

# Package ‘rFreight’

October 5, 2016

**Title** Support for disaggregate simulation of freight movement

**Version** 0.1

**Description** The functions can be used to create a complete model system that simulates firms, trading relationships, freight demand, shipment frequency and routing, and movements of freight by truck, rail, ship, and airplane.

**Depends** R (>= 3.1.1)

**License** GPL-3

**LazyData** true

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corresp\_naics6\_n6io\_sctg

*Correspondence between NAICS 6, NAICS IO, and SCTG Codes*

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## Description

This file is a correspondence between three classifications and shows the commodities produced by each industry. Industries and commodities are defined at the 6-digit NAICS level using both the systems used by the U.S. Census Bureau and the slightly more aggregated system used by the U.S. Bureau of Economic Analysis. In addition, the table indicates the correspondence between these detailed NAICS 6-digit industry codings and the much more aggregate 2-digit SCTG commodity classification. The table shows the commodities that are produced by each industry. In some cases, industries produce more than one commodity; the final column is a proportion that is used to account for this. In many cases, a single industry is credited with making the entire domestic supply of a commodity (proportion = 1.0), which is expected given the 6-digit level of detail. Where the proportion is less than 1.0, there should be multiple industry entries for the same commodity, such that their proportions sum to 1.0.

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## Usage

corresp\_naics6\_n6io\_sctg

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corresp\_naics6\_n6io\_sctg

**Format**

A dataframe with 7 variables

**Industry\_NAICS6\_Make** Six-digit NAICS code of the industry

**Industry\_NAICS6\_Make\_desc** SCTG two-digit code of the commodity

**Industry\_NAICS6\_CBP** Six-digit NAICS (Census) industry code

**Industry\_NAICS6\_CBP\_desc** Description of the NAICS (Census) industry code

**Commodity\_SCTG** SCTG two-digit code of the commodity

**Commodity\_SCTG\_desc** SCTG code description

**Proportion** Proportion of the SCTG commodity made by the NAICS6\_Make industry

**Details**

This correspondence file is an input to the firm synthesis step to identify what a firm in that industry produces and to convert between the two different systems of NAICS coding (used in employment data and input-output data respectively).

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corresp\_sctg\_category    *Correspondence between SCTG Codes and other Commodity Aggregations*

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## Description

This file shows the commodity group categories used for parameter assumptions. Commodities in Category are categorized (animals, bulk natural resources, intermediate processed goods, finished goods and others) based on the commodity's physical characteristics. Commodities in Category2 are categorized (functional, semi-functional, semi-innovative, and innovative) based on the commodity and supply chain characteristics (e.g. demand pattern, time-sensitivity, cost level, etc.).

## Usage

corresp\_sctg\_category

## Format

A dataframe with 43 rows and 5 variables

**Commodity\_SCTG** Two digits SCTG commodity code

**Commodity\_SCTG\_desc\_short** Short name of the SCTG commodity

**Commodity\_SCTG\_desc\_long** SCTG commodity description

**Category** Commodity category group 1, used in mode and path choice model

**Category2** Commodity category group 2, used in the assignment of cost and time weights for use in the PMGs

## Details

This table is used to provide a correspondence between the SCTG codes and more aggregate commodity groups used in various model steps. The categories are defined based on physical characteristics or commodity and supply chain characteristics, and specific model parameters are associated with each of these aggregate commodity groups in, for example, the total cost equation used in the mode choice model.

## Source

The sources of this table include the article by Marshall L. Fisher (1997), What is the right supply chain for your product? (Harvard business review 75 (1997): 105-117) which helped with the idea of categorizing product types based on different product characteristics.

data\_2010io

*Data: detailed 2010 use table after redefinitions***Description**

This file contains detailed 2010 Use table after redefinitions data developed using the 2007 benchmark Input-Output (I-O) accounts. The Input-Output accounts show how industries interact. This table shows the inputs to industry production and the commodities that are consumed by final users. For each production industry, the table reports the value of goods consumed by each buyer industry. The table includes 386 different producing industries showing about 5.7 trillion dollar value of inputs.

**Usage**

data\_2010io

**Format**

A dataframe with 302 rows and 387 variables

**Industry\_NAICS6\_MakeUse** NAICS (BEA) commodity code of the making industry

**X1111A0** (and all subsequent fields) Annual values of commodities exchanged between industries, where columns are the using industry (units of millions of dollars per year)

**Details**

The model uses this information to identify for each buyer industry the most important commodities that are consumed and their associated supplier industries.

