengers, Warehousing & Storage	49,897,518	0.642	30
51	Information	4,652	1.344	40
55	Management of Companies and Enterprises	51,527	4.10	35

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (45)

Table 30: Freight Production (FP) 2-Digit NAICS- All Modes- Non-Linear Models - (CFS)

CFS - New York - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	1.43E+09	0.049	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	5,368,605	0.024	180
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	946,011,717	0.002	470
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	1,246,411	0.006	540
42	Wholesale Trade	34,011,548	0.029	985
45	Sporting Goods, Hobby, Books & Music Stores	147,124,041	0.014	80
49	Postal Service, Couriers & Messengers, Warehousing & Storage	91,821,538	0.010	30
51	Information	205,784	0.010	40
55	Management of Companies and Enterprises	4.04E+09	0.009	35

Freight Production (in pounds/year) 3-digit NAICS–All Modes– Non-Linear Models-NY (CFS)

Lin-Log Model:

$FP_i = \beta * Ln(E_i)$; Where Ln is the natural logarithmic (46)

Table 31: Freight Production (FP) 3-Digit NAICS- All Modes- Non-Linear Models - (CFS)

CFS - New York - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (Except Oil and Gas)	246,867,379	65
311	Food Manufacturing	20,865,881	100
312	Beverage and Tobacco Manufacturing	37,826,939	25
313	Textile Mills	419,055	15
314	Textile Product Mills	468,595	15
315	Apparel Manufacturing	178,778	20
321	Wood Product Manufacturing	6,033,498	60
322	Paper Manufacturing	20,232,004	60
323	Printing and Related Support Activities	2,634,454	55
324	Petroleum and Coal Products Manufacturing	180,043,872	20
325	Chemical Manufacturing	11,510,364	100
326	Plastics and Rubber Products Manufacturing	3,146,431	90
327	Nonmetallic Mineral Product Manufacturing	30,485,284	90
331	Primary Metal Manufacturing	18,595,964	40
332	Fabricated Metal Product Manufacturing	1,412,150	125
333	Machinery Manufacturing	964,732	95
334	Computer and Electronic Product	153,129	70
335	Electrical Equipment, Appliance, and Component Manufacturing	335,552	30
336	Transportation Equipment Manufacturing	5,384,491	50
337	Furniture and Related Product Manufacturing	701,716	50
339	Miscellaneous Manufacturing	328,636	80
423	Merchant Wholesalers, Durable Goods	2,798,542	545
424	Merchant Wholesalers, Nondurable Goods	16,085,108	440
454	Nonstore Retailers	6,315,305	80
493	Warehousing and Storage	25,309,371	30
511	Publishing Industries (except Internet)	1,594,972	40
551	Management of Companies and Enterprises	10,991,421	30

Log-Log Model:

$$FP_i = \alpha^* \times E_i^{\beta} \quad (47)$$

Table 32: Freight Production (FP) 3-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - New York - All Modes [pounds/year]				
NAICS	Description	α*	β	Obs.
212	Mining (Except Oil and Gas)	169,688,897	1.28	65
311	Food Manufacturing	81,344	1.76	100
312	Beverage and Tobacco Manufacturing	1,243,252	1.13	25
313	Textile Mills	54,408	0.84	15
314	Textile Product Mills	1,744	1.66	15
315	Apparel Manufacturing	8,039	0.97	20
321	Wood Product Manufacturing	119,417	1.86	60
322	Paper Manufacturing	35,012	1.71	60
323	Printing and Related Support Activities	6,691	1.48	55
324	Petroleum and Coal Products Manufacturing	3.04E+20	9.08	20
325	Chemical Manufacturing	59,106	1.57	100
326	Plastics and Rubber Products Manufacturing	1,503	2.09	90
327	Nonmetallic Mineral Product Manufacturing	275,040,184	0.59	90
331	Primary Metal Manufacturing	119,355	1.40	40
332	Fabricated Metal Product Manufacturing	73,368	1.19	125
333	Machinery Manufacturing	4,773	1.31	95
334	Computer and Electronic Product Manufacturing	2,189	1.06	70
335	Electrical Equipment, Appliance, and Component Manufacturing	9,485	1.12	30
336	Transportation Equipment Manufacturing	85,317	0.96	50
337	Furniture and Related Product Manufacturing	3,975	1.49	50
339	Miscellaneous Manufacturing	6,462	1.39	80
423	Merchant Wholesalers, Durable Goods	2,085,726	1.21	545
424	Merchant Wholesalers, Nondurable Goods	3,986,660	0.97	440
454	Nonstore Retailers	8,661,789	1.14	80
493	Warehousing and Storage	3.84E+22	5.33	30
511	Publishing Industries (except Internet)	4,652	1.34	40
551	Management of Companies and Enterprises	51,527	4.10	30

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (48)

Table 33: Freight Production (FP) 3-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - New York - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
212	Mining (Except Oil and Gas)	1,430,291,766	0.049	65
311	Food Manufacturing	24,994,127	0.020	100
312	Beverage and Tobacco Manufacturing	9,883,289	0.020	25
313	Textile Mills	186,660	0.029	15
314	Textile Product Mills	96,032	0.034	15
315	Apparel Manufacturing	8.51E+18	0.083	20
321	Wood Product Manufacturing	6,908,406	0.074	60
322	Paper Manufacturing	20,682,599	0.013	60
323	Printing and Related Support Activities	224,407	0.023	55
324	Petroleum and Coal Products Manufacturing	1.96E+59	0.638	20
325	Chemical Manufacturing	20,804,687	0.001	100
326	Plastics and Rubber Products Manufacturing	3,755,021	0.018	90
327	Nonmetallic Mineral Product Manufacturing	1.98E+45	0.141	90
331	Primary Metal Manufacturing	12,666,016	0.012	40
332	Fabricated Metal Product Manufacturing	1,540,908	0.017	125
333	Machinery Manufacturing	279,542	0.010	95
334	Computer and Electronic Product Manufacturing	41,253	0.003	70
335	Electrical Equipment, Appliance, and Component Manufacturing	125,519	0.010	30
336	Transportation Equipment Manufacturing	1,435,495	0.005	50
337	Furniture and Related Product Manufacturing	351,232	0.015	50
339	Miscellaneous Manufacturing	205,476	0.012	80
423	Merchant Wholesalers, Durable Goods	13,933,033	0.045	545
424	Merchant Wholesalers, Nondurable Goods	20,115,663	0.021	440
454	Nonstore Retailers	147,124,041	0.014	80
493	Warehousing and Storage	91,821,538	0.010	30
511	Publishing Industries (except Internet)	205,784	0.010	40
551	Management of Companies and Enterprises	4,040,975,454	0.009	30

Freight Production (in pounds/year) 2-digit NAICS–Road Modes–Non-Linear Models-NY (CFS)

Lin-Log Model:

$FP_i = \beta * Ln(E_i)$; Where Ln is the natural logarithmic

(49)

Table 34: Freight Production (FP) 2-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - New York - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Mining	235,396,875	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	15,786,981	180
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	18,982,265	470
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	2,007,680	540
42	Wholesale Trade	8,006,293	985
45	Sporting Goods, Hobby, Books & Music Stores	6,132,574	80
51	Information	1,590,763	40
55	Management of Companies and Enterprises	10,981,410	30

Log-Log Model:

$$FP_i = \alpha^* \times E_i^{\beta} \quad (50)$$

Table 35: Freight Production (FP) 2-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - New York - Road Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	167,820,623	1.26	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	204,792	1.41	180
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	27,471,096	1.11	470
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	15,082	1.34	540
42	Wholesale Trade	5,598,338	1.04	985
45	Sporting Goods, Hobby, Books & Music Stores	11,536,835	1.111	80
51	Information	4,177	1.359	40
55	Management of Companies and Enterprises	45,121	4.08	30

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (51)

Table 36: Freight Production (FP) 2-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - New York - Road Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	1.43E+09	0.049	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	4,887,278	0.024	180
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	955,591,459	0.002	470
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	1,255,454	0.006	540
42	Wholesale Trade	29,330,047	0.029	985
45	Sporting Goods, Hobby, Books & Music Stores	175,137,309	0.014	80
51	Information	186,841	0.010	40
55	Management of Companies and Enterprises	3.81E+09	0.009	30

Freight Production (in pounds/year) 3-digit NAICS–Road Modes–Non-Linear Models-NY (CFS)

Lin-Log Model:

$FP_i = \beta^* Ln(E_i)$; Where Ln is the natural logarithmic (52)

Table 37: Freight Production (FP) 3-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - New York - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (Except Oil and Gas)	235,396,875	65
311	Food Manufacturing	20,343,134	100
312	Beverage and Tobacco Manufacturing	36,277,995	25
314	Textile Product Mills	462,165	15
321	Wood Product Manufacturing	5,896,322	60
322	Paper Manufacturing	17,231,624	60
323	Printing and Related Support Activities	2,562,800	55
325	Chemical Manufacturing	6,318,337	100
327	Nonmetallic Mineral Product Manufacturing	29,737,028	90
331	Primary Metal Manufacturing	15,281,532	40
332	Fabricated Metal Product Manufacturing	1,396,123	125
333	Machinery Manufacturing	881,285	95
335	Electrical Equipment, Appliance, and Component Manufacturing	323,614	30
336	Transportation Equipment Manufacturing	3,715,722	50
337	Furniture and Related Product Manufacturing	696,881	50
423	Merchant Wholesalers, Durable Goods	2,456,332	545
424	Merchant Wholesalers, Nondurable Goods	15,324,097	440
454	Nonstore Retailers	6,132,574	80
511	Publishing Industries (except Internet)	1,590,763	40
551	Management of Companies and Enterprises	10,981,410	30

Log-Log Model:

$$FP_i = \alpha^* \times E_i^{\beta} \quad (53)$$

Table 38: Freight Production (FP) 3-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - New York - Road Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
212	Mining (Except Oil and Gas)	167,820,623	1.26	65
311	Food Manufacturing	83,167	1.75	100
312	Beverage and Tobacco Manufacturing	1,236,020	1.13	25
314	Textile Product Mills	1,756	1.66	15
321	Wood Product Manufacturing	118,825	1.85	60
322	Paper Manufacturing	36,996	1.69	60
323	Printing and Related Support Activities	6,735	1.46	55
325	Chemical Manufacturing	61,351	1.54	100
327	Nonmetallic Mineral Product Manufacturing	2.67E+15	5.45	90
331	Primary Metal Manufacturing	152,037	1.37	40
332	Fabricated Metal Product Manufacturing	74,568	1.17	125
333	Machinery Manufacturing	5,356	1.27	95
335	Electrical Equipment, Appliance, and Component Manufacturing	9,884	1.09	30
336	Transportation Equipment Manufacturing	105,514	0.88	50
337	Furniture and Related Product Manufacturing	5,047	1.43	50
423	Merchant Wholesalers, Durable Goods	1,880,746	1.20	545
424	Merchant Wholesalers, Nondurable Goods	3,370,818	0.94	440
454	Nonstore Retailers	11,536,835	1.11	80
511	Publishing Industries (except Internet)	4,177	1.36	40
551	Management of Companies and Enterprises	45,121	4.08	30

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (54)

Table 39: Freight Production (FP) 3-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - New York - Road Modes [pounds/year]				
NAICS	**Description**	**α**	**β**	**Obs.**
212	Mining (Except Oil and Gas)	151,748,280	0.048	65
311	Food Manufacturing	1,963,482	0.020	100
312	Beverage and Tobacco Manufacturing	2,034,542	0.020	25
314	Textile Product Mills	78,784	0.034	15
321	Wood Product Manufacturing	958,188	0.073	60
322	Paper Manufacturing	7,777,389	0.013	60
323	Printing and Related Support Activities	71,291	0.023	55
325	Chemical Manufacturing	815,494	0.001	100
327	Nonmetallic Mineral Product Manufacturing	1,350	0.140	90
331	Primary Metal Manufacturing	3,245,717	0.012	40
332	Fabricated Metal Product Manufacturing	169,578	0.017	125
333	Machinery Manufacturing	86,960	0.009	95
335	Electrical Equipment, Appliance, and Component Manufacturing	59,669	0.010	30
336	Transportation Equipment Manufacturing	398,960	0.005	50
337	Furniture and Related Product Manufacturing	170,149	0.014	50
423	Merchant Wholesalers, Durable Goods	237,918	0.044	545
424	Merchant Wholesalers, Nondurable Goods	2,280,188	0.020	440
454	Nonstore Retailers	3,024,844	0.014	80
511	Publishing Industries (except Internet)	16,743	0.010	40
551	Management of Companies and Enterprises	276,550	0.009	30

Freight Production (in pounds/year) 2-digit NAICS–All Modes–Linear Models-CA (CFS)

$$FP_i = \beta E_i \quad (55)$$

Table 40: Freight Production (FP) 2-Digit NAICS- All Modes-Linear Models - (CFS)

CFS - California - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Mining	31,294,508	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	590,798	470
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	551,889	810
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	42,751	1000
42	Wholesale Trade	610,208	1890
45	Sporting Goods, Hobby, Books & Music	65,478	70
49	Postal Service, Couriers & Messengers, Warehousing & Storage	962,702	125
51	Information	126,226	50
55	Management of Companies and Enterprises	212,740	95

Freight Production (in pounds/year) 3-digit NAICS–All Modes–Linear Models-CA (CFS)

$$FP_i = \beta E_i \quad (56)$$

Table 41: Freight Production (FP) 3-Digit NAICS -All Modes- Linear Models - (CFS)

CFS - California - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (except Oil and Gas)	31,294,508	65
311	Food Manufacturing	526,756	290
312	Beverage and Tobacco Product Manufacturing	1,350,394	70
313	Textile Mills	21,340	20
314	Textile Product Mills	109,208	30
315	Apparel Manufacturing	10,790	50
316	Leather and Allied Product Manufacturing	2,921	10
321	Wood Product Manufacturing	713,111	105
322	Paper Manufacturing	689,784	80
323	Printing and Related Support Activities	180,576	90
324	Petroleum and Coal Products Manufacturing	9,622,939	80
325	Chemical Manufacturing	31,388	170
326	Plastics and Rubber Products Manufacturing	117,861	140
327	Nonmetallic Mineral Product Manufacturing	3,393,056	155
331	Primary Metal Manufacturing	1,961,209	45
332	Fabricated Metal Product Manufacturing	88,210	225
333	Machinery Manufacturing	18,939	105
334	Computer and Electronic Product	1,913	230
335	Electrical Equipment, Appliance, and Component Manufacturing	55,085	80
336	Transportation Equipment Manufacturing	30,664	95
337	Furniture and Related Product Manufacturing	89,697	100
339	Miscellaneous Manufacturing	3,444	115
423	Merchant Wholesalers, Durable Goods	293,427	1075
424	Merchant Wholesalers, Nondurable Goods	852,945	815
454	Nonstore Retailers	65,478	70
493	Warehousing and Storage	962,702	125
511	Publishing Industries (except Internet)	126,226	50
551	Management of Companies and Enterprises	212,740	95

Freight Production (in pounds/year) 2-digit NAICS–Road Modes–Linear Models-CA (CFS)

$$FP_i = \beta E_i \quad (57)$$

Table 42: Freight Production (FP) 2-Digit NAICS- Road Modes-Linear Models - (CFS)

CFS - California - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Mining	22,824,611	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	523,136	470
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	282,044	810
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	27,392	1000
42	Wholesale Trade	569,334	1890
49	Postal Service, Couriers & Messengers, Warehousing & Storage	952,758	125
51	Information	126,123	50
55	Management of Companies and Enterprises	202,911	95

Freight Production (in pounds/year) 3-digit NAICS–Road Modes–Linear Models-CA (CFS)

$$FP_i = \beta E_i \quad (58)$$

Table 43: Freight Production (FP) 3-Digit NAICS- Road Modes-Linear Models - (CFS)

CFS - California - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (except Oil and Gas)	22,824,611	65
311	Food Manufacturing	465,422	290
312	Beverage and Tobacco Product Manufacturing	1,200,033	70
313	Textile Mills	21,301	20
314	Textile Product Mills	104,372	30
315	Apparel Manufacturing	9,366	50
321	Wood Product Manufacturing	590,528	105
322	Paper Manufacturing	644,367	80
323	Printing and Related Support Activities	178,115	90
324	Petroleum and Coal Products Manufacturing	3,187,020	80
325	Chemical Manufacturing	21,700	165
326	Plastics and Rubber Products Manufacturing	108,286	140
327	Nonmetallic Mineral Product Manufacturing	2,955,178	155
332	Fabricated Metal Product Manufacturing	78,014	225
333	Machinery Manufacturing	17,012	105
334	Computer and Electronic Product	1,489	230
335	Electrical Equipment, Appliance, and Component Manufacturing	47,240	80
336	Transportation Equipment Manufacturing	25,276	95
337	Furniture and Related Product Manufacturing	78,845	100
339	Miscellaneous Manufacturing	2,795	115
423	Merchant Wholesalers, Durable Goods	270,730	1075
424	Merchant Wholesalers, Nondurable Goods	798,142	815
493	Warehousing and Storage	952,758	125
511	Publishing Industries (except Internet)	126,123	50
551	Management of Companies and Enterprises	202,911	95

Freight Production (in pounds/year) 2-digit NAICS–All Modes–Non-Linear Models-CA (CFS)

Lin-Log Model:

$FP_i = \beta * Ln(E_i)$; Where Ln is the natural logarithmic (59)

Table 44: Freight Production (FP) 2-Digit NAICS- All Modes- Non-Linear Models - (CFS)

CFS - California - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Mining	424,606,800	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	23,567,728	470
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	60,417,115	810
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	2,347,140	1000
42	Wholesale Trade	14,215,616	1890
45	Sporting Goods, Hobby, Books & Music	1,069,771	70
49	Postal Service, Couriers & Messengers, Warehousing & Storage	35,170,984	125
51	Information	3,831,102	50
55	Management of Companies and Enterprises	27,776,524	95

Log-Log Model:

$FP_i = \alpha^* \times E_i^{\beta}$ (60)

Table 45: Freight Production (FP) 2-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - California - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	39,153,022	1.29	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	539,826	1.55	470
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	909,592,631	0.94	810
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	10,924	1.32	1000
42	Wholesale Trade	2,169,296	1.30	1890
45	Sporting Goods, Hobby, Books & Music Stores	64,420	1.82	70
49	Postal Service, Couriers & Messengers, Warehousing & Storage	50,964,839.69	0.29	125
51	Information	11,326.89	1.27	50
55	Management of Companies and Enterprises	5.55E+20	5.06	95

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (61)

Table 46: Freight Production (FP) 2-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - California - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	688,538,046	0.036	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	179,205,213	0.010	470
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	1.16E+50	0.024	810
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	1,008,544	0.005	1000
42	Wholesale Trade	37,926,079	0.023	1890
45	Sporting Goods, Hobby, Books & Music Stores	3,676,540	0.032	70
49	Postal Service, Couriers & Messengers, Warehousing & Storage	75,799,546	0.006	125
51	Information	210,257	0.009	50
55	Management of Companies and Enterprises	8.66E+50	0.031	95

Freight Production (in pounds/year) 3-digit NAICS–All Modes–Non-Linear Models-CA (CFS)

Lin-Log Model:

$FP_i = \beta * Ln(E_i)$; Where Ln is the natural logarithmic (62)

Table 47: Freight Production (FP) 3-Digit NAICS- All Modes- Non-Linear Models - (CFS)

CFS - California - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (except Oil and Gas)	424,606,800	65
311	Food Manufacturing	29,286,811	290
312	Beverage and Tobacco Product Manufacturing	39,038,842	70
313	Textile Mills	455,842	20
314	Textile Product Mills	2,048,024	30
315	Apparel Manufacturing	313,203	50
316	Leather and Allied Product Manufacturing	81,061	10
321	Wood Product Manufacturing	13,875,575	105
322	Paper Manufacturing	15,858,188	80
323	Printing and Related Support Activities	2,023,073	90
324	Petroleum and Coal Products Manufacturing	299,851,573	80
325	Chemical Manufacturing	13,397,054	170
326	Plastics and Rubber Products Manufacturing	4,263,735	140
327	Nonmetallic Mineral Product Manufacturing	103,187,661	155
331	Primary Metal Manufacturing	23,286,173	45
332	Fabricated Metal Product Manufacturing	2,189,669	225
333	Machinery Manufacturing	471,154	105
334	Computer and Electronic Product	159,577	230
335	Electrical Equipment, Appliance, and Component Manufacturing	1,394,323	80
336	Transportation Equipment Manufacturing	3,002,591	95
337	Furniture and Related Product Manufacturing	2,124,498	100
339	Miscellaneous Manufacturing	267,461	115
423	Merchant Wholesalers, Durable Goods	5,556,032	1075
424	Merchant Wholesalers, Nondurable Goods	26,492,275	815
454	Nonstore Retailers	1,069,771	70
493	Warehousing and Storage	35,170,984	125
511	Publishing Industries (except Internet)	3,831,102	50
551	Management of Companies and Enterprises	27,776,524	95

Log-Log Model:

$$FP_i = \alpha^* \times E_i^{\beta} \quad (63)$$

Table 48: Freight Production (FP) 3-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - California - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
212	Mining (except Oil and Gas)	39,153,022	1.29	65
311	Food Manufacturing	1,218,533	1.31	290
312	Beverage and Tobacco Product Manufacturing	41,628	1.77	70
313	Textile Mills	16,424	1.20	20
314	Textile Product Mills	158,293	0.89	30
315	Apparel Manufacturing	1,193	1.87	50
316	Leather and Allied Product Manufacturing	1,038	1.48	10
321	Wood Product Manufacturing	322,252	1.69	105
322	Paper Manufacturing	212,028	1.37	80
323	Printing and Related Support Activities	4,760	1.66	90
324	Petroleum and Coal Products Manufacturing	9.22E+17	8.75	80
325	Chemical Manufacturing	666,465	1.61	170
326	Plastics and Rubber Products Manufacturing	11,276	1.97	140
327	Nonmetallic Mineral Product Manufacturing	1.79E+18	5.52	155
331	Primary Metal Manufacturing	36,458	1.71	45
332	Fabricated Metal Product Manufacturing	13,086	1.48	225
333	Machinery Manufacturing	4,477	1.24	105
334	Computer and Electronic Product Manufacturing	3,199	1.07	230
335	Electrical Equipment, Appliance, and Component Manufacturing	4,286	1.47	80
336	Transportation Equipment Manufacturing	34,691	1.11	95
337	Furniture and Related Product Manufacturing	22,063	1.29	100
339	Miscellaneous Manufacturing	2,767	1.25	115
423	Merchant Wholesalers, Durable Goods	400,385	1.43	1075
424	Merchant Wholesalers, Nondurable Goods	9,727,884	1.09	815
454	Nonstore Retailers	64,420	1.82	70
493	Warehousing and Storage	50,964,840	0.29	125
511	Publishing Industries (except Internet)	11,327	1.27	50
551	Management of Companies and Enterprises	5.55E+20	5.06	95

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (64)

Table 49: Freight Production (FP) 3-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - California - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
212	Mining (except Oil and Gas)	688,538,046	0.036	65
311	Food Manufacturing	200,141,034	0.006	290
312	Beverage and Tobacco Product Manufacturing	22,008,269	0.015	70
313	Textile Mills	579,819	0.010	20
314	Textile Product Mills	1,269,000	0.015	30
315	Apparel Manufacturing	544,819	0.016	50
316	Leather and Allied Product Manufacturing	6.51E+15	0.103	10
321	Wood Product Manufacturing	48,422,963	0.025	105
322	Paper Manufacturing	20,535,666	0.014	80
323	Printing and Related Support Activities	208,535	0.029	90
324	Petroleum and Coal Products Manufacturing	1,873,289,492	0.006	80
325	Chemical Manufacturing	1.92E+42	0.007	170
326	Plastics and Rubber Products Manufacturing	31,966,463	0.012	140
327	Nonmetallic Mineral Product Manufacturing	36,648,177,981	0.012	155
331	Primary Metal Manufacturing	11,456,743	0.013	45
332	Fabricated Metal Product Manufacturing	656,081	0.024	225
333	Machinery Manufacturing	105,301	0.011	105
334	Computer and Electronic Product Manufacturing	133,690	0.004	230
335	Electrical Equipment, Appliance, and Component Manufacturing	234,480	0.016	80
336	Transportation Equipment Manufacturing	2,789,199	0.003	95
337	Furniture and Related Product Manufacturing	694,810	0.019	100
339	Miscellaneous Manufacturing	72,677	0.006	115
423	Merchant Wholesalers, Durable Goods	9,621,223	0.027	1075
424	Merchant Wholesalers, Nondurable Goods	104,914,020	0.017	815
454	Nonstore Retailers	3,676,540	0.032	70
493	Warehousing and Storage	75,799,546	0.006	125
511	Publishing Industries (except Internet)	210,257	0.009	50
551	Management of Companies and Enterprises	8.66323E+50	0.031	95

Freight Production (in pounds/year) 2-digit NAICS–Road Modes–Non-Linear Models-CA (CFS)

$FP_i = \beta * Ln(E_i)$; Where Ln is the natural logarithmic (65)

Lin-Log Model:

Table 50: Freight Production (FP) 2-Digit NAICS- Road Modes- Non-Linear Models - (CFS)

CFS - California - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Mining	285,150,949	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	21,286,700	470
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	48,684,193	810
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	1,780,223	1000
42	Wholesale Trade	13,291,802	1890
49	Postal Service, Couriers & Messengers, Warehousing & Storage	34,563,636	125
51	Information	3,821,957	50
55	Management of Companies and Enterprises	26,140,670	95

Log-Log Model:

$FP_i = \alpha^* \times E_i^{\beta}$ (66)

Table 51: Freight Production (FP) 2-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - California - Road Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	40,515,715	1.22	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	457,894	1.57	470
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	800,715,035	0.83	810
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	12,636	1.27	1000
42	Wholesale Trade	2,160,985	1.30	1890
49	Postal Service, Couriers & Messengers, Warehousing & Storage	50,400,999	0.29	125
51	Information	7,553	1.32	50
55	Management of Companies and Enterprises	5.50E+20	5.06	95

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (67)

Table 52: Freight Production (FP) 2-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - California - Road Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	599,926,026	0.034	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	169,294,022	0.010	470
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	1.51E+49	0.024	810
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	966,684	0.005	1000
42	Wholesale Trade	37,690,540	0.023	1890
49	Postal Service, Couriers & Messengers, Warehousing & Storage	74,475,722	0.006	125
51	Information	146,922	0.009	50
55	Management of Companies and Enterprises	2.54E+50	0.030	95

Freight Production (in pounds/year) 3-digit NAICS–Road Modes–Non-Linear Models-CA (CFS)

Lin-Log Model:

$FP_i = \beta * Ln(E_i)$; Where Ln is the natural logarithmic (68)

Table 53: Freight Production (FP) 3-Digit NAICS- Road Modes- Non-Linear Models - (CFS)

CFS - California - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (except Oil and Gas)	285,150,949	65
311	Food Manufacturing	26,372,867	290
312	Beverage and Tobacco Product Manufacturing	35,594,221	70
313	Textile Mills	453,417	20
314	Textile Product Mills	1,797,942	30
315	Apparel Manufacturing	288,476	50
321	Wood Product Manufacturing	11,795,379	105
322	Paper Manufacturing	14,775,129	80
323	Printing and Related Support Activities	1,989,216	90
324	Petroleum and Coal Products Manufacturing	227,781,426	80
325	Chemical Manufacturing	10,766,630	165
326	Plastics and Rubber Products Manufacturing	4,012,883	140
327	Nonmetallic Mineral Product Manufacturing	89,408,739	155
332	Fabricated Metal Product Manufacturing	2,033,204	225
333	Machinery Manufacturing	416,752	105
334	Computer and Electronic Product	132,651	230
335	Electrical Equipment, Appliance, and Component Manufacturing	1,207,746	80
336	Transportation Equipment Manufacturing	2,584,437	95
337	Furniture and Related Product Manufacturing	1,625,375	100
339	Miscellaneous Manufacturing	215,948	115
423	Merchant Wholesalers, Durable Goods	5,019,491	1075
424	Merchant Wholesalers, Nondurable Goods	25,019,426	815
493	Warehousing and Storage	34,563,636	125
511	Publishing Industries (except Internet)	3,821,957	50
551	Management of Companies and Enterprises	26,140,670	95

Log-Log Model:

$$FP_i = \alpha^* \times E_i^{\beta} \quad (69)$$

Table 54: Freight Production (FP) 3-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - California - Road Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
212	Mining (except Oil and Gas)	40,515,715	1.22	65
311	Food Manufacturing	1,124,369	1.29	290
312	Beverage and Tobacco Manufacturing	33,312	1.81	70
313	Textile Mills	16,569	1.19	20
314	Textile Product Mills	98,651	0.99	30
315	Apparel Manufacturing	962	1.91	50
321	Wood Product Manufacturing	323,906	1.67	105
322	Paper Manufacturing	219,471	1.35	80
323	Printing and Related Support Activities	5,748	1.53	90
324	Petroleum and Coal Products Manufacturing	451,123,557	0.74	80
325	Chemical Manufacturing	640,743	1.58	165
326	Plastics and Rubber Products Manufacturing	11,222	1.99	140
327	Nonmetallic Mineral Product Manufacturing	9,047,178,128	0.63	155
332	Fabricated Metal Product Manufacturing	13,624	1.46	225
333	Machinery Manufacturing	4,985	1.20	105
334	Computer and Electronic Product Manufacturing	3,611	0.99	230
335	Electrical Equipment, Appliance, and Component Manufacturing	4,857	1.42	80
336	Transportation Equipment Manufacturing	49,571	1.02	95
337	Furniture and Related Product Manufacturing	25,736	1.29	100
339	Miscellaneous Manufacturing	2,819	1.18	115
423	Merchant Wholesalers, Durable Goods	358,077	1.44	1075
424	Merchant Wholesalers, Nondurable Goods	9,979,572	1.10	815
493	Warehousing and Storage	50,400,999	0.29	125
511	Publishing Industries (except Internet)	7,553	1.32	50
551	Management of Companies and Enterprises	5.50E+20	5.06	95

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (70)

Table 55: Freight Production (FP) 3-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - California - Road Modes [pounds/year]				
NAICS	**Description**	**α**	**β**	**Obs.**
212	Mining (except Oil and Gas)	599,926,026	0.034	65
311	Food Manufacturing	166,760,319	0.006	290
312	Beverage and Tobacco Manufacturing	24,198,696	0.015	70
313	Textile Mills	574,277	0.010	20
314	Textile Product Mills	1,172,765	0.015	30
315	Apparel Manufacturing	536,007	0.016	50
321	Wood Product Manufacturing	44,811,236	0.025	105
322	Paper Manufacturing	20,237,464	0.014	80
323	Printing and Related Support Activities	158,547	0.027	90
324	Petroleum and Coal Products Manufacturing	1,761,324,633	0.004	80
325	Chemical Manufacturing	212,239,428	0.001	165
326	Plastics and Rubber Products Manufacturing	38,947,270	0.012	140
327	Nonmetallic Mineral Product Manufacturing	34,364,831,433	0.011	155
332	Fabricated Metal Product Manufacturing	660,247	0.023	225
333	Machinery Manufacturing	106,423	0.011	105
334	Computer and Electronic Product Manufacturing	111,189	0.003	230
335	Electrical Equipment, Appliance, and Component Manufacturing	220,703	0.016	80
336	Transportation Equipment Manufacturing	2,787,997	0.002	95
337	Furniture and Related Product Manufacturing	752,072	0.019	100
339	Miscellaneous Manufacturing	60,058	0.005	115
423	Merchant Wholesalers, Durable Goods	9,108,737	0.027	1075
424	Merchant Wholesalers, Nondurable Goods	107,541,102	0.018	815
493	Warehousing and Storage	74,475,722	0.006	125
511	Publishing Industries (except Internet)	146,922	0.009	50
551	Management of Companies and Enterprises	2.54E+50	0.030	95

Freight Production (in pounds/year) 2-digit NAICS–All Modes–Linear Models-TX (CFS)

$$FP_i = \beta E_i \quad (71)$$

Table 56: Freight Production (FP) 2-Digit NAICS- All Modes-Linear Models - (CFS)

CFS - Texas - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Mining	48,689,606	60
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	580,353	235
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	4,371,744	730
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	64,431	700
42	Wholesale Trade	757,778	1245
45	Sporting Goods, Hobby, Books & Music	37,277	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	1,329,914	85
51	Information	42,013	25

Freight Production (in pounds/year) 3-digit NAICS–All Modes–Linear Models-TX (CFS)

$$FP_i = \beta E_i \quad (72)$$

Table 57: Freight Production (FP) 3-Digit NAICS -All Modes- Linear Models - (CFS)

CFS - Texas - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (except Oil and Gas)	48,689,606	60
311	Food Manufacturing	429,910	165
312	Beverage and Tobacco Product Manufacturing	3,736,219	25
314	Textile Product Mills	65,915	15
315	Apparel Manufacturing	40,207	10
321	Wood Product Manufacturing	913,417	85
322	Paper Manufacturing	1,352,247	40
323	Printing and Reltaed Support Activities	168,462	65
324	Petroleum and Coal Products Manufacturing	23,145,410	60
325	Chemical Manufacturing	1,473,751	225
326	Plastics and Rubber Products Manufacturing	288,629	115
327	Nonmetallic Mineral Product Manufacturing	3,725,196	150
331	Primary Metal Manufacturing	973,844	55
332	Fabricated Metal Product Manufacturing	155,994	200
333	Machinery Manufacturing	93,585	130
334	Computer and Electronic Product Manufacturing	6,505	85
335	Electrical Equipment, Appliance, and Component Manufacturing	51,356	30
336	Transportation Equipment Manufacturing	48,289	60
337	Furniture and Related Product Manufacturing	98,524	75
339	Miscellaneous Manufacturing	37,210	65
423	Merchan Wholesalers, Durable Goods	409,823	730
424	Merchant Wholesalers, Nondurable Goods	1,080,614	510
454	Nonstore Retailers	37,277	50
493	Warehousing and Storage	1,329,914	85
511	Publishing Industries (except Internet)	42,013	25

Freight Production (in pounds/year) 2-digit NAICS–Road Modes–Linear Models-TX (CFS)

$$FP_i = \beta E_i \quad (73)$$

Table 58: Freight Production (FP) 2-Digit NAICS- Road Modes-Linear Models - (CFS)

CFS - Texas - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Mining	31,516,621	60
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	539,411	235
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	719,978	730
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	47,611	700
42	Wholesale Trade	588,205	1245
49	Postal Service, Couriers & Messengers, Warehousing & Storage	1,325,751	85
51	Postal Service, Couriers & Messengers,	41,393	25

Freight Production (in pounds/year) 3-digit NAICS–Road Modes–Linear Models-TX (CFS)

$$FP_i = \beta E_i \quad (74)$$

Table 59: Freight Production (FP) 3-Digit NAICS- Road Modes-Linear Models - (CFS)

CFS - Texas - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (except Oil and Gas)	31,516,621	60
311	Food Manufacturing	385,644	165
321	Wood Product Manufacturing	769,736	85
322	Paper Manufacturing	809,648	40
323	Printing and Related Support Activities	166,740	65
324	Petroleum and Coal Products Manufacturing	1,413,470	60
325	Chemical Manufacturing	298,897	225
326	Plastics and Rubber Products Manufacturing	265,060	115
327	Nonmetallic Mineral Product Manufacturing	3,459,746	150
331	Primary Metal Manufacturing	638,526	55
332	Fabricated Metal Product Manufacturing	152,537	200
333	Machinery Manufacturing	89,553	130
334	Computer and Electronic Product Manufacturing	6,456	85
335	Electrical Equipment, Appliance, and Component Manufacturing	50,557	30
336	Transportation Equipment Manufacturing	22,877	60
339	Miscellaneous Manufacturing	26,335	65
423	Merchant Wholesalers, Durable Goods	368,432	730
424	Merchant Wholesalers, Nondurable Goods	792,114	510
493	Warehousing and Storage	1,325,751	85
511	Publishing Industries (except Internet)	41,393	25

Freight Production (in pounds/year) 2-digit NAICS–All Modes–Non-Linear Models-TX (CFS)

Lin-Log Model:

$FP_i = \beta * Ln(E_i)$; Where Ln is the natural logarithmic (75)

Table 60: Freight Production (FP) 2-Digit NAICS- All Modes- Non-Linear Models - (CFS)

CFS - Texas - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Mining	522,087,613	60
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	28,930,812	235
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	103,692,655	730
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	5,554,549	700
42	Wholesale Trade	21,107,112	1245
45	Sporting Goods, Hobby, Books & Music	799,771	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	30,201,083	85
51	Information	1,273,006	25
55	Management of Companies and Enterprises	58,485,178	60

Log-Log Model:

$FP_i = \alpha^* \times E_i^{\beta}$ (76)

Table 61: Freight Production (FP) 2-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - Texas - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	94,467,304	1.30	60
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	398,834	1.55	235
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	42,964,256	1.18	730
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	35,811	1.38	700
42	Wholesale Trade	10,847,010	1.17	1245
45	Sporting Goods, Hobby, Books & Music Stores	126,031	1.52	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	34,802,449	0.54	85
51	Information	9,978	1.19	25
55	Management of Companies and Enterprises	4.57E+18	5.22	60

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (77)

Table 62: Freight Production (FP) 2-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - Texas - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	922,158,839	0.055	60
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	173,997,212	0.007	235
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	1,130,395,413	0.010	730
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	9,958,536	0.003	700
42	Wholesale Trade	157,826,503	0.016	1245
45	Sporting Goods, Hobby, Books & Music Stores	3,067,530	0.027	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	83,965,253	0.008	85
51	Information	153,948	0.012	25
55	Management of Companies and Enterprises	1.042E+51	0.018	60

Freight Production (in pounds/year) 3-digit NAICS–All Modes–Non-Linear Models-TX (CFS)

Lin-Log Model:

$FP_i = \beta * Ln(E_i)$; Where Ln is the natural logarithmic (78)

Table 63: Freight Production (FP) 3-Digit NAICS- All Modes- Non-Linear Models - (CFS)

CFS - Texas - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (Except Oil and Gas)	522,087,613	60
311	Food Manufacturing	26,101,350	165
312	Beverage and Tobacco Manufacturing	96,413,378	25
314	Textile Product Mills	929,959	15
315	Apparel Manufacturing	1,067,738	10
321	Wood Product Manufacturing	16,340,824	85
322	Paper Manufacturing	31,730,237	40
323	Printing and Related Support Activities	1,887,651	65
324	Petroleum and Coal Products Manufacturing	657,510,948	60
325	Chemical Manufacturing	75,026,632	225
326	Plastics and Rubber Products Manufacturing	6,805,859	115
327	Nonmetallic Mineral Product Manufacturing	114,875,348	150
331	Primary Metal Manufacturing	39,519,914	55
332	Fabricated Metal Product Manufacturing	4,397,262	200
333	Machinery Manufacturing	2,889,300	130
334	Computer and Electronic Product Manufacturing	707,755	85
335	Electrical Equipment, Appliance, and Component Manufacturing	2,389,584	30
336	Transportation Equipment Manufacturing	3,672,614	60
337	Furniture and Related Product Manufacturing	1,939,961	75
339	Miscellaneous Manufacturing	983,396	65
423	Merchant Wholesalers, Durable Goods	9,157,917	730
424	Merchant Wholesalers, Nondurable Goods	39,588,964	510
454	Nonstore Retailers	799,771	50
493	Warehousing and Storage	30,201,083	85
511	Publishing Industries (except Internet)	1,273,006	25
551	Management of Companies and Enterprises	58,485,178	60

Log-Log Model:

$$FP_i = \alpha^* \times E_i^{\beta} \quad (79)$$

Table 64: Freight Production (FP) 3-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - Texas - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
212	Mining (except Oil and Gas)	94,467,304	1.30	60
311	Food Manufacturing	449,285	1.35	165
312	Beverage and Tobacco Product Manufacturing	50,417	2.09	25
314	Textile Product Mills	38,973	0.97	15
315	Apparel Manufacturing	8,920	1.43	10
321	Wood Product Manufacturing	20,665	1.99	85
322	Paper Manufacturing	49,966	1.77	40
323	Printing and Related Support Activities	8,701	1.27	65
324	Petroleum and Coal Products Manufacturing	23,508,399	1.46	60
325	Chemical Manufacturing	4,539,987	1.26	225
326	Plastics and Rubber Products Manufacturing	29,823	1.56	115
327	Nonmetallic Mineral Product Manufacturing	1,292,730,909	0.71	150
331	Primary Metal Manufacturing	4,712	2.08	55
332	Fabricated Metal Product Manufacturing	49,577	1.48	200
333	Machinery Manufacturing	6,993	1.50	130
334	Computer and Electronic Product Manufacturing	2,336	1.30	85
335	Electrical Equipment, Appliance, and Component Manufacturing	107,288	1.01	30
336	Transportation Equipment Manufacturing	26,142	1.03	60
337	Furniture and Related Product Manufacturing	13,442	1.37	75
339	Miscellaneous Manufacturing	14,616	1.11	65
423	Merchant Wholesalers, Durable Goods	2,584,289	1.24	730
424	Merchant Wholesalers, Nondurable Goods	27,881,018	1.16	510
454	Nonstore Retailers	126,031	1.52	50
493	Warehousing and Storage	34,802,449	0.54	85
511	Publishing Industries (except Internet)	9,978	1.19	25
551	Management of Companies and Enterprises	4.57E+18	5.22	60

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (80)

Table 65: Freight Production (FP) 3-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - Texas - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
212	Mining (except Oil and Gas)	922,158,839	0.055	60
311	Food Manufacturing	91,693,916	0.005	165
312	Beverage and Tobacco Product Manufacturing	284,744,377	0.011	25
314	Textile Product Mills	183,109	0.022	15
315	Apparel Manufacturing	490,937	0.017	10
321	Wood Product Manufacturing	3,351,094	0.032	85
322	Paper Manufacturing	51,205,633	0.012	40
323	Printing and Related Support Activities	89,898	0.027	65
324	Petroleum and Coal Products Manufacturing	718,145,079	0.010	60
325	Chemical Manufacturing	289,556,202	0.007	225
326	Plastics and Rubber Products Manufacturing	11,321,834	0.010	115
327	Nonmetallic Mineral Product Manufacturing	6,123,672,708	0.011	150
331	Primary Metal Manufacturing	72,112,874	0.012	55
332	Fabricated Metal Product Manufacturing	3,734,653	0.016	200
333	Machinery Manufacturing	2,418,955	0.010	130
334	Computer and Electronic Product Manufacturing	730,574	0.001	85
335	Electrical Equipment, Appliance, and Component Manufacturing	1,712,671	0.010	30
336	Transportation Equipment Manufacturing	996,716	0.003	60
337	Furniture and Related Product Manufacturing	464,811	0.019	75
339	Miscellaneous Manufacturing	155,461	0.016	65
423	Merchant Wholesalers, Durable Goods	48,778,394	0.016	730
424	Merchant Wholesalers, Nondurable Goods	393,807,458	0.014	510
454	Nonstore Retailers	3,067,530	0.027	50
493	Warehousing and Storage	83,965,253	0.008	85
511	Publishing Industries (except Internet)	153,948	0.012	25
551	Management of Companies and Enterprises	1.042E+51	0.018	60

Freight Production (in pounds/year) 2-digit NAICS–Road Modes–Non-Linear Models-TX (CFS)

Lin-Log Model:

$FP_i = \beta * Ln(E_i)$; Where Ln is the natural logarithmic (81)

Table 66: Freight Production (FP) 2-Digit NAICS- Road Modes- Non-Linear Models - (CFS)

CFS - Texas - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Mining	359,883,900	60
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	26,970,714	235
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	40,781,501	730
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	4,360,175	700
42	Wholesale Trade	14,769,009	1245
49	Postal Service, Couriers & Messengers, Warehousing & Storages	30,027,564	85
51	Postal Service, Couriers & Messengers, Warehousing & Storage	1,218,385	25
55	Management of Companies and Enterprises	58,169,092	60

Log-Log Model:

$FP_i = \alpha^* \times E_i^{\beta}$ (82)

Table 67: Freight Production (FP) 2-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - Texas - Road Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	102,785,401	1.16	60
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	402,732	1.55	235
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	45,002,445	1.12	730
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	37,193	1.36	700
42	Wholesale Trade	9,339,931	1.13	1245
49	Postal Service, Couriers & Messengers, Warehousing & Storage	23,011,651	0.68	85
51	Information	3,767	1.41	25
55	Management of Companies and Enterprises	2.19E+18	5.17	60

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (83)

Table 68: Freight Production (FP) 2-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - Texas - Road Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	699,546,594	0.053	60
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	176,110,888	0.007	235
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	1,028,883,496	0.008	730
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	9,319,545	0.003	700
42	Wholesale Trade	118,079,027	0.015	1245
49	Postal Service, Couriers & Messengers, Warehousing & Storage	78,873,919	0.008	85
51	Information	164,520	0.011	25
55	Management of Companies and Enterprises	1.23E+50	0.018	60

Freight Production (in pounds/year) 3-digit NAICS–Road Modes–Non-Linear Models-TX (CFS)

Lin-Log Model:

$FP_i = \beta * Ln(E_i)$; Where Ln is the natural logarithmic (84)

Table 69: Freight Production (FP) 3-Digit NAICS- Road Modes- Non-Linear Models - (CFS)

CFS - Texas - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (Except Oil and Gas)	359,883,900	60
311	Food Manufacturing	23,451,751	165
321	Wood Product Manufacturing	13,693,827	85
322	Paper Manufacturing	22,038,050	40
323	Printing and Related Support Activities	1,859,197	65
324	Petroleum and Coal Products Manufacturing	105,971,020	60
325	Chemical Manufacturing	16,667,414	225
326	Plastics and Rubber Products Manufacturing	6,293,540	115
327	Nonmetallic Mineral Product Manufacturing	108,866,091	150
331	Primary Metal Manufacturing	26,114,569	55
332	Fabricated Metal Product Manufacturing	4,288,540	200
333	Machinery Manufacturing	2,771,366	130
334	Computer and Electronic Product Manufacturing	698,155	85
335	Electrical Equipment, Appliance, and Component Manufacturing	2,346,465	30
336	Transportation Equipment Manufacturing	2,266,513	60
339	Miscellaneous Manufacturing	761,226	65
423	Merchant Wholesalers, Durable Goods	8,310,361	730
424	Merchant Wholesalers, Nondurable Goods	24,758,619	510
493	Warehousing and Storage	30,027,564	85
511	Publishing Industries (except Internet)	1,218,385	25
551	Management of Companies and Enterprises	58,169,092	60

Log-Log Model:

$$FP_i = \alpha^* \times E_i^{\beta} \quad (85)$$

Table 70: Freight Production (FP) 3-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - Texas - Road Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
212	Mining (except Oil and Gas)	102,785,401	1.16	60
311	Food Manufacturing	447,775	1.34	165
321	Wood Product Manufacturing	21,275	1.96	85
322	Paper Manufacturing	45,363	1.77	40
323	Printing and Related Support Activities	13,657	1.24	65
324	Petroleum and Coal Products Manufacturing	39,325,164	1.19	60
325	Chemical Manufacturing	2,746,979	1.19	225
326	Plastics and Rubber Products Manufacturing	20,849	1.59	115
327	Nonmetallic Mineral Product Manufacturing	1,342,484,521	0.69	150
331	Primary Metal Manufacturing	4,830	2.01	55
332	Fabricated Metal Product Manufacturing	51,956	1.46	200
333	Machinery Manufacturing	6,999	1.49	130
334	Computer and Electronic Product Manufacturing	2,504	1.29	85
335	Electrical Equipment, Appliance, and Component Manufacturing	112,819	0.99	30
336	Transportation Equipment Manufacturing	29,914	1.00	60
339	Miscellaneous Manufacturing	14,737	1.10	65
423	Merchant Wholesalers, Durable Goods	2,588,922	1.22	730
424	Merchant Wholesalers, Nondurable Goods	18,856,872	1.08	510
493	Warehousing and Storage	23,011,651	0.68	85
511	Publishing Industries (except Internet)	3,767	1.41	25
551	Management of Companies and Enterprises	2.19E+18	5.17	60

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (86)

Table 71: Freight Production (FP) 3-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - Texas - Road Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
212	Mining (except Oil and Gas)	699,546,594	0.053	60
311	Food Manufacturing	86,385,156	0.005	165
321	Wood Product Manufacturing	3,233,715	0.031	85
322	Paper Manufacturing	50,918,448	0.011	40
323	Printing and Related Support Activities	110,290	0.028	65
324	Petroleum and Coal Products Manufacturing	698,807,153	0.006	60
325	Chemical Manufacturing	131,469,881	0.005	225
326	Plastics and Rubber Products Manufacturing	8,618,854	0.010	115
327	Nonmetallic Mineral Product Manufacturing	6,055,357,455	0.010	150
331	Primary Metal Manufacturing	53,784,754	0.011	55
332	Fabricated Metal Product Manufacturing	3,603,157	0.016	200
333	Machinery Manufacturing	2,259,754	0.010	130
334	Computer and Electronic Product Manufacturing	653,775	0.001	85
335	Electrical Equipment, Appliance, and Component Manufacturing	1,682,920	0.010	30
336	Transportation Equipment Manufacturing	1,017,399	0.003	60
339	Miscellaneous Manufacturing	157,543	0.016	65
423	Merchant Wholesalers, Durable Goods	46,085,010	0.015	730
424	Merchant Wholesalers, Nondurable Goods	205,830,914	0.014	510
493	Warehousing and Storage	78,873,919	0.008	85
511	Publishing Industries (except Internet)	164,520	0.011	25
551	Management of Companies and Enterprises	1.23E+50	0.018	60

Freight Production (in pounds/year) 2-digit NAICS–All Modes–Linear Models-WY (CFS)

$$FP_i = \beta E_i \quad (87)$$

Table 72: Freight Production (FP) 2-Digit NAICS- All Modes-Linear Models - (CFS)

CFS - Wyoming - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Mining	153,230,056	15
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	8,166,167	50
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	50,544	30
42	Wholesale Trade	428,427	80

Freight Production (in pounds/year) 3-digit NAICS–All Modes–Linear Models-WY (CFS)

$$FP_i = \beta E_i \quad (88)$$

Table 73: Freight Production (FP) 3-Digit NAICS -All Modes- Linear Models - (CFS)

CFS - Wyoming - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (except Oil and Gas)	153,230,056	15
332	Fabricated Metal Product Manufacturing	129,651	10
423	Merchant Wholesalers, Durable Goods	206,047	40
424	Merchant Wholesalers, Nondurable Goods	660,248	35

Freight Production (in pounds/year) 2-digit NAICS–Road Modes–Linear Models-WY (CFS)

$$FP_i = \beta E_i \quad (89)$$

Table 74: Freight Production (FP) 2-Digit NAICS- Road Modes-Linear Models - (CFS)

CFS - Wyoming - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Mining	1,289,196	15
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	3,329,018	50
42	Wholesale Trade	409,019	80

Freight Production (in pounds/year) 3-digit NAICS–Road Modes–Linear Models-WY (CFS)

$$FP_i = \beta E_i \quad (90)$$

Table 75: Freight Production (FP) 3-Digit NAICS- Road Modes-Linear Models - (CFS)

CFS - Wyoming - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (except Oil and Gas)	1,289,196	15
423	Merchant Wholesalers, Durable Goods	173,152	40

Freight Production (in pounds/year) 2-digit NAICS–All Modes–Non-Linear Models-WY (CFS)

Lin-Log Model:

$FP_i = \beta^* Ln(E_i)$; Where Ln is the natural logarithmic (91)

Table 76: Freight Production (FP) 2-Digit NAICS- All Modes- Non-Linear Models - (CFS)

CFS - Wyoming - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Mining	5,104,333,216	15
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	101,518,191	50
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	1,003,926	30
42	Wholesale Trade	2,882,665	80

Log-Log Model:

$$FP_i = \alpha^* \times E_i^{\beta} \quad (92)$$

Table 77: Freight Production (FP) 2-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - Wyoming - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	740,830,598	1.53	15
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	254,462,711	1.10	50
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	60,010	1.34	30
42	Wholesale Trade	5,339,064,756	6.58	80

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (93)

Table 78: Freight Production (FP) 2-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - Wyoming - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	148,312,541,348	0.02	15
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	1,205,000,027	0.04	50
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	848,541	0.03	30
42	Wholesale Trade	18,949,698	0.06	80

Freight Production (in pounds/year) 3-digit NAICS–All Modes–Non-Linear Models-WY (CFS)

Lin-Log Model:

$FP_i = \beta^* Ln(E_i)$; Where Ln is the natural logarithmic (94)

Table 79: Freight Production (FP) 3-Digit NAICS- All Modes- Non-Linear Models - (CFS)

CFS - Wyoming - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (Except Oil and Gas)	5,104,333,216	15
332	Fabricated Metal Product Manufacturing	2,158,712	10
423	Merchant Wholesalers, Durable Goods	1,404,805	40
424	Merchant Wholesalers, Nondurable Goods	4,678,188	35

Log-Log Model:

$FP_i = \alpha^* \times E_i^{\beta}$ (95)

Table 80: Freight Production (FP) 3-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - Wyoming - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
212	Mining (except Oil and Gas)	740,830,598	1.53	15
332	Fabricated Metal Product Manufacturing	620,232	0.88	10
423	Merchant Wholesalers, Durable Goods	5,413,965	6.08	40
424	Merchant Wholesalers, Nondurable Goods	5.64E+12	7.19	35

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (96)

Table 81: Freight Production (FP) 3-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - Wyoming - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
212	Mining (except Oil and Gas)	148,312,541,348	0.02	15
332	Fabricated Metal Product Manufacturing	1,794,685	0.03	10
423	Merchant Wholesalers, Durable Goods	6,281,929	0.08	40
424	Merchant Wholesalers, Nondurable Goods	1.50E+29	0.83	35

Freight Production (in pounds/year) 2-digit NAICS–Road Modes–Non-Linear Models-WY (CFS)

Lin-Log Model:

$FP_i = \beta^* Ln(E_i)$; Where Ln is the natural logarithmic (97)

Table 82: Freight Production (FP) 2-Digit NAICS- Road Modes- Non-Linear Models - (CFS)

CFS - Wyoming - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Mining	94,326,921	15
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	51,872,206	50
42	Wholesale Trade	2,765,512	80

Log-Log Model:

$FP_i = \alpha^* \times E_i^{\beta}$ (98)

Table 83: Freight Production (FP) 2-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - Wyoming - Road Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	96,777,091	0.360	15
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	262,026,868	1.02	50
42	Wholesale Trade	6,745,053,865	6.50	80

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (99)

Table 84: Freight Production (FP) 2-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - Wyoming - Road Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	174,342,140	0.004	15
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	1,250,222,485	0.032	50
42	Wholesale Trade	8.77E+22	0.789	80

Freight Production (in pounds/year) 3-digit NAICS–Road Modes–Non-Linear Models-WY (CFS)

Lin-Log Model:

$FP_i = \beta^* Ln(E_i)$; Where Ln is the natural logarithmic (100)

Table 85: Freight Production (FP) 3-Digit NAICS- Road Modes- Non-Linear Models - (CFS)

CFS - Wyoming - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (Except Oil and Gas)	94,326,921	15
423	Merchant Wholesalers, Durable Goods	1,255,856	40

Log-Log Model:

$FP_i = \alpha^* \times E_i^{\beta}$ (101)

Table 86: Freight Production (FP) 3-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - Wyoming - Road Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
212	Mining (except Oil and Gas)	96,777,091	0.36	15
423	Merchant Wholesalers, Durable Goods	6,967,018	5.91	40

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (102)

Table 87: Freight Production (FP) 3-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - Wyoming - Road Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
212	Mining (except Oil and Gas)	174,342,140	0.004	15
423	Merchant Wholesalers, Durable Goods	6.34E+17	0.753	40

Freight Production (in pounds/year) 2-digit NAICS–All Modes–Linear Models-OH (CFS)

$$FP_i = \beta E_i \quad (103)$$

Table 88: Freight Production (FP) 2-Digit NAICS- All Modes-Linear Models - (CFS)

CFS - Ohio - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Mining	37,433,995	85
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	960,538	155
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	733,006	690
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	287,457	835
42	Wholesale Trade	1,204,735	935
45	Sporting Goods, Hobby, Books & Music Stores	21,156	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	1,046,450	70
51	Information	79,478	15
55	Management of Companies and Enterprises	446,118	55

Freight Production (in pounds/year) 3-digit NAICS–All Modes–Linear Models-OH (CFS)

$$FP_i = \beta E_i \quad (104)$$

Table 89: Freight Production (FP) 3-Digit NAICS -All Modes- Linear Models - (CFS)

CFS - Ohio - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (except Oil and Gas)	37,433,995	85
311	Food Manufacturing	746,513	115
312	Beverage and Tobacco Product Manufacturing	4,050,008	20
321	Wood Product Manufacturing	264,828	80
322	Paper Manufacturing	523,207	80
323	Printing and Related Support Activities	137,411	55
324	Petroleum and Coal Products Manufacturing	15,587,655	30
325	Chemical Manufacturing	741,631	155
326	Plastics and Rubber Products Manufacturing	150,044	165
327	Nonmetallic Mineral Product Manufacturing	680,959	120
331	Primary Metal Manufacturing	1,511,607	95
332	Fabricated Metal Product Manufacturing	107,167	250
333	Machinery Manufacturing	249,092	140
334	Computer and Electronic Product Manufacturing	10,081	45
335	Electrical Equipment, Appliance, and Component Manufacturing	160,615	45
336	Transportation Equipment Manufacturing	218,796	160
337	Furniture and Related Product Manufacturing	57,970	40
339	Miscellaneous Manufacturing	49,377	60
423	Merchant Wholesalers, Durable Goods	840,489	570
424	Merchant Wholesalers, Nondurable Goods	1,657,872	360
454	Nonstore Retailers	21,156	50
493	Warehousing and Storage	1,046,450	70
511	Publishing Industries (except Internet)	79,478	15
551	Management of Companies and Enterprises	446,118	55

Freight Production (in pounds/year) 2-digit NAICS–Road Modes–Linear Models-OH (CFS)

$$FP_i = \beta E_i \quad (105)$$

Table 90: Freight Production (FP) 2-Digit NAICS- Road Modes-Linear Models - (CFS)

CFS - Ohio - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Construction	17,710,145	85
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	888,331	155
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	423,773	690
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	160,857	835
42	Wholesale Trade	855,584	935
45	Sporting Goods, Hobby, Books & Music Stores	21,053	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	1,040,823	70
55	Management of Companies and Enterprises	445,052	55

Freight Production (in pounds/year) 3-digit NAICS–Road Modes–Linear Models-OH (CFS)

$$FP_i = \beta E_i \quad (106)$$

Table 91: Freight Production (FP) 3-Digit NAICS- Road Modes-Linear Models - (CFS)

CFS - Ohio - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (except Oil and Gas)	17,710,145	85
311	Food Manufacturing	669,639	115
321	Wood Product Manufacturing	250,766	80
322	Paper Manufacturing	514,322	80
323	Printing and Related Support Activities	136,961	55
324	Petroleum and Coal Products Manufacturing	2,759,436	30
325	Chemical Manufacturing	586,343	155
326	Plastics and Rubber Products Manufacturing	147,403	165
327	Nonmetallic Mineral Product Manufacturing	609,653	120
331	Primary Metal Manufacturing	645,007	95
332	Fabricated Metal Product Manufacturing	90,393	250
333	Machinery Manufacturing	219,023	140
334	Computer and Electronic Product Manufacturing	8,751	45
336	Transportation Equipment Manufacturing	119,734	160
339	Miscellaneous Manufacturing	47,467	60
423	Merchant Wholesalers, Durable Goods	405,279	570
424	Merchant Wholesalers, Nondurable Goods	1,415,782	360
454	Nonstore Retailers	21,053	50
493	Warehousing and Storage	1,040,823	70
551	Management of Companies and Enterprises	445,052	55

Freight Production (in pounds/year) 2-digit NAICS–All Modes–Non-Linear Models-OH (CFS)

Lin-Log Model:

$FP_i = \beta * Ln(E_i)$; Where Ln is the natural logarithmic (107)

Table 92: Freight Production (FP) 2-Digit NAICS- All Modes- Non-Linear Models - (CFS)

CFS - Ohio - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Mining	437,239,086	85
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	45,968,090	155
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	26,087,617	690
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	12,291,675	835
42	Wholesale Trade	40,977,856	935
45	Sporting Goods, Hobby, Books & Music Stores	1,991,229	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	37,221,805	70
51	Information	3,781,415	15
55	Management of Companies and Enterprises	28,878,334	55

Log-Log Model:

$$FP_i = \alpha^* \times E_i^{\beta} \quad (108)$$

Table 93: Freight Production (FP) 2-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - Ohio - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	114,459,571	1.15	85
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	2,383,452	1.27	155
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	11,209,680	1.07	690
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	47,729	1.38	835
42	Wholesale Trade	17,285,209	1.10	935
45	Sporting Goods, Hobby, Books & Music Stores	1.40E+14	5.33	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	3.10E+21	4.95	70
51	Information	73,721	1.57	15
55	Management of Companies and Enterprises	2.71E+18	4.65	55

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (109)

Table 94: Freight Production (FP) 2-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - Ohio - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	1,056,642,075	0.029	85
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	221,718,215	0.008	155
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	251,033,410	0.011	690
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	12,560,516	0.005	835
42	Wholesale Trade	205,704,435	0.021	935
45	Sporting Goods, Hobby, Books & Music Stores	9,759,193	0.003	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	70,547,893	0.006	70
51	Information	14,633,400	0.006	15
55	Management of Companies and Enterprises	7.61E+50	0.033	55

Freight Production (in pounds/year) 3-digit NAICS–All Modes–Non-Linear Models-OH (CFS)

Lin-Log Model:

$FP_i = \beta * Ln(E_i)$; Where Ln is the natural logarithmic (110)

Table 95: Freight Production (FP) 3-Digit NAICS- All Modes- Non-Linear Models - (CFS)

CFS - Ohio - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (Except Oil and Gas)	437,239,086	85
311	Food Manufacturing	47,359,757	115
312	Beverage and Tobacco Manufacturing	75,432,014	20
321	Wood Product Manufacturing	4,369,943	80
322	Paper Manufacturing	16,770,038	80
323	Printing and Related Support Activities	2,510,261	55
324	Petroleum and Coal Products Manufacturing	214,026,130	30
325	Chemical Manufacturing	29,741,427	155
326	Plastics and Rubber Products Manufacturing	4,743,365	165
327	Nonmetallic Mineral Product Manufacturing	32,051,613	120
331	Primary Metal Manufacturing	52,192,746	95
332	Fabricated Metal Product Manufacturing	7,404,703	250
333	Machinery Manufacturing	4,185,654	140
334	Computer and Electronic Product Manufacturing	447,342	45
335	Electrical Equipment, Appliance, and Component Manufacturing	8,397,457	45
336	Transportation Equipment Manufacturing	14,917,454	160
337	Furniture and Related Product Manufacturing	3,617,000	40
339	Miscellaneous Manufacturing	1,059,820	60
423	Merchant Wholesalers, Durable Goods	38,025,405	570
424	Merchant Wholesalers, Nondurable Goods	45,701,387	360
454	Nonstore Retailers	1,991,229	50
493	Warehousing and Storage	37,221,805	70
511	Publishing Industries (except Internet)	3,781,415	15
551	Management of Companies and Enterprises	28,878,334	55

Log-Log Model:

$$FP_i = \alpha^* \times E_i^{\beta} \quad (111)$$

Table 96: Freight Production (FP) 3-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - Ohio - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
212	Mining (Except Oil and Gas)	114,459,571	1.15	85
311	Food Manufacturing	1,344,421	1.33	115
312	Beverage and Tobacco Manufacturing	951,233	1.62	20
321	Wood Product Manufacturing	257,042	1.28	80
322	Paper Manufacturing	59,846	1.51	80
323	Printing and Related Support Activities	4,427	1.54	55
324	Petroleum and Coal Products Manufacturing	9.75E+27	7.57	30
325	Chemical Manufacturing	3,275,582	1.18	155
326	Plastics and Rubber Products Manufacturing	37,493	1.49	165
327	Nonmetallic Mineral Product Manufacturing	2,837,260	1.61	120
331	Primary Metal Manufacturing	56,033	1.59	95
332	Fabricated Metal Product Manufacturing	56,212	1.40	250
333	Machinery Manufacturing	11,991	1.27	140
334	Computer and Electronic Product Manufacturing	8,033	0.98	45
335	Electrical Equipment, Appliance, and Component Manufacturing	34,244	1.15	45
336	Transportation Equipment Manufacturing	32,336	1.35	160
337	Furniture and Related Product Manufacturing	172,678	0.78	40
339	Miscellaneous Manufacturing	2,991	1.83	60
423	Merchant Wholesalers, Durable Goods	1,202,986	1.33	570
424	Merchant Wholesalers, Nondurable Goods	148,557,762	0.68	360
454	Nonstore Retailers	1.40E+14	5.33	50
493	Warehousing and Storage	3.10E+21	4.95	70
511	Publishing Industries (except Internet)	73,721	1.57	15
551	Management of Companies and Enterprises	2.71E+18	4.65	55

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (112)

Table 97: Freight Production (FP) 3-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - Ohio - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
212	Mining (Except Oil and Gas)	1,056,642,075	0.029	85
311	Food Manufacturing	322,047,497	0.006	115
312	Beverage and Tobacco Manufacturing	68,110,697	0.016	20
321	Wood Product Manufacturing	3,572,284	0.041	80
322	Paper Manufacturing	18,104,272	0.012	80
323	Printing and Related Support Activities	392,048	0.015	55
324	Petroleum and Coal Products Manufacturing	3.25E+68	0.124	30
325	Chemical Manufacturing	229,922,408	0.009	155
326	Plastics and Rubber Products Manufacturing	13,017,950	0.011	165
327	Nonmetallic Mineral Product Manufacturing	521,723,610	0.012	120
331	Primary Metal Manufacturing	49,660,989	0.007	95
332	Fabricated Metal Product Manufacturing	10,897,324	0.006	250
333	Machinery Manufacturing	1,102,321	0.007	140
334	Computer and Electronic Product Manufacturing	194,139	0.007	45
335	Electrical Equipment, Appliance, and Component Manufacturing	4,334,602	0.003	45
336	Transportation Equipment Manufacturing	16,494,171	0.003	160
337	Furniture and Related Product Manufacturing	1,171,394	0.003	40
339	Miscellaneous Manufacturing	961,311	0.024	60
423	Merchant Wholesalers, Durable Goods	28,027,892	0.027	570
424	Merchant Wholesalers, Nondurable Goods	596,683,597	0.013	360
454	Nonstore Retailers	9,759,193	0.003	50
493	Warehousing and Storage	70,547,893	0.006	70
511	Publishing Industries (except Internet)	14,633,400	0.006	15
551	Management of Companies and Enterprises	7.61E+50	0.033	55

Freight Production (in pounds/year) 2-digit NAICS–Road Modes–Non-Linear Models-OH (CFS)

Lin-Log Model:

$FP_i = \beta * Ln(E_i)$; Where Ln is the natural logarithmic (113)

Table 98: Freight Production (FP) 2-Digit NAICS- Road Modes- Non-Linear Models - (CFS)

CFS - Ohio - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Construction	334,763,266	85
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	38,278,592	155
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	19,214,095	690
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	7,957,992	835
42	Wholesale Trade	16,870,788	935
45	Sporting Goods, Hobby, Books & Music Stores	1,977,430	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	36,788,653	70
55	Management of Companies and Enterprises	28618067.8	55

Log-Log Model:

$FP_i = \alpha^* \times E_i^{\beta}$ (114)

Table 99: Freight Production (FP) 2-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - Ohio - Road Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	99,246,911	1.11	85
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	2,388,019	1.27	155
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	11,178,918	1.04	690
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	50,631	1.37	835
42	Wholesale Trade	8,881,110	1.09	935
45	Sporting Goods, Hobby, Books & Music Stores	1.48E+14	5.32	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	3.21E+21	4.95	70
55	Management of Companies and Enterprises	3.18E+18	4.62	55

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (115)

Table 100: Freight Production (FP) 2-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - Ohio - Road Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	920,429,626	0.025	85
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	208,632,582	0.008	155
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	215,648,109	0.010	690
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	12,695,153	0.005	835
42	Wholesale Trade	98,117,414	0.022	935
45	Sporting Goods, Hobby, Books & Music Stores	9,666,491	0.003	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	70,904,907	0.006	70
55	Management of Companies and Enterprises	3.76E+50	0.033	55

Freight Production (in pounds/year) 3-digit NAICS–Road Modes–Non-Linear Models-OH (CFS)

Lin-Log Model:

$FP_i = \beta * Ln(E_i)$; Where Ln is the natural logarithmic (116)

Table 101: Freight Production (FP) 3-Digit NAICS- Road Modes- Non-Linear Models - (CFS)

CFS - Ohio - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (Except Oil and Gas)	334,763,266	85
311	Food Manufacturing	37,033,322	115
321	Wood Product Manufacturing	4,158,012	80
322	Paper Manufacturing	16,435,129	80
323	Printing and Related Support Activities	2,498,985	55
324	Petroleum and Coal Products Manufacturing	115,068,182	30
325	Chemical Manufacturing	21,863,075	155
326	Plastics and Rubber Products Manufacturin	4,626,915	165
327	Nonmetallic Mineral Product Manufacturing	29,417,743	120
331	Primary Metal Manufacturing	25,651,462	95
332	Fabricated Metal Product Manufacturing	6,356,113	250
333	Machinery Manufacturing	3,747,734	140
334	Computer and Electronic Product Manufacturing	409,188	45
336	Transportation Equipment Manufacturing	10,126,744	160
339	Miscellaneous Manufacturing	991,311	60
423	Merchant Wholesalers, Durable Goods	6,943,331	570
424	Merchant Wholesalers, Nondurable Goods	32,753,402	360
454	Nonstore Retailers	1,977,430	50
493	Warehousing and Storage	36,788,653	70
551	Management of Companies and Enterprises	28,618,068	55

Log-Log Model:

$$FP_i = \alpha^* \times E_i^{\beta} \quad (117)$$

Table 102: Freight Production (FP) 3-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - Ohio - Road Modes [pounds/year]				
NAICS	**Description**	**α**	**β**	**Obs.**
212	Mining (Except Oil and Gas)	99,246,911	1.11	85
311	Food Manufacturing	1,196,188	1.34	115
321	Wood Product Manufacturing	260,368	1.26	80
322	Paper Manufacturing	62,709	1.49	80
323	Printing and Related Support Activities	3,060	1.64	55
324	Petroleum and Coal Products Manufacturing	8.69E+27	7.64	30
325	Chemical Manufacturing	1,909,687	1.21	155
326	Plastics and Rubber Products Manufacturing	36,961	1.49	165
327	Nonmetallic Mineral Product Manufacturing	3,600,178	1.61	120
331	Primary Metal Manufacturing	73,890	1.50	95
332	Fabricated Metal Product Manufacturing	55,145	1.40	250
333	Machinery Manufacturing	12,342	1.26	140
334	Computer and Electronic Product Manufacturing	9,164	0.93	45
336	Transportation Equipment Manufacturing	38,920	1.31	160
339	Miscellaneous Manufacturing	2,701	1.86	60
423	Merchant Wholesalers, Durable Goods	730,667	1.39	570
424	Merchant Wholesalers, Nondurable Goods	66,140,782	0.47	360
454	Nonstore Retailers	1.48E+14	5.32	50
493	Warehousing and Storage	3.21E+21	4.95	70
551	Management of Companies and Enterprises	3.18E+18	4.62	55

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (118)

Table 103: Freight Production (FP) 3-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - Ohio - Road Modes [pounds/year]				
NAICS	**Description**	**α**	**β**	**Obs.**
212	Mining (Except Oil and Gas)	920,429,626	0.025	85
311	Food Manufacturing	300,907,755	0.006	115
321	Wood Product Manufacturing	3,578,829	0.040	80
322	Paper Manufacturing	17,337,210	0.012	80
323	Printing and Related Support Activities	407,586	0.014	55
324	Petroleum and Coal Products Manufacturing	3.06E+68	0.118	30
325	Chemical Manufacturing	155,488,145	0.009	155
326	Plastics and Rubber Products Manufacturing	12,619,957	0.011	165
327	Nonmetallic Mineral Product Manufacturing	636,135,771	0.012	120
331	Primary Metal Manufacturing	50,259,157	0.006	95
332	Fabricated Metal Product Manufacturing	10,407,126	0.006	250
333	Machinery Manufacturing	1,054,333	0.007	140
334	Computer and Electronic Product Manufacturing	179,918	0.007	45
336	Transportation Equipment Manufacturing	16,389,868	0.003	160
339	Miscellaneous Manufacturing	1,105,807	0.024	60
423	Merchant Wholesalers, Durable Goods	20,530,513	0.028	570
424	Merchant Wholesalers, Nondurable Goods	147,941,861	0.012	360
454	Nonstore Retailers	9,666,491	0.003	50
493	Warehousing and Storage	70,904,907	0.006	70
551	Management of Companies and Enterprises	3.76E+50	0.033	55

Freight Production (in pounds/year) 2-digit NAICS–All Modes–Linear Models-USA (CFS)

$$FP_i = \beta E_i \quad (119)$$

Table 104: Freight Production (FP) 2-Digit NAICS- All Modes-Linear Models - (CFS)

CFS - United States - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Mining	30,950,434	1550
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	506,712	4480
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	1,021,071	12310
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc, Manufacturing	153,426	12700
42	Wholesale Trade	787,685	20065
45	Sporting Goods, Hobby, Books & Music Stores	55,970	1225
49	Postal Service, Couriers & Messengers, Warehousing & Storage	792,551	1245
51	Information	50,498	665
55	Management of Companies and Enterprises	187,803	1000

Freight Production (in pounds/year) 3-digit NAICS–All Modes–Linear Models-USA (CFS)

$$FP_i = \beta E_i \quad (120)$$

Table 105: Freight Production (FP) 3-Digit NAICS -All Modes- Linear Models - (CFS)

CFS - United States - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (except Oil and Gas)	30,950,434	1550
311	Food Manufacturing	479,233	2930
312	Beverage and Tobacco Product Manufacturing	1,247,982	470
313	Textile Mills	121,735	380
314	Textile Product Mills	156,603	345
315	Apparel Manufacturing	13,069	245
316	Leather and Allied Product Manufacturing	26,298	115
321	Wood Product Manufacturing	535,798	1945
322	Paper Manufacturing	983,715	1210
323	Printing and Related Support Activities	206,843	1370
324	Petroleum and Coal Products Manufacturing	21,353,264	660
325	Chemical Manufacturing	331,190	2480
326	Plastics and Rubber Products Manufacturing	173,722	2145
327	Nonmetallic Mineral Product Manufacturing	2,324,909	2495
331	Primary Metal Manufacturing	1,344,674	995
332	Fabricated Metal Product Manufacturing	124,851	3365
333	Machinery Manufacturing	93,915	2075
334	Computer and Electronic Product Manufacturing	5,551	1360
335	Electrical Equipment, Appliance, and Component Manufacturing	124,671	835
336	Transportation Equipment Manufacturing	91,317	1755
337	Furniture and Related Product Manufacturing	79,134	1145
339	Miscellaneous Manufacturing	20,208	1175
423	Merchant Wholesalers, Durable Goods	463,162	11315
424	Merchant Wholesalers, Nondurable Goods	1,004,441	8750
454	Nonstore Retailers	55,970	1225
493	Warehousing and Storage	792,551	1245
511	Publishing Industries (except Internet)	50,498	665
551	Management of Companies and Enterprises	187,803	1000

Freight Production (in pounds/year) 2-digit NAICS–Road Modes–Linear Models-USA (CFS)

$$FP_i = \beta E_i \quad (121)$$

Table 106: Freight Production (FP) 2-Digit NAICS- Road Modes-Linear Models - (CFS)

CFS - United States - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Mining	7,745,393	1550
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	438,112	4480
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	400,204	12310
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc, Manufacturing	96,430	12700
42	Wholesale Trade	634,793	20065
45	Sporting Goods, Hobby, Books & Music Stores	55,162	1225
49	Postal Service, Couriers & Messengers, Warehousing & Storage	776,337	1245
51	Information	50,264	665
55	Management of Companies and Enterprises	131,126	1000

Freight Production (in pounds/year) 3-digit NAICS–Road Modes–Linear Models-USA (CFS)

$$FP_i = \beta E_i \quad (122)$$

Table 107: Freight Production (FP) 3-Digit NAICS- Road Modes-Linear Models - (CFS)

CFS - United States - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (except Oil and Gas)	7,745,393	1550
311	Food Manufacturing	407,308	2930
312	Beverage and Tobacco Product Manufacturing	1,141,177	470
313	Textile Mills	107,003	380
314	Textile Product Mills	149,057	345
315	Apparel Manufacturing	12,406	245
316	Leather and Allied Product Manufacturing	14,818	115
321	Wood Product Manufacturing	442,228	1940
322	Paper Manufacturing	681,290	1210
323	Printing and Related Support Activities	199,029	1370
324	Petroleum and Coal Products Manufacturing	3,049,815	660
325	Chemical Manufacturing	140,199	2480
326	Plastics and Rubber Products Manufacturing	165,006	2145
327	Nonmetallic Mineral Product Manufacturing	2,071,737	2495
331	Primary Metal Manufacturing	688,961	995
332	Fabricated Metal Product Manufacturing	116,781	3365
333	Machinery Manufacturing	79,544	2075
334	Computer and Electronic Product Manufacturing	5,068	1360
335	Electrical Equipment, Appliance, and Component Manufacturing	109,183	835
336	Transportation Equipment Manufacturing	62,432	1755
337	Furniture and Related Product Manufacturing	78,062	1145
339	Miscellaneous Manufacturing	18,846	1175
423	Merchant Wholesalers, Durable Goods	364,029	11315
424	Merchant Wholesalers, Nondurable Goods	815,641	8750
454	Nonstore Retailers	55,162	1225
493	Warehousing and Storage	776,337	1245
511	Publishing Industries (except Internet)	50,264	665
551	Management of Companies and Enterprises	131,126	1000

Freight Production (in pounds/year) 2-digit NAICS–All Modes–Non-Linear Models-USA (CFS)

Lin-Log Model:

$FP_i = \beta * Ln(E_i)$; Where Ln is the natural logarithmic (123)

Table 108: Freight Production (FP) 2-Digit NAICS- All Modes- Non-Linear Models - (CFS)

CFS - United States - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Mining	429,983,087	1550
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	31,333,710	4480
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	47,847,304	12310
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	6,476,103	12700
42	Wholesale Trade	22,315,863	20065
45	Sporting Goods, Hobby, Books & Music Stores	3,395,976	1225
49	Postal Service, Couriers & Messengers, Warehousing & Storage	35,471,262	1245
51	Information	2,334,908	665
55	Management of Companies and Enterprises	45,286,940	1000

Log-Log Model:

$FP_i = \alpha^* \times E_i^{\beta}$ (124)

Table 109: Freight Production (FP) 2-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - United States - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	102,966,643	1.04	1550
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	468,066	1.60	4480
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	53,474,643	1.09	12310
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	26,863	1.44	12700
42	Wholesale Trade	13,820,918	1.03	20065
45	Sporting Goods, Hobby, Books & Music Stores	3,506,710	1.079	1225
49	Postal Service, Couriers & Messengers, Warehousing & Storage	55,234,357	0.384	1245
51	Information	18,122	1.221	665
55	Management of Companies and Enterprises	1.30E+19	5.27	1000

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (125)

Table 110: Freight Production (FP) 2-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - United States - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	1,199,901,388	0.013	1550
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	326,892,029	0.007	4480
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	1,487,452,490	0.006	12310
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	7,567,683	0.005	12700
42	Wholesale Trade	122,367,091	0.017	20065
45	Sporting Goods, Hobby, Books & Music Stores	34,579,096	0.005	1225
49	Postal Service, Couriers & Messengers, Warehousing & Storage	101,248,238	0.005	1245
51	Information	638,169	0.006	665
55	Management of Companies and Enterprises	7.52E+52	0.018	1000

Freight Production (in pounds/year) 3-digit NAICS–All Modes–Non-Linear Models-USA (CFS)

Lin-Log Model:

$FP_i = \beta * Ln(E_i)$; Where Ln is the natural logarithmic (126)

Table 111: Freight Production (FP) 3-Digit NAICS- All Modes- Non-Linear Models - (CFS)

CFS - United States - All Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (except Oil and Gas)	429,983,087	1550
311	Food Manufacturing	37,931,394	2930
312	Beverage and Tobacco Product Manufacturing	57,115,808	470
313	Textile Mills	3,450,167	380
314	Textile Product Mills	3,225,652	345
315	Apparel Manufacturing	377,710	245
316	Leather and Allied Product Manufacturing	839,479	115
321	Wood Product Manufacturing	16,779,809	1945
322	Paper Manufacturing	29,828,941	1210
323	Printing and Related Support Activities	3,131,831	1370
324	Petroleum and Coal Products Manufacturing	319,927,314	660
325	Chemical Manufacturing	38,833,673	2480
326	Plastics and Rubber Products Manufacturing	5,098,086	2145
327	Nonmetallic Mineral Product Manufacturing	69,302,012	2495
331	Primary Metal Manufacturing	43,046,210	995
332	Fabricated Metal Product Manufacturing	4,391,241	3365
333	Machinery Manufacturing	2,571,528	2075
334	Computer and Electronic Product Manufacturing	420,467	1360
335	Electrical Equipment, Appliance, and Component Manufacturing	4,105,737	835
336	Transportation Equipment Manufacturing	8,370,088	1755
337	Furniture and Related Product Manufacturing	2,020,253	1145
339	Miscellaneous Manufacturing	767,475	1175
423	Merchant Wholesalers, Durable Goods	11,144,484	11315
424	Merchant Wholesalers, Nondurable Goods	37,457,598	8750
454	Nonstore Retailers	3,395,976	1225
493	Warehousing and Storage	35,471,262	1245
511	Publishing Industries (except Internet)	2,334,908	665
551	Management of Companies and Enterprises	45,286,940	1000

Log-Log Model:

$$FP_i = \alpha^* \times E_i^{\beta} \quad (127)$$

Table 112: Freight Production (FP) 3-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - United States - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
212	Mining (Except Oil and Gas)	102,966,643	1.04	1550
311	Food Manufacturing	1,041,245	1.39	2930
312	Beverage and Tobacco Manufacturing	688,916	1.46	470
313	Textile Mills	36,487	1.28	380
314	Textile Product Mills	7,960	1.51	345
315	Apparel Manufacturing	4,037	1.40	245
316	Leather and Allied Product Manufacturing	12,208	1.29	115
321	Wood Product Manufacturing	694,425	1.35	1945
322	Paper Manufacturing	83,322	1.57	1210
323	Printing and Related Support Activities	7,131	1.49	1370
324	Petroleum and Coal Products Manufacturing	515,913,515	0.63	660
325	Chemical Manufacturing	2,044,183	1.45	2480
326	Plastics and Rubber Products Manufacturing	31,214	1.53	2145
327	Nonmetallic Mineral Product Manufacturing	203,230,866	0.99	2495
331	Primary Metal Manufacturing	52,303	1.69	995
332	Fabricated Metal Product Manufacturing	47,856	1.50	3365
333	Machinery Manufacturing	10,987	1.45	2075
334	Computer and Electronic Product Manufacturing	5,393	1.07	1350
335	Electrical Equipment, Appliance, and Component Manufacturing	5,733	1.54	835
336	Transportation Equipment Manufacturing	23,124	1.40	1755
337	Furniture and Related Product Manufacturing	18,220	1.27	1145
339	Miscellaneous Manufacturing	5,837	1.43	1175
423	Merchant Wholesalers, Durable Goods	1,862,995	1.25	11315
424	Merchant Wholesalers, Nondurable Goods	39,048,068	0.85	8750
454	Nonstore Retailers	3,506,710	1.08	1225
493	Warehousing and Storage	55,234,357	0.38	1245
511	Publishing Industries (except Internet)	18,122	1.22	665
551	Management of Companies and Enterprises	1.30E+19	5.27	1000

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (128)

Table 113: Freight Production (FP) 3-Digit NAICS- All Modes- Non-Linear Models- (CFS)

CFS - United States - All Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
212	Mining (Except Oil and Gas)	1,199,901,388	0.013	1550
311	Food Manufacturing	375,169,495	0.005	2930
312	Beverage and Tobacco Manufacturing	94,574,636	0.008	470
313	Textile Mills	2,228,393	0.011	380
314	Textile Product Mills	398,747	0.015	345
315	Apparel Manufacturing	231,302	0.014	245
316	Leather and Allied Product Manufacturing	269,358	0.020	115
321	Wood Product Manufacturing	37,582,650	0.015	1945
322	Paper Manufacturing	47,435,340	0.011	1210
323	Printing and Related Support Activities	283,656	0.019	1370
324	Petroleum and Coal Products Manufacturing	1,409,085,570	0.009	660
325	Chemical Manufacturing	554,139,014	0.003	2480
326	Plastics and Rubber Products Manufacturing	9,675,381	0.011	2145
327	Nonmetallic Mineral Product Manufacturing	2,352,689,371	0.013	2495
331	Primary Metal Manufacturing	162,668,499	0.007	995
332	Fabricated Metal Product Manufacturing	5,879,730	0.014	3365
333	Machinery Manufacturing	2,626,627	0.008	2075
334	Computer and Electronic Product	265,544	0.003	1350
335	Electrical Equipment, Appliance, and Component Manufacturing	2,002,370	0.007	835
336	Transportation Equipment Manufacturing	18,410,870	0.003	1755
337	Furniture and Related Product Manufacturing	851,389	0.008	1145
339	Miscellaneous Manufacturing	447,156	0.009	1175
423	Merchant Wholesalers, Durable Goods	30,415,674	0.024	11315
424	Merchant Wholesalers, Nondurable Goods	218,477,972	0.012	8750
454	Nonstore Retailers	34,579,096	0.005	1225
493	Warehousing and Storage	101,248,238	0.005	1245
511	Publishing Industries (except Internet)	638,169	0.006	665
551	Management of Companies and Enterprises	7.52E+52	0.018	1000

Freight Production (in pounds/year) 2-digit NAICS–Road Modes–Non-Linear Models-USA (CFS)

Lin-Log Model:

$FP_i = \beta * Ln(E_i)$; Where Ln is the natural logarithmic (129)

Table 114: Freight Production (FP) 2-Digit NAICS- Road Modes- Non-Linear Models - (CFS)

CFS - United States - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
21	Mining	282,432,192	1550
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	26,039,527	4480
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	31,515,922	12310
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	4,777,409	12700
42	Wholesale Trade	16,109,203	20065
45	Sporting Goods, Hobby, Books & Music Stores	3,344,522	1225
49	Postal Service, Couriers & Messengers, Warehousing & Storage	32,568,847	1245
51	Information	2,302,358	665
55	Management of Companies and Enterprises	27,154,413	1000

Log-Log Model:

$FP_i = \alpha^* \times E_i^{\beta}$ (130)

Table 115: Freight Production (FP) 2-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - United States - Road Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	112,096,301	0.96	1550
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	432,129	1.60	4480
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	55,617,478	1.05	12310
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	28,786	1.43	12700
42	Wholesale Trade	10,850,958	1.01	20065
45	Sporting Goods, Hobby, Books & Music Stores	3,660,418	1.08	1225
49	Postal Service, Couriers & Messengers, Warehousing & Storage	43,493,667	0.41	1245
51	Information	14,244	1.25	665
55	Management of Companies and Enterprises	1.10E+18	5.19	1000

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (131)

Table 116: Freight Production (FP) 2-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - United States - Road Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
21	Mining	1,060,968,078	0.011	1550
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	284,051,672	0.007	4480
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	1,325,290,816	0.006	12310
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	7,183,053	0.005	12700
42	Wholesale Trade	89,493,563	0.017	20065
45	Sporting Goods, Hobby, Books & Music Stores	35,653,332	0.005	1225
49	Postal Service, Couriers & Messengers, Warehousing & Storage	83,685,705	0.005	1245
51	Information	543,866	0.006	665
55	Management of Companies and Enterprises	2.11E+50	0.018	1000

Freight Production (in pounds/year) 3-digit NAICS–Road Modes–Non-Linear Models-USA (CFS)

Lin-Log Model:

$FP_i = \beta * Ln(E_i)$; Where Ln is the natural logarithmic (132)

Table 117: Freight Production (FP) 3-Digit NAICS- Road Modes- Non-Linear Models - (CFS)

CFS - United States - Road Modes [pounds/year]			
NAICS	**Description**	**β**	**Obs.**
212	Mining (except Oil and Gas)	282,432,192	1550
311	Food Manufacturing	30,186,424	2930
312	Beverage and Tobacco Product Manufacturing	55,070,117	470
313	Textile Mills	3,236,767	380
314	Textile Product Mills	3,100,576	345
315	Apparel Manufacturing	360,950	245
316	Leather and Allied Product Manufacturing	452,518	115
321	Wood Product Manufacturing	14,202,550	1940
322	Paper Manufacturing	22,255,566	1210
323	Printing and Related Support Activities	3,034,954	1370
324	Petroleum and Coal Products Manufacturing	148,268,574	660
325	Chemical Manufacturing	18,347,836	2480
326	Plastics and Rubber Products Manufacturing	4,918,655	2145
327	Nonmetallic Mineral Product Manufacturing	64,152,503	2495
331	Primary Metal Manufacturing	25,910,905	995
332	Fabricated Metal Product Manufacturing	4,085,332	3365
333	Machinery Manufacturing	2,346,774	2075
334	Computer and Electronic Product Manufacturing	388,738	1360
335	Electrical Equipment, Appliance, and Component Manufacturing	3,422,187	835
336	Transportation Equipment Manufacturing	6,425,835	1755
337	Furniture and Related Product Manufacturing	1,974,956	1145
339	Miscellaneous Manufacturing	718,824	1175
423	Merchant Wholesalers, Durable Goods	7,321,444	11315
424	Merchant Wholesalers, Nondurable Goods	28,020,169	8750
454	Nonstore Retailers	3,344,522	1225
493	Warehousing and Storage	32,568,847	1245
511	Publishing Industries (except Internet)	2,302,358	665
551	Management of Companies and Enterprises	27,154,413	1000

Log-Log Model:

$$FP_i = \alpha^* \times E_i^{\beta} \quad (133)$$

Table 118: Freight Production (FP) 3-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - United States - Road Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
212	Mining (Except Oil and Gas)	112,096,301	0.96	1550
311	Food Manufacturing	922,466	1.39	2930
312	Beverage and Tobacco Manufacturing	668,480	1.47	470
313	Textile Mills	36,636	1.27	380
314	Textile Product Mills	7,343	1.58	345
315	Apparel Manufacturing	3,324	1.43	245
316	Leather and Allied Product Manufacturing	11,815	1.25	115
321	Wood Product Manufacturing	694,240	1.32	1945
322	Paper Manufacturing	86,482	1.54	1210
323	Printing and Related Support Activities	6,771	1.52	1370
324	Petroleum and Coal Products Manufacturing	628,206,677	0.51	660
325	Chemical Manufacturing	1,616,289	1.40	2480
326	Plastics and Rubber Products Manufacturing	30,572	1.53	2145
327	Nonmetallic Mineral Product Manufacturing	213,404,854	0.97	2495
331	Primary Metal Manufacturing	53,094	1.66	995
332	Fabricated Metal Product Manufacturing	48,237	1.49	3365
333	Machinery Manufacturing	10,940	1.44	2075
334	Computer and Electronic Product	5,783	1.06	1350
335	Electrical Equipment, Appliance, and Component Manufacturing	6,738	1.50	835
336	Transportation Equipment Manufacturing	25,131	1.37	1755
337	Furniture and Related Product Manufacturing	17,983	1.28	1145
339	Miscellaneous Manufacturing	6,346	1.41	1175
423	Merchant Wholesalers, Durable Goods	1,689,523	1.23	11315
424	Merchant Wholesalers, Nondurable Goods	26,846,992	0.83	8750
454	Nonstore Retailers	3,660,418	1.08	1225
493	Warehousing and Storage	43,493,667	0.41	1245
511	Publishing Industries (except Internet)	14,244	1.25	665
551	Management of Companies and Enterprises	1.10E+18	5.19	1000

Log-Lin Model:

$FP_i = \alpha^* \times e^{\beta E_i}$; Where e is the exponential function (e^x) (134)

Table 119: Freight Production (FP) 3-Digit NAICS- Road Modes- Non-Linear Models- (CFS)

CFS - United States - Road Modes [pounds/year]				
NAICS	**Description**	**α***	**β**	**Obs.**
212	Mining (Except Oil and Gas)	1,060,968,078	0.011	1550
311	Food Manufacturing	318,001,220	0.005	2930
312	Beverage and Tobacco Manufacturing	95,152,870	0.008	470
313	Textile Mills	2,177,178	0.011	380
314	Textile Product Mills	490,646	0.015	345
315	Apparel Manufacturing	219,800	0.014	245
316	Leather and Allied Product Manufacturing	223,977	0.020	115
321	Wood Product Manufacturing	34,288,321	0.014	1945
322	Paper Manufacturing	45,453,085	0.010	1210
323	Printing and Related Support Activities	298,928	0.019	1370
324	Petroleum and Coal Products Manufacturing	1,488,870,669	0.005	660
325	Chemical Manufacturing	332,634,484	0.003	2480
326	Plastics and Rubber Products Manufacturing	9,656,265	0.011	2145
327	Nonmetallic Mineral Product Manufacturing	2,347,809,210	0.013	2495
331	Primary Metal Manufacturing	138,818,749	0.007	995
332	Fabricated Metal Product Manufacturing	5,756,215	0.014	3365
333	Machinery Manufacturing	2,441,740	0.007	2075
334	Computer and Electronic Product	264,753	0.003	1350
335	Electrical Equipment, Appliance, and Component Manufacturing	1,815,183	0.007	835
336	Transportation Equipment Manufacturing	15,747,364	0.003	1755
337	Furniture and Related Product Manufacturing	883,908	0.008	1145
339	Miscellaneous Manufacturing	434,962	0.009	1175
423	Merchant Wholesalers, Durable Goods	26,560,430	0.023	11315
424	Merchant Wholesalers, Nondurable Goods	138,593,836	0.013	8750
454	Nonstore Retailers	35,653,332	0.005	1225
493	Warehousing and Storage	83,685,705	0.005	1245
511	Publishing Industries (except Internet)	543,866	0.006	665
551	Management of Companies and Enterprises	2.11E+50	0.018	1000

IX. Illustrative Applications

This chapter discusses a number of illustrative applications of the kind that could be conducted using the models included in the Guidebook. The applications describe the use of:

- FTG models to estimate commercial parking needs at a commercial center.
- FTG models to analyze historic trends using the Zip Code Business Pattern database.
- FTG models to support the development of a freight model at the MPO level.
- FG models analyze the importance of freight corridors at the state level.