**Source**

The sources of this table include the U.S. Bureau of Economic Analysis (2007), BEA Input-Output Make and Use tables ([http://www.bea.gov/industry/io\\_annual.htm](http://www.bea.gov/industry/io_annual.htm)). It is derived from Make Tables/After Redefinitions in the detailed version from the Industry Input-Output Accounts Data. The 2010 detailed use table (6 digits NAICS codes) was developed by factoring up the 2007 detailed table by growth factors calculated from the 207 and 2010 summary level (3 digits NAICS codes) tables and it was assumed all 6 digits NAICS industries under a 3 digits NAICS industry grow with the same growth factor from 2007 to 2010.

data\_emp\_cbp

*Correspondence between NAICS 6, NAICS IO, and SCTG Codes***Description**

This file shows the number of employees and establishments by six digits NAICS industry, FAF zone, and county, , although the employment data in this file are derived from the County Business Patterns data are subject to censoring. This file also has the number of establishments by eight different employment size groups.



**Usage**

data\_emp\_cbp

**Format**

A dataframe with 113409 rows and 13 variables

**Industry\_NAICS6\_CBP** Six digits NAICS (Census) code**FAFZONE** FAF zone**CBPZONE** County Business Pattern (CBP) zone**employment** Total number of employees (subject to censoring)**establishment** Total number of establishments**e1** Total number of establishments with 1-19 employees**e2** Total number of establishments with 20-99 employees**e3** Total number of establishments with 100-249 employees**e4** Total number of establishments with 250-499 employees**e5** Total number of establishments with 500-999 employees**e6** Total number of establishments with 1000-2499 employees**e7** Total number of establishments with 2500-4999 employees**e8** Total number of establishments with more than 5000 employees**Details**

This employment data is used in the firm synthesis step and in conjunction with information from the Make and Use tables to develop a set of synthetic firms characterized with commodities produced and consumption requirements. County-level employment data for the United States outside of CMAP area, in the form of County Business Patterns (CBP) data, are aggregated to a FAF zone resolution, while the county level data are used with the CMAP area and during the firm synthesis step allocated to the smaller mesozones used in the model.

**Source**

The sources of this table include the 2010 U.S. Census County Business Pattern data (<http://www.census.gov/econ/cbp/>). The dataset is an annual series that provides subnational economic data by industry.

data\_emp\_cbpzone

*Data table of employment by county***Description**

This file shows total employment for each of the zones in the CBP zone system.

**Usage**

data\_emp\_cbpzone

**Format**

A dataframe with 151 rows and 2 variables

**COUNTY** Zone numbering for CBP zone system (combination of FAF zones and counties)

**CBP\_EMP** Total employment in the zone

**Details**

This employment data is used in the vehicle and tour pattern model to develop the employment by zone variable for the choice model.

**Source**

The sources of this table include the 2010 U.S. Census County Business Pattern data (<http://www.census.gov/econ/cbp/>). The dataset is an annual series that provides subnational economic data by industry.

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data\_firm\_pref\_weights

*Data: cost and time preference weights by SCTG commodity categories*

---

**Description**

This file shows the cost and time preference weights and the maximum single source fraction by SCTG commodity categories. Weights are calculated using the categorization of commodities (functional, semi-functional, semi-innovative, and innovative) which are determined using assumptions on commodity characteristics (e.g. demand pattern, time-sensitivity, and cost level). Commodity cost-weight is determined using FAF dollar/ton values. Commodity time-weight is determined based on commodity supply chain-related characteristics (e.g. demand pattern, lead-time focus, transportation strategy).

**Usage**

data\_firm\_pref\_weights

**Format**

A dataframe with 43 rows and 6 variables

**Commodity\_SCTG** SCTG commodity code

**Commodity\_SCTG\_desc** SCTG commodity description

**Commodity\_Type** Commodity category, e.g., Innovative

**CostWeight** Cost weight as a share (calculated based on commodity type)

**TimeWeight** Time weight as a share (calculated based on commodity type)

**SingleSourceMaxFraction** Single source max fraction as a share (calculated based on commodity type)

## Details

This table is used to develop inputs for the Procurement Market Games (PMGs). In the PMG, agents representing producers of an output commodity (buyers) are instantiated with a quantity of an input commodity to purchase and a set of preference weights that allow them to tradeoff unit costs, service time, and potentially other attributes when considering the utility of a potential trading partner.

## Source

The sources of this table include the FHWA's 2007 Freight Analysis Framework data ([http://www.ops.fhwa.dot.gov/freight/freight\\_analysis/faf/](http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/)). The article by Marshall L. Fisher (1997), What is the right supply chain for your product?, is also a source for this input table that helped with the idea of categorizing product types (commodities) based on different product characteristics.

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data_foreign_cons	<i>Data: total export value by Country and commodity</i>
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## Description

This file shows the total exports value (domestic and foreign) valued on a free alongside ship (FAS) basis. The FAS reflects transaction price including inland freight, insurance and other charges incurred in placing the merchandise alongside the ship at the port of export. The export value in this input table is reported by six digits NAICS code and the country where the goods are to be consumed, further processed, or manufactured as known to the shipper at the time of exportation.

## Usage

data\_foreign\_cons

## Format

A dataframe with 53486 rows and 6 variables

**Country** Foreign country of destination names (trading with USA)

**Commodity\_NAICS6** Six-digit NAICS commodity code

**USExpVal** Total exports value in dollars

**FAFZONE** FAF zone of the country of destination

**ctrycod** Country code of the country of destination

**CBPZONE** CBP Zone code of the country of destination

## Details

Since the CBP data does not contain foreign employment data, this table is used to include foreign firms in the model to ensure that international flows between the U.S. and foreign countries can be allocated to consuming firms at the foreign country end. This table is used in firm synthesis to develop and characterize a set of agents located in foreign countries that consume goods.

## Source

The sources of this table include the USA Census Trade Online (NAICS-based data) (<https://usatrade.census.gov/>). Provided by the U.S. Census Bureau's Foreign Trade Division, USA Trade Online provide current and cumulative U.S. export and import data on more than 9,000 export commodities and 17,000 import commodities worldwide. NAICS-based data as part of Foreign Trade Statistics data is the most detailed available data on US imports and exports by NAICS codes (6 digits) and by country.

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data\_foreign\_prod

*Data: total import value by Country and commodity*

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## Description

This file shows the cost, insurance, and freight (CIF) value of US imports by country and 6-digit NAICS code. The CIF value represents the landed value of the merchandise at the first port of arrival in the US. It is computed by adding the Customs Value to the aggregate cost of all freight, insurance, and other charges (excluding US import duties) incurred in moving merchandise from alongside the carrier at the port of exportation in the country of export and placing it alongside the carrier at the first port of entry in the US.

## Usage

data\_foreign\_prod

## Format

A dataframe with 28470 rows and 6 variables

**Country** Foreign country of origin names (trading with USA)

**Commodity\_NAICS6** Six-digit NAICS commodity code

**USImpVal** Total imports value

**FAFZONE** FAF zone of the country of origin

**ctrycod** Country code of the country of origin

**CBPZONE** CBP Zone code the country of origin

## Details

Since the CBP data does not contain foreign employment data, this table is used to include foreign firms in the model to ensure that international flows to the U.S. from foreign countries can be allocated to producing firms at the foreign country end. This table is used in firm synthesis to develop and characterize a set of agents located in foreign countries that produce goods.

## Source

The sources of this table include the USA Census Trade Online (NAICS-based data) (<https://usatrade.census.gov/>). Provided by the U.S. Census Bureau's Foreign Trade Division, USA Trade Online provide current and cumulative U.S. export and import data on more than 9,000 export commodities and 17,000 import commodities worldwide. NAICS-based data as part of Foreign Trade Statistics data is the most detailed available data on US imports and exports by NAICS codes (6 digits) and by country.

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`data_mesozone_centroids`*Data: centroids of the mesozones*

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**Description**

This file contains the centroids of the mesozones.

**Usage**`data_mesozone_centroids`**Format**

A dataframe with 269 rows and 3 variables

**stop\_zone** Mesozone ID number

**x\_coord** X coordinate of the zone centroid

**y\_coord** Y coordinate of the zone centroid

**Details**

This file is used in the stop sequence portion of the truck-touring model.

**Source**

The data are derived from the mesozone GIS polygon layer used in the mesoscale model.

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`data_mesozone_emprankings`*Employment Ranking by Industry by County*

---

**Description**

This file shows the employment ranking by industry by county. A dataset is prepared from employment data that contains the percentile ranking of each of 21 NAICS categories by TAZ based on employment numbers in each of those industries. Higher employment numbers implies a higher percentile rank. Within each county, each mesozone is assigned to one of ten percentile-ranking categories. Thresholds of 10 percent are used to determine the categories. Mesozones with the highest employment are classified as Rank 10, zones with the lowest employment Rank 1, and so on. Mesozones are FAF3 zones outside of the region, county-sized zones on the fringes of the region, and township-sized zones in the inner counties.

**Usage**`data_mesozone_emprankings`

**Format**

A dataframe with 23 variables

**COUNTY** County FIPS code

**MESOZONE** Mesozone ID number

**rank11 to rank3133** Rank of each 2 digit NAICS code industry

**Details**

For the purpose of mode choice and simulation of freight traffic, the firms in the CMAP region modeling area are assigned to mesozones within each county. A few county zones correspond to only one TAZ. The other counties correspond to more than one TAZ. TAZs are assigned to firms in these counties based on employment ranking by industry. The model uses percentile rankings to assign larger firms to mesozones with more employment and smaller firms to zones with any employment in their industry classes. The model prevents firms from being assigned to mesozones with no employment in the firms industry class.

**Source**

The sources of this table include the 2010 U.S. Census County Business Pattern data (<http://www.census.gov/econ/cbp/>).