These applications are briefly described next.

Application #1: Quantification of Commercial Parking Needs for a Commercial Center

This example illustrates the use of the Guidebook models to quantify commercial (freight and service) parking needs for a commercial center. The approach used in this application could also be used to assess FSA parking needs for commercial streets, buildings, and the like. The example use real data from a commercial center that houses 19 businesses with the majority in the retail sector (NAICS 44-45) and accommodation and food services (NAICS 72). The remaining establishments are in Finance and Insurance (NAICS 52), Real Estate and Rental and Leasing (NAICS 53), Professional, Scientific, and Technical Services (NAICS 54), and Other Services (except Public Administration) (NAICS 81). In this case, since the commercial center was already in operation, team members interviewed the staff at the stores to obtain accurate estimates of employment, both full-time and part-time. In applications where the employment numbers not known, estimates from establishments of similar sizes and line of businesses could be used without major problems.

Table 120 shows the estimated FTG. The FTA was estimated using Equation 24 and the parameters found in Table 9 for the linear model, and Equation 25 with the parameters of Table 10 for the non-linear models. For FTP, Equation 26 and the parameters found in Table 11 were used for linear model estimates, while Equation 27 and Table 12 were used for the non-linear FTP estimates. Table 73 presents the estimates for number of service trips attracted per day. Only STA is shown because, as the reader may remember, there are no models for STP. To arrive at the estimates of FSA, the parameters in Table 14 and the FTE employment for the businesses were incorporated into the formula in Equation 29. To derive the non-linear estimates, the parameters in Table 15 and Equation 30 were used.

As shown in Tables 120 and 121, the estimates of total FTG range between 37.43 (24.49+12.94) (linear model) and 48.02 (27.79+20.23) (non-linear model) while the ones for total STA range between 5.34 (linear model) and 6.81 (non-linear model). These differences are expected on account of the variability in the data. Using the estimates from the non-linear model, which provides a more conservative analysis, one could estimate the number of parking spaces needed to make deliveries. To do so one needs to have an idea about the temporal distribution of deliveries and service activity, and the amount of time that the typical freight and service vehicles spend making a delivery/pick-up or performing a service activity.

Table 120: Freight Trip Generation Estimates for the Commercial Center in Troy, NY

Freight Trip Attraction (FTA)

ID	NAICS Description	Actual NAICS	Model Used		FTE	Deliveries Received/Day	
			NAICS	Geography		Linear Model	Non-linear Model
1	Retail Trade	44	44	CR	11.2	3.21	3.91
2		44	44	CR	3.15	2.37	2.44
3		44	44	CR	7	2.77	3.28
4		44	44	CR	4.15	2.48	2.70
5		44	44	CR	1.9	2.24	2.02
6		45	45	CR	4.25	1.11	2.29
7		45	45	CR	12.75	3.34	3.82
8		45	45	CR	4.8	1.26	2.42
9	Accommodation and Food Services	72	72	CR	21	1.14	1.64
10		72	72	CR	9.5	1.14	1.08
11		72	72	CR	4.8	1.14	0.76
12		72	72	CR	4.9	1.14	0.77
13		72	72	CR	3.8	1.14	0.67
	All FIS				**93.2**	**24.49**	**27.79**
	FTA (1 delivery = 1 vehicle trip):					**24.49**	**27.79**

Freight Trip Production (FTP)

ID	NAICS Description	Actual NAICS	Model Used		FTE	Shipments Out/Day	
			NAICS	Geography		Linear Model	Non-linear Model
1	Retail Trade	44	44	CR	11.2	4.68	5.79
2		44	44	CR	3.15	1.32	2.61
3		44	44	CR	7	2.93	4.31
4		44	44	CR	4.15	1.73	3.11
5		44	44	CR	1.9	0.79	1.90
6		45	44, 45	CR	4.25	1.84	3.09
7		45	44, 45	CR	12.75	5.51	6.33
8		45	44, 45	CR	4.8	2.07	3.34
9	Accommodation and Food Services	72	72	NYC + CR	21	2.39	3.86
10		72	72	NYC + CR	9.5	1.08	2.21
11		72	72	NYC + CR	4.8	0.55	1.36
12		72	72	NYC + CR	4.9	0.56	1.38
13		72	72	NYC + CR	3.8	0.43	1.16
	All FIS				**93.2**	**25.89**	**40.46**
	FTP (2 shipments = 1 vehicle trip):					**12.94**	**20.23**

Note: Six of the commercial establishments were in industry sectors (i.e., NAICS 51, 52, 53, 54, and 81) for which there were no FTG models. These establishments were not included in the calculations.

Table 121: Service Trip Attraction Estimates for a Commercial Center

ID	NAICS Description	Actual NAICS	Model Used		FTE	Service Trips/Day	
			NAICS	Geography		Linear Model	Non-linear Model
1	Retail Trade	44	44	CR	11.2	0.20	0.19
2		44	44	CR	3.15	0.06	0.05
3		44	44	CR	7	0.13	0.12
4		44	44	CR	4.15	0.07	0.07
5		44	44	CR	1.9	0.03	0.03
6		45	45	CR	4.25	0.07	0.37
7		45	45	CR	12.75	0.21	0.37
8		45	45	CR	4.8	0.08	0.37
9	Accommodation and Food Services	72	72	CR	21	1.14	1.72
10		72	72	CR	9.5	0.51	0.50
11		72	72	CR	4.8	0.26	0.18
12		72	72	CR	4.9	0.27	0.18
13		72	72	CR	3.8	0.21	0.12
14	Information	51	51	CR	1.45	0.02	0.03
15	Finance and Insurance	52	52	NYC+ CR	4.35	0.85	1.17
16	Real Estate Rental and Leasing	53	53	CR	4.9	0.08	0.08
17		53	53	CR	3.9	0.08	0.08
18	Professional, Scientific, and Technical Services	54	54	CR	1.9	0.50	0.56
19	Other Services (except Public Administration)	81	81	NY	5.6	0.57	0.60
	All Sectors				**115**	**5.34**	**6.81**
STA (1 service call = 1 vehicle trip):						**5.34**	**6.81**

Table 122 shows the computation of the number of parking spaces needed for FSA activity. The assumptions embedded in the calculations are that:

1) About 25% of the total freight trip generation takes place during the peak hour (typically 7AM-8AM), which is consistent with the data collected by Holguín-Veras et al. (2007).
2) The service trips are uniformly distributed during normal office hours, which leads to 12.5% being performed in any of the eight hours of the regular business day.
3) Delivery and service vehicles occupy the parking space for 0.5 hour 1.5 hours in respectively.

Under these assumptions, the number of parking spaces (or loading docks) needed to accommodate the freight and service activity at the commercial center is the traffic during the peak-hour traffic (in vehicles/hour) multiplied by the parking time (in hours), as shown in Table 41.

Table 122: Freight and Service Vehicle Parking Needs

Measure of freight and service activity	Daily total	Peak hour as % of total	Vehicles/hour (peak hour)	Parking time (hours)	Parking spaces
Freight trip generation	48.02	25.00%	12.01	0.50	6.00
Service trips	6.81	12.50%	0.85	1.50	1.28
Total	54.83		12.86		7.28

Table 122 shows that about 7 to 8 parking spaces are needed to satisfy the needs of FSA. It is worthy of notice that the parking needs of service trips are more than proportional to their traffic, simply because they tend to occupy parking spaces for longer periods of time. The table also hints at the potential benefits of freight demand management. If a staggered delivery program helps spread out the deliveries during the work hours, the peak hour traffic could come down. The smallest number of parking spaces would be achieved if the FSA vehicles arrive uniformly during the work hours, at a rate of 12.5% of the total traffic

every hour. In this case, the number parking spaces needed by freight vehicles would be only three, meaning that four to five parking spaces would satisfy the combined needs of FSA.

Application #2: FTG Trends at the County/Borough Level

This application was conducted by RPI in response to a request from the New York City Department of Transportation (NYCDOT). It illustrates the use of FTG models to analyze the evolution of freight activity over time, in this case at the borough level. To design mobility policies in NYC, NYCDOT needs to analyze the freight activities and their trends in the past few years. Freight activity statistics used to be available only at a broader, (sub) regional, level. To understand freight impacts at sub-area level—which is also mandated by the NYC Council and City Hall—such statistics must be disaggregated into the borough level. Such disaggregated freight activity statistics provide a foundation for more effective transportation strategy design, which is essential for NYC local task forces and working groups that involve multiple agencies, such as the Port Authority of New York & New Jersey (PANYNJ), New York State Department of Transportation (NYSDOT) and NYC Metropolitan Transportation Authority (MTA).

The RPI team assembled and processed employment and establishment data at the borough level, from 1998 through 2013. Employment data from the Census Bureau was first checked against the data provided by New York State Department of Labor to ensure data quality. Using the FTG models, the team then estimated the freight traffic and deliveries produced by each of the five boroughs in the NYC metropolitan area, as well as the area below Central Park (Midtown and Downtown), which is of great interest because of its extreme congestion and pollution concentrations. The trends of FTG over the last decade can be seen in Figure 6.

These estimates provided NYCDOT with great insight into the magnitude and pervasiveness of freight traffic in the city. First, it shows the differential effects produced by the fiscal crisis of 2009. As shown, the FTG in Manhattan experienced a significant drop. Staten Island, a primarily housing borough was also visible impacted. In contrast, Brooklyn, Queens, and the Bronx, maintained their previous trends. Moreover, the estimates put Manhattan—and particularly the areas below Central Park—in the spotlight as the largest FTG in the city. Up to this point, many believed that Brooklyn was the most important FTG in NYC. In fact, while Brooklyn is the home a great deal of manufacturing activity that relies on large trucks; the number of commercial establishments in Manhattan is more than double the one in Brooklyn. The small commercial establishments in Manhattan produce a significant amount of freight trips, typically using small trucks and delivery bans. In response to these insights, NYCDOT is considering a number of freight initiatives with special focus on the areas below Central Park. The interest generated by the results at the borough level prompted NYCDOT to ask RPI to conduct further analyses at the ZIP code level.

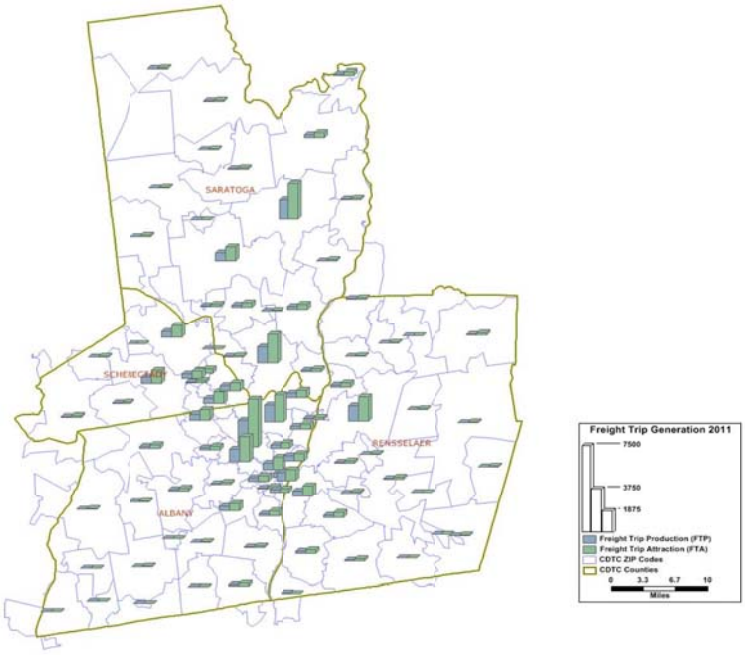
Figure 6: Freight Trip Generation by Borough

Application #3: FTG Analyses to Support Development of Freight Model

This application is an example of the use of FTG models to estimate ground-level estimates of freight activity, at the ZIP code level. These estimates are very important because, since they are obtained from

solid data about employment, they provide a robust way to anchor the estimates of regional freight demand models. This application was conducted in collaboration with a project funded by a grant from the SHRP2-C20 Program. As part of this effort, the Capital District Transportation Committee (CDTC)—the designated MPO of New York state's Capital Region—collaborated with RPI to use different data sources to produce a unified freight dataset that comprehensively describe freight activity in the CDTC region. This effort was intended to overcome a fundamental limitation of the freight data readily available, which is that they are too aggregate for MPO purposes. Hence, CDTC was lacking a solid picture of local freight activity and needs at a fine level of detail, which limited the CDTC's ability to take into account freight industry needs when making decisions about projects and policies. A key effort was to estimate freight activity at the ZIP code level, with the ultimate goal of producing estimates at the Transportation Analysis Zone (TAZ) level. The resulting estimates allow CDTC to make sure infrastructure investments have the highest benefit possible. To this effect, the RPI team applied the FTG models estimated to the ZIP Code Business Pattern Database. Figure 7 is an example of FTG patterns by ZIP code.

Figure 7: FTG at ZIP Code Level in CDTC Region



The FTG estimates were put together with other freight-related data to form a dynamic database that allows CDTC to better understand how, why, and where the freight industry moves through the region, to help facilitate the efficient and sustainable movement of goods, while maintaining quality of life. The FTG estimates produced enabled CDTC to identify the corridors that are essential to freight movement, as well as what barriers exist for greater efficiency of freight activity. These estimates are of vital importance for: (1) prioritizing infrastructure investments; (2) transportation system performance forecasting; (3) mitigating the impacts of truck traffic; (4) determining the impacts of freight activities on quality of life; and (5) improving the safety and security performance of the network.

Application #4: Freight Generation (FG) Analyses at the State/MPO Level

This application is an instance of the potential use of FG models to estimate, at the ZIP code level, the amount of freight that is being produced. As in the previous case, ground-level employment data are used to produce estimates of freight production that cannot be produced by alternative modeling methodologies. The need to conduct this application was prompted by the "Moving Ahead for Progress in the 21st Century Act" (MAP-21), promulgated into law in 2012.

MAP-21 required the designation of a national freight network to assist States in strategically allocating resources to improve freight efficiency. The goal of this freight network designation was to reduce freight transportation delay time, and improve reliability for each freight transportation mode through infrastructure improvement, technology development, regulations, enhancement of multimodal transportation capacity and connectivity, among other methods. The highway portion of this network was called the Primary Freight Network (PFN), which would be comprised of 29,966 miles of highways and key land ports of entry. The designation of the PFN was mainly based on the national freight volume, including origins, destinations, total freight tonnage and value by highways. Population distribution, network connectivity, truck traffic data, including the truck traffic volume and its percentage in the overall traffic, and the access to major ports of entry and main production areas are also key considerations. An inventory of current and forecasted national freight patterns was critical to the design of PFN.

To ensure that the PFN was correctly identified, the USDOT developed a draft PFN based on information provided by the Federal Highway Administration. On November 19, 2013, U.S. DOT published the draft, and issued the Request for Comments to collect feedback from stakeholders, including States, transport providers, and the network users. In response to this request for comments, the RPI team conducted a series of analyses on freight activities in New York State (NYS) to support NYSDOT and NYS Thruway Authority, and to suggest changes to the PFN. The team examined the NYS employment data and used it in combination with the FG models of Table 25 to estimate FG at the ZIP code level. The FG for major NYS interstate highways was then analyzed, based on each highway's catchment areas. The results are shown in Figures 8 and 9.

In interpreting the results it is important to note that these estimates—that correspond to local production of freight—do not include the amount of cargo at border crossings; and that the employment data, particularly in the metropolitan areas, could be affected by the "headquarter problem." The latter condition occurs when company headquarters, typically located in city centers, report the entire company employment, as it were located at the headquarters. This practice, when it happens, could artificially increase the employment numbers in city centers, and in doing so could exaggerate the freight production in urban areas.

Notwithstanding the potential effects of the "headquarter problem" the FP estimates in Figures 8 and 9 provide a compelling geographic map of FP at a ZIP code level, that cannot be obtained by other means. The data clearly show that I-90 and I-87 are the two most heavily used freight corridors, especially the segments close to metropolitan areas. These estimates were included in the memo to USDOT where the agencies argued for the inclusion of the entirety of I-87 and I-90 as part of the PFN. In 2015, "Fixing America's Surface Transportation Act" (FAST) repealed both the MAP-21 and PFN.

Figure 8: FG on the East-West Corridors

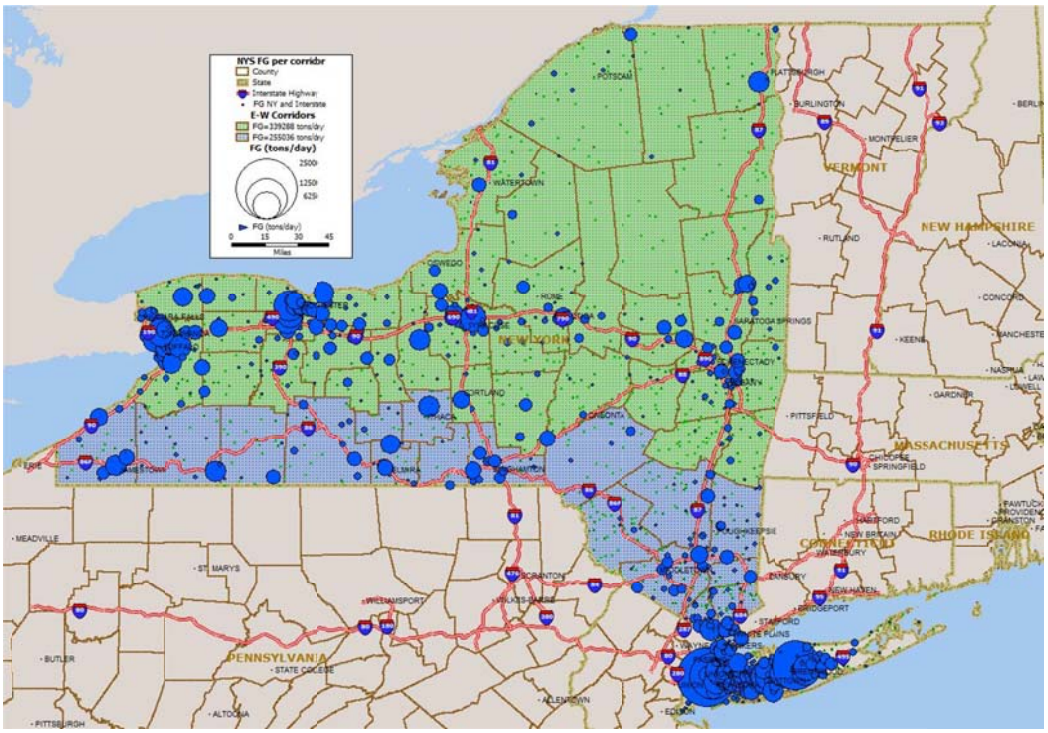
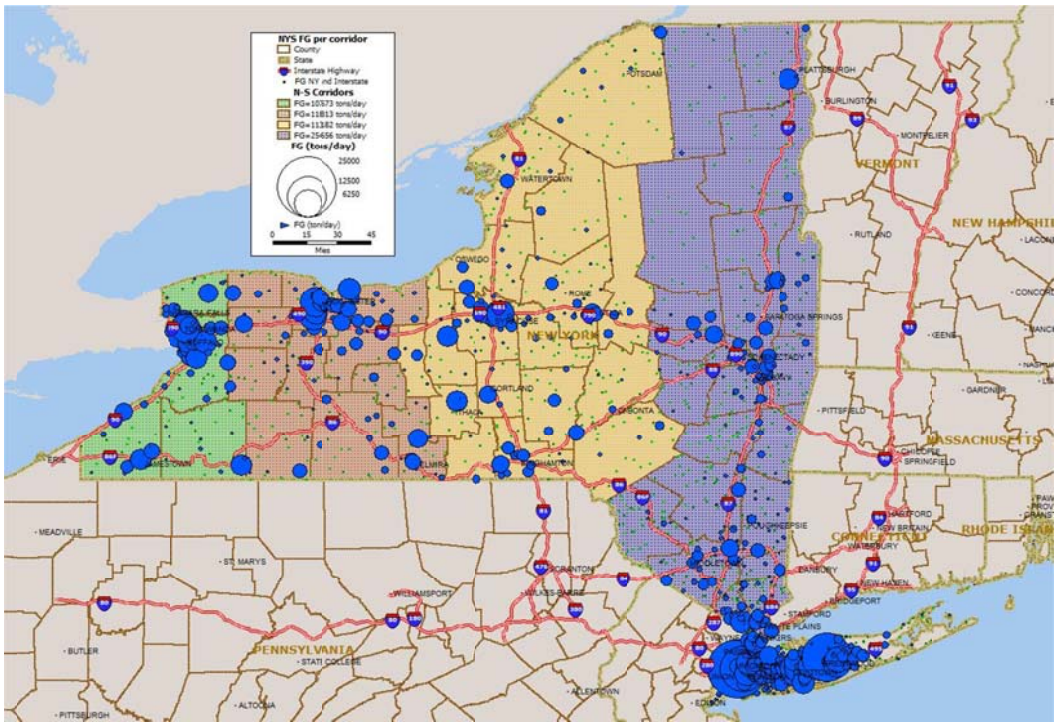


Figure 9: FG on the North-South Corridors



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Appendix A: Descriptive Statistics for the Sample Used to Estimate the RPI Models

FREIGHT TRIP ATTRACTION (FTA)

Table 123: Breakdown of Freight Trip Attraction Sample by Industry Type (2-Digit NAICS)

NAICS	Industry	NYC Sample		CR Sample		Whole Sample	
		Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
23	Construction	57	7.50%	9	8.04%	66	7.57%
31	Manufacturing	49	6.45%	5	4.46%	54	6.19%
32		50	6.58%	15	13.39%	65	7.45%
33		67	8.82%	16	14.29%	83	9.52%
42	Wholesale	198	26.05%	29	25.89%	227	26.03%
44	Retail	158	20.79%	22	19.64%	180	20.64%
45		74	9.74%	5	4.46%	79	9.06%
48	Modal Transportation & Support Activities	11	1.45%	3	2.68%	14	1.61%
49		1	0.13%	1	0.89%	2	0.23%
72	Accommodation and Food	95	12.50%	7	6.25%	102	11.70%
Total		**760**	**100%**	**112**	**100%**	**872**	**100%**

Table 124: Breakdown of Number of Trips Attracted per Day for the Sample

FTA (No. of Trips Attracted/Day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=2	378	49.7%	60	53.6%	438	50.2%
>2 - 5	236	31.1%	35	31.3%	271	31.1%
>5 - 10	78	10.3%	9	8.0%	87	10.0%
>10-20	44	5.8%	6	5.4%	50	5.7%
>20-40	15	2.0%	1	0.9%	16	1.8%
>40	9	1.2%	1	0.9%	10	1.1%
Total	**760**	**100%**	**112**	**100%**	**872**	**100%**

Table 125: Breakdown of Freight Trip Attraction per Day for Each Industry Sector

NAICS 23						
FTA (No. of Trips Attracted/Day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=2	34	59.6%	6	66.7%	40	60.6%
>2 - 5	15	26.3%	2	22.2%	17	25.8%
>5 - 10	5	8.8%	1	11.1%	6	9.1%
>10-20	2	3.5%	0	0.0%	2	3.0%
>20	1	1.8%	0	0.0%	1	1.5%
Total	**57**	**100%**	**9**	**100%**	**66**	**100%**

NAICS 31-33						
FTA (No. of Trips Attracted/Day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=2	89	53.6%	17	47.2%	106	52.5%
>2 - 5	49	29.5%	13	36.1%	62	30.7%
>5 - 10	11	6.6%	4	11.1%	15	7.4%
>10 - 20	12	7.2%	1	2.8%	13	6.4%
>20-40	3	1.8%	1	2.8%	4	2.0%
>40	2	1.2%	0	0.0%	2	1.0%
Total	**166**	**100%**	**36**	**100%**	**202**	**100%**

NAICS 42						
FTA (No. of Trips Attracted/Day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=2	88	44.4%	19	65.5%	107	47.1%
>2 - 5	66	33.3%	6	20.7%	72	31.7%
>5 - 10	25	12.6%	2	6.9%	27	11.9%
>10 - 20	12	6.1%	2	6.9%	14	6.2%
>20-40	3	1.5%	0	0.0%	3	1.3%
>40	4	2.0%	0	0.0%	4	1.8%
Total	**198**	**100%**	**29**	**100%**	**227**	**100%**

NAICS 44-45						
FTA (No. of Trips Attracted/Day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=2	113	48.7%	12	44.4%	125	48.3%
>2 - 5	77	33.2%	11	40.7%	88	34.0%
>5 - 10	21	9.1%	2	7.4%	23	8.9%
>10 - 20	13	5.6%	2	7.4%	15	5.8%
>20-40	6	2.6%	0	0.0%	6	2.3%
>40	2	0.9%	0	0.0%	2	0.8%
Total	**232**	**100%**	**27**	**100%**	**259**	**100%**

Table 125 (cont.): Breakdown of Freight Trip Attraction for Each Industry Sector

NAICS 48-49						
FTA (No. of Trips Attracted/Day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=2	5	41.7%	0	0%	5	31.3%
>2 - 5	4	33.3%	3	75%	7	43.8%
>5 - 10	0	0.0%	0	0%	0	0%
>10 - 20	1	8.3%	1	25%	2	12.5%
>20-40	1	8.3%	0	0%	1	6.3%
>40	1	8.3%	0	0%	1	6.3%
Total	**12**	**100%**	**4**	**100%**	**16**	**100%**

NAICS 72						
FTA (No. of Trips Attracted/Day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=2	49	51.6%	6	85.7%	55	53.9%
>2 - 5	25	26.3%	1	14.3%	26	25.5%
>5 - 10	16	16.8%	0	0.0%	16	15.7%
>10 - 20	4	4.2%	0	0.0%	4	3.9%
>20	1	1.1%	0	0.0%	1	1.0%
Total	95	100%	7	100%	102	100%

FREIGHT TRIP PRODUCTION (FTP)

Table 126: Breakdown of Freight Trip Production Sample by Industry Sectors (2-Digit NAICS)

NAICS	Industry	NYC Sample		CR Sample		Whole Sample	
		Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
23	Construction	17	8.54%	3	4.35%	20	7.46%
31	Manufacturing	15	7.54%	3	4.35%	18	6.72%
32		24	12.06%	12	17.39%	36	13.43%
33		30	15.08%	12	17.39%	42	15.67%
42	Wholesale	44	22.11%	24	34.78%	68	25.37%
44	Retail	32	16.08%	10	14.49%	42	15.67%
45		19	9.55%	2	2.90%	21	7.84%
48	Modal Transportation & Support Activities	6	3.02%	2	2.90%	8	2.99%
49		1	0.50%	0	0.00%	1	0.37%
72	Accommodation and Food	11	5.53%	1	1.45%	12	4.48%
Total		**199**	**100%**	**69**	**100%**	**268**	**100%**

Table 127: Breakdown of Number of Trips Produced per Day for the Sample

FTP (No. of Trips Produced/Day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=2	100	50.3%	23	33.3%	123	45.9%
>2 - 5	39	19.6%	18	26.1%	57	21.3%
>5 - 10	24	12.1%	11	15.9%	35	13.1%
>10 - 20	18	9.0%	15	21.7%	33	12.3%
>20 - 30	13	6.5%	2	2.9%	15	5.6%
>30	5	2.5%	0	0.0%	5	1.9%
Total	199	100%	69	100%	268	100%

Table 128: Breakdown of Freight Trip Production per Day for Each Industry Sector

NAICS 23						
FTP (No. of Trips Produced/Day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=2	9	52.9%	2	66.7%	11	55.0%
>2 - 5	5	29.4%	0	0.0%	5	25.0%
>5 - 10	2	11.8%	1	33.3%	3	15.0%
>10	1	5.9%	0	0.0%	1	5.0%
Total	**17**	**100%**	**3**	**100%**	**20**	**100%**

NAICS 31-33						
FTP (No. of Trips Produced/Day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=2	30	43.5%	8	29.6%	38	39.6%
>2 - 5	12	17.4%	9	33.3%	21	21.9%
>5 - 10	10	14.5%	4	14.8%	14	14.6%
>10 - 20	7	10.1%	5	18.5%	12	12.5%
>20 - 30	5	7.2%	1	3.7%	6	6.3%
>30	5	7.2%	0	0.0%	5	5.2%
Total	**69**	**100%**	**27**	**100%**	**96**	**100%**

NAICS 42						
FTP (No. of Trips Produced/Day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=2	20	45.5%	8	33.3%	28	41.2%
>2 - 5	10	22.7%	6	25.0%	16	23.5%
>5 - 10	6	13.6%	3	12.5%	9	13.2%
>10 - 20	6	13.6%	6	25.0%	12	17.6%
>20	2	4.5%	1	4.2%	3	4.4%
Total	**44**	**100%**	**24**	**100%**	**68**	**100%**

NAICS 44-45						
FTP (No. of Trips Produced/Day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=2	32	62.7%	4	33.3%	36	57.1%
>2 - 5	9	17.6%	3	25.0%	12	19.0%
>5 - 10	2	3.9%	2	16.7%	4	6.3%
>10 - 20	3	5.9%	3	25.0%	6	9.5%
>20	5	9.8%	0	0.0%	5	7.9%
Total	**51**	**100%**	**12**	**100%**	**63**	**100%**

NAICS 48-49						
FTP (No. of Trips Produced/Day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=2	3	42.9%	0	0%	3	33.3%
>2 - 5	2	28.6%	0	0%	2	22.2%
>5 - 10	1	14.3%	1	50%	2	22.2%
>10 - 20	0	0.0%	1	50%	1	11.1%
>20	1	14.3%	0	0%	1	11.1%
Total	**7**	**100%**	**2**	**100%**	**9**	**100%**

Table 128 (cont.): Breakdown of Freight Trip Production per Day for Each Industry Sector

NAICS 72						
FTP (No. of Trips Produced/Day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=2	6	54.5%	1	100.0%	7	58.3%
>2 - 5	1	9.1%	0	0.0%	1	8.3%
>5 - 10	3	27.3%	0	0.0%	3	25.0%
>10	1	9.1%	0	0.0%	1	8.3%
Total	11	100%	1	100%	12	100%

SERVICE TRIP ATTRACTION (STA)

Table 129: Breakdown of Service Trip Attraction for the Sample

No. of Service Trips Attracted/Day	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=1	155	90.6%	96	90.6%	251	90.6%
>1 - 2	9	5.3%	4	3.8%	13	4.7%
>2 - 3	6	3.5%	3	2.8%	9	3.2%
>3 - 4	0	0.0%	3	2.8%	3	1.1%
>5 - 6	1	0.6%	0	0.0%	1	0.4%
Total	**171**	**100%**	**106**	**100%**	**277**	**100%**

Table 130: Breakdown of Service Trip Attraction Sample by Industry Sectors (2-Digit NAICS)

NAICS	Industry	NYC Sample		CR Sample		Whole Sample	
		Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
23	Construction	6	3.51%	3	2.83%	9	3.25%
31	Manufacturing	3	1.75%	3	2.83%	6	2.17%
32		15	8.77%	8	7.55%	23	8.30%
33		11	6.43%	7	6.60%	18	6.50%
42	Wholesale	13	7.60%	18	16.98%	31	11.19%
44	Retail	10	5.85%	8	7.55%	18	6.50%
45		3	1.75%	3	2.83%	6	2.17%
48	Modal Transportation & Support Activities	8	4.68%	1	0.94%	9	3.25%
51	Information	13	7.60%	7	6.60%	20	7.22%
52	Finance and Insurance	11	6.43%	2	1.89%	13	4.69%
53	Real Estate	8	4.68%	4	3.77%	12	4.33%
54	Professional and Technical Services	7	4.09%	16	15.09%	23	8.30%
56	Educational Services	11	6.43%	11	10.38%	22	7.94%
61	Education Services	11	6.43%	4	3.77%	15	5.42%
62	Health Care and Social Assistance	9	5.26%	5	4.72%	14	5.05%
71	Entertainment	12	7.02%	2	1.89%	14	5.05%
72	Accommodation and Food	13	7.60%	4	3.77%	17	6.14%
81	Other Services (except Public Admin)	7	4.09%	0	0.00%	7	2.53%
Total		**171**	**100%**	**106**	**100%**	**277**	**100%**

Table 131: Breakdown of Service Trip Attraction per Day for Each Industry Sector

NAICS 23						
No. of Service Trips Attracted/Day	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=1	6	100%	3	100%	9	100%

NAICS 31-33						
No. of Service Trips Attracted/Day	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=1	29	100%	18	100%	47	100%

NAICS 42						
No. of Service Trips Attracted/Day	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=1	13	100%	15	83.3%	28	90.3%
>1 - 2	0	0%	3	16.7%	3	9.7%
Total	**13**	**100%**	**18**	**100%**	**31**	**100%**

NAICS 44-45						
No. of Service Trips Attracted/Day	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=1	13	100%	10	90.9%	23	95.8%
>3 - 4	0	0%	1	9.1%	1	4.2%
Total	**13**	**100%**	**11**	**100%**	**24**	**100%**

NAICS 48						
No. of Service Trips Attracted/Day	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=1	8	100.0%	1	100.0%	9	100.0%

NAICS 51						
No. of Service Trips Attracted/Day	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=1	10	76.9%	7	100%	17	85%
>1 - 2	2	15.4%	0	0%	2	10%
>2 - 3	1	7.7%	0	0%	1	5%
Total	**13**	**100%**	**7**	**100%**	**20**	**100%**

NAICS 52						
No. of Service Trips Attracted/Day	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=1	9	81.8%	1	50%	10	76.9%
>1 - 2	2	18.2%	0	0%	2	15.4%
>3 - 4	0	0%	1	50%	1	7.7%
Total	**11**	**100%**	**2**	**100%**	**13**	**100%**

NAICS 53						
No. of Service Trips Attracted/Day	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=1	7	87.5%	4	100.0%	11	91.7%
>2 - 3	1	12.5%	0	0%	1	8.3%
Total	**8**	**100%**	**4**	**100%**	**12**	**100%**

Table 131 (cont.): Breakdown of Service Trip Attraction per Day for Each Industry Sector

NAICS 54						
No. of Service Trips Attracted/Day	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=1	6	85.7%	14	87.5%	20	87.0%
>1 - 2	0	0%	1	6.3%	1	4.3%
>2 - 3	1	14.3%	1	6.3%	2	8.7%
Total	**7**	**100%**	**16**	**100%**	**23**	**100%**

NAICS 56						
No. of Service Trips Attracted/Day	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=1	10	90.9%	11	100%	21	95.5%
>1 - 2	1	9.1%	0	0%	1	4.5%
Total	**11**	**100%**	**11**	**100%**	**22**	**100%**

NAICS 61						
No. of Service Trips Attracted/Day	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=1	11	100%	3	75%	14	93.3%
>2 - 3	0	0%	1	25%	1	6.7%
Total	**11**	**100%**	**4**	**100%**	**15**	**100%**

NAICS 62						
No. of Service Trips Attracted/Day	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=1	7	77.8%	4	80%	11	78.6%
>2 - 3	1	11.1%	0	0%	1	7.1%
>3 - 4	0	0%	1	20%	1	7.1%
>5 - 6	1	11.1%	0	0%	1	7.1%
Total	**9**	**100%**	**5**	**100%**	**14**	**100%**

NAICS 71						
No. of Service Trips Attracted/Day	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=1	8	66.7%	2	100%	10	71.4%
>1 - 2	2	16.7%	0	0%	2	14.3%
>2 - 3	2	16.7%	0	0%	2	14.3%
Total	**12**	**100%**	**2**	**100%**	**14**	**100%**

NAICS 72						
No. of Service Trips Attracted/Day	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=1	11	84.6%	3	75%	14	82.4%
>1 - 2	2	15.4%	0	0%	2	11.8%
>2 - 3	0	0.0%	1	25%	1	5.9%
Total	**13**	**100%**	**4**	**100%**	**17**	**100%**

NAICS 81						
No. of Service Trips Attracted/Day	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=1	7	100%	0	-	7	100%

FREIGHT ATTRACTION (FA)

Table 132: Breakdown of Freight Attraction for the Sample

Freight Attraction (in lbs./day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=20	25	15.2%	13	13%	38	14.3%
>20-100	28	17%	15	15%	43	16.2%
>100-500	30	18.2%	20	20%	50	18.9%
>500-1,000	17	10.3%	13	13%	30	11.3%
>1,000-2,000	11	6.7%	7	7%	18	6.8%
>2,000-5,000	15	9.1%	8	8%	23	8.7%
>5,000-10,000	8	4.8%	10	10%	18	6.8%
>10,000-25,000	12	7.3%	4	4%	16	6%
>25,000-50,000	9	5.5%	3	3%	12	4.5%
>50,000-150,000	7	4.2%	3	3%	10	3.8%
>150,000	3	1.8%	4	4%	7	2.6%
Total	165	100%	100	100%	265	100%

Table 133: Breakdown of Freight Attraction Sample by Industry Sectors (2-Digit NAICS)

NAICS	Industry	NYC Sample		CR Sample		Whole Sample	
		Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
23	Construction	16	9.7%	8	8%	24	9.1%
31	Manufacturing	7	4.2%	4	4%	11	4.2%
32		22	13.3%	12	12%	34	12.8%
33		22	13.3%	14	14%	36	13.6%
42	Wholesale Trade	21	12.7%	27	27%	48	18.1%
44	Retail	18	10.9%	20	20%	38	14.3%
45		6	3.6%	5	5%	11	4.2%
48	Transportation and Warehousing	12	7.3%	3	3%	15	5.7%
49		0	0%	1	1%	1	0.4%
71	Arts, Entertainment, and Recreation	17	10.3%	2	2%	19	7.2%
72	Accommodation and Food Services	24	14.5%	4	4%	28	10.6%
Total		**165**	**100%**	**100**	**100%**	**265**	**100%**

Table 134: Breakdown of Freight Attraction per Day for Each Industry Sector

NAICS 23						
Freight Attraction (in lbs./day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=200	7	43.8%	3	37.5%	10	41.7%
>200-500	2	12.5%	0	0%	2	8.3%
>500-1,000	2	12.5%	3	37.5%	5	20.8%
>1,000	5	31.3%	2	25%	7	29.2%
Total	**16**	**100%**	**8**	**100%**	**24**	**100%**

NAICS 31-33						
Freight Attraction (in Pounds)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=100	16	31.4%	10	33.3%	26	32.1%
>100-500	6	11.8%	6	20.0%	12	14.8%
>500-1,000	2	3.9%	3	10.0%	5	6.2%
>1,000-5,000	8	15.7%	4	13.3%	12	14.8%
>5,000-10,000	4	7.8%	3	10.0%	7	8.6%
>10,000	15	29.4%	4	13.3%	19	23.5%
Total	**51**	**100%**	**30**	**100%**	**81**	**100%**

NAICS 42						
Freight Attraction (in lbs./day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=100	4	19%	8	29.63%	12	25%
>100-500	2	9.5%	3	11.11%	5	10.4%
>500-1,000	3	14.3%	4	14.81%	7	14.6%
>1,000-5,000	4	19%	5	18.52%	9	18.8%
>5,000-20,000	0	0%	3	11.11%	3	6.3%
>20,000-100,000	5	23.8%	0	0%	5	10.4%
>100,000	3	14.3%	4	14.81%	7	14.6%
Total	**21**	**100%**	**27**	**100%**	**48**	**100%**

NAICS 44-45						
Freight Attraction (in Pounds)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=100	9	37.5%	5	20%	14	28.6%
>100-500	3	12.5%	8	32%	11	22.4%
>500-1,000	2	8.3%	2	8%	4	8.2%
>1,000-5,000	5	20.8%	3	12%	8	16.3%
>5,000-10,000	3	12.5%	3	12%	6	12.2%
>10,000	2	8.3%	4	16%	6	12.2%
Total	**24**	**100%**	**25**	**100%**	**49**	**100%**

NAICS 48-49						
Freight Attraction (in Pounds)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=100	4	33.3%	1	25%	5	31.3%
>100-1,000	3	25%	0	0%	3	18.8%
>1,000-10,000	2	16.7%	1	25%	3	18.8%
>10,000	3	25%	2	50%	5	31.3%
Total	**12**	**100%**	**4**	**100%**	**16**	**100%**

Table 134 (cont.): Breakdown of Freight Attraction per Day for Each Industry Sector