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data_mesozone_gcd	<i>Great Circle Distances between Mesozones</i>
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**Description**

This file shows the great circle distance (GCD) between the mesozones in the model.

**Usage**

data\_mesozone\_gcd

**Format**

A dataframe with 7 variables

**Production\_zone** Production zone ID number

**Production\_lon** Longitude of the Pzone

**Production\_lat** Latitude of the Pzone

**Consumption\_zone** Consumption zone ID number

**Consumption\_lon** Longitude of the Czone

**Consumption\_lat** Latitude of the Czone

**GCD** Great Circle Distance between the Pzone and Czone (in Miles)

**Details**

This table is used to calculate distances used as a variable in the distribution channel model.

**Source**

Distances between zones were estimated using the Haversine formula ([http://en.wikipedia.org/wiki/Haversine\\_formula](http://en.wikipedia.org/wiki/Haversine_formula))

---

data_mesozone_skims	<i>Zone to Zone Travel Times Between Mesozones</i>
---------------------	--

---

**Description**

This file shows the zone to zone travel times between mesozones within the CMAP region.

**Usage**

data\_mesozone\_skims

**Format**

A dataframe with 3 variables

**Origin** Origin mesozone ID number

**Destination** Destination mesozone ID number

**Time** Zone to zone travel time (Hours)

**Details**

This file is used in the stop sequencing component of the truck-touring model.

**Source**

The skims values in this file are derived from CMAPs meso freight network.

---

data_modepath_skims	<i>Skimmed Costs and Travel Times for Mode and Path Combinations</i>
---------------------	--

---

**Description**

This file contains the skims for origins and destinations with available path costs and times. The skims are based on 54 paths for different modal and route alternatives defined in the mesoscale model. These alternatives included direct modes (such as truck “ Full truck load, truck “ less than truck load, rail etc), indirect mode (such as rail-truck, water-truck etc), and also intermodal facilities (such as airports, truck terminals, rail terminals, and ports). This table has times and costs associated with all the 54 mode-path choices between all buyer-seller pairs.

**Usage**

data\_modepath\_skims

**Format**

A dataframe with 241 variables

**Origin** Origin ID of the zone pair

**Destination** Destination ID of the zone pair

... (series of fields not used in the model)

**Cost 1 : Cost 54** Travel Cost per unit weight for each of 54 path alternatives

**Time 1 : Time 54** Travel Time for each of 54 path alternatives

**Details**

This table is used in the mode and path choice model to define travel times and cost for each of the 54 path alternatives for travel to, from and within the CMAP region.

**Source**

The sources of this table are the networks, cost assumptions, and path-building assumptions as defined in the mesoscale model documentation.

---

data_unitcost	<i>Unit Costs for SCTG Commodities</i>
---------------	--

---

**Description**

This file shows the unit cost (dollar per ton) by two digits SCTG commodity codes. Commodity unit cost is determined using FAF dollar per ton values for all modes by commodity. The total tons carried by all modes all movements are divided to the total value to calculate the unit cost of the commodity.

**Usage**

data\_unitcost

**Format**

A dataframe with 2 variables

**Commodity\_SCTG** Two digits SCTG commodity code

**UnitCost** Commodity unit cost (Dollars/Ton)

**Details**

This table is used to convert production and consumption values from the BEA input output tables to tonnages produced and consumed.

**Source**

The sources of this table include the FHWA's 2007 Freight Analysis Framework data ([http://www.ops.fhwa.dot.gov/freight/freight\\_analysis/faf/](http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/)).



---

loadInputs	<i>Load a set of files to objects</i>
------------	---------------------------------------

---

**Description**

Loads a set of inputs files to objects in the global environment

**Usage**

```
loadInputs(filelist, inputdir)
```

**Arguments**

filelist	list of strings containing file names; uses the names of the list as the object names
inputdir	file path to the inputs directory (e.g. model\$inputdir)

---

loadPackage	<i>Install and load required R packages</i>
-------------	---

---

**Description**

Load required R packaging, first testing whether a package is available and installs without popping up the Cran mirror list.

**Usage**

```
loadPackage(package)
```

**Arguments**

package	Name of R package to load/download and install (character string)
---------	---

---

model_distchannel_calibration	<i>Distribution Channel Calibration Shares</i>
-------------------------------	--

---

**Description**

This file shows the distribution channel type (number of stops, 0, 1 or 2+ stops) shares by commodity groups. Shipping chain or distribution channel indicates whether the goods went through a consolidation center, a distribution center, and/or a warehouse. The commodity group codes are aggregations of the 43 SCTG commodity groups as follows: A: Agricultural Products, B: Chemical/Pharmaceutical products, C: Coal/Mineral/Ores, D: Electronics, E: Prepared Foodstuffs, F: Gravel/Natural Sands/Cements, G: Machinery/Metal Products, H: Mixed Freight/Miscellaneous, I: Motorized and Other Vehicles (incl. parts), J: Wood/Paper/textile/Leather products, K: Other

**Usage**

model\_distchannel\_calibration

**Format**

A dataframe with 3 variables

**Commodity\_Category** Commodity groups based on the reference paper used

**NumberofStops\_Choice** Shipping chain type

**Target\_Share** proportion of shipments by distribution channel for each commodity group

**Details**

This table is used for distribution channel model calibration.