NAICS 71						
Freight Attraction (in lbs./day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=20	4	23.5%	1	50%	5	26.3%
>20-40	3	17.6%	1	50%	4	21.1%
>40-100	4	23.5%	0	0%	4	21.1%
>100	6	35.3%	0	0%	6	31.6%
Total	**17**	**100%**	**2**	**100%**	**19**	**100%**

NAICS 72						
Freight Attraction (in lbs./day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=100	4	16.7%	1	25%	5	17.9%
>100-250	4	16.7%	1	25%	5	17.9%
>250-500	5	20.8%	0	0%	5	17.9%
>500-1,000	5	20.8%	1	25%	6	21.4%
>1,000	6	25%	1	25%	7	25%
Total	**24**	**100%**	**4**	**100%**	**28**	**100%**

FREIGHT PRODUCTION (FP)

Table 135: Breakdown of Freight Production for the Sample

Freight Production (in lbs./day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=20	30	28.3%	9	11.5%	39	21.2%
>20-100	13	12.3%	15	19.2%	28	15.2%
>100-500	15	14.2%	16	20.5%	31	16.8%
>500-1,000	3	2.8%	6	7.7%	9	4.9%
>1,000-2,000	4	3.8%	7	9.0%	11	6.0%
>2,000-5,000	10	9.4%	6	7.7%	16	8.7%
>5,000-10,000	7	6.6%	5	6.4%	12	6.5%
>10,000-25,000	8	7.5%	6	7.7%	14	7.6%
>25,000-50,000	8	7.5%	2	2.6%	10	5.4%
>50,000-150,000	5	4.7%	2	2.6%	7	3.8%
>150,000	3	2.8%	4	5.1%	7	3.8%
Total	**106**	**100%**	**78**	**100%**	**184**	**100%**

Table 136: Breakdown of Freight Production Sample by Industry Sectors (2-Digit NAICS)

NAICS	Industry	NYC Sample		CR Sample		Whole Sample	
		Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
23	Construction	9	8.5%	3	3.8%	12	6.5%
31	Manufacturing	6	5.7%	3	3.8%	9	4.9%
32		19	17.9%	14	17.9%	33	17.9%
33		18	17%	12	15.4%	30	16.3%
42	Wholesale Trade	18	17%	25	32.1%	43	23.4%
44	Retail	9	8.5%	13	16.7%	22	12%
45		2	1.9%	3	3.8%	5	2.7%
48	Transportation and Warehousing	9	8.5%	2	2.6%	11	6%
49		0	0%	1	1.3%	1	0.5%
71	Arts, Entertainment, and Recreation	8	7.5%	1	1.3%	9	4.9%
72	Accommodation and Food Services	8	7.5%	1	1.3%	9	4.9%
Total		**106**	**100%**	**78**	**100%**	**184**	**100%**

Table 137: Breakdown of Freight Production per Day for Each Industry Sector

NAICS 23						
Freight Production (in lbs./day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=100	7	77.8%	1	33.3%	8	66.7%
>100-250	1	11.1%	0	0%	1	8.3%
>250-500	1	11.1%	2	66.7%	3	25%
Total	**9**	**100%**	**3**	**100%**	**12**	**100%**

NAICS 31-33						
Freight Production (in Pounds)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=100	10	23.3%	9	31%	19	26.4%
>100-500	5	11.6%	7	24.1%	12	16.7%
>500-1,500	3	7%	3	10.3%	6	8.3%
>1,500-5,000	7	16.3%	3	10.3%	10	13.9%
>5,000-15,000	7	16.3%	2	6.9%	9	12.5%
>15,000	11	25.6%	5	17.2%	16	22.2%
Total	**43**	**100%**	**29**	**100%**	**72**	**100%**

NAICS 42						
Freight Production (in lbs./day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=100	2	11.1%	6	24%	8	18.6%
>100-500	4	22.2%	3	12%	7	16.3%
>500-1,000	1	5.6%	3	12%	4	9.3%
>1,000-10,000	5	27.8%	8	32%	13	30.2%
>10,000-100,000	5	27.8%	5	20%	10	23.3%
>100,000	1	5.6%	0	0%	1	2.3%
Total	**18**	**100%**	**25**	**100%**	**43**	**100%**

NAICS 44-45						
Freight Production (in Pounds)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=100	6	54.5%	6	37.5%	12	44.4%
>100-500	2	18.2%	4	25%	6	22.2%
>500-5,000	0	0%	2	12.5%	2	7.4%
>5,000-10,000	2	18.2%	2	12.5%	4	14.8%
>10,000	1	9.1%	2	12.5%	3	11.1%
Total	**11**	**100%**	**16**	**100%**	**27**	**100%**

NAICS 48-49						
Freight Production (in Pounds)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=100	4	44%	0	0%	4	33.3%
>100-1,000	1	11.1%	0	0%	1	8.3%
>1,000-10,000	1	11.1%	1	33%	2	16.7%
>10,000	3	33.3%	2	67%	5	41.7%
Total	**9**	**100%**	**3**	**100%**	**12**	**100%**

Table 137 (cont.): Breakdown of Freight Production per Day for Each Industry Sector

NAICS 71						
Freight Production (in lbs./day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
3	0	-	1	100%	1	100%

NAICS 72						
Freight Production (in lbs./day)	NYC Sample		CR Sample		Whole Sample	
	Obs.	Sample %	Obs.	Sample %	Obs.	Sample %
<=100	7	87.5%	1	100%	8	88.9%
>100	1	12.5%	0	0%	1	11.1%
Total	**8**	**100%**	**1**	**100%**	**9**	**100%**

Appendix B: Final Models Including Statistics

FREIGHT TRIP ATTRACTION (FTA)

Table 138: Freight Trip Attraction (FTA) Linear Models

NYC and CR - FTA [deliveries/day]											
NAICS	Description	α	t-stat	β	t-stat	R^2	F-stat	Obs.	Employment		
									Min.	Mean	Max.
23	Construction	2.132	2.57	0.059	2.83	0.11	8.03	66	3	28	201
31-33	**Manufacturing**	**1.427**	**2.57**	**0.087**	**10.62**	**0.36**	**112.80**	**202**	**1**	**41**	**350**
31	Food, Beverage, Tobacco, Textile, Apparel	1.825	6.06	0.032	6.26	0.43	39.19	54	2	39	200
32	Wood, paper, chemical, plastics, nonmetals	-	-	0.153	12.08	0.70	145.98	65	2	38	300
33	Metal, machinery, electronic, furniture & misc.	2.276	2.31	0.075	5.88	0.30	34.60	83	1	44	350
42	Wholesale Trade	3.669	4.55	0.081	3.20	0.04	10.27	227	1	20	200
44-45	**Retail Trade**	**2.756**	**5.33**	**0.118**	**6.62**	**0.15**	**43.78**	**259**	**1**	**17**	**173**
44	Motor vehicle, furniture, electronics, clothing	2.793	4.19	0.143	6.49	0.19	42.12	180	1	18	173
45	Sporting goods, hobby, book, & music stores	3.375	5.81	-	-	-	-	79	1	15	98
48	Modal Transportation & Support Activities	10.157	2.49	-	-	-	-	14	3	36	151
72	Accommodation and Food	1.918	4.23	0.070	6.06	0.27	36.74	102	3	27	180
All	**All Freight Intensive Sectors (FIS)**	**3.061**	**9.53**	**0.079**	**9.77**	**0.10**	**95.45**	**872**	**1**	**26**	**350**

Table 138 (cont.): Freight Trip Attraction (FTA) Linear Models

NYC - FTA [deliveries/day]											
NAICS	Description	α	t-stat	β	t-stat	R^2	F-stat	Obs.	Employment		
									Min.	Mean	Max.
23	Construction	2.168	2.29	0.059	2.64	0.11	6.96	57	3	30	201
31-33	**Manufacturing**	**1.144**	**1.81**	**0.096**	**10.39**	**0.40**	**107.87**	**166**	**1**	**41**	**350**
31	Food, Beverage, Tobacco, Textile, Apparel	1.705	5.31	0.035	6.23	0.45	38.82	49	2	37	200
32	Wood, paper, chemical, plastics, nonmetals	-	-	0.157	11.07	0.71	122.55	50	2	42	300
33	Metal, machinery, electronic, furniture & misc.	2.056	1.84	0.082	5.57	0.32	30.99	67	1	43	350
42	Wholesale Trade	3.910	4.27	0.079	2.91	0.04	8.46	198	1	21	200
44-45	**Retail Trade**	**2.871**	**5.06**	**0.117**	**6.21**	**0.14**	**38.57**	**232**	**1**	**17**	**173**
44	Motor vehicle, furniture, electronics, clothing	2.970	4.00	0.144	6.07	0.19	36.90	158	1	19	173
45	Sporting goods, hobby, book, & music stores	3.400	5.51	-	-	-	-	74	1	15	98
48	Modal Transportation & Support Activities	11.291	2.19	-	-	-	-	11	3	39	151
72	Accommodation and Food	2.081	4.32	0.069	5.76	0.26	33.20	95	3	28	180
All	**All Freight Intensive Sectors (FIS)**	**3.072**	**9.01**	**0.078**	**9.25**	**0.10**	**85.48**	**760**	**1**	**26**	**350**

CR - FTA [deliveries/day]											
NAICS	Description	α	t-stat	β	t-stat	R^2	F-stat	Obs.	Employment		
									Min.	Mean	Max.
23	Construction	2.789	2.86	-	-	-	-	9	4	16	40
31-33	**Manufacturing**	**2.674**	**2.68**	**0.043**	**2.85**	**0.19**	**8.14**	**36**	**3**	**38**	**300**
31	Food, Beverage, Tobacco, Textile, Apparel	3.400	5.01	-	-	-	-	5	6	51	175
32	Wood, paper, chemical, plastics, nonmetals	3.315	4.05	-	-	-	-	15	3	22	70
33	Metal, machinery, electronic, furniture & misc.	-	-	0.070	3.36	0.43	11.29	16	5	48	300
42	Wholesale Trade	3.282	4.12	-	-	-	-	29	2	12	53
44-45	**Retail Trade**	**1.905**	**2.06**	**0.113**	**2.30**	**0.17**	**5.29**	**27**	**1**	**14**	**50**
44	Motor vehicle, furniture, electronics, clothing	2.042	1.79	0.105	1.83	0.14	3.36	22	1	15	50
45	Sporting goods, hobby, book, & music stores	-	-	0.262	6.67	0.92	44.51	5	3	10	26
72	Accommodation and Food	1.141	3.00	-	-	-	-	7	4	15	51
All	**All Freight Intensive Sectors (FIS)**	**2.932**	**3.03**	**0.093**	**3.19**	**0.08**	**10.20**	**112**	**1**	**26**	**350**

Table 139: Freight Trip Attraction (FTA) Non-Linear Models

NYC and CR - Ln (FTA) [deliveries/day]														
NAICS	Description	α	t-stat	β	t-stat	S^2	Mean Ln FTA	Mean Ln E	R^2	F-stat	Obs.	Employment		
												Min.	Mean	Max.
23	Construction	-	-	0.275	7.31	0.896	0.825	2.981	0.45	53.49	66	3	28	201
31-33	**Manufacturing**	**-0.521**	**-3.25**	**0.499**	**9.91**	**0.736**	**0.949**	**2.970**	**0.33**	**98.19**	**202**	**1**	**41**	**350**
31	Food, Beverage, Tobacco, Textile, Apparel	-	-	0.298	12.41	0.312	0.886	2.998	0.74	154.13	54	2	39	200
32	Wood, paper, chemical, plastics, nonmetals	-0.815	-2.47	0.603	5.62	0.312	0.903	2.887	0.33	31.55	65	2	38	300
33	Metal, machinery, electronic, furniture & misc.	-0.602	-2.42	0.540	7.09	0.767	1.027	3.017	0.38	50.28	83	1	44	350
42	Wholesale Trade	-0.378	-1.99	0.539	7.71	1.021	0.990	2.533	0.21	59.44	227	1	20	200
44-45	**Retail Trade**	**-**	**-**	**0.427**	**17.81**	**0.915**	**0.947**	**2.249**	**0.55**	**317.27**	**259**	**1**	**17**	**173**
44	Motor vehicle, furniture, electronics, clothing	-	-	0.465	16.82	0.904	1.073	2.354	0.61	283.01	180	1	18	173
45	Sporting goods, hobby, book, & music stores	-	-	0.316	6.92	0.865	0.659	2.011	0.38	47.84	79	1	15	98
48	Modal Transportation & Support Activities	-	-	0.470	4.21	1.803	1.480	3.040	0.58	17.70	14	3	36	151
72	Accommodation and Food	-0.471	-1.74	0.477	5.17	0.772	0.858	2.810	0.21	26.77	102	3	27	180
All	**All Freight Intensive Sectors (FIS)**	**-0.150**	**-1.73**	**0.428**	**13.78**	**0.957**	**0.950**	**2.624**	**0.18**	**189.91**	**872**	**1**	**26**	**350**

NYC - Ln (FTA) [deliveries/day]														
NAICS	Description	α	t-stat	β	t-stat	S^2	Mean Ln FTA	Mean Ln E	R^2	F-stat	Obs.	Employment		
												Min.	Mean	Max.
23	Construction	-	-	0.280	7.02	0.908	0.855	3.046	0.47	49.31	57	3	30	201
31-33	**Manufacturing**	**-0.500**	**-2.93**	**0.495**	**9.24**	**0.722**	**0.953**	**2.960**	**0.34**	**85.42**	**166**	**1**	**41**	**350**
31	Food, Beverage, Tobacco, Textile, Apparel	-	-	0.292	11.07	0.335	0.860	2.974	0.72	122.51	49	2	37	200
32	Wood, paper, chemical, plastics, nonmetals	-0.805	-2.14	0.606	5.07	1.080	0.954	2.952	0.35	25.66	50	2	42	300
33	Metal, machinery, electronic, furniture & misc.	-0.574	-2.26	0.540	6.85	0.704	1.020	2.954	0.42	46.98	67	1	43	350
42	Wholesale Trade	-0.360	-1.72	0.538	7.09	1.054	1.035	2.588	0.20	50.33	198	1	21	200
44-45	**Retail Trade**	**-**	**-**	**0.431**	**16.94**	**0.930**	**0.964**	**2.248**	**0.55**	**286.88**	**232**	**1**	**17**	**173**
44	Motor vehicle, furniture, electronics, clothing	-	-	0.477	16.29	0.898	1.112	2.361	0.63	265.47	158	1	19	173
45	Sporting goods, hobby, book, & music stores	-	-	0.307	6.40	0.899	0.645	2.008	0.36	40.92	74	1	15	98
48	Modal Transportation & Support Activities	-	-	0.448	3.22	2.297	1.458	3.094	0.51	10.35	11	3	39	151
72	Accommodation and Food	-	-	0.342	11.51	0.742	0.935	2.847	0.59	132.49	95	3	28	180
All	**All Freight Intensive Sectors (FIS)**	**-**	**-**	**0.380**	**30.18**	**0.949**	**0.974**	**2.638**	**0.55**	**910.88**	**760**	**1**	**26**	**350**

Table 139 (cont.): Freight Trip Attraction (FTA) Non-Linear Models

CR - Ln (FTA) [deliveries/day]														
NAICS	Description	α	t-stat	β	t-stat	S^2	Mean Ln FTA	Mean Ln E	R^2	F-stat	Obs.	Employment		
												Min.	Mean	Max.
23	Construction	-	-	0.230	1.91	0.909	0.630	2.568	0.31	3.64	9	4	16	40
31-33	**Manufacturing**	**-**	**-**	**0.332**	**6.82**	**0.869**	**0.932**	**3.018**	**0.57**	**46.49**	**36**	**3**	**38**	**300**
31	Food, Beverage, Tobacco, Textile, Apparel	-	-	0.346	10.53	0.064	1.141	3.241	0.97	110.78	5	6	51	175
32	Wood, paper, chemical, plastics, nonmetals	-	-	0.304	3.44	0.921	0.732	2.665	0.46	11.87	15	3	22	70
33	Metal, machinery, electronic, furniture & misc.	-	-	0.345	4.44	1.141	1.054	3.278	0.57	19.72	16	5	48	300
42	Wholesale Trade	-	-	0.338	4.66	0.825	0.683	2.166	0.44	21.68	29	2	12	53
44-45	**Retail Trade**	**-**	**-**	**0.386**	**5.43**	**0.803**	**0.804**	**2.258**	**0.53**	**29.50**	**27**	**1**	**14**	**50**
44	Motor vehicle, furniture, electronics, clothing	-	-	0.372	4.49	0.928	0.792	2.305	0.49	20.20	22	1	15	50
45	Sporting goods, hobby, book, & music stores	-	-	0.467	4.12	0.302	0.855	2.052	0.81	16.96	5	3	10	26
72	Accommodation and Food	-1.398	-1.71	0.521	1.58	0.608	-0.195	2.308	0.33	2.50	7	4	15	51
All	**All Freight Intensive Sectors (FIS)**	**-0.776**	**-2.92**	**0.639**	**6.40**	**0.975**	**0.785**	**2.532**	**0.27**	**40.91**	**112**	**1**	**22**	**300**

FREIGHT TRIP PRODUCTION (FTP)

Table 140: Freight Trip Production (FTP) Linear Models

NYC and CR - FTP [shipments/day]											
NAICS	Description	α	t-stat	β	t-stat	R^2	F-stat	Obs.	Employment		
									Min	Mean	Max
23	Construction	-	-	0.092	8.07	0.77	65.17	20	6	39	201
31-33	**Manufacturing**	5.321	4.34	0.063	4.34	0.17	18.80	96	1	51	350
31	Food, Beverage, Tobacco, Textile, Apparel	-	-	0.117	4.37	0.53	19.08	18	2	43	150
32	Wood, paper, chemical, plastics, nonmetals	5.511	2.58	0.135	4.97	0.42	24.71	36	2	45	300
33	Metal, machinery, electronic, furniture & misc.	5.769	3.93	0.021	1.42	0.05	2.03	42	1	59	350
42	Wholesale Trade	6.455	8.18	-	-	-	-	68	2	22	200
44-45	**Retail Trade**	2.314	2.18	0.242	5.53	0.33	30.55	63	1	15	94
44	Motor vehicle, furniture, electronics, clothing	-	-	0.321	7.55	0.58	56.94	42	1	15	77
45	Sporting goods, hobby, book, & music stores	3.956	2.05	0.179	2.39	0.23	5.71	21	2	15	94
48	Modal Transportation & Support Activities	8.500	3.14	-	-	-	-	8	9	53	151
72	Accommodation and Food	-	-	0.114	5.89	0.76	34.68	12	5	35	159
All	**All Freight Intensive Sectors (FIS)**	**3.800**	**6.86**	**0.085**	**6.12**	**0.18**	**37.51**	**268**	**1**	**33**	**350**

Table 140 (cont.): Freight Trip Production (FTP) Linear Models

NYC - FTP [shipments/day]											
NAICS	Description	α	t-stat	β	t-stat	R^2	F-stat	Obs.	Employment		
									Min	Mean	Max
23	Construction	-	-	0.091	10.39	0.87	107.96	17	3	34	250
31-33	**Manufacturing**	5.441	3.33	0.065	3.62	0.16	13.14	69	1	41	300
31	Food, Beverage, Tobacco, Textile, Apparel	-	-	0.110	4.06	0.54	16.47	15	2	47	200
32	Wood, paper, chemical, plastics, nonmetals	7.394	2.34	0.126	3.73	0.39	13.92	24	2	61	300
33	Metal, machinery, electronic, furniture & misc.	6.612	4.94	-	-	-	-	30	1	81	400
42	Wholesale Trade	6.021	6.27	-	-	-	-	44	1	21	200
44-45	**Retail Trade**	-	-	0.279	6.96	0.49	48.44	51	1	17	173
44	Motor vehicle, furniture, electronics, clothing	-	-	0.295	5.69	0.51	32.34	32	1	20	202
45	Sporting goods, hobby, book, & music stores	3.490	1.71	0.186	2.47	0.26	6.11	19	1	15	98
48	Modal Transportation & Support Activities	7.667	2.12	-	-	-	-	6	3	39	151
72	Accommodation and Food	-	-	0.115	5.64	0.76	31.80	11	3	28	180
All	**All Freight Intensive Sectors (FIS)**	**3.386**	**5.34**	**0.087**	**5.94**	**0.21**	**35.33**	**199**	**1**	**28**	**400**

CR - FTP [shipments/day]											
NAICS	Description	α	t-stat	β	t-stat	R^2	F-stat	Obs.	Employment		
									Min	Mean	Max
31-33	**Manufacturing**	5.181	3.44	0.048	2.16	0.04	4.68	27	3	38	300
32	Wood, paper, chemical, plastics, nonmetals	2.564	1.43	0.140	2.55	0.39	6.48	12	3	22	70
33	Metal, machinery, electronic, furniture & misc.	6.041	2.01	0.037	1.19	0.12	1.41	12	5	48	300
42	Wholesale Trade	7.250	5.21	-	-	-	-	24	2	12	53
44-45	**Retail Trade**	-	-	0.432	5.92	0.76	35.07	12	1	14	50
44	Motor vehicle, furniture, electronics, clothing	-	-	0.418	7.57	0.86	57.36	10	1	15	50
All	**All Freight Intensive Sectors (FIS)**	**5.189**	**4.44**	**0.090**	**1.88**	**0.11**	**3.53**	**69**	**1**	**22**	**300**

Table 141: Freight Trip Production (FTP) Non-Linear Models

NYC and CR - Ln (FTP) [shipments/day]														
NAICS	Description	α	t-stat	β	t-stat	S^2	Mean Ln FTP	Mean Ln E	R^2	F-stat	Obs.	Employment		
												Min.	Mean	Max.
23	Construction	-2.283	-1.90	0.896	2.53	1.989	0.641	3.263	0.26	6.39	20	6	39	201
31-33	**Manufacturing**	**-**	**-**	**0.445**	**12.14**	**1.495**	**1.355**	**3.136**	**0.61**	**147.32**	**96**	**1**	**51**	**350**
31	Food, Beverage, Tobacco, Textile, Apparel	-	-	0.369	5.57	0.917	1.118	3.204	0.65	31.06	18	2	43	150
32	Wood, paper, chemical, plastics, nonmetals	-	-	0.572	8.80	1.578	1.601	2.934	0.69	77.36	1.58	2	45	300
33	Metal, machinery, electronic, furniture & misc.	-	-	0.385	7.21	1.515	1.246	3.281	0.56	51.97	42	1	59	350
42	Wholesale Trade	1.320	9.96	-	-	1.195	1.320	2.494	-	-	68	2	22	200
44-45	**Retail Trade**	**-0.589**	**-2.10**	**0.737**	**6.06**	**1.109**	**0.909**	**2.032**	**0.38**	**36.68**	**63**	**1**	**15**	**94**
44	Motor vehicle, furniture, electronics, clothing	-0.773	-2.26	0.762	5.16	1.115	0.785	2.046	0.40	26.67	42	1	15	77
45	Sporting goods, hobby, book, & music stores	-	-	0.603	6.12	1.048	1.157	2.004	0.65	37.44	21	2	15	94
48	Modal Transportation & Support Activities	1.750	4.84	-	-	1.047	1.750	3.559	-	-	8	9	53	151
72	Accommodation and Food	-1.047	-1.51	0.706	3.15	0.740	0.987	2.880	0.50	9.91	12	5	35	159
All	**All Freight Intensive Sectors (FIS)**	**-0.322**	**-2.08**	**0.544**	**9.67**	**1.240**	**1.178**	**2.714**	**0.26**	**93.43**	**268**	**1**	**33**	**350**

NYC - Ln (FTP) [shipments/day]														
NAICS	Description	α	t-stat	β	t-stat	S^2	Mean Ln FTP	Mean Ln E	R^2	F-stat	Obs.	Employment		
												Min.	Mean	Max.
23	Construction	-1.196	-1.89	0.639	3.54	0.446	0.971	3.391	0.45	12.50	17	3	34	250
31-33	**Manufacturing**	**-**	**-**	**0.446**	**11.19**	**1.331**	**1.406**	**3.184**	**0.65**	**125.20**	**69**	**1**	**41**	**300**
31	Food, Beverage, Tobacco, Textile, Apparel	-	-	0.337	4.63	0.949	0.995	3.223	0.60	21.41	15	2	47	200
32	Wood, paper, chemical, plastics, nonmetals	-	-	0.608	8.58	1.416	1.884	3.077	0.76	72.64	24	2	61	300
33	Metal, machinery, electronic, furniture & misc.	-	-	0.379	6.88	1.155	1.230	3.250	0.62	47.32	30	1	81	400
42	Wholesale Trade	1.228	7.37	-	-	1.222	1.228	2.743	-	-	44	1	21	200
44-45	**Retail Trade**	**-**	**-**	**0.702**	**5.27**	**1.235**	**0.777**	**1.961**	**0.49**	**47.43**	**51**	**1**	**17**	**173**
44	Motor vehicle, furniture, electronics, clothing	-	-	0.404	4.42	1.345	0.585	1.927	0.39	19.50	32	1	20	202
45	Sporting goods, hobby, book, & music stores	-	-	0.583	5.85	1.003	1.100	2.019	0.66	34.24	19	1	15	98
48	Modal Transportation & Support Activities	-	-	0.413	3.72	1.082	1.535	3.707	0.73	13.81	6	3	39	151
72	Accommodation and Food	-	-	0.421	4.94	0.768	1.077	2.875	0.71	24.40	11	3	28	180
All	**All Freight Intensive Sectors (FIS)**	**-0.409**	**-2.59**	**0.557**	**9.81**	**1.049**	**1.147**	**2.775**	**0.33**	**96.19**	**199**	**1**	**28**	**400**

Table 141 (cont.): Freight Trip Production (FTP) Non-Linear Models

CR - Ln (FTP) [shipments/day]														
NAICS	Description	α	t-stat	β	t-stat	S^2	Mean Ln FTP	Mean Ln E	R^2	F-stat	Obs.	Employment		
												Min.	Mean	Max.
31-33	**Manufacturing**	**-**	**-**	**0.4420**	**5.20**	**1.979**	**1.22**	3.01	**0.510**	**27.04**	**27**	**3**	**38**	**300**
32	Wood, paper, chemical, plastics, nonmetals	-	-	0.4660	3.27	1.929	1.04	2.65	0.493	10.69	12	3	22	70
33	Metal, machinery, electronic, furniture & misc.	-	-	0.403	3.05	2.595	1.29	3.36	0.458	9.30	12	5	48	300
42	Wholesale Trade	-	-	0.644	5.85	1.393	1.49	2.04	0.598	34.25	24	2	12	53
44-45	**Retail Trade**	**-**	**-**	**0.653**	**6.18**	**0.816**	**1.470**	**2.333**	**0.78**	**38.18**	**12**	**1**	**14**	**50**
44	Motor vehicle, furniture, electronics, clothing	-	-	0.6277	6.13	0.694	1.42	2.43	0.807	37.57	10	1	15	50
All	**All Freight Intensive Sectors (FIS)**	**-**	**-**	**0.4994**	**7.69**	**1.956**	**1.27**	**2.54**	**0.465**	**59.14**	**69**	**1**	**22**	**300**

SERVICE TRIP ATTRACTION (STA)

Table 142: Service Trip Attraction (STA) Linear Models

NYC and CR - STA [trips/day]											
NAICS	Description	α	t-stat	β	t-stat	R^2	F-stat	Obs.	Employment		
									Min.	Mean	Max.
23	Construction	-	-	4.07E-03	4.10	0.68	16.77	9	9	55	201
31-33	**Manufacturing**	**0.236**	**6.15**	**-**	**-**	**-**	**-**	**47**	**3**	**68**	**309**
31	Food, Beverage, Tobacco, Textile, Apparel	0.197	2.77	-	-	-	-	6	28	104	184
32	Wood, paper, chemical, plastics, nonmetals	0.251	4.15	-	-	-	-	23	3	48	223
33	Metal, machinery, electronic, furniture & misc.	0.230	3.73	-	-	-	-	18	5	82	309
42	Wholesale	0.304	4.31	-	-	-	-	31	2	46	355
44-45	**Retail Trade**	**-**	**-**	**0.010**	**5.15**	**0.57**	**26.50**	**21**	**1**	**38**	**202**
44	Motor vehicle, furniture, electronics, clothing	-	-	0.012	5.17	0.64	26.74	16	1	39	202
45	Sporting goods, hobby, book, & music stores	0.174	2.74	-	-	-	-	6	3	35	91
48	Modal Transportation & Support Activities	-	-	9.30E-03	6.15	0.86	37.83	7	8	37	100
51	Information	0.595	3.78	-	-	-	-	20	2	142	900
52	Finance and Insurance	0.850	3.10	-	-	-	-	13	5	707	4000
53	Real Estate	-	-	9.23E-04	3.02	0.48	9.15	11	6	93	405
54	Professional and Technical Services	0.391	2.51	7.99E-04	2.36	0.22	5.57	22	1	181	2000
56	Administrative and Waste Services	0.291	3.82	-	-	-	-	22	4	86	523
61	Education Services	0.439	2.49	-	-	-	-	15	5	68	177
62	Health Care and Social Assistance	1.179	2.80	-	-	-	-	14	11	136	500
71	Entertainment	0.763	3.18	-	-	-	-	14	3	62	300
72	Accommodation and Food Services	-	-	0.022	5.50	0.67	30.21	16	4	28	79
81	Other Services (except Public Admin)	0.571	5.28	-	-	-	-	7	31	114	305
All	**All Sectors - Weighted**	**0.408**	**9.18**	**1.09E-03**	**3.71**	**0.05**	**13.78**	**260**	**1**	**111**	**4000**

Table 142 (cont.): Service Trip Attraction (STA) Linear Models

NYC - STA [trips/day]											
NAICS	Description	α	t-stat	β	t-stat	R^2	F-stat	Obs.	Employment		
									Min.	Mean	Max.
23	Construction	-	-	3.92E-03	4.49	0.80	20.19	6	12	72	201
31-33	**Manufacturing**	**0.251**	**5.20**	**-**	**-**	**-**	**-**	**29**	**3**	**89**	**309**
31	Food, Beverage, Tobacco, Textile, Apparel	0.167	1.68	-	-	-	-	3	100	142	184
32	Wood, paper, chemical, plastics, nonmetals	0.233	3.83	-	-	-	-	15	3	61	223
33	Metal, machinery, electronic, furniture & misc.	0.298	3.12	-	-	-	-	11	12	115	309
42	Wholesale	0.266	4.50	-	-	-	-	13	10	92	355
44-45	**Retail Trade**	**0.248**	**2.83**	**-**	**-**	**-**	**-**	**13**	**11**	**52**	**125**
44	Motor vehicle, furniture, electronics, clothing	0.295	2.68	-	-	-	-	10	11	48	125
45	Sporting goods, hobby, book, & music stores	0.091	2.00	-	-	-	-	3	45	68	91
48	Modal Transportation & Support Activities	-	-	9.25E-03	5.66	0.87	32.07	6	8	42	100
51	Information	0.804	3.73	-	-	-	-	13	15	209	900
52	Finance and Insurance	0.428	2.79	3.22E-04	3.13	0.55	9.77	10	15	844	4000
53	Real Estate	-	-	9.15E-04	2.51	0.51	6.29	7	17	137	405
54	Professional, Sci, and Tech Services	-	-	1.10E-03	5.64	0.84	31.78	7	65	514	2000
56	Administrative and Waste Services	0.393	3.07	-	-	-	-	11	40	159	523
61	Education Services	-	-	2.77E-03	4.93	0.71	24.32	11	10	84	177
62	Health Care and Social Assistance	1.126	1.91	-	-	-	-	9	40	152	500
71	Entertainment	0.879	3.30	-	-	-	-	12	13	75	300
72	Accommodation and Food Services	-	-	0.017	5.95	0.76	35.44	12	6	32	79
81	Other Services (except Public Admin)	0.571	5.28	-	-	-	-	7	31	114	305
All	**All Sectors - Weighted**	**0.42**	**10.15**	**4.10E-04**	**1.82**	**0.02**	**3.32**	**156**	**3**	**167**	**4000**

Table 142 (cont.): Service Trip Attraction (STA) Linear Models

CR - STA [trips/day]											
NAICS	Description	α	t-stat	β	t-stat	R^2	F-stat	Obs.	Employment		
									Min.	Mean	Max.
23	Construction	0.258	1.73	-	-	-	-	3	9	21	40
31-33	**Manufacturing**	**0.212**	**3.29**	**-**	**-**	**-**	**-**	**18**	**3**	**36**	**175**
31	Food, Beverage, Tobacco, Textile, Apparel	0.227	1.89	-	-	-	-	3	28	78	175
32	Wood, paper, chemical, plastics, nonmetals	0.284	2.07	-	-	-	-	8	3	25	70
33	Metal, machinery, electronic, furniture & misc.	0.123	4.48	-	-	-	-	7	5	30	85
42	Wholesale	-	-	0.021	3.74	0.45	14.00	18	2	13	53
44-45	**Retail Trade**	**-**	**-**	**0.018**	**39.52**	**0.99**	**1561.91**	**11**	**1**	**25**	**202**
44	Motor vehicle, furniture, electronics, clothing	-	-	0.018	52.00	1.00	2704.44	8	1	30	202
45	Sporting goods, hobby, book, & music stores	-	-	0.017	2.91	0.81	8.46	3	3	13	26
51	Information	-	-	0.013	7.63	0.91	58.29	7	2	18	60
53	Real Estate	0.080	2.33	-	-	-	-	4	6	16	41
54	Professional, Sci, and Tech Services	0.500	2.74	-	-	-	-	16	1	26	103
56	Administrative and Waste Services	0.190	2.45	-	-	-	-	11	4	20	82
61	Education Services	-	-	0.036	10.59	0.97	112.18	4	5	25	76
62	Health Care and Social Assistance	0.466	3.55	8.53E-03	12.16	0.99	147.90	4	11	105	373
72	Accommodation and Food Services	-	-	0.054	11.98	0.98	143.55	4	4	17	51
All	**All Sectors - Weighted**	**0.184**	**2.78**	**0.012**	**11.47**	**0.56**	**131.56**	**104**	**1**	**26**	**373**

Table 143: Service Trip Attraction (STA) Non-Linear Models

NYC and CR - Ln (STA) [trips/day]														
NAICS	Description	α	t-stat	β	t-stat	S^2	Mean Ln STA	Mean Ln E	R^2	F-stat	Obs.	Employment		
												Min.	Mean	Max.
23	Construction	-1.712	-4.95	-	-	1.075	-0.890	4.294	-	-	9	9	55	201
31-33	**Manufacturing**	**-2.803**	**-6.24**	**0.233**	**1.97**	**0.992**	**-1.419**	**3.756**	**0.08**	**3.86**	**45**	**3**	**68**	**309**
31	Food, Beverage, Tobacco, Textile, Apparel	-2.014	-4.90	-	-	1.014	-2.629	3.999	-	-	6	28	104	184
32	Wood, paper, chemical, plastics, nonmetals	-1.959	-8.61	-	-	1.192	-1.298	4.078	-	-	23	3	48	223
33	Metal, machinery, electronic, furniture & misc.	-3.248	-4.79	0.347	2.04	0.808	-1.362	3.150	0.21	4.15	18	5	82	309
42	Wholesale Trade	-2.564	-5.53	0.263	1.84	1.107	-2.085	3.222	0.10	3.39	31	2	46	355
44-45	**Retail Trade**	**-2.180**	**-8.09**	**-**	**-**	**1.743**	**-0.633**	**4.138**	**-**	**-**	**24**	**1**	**38**	**202**
44	Motor vehicle, furniture, electronics, clothing	-2.184	-6.49	-	-	2.038	-0.535	3.970	-	-	18	1	39	202
45	Sporting goods, hobby, book, & music stores	-2.167	-5.09	-	-	1.089	-0.828	4.854	-	-	6	3	35	91
48	Modal Transportation & Support Activities	-5.261	-4.81	1.073	3.27	0.691	-2.744	3.756	0.68	10.66	7	8	37	100
51	Information	-3.541	-6.65	0.582	4.67	0.831	-1.627	3.115	0.55	21.83	20	2	142	900
52	Finance and Insurance	-0.891	-2.22	-	-	2.101	-1.383	2.841	-	-	13	5	707	4000
53	Real Estate	-2.120	-5.66	-	-	1.685	-1.288	3.598	-	-	12	6	93	405
54	Professional and Technical Services	-1.497	-4.97	-	-	2.085	-1.357	3.405	-	-	23	1	181	2000
56	Educational Services	-3.150	-4.46	0.362	1.99	1.167	-1.710	3.413	0.17	3.95	21	4	86	523
61	Education Services	-1.575	-4.89	-	-	1.555	-1.481	3.389	-	-	15	5	68	177
62	Health Care and Social Assistance	-0.730	-1.75	-	-	2.439	-1.841	3.649	-	-	14	11	136	500
71	Entertainment	-1.155	-2.84	-	-	2.315	-1.615	3.304	-	-	14	3	62	300
72	Accommodation and Food	-3.002	-3.74	0.697	2.69	0.956	-1.051	4.082	0.34	7.26	16	4	28	79
81	Other Services (except Public Admin)	-0.692	-3.10	-	-	0.348	-2.629	2.548	-	-	7	31	114	305
All	**All Sectors - Weighted**	**-2.730**	**-13.30**	**0.362**	**6.18**	**1.487**	**-1.502**	**3.528**	**0.13**	**38.17**	**260**	**1**	**111**	**4000**

Table 143 (cont.): Service Trip Attraction (STA) Non-Linear Models

NYC - Ln (STA) [trips/day]														
NAICS	Description	α	t-stat	β	t-stat	S^2	Mean Ln STA	Mean Ln E	R^2	F-stat	Obs.	Employment		
												Min.	Mean	Max.
23	Construction	-1.668	-3.91	-	-	1.093	-1.244	4.322	-	-	6	12	72	201
31-33	**Manufacturing**	**-1.851**	**-9.95**	**-**	**-**	**1.004**	**-1.397**	**3.677**	**-**	**-**	**29**	3	89	309
31	Food, Beverage, Tobacco, Textile, Apparel	-2.167	-3.54	-	-	1.121	-3.091	3.417	-	-	3	100	142	184
32	Wood, paper, chemical, plastics, nonmetals	-1.894	-7.38	-	-	0.988	-1.383	4.089	-	-	15	3	61	223
33	Metal, machinery, electronic, furniture & misc.	-1.707	-5.28	-	-	1.148	-1.165	3.163	-	-	11	12	115	309
42	Wholesale Trade	-1.727	-6.04	-	-	1.061	-2.233	2.958	-	-	13	10	92	355
44-45	**Retail Trade**	**-2.172**	**-6.18**	**-**	**-**	**1.606**	**-1.205**	**3.607**	**-**	**-**	**13**	**11**	**52**	**125**
44	Motor vehicle, furniture, electronics, clothing	-2.035	-4.66	-	-	1.909	-1.302	3.440	-	-	10	11	48	125
45	Sporting goods, hobby, book, & music stores	-2.629	-5.69	-	-	0.641	-1.012	4.444	-	-	3	45	68	91
48	Modal Transportation & Support Activities	-6.126	-6.08	1.278	4.40	0.462	-2.744	3.909	0.83	19.38	6	8	42	100
51	Information	-0.692	-2.33	-	-	1.144	-2.099	2.857	-	-	13	15	209	900
52	Finance and Insurance	-0.889	-2.36	-	-	1.561	-2.167	2.832	-	-	11	15	844	4000
53	Real Estate	-4.720	-3.79	0.567	2.07	0.615	-1.094	3.824	0.46	4.30	7	17	137	405
54	Professional, Sci, and Tech Services	-1.088	-2.07	-	-	1.929	-1.794	3.090	-	-	7	65	514	2000
56	Educational Services	-1.554	-4.13	-	-	1.554	-2.596	2.333	-	-	11	40	159	523
61	Education Services	-4.208	-4.25	0.592	2.47	0.673	-1.936	3.137	0.40	6.10	11	10	84	177
62	Health Care and Social Assistance	-1.078	-1.81	-	-	3.204	-2.342	3.619	-	-	9	40	152	500
71	Entertainment	-0.890	-2.09	-	-	2.177	-1.600	3.351	-	-	12	13	75	300
72	Accommodation and Food	-0.742	-3.48	-	-	0.592	-1.705	3.590	-	-	13	6	32	79
81	Other Services (except Public Admin)	-0.692	-3.10	-	-	0.348	-2.629	2.548	-	-	7	31	114	305
All	**All Sectors - Weighted**	**-1.440**	**-15.05**	**-**	**-**	**1.566**	**-1.864**	**3.302**	**-**	**-**	**171**	**3**	**167**	**4000**

Table 143 (cont.): Service Trip Attraction (STA) Non-Linear Models

CR - Ln (STA) [trips/day]													
NAICS	Description	α	t-stat	β	t-stat	S^2	Mean Ln STA	Mean Ln E	R^2	F-stat	Obs.	Employment		
												Min.	Mean	Max.
23	Construction	-1.801	-2.50	-	-	1.551	-0.004	4.238	-	-	3	9	21	40
31-33	**Manufacturing**	**-2.130**	**-8.63**	**-**	**-**	**1.096**	**-1.597**	**3.787**	**-**	**-**	**18**	**3**	**36**	**175**
31	Food, Beverage, Tobacco, Textile, Apparel	-1.861	-2.78	-	-	1.344	-2.398	4.387	-	-	3	28	78	175
32	Wood, paper, chemical, plastics, nonmetals	-2.082	-4.46	-	-	1.744	-1.238	4.057	-	-	8	3	25	70
33	Metal, machinery, electronic, furniture & misc.	-3.521	-5.37	0.433	1.99	0.368	-2.051	3.127	0.44	3.95	7	5	30	85
42	Wholesale Trade	-3.448	-5.90	0.742	3.01	0.920	-1.966	3.408	0.36	9.04	18	2	13	53
44-45	**Retail Trade**	**-4.170**	**-10.36**	**0.973**	**5.78**	**0.491**	**-0.251**	**4.847**	**0.79**	**33.42**	**11**	**1**	**25**	**202**
44	Motor vehicle, furniture, electronics, clothing	-4.274	-9.36	0.960	5.06	0.536	-0.024	4.728	0.81	25.65	8	1	30	202
45	Sporting goods, hobby, book, & music stores	-1.705	-2.46	-	-	1.441	-0.706	5.263	-	-	3	3	13	26
51	Information	-3.977	-5.72	0.749	2.73	0.646	-1.061	3.787	0.60	7.48	7	2	18	60
53	Real Estate	-2.744	-7.92	-	-	0.480	-0.982	3.885	-	-	4	6	16	41
54	Professional, Sci, and Tech Services	-1.675	-4.54	-	-	2.175	-1.138	3.540	-	-	16	1	26	103
56	Educational Services	-2.215	-7.21	-	-	1.038	-1.090	4.614	-	-	11	4	20	82
61	Education Services	-3.946	-2.63	1.198	2.22	1.266	-0.799	3.956	0.71	4.92	4	5	25	76
62	Health Care and Social Assistance	-2.221	-7.41	0.602	7.62	0.050	-2.051	3.538	0.97	58.02	4	11	105	373
72	Accommodation and Food	-4.748	-3.79	1.546	2.98	1.163	-0.888	5.340	0.82	8.89	4	4	17	51
All	**All Sectors - Weighted**	**-3.828**	**-16.82**	**0.846**	**9.83**	**1.058**	**-1.158**	**3.898**	**0.49**	**96.64**	**104**	**1**	**26**	**373**

Table 144: Freight Attraction (FA) Linear Models

NYC and CR - FA [pounds/day]									
NAICS	Description	β	t-stat	R^2	F-stat	Obs.	Employment		
							Min.	Mean	Max.
31-33	**Manufacturing**	**46.492**	**2.25**	**0.06**	**5.06**	**75**	**2**	**82**	**607**
31	Food, Beverage, Tobacco, Textile, Apparel	109.978	3.26	0.57	10.61	9	10	99	200
33	Metal, machinery, electronic, furniture & misc.	25.427	1.77	0.089	3.13	33	2	106	607
42	Wholesale Trade	431.221	2.1	0.086	4.41	48	2	38	355
44-45	**Retail Trade**	**74.999**	**2.38**	**0.12**	**5.68**	**44**	**3**	**38**	**202**
44	Motor vehicle, furniture, electronics, clothing	100.519	2.91	0.20	8.49	34	3	36	202
72	Accommodation and Food	8.853	2.7	0.212	7.27	28	4	36	180

NYC - FA [pounds/day]									
NAICS	Description	β	t-stat	R^2	F-stat	Obs.	Employment		
							Min.	Mean	Max.
31-33	**Manufacturing**	**42.723**	**1.9**	**0.07**	**3.6**	**46**	**2**	**110**	**607**
31	Food, Beverage, Tobacco, Textile, Apparel	137.905	3.67	0.77	13.49	5	10	129	200
42	Wholesale Trade	351.038	3.40	0.37	11.57	21	10	72	355
44-45	**Retail Trade**	**60.822**	**1.82**	**0.16**	**3.32**	**19**	**3**	**68**	**202**
44	Motor vehicle, furniture, electronics, clothing	87.484	1.9	0.217	3.60	14	3	64	202
72	Accommodation and Food	8.135	2.32	0.19	5.38	24	5	38	180