**Source**

The source of this table is the study done by University of Illinois at Chicago: Pourabdollahi, Z., Karimi, B., Mohammadian, A. K., & Kawamura, K. (2014). Shipping Chain Choices in Long Distance Supply Chains: Descriptive Analysis and a Decision Tree Model 2. In Transportation Research Board 93rd Annual Meeting (No. 14-1706).

---

model\_distchannel\_food

*Distribution Channel Model Variables and Coefficients: Food Products*

---

**Description**

This file shows the distribution channel model variables and coefficients by distributing channel type for food products. A multinomial logit (MNL) model was estimated for choice of distribution channel.

**Usage**

model\_distchannel\_food

**Format**

A dataframe with 5 variables

**CHID** Distribution channel choice ID

**CHDESC** Distribution channel choice description

**VAR** Explanatory variable

**TYPE** Type of the explanatory variable

**COEFF** Coefficient of the variable

**Details**

This table is used in the distribution channel step of the model for food commodities.

**Source**

The sources of this table include the FAME survey data developed by the University of Illinois at Chicago

---

model_distchannel_mfg	<i>Distribution Channel Model Variables and Coefficients: Manufactured Goods</i>
-----------------------	--

---

**Description**

This file shows the distribution channel model variables and coefficients by distributing channel type for manufactured goods. A multinomial logit (MNL) model was estimated for choice of distribution channel.

**Usage**

model\_distchannel\_mfg

**Format**

A dataframe with 5 variables

**CHID** Distribution channel choice ID

**CHDESC** Distribution channel choice description

**VAR** Explanatory variable

**TYPE** Type of the explanatory variable

**COEFF** Coefficient of the variable

**Details**

This table is used in the distribution channel step of the model for manufactured goods.

**Source**

The sources of this table include the FAME survey data developed by the University of Illinois at Chicago.

---

model_numberoftours	<i>Number of Tours Model Variables and Coefficients</i>
---------------------	---

---

### Description

This file shows the number of tours model variables and coefficients by number of tours. A multinomial logit (MNL) model was estimated for choice of the number of tours.

### Usage

model\_numberoftours

### Format

A dataframe with 5 variables

**CHID** Number of tours model choice ID

**CHDESC** Number of tours model choice description

**VAR** Explanatory variable

**TYPE** Type of the explanatory variable

**COEFF** Coefficient of the variable

### Details

This table is used in the number of tours component of the truck-touring model.

### Source

The number of tours model was estimated using the Texas Commercial Vehicle Survey (RSG (2012) Tour-based and Supply Chain Freight Forecasting Framework Final Report Framework, developed for the Federal Highway Administration with University of Illinois at Chicago and John Bowman BAA DTFH61-10-R-00013.)

---

model_shipsize_calibration	<i>Shipment Size Calibration Shares</i>
----------------------------	---

---

### Description

This file shows the shipment size shares by shipment weight groups and commodity groups for value and tons.

### Usage

model\_shipsize\_calibration

**Format**

A dataframe with 6 variables

**Commodity\_SCTG** Two digits SCTG commodity code

**Commodity\_SCTG\_desc** Description of SCTG commodity

**ShipmentWeight** Shipment weight category (lbs)

**WeightCategory** Shipment weight category ID

**ValuePct** Percentage of value in each shipment weight category by SCTG commodity

**TonsPct** Percentage of tons in each shipment weight category by SCTG commodity

**Details**

This table is used for shipment size model calibration.

**Source**

The sources of this table include the Census Bureau and the Bureau of Transportation Statistics (BTS) Commodity Flow Survey (CFS 2007) data. The CFS is the primary source of national and state-level data on domestic freight shipments by American establishments in mining, manufacturing, wholesale, auxiliaries, and selected retail and services trade industries. Data are provided on the types, origins and destinations, values, weights, modes of transport, distance shipped, and ton-miles of commodities shipped.

---

model_shipsize_food	<i>Shipment Size Model Variables and Coefficients: Food Products</i>
---------------------	--

---

**Description**

This file shows the shipment size model variables and coefficients by shipment size groups for food products. A multinomial logit (MNL) model was estimated for choice of shipment size.

**Usage**

model\_shipsize\_food

**Format**

A dataframe with 5 variables

**CHID** Shipment size choice ID

**CHDESC** Shipment size choice description

**VAR** Explanatory variable

**TYPE** Type of the explanatory variable

**COEFF** Coefficient of the variable

**Details**

This table is used in the shipment size step of the model for food commodities.