CR - FA [pounds/day]									
NAICS	Description	β	t-stat	R^2	F-stat	Obs.	Employment		
							Min.	Mean	Max.
23	Construction	153.338	3.72	0.66	13.85	8	4	16	40
32	Manufacturing - Wood, paper, chemical, plastics, nonmetals	818.186	3.31	0.50	10.98	12	3	23	70
42	Wholesale Trade	3089.543	2.16	0.15	4.65	27	2	12	53
44-45	**Retail Trade**	**299.423**	**2.5**	**0.21**	**6.23**	**25**	**3**	**15**	**50**
44	Motor vehicle, furniture, electronics, clothing	248.448	2.82	0.29	7.93	20	3	16	50
72	Accommodation and Food	26.734	3.64	0.82	13.26	4	4	20	51

Table 145: Freight Attraction (FA) Non-Linear Models

NYC and CR - Ln (FA) [pounds/day]													
NAICS	Description	α	t-stat	β	t-stat	S^2	Mean Ln FA	Mean Ln E	R^2	F-stat	Obs.	Employment		
												Min.	Mean	Max.
23	Construction	-	-	1.627	10.28	7.83	6.033	3.389	0.82	105.58	24	4	78	810
31-33	**Manufacturing**	**3.264**	**3.91**	**0.962**	**4.39**	**7.049**	**6.728**	**3.538**	**0.21**	**19.23**	**75**	**2**	**82**	**607**
31	Food, Beverage, Tobacco, Textile, Apparel	-	-	1.645	7.23	8.449	6.908	4.103	0.87	52.23	9	10	99	200
32	Wood, paper, chemical, plastics, nonmetals	4.012	2.83	0.982	2.40	8.697	7.316	3.234	0.16	5.76	34	3	54	300
33	Metal, machinery, electronic, furniture & misc.	2.329	2.47	1.029	4.35	4.276	6.117	3.687	0.38	18.91	33	2	106	607
42	Wholesale Trade	4.967	4.55	0.802	2.29	8.766	7.267	2.867	0.10	5.23	48	2	38	355
44-45	**Retail Trade**	-	-	**1.886**	**11.98**	**11.181**	**6.316**	**2.979**	**0.77**	**143.45**	**44**	**3**	**38**	**202**
44	Motor vehicle, furniture, electronics, clothing	3.899	3.23	0.733	1.92	6.489	6.164	2.950	0.10	3.70	34	3	36	202
45	Sporting goods, hobby, book, & music stores	-	-	1.900	4.18	22.808	6.840	3.080	0.66	17.46	10	3	45	200
48-49	**Modal Transportation & Support Activities**	-	-	**2.042**	**5.54**	**27.108**	**7.626**	**3.546**	**0.70**	**30.71**	**14**	**4**	**91**	**700**
72	Accommodation and Food	-	-	1.691	11.64	6.156	5.720	3.059	0.83	135.54	28	4	36	180
All	**All Freight Intensive Sectors (FIS)**	**4.952**	**10.36**	**0.452**	**3.14**	**6.883**	**6.627**	**3.222**	**0.04**	**9.83**	**233**	**2**	**59**	**810**

NYC - Ln (FA) [pounds/day]													
NAICS	Description	α	t-stat	β	t-stat	S^2	Mean Ln FA	Mean Ln E	R^2	F-stat	Obs.	Employment		
												Min.	Mean	Max.
23	Construction	-	-	1.484	8.31	8.1527	6.0225	3.791	0.822	69.12	16	5	109	810
31-33	**Manufacturing**	**3.299**	**2.81**	**0.929**	**3.28**	**8.059**	**6.938**	**3.876**	**0.20**	**10.78**	**46**	**2**	**110**	**607**
31	Food, Beverage, Tobacco, Textile, Apparel	-	-	1.615	5.09	10.773	7.154	4.486	0.87	25.89	5	10	129	200
32	Wood, paper, chemical, plastics, nonmetals	-	-	1.867	9.28	12.18	7.393	3.553	0.81	86.12	21	3	71	300
33	Metal, machinery, electronic, furniture & misc.	2.385	1.73	1.031	3.27	5.363	6.415	4.062	0.37	10.68	20	2	145	607
44-45	**Retail Trade**	**-**	**-**	**1.496**	**8.61**	**8.956**	**5.943**	**3.819**	**0.80**	**74.12**	**19**	**3**	**68**	**202**
44	Motor vehicle, furniture, electronics, clothing	-	-	1.559	7.62	8.775	6.177	3.716	0.82	58.14	14	3	64	202
45	Sporting goods, hobby, book, & music stores	-	-	1.342	3.76	11.057	5.243	4.107	0.78	14.16	5	30	80	200
48-49	**Modal Transportation & Support Activities**	**-**	**-**	**2.029**	**4.21**	**28.483**	**5.699**	**3.139**	**0.66**	**17.70**	**10**	**4**	**47**	**151**
72	Accommodation and Food	-	-	1.645	10.41	6.537	5.699	3.139	0.82	108.33	24	5	38	180
All	**All Freight Intensive Sectors (FIS)**	**4.306**	**5.87**	**0.532**	**2.68**	**7.053**	**6.599**	**3.678**	**0.05**	**7.16**	**136**	**2**	**81**	**810**

Table 145 (cont.): Freight Attraction (FA) Non-Linear Models

CR - Ln (FA) [pounds/day]														
NAICS	Description	α	t-stat	β	t-stat	S^2	Mean Ln FA	Mean Ln E	R^2	F-stat	Obs.	Employment		
												Min.	Mean	Max.
23	Construction	**-**	**-**	**2.271**	**8.38**	4.16	**6.054**	**2.586**	**0.91**	**70.22**	**8**	**4**	**16**	**40**
31-33	**Manufacturing**	**2.757**	**2.04**	**1.180**	**2.78**	**5.826**	**6.370**	**3.002**	**0.22**	**7.71**	**29**	**3**	**39**	**300**
31	Food, Beverage, Tobacco, Textile, Apparel	**-**	**-**	**1.701**	**4.49**	**8.076**	**6.479**	**3.625**	**0.87**	**20.14**	**4**	**13**	**62**	**175**
32	Wood, paper, chemical, plastics, nonmetals	-	-	2.664	12.37	4.470	7.176	2.676	0.93	152.91	12	3	23	70
33	Metal, machinery, electronic, furniture & misc.	2.490	1.64	0.947	2.05	3.247	5.648	3.111	0.28	4.21	13	5	47	300
42	Wholesale Trade	4.123	2.64	1.304	1.91	8.874	6.894	2.126	0.13	3.65	27	2	12	53
44-45	**Retail Trade**	**-**	**-**	**2.637**	**11.72**	**7.81**	**6.673**	**2.341**	**0.85**	**137.28**	**25**	**3**	**15**	**50**
44	Motor vehicle, furniture, electronics, clothing	3.330	2.33	1.169	2.09	4.469	6.152	2.413	0.20	4.36	20	3	16	50
45	Sporting goods, hobby, book, & music stores	-	-	3.958	6.54	8.60	8.757	2.052	0.91	42.82	5	3	10	26
48-49	**Modal Transportation & Support Activities**	**-**	**-**	**2.061**	**3.20**	**32.003**	**9.403**	**4.118**	**0.77**	**10.26**	**4**	**10**	**200**	**700**
72	Accommodation and Food	-	-	2.091	6.14	3.493	5.848	2.574	0.93	37.68	4	4	20	51
All	**All Freight Intensive Sectors (FIS)**	**4.383**	**6.42**	**0.913**	**3.53**	**6.020**	**6.669**	**2.582**	**0.12**	**12.45**	**97**	**2**	**29**	**700**

FREIGHT PRODUCTION (FP)

Table 146: Freight Production (FP) Linear Models

NYC and CR - FP [pounds/day]									
NAICS	Description	β	t-stat	R^2	F-stat	Obs.	Employment		
							Min.	Mean	Max.
31-33	**Manufacturing**	**41.065**	**2.47**	**0.08**	**6.08**	**67**	**2**	**83**	**607**
31	Food, Beverage, Tobacco, Textile, Apparel	216.084	4.10	0.74	16.83	7	13	84	184
32	Wood, paper, chemical, plastics, nonmetals	119.151	2.41	0.16	5.82	31	3	54	300
33	Metal, machinery, electronic, furniture & misc.	9.993	1.98	0.12	3.93	29	2	54	607
44-45	**Retail Trade**	**46.849**	**1.64**	**0.10**	**2.68**	**25**	**3**	**35**	**200**
44	Motor vehicle, furniture, electronics, clothing	91.439	2.83	0.30	8.03	20	3	31	125
72	Accommodation and Food	1.855	5.45	0.79	29.67	9	6	30	100

NYC - FP [pounds/day]									
NAICS	Description	β	t-stat	R^2	F-stat	Obs.	Employment		
							Min.	Mean	Max.
31-33	**Manufacturing**	**35.817**	**2.15**	**0.11**	**4.6**	**38**	**2**	**121**	**607**
31	Food, Beverage, Tobacco, Textile, Apparel	212.291	3.35	0.79	11.25	4	80	128	184
32	Wood, paper, chemical, plastics, nonmetals	88.971	1.94	0.19	3.78	17	3	82	300
42	Wholesale Trade	229.101	2.17	0.22	4.72	18	10	79	355
72	Accommodation and Food	1.867	5.09	0.79	25.87	8	6	31	100

CR - FP [pounds/day]									
NAICS	Description	β	t-stat	R^2	F-stat	Obs.	Employment		
							Min.	Mean	Max.
23	Construction	16.302	2.38	0.74	5.64	3	9	14	20
31-33	**Manufacturing**	**97.083**	**1.62**	**0.09**	**2.63**	**29**	**3**	**33**	**300**
32	Wood, paper, chemical, plastics, nonmetals	698.234	3.63	0.50	13.15	14	3	21	70
42	Wholesale Trade	4442.041	2.76	0.24	7.61	25	2	12	53
44-45	**Retail Trade**	**158.223**	**1.79**	**0.18**	**3.21**	**16**	**4**	**16**	**50**
44	Motor vehicle, furniture, electronics, clothing	125.219	2.39	0.32	5.70	13	4	18	50
45	Sporting goods, hobby, book, & music stores	1588.257	1.74	0.6	3.03	3	6	7	9

Table 147: Freight Production (FP) Non-Linear Models

NYC and CR - Ln (FP) [pounds/day]														
NAICS	Description	α	t-stat	β	t-stat	S^2	Mean Ln FP	Mean Ln E	R^2	F-stat	Obs.	Employment		
												Min.	Mean	Max.
23	Construction	-	-	1.060	7.33	3.187	3.852	3.431939	0.83	53.7	12	9	47	201
31-33	**Manufacturing**	**4.814**	**5.360**	**0.571**	**2.42**	**7.556**	**6.897**	**3.524**	**0.08**	**5.84**	**67**	**2**	**83**	**607**
31	Food, Beverage, Tobacco, Textile, Apparel	-	-	1.916	8.71	5.919	7.678	4.077	0.93	75.79	7	13	84	184
32	Wood, paper, chemical, plastics, nonmetals	-	-	2.185	11.49	13.296	8.161	3.192	0.81	131.91	31	3	54	300
33	Metal, machinery, electronic, furniture & misc.	-	-	1.366	13.83	4.656	5.271	3.745	0.87	191.41	29	2	54	607
42	Wholesale Trade	5.44	5.01	0.673	1.93	8.316	7.360	2.850	0.08	3.74	43	2	40	355
44-45	**Retail Trade**	**-**	**-**	**1.644**	**7.13**	**12.973**	**5.304**	**2.908**	**0.68**	**50.83**	**25**	**3**	**35**	**200**
44	Motor vehicle, furniture, electronics, clothing	-	-	1.695	8.51	7.540	4.973	2.883	0.79	72.34	20	3	31	125
45	Sporting goods, hobby, book, & music stores	-	-	1.462	1.67	41.450	6.758	3.005	0.41	2.80	5	6	53	200
48-49	**Modal Transportation & Support Activities**	**-**	**-**	**2.000**	**4.77**	**31.678**	**7.835**	**3.830**	**0.69**	**22.73**	**11**	**4**	**111**	**700**
72	Accommodation and Food	-	-	0.693	3.43	3.582	1.955	3.001	0.60	11.79	9	6	30	100
All	**All Freight Intensive Sectors (FIS)**	**2.54**	**3.35**	**0.653**	**2.81**	**11.279**	**6.366**	**3.244**	**0.05**	**7.92**	**167**	**2**	**61**	**700**

NYC - Ln (FP) [pounds/day]														
NAICS	Description	α	t-stat	β	t-stat	S^2	Mean Ln FP	Mean Ln E	R^2	F-stat	Obs.	Employment		
												Min.	Mean	Max.
23	Construction	-	-	0.932	8.18	1.693	3.464	3.706	0.89	66.90	9	10	58	201
31-33	**Manufacturing**	-	-	1.639	12.63	11.764	7.375	4.020	0.81	159.60	38	2	121	607
31	Food, Beverage, Tobacco, Textile, Apparel	-	-	1.838	7.26	5.931	8.243	4.802	0.95	52.75	4	80	128	184
32	Wood, paper, chemical, plastics, nonmetals	-	-	1.983	7.62	17.748	8.740	3.681	0.78	58.06	17	3	82	300
33	Metal, machinery, electronic, furniture & misc.	-	-	1.323	12.24	4.030	5.649	4.175	0.90	149.70	17	2	160	607
42	Wholesale Trade	-	-	1.914	10.33	9.916	7.823	3.884	0.86	106.73	18	10	79	355
44-45	**Retail Trade**	**-**	**-**	**1.199**	**3.810**	**13.821**	**4.568**	**3.763**	**0.65**	**14.55**	**9**	**3**	**69**	**200**
44	Motor vehicle, furniture, electronics, clothing	-	-	1.468	4.03	12.913	4.907	3.537	0.73	16.21	7	3	54	125
48-49	**Modal Transportation & Support Activities**	-	-	**1.950**	**3.61**	**31.527**	**6.691**	**3.496**	**0.65**	**13.04**	**8**	**4**	**54**	**151**
72	Accommodation and Food	-	-	0.650	2.94	3.871	**1.797**	**3.009**	0.55	8.64	8	6	31	100
All	**All Freight Intensive Sectors (FIS)**	**-**	**-**	**1.110**	**12.15**	**9.707**	**6.265**	**3.799**	**0.62**	**147.64**	**90**	**2**	**87**	**607**

Table 147 (cont.): Freight Production (FP) Non-Linear Models

CR - Ln (FP) [pounds/day]													
NAICS	Description	α	t-stat	β	t-stat	S^2	Mean Ln FP	Mean Ln E	R^2	F-stat	Obs.	Employment		
												Min.	Mean	Max.
23	Construction	-	-	1.890	5.55	2.421	5.016	2.608282	0.9391	30.82	3	9	14	20
31-33	**Manufacturing**	**3.38**	**2.14**	**0.977**	**1.88**	**7.713**	**6.186**	**2.874**	**0.12**	**3.55**	**29**	**3**	**33**	**300**
31	Food, Beverage, Tobacco, Textile, Apparel	-	-	2.163	4.24	7.673	6.548	3.112	0.90	18.00	3	13	24	31
32	Wood, paper, chemical, plastics, nonmetals	3.87	2.16	1.350	2.07	4.666	7.379	2.597	0.26	4.28	14	3	21	70
33	Metal, machinery, electronic, furniture & misc.	-	-	1.476	7.08	5.787	4.704	3.137	0.82	50.13	12	5	49	300
42	Wholesale Trade	4.09	2.57	1.393	1.99	8.900	7.026	2.106	0.15	3.97	25	2	12	53
44-45	**Retail Trade**	**-**	**-**	**2.239**	**7.59**	**9.085**	**5.810**	**2.426**	**0.79**	**57.55**	**16**	**4**	**16**	**50**
44	Motor vehicle, furniture, electronics, clothing	-	-	1.934	8.66	4.622	5.019	2.532	0.86	74.95	13	4	18	50
45	Sporting goods, hobby, book, & music stores	-	-	4.644	10.70	2.208	9.236	1.970	0.98	114.47	3	6	7	9
48-49	**Modal Transportation & Support Activities**	**-**	**-**	**2.070**	**2.55**	**47.714**	**11.268**	**4.723**	**0.76**	**6.49**	**3**	**40**	**264**	**700**
All	**All Freight Intensive Sectors (FIS)**	**4.11**	**4.15**	**0.699**	**1.89**	**8.158**	**6.495**	**2.594**	**0.05**	**4.31**	**77**	**2**	**31**	**700**

RELATIONSHIP BETWEEN FREIGHT GENERATION (FG) AND FREIGHT TRIP GENERATION (FTG)

Table 148: Relationship between FA and FTA Linear Models

NYC and CR - FTA [deliveries/day]									
NAICS	Description	λ	t-stat	R^2	F-stat	Obs.	Employment		
							Min	Mean	Max
23	Construction	4.24E-04	2.31	0.20	5.34	22	4	37	201
31-33	**Manufacturing**	**1.86E-04**	**2.60**	**0.09**	**6.75**	**67**	**2**	**63**	**350**
31	Food, Beverage, Tobacco, Textile, Apparel	4.11E-04	3.30	0.61	10.88	8	10	93	200
33	Metal, machinery, electronic, furniture & misc.	6.90E-04	4.36	0.41	18.98	28	2	69	350
44-45	**Retail Trade**	**3.81E-04**	**2.42**	**0.14**	**5.87**	**38**	**3**	**25**	**125**
44	Motor vehicle, furniture, electronics, clothing	5.55E-04	2.69	0.21	7.24	29	3	24	125
48	Modal Transportation & Support Activities	8.40E-05	17.94	0.97	321.96	10	7	46	151
72	Accommodation and Food	3.66E-03	4.10	0.38	16.77	28	4	36	180
All	**All Freight Intensive Sectors (FIS)**	**3.15E-05**	**6.03**	**0.15**	**36.31**	**213**	**2**	**42**	**350**

Table 149: Relationship between FA and FTA Non-Linear Models

NYC and CR - Ln (FTA) [deliveries/day]												
NAICS	Description	λ	t-stat	S^2	Mean Ln FA	Mean Ln FTA	R^2	F-stat	Obs.	Employment		
										Min.	Mean	Max.
23	Construction	0.184	6.68	0.728	6.144	1.085	0.68	44.57	22	4	37	201
31-33	**Manufacturing**	**0.215**	**10.95**	**1.283**	**6.416**	**1.414**	**0.65**	**119.96**	**67**	**2**	**63**	**350**
31	Food, Beverage, Tobacco, Textile, Apparel	0.207	5.38	0.590	6.274	1.432	0.81	28.95	8	10	93	200
32	Wood, paper, chemical, plastics, nonmetals	0.180	6.46	1.420	7.010	1.292	0.58	41.78	31	3	50	300
33	Metal, machinery, electronic, furniture & misc.	0.272	8.39	1.186	5.800	1.543	0.72	70.31	28	2	69	350
44-45	**Retail Trade**	**0.196**	**7.85**	**1.121**	**6.387**	**1.298**	**0.63**	**61.69**	**38**	**3**	**25**	**125**
44	Sporting goods, hobby, book, & music stores	0.208	7.18	1.020	5.962	1.277	0.65	51.56	29	3	24	125
45	Modal Transportation & Support Activities	0.170	3.33	1.541	7.756	1.365	0.58	11.12	9	3	28	91
48	Modal Transportation & Support Activities	0.227	8.99	0.409	6.765	1.644	0.90	80.84	10	7	46	151
72	Accommodation and Food	0.193	6.17	0.980	5.720	1.051	0.59	38.07	28	4	36	180
All	**All Freight Intensive Sectors (FIS)**	**0.194**	**18.67**	**1.098**	**6.512**	**1.293**	**0.62**	**348.44**	**213**	**2**	**42**	**350**

Table 150: Relationship between FP and FTP Linear Models

NYC and CR - FTP [shipments/day]									
NAICS	Description	λ	t-stat	R^2	F-stat	Obs.	Employment		
							Min	Mean	Max
31-33	**Manufacturing**	**5.10E-04**	**4.05**	**0.23**	**16.44**	**56**	**2**	**59**	**350**
31	Food, Beverage, Tobacco, Textile, Apparel	1.93E-03	3.59	0.72	12.78	6	13	73	184
32	Wood, paper, chemical, plastics, nonmetals	3.36E-04	2.58	0.20	6.65	27	3	45	300
33	Metal, machinery, electronic, furniture & misc.	9.68E-04	2.33	0.20	5.44	23	2	72	350
42	Wholesale Trade	8.45E-05	1.84	0.11	3.40	30	2	32	200
44-45	**Retail Trade**	**7.22E-04**	**1.80**	**0.21**	**3.22**	**13**	**3**	**18**	**50**
48	Modal Transportation & Support Activities	1.55E-04	5.03	0.84	25.34	6	9	66	151
All	**All Freight Intensive Sectors (FIS)**	**1.02E-04**	**12.70**	**0.57**	**161.20**	**123**	**2**	**46**	**350**

Table 151: Relationship between FP and FTP Non-Linear Models

NYC and CR - Ln (FTP) [shipments/day]														
NAICS	Description	α	t-stat	λ	t-stat	S^2	Mean Ln FP	Mean Ln FTP	R^2	F-stat	Obs.	Employment		
												Min.	Mean	Max.
31-33	**Manufacturing**	**1.021**	**2.05**	**0.129**	**1.90**	**2.075**	**6.694**	**1.893**	**0.06**	**3.60**	**56**	**2**	**59**	**350**
31	Food, Beverage, Tobacco, Textile, Apparel	-	-	0.347	5.31	1.570	7.314	2.699	0.85	28.19	6	13	73	184
32	Wood, paper, chemical, plastics, nonmetals	-	-	0.231	6.57	2.349	8.026	1.959	0.62	43.12	27	3	45	300
33	Metal, machinery, electronic, furniture & misc.	-	-	0.280	5.22	2.147	5.042	1.606	0.55	27.26	23	2	72	350
42	Wholesale Trade	-	-	0.235	9.66	0.919	6.617	1.670	0.76	93.39	30	2	32	200
44-45	**Retail Trade**	**-**	**-**	**0.293**	**5.14**	**1.782**	**5.509**	**1.973**	**0.69**	**26.40**	**13**	**3**	**18**	**50**
44	Sporting goods, hobby, book, & music stores	-	-	0.319	4.69	1.620	4.881	1.903	0.71	22.02	10	3	17	50
48	Modal Transportation & Support Activities	-	-	0.240	6.39	0.485	5.970	1.603	0.89	40.78	6	9	66	151
72	Accommodation and Food	-	-	0.398	3.21	1.041	2.113	1.166	0.63	10.31	7	6	32	100
All	**All Freight Intensive Sectors (FIS)**	**0.816**	**3.59**	**0.160**	**4.28**	**1.553**	**6.025**	**1.705**	**0.13**	**18.36**	**123**	**2**	**46**	**350**

FREIGHT GENERATION (FG) – COMMODITY FLOW SURVEY (CFS) 2007

NEW YORK

Table 152: Freight Production 2-Digit NAICS-All Modes–Linear Models (CFS 2007)

CFS - New York - All Modes [pounds/year]							
NAICS	**Description**	**β**	**t-stat**	**Adj. R^2**	**F-stat**	**RMSE**	**Obs.**
21	Mining	26,126,448	5.39	0.538	29.05	4.52E+08	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	876,226	5.67	0.474	32.13	7.82E+07	180
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	62,289	1.29	0.003	1.66	1.88E+08	470
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	48,081	2.37	0.057	5.60	3.28E+07	540
42	Wholesale Trade	565,253	7.82	0.065	61.11	6.97E+07	985
45	Sporting Goods, Hobby, Books & Music	266,125	2.05	0.251	4.19	2.40E+07	80
49	Postal Service, Couriers & Messengers, Warehousing & Storage	838,638	3.20	0.520	10.27	7.31E+07	30
51	Information	39,166	6.85	0.635	46.95	5.31E+06	40
55	Management of Companies and Enterprises	231,546	1.61	0.179	2.60	7.25E+07	35

Table 153: Freight Production 3-Digit NAICS-All Modes–Linear Models (CFS 2007)

CFS - New York - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (except Oil and Gas)	26,126,448	5.39	0.538	29.05	4.52E+08	65
311	Food Manufacturing	736,479	8.41	0.511	70.81	8.68E+07	100
312	Beverage and Tobacco Product Manufacturing	2,178,828	13.11	0.892	171.91	5.70E+07	25
313	Textile Mills	35,721	1.61	0.296	2.59	1.88E+06	15
314	Textile Product Mills	39,006	3.19	0.595	10.18	1.68E+06	15
315	Apparel Manufacturing	5,359	1.38	0.086	1.90	6.77E+05	20
321	Wood Product Manufacturing	652,905	4.34	0.441	18.81	1.97E+07	60
322	Paper Manufacturing	703,119	3.58	0.282	12.82	1.48E+08	60
323	Printing and Related Support Activities	332,054	2.65	0.505	7.01	2.18E+07	55
324	Petroleum and Coal Products Manufacturing	17,085,653	3.00	0.216	9.02	4.59E+08	20
325	Chemical Manufacturing	17,968	1.56	-0.005	2.42	1.16E+08	100
326	Plastics and Rubber Products Manufacturing	144,649	6.89	0.512	47.50	1.52E+07	90
327	Nonmetallic Mineral Product Manufacturing	1,074,852	4.58	0.178	21.02	1.20E+08	90
331	Primary Metal Manufacturing	628,500	3.51	0.351	12.29	1.35E+08	40
332	Fabricated Metal Product Manufacturing	60,080	3.70	0.166	13.71	1.04E+07	125
333	Machinery Manufacturing	40,849	1.65	0.254	2.72	1.03E+07	95
334	Computer and Electronic Product	1,669	9.64	0.247	92.97	8.52E+05	70
335	Electrical Equipment, Appliance, and Component Manufacturing	10,610	1.92	0.211	3.69	1.97E+06	30
336	Transportation Equipment Manufacturing	109,445	2.09	0.373	4.37	4.51E+07	50
337	Furniture and Related Product Manufacturing	27,090	3.61	0.238	13.06	4.01E+06	50
339	Miscellaneous Manufacturing	6,579	4.31	0.131	18.54	1.68E+06	80
423	Merchant Wholesalers, Durable Goods	240,429	4.71	0.076	22.20	2.06E+07	545
424	Merchant Wholesalers, Nondurable Goods	723,241	6.24	0.074	38.92	1.03E+08	440
454	Nonstore Retailers	266,125	2.05	0.251	4.19	2.40E+07	80
493	Warehousing and Storage	838,638	3.20	0.520	10.27	7.31E+07	30
511	Publishing Industries (except Internet)	39,166	6.85	0.635	46.95	5.31E+06	40
551	Management of Companies and Enterprises	231,546	1.61	0.179	2.60	7.25E+07	30

Table 154: Freight Production 2-Digit NAICS-Road Modes–Linear Models (CFS 2007)

CFS - New York - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Mining	25,335,647	5.20	0.542	27.02	4.4E+08	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	856,281	5.52	0.468	30.49	7.7E+07	180
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	53,399	1.32	0.002	1.74	1.8E+08	470
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	37,748	2.35	0.062	5.51	2.5E+07	540
42	Wholesale Trade	548,908	7.78	0.066	60.49	6.7E+07	985
45	Sporting Goods, Hobby, Books & Music Stores	255,977	2.06	0.249	4.23	2.3E+07	80
51	Information	39,140	6.85	0.636	46.95	5.3E+06	40
55	Management of Companies and Enterprises	231,297	1.61	0.178	2.60	7.3E+07	30

Table 155: Freight Production 3-Digit NAICS-Road Modes–Linear Models (CFS 2007)

CFS - New York - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (except Oil and Gas)	25,335,647	5.20	0.542	27.02	4.36E+08	65
311	Food Manufacturing	722,970	8.28	0.506	68.61	8.61E+07	100
312	Beverage and Tobacco Product Manufacturing	2,115,619	10.29	0.873	105.91	6.05E+07	25
314	Textile Product Mills	38,337	3.26	0.602	10.66	1.63E+06	15
321	Wood Product Manufacturing	640,232	4.24	0.431	17.99	1.97E+07	60
322	Paper Manufacturing	591,017	5.16	0.466	26.64	8.42E+07	60
323	Printing and Related Support Activities	323,522	2.71	0.514	7.34	2.09E+07	55
325	Chemical Manufacturing	11,948	2.34	0.011	5.47	3.64E+07	100
327	Nonmetallic Mineral Product Manufacturing	1,044,915	4.53	0.174	20.54	1.18E+08	90
331	Primary Metal Manufacturing	520,289	3.48	0.428	12.13	9.58E+07	40
332	Fabricated Metal Product Manufacturing	59,649	3.68	0.164	13.52	1.04E+07	125
333	Machinery Manufacturing	35,581	1.57	0.236	2.47	9.40E+06	95
335	Electrical Equipment, Appliance, and Component Manufacturing	10,050	1.83	0.190	3.34	1.98E+06	30
336	Transportation Equipment Manufacturing	76,299	2.05	0.364	4.20	3.20E+07	50
337	Furniture and Related Product Manufacturing	26,976	3.61	0.236	13.02	4.02E+06	50
423	Merchant Wholesalers, Durable Goods	206,510	5.36	0.093	28.75	1.59E+07	545
424	Merchant Wholesalers, Nondurable Goods	715,443	6.23	0.078	38.77	9.94E+07	440
454	Nonstore Retailers	255,977	2.06	0.249	4.23	2.32E+07	80
511	Publishing Industries (except Internet)	39,140	6.85	0.636	46.95	5.30E+06	40
551	Management of Companies and Enterprises	231,297	1.61	0.178	2.59	7.26E+07	30

Table 156: Freight Production 2-Digit NAICS-All Modes-Non-Linear Model-Lin-Log (CFS 2007)

CFS - New York - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Mining	246,867,379	7.91	0.450	62.58	4.94E+08	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	16,281,311	6.84	0.175	46.74	9.80E+07	180
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	20,645,218	6.66	0.081	44.37	1.80E+08	470
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	2,401,143	5.12	0.035	26.23	3.32E+07	540
42	Wholesale Trade	8,529,135	7.67	0.054	58.77	7.01E+07	985
45	Sporting Goods, Hobby, Books & Music	6,315,305	6.26	0.253	39.18	2.40E+07	80
49	Postal Service, Couriers & Messengers, Warehousing & Storage	25,309,371	2.85	0.186	8.15	9.52E+07	30
51	Information	1,594,972	3.17	0.204	10.06	7.85E+06	40
55	Management of Companies and Enterprises	10,991,421	2.46	0.099	6.07	7.60E+07	35

Table 157: Freight Production 2-Digit NAICS-All Modes–Non-Linear Model-Log-Log (CFS 2007)

CFS - New York - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	16.11	17.01	1.28	3.45	0.259	11.87	5.67	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	9.34	11.48	1.40	6.59	0.447	43.45	5.95	180
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	11.42	11.87	1.12	4.04	0.179	16.32	11.29	470
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	7.60	18.56	1.35	12.47	0.540	155.61	3.93	540
42	Wholesale Trade	10.58	29.95	1.06	8.61	0.127	74.21	10.10	985
45	Sporting Goods, Hobby, Books & Music Stores	11.50	7.90	1.14	2.29	0.220	5.23	8.96	80
49	Postal Service, Couriers & Messengers, Warehousing & Storage	13.20	7.39	0.64	1.30	0.053	1.68	9.05	30
51	Information	6.37	20.58	1.34	9.69	0.601	93.89	4.15	40
55	Management of Companies and Enterprises	-	-	4.10	10.6	0.838	112.11	21.70	35

Table 158: Freight Production 2-Digit NAICS-All Modes-Non-Linear Model-Log-Lin (CFS 2007)

CFS - New York - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	17.54	26.19	0.049	3.26	0.074	10.66	7.09	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	11.77	25.37	0.024	7.77	0.307	60.43	7.46	180
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	13.85	33.44	0.002	1.41	0.008	1.99	13.64	470
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	10.27	36.06	0.006	3.22	0.119	10.37	7.53	540
42	Wholesale Trade	11.96	58.45	0.029	8.02	0.068	64.28	10.77	985
45	Sporting Goods, Hobby, Books & Music Stores	13.26	17.05	0.014	1.90	0.034	3.62	11.09	80
49	Postal Service, Couriers & Messengers, Warehousing & Storage	13.82	10.92	0.010	3.26	0.057	10.65	9.02	30
51	Information	8.37	10.41	0.010	3.90	0.256	15.22	7.74	40
55	Management of Companies and Enterprises	10.1	4.80	0.009	2.2	0.045	4.91	23.99	35

Table 159: Freight Production 3-Digit NAICS-All Modes–Non-Linear Model-Lin-Log (CFS 2007)

CFS - New York - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (Except Oil and Gas)	246,867,379	7.91	0.450	62.58	4.94E+08	65
311	Food Manufacturing	20,865,881	7.17	0.327	51.42	1.02E+08	100
312	Beverage and Tobacco Manufacturing	37,826,939	3.16	0.225	10.01	1.52E+08	25
313	Textile Mills	419,055	1.95	0.124	3.80	2.10E+06	15
314	Textile Product Mills	468,595	2.52	0.227	6.36	2.32E+06	15
315	Apparel Manufacturing	178,778	2.60	0.268	6.77	6.06E+05	20
321	Wood Product Manufacturing	6,033,498	5.27	0.296	27.73	2.21E+07	60
322	Paper Manufacturing	20,232,004	3.86	0.189	14.93	1.57E+08	60
323	Printing and Related Support Activities	2,634,454	1.86	0.024	3.46	3.06E+07	55
324	Petroleum and Coal Products Manufacturing	180,043,872	3.78	0.351	14.26	4.18E+08	20
325	Chemical Manufacturing	11,510,364	2.91	0.055	8.44	1.12E+08	100
326	Plastics and Rubber Products Manufacturing	3,146,431	5.48	0.224	30.05	1.91E+07	90
327	Nonmetallic Mineral Product Manufacturing	30,485,284	6.98	0.340	48.78	1.07E+08	90
331	Primary Metal Manufacturing	18,595,964	3.40	0.169	11.58	1.53E+08	40
332	Fabricated Metal Product Manufacturing	1,412,150	4.21	0.103	17.69	1.08E+07	125
333	Machinery Manufacturing	964,732	2.25	0.047	5.05	1.16E+07	95
334	Computer and Electronic Product	153,129	3.66	0.131	13.37	9.15E+05	70
335	Electrical Equipment, Appliance, and Component Manufacturing	335,552	2.33	0.097	5.45	2.11E+06	30
336	Transportation Equipment Manufacturing	5,384,491	2.13	0.086	4.55	5.44E+07	50
337	Furniture and Related Product Manufacturing	701,716	3.52	0.184	12.39	4.15E+06	50
339	Miscellaneous Manufacturing	328,636	4.39	0.157	19.26	1.66E+06	80
423	Merchant Wholesalers, Durable Goods	2,798,542	7.31	0.066	53.44	2.07E+07	545
424	Merchant Wholesalers, Nondurable Goods	16,085,108	6.45	0.087	41.62	1.02E+08	440
454	Nonstore Retailers	6,315,305	6.26	0.253	39.18	2.40E+07	80
493	Warehousing and Storage	25,309,371	2.85	0.186	8.15	9.52E+07	30
511	Publishing Industries (except Internet)	1,594,972	3.17	0.204	10.06	7.85E+06	40
551	Management of Companies and Enterprises	10,991,421	2.46	0.099	6.07	7.60E+07	30

Table 160: Freight Production 3-Digit NAICS-All Modes–Non-Linear Model-Log-Log (CFS 2007)

CFS - New York - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (Except Oil and Gas)	16.11	17.01	1.28	3.45	0.259	11.87	5.67	65
311	Food Manufacturing	9.00	17.04	1.76	18.53	0.618	343.21	4.61	100
312	Beverage and Tobacco Manufacturing	11.97	16.92	1.13	6.33	0.431	40.03	4.13	25
313	Textile Mills	9.63	18.38	0.84	2.84	0.243	8.07	2.56	15
314	Textile Product Mills	7.01	17.28	1.66	10.06	0.768	101.11	0.90	15
315	Apparel Manufacturing	8.12	15.86	0.97	4.39	0.504	19.25	1.75	20
321	Wood Product Manufacturing	9.83	7.62	1.86	4.30	0.586	18.45	3.72	60
322	Paper Manufacturing	9.60	9.56	1.71	7.86	0.704	61.85	1.72	60
323	Printing and Related Support Activities	7.84	7.85	1.48	4.76	0.690	22.66	1.93	55
324	Petroleum and Coal Products Manufacturing	-	-	9.08	7.62	0.735	58.01	94.33	20
325	Chemical Manufacturing	8.89	14.20	1.57	9.76	0.562	95.24	4.20	100
326	Plastics and Rubber Products Manufacturing	6.29	8.34	2.09	11.14	0.783	124.21	2.05	90
327	Nonmetallic Mineral Product Manufacturing	14.62	8.81	0.59	1.28	0.053	1.63	9.63	90
331	Primary Metal Manufacturing	9.86	13.42	1.40	8.92	0.496	79.63	3.66	40
332	Fabricated Metal Product Manufacturing	8.77	8.60	1.19	4.28	0.426	18.32	4.87	125
333	Machinery Manufacturing	7.61	25.15	1.31	19.22	0.722	369.41	1.72	95
334	Computer and Electronic Product	6.98	20.08	1.06	11.60	0.650	134.50	1.43	70
335	Electrical Equipment, Appliance, and Component Manufacturing	8.32	8.47	1.12	4.28	0.596	18.31	1.67	30
336	Transportation Equipment Manufacturing	9.85	16.89	0.96	8.44	0.515	71.21	3.01	50
337	Furniture and Related Product Manufacturing	7.72	22.82	1.49	14.96	0.748	223.82	1.13	50
339	Miscellaneous Manufacturing	6.60	7.57	1.39	5.66	0.482	31.99	4.35	80
423	Merchant Wholesalers, Durable Goods	9.28	18.11	1.21	6.58	0.143	43.32	10.53	545
424	Merchant Wholesalers, Nondurable Goods	12.09	30.34	0.97	6.99	0.177	48.83	6.21	440
454	Nonstore Retailers	11.50	7.90	1.14	2.29	0.220	5.23	8.96	80
493	Warehousing and Storage	-	-	5.33	7.92	0.497	62.78	104.01	30
511	Publishing Industries (except Internet)	6.37	20.58	1.34	9.69	0.601	93.89	4.15	40
551	Management of Companies and Enterprises	-	-	4.10	10.59	0.838	112.11	21.70	30

Table 161: Freight Production 3-Digit NAICS-All Modes–Non-Linear Model-Log-Lin (CFS 2007)

CFS - New York - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (Except Oil and Gas)	17.54	26.19	0.049	3.26	0.074	10.66	7.09	65
311	Food Manufacturing	13.12	16.83	0.020	5.76	0.351	33.18	7.84	100
312	Beverage and Tobacco Manufacturing	13.42	17.14	0.020	2.70	0.259	7.29	5.38	25
313	Textile Mills	10.83	28.58	0.029	3.55	0.228	12.62	2.61	15
314	Textile Product Mills	10.63	25.44	0.034	6.32	0.562	39.92	1.69	15
315	Apparel Manufacturing	-	-	0.083	1.83	0.116	3.35	87.18	20
321	Wood Product Manufacturing	12.51	13.55	0.074	3.54	0.277	12.57	6.48	60
322	Paper Manufacturing	14.90	27.52	0.013	3.93	0.333	15.42	3.88	60
323	Printing and Related Support Activities	10.22	15.42	0.023	3.98	0.327	15.88	4.20	55
324	Petroleum and Coal Products Manufacturing	-	-	0.638	3.20	0.232	10.22	273.05	20
325	Chemical Manufacturing	12.13	19.61	0.001	1.89	0.015	3.57	9.44	100
326	Plastics and Rubber Products Manufacturing	11.78	13.41	0.018	3.47	0.288	12.05	6.71	90
327	Nonmetallic Mineral Product Manufacturing	-	-	0.141	8.16	0.205	66.61	208.60	90
331	Primary Metal Manufacturing	13.92	22.08	0.012	4.92	0.329	24.21	4.87	40
332	Fabricated Metal Product Manufacturing	10.77	17.11	0.017	4.42	0.179	19.57	6.95	125
333	Machinery Manufacturing	10.35	20.02	0.010	4.91	0.292	24.11	4.38	95
334	Computer and Electronic Product	8.85	22.56	0.003	2.73	0.128	7.47	3.56	70
335	Electrical Equipment, Appliance, and Component Manufacturing	10.11	12.92	0.010	3.08	0.214	9.51	3.26	30
336	Transportation Equipment Manufacturing	12.06	16.28	0.005	4.16	0.319	17.35	4.23	50
337	Furniture and Related Product Manufacturing	11.17	18.39	0.015	3.44	0.286	11.86	3.20	50
339	Miscellaneous Manufacturing	8.66	13.60	0.012	4.57	0.151	20.91	7.14	80
423	Merchant Wholesalers, Durable Goods	10.80	37.08	0.045	6.80	0.081	46.20	11.29	545
424	Merchant Wholesalers, Nondurable Goods	13.36	56.09	0.021	6.23	0.083	38.87	6.92	440
454	Nonstore Retailers	13.26	17.05	0.014	1.90	0.034	3.62	11.09	80
493	Warehousing and Storage	13.82	10.92	0.010	3.26	0.057	10.65	9.02	30
511	Publishing Industries (except Internet)	8.37	10.41	0.010	3.90	0.256	15.22	7.74	40
551	Management of Companies and Enterprises	10.12	4.80	0.009	2.22	0.045	4.91	23.99	30

Table 162: Freight Production 2-Digit NAICS-Road Mode–Non-Linear Model-Log-Lin (CFS 2007)

CFS - New York - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Mining	235,396,875	7.75	0.438	60.08	4.8E+08	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	15,786,981	6.72	0.170	45.22	9.7E+07	180
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	18,982,265	6.41	0.077	41.07	1.7E+08	470
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	2,007,680	5.62	0.043	31.59	2.5E+07	540
42	Wholesale Trade	8,006,293	7.48	0.052	55.95	6.7E+07	985
45	Sporting Goods, Hobby, Books & Music Stores	6,132,574	6.29	0.255	39.55	2.3E+07	80
51	Information	1,590,763	3.17	0.203	10.02	7.8E+06	40
55	Management of Companies and Enterprises	10,981,410	2.46	0.098	6.06	7.6E+07	30

Table 163: Freight Production 2-Digit NAICS-Road Mode–Non-Linear Model-Log-Log (CFS 2007)

CFS - New York - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	16.12	17.01	1.26	3.41	0.255	11.60	5.64	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	9.32	11.39	1.41	6.62	0.455	43.79	5.82	180
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	11.42	11.82	1.11	3.98	0.174	15.87	11.42	470
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	7.55	17.94	1.34	12.04	0.521	144.87	4.15	540
42	Wholesale Trade	10.55	30.22	1.04	8.49	0.124	72.14	9.98	985
45	Sporting Goods, Hobby, Books & Music Stores	11.51	7.91	1.111	2.21	0.200	4.90	9.50	80
51	Information	6.34	20.88	1.359	9.99	0.616	99.83	3.98	40
55	Management of Companies and Enterprises	-	-	4.08	10.62	0.839	112.83	21.43	30

Table 164: Freight Production 2-Digit NAICS-Road Mode–Non-Linear Model-Log-Lin (CFS 2007)

CFS - New York - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	17.51	26.22	0.048	3.25	0.233	28.54	7.01	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	11.74	25.37	0.024	7.80	0.312	60.81	7.32	180
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	13.82	33.21	0.002	1.42	0.008	2.00	13.72	470
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	10.20	35.34	0.006	3.10	0.111	9.59	7.69	540
42	Wholesale Trade	11.90	58.97	0.029	8.05	0.068	64.83	10.59	985
45	Sporting Goods, Hobby, Books & Music Stores	13.23	17.00	0.014	1.90	0.031	3.62	11.51	80
51	Information	8.35	10.48	0.010	3.89	0.264	15.17	7.58	40
55	Management of Companies and Enterprises	10.08	4.80	0.009	2.2	0.045	4.84	23.95	30

Table 165: Freight Production 3-Digit NAICS-Road Mode–Non-Linear Model-Lin-Log (CFS 2007)