**Source**

The Texas commercial vehicle survey dataset was used for estimating the discrete choice model.

---

model_shipsize_mfg	<i>Shipment Size Model Variables and Coefficients: Manufactured Goods</i>
--------------------	---

---

### Description

This file shows the shipment size model variables and coefficients by shipment size groups for manufactured. A multinomial logit (MNL) model was estimated for choice of shipment size.

### Usage

model\_shipsize\_mfg

### Format

A dataframe with 5 variables

**CHID** Shipment size choice ID

**CHDESC** Shipment size choice description

**VAR** Explanatory variable

**TYPE** Type of the explanatory variable

**COEFF** Coefficient of the variable

### Details

This table is used in the shipment size step of the model for manufactured goods.

### Source

The Texas commercial vehicle survey dataset was used for estimating the discrete choice model.

---

model_stopduration	<i>Stop Duration Model Variables and Coefficients</i>
--------------------	---

---

### Description

This file shows the stop duration model and coefficients. A multinomial logit (MNL) model was estimated for choice of stop duration.

### Usage

model\_stopduration

### Format

A dataframe with 5 variables

**CHID** Stop duration model choice ID

**CHDESC** Stop duration model choice description

**VAR** Explanatory variable

**TYPE** Type of the explanatory variable

**COEFF** Coefficient of the variable

### Details

This table is used in the stop duration component of the truck-touring model.

### Source

The stop duration model was estimated using the Texas Commercial Vehicle Survey (RSG (2012) Tour-based and Supply Chain Freight Forecasting Framework Final Report Framework, developed for the Federal Highway Administration with University of Illinois at Chicago and John Bowman BAA DTFH61-10-R-00013.)

---

model_timeofday	<i>Time of Day Model Variables and Coefficients</i>
-----------------	---

---

### Description

This file shows the time of day model and coefficients. A multinomial logit (MNL) model was estimated for choice of tour start time of day.

### Usage

model\_timeofday

### Format

A dataframe with 5 variables

**CHID** Time of day model choice ID

**CHDESC** Time of day model choice description

**VAR** Explanatory variable

**TYPE** Type of the explanatory variable

**COEFF** Coefficient of the variable

### Details

This table is used in the tour time of day component of the truck-touring model.

### Source

The time of day model was estimated using the Texas Commercial Vehicle Survey (RSG (2012) Tour-based and Supply Chain Freight Forecasting Framework Final Report Framework, developed for the Federal Highway Administration with University of Illinois at Chicago and John Bowman BAA DTFH61-10-R-00013.)

---

model\_vehicle\_tourpattern

*Vehicle and Tour Pattern Model Variables and Coefficients*


---

### Description

This file shows the vehicle and tour pattern model and coefficients. A multinomial logit (MNL) model was estimated for the joint choice of vehicle type and tour pattern.

### Usage

```
model_vehicle_tourpattern
```

### Format

A dataframe with 5 variables

**CHID** Vehicle and tour pattern model choice ID

**CHDESC** Vehicle and tour pattern model choice description

**VAR** Explanatory variable

**TYPE** Type of the explanatory variable

**COEFF** Coefficient of the variable

### Details

This table is used in the vehicle and tour pattern component of the truck-touring model.

### Source

The vehicle and tour pattern model was estimated using the Texas Commercial Vehicle Survey (RSG (2012) Tour-based and Supply Chain Freight Forecasting Framework Final Report Framework, developed for the Federal Highway Administration with University of Illinois at Chicago and John Bowman BAA DTFH61-10-R-00013.)

---

naics6naics2

*Convert NAICS 6 to top level 2 digit codes*


---

### Description

Given naics6 codes (Census, not BEA IO), returns naics2 codes with some aggregation (e.g. 31,32,33 reclassified as 31 Manufacturing)

### Usage

```
naics6naics2(naics6)
```

### Arguments

**naics6** vector of naics6 codes (Census, not BEA IO)



---

predict_logit	<i>Simulates the application of a logit model, with calibration</i>
---------------	---

---

### Description

This is a generic function that is capable for simulating a logit choice inputs required are a data.table and model specification data.frame the output is a vector of the simulated choices

### Usage

```
predict_logit(df, mod, cal = NULL, calcats = NULL, iter = 1)
```

### Arguments

df	data.table of observations
mod	a table of coefficients (df and mod must contain the same set of variables)
cal	a table of calibration data
caltcats	a correspondence table between the choice categories and the calibration categories
iter	the number of iterations of the application to run; 1 simply applies the model, >1 adjusts constants in the model to match calibration targets

### Examples

```
## Not run:
predict_logit(df,mod) #applies the model without calibration

## End(Not run)
```

---

progressEnd	<i>Ends a model step</i>
-------------	--------------------------

---

### Description

This function is called at the end of a model component. It produces outputs, save workspaces, closes the progress bar, and saves the runtimes for the model component.

### Usage

```
progressEnd(stepList, modellist = model)
```

### Arguments

stepList	List object for the current model component
modellist	List object for the model, defaults to model

### Examples

```
## Not run:
progressEnd(firm_synthesis)

## End(Not run)
```

---

progressManager	<i>Starts and stops the overall progress management system for a model</i>
-----------------	--

---

### Description

This function is the main manager for the model progress management framework that controls the progress bars, run time recording, logging, and profiling

### Usage

```
progressManager(StartStop, Step_RunTimes, outputlog = FALSE,
  Main_Log = "Main_Log.txt", outputprofile = FALSE,
  Profile_Log = "Profile.out", Profile_Summary = "Profile_Summary.txt")
```

### Arguments

StartStop	flag to either start or stop progress managements, "Start" or "Stop" character string
Step_RunTimes	file path and file name for run times .csv file
outputlog	TRUE/FALSE for logging in a text file
Main_Log	file path and file name for log text file
outputprofile	TRUE/FALSE for run profiling via Rprof() and summaryRprof()
Profile_Log	file path and file name for profile output file
Profile_Summary	file path and file name for profile summary file

### Examples

```
## Not run:
progressManager("Start", Step_RunTimes, outputlog, Main_Log,
  outputprofile, Profile_Log, Profile_Summary)

## End(Not run)
```

---

progressNextStep	<i>Increments the progress bar to the next progress step</i>
------------------	--

---

### Description

This function is called at the beginning of a step within a model component. It increments the progress bar and change the text describing the step now taking place. It also calculate the run time for the preceding step.

### Usage

```
progressNextStep(stepname)
```

**Arguments**

stepname            Name of the step within a model component about to be run, character string

**Examples**

```
## Not run:
progressNextStep("Reading Inputs")

## End(Not run)
```

---

progressStart	<i>Starts a model step: progress bar, timing, loading inputs</i>
---------------	--

---

**Description**

This function is called at the beginning of a model component to initiate the progress bar, to start timing the model steps, and to load the input used during the model

**Usage**

```
progressStart(stepList, steps, modellist = model)
```

**Arguments**

stepList            List object for the current model component

steps               Number of progress bar steps, integer ( $\geq 1$ )

modellist            List object for the model, defaults to model

**Examples**

```
## Not run:
progressStart(firm_Synthesis,9)

## End(Not run)
```

---

rFreight	<i>Freight forecasting functions</i>
----------	--------------------------------------

---

**Description**

A set of functions to support disaggregate simulation of freight movement – both shipments and the resulting freight vehicle movements.

## Details

The functions can be used to create a complete model system that simulates firms, trading relationships, freight demand, shipment frequency and routing, and movements of freight by truck, rail, ship, and airplane.

The functions can be grouped into the following categories:

**Application** General model application functions; for example, simulating logit choice models

**Freight-Data** Functions that process elements of freight data and embody freight data specific nuances

**Managerment** Functions that support management of the model flow; for example, organizing inputs and outputs and reporting progress to the model user

**PMG** Functions to support integration with the procurement market game application

**Truck-touring** Functions to support application of the truck touring model components

The package also includes a complete set of documented input datasets that have been used for an implementation of a model system in the CMAP region

---

runPMG	<i>Builds the system call to the PMG application and runs the application</i>
--------	---

---

## Description

Builds the systems call including the command line options to run the PMG application for a particular NAICS market and group sample from within the full set of buyers and sellers in that NAICS market.

## Usage

```
runPMG(naics_io_code, groupnum = NA, writelog = FALSE, invisible = TRUE,
       wait = FALSE, pmgexe = "./PMG/pmg.exe", inipath = "./PMG/pmg.ini",
       inpath = "./outputs", outpath = "./outputs", logpath = "./outputs")
```

## Arguments

naics_io_code	BEA io code for the commodity to be run, i.e., that matches with the filenames used for the buy/sell/costs files (character string).
groupnum	is the sample group numbers for the group to be run, i.e., that matches with the numbering used for the buy/sell/costs files (integer).
writelog	TRUE/FALSE to indicate whether to capture standard output from the PMG application is a text file.
invisible	TRUE/FALSE to indicate whether to show the command window or not.
wait	TRUE/FALSE to indicate whether to R should wait for the PMG application to finish, or (if false) should run the PMG application asynchronously.
pmgexe	Path to the pmg executable, defaults to "./PMG/pmg.exe"
inipath	Path to the ini file, defaults to "./PMG/PMG.ini"
inpath	Path to the PMG inputs folder, defaults to "./outputs"
outpath	Path to the PMG outputs folder, defaults to "./outputs"
logpath	Path to the log file folder, defaults to "./outputs"