CFS - New York - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (Except Oil and Gas)	235,396,875	7.75	0.438	60.08	4.83E+08	65
311	Food Manufacturing	20,343,134	7.05	0.319	49.67	1.01E+08	100
312	Beverage and Tobacco Manufacturing	36,277,995	3.08	0.214	9.48	1.51E+08	25
314	Textile Product Mills	462,165	2.55	0.233	6.51	2.26E+06	15
321	Wood Product Manufacturing	5,896,322	5.16	0.286	26.60	2.21E+07	60
322	Paper Manufacturing	17,231,624	5.49	0.326	30.16	9.46E+07	60
323	Printing and Related Support Activities	2,562,800	1.87	0.025	3.50	2.96E+07	55
325	Chemical Manufacturing	6,318,337	4.74	0.188	22.44	3.30E+07	100
327	Nonmetallic Mineral Product Manufacturing	29,737,028	6.88	0.335	47.29	1.06E+08	90
331	Primary Metal Manufacturing	15,281,532	3.74	0.205	13.97	1.13E+08	40
332	Fabricated Metal Product Manufacturing	1,396,123	4.16	0.100	17.29	1.08E+07	125
333	Machinery Manufacturing	881,285	2.28	0.049	5.20	1.05E+07	95
335	Electrical Equipment, Appliance, and Component Manufacturing	323,614	2.27	0.090	5.15	2.09E+06	30
336	Transportation Equipment Manufacturing	3,715,722	2.07	0.082	4.28	3.84E+07	50
337	Furniture and Related Product Manufacturing	696,881	3.49	0.181	12.20	4.16E+06	50
423	Merchant Wholesalers, Durable Goods	2,456,332	7.88	0.083	62.08	1.60E+07	545
424	Merchant Wholesalers, Nondurable Goods	15,324,097	6.35	0.084	40.32	9.90E+07	440
454	Nonstore Retailers	6,132,574	6.29	0.255	39.55	2.31E+07	80
511	Publishing Industries (except Internet)	1,590,763	3.17	0.203	10.02	7.84E+06	40
551	Management of Companies and Enterprises	10,981,410	2.46	0.098	6.06	7.60E+07	30

Table 166: Freight Production 3-Digit NAICS-Road Mode–Non-Linear Model-Log-Log (CFS 2007)

CFS - New York - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (Except Oil and Gas)	16.12	17.01	1.26	3.41	0.255	11.60	5.64	65
311	Food Manufacturing	9.01	17.09	1.75	18.46	0.614	340.61	4.64	100
312	Beverage and Tobacco Manufacturing	11.97	16.92	1.13	6.32	0.431	39.91	4.11	25
314	Textile Product Mills	7.02	17.32	1.66	10.04	0.767	100.76	0.90	15
321	Wood Product Manufacturing	9.84	7.61	1.85	4.27	0.585	18.21	3.69	60
322	Paper Manufacturing	9.65	9.66	1.69	7.81	0.697	60.93	1.73	60
323	Printing and Related Support Activities	7.84	7.82	1.46	4.69	0.683	21.97	1.95	55
325	Chemical Manufacturing	8.91	14.04	1.54	9.49	0.551	90.09	4.22	100
327	Nonmetallic Mineral Product Manufacturing	-	-	5.45	20.86	0.730	435.04	71.04	90
331	Primary Metal Manufacturing	9.89	13.41	1.37	8.70	0.458	75.70	4.08	40
332	Fabricated Metal Product Manufacturing	8.76	8.59	1.17	4.21	0.416	17.77	4.92	125
333	Machinery Manufacturing	7.64	25.34	1.27	17.78	0.690	316.13	1.89	95
335	Electrical Equipment, Appliance, and Component Manufacturing	8.35	8.44	1.09	4.15	0.581	17.22	1.70	30
336	Transportation Equipment Manufacturing	9.88	16.96	0.88	7.68	0.442	58.96	3.38	50
337	Furniture and Related Product Manufacturing	7.82	20.91	1.43	11.95	0.687	142.92	1.41	50
423	Merchant Wholesalers, Durable Goods	9.19	18.10	1.20	6.56	0.141	43.06	10.51	545
424	Merchant Wholesalers, Nondurable Goods	12.16	32.26	0.94	7.07	0.179	49.97	5.74	440
454	Nonstore Retailers	11.51	7.91	1.11	2.21	0.200	4.90	9.50	80
511	Publishing Industries (except Internet)	6.34	20.88	1.36	9.99	0.616	99.83	3.98	40
551	Management of Companies and Enterprises	-	-	4.08	10.62	0.839	112.83	21.43	30

Table 167: Freight Production 3-Digit NAICS-Road Mode–Non-Linear Model-Log-Lin (CFS 2007)

CFS - New York - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (Except Oil and Gas)	17.51	26.22	0.048	3.25	0.073	10.58	2.65	65
311	Food Manufacturing	13.09	16.91	0.020	5.79	0.352	33.49	2.79	100
312	Beverage and Tobacco Manufacturing	13.38	17.19	0.020	2.72	0.258	7.41	2.30	25
314	Textile Product Mills	10.62	25.49	0.034	6.31	0.562	39.87	1.30	15
321	Wood Product Manufacturing	12.50	13.57	0.073	3.53	0.276	12.46	2.54	60
322	Paper Manufacturing	14.89	27.70	0.013	3.95	0.329	15.63	1.96	60
323	Printing and Related Support Activities	10.16	15.51	0.023	4.01	0.332	16.08	2.03	55
325	Chemical Manufacturing	12.09	19.62	0.001	1.91	0.015	3.66	3.04	100
327	Nonmetallic Mineral Product Manufacturing	-	-	0.140	8.19	0.203	67.01	14.42	90
331	Primary Metal Manufacturing	13.86	22.02	0.012	5.01	0.312	25.09	2.28	40
332	Fabricated Metal Product Manufacturing	10.73	17.18	0.017	4.42	0.179	19.54	2.63	125
333	Machinery Manufacturing	10.31	20.26	0.009	4.48	0.267	20.10	2.12	95
335	Electrical Equipment, Appliance, and Component Manufacturing	10.10	12.94	0.010	2.99	0.205	8.94	1.80	30
336	Transportation Equipment Manufacturing	11.88	17.42	0.005	4.47	0.311	19.96	2.04	50
337	Furniture and Related Product Manufacturing	11.13	18.60	0.014	3.46	0.268	12.01	1.82	50
423	Merchant Wholesalers, Durable Goods	10.70	36.97	0.044	6.79	0.079	46.04	3.35	545
424	Merchant Wholesalers, Nondurable Goods	13.38	59.36	0.020	6.31	0.086	39.79	2.52	440
454	Nonstore Retailers	13.23	17.00	0.014	1.90	0.031	3.62	3.39	80
511	Publishing Industries (except Internet)	8.35	10.48	0.010	3.89	0.264	15.17	2.75	40
551	Management of Companies and Enterprises	10.08	4.80	0.009	2.20	0.045	4.84	4.89	30

CALIFORNIA

Table 168: Freight Production 2-Digit NAICS-All Modes–Linear Models (CFS 2007)

CFS - California - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Mining	31,294,508	3.52	0.113	12.36	2.24E+09	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	590,798	7.91	0.271	62.63	1.45E+08	470
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	551,889	1.65	0.021	2.72	5.31E+08	810
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	42,751	2.20	0.019	4.82	5.44E+07	1000
42	Wholesale Trade	610,208	8.22	0.032	67.54	1.32E+08	1890
45	Sporting Goods, Hobby, Books & Music	65,478	3.99	0.167	15.94	4.28E+06	70
49	Postal Service, Couriers & Messengers, Warehousing & Storage	962,702	6.32	0.303	39.90	1.27E+08	125
51	Information	126,226	10.62	0.834	112.74	9.73E+06	50
55	Management of Companies and Enterprises	212,740	2.45	0.014	6.00	1.62E+08	95

Table 169: Freight Production 3-Digit NAICS-All Modes–Linear Models (CFS 2007)

CFS - California - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (except Oil and Gas)	31,294,508	3.52	0.113	12.36	2.24E+09	65
311	Food Manufacturing	526,756	8.15	0.270	66.42	1.58E+08	290
312	Beverage and Tobacco Product Manufacturing	1,350,394	2.95	0.488	8.72	1.65E+08	70
313	Textile Mills	21,340	1.59	0.181	2.53	3.25E+06	20
314	Textile Product Mills	109,208	3.02	0.473	9.15	9.10E+06	30
315	Apparel Manufacturing	10,790	2.41	0.181	5.83	2.14E+06	50
316	Leather and Allied Product Manufacturing	2,921	2.79	0.218	7.77	3.52E+05	10
321	Wood Product Manufacturing	713,111	4.70	0.317	22.09	6.81E+07	105
322	Paper Manufacturing	689,784	7.22	0.513	52.08	6.77E+07	80
323	Printing and Related Support Activities	180,576	5.03	0.597	25.34	8.36E+06	90
324	Petroleum and Coal Products Manufacturing	9,622,939	3.48	0.293	12.12	8.58E+08	80
325	Chemical Manufacturing	31,388	1.21	0.002	1.47	1.01E+08	170
326	Plastics and Rubber Products Manufacturing	117,861	6.15	0.247	37.87	2.65E+07	140
327	Nonmetallic Mineral Product Manufacturing	3,393,056	4.66	0.173	21.72	4.69E+08	155
331	Primary Metal Manufacturing	1,961,209	3.27	0.600	10.72	2.01E+08	45
332	Fabricated Metal Product Manufacturing	88,210	4.43	0.102	19.59	1.73E+07	225
333	Machinery Manufacturing	18,939	2.94	0.386	8.67	2.58E+06	105
334	Computer and Electronic Product	1,913	2.48	0.119	6.15	1.55E+06	230
335	Electrical Equipment, Appliance, and Component Manufacturing	55,085	2.22	0.096	4.94	1.44E+07	80
336	Transportation Equipment Manufacturing	30,664	1.38	0.081	1.91	3.76E+07	95
337	Furniture and Related Product Manufacturing	89,697	5.73	0.156	32.79	1.74E+07	100
339	Miscellaneous Manufacturing	3,444	2.51	0.076	6.29	1.82E+06	115
423	Merchant Wholesalers, Durable Goods	293,427	5.04	0.061	25.44	3.85E+07	1075
424	Merchant Wholesalers, Nondurable Goods	852,945	7.13	0.037	50.89	2.06E+08	815
454	Nonstore Retailers	65,478	3.99	0.167	15.94	4.28E+06	70
493	Warehousing and Storage	962,702	6.32	0.303	39.90	1.27E+08	125
511	Publishing Industries (except Internet)	126,226	10.62	0.834	112.74	9.73E+06	50
551	Management of Companies and Enterprises	212,740	2.45	0.014	6.00	1.62E+08	95

Table 170: Freight Production 2-Digit NAICS-Road Modes–Linear Models (CFS 2007)

CFS - California - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Mining	22,824,611	4.64	0.393	21.57	7.6E+08	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	523,136	8.02	0.252	64.33	1.3E+08	470
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	282,044	1.76	0.010	3.08	3.8E+08	810
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	27,392	2.49	0.028	6.21	2.9E+07	1000
42	Wholesale Trade	569,334	8.60	0.034	73.91	1.2E+08	1890
49	Postal Service, Couriers & Messengers, Warehousing & Storage	952,758	6.32	0.303	39.98	1.3E+08	125
51	Information	126,123	10.58	0.834	111.95	9.7E+06	50
55	Management of Companies and Enterprises	202,911	2.46	0.014	6.06	1.6E+08	95

Table 171: Freight Production 3-Digit NAICS-Road Modes–Linear Models (CFS 2007)

CFS - California - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (except Oil and Gas)	22,824,611	4.64	0.393	21.57	7.62E+08	65
311	Food Manufacturing	465,422	9.54	0.255	91.07	1.45E+08	290
312	Beverage and Tobacco Product Manufacturing	1,200,033	2.73	0.442	7.45	1.61E+08	70
313	Textile Mills	21,301	1.59	0.181	2.53	3.25E+06	20
314	Textile Product Mills	104,372	2.89	0.532	8.37	7.75E+06	30
315	Apparel Manufacturing	9,366	2.71	0.189	7.36	1.81E+06	50
321	Wood Product Manufacturing	590,528	4.63	0.313	21.40	5.68E+07	105
322	Paper Manufacturing	644,367	7.35	0.552	53.97	5.84E+07	80
323	Printing and Related Support Activities	178,115	4.93	0.590	24.34	8.36E+06	90
324	Petroleum and Coal Products Manufacturing	3,187,020	3.36	0.058	11.29	6.83E+08	80
325	Chemical Manufacturing	21,700	1.31	0.001	1.71	7.57E+07	165
326	Plastics and Rubber Products Manufacturing	108,286	5.85	0.227	34.25	2.58E+07	140
327	Nonmetallic Mineral Product Manufacturing	2,955,178	4.39	0.211	19.28	3.62E+08	155
332	Fabricated Metal Product Manufacturing	78,014	4.37	0.091	19.07	1.62E+07	225
333	Machinery Manufacturing	17,012	2.80	0.357	7.84	2.46E+06	105
334	Computer and Electronic Product	1,489	2.01	0.078	4.05	1.51E+06	230
335	Electrical Equipment, Appliance, and Component Manufacturing	47,240	2.33	0.102	5.44	1.20E+07	80
336	Transportation Equipment Manufacturing	25,276	1.13	0.053	1.28	3.76E+07	95
337	Furniture and Related Product Manufacturing	78,845	8.36	0.478	69.86	7.01E+06	100
339	Miscellaneous Manufacturing	2,795	2.48	0.053	6.13	1.75E+06	115
423	Merchant Wholesalers, Durable Goods	270,730	4.98	0.059	24.78	3.60E+07	1075
424	Merchant Wholesalers, Nondurable Goods	798,142	7.59	0.039	57.58	1.87E+08	815
493	Warehousing and Storage	952,758	6.32	0.303	39.98	1.25E+08	125
511	Publishing Industries (except Internet)	126,123	10.58	0.834	111.95	9.74E+06	50
551	Management of Companies and Enterprises	202,911	2.46	0.014	6.06	1.55E+08	95

Table 172: Freight Production 2-Digit NAICS-All Modes-Non-Linear Model-Lin-Log (CFS 2007)

CFS - California - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Mining	424,606,800	3.35	0.182	11.24	2.15E+09	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	23,567,728	11.14	0.191	124.01	1.52E+08	470
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	60,417,115	8.86	0.087	78.54	5.13E+08	810
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	2,347,140	4.21	0.013	17.75	5.46E+07	1000
42	Wholesale Trade	14,215,616	10.19	0.052	103.83	1.31E+08	1890
45	Sporting Goods, Hobby, Books & Music	1,069,771	4.44	0.203	19.70	4.18E+06	70
49	Postal Service, Couriers & Messengers, Warehousing & Storage	35,170,984	7.00	0.290	48.97	1.28E+08	125
51	Information	3,831,102	3.12	0.133	9.75	2.22E+07	50
55	Management of Companies and Enterprises	27,776,524	3.91	0.163	15.29	1.49E+08	95

Table 173: Freight Production 2-Digit NAICS-All Modes–Non-Linear Model-Log-Log (CFS 2007)

CFS - California - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	16.13	18.56	1.29	4.50	0.378	20.28	2.71	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	9.54	12.85	1.55	8.77	0.458	76.97	7.31	470
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	12.92	16.97	0.94	4.44	0.097	19.73	15.42	810
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	7.22	26.44	1.32	18.11	0.508	327.84	4.17	1000
42	Wholesale Trade	10.80	45.46	1.30	16.22	0.236	263.03	7.58	1890
45	Sporting Goods, Hobby, Books & Music Stores	7.95	9.13	1.82	6.08	0.320	36.99	6.26	70
49	Postal Service, Couriers & Messengers, Warehousing & Storage	16.00	30.48	0.29	2.01	0.038	4.05	3.50	125
51	Information	7.06	9.16	1.27	6.45	0.450	41.63	4.54	50
55	Management of Companies and Enterprises	-	-	5.06	13.28	0.611	176.42	95.53	95

Table 174: Freight Production 2-Digit NAICS-All Modes–Non-Linear Model-Log-Lin (CFS 2007)

CFS - California - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	18.46	33.76	0.036	2.72	0.132	7.40	3.77	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	13.22	31.43	0.010	6.99	0.142	48.86	11.58	470
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	-	-	0.024	1.92	0.049	3.70	230.55	810
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	10.00	54.97	0.005	5.04	0.096	25.40	7.66	1000
42	Wholesale Trade	12.84	95.07	0.023	9.15	0.070	83.77	9.23	1890
45	Sporting Goods, Hobby, Books & Music Stores	10.85	18.31	0.032	4.41	0.072	19.44	8.53	70
49	Postal Service, Couriers & Messengers, Warehousing & Storage	16.42	50.81	0.006	4.27	0.052	18.23	3.44	125
51	Information	9.12	14.41	0.009	4.22	0.239	17.82	6.28	50
55	Management of Companies and Enterprises	-	-	0.031	3.09	0.045	9.54	234.58	95

Table 175: Freight Production 3-Digit NAICS-All Modes–Non-Linear Model-Lin-Log (CFS 2007)

CFS - California - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (except Oil and Gas)	424,606,800	3.35	0.182	11.24	2.15E+09	65
311	Food Manufacturing	29,286,811	10.96	0.294	120.09	1.56E+08	290
312	Beverage and Tobacco Product Manufacturing	39,038,842	4.49	0.185	20.14	2.08E+08	70
313	Textile Mills	455,842	2.03	0.104	4.13	3.40E+06	20
314	Textile Product Mills	2,048,024	2.90	0.196	8.43	1.12E+07	30
315	Apparel Manufacturing	313,203	3.32	0.133	11.04	2.20E+06	50
316	Leather and Allied Product Manufacturing	81,061	2.88	0.417	8.27	3.04E+05	10
321	Wood Product Manufacturing	13,875,575	5.68	0.204	32.30	7.35E+07	105
322	Paper Manufacturing	15,858,188	7.29	0.417	53.13	7.40E+07	80
323	Printing and Related Support Activities	2,023,073	4.19	0.113	17.53	1.24E+07	90
324	Petroleum and Coal Products Manufacturing	299,851,573	6.33	0.289	40.05	8.61E+08	80
325	Chemical Manufacturing	13,397,054	5.10	0.125	26.02	9.44E+07	170
326	Plastics and Rubber Products Manufacturing	4,263,735	7.31	0.245	53.40	2.65E+07	140
327	Nonmetallic Mineral Product Manufacturing	103,187,661	7.42	0.287	54.99	4.36E+08	155
331	Primary Metal Manufacturing	23,286,173	2.11	0.050	4.43	3.10E+08	45
332	Fabricated Metal Product Manufacturing	2,189,669	5.23	0.099	27.37	1.73E+07	225
333	Machinery Manufacturing	471,154	4.45	0.120	19.79	3.09E+06	105
334	Computer and Electronic Product	159,577	5.19	0.087	26.96	1.57E+06	230
335	Electrical Equipment, Appliance, and Component Manufacturing	1,394,323	2.65	0.056	7.02	1.47E+07	80
336	Transportation Equipment Manufacturing	3,002,591	2.44	0.053	5.94	3.81E+07	95
337	Furniture and Related Product Manufacturing	2,124,498	3.46	0.099	11.94	1.80E+07	100
339	Miscellaneous Manufacturing	267,461	4.44	0.097	19.73	1.80E+06	115
423	Merchant Wholesalers, Durable Goods	5,556,032	10.97	0.088	120.25	3.79E+07	1075
424	Merchant Wholesalers, Nondurable Goods	26,492,275	8.18	0.079	66.94	2.01E+08	815
454	Nonstore Retailers	1,069,771	4.44	0.203	19.70	4.18E+06	70
493	Warehousing and Storage	35,170,984	7.00	0.290	48.97	1.28E+08	125
511	Publishing Industries (except Internet)	3,831,102	3.12	0.133	9.75	2.22E+07	50
551	Management of Companies and Enterprises	27,776,524	3.91	0.163	15.29	1.49E+08	95

Table 176: Freight Production 3-Digit NAICS-All Modes–Non-Linear Model-Log-Log (CFS 2007)

CFS - California - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (except Oil and Gas)	16.13	18.56	1.29	4.50	0.378	20.28	2.71	65
311	Food Manufacturing	11.65	10.53	1.31	5.07	0.474	25.66	4.72	290
312	Beverage and Tobacco Product Manufacturing	9.14	16.30	1.77	11.88	0.763	141.09	2.99	70
313	Textile Mills	8.80	7.35	1.20	3.60	0.397	12.94	1.81	20
314	Textile Product Mills	10.78	41.85	0.89	6.95	0.438	48.29	2.38	30
315	Apparel Manufacturing	4.96	2.61	1.87	3.86	0.570	14.86	4.25	50
316	Leather and Allied Product Manufacturing	6.27	9.21	1.48	7.69	0.715	59.17	1.36	10
321	Wood Product Manufacturing	10.03	7.59	1.69	4.79	0.522	22.94	5.31	105
322	Paper Manufacturing	11.27	15.54	1.37	8.65	0.429	74.85	1.99	80
323	Printing and Related Support Activities	7.46	12.16	1.66	8.20	0.711	67.22	2.01	90
324	Petroleum and Coal Products Manufacturing	-	-	8.75	16.09	0.761	258.86	82.73	80
325	Chemical Manufacturing	9.79	10.63	1.61	6.07	0.372	36.80	7.24	170
326	Plastics and Rubber Products Manufacturing	6.92	3.23	1.97	3.84	0.564	14.75	4.82	140
327	Nonmetallic Mineral Product Manufacturing	-	-	5.52	22.47	0.725	505.03	84.06	155
331	Primary Metal Manufacturing	8.22	10.24	1.71	8.67	0.413	75.13	4.57	45
332	Fabricated Metal Product Manufacturing	7.32	11.43	1.48	7.66	0.524	58.63	4.32	225
333	Machinery Manufacturing	7.35	16.22	1.24	11.03	0.613	121.77	2.11	105
334	Computer and Electronic Product Manufacturing	6.48	9.58	1.07	7.12	0.532	50.72	3.19	230
335	Electrical Equipment, Appliance, and Component Manufacturing	6.60	6.50	1.47	5.43	0.501	29.47	3.53	80
336	Transportation Equipment Manufacturing	8.27	9.30	1.11	5.45	0.491	29.74	4.38	95
337	Furniture and Related Product Manufacturing	8.94	18.52	1.29	9.97	0.654	99.33	2.13	100
339	Miscellaneous Manufacturing	6.69	13.87	1.25	8.84	0.568	78.12	2.48	115
423	Merchant Wholesalers, Durable Goods	9.82	38.18	1.43	15.95	0.297	254.25	6.16	1075
424	Merchant Wholesalers, Nondurable Goods	12.35	31.90	1.09	8.73	0.199	76.24	7.49	815
454	Nonstore Retailers	7.95	9.13	1.82	6.08	0.320	36.99	6.26	70
493	Warehousing and Storage	16.00	30.48	0.29	2.01	0.038	4.05	3.50	125
511	Publishing Industries (except Internet)	7.06	9.16	1.27	6.45	0.450	41.63	4.54	50
551	Management of Companies and Enterprises	-	-	5.06	13.28	0.611	176.42	95.53	95

Table 177: Freight Production 3-Digit NAICS-All Modes–Non-Linear Model-Log-Lin (CFS 2007)

CFS - California - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (except Oil and Gas)	18.46	33.76	0.036	2.72	0.132	7.40	3.77	65
311	Food Manufacturing	15.20	29.15	0.006	4.98	0.128	24.80	7.84	290
312	Beverage and Tobacco Product Manufacturing	12.05	16.28	0.015	2.39	0.230	5.70	9.72	70
313	Textile Mills	11.96	20.51	0.010	2.28	0.124	5.19	2.63	20
314	Textile Product Mills	12.45	19.97	0.015	4.07	0.240	16.56	3.21	30
315	Apparel Manufacturing	9.24	8.03	0.016	3.05	0.197	9.30	7.93	50
316	Leather and Allied Product Manufacturing	-	-	0.103	3.32	0.408	11.02	72.82	10
321	Wood Product Manufacturing	13.20	15.10	0.025	3.76	0.190	14.11	9.00	105
322	Paper Manufacturing	15.59	42.31	0.014	4.75	0.283	22.59	2.50	80
323	Printing and Related Support Activities	9.95	23.32	0.029	5.52	0.341	30.48	4.59	90
324	Petroleum and Coal Products Manufacturing	18.37	42.72	0.006	3.40	0.004	11.54	5.95	80
325	Chemical Manufacturing	-	-	0.007	1.84	0.015	3.40	194.7	170
326	Plastics and Rubber Products Manufacturing	12.71	12.62	0.012	2.99	0.172	8.95	9.14	140
327	Nonmetallic Mineral Product Manufacturing	16.71	22.97	0.012	2.45	0.023	6.00	15.23	155
331	Primary Metal Manufacturing	13.38	25.87	0.013	4.99	0.263	24.87	5.74	45
332	Fabricated Metal Product Manufacturing	9.92	25.47	0.024	6.05	0.235	36.56	6.95	225
333	Machinery Manufacturing	9.50	25.79	0.011	4.87	0.242	23.70	4.14	105
334	Computer and Electronic Product Manufacturing	8.91	21.94	0.004	2.96	0.151	8.75	5.79	230
335	Electrical Equipment, Appliance, and Component Manufacturing	9.74	17.78	0.016	4.56	0.257	20.82	5.24	80
336	Transportation Equipment Manufacturing	10.98	15.53	0.003	3.31	0.102	10.96	7.72	95
337	Furniture and Related Product Manufacturing	11.43	28.56	0.019	4.45	0.343	19.79	4.04	100
339	Miscellaneous Manufacturing	8.71	25.23	0.006	3.06	0.135	9.34	4.97	115
423	Merchant Wholesalers, Durable Goods	12.04	72.84	0.027	5.17	0.079	26.71	8.08	1075
424	Merchant Wholesalers, Nondurable Goods	14.09	66.43	0.017	7.81	0.063	61.01	8.76	815
454	Nonstore Retailers	10.85	18.31	0.032	4.41	0.072	19.44	8.53	70
493	Warehousing and Storage	16.42	50.81	0.006	4.27	0.052	18.23	3.44	125
511	Publishing Industries (except Internet)	9.12	14.41	0.009	4.22	0.239	17.82	6.28	50
551	Management of Companies and Enterprises	-	-	0.031	3.09	0.045	9.54	234.6	95

Table 178: Freight Production 2-Digit NAICS-Road Mode–Non-Linear Model-Lin-Log (CFS 2007)

CFS - California - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Mining	285,150,949	8.59	0.514	73.71	6.8E+08	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	21,286,700	10.85	0.185	117.81	1.4E+08	470
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	48,684,193	9.27	0.113	85.99	3.6E+08	810
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	1,780,223	5.99	0.028	35.82	2.9E+07	1000
42	Wholesale Trade	13,291,802	10.04	0.055	100.85	1.2E+08	1890
49	Postal Service, Couriers & Messengers, Warehousing & Storage	34,563,636	6.93	0.287	47.97	1.3E+08	125
51	Information	3,821,957	3.12	0.132	9.70	2.2E+07	50
55	Management of Companies and Enterprises	26,140,670	3.80	0.156	14.40	1.4E+08	95

Table 179: Freight Production 2-Digit NAICS-Road Mode–Non-Linear Model-Log-Log (CFS 2007)

CFS - California - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	16.16	18.54	1.22	4.31	0.352	18.61	2.71	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	9.42	12.59	1.57	8.78	0.467	77.08	7.22	470
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	13.23	17.99	0.83	4.07	0.083	16.56	14.55	810
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	7.24	26.41	1.27	17.31	0.475	299.47	4.40	1000
42	Wholesale Trade	10.67	44.38	1.30	16.06	0.230	257.94	7.83	1890
49	Postal Service, Couriers & Messengers, Warehousing & Storage	15.99	30.4	0.29	2	0.037	3.9993	3.49	125
51	Information	6.999	9.09	1.32	7.22	0.513	52.18	3.86	50
55	Management of Companies and Enterprises	-	-	5.06	13.3	0.611	176	95.5	95

Table 180: Freight Production 2-Digit NAICS-Road Mode–Non-Linear Model-Log-Lin (CFS 2007)

CFS - California - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	18.37	34.23	0.034	2.64	0.120	6.98	3.68	65
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	13.14	30.84	0.010	6.93	0.140	48.00	11.62	470
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	-	-	0.024	1.93	0.048	3.71	226.5	810
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	9.96	55.10	0.005	4.80	0.081	23.03	7.65	1000
42	Wholesale Trade	12.72	93.19	0.023	8.86	0.068	78.50	9.44	1890
49	Postal Service, Couriers & Messengers, Warehousing & Storage	16.41	50.63	0.01	4.28	0.053	18.33	3.43	125
51	Information	9.05	14.63	0.01	4.22	0.264	17.79	5.69	50
55	Management of Companies and Enterprises	-	-	0.03	3.09	0.044	9.55	232.12	95

Table 181: Freight Production 3-Digit NAICS-Road Mode-Non-Linear Model-Lin-Log (CFS 2007)

CFS - California - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (except Oil and Gas)	22,824,611	4.64	0.393	21.57	7.62E+08	65
311	Food Manufacturing	465,422	9.54	0.255	91.07	1.45E+08	290
312	Beverage and Tobacco Product Manufacturing	1,200,033	2.73	0.442	7.45	1.61E+08	70
313	Textile Mills	21,301	1.59	0.181	2.53	3.25E+06	20
314	Textile Product Mills	104,372	2.89	0.532	8.37	7.75E+06	30
315	Apparel Manufacturing	9,366	2.71	0.189	7.36	1.81E+06	50
321	Wood Product Manufacturing	590,528	4.63	0.313	21.40	5.68E+07	105
322	Paper Manufacturing	644,367	7.35	0.552	53.97	5.84E+07	80
323	Printing and Related Support Activities	178,115	4.93	0.590	24.34	8.36E+06	90
324	Petroleum and Coal Products Manufacturing	3,187,020	3.36	0.058	11.29	6.83E+08	80
325	Chemical Manufacturing	21,700	1.31	0.001	1.71	7.57E+07	165
326	Plastics and Rubber Products Manufacturing	108,286	5.85	0.227	34.25	2.58E+07	140
327	Nonmetallic Mineral Product Manufacturing	2,955,178	4.39	0.211	19.28	3.62E+08	155
332	Fabricated Metal Product Manufacturing	78,014	4.37	0.091	19.07	1.62E+07	225
333	Machinery Manufacturing	17,012	2.80	0.357	7.84	2.46E+06	105
334	Computer and Electronic Product	1,489	2.01	0.078	4.05	1.51E+06	230
335	Electrical Equipment, Appliance, and Component Manufacturing	47,240	2.33	0.102	5.44	1.20E+07	80
336	Transportation Equipment Manufacturing	25,276	1.13	0.053	1.28	3.76E+07	95
337	Furniture and Related Product Manufacturing	78,845	8.36	0.478	69.86	7.01E+06	100
339	Miscellaneous Manufacturing	2,795	2.48	0.053	6.13	1.75E+06	115
423	Merchant Wholesalers, Durable Goods	270,730	4.98	0.059	24.78	3.60E+07	1075
424	Merchant Wholesalers, Nondurable Goods	798,142	7.59	0.039	57.58	1.87E+08	815
493	Warehousing and Storage	952,758	6.32	0.303	39.98	1.25E+08	125
511	Publishing Industries (except Internet)	126,123	10.58	0.834	111.95	9.74E+06	50
551	Management of Companies and Enterprises	202,911	2.46	0.014	6.06	1.55E+08	95

Table 182: Freight Production 3-Digit NAICS-Road Mode–Non-Linear Model-Log-Log (CFS 2007)

CFS - California - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (except Oil and Gas)	16.16	18.54	1.22	4.31	0.352	18.61	2.71	65
311	Food Manufacturing	11.64	10.55	1.29	5.02	0.476	25.16	4.58	290
312	Beverage and Tobacco Manufacturing	8.92	15.61	1.81	12.30	0.771	151.17	3.00	70
313	Textile Mills	8.81	7.34	1.19	3.57	0.395	12.74	1.80	20
314	Textile Product Mills	10.33	37.00	0.99	7.72	0.500	59.53	2.33	30
315	Apparel Manufacturing	4.74	2.61	1.91	4.14	0.580	17.10	4.27	50
321	Wood Product Manufacturing	10.05	7.58	1.67	4.71	0.518	22.22	5.27	105
322	Paper Manufacturing	11.31	15.58	1.35	8.55	0.423	73.05	1.98	80
323	Printing and Related Support Activities	7.91	19.33	1.53	10.52	0.737	110.61	1.50	90
324	Petroleum and Coal Products Manufacturing	17.21	16.16	0.74	1.52	0.074	2.31	5.44	80
325	Chemical Manufacturing	9.84	10.59	1.58	5.89	0.369	34.73	7.05	165
326	Plastics and Rubber Products Manufacturing	6.76	2.96	1.99	3.66	0.554	13.38	5.13	140
327	Nonmetallic Mineral Product Manufacturing	15.57	10.05	0.63	1.42	0.047	2.01	14.71	155
332	Fabricated Metal Product Manufacturing	7.35	11.53	1.46	7.58	0.516	57.43	4.34	225
333	Machinery Manufacturing	7.36	15.63	1.20	10.03	0.574	100.61	2.31	105
334	Computer and Electronic Product Manufacturing	6.45	9.33	0.99	6.49	0.476	42.08	3.48	230
335	Electrical Equipment, Appliance, and Component Manufacturing	6.67	6.56	1.42	5.22	0.476	27.30	3.64	80
336	Transportation Equipment Manufacturing	8.39	9.31	1.02	4.89	0.42	23.91	4.84	95
337	Furniture and Related Product Manufacturing	8.76	15.18	1.29	8.57	0.589	73.36	2.79	100
339	Miscellaneous Manufacturing	6.73	14.37	1.18	8.53	0.546	72.69	2.44	115
423	Merchant Wholesalers, Durable Goods	9.62	37.47	1.44	16.20	0.296	262.53	6.33	1075
424	Merchant Wholesalers, Nondurable Goods	12.23	31.04	1.10	8.66	0.195	74.99	7.77	815
493	Warehousing and Storage	15.99	30.38	0.29	2.00	0.037	4.00	3.49	125
511	Publishing Industries (except Internet)	6.999	9.09	1.32	7.22	0.513	52.18	3.86	50
551	Management of Companies and Enterprises	-	-	5.06	13.27	0.611	176.00	95.51	95

Table 183: Freight Production 3-Digit NAICS-Road Mode–Non-Linear Model-Log-Lin (CFS 2007)

CFS - California - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (except Oil and Gas)	18.37	34.23	0.034	2.64	0.120	6.98	3.68	65
311	Food Manufacturing	15.13	29.38	0.006	4.99	0.129	24.94	7.60	290
312	Beverage and Tobacco Manufacturing	11.90	15.40	0.015	2.38	0.221	5.64	10.20	70
313	Textile Mills	11.95	20.55	0.010	2.28	0.123	5.18	2.61	20
314	Textile Product Mills	12.22	16.93	0.015	3.73	0.246	13.95	3.51	30
315	Apparel Manufacturing	9.11	8.02	0.016	3.11	0.196	9.65	8.17	50
321	Wood Product Manufacturing	13.18	15.11	0.025	3.72	0.186	13.81	8.88	105
322	Paper Manufacturing	15.58	42.01	0.014	4.64	0.274	21.52	2.49	80
323	Printing and Related Support Activities	10.29	30.71	0.027	5.79	0.385	33.47	3.36	90
324	Petroleum and Coal Products Manufacturing	18.34	42.65	0.004	2.66	-0.004	7.06	5.89	80
325	Chemical Manufacturing	13.59	25.06	0.001	1.61	-0.002	2.58	11.17	165
326	Plastics and Rubber Products Manufacturing	12.64	12.05	0.012	2.85	0.159	8.11	9.67	140
327	Nonmetallic Mineral Product Manufacturing	16.70	22.95	0.011	2.28	0.020	5.21	15.12	155
332	Fabricated Metal Product Manufacturing	9.93	25.48	0.023	5.97	0.225	35.67	6.95	225
333	Machinery Manufacturing	9.47	24.95	0.011	4.90	0.219	24.05	4.21	105
334	Computer and Electronic Product Manufacturing	8.73	21.46	0.003	2.92	0.129	8.53	5.78	230
335	Electrical Equipment, Appliance, and Component Manufacturing	9.70	17.90	0.016	4.58	0.249	20.97	5.21	80
336	Transportation Equipment Manufacturing	10.91	15.61	0.002	2.20	0.048	4.84	7.86	95
337	Furniture and Related Product Manufacturing	11.24	27.72	0.019	4.49	0.324	20.15	4.59	100
339	Miscellaneous Manufacturing	8.70	26.23	0.005	3.15	0.124	9.94	4.60	115
423	Merchant Wholesalers, Durable Goods	11.90	71.30	0.027	4.93	0.075	24.31	8.24	1075
424	Merchant Wholesalers, Nondurable Goods	13.97	64.71	0.018	7.82	0.063	61.14	9.04	815
493	Warehousing and Storage	16.41	50.63	0.006	4.28	0.053	18.33	3.43	125
511	Publishing Industries (except Internet)	9.05	14.63	0.009	4.22	0.264	17.79	5.69	50
551	Management of Companies and Enterprises	-	-	0.030	3.09	0.044	9.55	232.12	95

TEXAS

Table 184: Freight Production 2-Digit NAICS-All Modes–Linear Models (CFS 2007)

CFS - Texas - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Mining	48,689,606	8.07	0.571	65.11	1.25E+09	60
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	580,353	5.01	0.279	25.15	1.78E+08	235
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	4,371,744	3.04	0.169	9.21	1.08E+09	730
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	64,431	2.01	0.041	4.04	8.30E+07	700
42	Wholesale Trade	757,778	3.68	0.015	13.52	2.73E+08	1245
45	Sporting Goods, Hobby, Books & Music	37,277	3.49	0.139	12.20	2.31E+06	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	1,329,914	4.00	0.390	15.98	1.13E+08	85
51	Information	42,013	5.78	0.858	33.40	2.24E+06	25

Table 185: Freight Production 3-Digit NAICS-All Modes–Linear Models (CFS 2007)

CFS - Texas - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (except Oil and Gas)	48,689,606	8.07	0.571	65.11	1.25E+09	60
311	Food Manufacturing	429,910	8.64	0.430	74.59	1.12E+08	165
312	Beverage and Tobacco Product Manufacturing	3,736,219	8.04	0.859	64.63	2.48E+08	25
314	Textile Product Mills	65,915	2.21	0.527	4.90	3.66E+06	15
315	Apparel Manufacturing	40,207	1.35	0.076	1.82	7.06E+06	10
321	Wood Product Manufacturing	913,417	3.77	0.448	14.19	6.74E+07	85
322	Paper Manufacturing	1,352,247	3.67	0.586	13.49	1.76E+08	40
323	Printing and Reltaed Support Activities	168,462	2.26	0.288	5.13	1.40E+07	65
324	Petroleum and Coal Products Manufacturing	23,145,410	4.87	0.731	23.67	1.68E+09	60
325	Chemical Manufacturing	1,473,751	2.74	0.205	7.50	4.38E+08	225
326	Plastics and Rubber Products Manufacturing	288,629	5.83	0.669	33.97	2.85E+07	115
327	Nonmetallic Mineral Product Manufacturing	3,725,196	2.76	0.163	7.63	5.17E+08	150
331	Primary Metal Manufacturing	973,844	3.52	0.378	12.38	2.67E+08	55
332	Fabricated Metal Product Manufacturing	155,994	7.48	0.264	55.91	2.54E+07	200
333	Machinery Manufacturing	93,585	5.50	0.471	30.30	1.97E+07	130
334	Computer and Electronic Product Manufacturing	6,505	0.92	0.096	0.85	1.26E+07	85
335	Electrical Equipment, Appliance, and Component Manufacturing	51,356	3.40	0.391	11.53	9.91E+06	30
336	Transportation Equipment Manufacturing	48,289	1.65	0.224	2.74	3.30E+07	60
337	Furniture and Related Product Manufacturing	98,524	7.38	0.637	54.53	6.40E+06	75
339	Miscellaneous Manufacturing	37,210	3.07	0.295	9.40	6.13E+06	65
423	Merchan Wholesalers, Durable Goods	409,823	1.82	0.013	3.33	1.37E+08	730
424	Merchant Wholesalers, Nondurable Goods	1,080,614	4.91	0.018	24.11	3.99E+08	510
454	Nonstore Retailers	37,277	3.49	0.139	12.20	2.31E+06	50
493	Warehousing and Storage	1,329,914	4.00	0.390	15.98	1.13E+08	85
511	Publishing Industries (except Internet)	42,013	5.78	0.858	33.40	2.24E+06	25

Table 186: Freight Production 2-Digit NAICS-Road Modes– Linear Models (CFS 2007)

CFS - Texas - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Mining	31,516,621	5.47	0.444	29.97	1.0E+09	60
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	539,411	4.75	0.264	22.55	1.7E+08	235
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	719,978	4.19	0.064	17.56	3.0E+08	730
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	47,611	2.01	0.045	4.02	5.9E+07	700
42	Wholesale Trade	588,205	4.05	0.034	16.39	1.4E+08	1245
49	Postal Service, Couriers & Messengers, Warehousing & Storage	1,325,751	3.98	0.390	15.87	1.1E+08	85
51	Postal Service, Couriers & Messengers,	41,393	5.67	0.841	32.13	2.4E+06	25

Table 187: Freight Production 3-Digit NAICS for Road Modes - Linear Models (CFS 2007)

CFS - Texas - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (except Oil and Gas)	31,516,621	5.47	0.444	29.97	1.04E+09	60
311	Food Manufacturing	385,644	9.26	0.464	85.70	9.42E+07	165
321	Wood Product Manufacturing	769,736	3.45	0.442	11.91	5.75E+07	85
322	Paper Manufacturing	809,648	4.94	0.753	24.42	7.23E+07	40
323	Printing and Related Support Activities	166,740	2.24	0.285	5.00	1.40E+07	65
324	Petroleum and Coal Products Manufacturing	1,413,470	2.58	0.110	6.64	4.53E+08	60
325	Chemical Manufacturing	298,897	4.07	0.275	16.60	7.33E+07	225
326	Plastics and Rubber Products Manufacturing	265,060	5.98	0.677	35.78	2.57E+07	115
327	Nonmetallic Mineral Product Manufacturing	3,459,746	2.74	0.157	7.50	4.90E+08	150
331	Primary Metal Manufacturing	638,526	2.98	0.342	8.86	1.89E+08	55
332	Fabricated Metal Product Manufacturing	152,537	7.44	0.267	55.37	2.47E+07	200
333	Machinery Manufacturing	89,553	5.41	0.459	29.30	1.93E+07	130
334	Computer and Electronic Product Manufacturing	6,456	0.92	0.095	0.84	1.26E+07	85
335	Electrical Equipment, Appliance, and Component Manufacturing	50,557	3.38	0.384	11.40	9.90E+06	30
336	Transportation Equipment Manufacturing	22,877	1.50	0.124	2.26	2.18E+07	60
339	Miscellaneous Manufacturing	26,335	3.47	0.320	12.01	4.10E+06	65
423	Merchant Wholesalers, Durable Goods	368,432	1.77	0.011	3.13	1.35E+08	730
424	Merchant Wholesalers, Nondurable Goods	792,114	12.21	0.068	149.18	1.51E+08	510
493	Warehousing and Storage	1,325,751	3.98	0.390	15.87	1.13E+08	85
511	Publishing Industries (except Internet)	41,393	5.67	0.841	32.13	2.36E+06	25

Table 188: Freight Production 2-Digit NAICS-All Modes–Non-Linear Model-Lin-Log (CFS 2007)

CFS - Texas - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Mining	522,087,613	7.14	0.446	50.94	1.41E+09	60
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	28,930,812	7.42	0.180	55.04	1.90E+08	235
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	103,692,655	7.09	0.052	50.29	1.15E+09	730
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	5,554,549	6.08	0.040	36.93	8.31E+07	700
42	Wholesale Trade	21,107,112	6.47	0.028	41.89	2.72E+08	1245
45	Sporting Goods, Hobby, Books & Music	799,771	4.68	0.348	21.93	2.01E+06	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	30,201,083	5.01	0.186	25.12	1.30E+08	85
51	Information	1,273,006	3.04	0.245	9.23	5.16E+06	25
55	Management of Companies and Enterprises	58,485,178	2.18	0.069	4.74	4.68E+08	60

Table 189: Freight Production 2-Digit NAICS-All Modes–Non-Linear Model-Log-Log (CFS 2007)

CFS - Texas - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	15.86	14.74	1.30	4.33	0.347	18.78	5.01	60
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	10.02	14.29	1.55	9.24	0.521	85.45	5.76	235
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	12.32	23.18	1.18	8.46	0.228	71.56	10.50	730
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	8.20	23.11	1.38	16.65	0.534	277.30	4.57	700
42	Wholesale Trade	11.70	34.72	1.17	10.21	0.167	104.14	8.99	1245
45	Sporting Goods, Hobby, Books & Music Stores	9.20	12.91	1.52	5.12	0.330	26.18	5.09	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	14.69	20.13	0.54	2.17	0.074	4.73	5.36	85
51	Information	8.25	17.33	1.19	7.94	0.702	63.12	1.92	25
55	Management of Companies and Enterprises	-	-	5.22	13.33	0.644	177.58	85.93	60

Table 190: Freight Production 2-Digit NAICS-All Modes–Non-Linear Model-Log-Lin (CFS 2007)

CFS - Texas - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	17.66	25.28	0.055	4.03	0.222	16.22	5.97	60
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	13.73	30.23	0.007	4.70	0.127	22.06	10.48	235
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	14.57	49.72	0.010	4.10	0.078	16.80	12.55	730
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	11.59	46.34	0.003	2.23	0.078	4.98	9.04	700
42	Wholesale Trade	13.70	78.98	0.016	3.75	0.041	14.09	10.36	1245
45	Sporting Goods, Hobby, Books & Music Stores	11.28	19.11	0.027	3.25	0.038	10.56	7.31	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	15.46	35.78	0.008	4.47	0.036	19.95	5.58	85
51	Information	9.85	19.15	0.012	4.58	0.349	20.96	4.19	25
55	Management of Companies and Enterprises	-	-	0.018	2.80	0.026	7.85	234.95	60

Table 191: Freight Production 3-Digit NAICS- All Modes–Non-Linear Model-Lin-Log (CFS 2007)

CFS - Texas - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (Except Oil and Gas)	522,087,613	7.14	0.446	50.94	1.41E+09	60
311	Food Manufacturing	26,101,350	8.50	0.319	72.29	1.23E+08	165
312	Beverage and Tobacco Manufacturing	96,413,378	3.48	0.297	12.09	5.55E+08	25
314	Textile Product Mills	929,959	2.10	0.131	4.42	4.97E+06	15
315	Apparel Manufacturing	1,067,738	1.59	0.104	2.52	6.96E+06	10
321	Wood Product Manufacturing	16,340,824	5.26	0.198	27.66	8.12E+07	85
322	Paper Manufacturing	31,730,237	3.28	0.178	10.78	2.48E+08	40
323	Printing and Related Support Activities	1,887,651	2.57	0.057	6.63	1.61E+07	65
324	Petroleum and Coal Products Manufacturing	657,510,948	3.83	0.175	14.68	2.95E+09	60
325	Chemical Manufacturing	75,026,632	7.97	0.174	63.59	4.46E+08	225
326	Plastics and Rubber Products Manufacturing	6,805,859	5.29	0.186	27.98	4.46E+07	115
327	Nonmetallic Mineral Product Manufacturing	114,875,348	8.11	0.259	65.73	4.86E+08	150
331	Primary Metal Manufacturing	39,519,914	3.51	0.153	12.34	3.11E+08	55
332	Fabricated Metal Product Manufacturing	4,397,262	7.58	0.193	57.41	2.66E+07	200
333	Machinery Manufacturing	2,889,300	4.32	0.122	18.64	2.54E+07	130
334	Computer and Electronic Product Manufacturing	707,755	1.41	0.021	2.00	1.31E+07	85
335	Electrical Equipment, Appliance, and Component Manufacturing	2,389,584	4.36	0.357	18.99	1.02E+07	30
336	Transportation Equipment Manufacturing	3,672,614	2.57	0.096	6.62	3.56E+07	60
337	Furniture and Related Product Manufacturing	1,939,961	5.38	0.243	28.94	9.24E+06	75
339	Miscellaneous Manufacturing	983,396	3.58	0.129	12.80	6.82E+06	65
423	Merchant Wholesalers, Durable Goods	9,157,917	5.13	0.021	26.29	1.36E+08	730
424	Merchant Wholesalers, Nondurable Goods	39,588,964	5.10	0.045	26.03	3.93E+08	510
454	Nonstore Retailers	799,771	4.68	0.348	21.93	2.01E+06	50
493	Warehousing and Storage	30,201,083	5.01	0.186	25.12	1.30E+08	85
511	Publishing Industries (except Internet)	1,273,006	3.04	0.245	9.23	5.16E+06	25
551	Management of Companies and Enterprises	58,485,178	2.18	0.069	4.74	4.68E+08	60

Table 192: Freight Production 3-Digit NAICS-All Modes–Non-Linear Model-Log-Log (CFS 2007)

CFS - Texas - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (except Oil and Gas)	15.86	14.74	1.30	4.33	0.347	18.78	5.01	60
311	Food Manufacturing	11.49	18.19	1.35	8.86	0.607	78.48	3.04	165
312	Beverage and Tobacco Product Manufacturing	9.25	9.27	2.09	10.63	0.661	112.92	3.15	25
314	Textile Product Mills	9.13	11.56	0.97	3.72	0.346	13.83	2.87	15
315	Apparel Manufacturing	7.32	8.12	1.43	4.17	0.389	17.41	3.55	10
321	Wood Product Manufacturing	8.45	11.53	1.99	10.29	0.709	105.87	2.97	85
322	Paper Manufacturing	9.69	4.50	1.77	3.90	0.697	15.23	2.25	40
323	Printing and Related Support Activities	8.42	17.44	1.27	7.72	0.671	59.56	1.30	65
324	Petroleum and Coal Products Manufacturing	14.08	13.70	1.46	5.18	0.404	26.87	5.78	60
325	Chemical Manufacturing	12.42	21.41	1.26	8.65	0.418	74.90	5.82	225
326	Plastics and Rubber Products Manufacturing	9.20	11.78	1.56	7.89	0.731	62.21	2.20	115
327	Nonmetallic Mineral Product Manufacturing	15.74	13.96	0.71	2.30	0.081	5.31	10.47	150
331	Primary Metal Manufacturing	6.91	12.19	2.08	18.13	0.825	328.58	3.10	55
332	Fabricated Metal Product Manufacturing	8.89	12.26	1.48	8.10	0.529	65.69	3.84	200
333	Machinery Manufacturing	7.46	13.42	1.50	12.53	0.745	157.02	2.78	130
334	Computer and Electronic Product Manufacturing	5.89	5.04	1.30	5.04	0.580	25.41	3.72	85
335	Electrical Equipment, Appliance, and Component Manufacturing	10.02	7.75	1.01	3.70	0.508	13.66	3.13	30
336	Transportation Equipment Manufacturing	8.77	16.94	1.03	8.77	0.543	76.96	2.81	60
337	Furniture and Related Product Manufacturing	8.94	15.03	1.37	8.58	0.802	73.65	1.13	75
339	Miscellaneous Manufacturing	7.69	9.67	1.11	5.74	0.489	32.92	3.81	65
423	Merchant Wholesalers, Durable Goods	10.83	24.87	1.24	8.12	0.191	65.90	7.88	730
424	Merchant Wholesalers, Nondurable Goods	12.86	25.45	1.16	6.90	0.186	47.64	8.57	510
454	Nonstore Retailers	9.20	12.91	1.52	5.12	0.330	26.18	5.09	50
493	Warehousing and Storage	14.69	20.13	0.54	2.17	0.074	4.73	5.36	85
511	Publishing Industries (except Internet)	8.25	17.33	1.19	7.94	0.702	63.12	1.92	25
551	Management of Companies and Enterprises	-	-	5.22	13.33	0.644	177.58	85.93	60

Table 193: Freight Production 3-Digit NAICS-All Modes–Non-Linear Model-Log-Lin (CFS 2007)

CFS - Texas - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (except Oil and Gas)	17.66	25.28	0.055	4.03	0.222	16.22	5.97	60
311	Food Manufacturing	14.97	32.67	0.005	4.56	0.131	20.80	6.72	165
312	Beverage and Tobacco Product Manufacturing	16.03	17.01	0.011	2.87	0.262	8.22	6.88	25
314	Textile Product Mills	10.65	20.10	0.022	3.66	0.331	13.36	2.94	15
315	Apparel Manufacturing	10.65	13.07	0.017	2.50	0.154	6.24	4.92	10
321	Wood Product Manufacturing	11.82	21.87	0.032	5.70	0.370	32.46	6.42	85
322	Paper Manufacturing	15.17	14.54	0.012	2.83	0.306	8.02	5.16	40
323	Printing and Related Support Activities	10.37	37.44	0.027	7.16	0.476	51.20	2.07	65
324	Petroleum and Coal Products Manufacturing	16.22	21.40	0.010	5.39	0.138	29.07	8.35	60
325	Chemical Manufacturing	14.95	37.70	0.007	2.39	0.094	5.69	9.07	225
326	Plastics and Rubber Products Manufacturing	13.01	20.06	0.010	4.22	0.210	17.77	6.47	115
327	Nonmetallic Mineral Product Manufacturing	16.99	28.48	0.011	2.32	0.027	5.38	11.09	150
331	Primary Metal Manufacturing	12.01	9.42	0.012	3.86	0.314	14.93	12.17	55
332	Fabricated Metal Product Manufacturing	12.10	29.95	0.016	7.36	0.258	54.15	6.06	200
333	Machinery Manufacturing	10.85	17.62	0.010	5.60	0.293	31.39	7.69	130
334	Computer and Electronic Product Manufacturing	9.40	12.74	0.001	1.93	0.075	3.72	8.21	85
335	Electrical Equipment, Appliance, and Component Manufacturing	12.08	17.58	0.010	3.42	0.285	11.67	4.54	30
336	Transportation Equipment Manufacturing	11.40	26.17	0.003	3.31	0.214	10.94	4.83	60
337	Furniture and Related Product Manufacturing	11.37	25.93	0.019	5.09	0.408	25.94	3.36	75
339	Miscellaneous Manufacturing	9.45	17.49	0.016	5.26	0.329	27.70	5.00	65
423	Merchant Wholesalers, Durable Goods	13.01	57.85	0.016	1.92	0.036	3.69	9.39	730
424	Merchant Wholesalers, Nondurable Goods	14.76	54.90	0.014	5.73	0.044	32.87	10.06	510
454	Nonstore Retailers	11.28	19.11	0.027	3.25	0.038	10.56	7.31	50
493	Warehousing and Storage	15.46	35.78	0.008	4.47	0.036	19.95	5.58	85
511	Publishing Industries (except Internet)	9.85	19.15	0.012	4.58	0.349	20.96	4.19	25
551	Management of Companies and Enterprises	-	-	0.018	2.80	0.026	7.85	234.95	60

Table 194: Freight Production 2-Digit NAICS-Road Mode–Non-Linear Model-Lin-Log (CFS 2007)

CFS - Texas - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Mining	359,883,900	6.35	0.395	40.36	1.1E+09	60
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	26,970,714	7.20	0.171	51.85	1.8E+08	235
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	40,781,501	10.50	0.116	110.21	3.0E+08	730
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	4,360,175	6.61	0.050	43.65	5.8E+07	700
42	Wholesale Trade	14,769,009	9.07	0.051	82.24	1.4E+08	1245
49	Postal Service, Couriers & Messengers, Warehousing & Storages	30,027,564	4.99	0.185	24.89	1.3E+08	85
51	Postal Service, Couriers & Messengers, Warehousing & Storage	1,218,385	2.90	0.224	8.39	5.2E+06	25
55	Management of Companies and Enterprises	58,169,092	2.17	0.068	4.69	4.7E+08	60

Table 195: Freight Production 2-Digit NAICS-Road Mode–Non-Linear Model-Log-Log (CFS 2007)

CFS - Texas - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	15.99	15.40	1.16	4.06	0.299	16.47	4.92	60
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	9.95	14.04	1.55	9.17	0.513	84.07	5.92	235
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	12.23	22.58	1.12	7.89	0.206	62.18	10.79	730
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	8.19	23.03	1.36	16.49	0.525	271.78	4.66	700
42	Wholesale Trade	11.71	35.30	1.13	9.97	0.161	99.44	8.68	1245
49	Postal Service, Couriers & Messengers, Warehousing & Storage	14.30	20.10	0.68	2.80	0.117	7.84	5.30	85
51	Information	7.44	20.46	1.41	12.72	0.798	161.79	1.60	25
55	Management of Companies and Enterprises	-	-	5.17	13.40	0.643	179.51	84.46	60

Table 196: Freight Production 2-Digit NAICS-Road Mode–Non-Linear Model-Log-Lin (CFS 2007)

CFS - Texas - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	17.54	25.79	0.053	4.06	0.217	16.46	5.66	60
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	13.67	30.10	0.007	4.70	0.125	22.05	10.63	235
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	14.39	48.68	0.008	4.04	0.057	16.31	12.72	730
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	11.55	46.41	0.003	2.24	0.078	5.01	9.00	700
42	Wholesale Trade	13.63	80.06	0.015	3.63	0.040	13.19	9.91	1245
49	Postal Service, Couriers & Messengers, Warehousing & Storage	15.30	34.98	0.008	4.44	0.038	19.71	5.77	85
51	Information	10.17	20.16	0.011	4.87	0.335	23.72	3.67	25
55	Management of Companies and Enterprises	-	-	0.018	2.75	0.026	7.54	230.67	60

Table 197: Freight Production 3-Digit NAICS-Road Mode–Non-Linear Model-Lin-Log (CFS 2007)

CFS - Texas - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (Except Oil and Gas)	359,883,900	6.35	0.395	40.36	1.08E+09	60
311	Food Manufacturing	23,451,751	8.81	0.345	77.55	1.04E+08	165
321	Wood Product Manufacturing	13,693,827	5.22	0.192	27.21	6.91E+07	85
322	Paper Manufacturing	22,038,050	4.62	0.324	21.30	1.19E+08	40
323	Printing and Related Support Activities	1,859,197	2.55	0.055	6.49	1.61E+07	65
324	Petroleum and Coal Products Manufacturing	105,971,020	4.44	0.210	19.69	4.27E+08	60
325	Chemical Manufacturing	16,667,414	9.64	0.282	92.98	7.29E+07	225
326	Plastics and Rubber Products Manufacturing	6,293,540	5.36	0.191	28.73	4.06E+07	115
327	Nonmetallic Mineral Product Manufacturing	108,866,091	8.10	0.261	65.67	4.59E+08	150
331	Primary Metal Manufacturing	26,114,569	3.27	0.139	10.69	2.16E+08	55
332	Fabricated Metal Product Manufacturing	4,288,540	7.59	0.194	57.54	2.59E+07	200
333	Machinery Manufacturing	2,771,366	4.28	0.119	18.30	2.46E+07	130
334	Computer and Electronic Product Manufacturing	698,155	1.39	0.020	1.94	1.31E+07	85
335	Electrical Equipment, Appliance, and Component Manufacturing	2,346,465	4.28	0.349	18.32	1.02E+07	30
336	Transportation Equipment Manufacturing	2,266,513	2.65	0.095	7.01	2.21E+07	60
339	Miscellaneous Manufacturing	761,226	4.10	0.171	16.83	4.53E+06	65
423	Merchant Wholesalers, Durable Goods	8,310,361	4.78	0.017	22.81	1.34E+08	730
424	Merchant Wholesalers, Nondurable Goods	24,758,619	8.00	0.120	64.07	1.47E+08	510
493	Warehousing and Storage	30,027,564	4.99	0.185	24.89	1.30E+08	85
511	Publishing Industries (except Internet)	1,218,385	2.90	0.224	8.39	5.21E+06	25
551	Management of Companies and Enterprises	58,169,092	2.17	0.068	4.69	4.68E+08	60

Table 198: Freight Production 3-Digit NAICS-Road Mode–Non-Linear Model-Log-Log (CFS 2007)

CFS - Texas - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (except Oil and Gas)	15.99	15.40	1.16	4.06	0.299	16.47	4.92	60
311	Food Manufacturing	11.49	18.23	1.34	8.78	0.602	77.16	3.04	165
321	Wood Product Manufacturing	8.49	11.61	1.96	10.18	0.704	103.72	2.96	85
322	Paper Manufacturing	9.63	4.57	1.77	3.98	0.702	15.86	2.19	40
323	Printing and Related Support Activities	8.23	15.51	1.24	6.58	0.489	43.25	2.58	65
324	Petroleum and Coal Products Manufacturing	14.41	13.53	1.19	3.97	0.292	15.75	6.16	60
325	Chemical Manufacturing	11.99	18.34	1.19	7.42	0.399	55.13	5.68	225
326	Plastics and Rubber Products Manufacturing	8.95	12.08	1.59	8.34	0.758	69.57	1.98	115
327	Nonmetallic Mineral Product Manufacturing	15.76	13.99	0.69	2.24	0.076	5.02	10.51	150
331	Primary Metal Manufacturing	7.00	12.07	2.01	16.96	0.822	287.71	2.97	55
332	Fabricated Metal Product Manufacturing	8.92	12.31	1.46	8.01	0.520	64.11	3.88	200
333	Machinery Manufacturing	7.47	13.49	1.49	12.52	0.743	156.73	2.77	130
334	Computer and Electronic Product Manufacturing	5.83	5.02	1.29	5.04	0.560	25.37	4.00	85
335	Electrical Equipment, Appliance, and Component Manufacturing	10.04	7.80	0.99	3.64	0.494	13.22	3.18	30
336	Transportation Equipment Manufacturing	8.69	14.75	1.00	7.70	0.492	59.25	3.23	60
339	Miscellaneous Manufacturing	7.66	9.49	1.10	5.65	0.481	31.88	3.89	65
423	Merchant Wholesalers, Durable Goods	10.78	24.55	1.22	7.92	0.184	62.73	7.98	730
424	Merchant Wholesalers, Nondurable Goods	12.96	27.20	1.08	6.77	0.184	45.82	7.58	510
493	Warehousing and Storage	14.30	20.10	0.68	2.80	0.117	7.84	5.30	85
511	Publishing Industries (except Internet)	7.44	20.46	1.41	12.72	0.798	161.79	1.60	25
551	Management of Companies and Enterprises	-	-	5.17	13.40	0.643	179.51	84.46	60

Table 199: Freight Production 3-Digit NAICS-Road Mode–Non-Linear Model-Log-Lin (CFS 2007)

CFS - Texas - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (except Oil and Gas)	17.54	25.79	0.053	4.06	0.217	16.46	5.66	60
311	Food Manufacturing	14.96	32.79	0.005	4.56	0.129	20.79	6.63	165
321	Wood Product Manufacturing	11.81	21.92	0.031	5.70	0.364	32.52	6.36	85
322	Paper Manufacturing	15.12	14.57	0.011	2.75	0.285	7.54	5.25	40
323	Printing and Related Support Activities	10.09	33.89	0.028	7.22	0.397	52.09	3.04	65
324	Petroleum and Coal Products Manufacturing	16.20	21.42	0.006	3.27	0.033	10.67	8.32	60
325	Chemical Manufacturing	14.46	34.38	0.005	2.43	0.066	5.91	8.47	225
326	Plastics and Rubber Products Manufacturing	12.81	20.69	0.010	4.35	0.221	18.88	6.32	115
327	Nonmetallic Mineral Product Manufacturing	16.98	28.48	0.010	2.29	0.025	5.24	11.09	150
331	Primary Metal Manufacturing	11.96	9.53	0.011	3.76	0.296	14.14	11.69	55
332	Fabricated Metal Product Manufacturing	12.09	30.02	0.016	7.36	0.255	54.16	6.02	200
333	Machinery Manufacturing	10.83	17.71	0.010	5.62	0.289	31.57	7.60	130
334	Computer and Electronic Product Manufacturing	9.27	12.86	0.001	1.97	0.069	3.90	8.24	85
335	Electrical Equipment, Appliance, and Component Manufacturing	12.07	17.62	0.010	3.42	0.279	11.69	4.53	30
336	Transportation Equipment Manufacturing	11.24	25.97	0.003	3.31	0.186	10.97	5.18	60
339	Miscellaneous Manufacturing	9.41	17.28	0.016	5.18	0.316	26.84	5.11	65
423	Merchant Wholesalers, Durable Goods	12.93	57.42	0.015	1.85	0.033	3.41	9.42	730
424	Merchant Wholesalers, Nondurable Goods	14.74	58.69	0.014	5.87	0.047	34.43	8.81	510
493	Warehousing and Storage	15.30	34.98	0.008	4.44	0.038	19.71	5.77	85
511	Publishing Industries (except Internet)	10.17	20.16	0.011	4.87	0.335	23.72	3.67	25
551	Management of Companies and Enterprises	-	-	0.018	2.75	0.026	7.54	230.67	60

WYOMING

Table 200: Freight Production 2-Digit NAICS-All Modes–Linear Models (CFS 2007)

CFS - Wyoming - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Mining	153,230,056	3.92	0.757	15.40	1.29E+10	15
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	8,166,167	3.14	0.307	9.87	6.06E+08	50
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	50,544	2.08	0.145	4.32	4.93E+06	30
42	Wholesale Trade	428,427	5.29	0.112	27.95	1.38E+07	80

Table 201: Freight Production 3-Digit NAICS-All Modes–Linear Models (CFS 2007)

CFS - Wyoming - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (except Oil and Gas)	153,230,056	3.92	0.757	15.40	1.29E+10	15
332	Fabricated Metal Product Manufacturing	129,651	1.47	0.301	2.15	7.23E+06	10
423	Merchant Wholesalers, Durable Goods	206,047	3.01	0.087	9.08	7.12E+06	40
424	Merchant Wholesalers, Nondurable Goods	660,248	5.17	0.142	26.75	1.83E+07	35

Table 202: Freight Production 2-Digit NAICS-Road Modes–Linear Models (CFS 2007)

CFS - Wyoming - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Mining	1,289,196	2.18	0.074	4.74	5.1E+08	15
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	3,329,018	4.89	0.413	23.89	2.0E+08	50
42	Wholesale Trade	409,019	5.00	0.108	25.05	1.3E+07	80

Table 203: Freight Production 3-Digit NAICS-Road Modes–Linear Models (CFS 2007)

CFS - Wyoming - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (except Oil and Gas)	1,289,196	2.18	0.074	4.74	5.12E+08	15
423	Merchant Wholesalers, Durable Goods	173,152	2.64	0.058	6.96	7.07E+06	40

Table 204: Freight Production 2-Digit NAICS-All Modes–Non-Linear Model-Lin-Log (CFS 2007)

CFS - Wyoming - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Mining	5,104,333,216	2.62	0.272	6.86	2.23E+10	15
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	101,518,191	2.91	0.118	8.45	6.84E+08	50
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	1,003,926	2.68	0.171	7.17	4.85E+06	30
42	Wholesale Trade	2,882,665	6.50	0.127	42.30	1.37E+07	80

Table 205: Freight Production 2-Digit NAICS-All Modes–Non-Linear Model-Log-Log (CFS 2007)

CFS - Wyoming - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	15.56	5.67	1.53	2.49	0.543	6.21	9.72	15
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	12.80	7.24	1.10	2.14	0.153	4.60	13.11	50
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	7.85	6.17	1.34	3.30	0.249	10.86	6.30	30
42	Wholesale Trade	-	-	6.58	23.57	0.775	555.34	44.80	80

Table 206: Freight Production 2-Digit NAICS-All Modes–Non-Linear Model-Log-Lin (CFS 2007)

CFS - Wyoming - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	17.40	7.94	0.02	2.61	0.218	6.84	16.64	15
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	14.29	14.54	0.04	3.56	0.144	12.64	13.25	50
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	10.09	14.82	0.03	3.66	0.151	13.42	7.12	30
42	Wholesale Trade	13.43	26.12	0.06	2.15	0.024	4.63	6.66	80

Table 207: Freight Production 3-Digit NAICS-All Modes–Non-Linear Model-Lin-Log (CFS 2007)

CFS - Wyoming - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (Except Oil and Gas)	5,104,333,216	2.62	0.272	6.86	2.23E+10	15
332	Fabricated Metal Product Manufacturing	2,158,712	2.25	0.282	5.05	7.33E+06	10
423	Merchant Wholesalers, Durable Goods	1,404,805	3.40	0.113	11.53	7.02E+06	40
424	Merchant Wholesalers, Nondurable Goods	4,678,188	6.30	0.166	39.66	1.80E+07	35

Table 208: Freight Production 3-Digit NAICS-All Modes–Non-Linear Model-Log-Log (CFS 2007)

CFS - Wyoming - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (except Oil and Gas)	15.56	5.67	1.53	2.49	0.543	6.21	9.72	15
332	Fabricated Metal Product Manufacturing	10.12	10.94	0.88	1.89	0.111	3.58	6.43	10
423	Merchant Wholesalers, Durable Goods	-	-	6.08	18.43	0.817	339.67	31.01	40
424	Merchant Wholesalers, Nondurable Goods	-	-	7.19	15.11	0.746	228.21	58.72	35

Table 209: Freight Production 3-Digit NAICS-All Modes–Non-Linear Model-Log-Lin (CFS 2007)

CFS - Wyoming - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (except Oil and Gas)	17.40	7.94	0.02	2.61	0.218	6.84	16.64	15
332	Fabricated Metal Product Manufacturing	11.20	12.58	0.03	1.90	0.116	3.60	6.39	10
423	Merchant Wholesalers, Durable Goods	12.10	15.41	0.08	1.91	0.039	3.65	7.11	40
424	Merchant Wholesalers, Nondurable Goods	-	-	0.83	6.26	0.419	39.17	134.36	35

Table 210: Freight Production 2-Digit NAICS-Road Mode–Non-Linear Model-Lin-Log (CFS 2007)

CFS - Wyoming - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Mining	94,326,921	1.90	0.212	3.61	4.7E+08	15
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	51,872,206	4.53	0.266	20.55	2.2E+08	50
42	Wholesale Trade	2,765,512	6.35	0.124	40.31	1.3E+07	80

Table 211: Freight Production 2-Digit NAICS-Road Mode–Non-Linear Model-Log-Log (CFS 2007)

CFS - Wyoming - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	18.1	318	0.360	5.34	0.563	28.54	0.50	15
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	12.9	7.27	1.02	1.99	0.134	3.94	12.96	50
42	Wholesale Trade	-	-	6.50	22.8	0.769	520.03	45.26	80

Table 212: Freight Production 2-Digit NAICS-Road Mode–Non-Linear Model-Log-Lin (CFS 2007)

CFS - Wyoming - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	18.63	67.06	0.004	6.50	0.307	42.31	0.70	15
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	14.31	14.54	0.032	3.22	0.113	10.35	13.26	50
42	Wholesale Trade	-	-	0.789	8.52	0.456	72.51	105.66	80

Table 213: Freight Production 3-Digit NAICS-Road Mode–Non-Linear Model-Lin-Log (CFS 2007)

CFS - Wyoming - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (Except Oil and Gas)	94,326,921	1.90	0.212	3.61	4.72E+08	15
423	Merchant Wholesalers, Durable Goods	1,255,856	3.10	0.091	9.59	6.94E+06	40

Table 214: Freight Production 3-Digit NAICS-Road Mode–Non-Linear Model-Log-Log (CFS 2007)

CFS - Wyoming - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (except Oil and Gas)	18.14	317.85	0.36	5.34	0.563	28.54	0.50	15
423	Merchant Wholesalers, Durable Goods	-	-	5.91	17.32	0.806	300.03	31.51	40

Table 215: Freight Production 3-Digit NAICS-Road Mode–Non-Linear Model-Log-Lin (CFS 2007)

CFS - Wyoming - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (except Oil and Gas)	18.63	67.06	0.004	6.50	0.307	42.31	0.70	15
423	Merchant Wholesalers, Durable Goods	-	-	0.753	5.75	0.489	33.11	81.98	40

OHIO

Table 216: Freight Production 2-Digit NAICS-All Modes–Linear Models (CFS 2007)

CFS - Ohio - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Mining	37,433,995	5.11	0.519	26.15	1.02E+09	85
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	960,538	3.92	0.199	15.34	3.12E+08	155
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	733,006	3.35	0.045	11.23	3.44E+08	690
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	287,457	3.90	0.170	15.18	1.66E+08	835
42	Wholesale Trade	1,204,735	5.07	0.000	25.66	1.45E+09	935
45	Sporting Goods, Hobby, Books & Music Stores	21,156	3.10	0.094	9.61	6.47E+06	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	1,046,450	4.25	0.347	18.06	1.54E+08	70
51	Information	79,478	3.46	0.402	11.96	1.89E+07	15
55	Management of Companies and Enterprises	446,118	2.02	0.110	4.08	1.86E+08	55

Table 217: Freight Production 3-Digit NAICS-All Modes–Linear Models (CFS 2007)

CFS - Ohio - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (except Oil and Gas)	37,433,995	5.11	0.519	26.15	1.02E+09	85
311	Food Manufacturing	746,513	3.59	0.152	12.85	3.53E+08	115
312	Beverage and Tobacco Product Manufacturing	4,050,008	6.93	0.839	47.96	1.37E+08	20
321	Wood Product Manufacturing	264,828	6.89	0.343	47.50	1.37E+07	80
322	Paper Manufacturing	523,207	8.31	0.533	69.01	6.64E+07	80
323	Printing and Related Support Activities	137,411	3.71	0.480	13.75	1.46E+07	55
324	Petroleum and Coal Products Manufacturing	15,587,655	2.42	0.464	5.85	7.42E+08	30
325	Chemical Manufacturing	741,631	2.76	0.145	7.60	2.23E+08	155
326	Plastics and Rubber Products Manufacturing	150,044	7.88	0.575	62.14	1.97E+07	165
327	Nonmetallic Mineral Product Manufacturing	680,959	3.06	0.108	9.33	1.49E+08	120
331	Primary Metal Manufacturing	1,511,607	4.23	0.522	17.86	3.85E+08	95
332	Fabricated Metal Product Manufacturing	107,167	1.52	0.044	2.30	7.68E+07	250
333	Machinery Manufacturing	249,092	2.32	0.536	5.39	4.51E+07	140
334	Computer and Electronic Product Manufacturing	10,081	3.24	0.204	10.48	3.61E+06	45
335	Electrical Equipment, Appliance, and Component Manufacturing	160,615	6.34	0.830	40.25	3.89E+07	45
336	Transportation Equipment Manufacturing	218,796	2.35	0.318	5.53	1.55E+08	160
337	Furniture and Related Product Manufacturing	57,970	2.27	0.590	5.18	1.42E+07	40
339	Miscellaneous Manufacturing	49,377	5.51	0.636	30.37	3.56E+06	60
423	Merchant Wholesalers, Durable Goods	840,489	2.28	-0.001	5.20	1.84E+09	570
424	Merchant Wholesalers, Nondurable Goods	1,657,872	7.13	0.071	50.90	2.51E+08	360
454	Nonstore Retailers	21,156	3.10	0.094	9.61	6.47E+06	50
493	Warehousing and Storage	1,046,450	4.25	0.347	18.06	1.54E+08	70
511	Publishing Industries (except Internet)	79,478	3.46	0.402	11.96	1.89E+07	15
551	Management of Companies and Enterprises	446,118	2.02	0.110	4.08	1.86E+08	55

Table 218: Freight Production 2-Digit NAICS-Road Modes–Linear Models (CFS 2007)

CFS - Ohio - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Construction	17,710,145	2.90	0.248	8.43	8.6E+08	85
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	888,331	3.84	0.269	14.76	2.4E+08	155
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	423,773	6.14	0.064	37.74	1.6E+08	690
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	160,857	4.66	0.252	21.71	7.2E+07	835
42	Wholesale Trade	855,584	7.33	0.057	53.66	1.4E+08	935
45	Sporting Goods, Hobby, Books & Music Stores	21,053	3.09	0.093	9.54	6.5E+06	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	1,040,823	4.23	0.348	17.88	1.5E+08	70
55	Management of Companies and Enterprises	445,052	2.02	0.109	4.07	1.9E+08	55

Table 219: Freight Production 3-Digit NAICS-Road Modes–Linear Models (CFS 2007)

CFS - Ohio - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (except Oil and Gas)	17,710,145	2.90	0.248	8.43	8.61E+08	85
311	Food Manufacturing	669,639	3.51	0.258	12.31	2.30E+08	115
321	Wood Product Manufacturing	250,766	6.79	0.340	46.04	1.31E+07	80
322	Paper Manufacturing	514,322	8.86	0.542	78.51	6.42E+07	80
323	Printing and Related Support Activities	136,961	3.68	0.477	13.52	1.47E+07	55
324	Petroleum and Coal Products Manufacturing	2,759,436	3.86	0.069	14.87	3.82E+08	30
325	Chemical Manufacturing	586,343	2.50	0.133	6.26	1.85E+08	155
326	Plastics and Rubber Products Manufacturing	147,403	7.67	0.575	58.90	1.93E+07	165
327	Nonmetallic Mineral Product Manufacturing	609,653	3.10	0.099	9.64	1.39E+08	120
331	Primary Metal Manufacturing	645,007	5.31	0.605	28.23	1.39E+08	95
332	Fabricated Metal Product Manufacturing	90,393	1.56	0.063	2.43	5.41E+07	250
333	Machinery Manufacturing	219,023	2.52	0.565	6.35	3.74E+07	140
334	Computer and Electronic Product Manufacturing	8,751	2.85	0.154	8.14	3.65E+06	45
336	Transportation Equipment Manufacturing	119,734	2.84	0.382	8.04	7.38E+07	160
339	Miscellaneous Manufacturing	47,467	5.17	0.614	26.73	3.58E+06	60
423	Merchant Wholesalers, Durable Goods	405,279	5.34	0.117	28.49	4.15E+07	570
424	Merchant Wholesalers, Nondurable Goods	1,415,782	6.77	0.073	45.82	2.10E+08	360
454	Nonstore Retailers	21,053	3.09	0.093	9.54	6.46E+06	50
493	Warehousing and Storage	1,040,823	4.23	0.348	17.88	1.53E+08	70
551	Management of Companies and Enterprises	445,052	2.02	0.109	4.07	1.86E+08	55

Table 220: Freight Production 2-Digit NAICS-All Modes–Non-Linear Model-Lin-Log (CFS 2007)

CFS - Ohio - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Mining	437,239,086	7.77	0.381	60.38	1.15E+09	85
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	45,968,090	6.19	0.175	38.27	3.17E+08	155
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	26,087,617	6.67	0.045	44.37	3.44E+08	690
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	12,291,675	6.28	0.046	39.42	1.78E+08	835
42	Wholesale Trade	40,977,856	2.23	0.004	4.96	1.45E+09	935
45	Sporting Goods, Hobby, Books & Music Stores	1,991,229	5.01	0.350	25.09	5.48E+06	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	37,221,805	4.93	0.267	24.35	1.64E+08	70
51	Information	3,781,415	2.07	0.173	4.29	2.22E+07	15
55	Management of Companies and Enterprises	28,878,334	3.49	0.157	12.18	1.81E+08	55

Table 221: Freight Production 2-Digit NAICS-All Modes–Non-Linear Model-Log-Log (CFS 2007)

CFS - Ohio - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	16.69	32.77	1.15	6.33	0.299	40.09	3.72	85
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	11.98	15.23	1.27	7.40	0.456	54.71	5.41	155
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	11.98	21.95	1.07	7.71	0.251	59.50	8.50	690
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	8.75	24.89	1.38	15.70	0.594	246.48	4.04	835
42	Wholesale Trade	12.19	29.02	1.10	8.21	0.151	67.43	8.95	935
45	Sporting Goods, Hobby, Books & Music Stores	-	-	5.33	13.52	0.646	182.74	65.14	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	-	-	4.95	15.15	0.643	229.50	98.97	70
51	Information	7.66	6.51	1.57	5.00	0.334	24.96	7.11	15
55	Management of Companies and Enterprises	-	-	4.65	12.75	0.669	162.44	84.88	55

Table 222: Freight Production 2-Digit NAICS-All Modes–Non-Linear Model-Log-Lin (CFS 2007)

CFS - Ohio - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	18.39	51.78	0.029	3.20	0.099	10.26	4.78	85
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	14.96	26.66	0.008	4.67	0.144	21.84	8.52	155
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	14.16	48.70	0.011	6.95	0.088	48.36	10.36	690
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	12.13	55.39	0.005	6.49	0.153	42.14	8.42	835
42	Wholesale Trade	14.15	70.03	0.021	7.39	0.053	54.64	9.98	935
45	Sporting Goods, Hobby, Books & Music Stores	13.29	25.12	0.003	3.21	0.003	10.29	5.61	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	16.29	36.32	0.006	4.04	0.088	16.29	3.57	70
51	Information	11.64	12.18	0.006	3.97	0.090	15.77	9.71	15
55	Management of Companies and Enterprises	-	-	0.033	3.52	0.087	12.41	234.32	55

Table 223: Freight Production 3-Digit NAICS-All Modes–Non-Linear Model-Lin-Log (CFS 2007)

CFS - Ohio - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (Except Oil and Gas)	437,239,086	7.77	0.381	60.38	1.15E+09	85
311	Food Manufacturing	47,359,757	5.62	0.200	31.56	3.43E+08	115
312	Beverage and Tobacco Manufacturing	75,432,014	2.72	0.184	7.40	3.08E+08	20
321	Wood Product Manufacturing	4,369,943	6.33	0.376	40.12	1.34E+07	80
322	Paper Manufacturing	16,770,038	6.43	0.354	41.33	7.81E+07	80
323	Printing and Related Support Activities	2,510,261	2.80	0.109	7.84	1.92E+07	55
324	Petroleum and Coal Products Manufacturing	214,026,130	2.88	0.137	8.28	9.42E+08	30
325	Chemical Manufacturing	29,741,427	6.09	0.162	37.13	2.21E+08	155
326	Plastics and Rubber Products Manufacturing	4,743,365	8.69	0.299	75.45	2.53E+07	165
327	Nonmetallic Mineral Product Manufacturing	32,051,613	7.08	0.275	50.10	1.34E+08	120
331	Primary Metal Manufacturing	52,192,746	3.55	0.114	12.58	5.25E+08	95
332	Fabricated Metal Product Manufacturing	7,404,703	4.82	0.075	23.26	7.55E+07	250
333	Machinery Manufacturing	4,185,654	2.16	0.033	4.68	6.52E+07	140
334	Computer and Electronic Product Manufacturing	447,342	3.31	0.149	10.96	3.73E+06	45
335	Electrical Equipment, Appliance, and Component Manufacturing	8,397,457	2.30	0.122	5.29	8.84E+07	45
336	Transportation Equipment Manufacturing	14,917,454	3.68	0.093	13.57	1.79E+08	160
337	Furniture and Related Product Manufacturing	3,617,000	2.67	0.150	7.14	2.04E+07	40
339	Miscellaneous Manufacturing	1,059,820	4.58	0.220	20.95	5.20E+06	60
423	Merchant Wholesalers, Durable Goods	38,025,405	1.28	0.001	1.64	1.84E+09	570
424	Merchant Wholesalers, Nondurable Goods	45,701,387	8.30	0.179	68.90	2.36E+08	360
454	Nonstore Retailers	1,991,229	5.01	0.350	25.09	5.48E+06	50
493	Warehousing and Storage	37,221,805	4.93	0.267	24.35	1.64E+08	70
511	Publishing Industries (except Internet)	3,781,415	2.07	0.173	4.29	2.22E+07	15
551	Management of Companies and Enterprises	28,878,334	3.49	0.157	12.18	1.81E+08	55

Table 224: Freight Production 3-Digit NAICS-All Modes–Non-Linear Model-Log-Log (CFS 2007)

CFS - Ohio - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (Except Oil and Gas)	16.69	32.77	1.15	6.33	0.299	40.09	3.72	85
311	Food Manufacturing	12.02	9.59	1.33	4.76	0.509	22.67	4.18	115
312	Beverage and Tobacco Manufacturing	12.15	12.86	1.62	6.45	0.605	41.60	3.23	20
321	Wood Product Manufacturing	10.87	18.79	1.28	6.91	0.546	47.71	3.17	80
322	Paper Manufacturing	10.48	17.91	1.51	11.18	0.846	125.01	1.04	80
323	Printing and Related Support Activities	7.66	15.16	1.54	10.70	0.746	114.46	1.47	55
324	Petroleum and Coal Products Manufacturing			7.57	9.03	0.617	81.50	128.89	30
325	Chemical Manufacturing	12.15	17.65	1.18	7.59	0.395	57.66	5.71	155
326	Plastics and Rubber Products Manufacturing	9.10	9.03	1.49	6.42	0.691	41.20	2.86	165
327	Nonmetallic Mineral Product Manufacturing	11.25	12.94	1.61	6.92	0.391	47.83	7.22	120
331	Primary Metal Manufacturing	9.42	15.32	1.59	12.22	0.697	149.32	3.02	95
332	Fabricated Metal Product Manufacturing	9.24	22.91	1.40	13.53	0.594	183.17	3.39	250
333	Machinery Manufacturing	8.25	13.32	1.27	7.92	0.686	62.72	2.29	140
334	Computer and Electronic Product Manufacturing	8.11	29.98	0.98	11.65	0.607	135.71	1.76	45
335	Electrical Equipment, Appliance, and Component Manufacturing	9.37	15.81	1.15	10.12	0.649	102.32	2.14	45
336	Transportation Equipment Manufacturing	9.12	15.89	1.35	10.96	0.702	120.07	2.53	160
337	Furniture and Related Product Manufacturing	10.85	13.09	0.78	3.14	0.401	9.88	2.42	40
339	Miscellaneous Manufacturing	5.95	7.30	1.83	9.79	0.710	95.94	4.11	60
423	Merchant Wholesalers, Durable Goods	10.70	24.68	1.33	9.64	0.266	93.01	6.60	570
424	Merchant Wholesalers, Nondurable Goods	14.68	21.48	0.68	3.10	0.064	9.59	8.27	360
454	Nonstore Retailers	-	-	5.33	13.52	0.646	182.74	65.14	50
493	Warehousing and Storage	-	-	4.95	15.15	0.643	229.50	98.97	70
511	Publishing Industries (except Internet)	7.66	6.51	1.57	5.00	0.334	24.96	7.11	15
551	Management of Companies and Enterprises	-	-	4.65	12.75	0.669	162.44	84.88	55

Table 225: Freight Production 3-Digit NAICS-All Modes–Non-Linear Model-Log-Lin (CFS 2007)

CFS - Ohio - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (Except Oil and Gas)	18.39	51.78	0.029	3.20	0.099	10.26	4.78	85
311	Food Manufacturing	15.90	20.87	0.006	3.18	0.134	10.10	7.38	115
312	Beverage and Tobacco Manufacturing	14.48	14.61	0.016	3.09	0.131	9.53	7.12	20
321	Wood Product Manufacturing	12.49	28.00	0.041	4.80	0.256	23.06	5.20	80
322	Paper Manufacturing	14.37	20.86	0.012	2.17	0.304	4.73	4.68	80
323	Printing and Related Support Activities	11.01	29.79	0.015	3.59	0.354	12.87	3.73	55
324	Petroleum and Coal Products Manufacturing			0.124	3.77	0.063	14.23	315.51	30
325	Chemical Manufacturing	15.02	26.58	0.009	3.31	0.102	10.94	8.47	155
326	Plastics and Rubber Products Manufacturing	12.88	19.51	0.011	3.83	0.243	14.65	7.00	165
327	Nonmetallic Mineral Product Manufacturing	14.52	24.69	0.012	2.94	0.063	8.64	11.11	120
331	Primary Metal Manufacturing	14.06	18.18	0.007	4.44	0.264	19.69	7.33	95
332	Fabricated Metal Product Manufacturing	12.49	36.02	0.006	1.65	0.110	2.73	7.44	250
333	Machinery Manufacturing	11.15	26.75	0.007	3.84	0.242	14.76	5.53	140
334	Computer and Electronic Product Manufacturing	10.68	16.75	0.007	3.50	0.332	12.27	3.00	45
335	Electrical Equipment, Appliance, and Component Manufacturing	13.21	24.55	0.003	4.79	0.320	22.96	4.14	45
336	Transportation Equipment Manufacturing	13.35	25.00	0.003	3.66	0.227	13.39	6.55	160
337	Furniture and Related Product Manufacturing	12.23	29.16	0.003	3.01	0.137	9.05	3.49	40
339	Miscellaneous Manufacturing	8.83	9.95	0.024	5.55	0.303	30.79	9.90	60
423	Merchant Wholesalers, Durable Goods	13.06	55.41	0.027	5.28	0.091	27.86	8.19	570
424	Merchant Wholesalers, Nondurable Goods	15.90	53.09	0.013	4.54	0.025	20.61	8.62	360
454	Nonstore Retailers	13.29	25.12	0.003	3.21	0.003	10.29	5.61	50
493	Warehousing and Storage	16.29	36.32	0.006	4.04	0.088	16.29	3.57	70
511	Publishing Industries (except Internet)	11.64	12.18	0.006	3.97	0.090	15.77	9.71	15
551	Management of Companies and Enterprises	-	-	0.033	3.52	0.087	12.41	234.32	55

Table 226: Freight Production 2-Digit NAICS-Road Mode–Non-Linear Model-Lin-Log (CFS 2007)

CFS - Ohio - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Construction	334,763,266	8.99	0.491	80.79	7.1E+08	85
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	38,278,592	6.59	0.191	43.42	2.5E+08	155
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	19,214,095	8.82	0.106	77.86	1.6E+08	690
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	7,957,992	9.02	0.093	81.42	8.0E+07	835
42	Wholesale Trade	16,870,788	8.85	0.084	78.26	1.3E+08	935
45	Sporting Goods, Hobby, Books & Music Stores	1,977,430	4.97	0.346	24.65	5.5E+06	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	36,788,653	4.90	0.265	24.00	1.6E+08	70
55	Management of Companies and Enterprises	28,618,068	3.46	0.154	11.94	1.8E+08	55

Table 227: Freight Production 2-Digit NAICS-Road Mode–Non-Linear Model-Log-Log (CFS 2007)

CFS - Ohio - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	16.70	32.80	1.11	6.14	0.304	37.72	3.42	85
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	11.92	14.97	1.27	7.36	0.448	54.20	5.53	155
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	12.03	22.26	1.04	7.54	0.240	56.91	8.41	690
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	8.75	24.24	1.37	15.14	0.582	229.31	4.17	835
42	Wholesale Trade	12.00	31.35	1.09	8.99	0.163	80.83	8.00	935
45	Sporting Goods, Hobby, Books & Music Stores	-	-	5.32	13.44	0.644	180.66	65.25	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	-	-	4.95	15.13	0.642	228.78	99.04	70
55	Management of Companies and Enterprises	-	-	4.62	12.64	0.666	159.69	85.21	55