**Examples**

```
## Not run:  
runPMG(naics,g,writelog=FALSE,wait=TRUE)  
  
## End(Not run)
```

---

saveOutputs	<i>Save a set of objects to .csv files</i>
-------------	--

---

**Description**

Saves a set of outputs to .csv files and then removes the objects from memory

**Usage**

```
saveOutputs(filelist)
```

**Arguments**

filelist	list of strings containing file paths; uses the names of the list as the object names
----------	---

---

saveSummary	<i>Save a set of summary tables</i>
-------------	-------------------------------------

---

**Description**

Saves a set of summary tables to locations listed in summary

**Usage**

```
saveSummary(objects, locations)
```

**Arguments**

objects	list of tables
locations	list of file locations (list naming need to be consistent with objects list)

---

startModel	<i>Start the freight model</i>
------------	--------------------------------

---

### Description

Creates a model object to contain model and scenario structure and variable information. Creates an outputs folder if required (i.e. the scenario has not been run). Reads in the scenario variables. Loads packages required by the model. Creates the lists objects for each of the model components ready for use during the model run.

### Usage

```
startModel(basedir = getwd(), scenarioname = "base",
  scenvarfile = "scenario_variables.R", inputdir = "inputs",
  outputdir = "outputs", scriptsdir = "scripts", packages = NULL,
  steps = NULL, steptitles = NULL, stepscripts = NULL)
```

### Arguments

basedir	Path to the root directory of the model (character string); defaults to the current working directory returned by getwd()
scenarioname	Name of the scenario, which should be identical to the directory name in the file system (character string); defaults to "base"
scenvarfile	Name of the file containing scenario variables, defaults to "scenario_variables.R"
inputdir	Name of the directory containing inputs within the scenario folder, defaults to "inputs"
outputdir	Name of the directory containing outputs within the scenario folder, defaults to "outputs"
scriptsdir	Name of the directory in the model containing model scripts, defaults to "scripts"
packages	Character vector of package names, for packages used in the course of running the model
steps	Character vector of model component names in the order that they need to be run
steptitles	Character vector of model component titles for use in progress bars, print statements, in the order that they need to be run
stepscripts	Character vector of model component script filenames so that the components can be called, in the order that they need to be run

---

writePMGini	<i>Writes the ini file for the PMG application</i>
-------------	--

---

### Description

Writes the ini file for the PMG application based on variables that have been set and combined into a list, specifically: RandomSeed, IMax, Verbose, DynamicAlternatePayoffs, ClairvoyantInitialExpectedPayoffs, SellersRankOffersByOrderSize, InitExpPayoff, Temptation, BothCoop, BothDefect, Sucker, RefusalPayoff, WallflowerPayoff, BuyersIgnoreSoldOutSellers, IgnoreSoldOutSellersMinBuyerSellerRatio, and RawFastParser

**Usage**

```
writePMGini(pmg_vars, pmg_ini_path)
```

**Arguments**

<code>pmg_vars</code>	List of named ini file variables
<code>pmg_ini_path</code>	Path to ini file including ini file name, can be a relative path (character string)

**Examples**

```
pmg_vars <- list()
# random starting seed for the PMGs
pmg_vars$RandomSeed <- 41
# number of iterations
pmg_vars$IMax <- 6
# want lots of detail about tradebots?
pmg_vars$Verbose <- 0
# recalculate alternate payoffs every iteration based on updated expected payoffs
pmg_vars$DynamicAlternatePayoffs <- 1
# should initial expected tradeoffs know size of other traders?
pmg_vars$ClairvoyantInitialExpectedPayoffs <- 1
# should sellers accept offers based on order size instead of expected payoff?
pmg_vars$SellersRankOffersByOrderSize <- 1
# multiplier to goose initial expected tradeoff to encourage experimentation with other traders
pmg_vars$InitExpPayoff <- 0.9
pmg_vars$Temptation <- 0.6
pmg_vars$BothCoop <- 1.0
pmg_vars$BothDefect <- 0.6
pmg_vars$Sucker <- 1.0
# amount to downgrade expected payoff of seller who outright refuses a trade offer by buyer
pmg_vars$RefusalPayoff <- 0.5
# negative payoff to sellers for not participating
pmg_vars$WallflowerPayoff <- 0.0
#buyers don't try to trade with sold out sellers
pmg_vars$BuyersIgnoreSoldOutSellers <- 1
#ratio at which buyers don't try to trade with sold out sellers
pmg_vars$IgnoreSoldOutSellersMinBuyerSellerRatio = 100
#faster reading of input files but does less checks (ok for use with R)
pmg_vars$RawFastParser = 1
#Call the writePMGini function to write out the variables above to the PMG ini file at run time
writePMGini(pmg_vars, "./PMG.ini")
```

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