Table 228: Freight Production 2-Digit NAICS-Road Mode–Non-Linear Model-Log-Lin (CFS 2007)

CFS - Ohio - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	18.38	52.45	0.025	2.65	0.076	7.01	4.53	85
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	14.88	26.50	0.008	4.71	0.146	22.17	8.56	155
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	14.14	49.37	0.010	6.97	0.085	48.54	10.09	690
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	12.10	54.77	0.005	6.50	0.144	42.26	8.52	835
42	Wholesale Trade	13.94	73.81	0.022	7.78	0.063	60.48	8.92	935
45	Sporting Goods, Hobby, Books & Music Stores	13.26	25.10	0.003	3.23	0.003	10.41	5.64	50
49	Postal Service, Couriers & Messengers, Warehousing & Storage	16.28	36.29	0.006	4.02	0.087	16.20	3.59	70
55	Management of Companies and Enterprises	-	-	0.033	3.53	0.086	12.44	232.91	55

Table 229: Freight Production 3-Digit NAICS-Road Mode–Non-Linear Model-Lin-Log (CFS 2007)

CFS - Ohio - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (Except Oil and Gas)	334,763,266	8.99	0.491	80.79	7.08E+08	85
311	Food Manufacturing	37,033,322	6.52	0.255	42.46	2.30E+08	115
321	Wood Product Manufacturing	4,158,012	6.33	0.376	40.02	1.27E+07	80
322	Paper Manufacturing	16,435,129	6.46	0.358	41.77	7.60E+07	80
323	Printing and Related Support Activities	2,498,985	2.79	0.109	7.77	1.92E+07	55
324	Petroleum and Coal Products Manufacturing	115,068,182	3.43	0.290	11.76	3.33E+08	30
325	Chemical Manufacturing	21,863,075	5.41	0.127	29.27	1.86E+08	155
326	Plastics and Rubber Products Manufacturin	4,626,915	8.62	0.294	74.22	2.49E+07	165
327	Nonmetallic Mineral Product Manufacturing	29,417,743	6.92	0.267	47.83	1.26E+08	120
331	Primary Metal Manufacturing	25,651,462	4.54	0.180	20.62	2.00E+08	95
332	Fabricated Metal Product Manufacturing	6,356,113	5.86	0.111	34.32	5.27E+07	250
333	Machinery Manufacturing	3,747,734	2.27	0.037	5.16	5.57E+07	140
334	Computer and Electronic Product Manufacturing	409,188	3.06	0.127	9.34	3.71E+06	45
336	Transportation Equipment Manufacturing	10,126,744	5.46	0.178	29.85	8.52E+07	160
339	Miscellaneous Manufacturing	991,311	4.37	0.200	19.08	5.15E+06	60
423	Merchant Wholesalers, Durable Goods	6,943,331	10.04	0.144	100.80	4.08E+07	570
424	Merchant Wholesalers, Nondurable Goods	32,753,402	6.96	0.129	48.51	2.04E+08	360
454	Nonstore Retailers	1,977,430	4.97	0.346	24.65	5.48E+06	50
493	Warehousing and Storage	36,788,653	4.90	0.265	24.00	1.63E+08	70
551	Management of Companies and Enterprises	28,618,068	3.46	0.154	11.94	1.81E+08	55

Table 230: Freight Production 3-Digit NAICS-Road Mode–Non-Linear Model-Log-Log (CFS 2007)

CFS - Ohio - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (Except Oil and Gas)	16.70	32.80	1.11	6.14	0.304	37.72	3.42	85
311	Food Manufacturing	11.85	9.39	1.34	4.86	0.509	23.66	4.29	115
321	Wood Product Manufacturing	10.89	18.85	1.26	6.85	0.541	46.86	3.17	80
322	Paper Manufacturing	10.50	17.94	1.49	11.05	0.835	122.03	1.10	80
323	Printing and Related Support Activities	7.31	13.99	1.64	11.11	0.773	123.48	1.43	55
324	Petroleum and Coal Products Manufacturing	-	-	7.64	9.13	0.622	83.43	128.66	30
325	Chemical Manufacturing	11.76	21.37	1.21	10.32	0.421	106.43	5.41	155
326	Plastics and Rubber Products Manufacturing	9.10	9.04	1.49	6.42	0.692	41.25	2.84	165
327	Nonmetallic Mineral Product Manufacturing	11.18	12.32	1.61	6.71	0.370	45.07	7.84	120
331	Primary Metal Manufacturing	9.62	14.64	1.50	10.68	0.660	114.04	3.18	95
332	Fabricated Metal Product Manufacturing	9.25	22.96	1.40	13.56	0.597	183.86	3.34	250
333	Machinery Manufacturing	8.26	13.33	1.26	7.82	0.678	61.21	2.32	140
334	Computer and Electronic Product Manufacturing	8.17	28.12	0.93	10.15	0.561	102.94	1.91	45
336	Transportation Equipment Manufacturing	9.19	15.63	1.31	10.39	0.671	108.01	2.77	160
339	Miscellaneous Manufacturing	5.73	7.19	1.86	10.50	0.706	110.19	4.34	60
423	Merchant Wholesalers, Durable Goods	10.37	26.41	1.39	11.08	0.295	122.71	6.27	570
424	Merchant Wholesalers, Nondurable Goods	14.99	31.57	0.47	3.27	0.042	10.66	6.03	360
454	Nonstore Retailers	-	-	5.32	13.44	0.644	180.66	65.25	50
493	Warehousing and Storage	-	-	4.95	15.13	0.642	228.78	99.04	70
551	Management of Companies and Enterprises	-	-	4.62	12.64	0.666	159.69	85.21	55

Table 231: Freight Production 3-Digit NAICS-Road Mode–Non-Linear Model-Log-Lin (CFS 2007)

CFS - Ohio - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (Except Oil and Gas)	18.38	52.45	0.025	2.65	0.076	7.01	4.53	85
311	Food Manufacturing	15.77	20.57	0.006	3.24	0.139	10.47	7.51	115
321	Wood Product Manufacturing	12.49	28.03	0.040	4.75	0.247	22.60	5.19	80
322	Paper Manufacturing	14.35	21.04	0.012	2.18	0.304	4.77	4.64	80
323	Printing and Related Support Activities	11.27	37.56	0.014	3.72	0.354	13.82	3.30	55
324	Petroleum and Coal Products Manufacturing			0.118	3.67	0.055	13.46	315.39	30
325	Chemical Manufacturing	14.73	27.68	0.009	3.53	0.111	12.44	8.27	155
326	Plastics and Rubber Products Manufacturing	12.87	19.54	0.011	3.83	0.243	14.64	6.95	165
327	Nonmetallic Mineral Product Manufacturing	14.44	23.81	0.012	2.92	0.058	8.54	11.67	120
331	Primary Metal Manufacturing	14.05	18.20	0.006	4.00	0.213	16.02	7.37	95
332	Fabricated Metal Product Manufacturing	12.48	36.11	0.006	1.66	0.110	2.74	7.36	250
333	Machinery Manufacturing	11.13	26.83	0.007	3.84	0.241	14.73	5.48	140
334	Computer and Electronic Product Manufacturing	10.59	17.16	0.007	3.53	0.321	12.44	3.03	45
336	Transportation Equipment Manufacturing	13.31	25.17	0.003	3.67	0.212	13.49	6.61	160
339	Miscellaneous Manufacturing	8.67	9.50	0.024	5.50	0.290	30.22	10.49	60
423	Merchant Wholesalers, Durable Goods	12.84	56.49	0.028	5.39	0.099	29.09	8.00	570
424	Merchant Wholesalers, Nondurable Goods	15.78	67.43	0.012	5.60	0.034	31.33	6.07	360
454	Nonstore Retailers	13.26	25.10	0.003	3.23	0.003	10.41	5.64	50
493	Warehousing and Storage	16.28	36.29	0.006	4.02	0.087	16.20	3.59	70
551	Management of Companies and Enterprises	-	-	0.033	3.53	0.086	12.44	232.91	55

USA

Table 232: Freight Production 2-Digit NAICS-All Modes–Linear Models (CFS 2007)

CFS - United States - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Mining	30,950,434	4.52	0.281	20.39	2.27E+09	1550
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	506,712	18.54	0.185	343.83	2.11E+08	4480
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	1,021,071	5.51	0.041	30.36	6.04E+08	12310
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc, Manufacturing	153,426	7.20	0.095	51.77	1.09E+08	12700
42	Wholesale Trade	787,685	16.78	0.007	281.58	3.94E+08	20065
45	Sporting Goods, Hobby, Books & Music Stores	55,970	5.15	0.064	26.49	1.29E+07	1225
49	Postal Service, Couriers & Messengers, Warehousing & Storage	792,551	8.71	0.186	75.85	1.83E+08	1245
51	Information	50,498	5.17	0.307	26.76	1.59E+07	665
55	Management of Companies and Enterprises	187,803	2.57	0.002	6.61	5.38E+08	1000

Table 233: Freight Production 3-Digit NAICS-All Modes–Linear Models (CFS 2007)

CFS - United States - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (except Oil and Gas)	30,950,434	4.52	0.281	20.39	2.27E+09	1550
311	Food Manufacturing	479,233	18.64	0.182	347.64	2.51E+08	2930
312	Beverage and Tobacco Product Manufacturing	1,247,982	4.77	0.369	22.78	2.44E+08	470
313	Textile Mills	121,735	14.92	0.558	222.59	1.60E+07	380
314	Textile Product Mills	156,603	10.43	0.627	108.77	1.24E+07	345
315	Apparel Manufacturing	13,069	4.41	0.199	19.43	2.58E+06	245
316	Leather and Allied Product Manufacturing	26,298	2.76	0.049	7.59	7.78E+06	115
321	Wood Product Manufacturing	535,798	5.79	0.233	33.58	8.04E+07	1945
322	Paper Manufacturing	983,715	19.21	0.530	368.96	1.64E+08	1210
323	Printing and Related Support Activities	206,843	11.63	0.468	135.25	1.87E+07	1370
324	Petroleum and Coal Products Manufacturing	21,353,264	8.14	0.544	66.19	1.16E+09	660
325	Chemical Manufacturing	331,190	3.62	0.038	13.10	3.43E+08	2480
326	Plastics and Rubber Products Manufacturing	173,722	23.94	0.551	572.90	2.29E+07	2145
327	Nonmetallic Mineral Product Manufacturing	2,324,909	9.60	0.157	92.19	3.08E+08	2495
331	Primary Metal Manufacturing	1,344,674	10.64	0.529	113.25	3.37E+08	995
332	Fabricated Metal Product Manufacturing	124,851	7.97	0.102	63.60	3.68E+07	3365
333	Machinery Manufacturing	93,915	6.84	0.362	46.75	2.42E+07	2075
334	Computer and Electronic Product Manufacturing	5,551	3.06	0.098	9.36	5.58E+06	1360
335	Electrical Equipment, Appliance, and Component Manufacturing	124,671	8.14	0.265	66.22	4.70E+07	835
336	Transportation Equipment Manufacturing	91,317	5.48	0.234	30.01	8.16E+07	1755
337	Furniture and Related Product Manufacturing	79,134	7.92	0.548	62.80	1.00E+07	1145
339	Miscellaneous Manufacturing	20,208	5.10	0.174	26.05	5.90E+06	1175
423	Merchant Wholesalers, Durable Goods	463,162	9.49	0.001	90.04	4.53E+08	11315
424	Merchant Wholesalers, Nondurable Goods	1,004,441	14.54	0.027	211.37	3.00E+08	8750
454	Nonstore Retailers	55,970	5.15	0.064	26.49	1.29E+07	1225
493	Warehousing and Storage	792,551	8.71	0.186	75.85	1.83E+08	1245
511	Publishing Industries (except Internet)	50,498	5.17	0.307	26.76	1.59E+07	665
551	Management of Companies and Enterprises	187,803	2.57	0.002	6.61	5.38E+08	1000

Table 234: Freight Production 2-Digit NAICS-Road Modes–Linear Models (CFS 2007)

CFS - United States - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Mining	7,745,393	8.16	0.132	66.61	9.1E+08	1550
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	438,112	18.78	0.239	352.61	1.6E+08	4480
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	400,204	6.51	0.041	42.39	2.4E+08	12310
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc, Manufacturing	96,430	8.02	0.130	64.36	5.8E+07	12700
42	Wholesale Trade	634,793	19.27	0.033	371.26	1.4E+08	20065
45	Sporting Goods, Hobby, Books & Music Stores	55,162	5.15	0.063	26.56	1.3E+07	1225
49	Postal Service, Couriers & Messengers, Warehousing & Storage	776,337	8.63	0.256	74.40	1.5E+08	1245
51	Information	50,264	5.17	0.306	26.73	1.6E+07	665
55	Management of Companies and Enterprises	131,126	2.74	0.008	7.53	2.2E+08	1000

Table 235: Freight Production 3-Digit NAICS-Road Modes–Linear Models (CFS 2007)

CFS - United States - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (except Oil and Gas)	7,745,393	8.16	0.132	66.61	9.09E+08	1550
311	Food Manufacturing	407,308	19.88	0.288	395.31	1.58E+08	2930
312	Beverage and Tobacco Product Manufacturing	1,141,177	4.30	0.329	18.51	2.44E+08	470
313	Textile Mills	107,003	9.34	0.523	87.20	1.51E+07	380
314	Textile Product Mills	149,057	10.72	0.614	114.91	1.21E+07	345
315	Apparel Manufacturing	12,406	4.39	0.196	19.25	2.47E+06	245
316	Leather and Allied Product Manufacturing	14,818	5.56	0.124	30.91	2.76E+06	115
321	Wood Product Manufacturing	442,228	5.96	0.219	35.53	6.90E+07	1940
322	Paper Manufacturing	681,290	23.00	0.624	529.06	9.33E+07	1210
323	Printing and Related Support Activities	199,029	11.85	0.465	140.50	1.81E+07	1370
324	Petroleum and Coal Products Manufacturing	3,049,815	6.65	0.119	44.23	4.91E+08	660
325	Chemical Manufacturing	140,199	3.75	0.062	14.07	1.12E+08	2480
326	Plastics and Rubber Products Manufacturing	165,006	23.60	0.538	556.94	2.23E+07	2145
327	Nonmetallic Mineral Product Manufacturing	2,071,737	9.54	0.146	90.97	2.87E+08	2495
331	Primary Metal Manufacturing	688,961	12.13	0.573	147.05	1.58E+08	995
332	Fabricated Metal Product Manufacturing	116,781	8.15	0.120	66.50	3.13E+07	3365
333	Machinery Manufacturing	79,544	6.96	0.334	48.40	2.18E+07	2075
334	Computer and Electronic Product Manufacturing	5,068	2.84	0.084	8.08	5.53E+06	1360
335	Electrical Equipment, Appliance, and Component Manufacturing	109,183	7.31	0.586	53.47	2.08E+07	835
336	Transportation Equipment Manufacturing	62,432	4.84	0.189	23.39	6.39E+07	1755
337	Furniture and Related Product Manufacturing	78,062	7.83	0.552	61.35	9.81E+06	1145
339	Miscellaneous Manufacturing	18,846	5.08	0.164	25.81	5.70E+06	1175
423	Merchant Wholesalers, Durable Goods	364,029	10.50	0.031	110.24	7.22E+07	11315
424	Merchant Wholesalers, Nondurable Goods	815,641	17.16	0.038	294.39	2.02E+08	8750
454	Nonstore Retailers	55,162	5.15	0.063	26.56	1.27E+07	1225
493	Warehousing and Storage	776,337	8.63	0.256	74.40	1.46E+08	1245
511	Publishing Industries (except Internet)	50,264	5.17	0.306	26.73	1.59E+07	665
551	Management of Companies and Enterprises	131,126	2.74	0.008	7.53	2.18E+08	1000

Table 236: Freight Production 2-Digit NAICS-All Modes–Non-Linear Model-Lin-Log (CFS 2007)

CFS - United States - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Mining	429,983,087	17.67	0.134	312.20	2.49E+09	1550
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	31,333,710	32.17	0.181	1034.78	2.12E+08	4480
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	47,847,304	25.77	0.044	663.96	6.03E+08	12310
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	6,476,103	18.40	0.029	338.42	1.13E+08	12700
42	Wholesale Trade	22,315,863	17.35	0.016	301.06	3.93E+08	20065
45	Sporting Goods, Hobby, Books & Music Stores	3,395,976	20.77	0.246	431.57	1.16E+07	1225
49	Postal Service, Couriers & Messengers, Warehousing & Storage	35,471,262	15.80	0.172	249.65	1.84E+08	1245
51	Information	2,334,908	8.83	0.104	77.92	1.81E+07	665
55	Management of Companies and Enterprises	45,286,940	6.25	0.041	39.05	5.28E+08	1000

Table 237: Freight Production 2-Digit NAICS-All Modes–Non-Linear Model-Log-Log (CFS 2007)

CFS - United States - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	16.83	89.4	1.04	16.3	0.324	264	3.23	1550
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	9.67	48.17	1.60	33.53	0.521	1124.0	6.77	4480
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	12.31	82.36	1.09	27.09	0.199	733.8	10.97	12310
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	7.95	91.2	1.44	66.6	0.569	4441	4.50	12700
42	Wholesale Trade	12.13	147.62	1.03	37.34	0.145	1393.9	8.62	20065
45	Sporting Goods, Hobby, Books & Music Stores	11.60	44.58	1.079	10.56	0.154	111.50	6.93	1225
49	Postal Service, Couriers & Messengers, Warehousing & Storage	15.52	74.79	0.384	6.48	0.066	41.99	4.60	1245
51	Information	7.52	27.58	1.221	15.59	0.462	243.06	4.57	665
55	Management of Companies and Enterprises	-	-	5.27	51.8	0.650	2686	88.02	1000

Table 238: Freight Production 2-Digit NAICS-All Modes–Non-Linear Model-Log-Lin (CFS 2007)

CFS - United States - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	18.67	184.82	0.013	6.87	0.064	47.15	4.48	1550
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	13.49	104.44	0.007	15.23	0.135	231.94	12.24	4480
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	14.55	176.71	0.006	5.89	0.039	34.68	13.15	12310
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	11.24	184.71	0.005	14.17	0.117	200.68	9.20	12700
42	Wholesale Trade	13.81	319.45	0.017	18.07	0.045	326.53	9.63	20065
45	Sporting Goods, Hobby, Books & Music Stores	13.31	102.30	0.005	5.22	0.011	27.26	8.10	1225
49	Postal Service, Couriers & Messengers, Warehousing & Storage	16.10	132.06	0.005	10.20	0.051	104.12	4.68	1245
51	Information	9.81	56.10	0.006	5.06	0.164	25.63	7.10	665
55	Management of Companies and Enterprises	-	-	0.018	3.27	0.032	10.69	243.51	1000

Table 239: Freight Production 3-Digit NAICS-All Modes–Non-Linear Model-Lin-Log (CFS 2007)

CFS - United States - All Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (except Oil and Gas)	429,983,087	17.67	0.134	312.20	2.49E+09	1550
311	Food Manufacturing	37,931,394	30.25	0.232	915.22	2.43E+08	2930
312	Beverage and Tobacco Product Manufacturing	57,115,808	12.91	0.250	166.72	2.66E+08	470
313	Textile Mills	3,450,167	11.19	0.247	125.29	2.09E+07	380
314	Textile Product Mills	3,225,652	7.63	0.142	58.17	1.88E+07	345
315	Apparel Manufacturing	377,710	6.45	0.121	41.63	2.70E+06	245
316	Leather and Allied Product Manufacturing	839,479	3.09	0.064	9.56	7.71E+06	115
321	Wood Product Manufacturing	16,779,809	26.38	0.244	695.80	7.98E+07	1945
322	Paper Manufacturing	29,828,941	19.96	0.233	398.56	2.09E+08	1210
323	Printing and Related Support Activities	3,131,831	12.69	0.092	161.06	2.45E+07	1370
324	Petroleum and Coal Products Manufacturing	319,927,314	11.38	0.133	129.54	1.60E+09	660
325	Chemical Manufacturing	38,833,673	17.04	0.097	290.39	3.33E+08	2480
326	Plastics and Rubber Products Manufacturing	5,098,086	26.31	0.241	692.33	2.97E+07	2145
327	Nonmetallic Mineral Product Manufacturing	69,302,012	31.08	0.263	966.22	2.88E+08	2495
331	Primary Metal Manufacturing	43,046,210	10.04	0.106	100.80	4.65E+08	995
332	Fabricated Metal Product Manufacturing	4,391,241	20.51	0.102	420.69	3.68E+07	3365
333	Machinery Manufacturing	2,571,528	11.72	0.070	137.39	2.93E+07	2075
334	Computer and Electronic Product Manufacturing	420,467	7.83	0.048	61.37	5.73E+06	1360
335	Electrical Equipment, Appliance, and Component Manufacturing	4,105,737	7.11	0.058	50.56	5.32E+07	835
336	Transportation Equipment Manufacturing	8,370,088	12.04	0.099	144.90	8.85E+07	1755
337	Furniture and Related Product Manufacturing	2,020,253	13.62	0.141	185.59	1.38E+07	1145
339	Miscellaneous Manufacturing	767,475	11.74	0.090	137.73	6.19E+06	1175
423	Merchant Wholesalers, Durable Goods	11,144,484	5.71	0.003	32.58	4.53E+08	11315
424	Merchant Wholesalers, Nondurable Goods	37,457,598	25.74	0.074	662.38	2.93E+08	8750
454	Nonstore Retailers	3,395,976	20.77	0.246	431.57	1.16E+07	1225
493	Warehousing and Storage	35,471,262	15.80	0.172	249.65	1.84E+08	1245
511	Publishing Industries (except Internet)	2,334,908	8.83	0.104	77.92	1.81E+07	665
551	Management of Companies and Enterprises	45,286,940	6.25	0.041	39.05	5.28E+08	1000

Table 240: Freight Production 3-Digit NAICS-All Modes–Non-Linear Model-Log-Log (CFS 2007)

CFS - United States - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (Except Oil and Gas)	16.83	89.36	1.04	16.26	0.324	264.45	3.23	1550
311	Food Manufacturing	11.32	44.53	1.39	24.33	0.506	592.13	5.08	2930
312	Beverage and Tobacco Manufacturing	11.35	32.36	1.46	16.52	0.578	272.79	4.19	470
313	Textile Mills	9.38	19.58	1.28	10.90	0.638	118.71	2.25	380
314	Textile Product Mills	7.83	29.08	1.51	19.39	0.700	375.82	2.31	345
315	Apparel Manufacturing	6.92	14.18	1.40	10.72	0.623	115.01	2.76	245
316	Leather and Allied Product Manufacturing	7.74	10.96	1.29	6.27	0.537	39.30	3.34	115
321	Wood Product Manufacturing	11.31	48.76	1.35	20.77	0.489	431.55	4.28	1945
322	Paper Manufacturing	10.17	22.39	1.57	15.34	0.731	235.43	2.31	1210
323	Printing and Related Support Activities	7.91	53.95	1.49	34.23	0.718	1171.84	1.92	1370
324	Petroleum and Coal Products Manufacturing	17.04	53.77	0.63	5.44	0.077	29.64	6.05	660
325	Chemical Manufacturing	10.88	44.03	1.45	22.57	0.405	509.39	7.30	2480
326	Plastics and Rubber Products Manufacturing	8.94	37.15	1.53	26.22	0.679	687.28	2.82	2145
327	Nonmetallic Mineral Product Manufacturing	14.33	49.41	0.99	11.24	0.162	126.41	9.60	2495
331	Primary Metal Manufacturing	8.76	22.95	1.69	20.25	0.682	409.99	4.21	995
332	Fabricated Metal Product Manufacturing	8.56	53.01	1.50	34.87	0.548	1215.61	4.43	3365
333	Machinery Manufacturing	7.66	36.86	1.45	29.06	0.659	844.28	3.28	2075
334	Computer and Electronic Product Manufacturing	7.10	33.00	1.07	22.18	0.551	491.75	2.99	1350
335	Electrical Equipment, Appliance, and Component Manufacturing	7.13	24.16	1.54	23.03	0.692	530.29	3.05	835
336	Transportation Equipment Manufacturing	8.10	31.08	1.40	25.43	0.668	646.48	3.89	1755
337	Furniture and Related Product Manufacturing	9.11	52.01	1.27	25.53	0.712	651.59	1.41	1145
339	Miscellaneous Manufacturing	6.81	31.04	1.43	23.19	0.575	537.79	3.73	1175
423	Merchant Wholesalers, Durable Goods	10.78	104.34	1.25	35.45	0.217	1256.47	7.32	11315
424	Merchant Wholesalers, Nondurable Goods	13.68	123.27	0.85	23.32	0.123	544.04	7.60	8750
454	Nonstore Retailers	11.60	44.58	1.08	10.56	0.154	111.50	6.93	1225
493	Warehousing and Storage	15.52	74.79	0.38	6.48	0.066	41.99	4.60	1245
511	Publishing Industries (except Internet)	7.52	27.58	1.22	15.59	0.462	243.06	4.57	665
551	Management of Companies and Enterprises	-	-	5.27	51.83	0.650	2685.97	88.02	1000

Table 241: Freight Production 3-Digit NAICS-All Modes–Non-Linear Model-Log-Lin (CFS 2007)

CFS - United States - All Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (Except Oil and Gas)	18.67	184.82	0.013	6.87	0.064	47.15	4.48	1550
311	Food Manufacturing	15.23	101.59	0.005	12.63	0.123	159.61	9.02	2930
312	Beverage and Tobacco Manufacturing	14.13	52.68	0.008	4.63	0.147	21.45	8.47	470
313	Textile Mills	12.58	49.76	0.011	4.80	0.345	23.06	4.07	380
314	Textile Product Mills	10.15	44.07	0.015	4.36	0.287	19.02	5.50	345
315	Apparel Manufacturing	9.51	27.61	0.014	6.31	0.225	39.76	5.68	245
316	Leather and Allied Product Manufacturing	9.79	22.37	0.020	5.05	0.249	25.48	5.43	115
321	Wood Product Manufacturing	13.89	87.83	0.015	4.96	0.152	24.57	7.10	1945
322	Paper Manufacturing	14.70	59.29	0.011	10.79	0.307	116.40	5.95	1210
323	Printing and Related Support Activities	10.35	100.10	0.019	17.96	0.352	322.60	4.40	1370
324	Petroleum and Coal Products Manufacturing	17.92	105.81	0.009	10.03	0.039	100.64	6.30	660
325	Chemical Manufacturing	14.18	95.51	0.003	3.55	0.029	12.59	11.91	2480
326	Plastics and Rubber Products Manufacturing	12.70	80.49	0.011	13.52	0.229	182.85	6.78	2145
327	Nonmetallic Mineral Product Manufacturing	16.09	108.47	0.013	8.04	0.042	64.64	10.97	2495
331	Primary Metal Manufacturing	13.63	42.20	0.007	6.67	0.203	44.47	10.56	995
332	Fabricated Metal Product Manufacturing	11.58	94.27	0.014	7.71	0.181	59.43	8.01	3365
333	Machinery Manufacturing	10.97	72.02	0.008	10.66	0.207	113.74	7.63	2075
334	Computer and Electronic Product	9.58	64.49	0.003	5.77	0.126	33.34	5.82	1350
335	Electrical Equipment, Appliance, and Component Manufacturing	10.83	48.51	0.007	6.88	0.258	47.40	7.36	835
336	Transportation Equipment Manufacturing	11.75	60.48	0.003	8.25	0.150	68.01	9.96	1755
337	Furniture and Related Product Manufacturing	11.79	104.59	0.008	7.19	0.236	51.65	3.73	1145
339	Miscellaneous Manufacturing	9.34	59.87	0.009	7.84	0.161	61.49	7.35	1175
423	Merchant Wholesalers, Durable Goods	12.84	208.08	0.024	9.65	0.062	93.08	8.77	11315
424	Merchant Wholesalers, Nondurable Goods	15.03	251.98	0.012	15.91	0.038	253.06	8.33	8750
454	Nonstore Retailers	13.31	102.30	0.005	5.22	0.011	27.26	8.10	1225
493	Warehousing and Storage	16.10	132.06	0.005	10.20	0.051	104.12	4.68	1245
511	Publishing Industries (except Internet)	9.81	56.10	0.006	5.06	0.164	25.63	7.10	665
551	Management of Companies and Enterprises	-	-	0.018	3.27	0.032	10.69	243.51	1000

Table 242: Freight Production 2-Digit NAICS-Road Mode–Non-Linear Model-Lin-Log (CFS 2007)

CFS - United States - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
21	Mining	282,432,192	34.63	0.439	1199.27	7.3E+08	1550
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	26,039,527	35.25	0.216	1242.66	1.6E+08	4480
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	31,515,922	40.47	0.123	1637.75	2.3E+08	12310
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	4,777,409	25.63	0.054	657.02	6.0E+07	12700
42	Wholesale Trade	16,109,203	33.37	0.060	1113.53	1.4E+08	20065
45	Sporting Goods, Hobby, Books & Music Stores	3,344,522	20.66	0.244	426.66	1.1E+07	1225
49	Postal Service, Couriers & Messengers, Warehousing & Storage	32,568,847	18.31	0.208	335.18	1.5E+08	1245
51	Information	2,302,358	8.71	0.101	75.94	1.8E+07	665
55	Management of Companies and Enterprises	27,154,413	9.91	0.090	98.17	2.1E+08	1000

Table 243: Freight Production 2-Digit NAICS-Road Mode–Non-Linear Model-Log-Log (CFS 2007)

CFS - United States - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	16.90	94.60	0.96	15.93	0.286	253.85	3.27	1550
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	9.60	46.68	1.60	32.61	0.520	1063.23	6.76	4480
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	12.34	82.41	1.05	26.12	0.187	682.33	10.99	12310
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	7.93	90.28	1.43	65.34	0.553	4268.96	4.68	12700
42	Wholesale Trade	12.03	148.57	1.01	37.01	0.144	1369.77	8.33	20065
45	Sporting Goods, Hobby, Books & Music Stores	11.58	44.10	1.08	10.40	0.151	108.13	7.06	1225
49	Postal Service, Couriers & Messengers, Warehousing & Storage	15.39	75.58	0.41	6.95	0.076	48.24	4.40	1245
51	Information	7.37	27.30	1.25	16.14	0.483	260.60	4.39	665
55	Management of Companies and Enterprises	-	-	5.19	52.43	0.656	2748.57	83.09	1000

Table 244: Freight Production 2-Digit NAICS-Road Mode–Non-Linear Model-Log-Lin (CFS 2007)

CFS - United States - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
21	Mining	18.61	190.65	0.011	6.45	0.045	41.66	4.34	1550
31	Food, Beverage, Tobacco, Textile, Apparel, Leather & Allied Product Manufacturing	13.43	104.08	0.007	15.20	0.135	231.12	12.07	4480
32	Wood, Paper, Printing, Petroleum & Coal Products, Chemical, Plastics, Nonmetallic & Mineral Product Manufacturing	14.50	178.17	0.006	5.89	0.035	34.72	13.01	12310
33	Metal, Machinery, Computer, Electronics, Electrical Equipment, Transportation, Furniture & Misc. Manufacturing	11.20	185.30	0.005	14.58	0.118	212.51	9.18	12700
42	Wholesale Trade	13.68	322.55	0.017	17.98	0.047	323.34	9.26	20065
45	Sporting Goods, Hobby, Books & Music Stores	13.28	101.54	0.005	5.23	0.011	27.38	8.21	1225
49	Postal Service, Couriers & Messengers, Warehousing & Storage	16.00	134.27	0.005	10.38	0.056	107.76	4.49	1245
51	Information	9.73	55.87	0.006	5.07	0.168	25.75	6.96	665
55	Management of Companies and Enterprises	-	-	0.018	3.26	0.033	10.66	231.75	1000

Table 245: Freight Production 3-Digit NAICS-Road Mode–Non-Linear Model-Lin-Log (CFS 2007)

CFS - United States - Road Modes [pounds/year]							
NAICS	Description	β	t-stat	Adj. R^2	F-stat	RMSE	Obs.
212	Mining (except Oil and Gas)	282,432,192	34.63	0.439	1199.27	7.30E+08	1550
311	Food Manufacturing	30,186,424	36.27	0.322	1315.36	1.54E+08	2930
312	Beverage and Tobacco Product Manufacturing	55,070,117	12.91	0.248	166.58	2.58E+08	470
313	Textile Mills	3,236,767	11.88	0.264	141.17	1.87E+07	380
314	Textile Product Mills	3,100,576	7.66	0.142	58.71	1.80E+07	345
315	Apparel Manufacturing	360,950	6.42	0.120	41.23	2.59E+06	245
316	Leather and Allied Product Manufacturing	452,518	4.69	0.145	21.95	2.73E+06	115
321	Wood Product Manufacturing	14,202,550	26.17	0.242	684.71	6.80E+07	1940
322	Paper Manufacturing	22,255,566	24.03	0.319	577.35	1.26E+08	1210
323	Printing and Related Support Activities	3,034,954	12.78	0.092	163.39	2.36E+07	1370
324	Petroleum and Coal Products Manufacturing	148,268,574	17.30	0.311	299.38	4.34E+08	660
325	Chemical Manufacturing	18,347,836	24.77	0.198	613.34	1.04E+08	2480
326	Plastics and Rubber Products Manufacturing	4,918,655	26.46	0.243	700.36	2.86E+07	2145
327	Nonmetallic Mineral Product Manufacturing	64,152,503	30.92	0.264	955.81	2.66E+08	2495
331	Primary Metal Manufacturing	25,910,905	12.68	0.159	160.90	2.22E+08	995
332	Fabricated Metal Product Manufacturing	4,085,332	22.28	0.119	496.49	3.14E+07	3365
333	Machinery Manufacturing	2,346,774	12.38	0.075	153.29	2.57E+07	2075
334	Computer and Electronic Product Manufacturing	388,738	7.32	0.043	53.62	5.66E+06	1360
335	Electrical Equipment, Appliance, and Component Manufacturing	3,422,187	9.54	0.117	90.94	3.04E+07	835
336	Transportation Equipment Manufacturing	6,425,835	12.15	0.101	147.58	6.73E+07	1755
337	Furniture and Related Product Manufacturing	1,974,956	13.54	0.139	183.45	1.36E+07	1145
339	Miscellaneous Manufacturing	718,824	11.46	0.085	131.39	5.96E+06	1175
423	Merchant Wholesalers, Durable Goods	7,321,444	24.47	0.050	598.71	7.15E+07	11315
424	Merchant Wholesalers, Nondurable Goods	28,020,169	26.78	0.089	717.35	1.97E+08	8750
454	Nonstore Retailers	3,344,522	20.66	0.244	426.66	1.14E+07	1225
493	Warehousing and Storage	32,568,847	18.31	0.208	335.18	1.51E+08	1245
511	Publishing Industries (except Internet)	2,302,358	8.71	0.101	75.94	1.81E+07	665
551	Management of Companies and Enterprises	27,154,413	9.91	0.090	98.17	2.09E+08	1000

Table 246: Freight Production 3-Digit NAICS-Road Mode–Non-Linear Model-Lin-Log (CFS 2007)

CFS - United States - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (Except Oil and Gas)	16.90	94.60	0.96	15.93	0.286	253.85	3.27	1550
311	Food Manufacturing	11.22	43.20	1.39	23.64	0.507	559.06	5.03	2930
312	Beverage and Tobacco Manufacturing	11.32	31.45	1.47	16.07	0.580	258.39	4.19	470
313	Textile Mills	9.39	19.69	1.27	10.87	0.636	118.17	2.23	380
314	Textile Product Mills	7.53	23.76	1.58	17.09	0.681	292.08	2.75	345
315	Apparel Manufacturing	6.77	14.12	1.43	11.21	0.643	125.72	2.68	245
316	Leather and Allied Product Manufacturing	7.75	11.04	1.25	6.14	0.530	37.69	3.25	115
321	Wood Product Manufacturing	11.32	48.87	1.32	20.44	0.480	417.92	4.27	1945
322	Paper Manufacturing	10.23	22.64	1.54	15.15	0.726	229.42	2.28	1210
323	Printing and Related Support Activities	7.69	51.19	1.52	34.89	0.693	1217.15	2.25	1370
324	Petroleum and Coal Products Manufacturing	17.15	53.21	0.51	4.33	0.050	18.77	6.22	660
325	Chemical Manufacturing	10.79	43.51	1.40	21.84	0.399	477.14	7.01	2480
326	Plastics and Rubber Products Manufacturing	8.87	36.43	1.53	26.10	0.674	681.10	2.91	2145
327	Nonmetallic Mineral Product Manufacturing	14.33	49.21	0.97	11.02	0.155	121.42	9.70	2495
331	Primary Metal Manufacturing	8.78	23.13	1.66	20.02	0.674	400.96	4.21	995
332	Fabricated Metal Product Manufacturing	8.54	52.75	1.49	34.71	0.542	1204.90	4.50	3365
333	Machinery Manufacturing	7.63	37.46	1.44	29.43	0.651	866.18	3.33	2075
334	Computer and Electronic Product	6.97	30.19	1.06	19.88	0.513	395.04	3.39	1350
335	Electrical Equipment, Appliance, and Component Manufacturing	7.25	26.00	1.50	23.54	0.673	554.24	3.13	835
336	Transportation Equipment Manufacturing	8.06	31.06	1.37	25.09	0.646	629.41	4.14	1755
337	Furniture and Related Product Manufacturing	9.03	49.21	1.28	24.76	0.698	612.84	1.53	1145
339	Miscellaneous Manufacturing	6.77	30.32	1.41	22.55	0.551	508.58	3.98	1175
423	Merchant Wholesalers, Durable Goods	10.68	104.94	1.23	35.53	0.213	1262.13	7.31	11315
424	Merchant Wholesalers, Nondurable Goods	13.57	124.66	0.83	23.10	0.125	533.39	7.08	8750
454	Nonstore Retailers	11.58	44.10	1.08	10.40	0.151	108.13	7.06	1225
493	Warehousing and Storage	15.39	75.58	0.41	6.95	0.076	48.24	4.40	1245
511	Publishing Industries (except Internet)	7.37	27.30	1.25	16.14	0.483	260.60	4.39	665
551	Management of Companies and Enterprises	-	-	5.19	52.43	0.656	2748.57	83.09	1000

Table 247: Freight Production 3-Digit NAICS-Road Mode–Non-Linear Model-Lin-Log (CFS 2007)

CFS - United States - Road Modes [pounds/year]									
NAICS	Description	α	t-stat	β	t-stat	Adj. R^2	F-stat	S^2	Obs.
212	Mining (Except Oil and Gas)	18.61	190.65	0.011	6.45	0.045	41.66	4.34	1550
311	Food Manufacturing	15.13	101.11	0.005	12.64	0.124	159.70	8.89	2930
312	Beverage and Tobacco Manufacturing	14.11	51.90	0.008	4.58	0.144	20.97	8.52	470
313	Textile Mills	12.57	49.72	0.011	4.71	0.342	22.18	4.04	380
314	Textile Product Mills	10.03	39.94	0.015	4.34	0.270	18.81	6.15	345
315	Apparel Manufacturing	9.52	27.96	0.014	6.27	0.224	39.32	5.56	245
316	Leather and Allied Product Manufacturing	9.74	22.58	0.020	5.10	0.253	26.06	5.16	115
321	Wood Product Manufacturing	13.86	88.66	0.014	4.97	0.147	24.73	6.98	1945
322	Paper Manufacturing	14.69	59.55	0.010	10.62	0.292	112.76	5.89	1210
323	Printing and Related Support Activities	10.25	96.60	0.019	17.92	0.340	320.98	4.72	1370
324	Petroleum and Coal Products Manufacturing	17.89	104.25	0.005	6.26	0.011	39.13	6.47	660
325	Chemical Manufacturing	13.99	95.44	0.003	3.59	0.027	12.86	11.27	2480
326	Plastics and Rubber Products Manufacturing	12.67	80.43	0.011	13.50	0.226	182.19	6.82	2145
327	Nonmetallic Mineral Product Manufacturing	16.06	107.94	0.013	7.94	0.039	63.06	11.03	2495
331	Primary Metal Manufacturing	13.55	42.46	0.007	6.60	0.197	43.56	10.40	995
332	Fabricated Metal Product Manufacturing	11.55	94.16	0.014	7.71	0.179	59.51	8.04	3365
333	Machinery Manufacturing	10.95	72.76	0.007	10.59	0.201	112.07	7.51	2075
334	Computer and Electronic Product	9.41	61.46	0.003	5.75	0.112	33.01	6.16	1350
335	Electrical Equipment, Appliance, and Component Manufacturing	10.90	50.98	0.007	6.93	0.254	47.98	7.03	835
336	Transportation Equipment Manufacturing	11.67	61.52	0.003	8.54	0.152	72.89	9.80	1755
337	Furniture and Related Product Manufacturing	11.74	100.83	0.008	7.18	0.229	51.58	3.90	1145
339	Miscellaneous Manufacturing	9.32	60.10	0.009	7.83	0.152	61.35	7.32	1175
423	Merchant Wholesalers, Durable Goods	12.74	208.98	0.023	9.56	0.060	91.34	8.70	11315
424	Merchant Wholesalers, Nondurable Goods	14.88	257.40	0.013	16.04	0.043	257.15	7.73	8750
454	Nonstore Retailers	13.28	101.54	0.005	5.23	0.011	27.38	8.21	1225
493	Warehousing and Storage	16.00	134.27	0.005	10.38	0.056	107.76	4.49	1245
511	Publishing Industries (except Internet)	9.73	55.87	0.006	5.07	0.168	25.75	6.96	665
551	Management of Companies and Enterprises	-	-	0.018	3.26	0.033	10.66	231.75	1000

Appendix C: Survey Used to FSA Collect Data

Figure 10: FG, FTG and STG Survey Used in Case Study (Page 1)

Freight Trip Generation Study

Information you provide here will be kept confidential and will be used for planning purposes only

ESTABLISHMENT INFORMATION

Name: _____ Address _____

City: _____ State: _____

PIN: _____ Phone: _____

CONTACT INFORMATION FOR THE PERSON COMPLETING THE SURVEY

Name: _____ Position _____

Phone number: _____ E-mail: _____

BUSINESS ACTIVITY

Nature of business: Restaurants ☐ Food store ☐ Apparel/Accesory store ☐ Building materials ☐ Other: _____

TYPE OF ESTABLISHMENT

Is this the headquarters of the firm? YES ☐ NO ☐

NUMBER OF PEOPLE CURRENTLY EMPLOYED AT THIS ADDRESS

	Full time	Part time
Total number of employee at establishment		
Total number of employees in a typical day		

Is the work done at the premises performed in shifts? YES ☐ NO ☐

Total number of employees per shift: _____

TRIPS RELATED TO GOODS AND SUPPLIES

NUMBER OF DELIVERY TRIPS WITH THIS ADDRESS AS ORIGIN OR DESTINATION BY VEHICLE TYPE

In the table below, provide the average number of deliveries PER DAY/ PER WEEK (e.g., office supplies and food)
If no information is available use "n/a". If the answer is zero use "0"

Description	Example	MADE FROM this address (deliveries to customers)	RECEIVED AT this address (deliveries to establishment)	Time unit
Cars				☐ per day ☐ per week
Small pickups/vans				☐ per day ☐ per week
2 axle single unit trucks				☐ per day ☐ per week
Large trucks				☐ per day ☐ per week
Couriers	e.g.: FedEx, UPS			☐ per day ☐ per week
Other / Don't know				☐ per day ☐ per week

Figure 11: FG, FTG and STG Survey Used in Case Study (Page 2)

TYPE OF CARGO PRODUCED AND RECEIVED BY THE ESTABLISHMENT

Type of cargo produced	Quantity	Unit (e.g., tons, lbs)	Type of cargo received	Quantity	Unit (e.g., tons, lbs)

TRIPS RELATED TO SERVICES

NUMBER OF SERVICE TRIPS WITH THIS ADDRESS AS ORIGIN OR DESTINATION BY VEHICLE TYPE

In the table below, provide the average number of service trips PER DAY/ PER WEEK (e.g., cleaning the windows)
If no information is available use "n/a". If the answer is zero use "0"

Description	Example	LEAVING this address	RECEIVED AT this address	Time unit
Cars				☐ per day ☐ per week
Small pickups/vans				☐ per day ☐ per week
2 axle single unit trucks				☐ per day ☐ per week
Other / Don't know				☐ per day ☐ per week

SITE AND GROSS FLOOR AREA

Is your establishment the only one at this site?	Total site area*	Establishment Floor Area*
NO		
YES	N/A	

* Specify units (e.g., sq. yds, sq. ft, acres)
Number of floors of the main building occupied by the firm: _____

NUMBER OF VEHICLES OPERATED FROM THIS ADDRESS BY TYPE

Notes: (1) Include leased vehicles. See the diagram of vehicle types in the next question.
(2) If you do not know the answer fill it in using "n/a"

Cars:		4 or fewer axle single-trailer trucks:	
Small pickups/vans:		5 axle single or multi-trailer trucks:	
2 axle single unit trucks:		6 or more axle single or multi-trailer trucks:	
3 or 4 axle single unit trucks:		others/ not specified:	