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FINAL

Prototype Model Development & Validation

Montgomery MPO

Cube Land Model Development



AUBURN UNIVERSITY
URBAN MODELING LAB



DEDICATION



This report is dedicated to the memory of Kenneth (Ken) Groves, Jr. Ken actively promoted the development of integrated land use and transportation forecasting tools and worked for the past four years to implement one of these modeling systems for the City of Montgomery. As the director of planning and development for the City of Montgomery, Mr. Groves sponsored the development of this model and was a key factor in the project receiving support from the Alabama Department of Transportation. He and his staff provided the impetus, ideas and much of the data required to build the model.

Kenneth Groves, Jr (1946-2010)

Ken's vision was that by integrating land use and transportation analytical tools within a single framework he could help elected officials and the public understand how different combinations of transportation improvement projects and land use policies could be melded to improve the quality of life of everyone in the greater Montgomery Region. He was a colleague and friend to many within the field of city planning.

He will be missed by all he touched.

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DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of Alabama Department of Transportation, City of Montgomery and the Federal Highway Administration". This report does not constitute a standard, specification, or regulation. Comments contained in this paper related to specific testing equipment and materials should not be considered an endorsement of any commercial product or service; no such endorsement is intended or implied.

DATA DEVELOPMENT

In 2007 the Alabama Department of Transportation (ALDOT) in cooperation with the Montgomery Area Metropolitan Planning Organization (MPO) and Auburn University initiated a research project to explore the potential of developing an integrated transportation/land use model framework for use in transportation planning throughout the state. The Montgomery area was selected as the “test bed” of those efforts as the Montgomery MPO had both a strong commitment to the success of the project and much of the data required to undertake such an effort. Those efforts culminated in 2009 with the development of rich geospatial datasets.

Following those efforts ALDOT decided to continue the research. In 2009 ALDOT initiated a second phase research project with Auburn University to implement Cube Land as the land use model component of an integrated transportation/land use model. The Montgomery case study serves as the first time this particular land use model has been employed in the United States. However, a predecessor of Cube Land has been successfully employed in Santiago Chile under the name MUSSA (Martínez, 2007).

Background

The Montgomery Area MPO encompasses portions of three counties in central Alabama: Autauga, Elmore, and Montgomery. The study area’s largest city, Montgomery (pop. ~ 200,000), is located at the intersection of Interstates 65 and 85 and is bounded to the north by the Alabama River and the south by large floodplains and designated wetlands. Autauga and Elmore Counties are experiencing rapid growth as commuters take advantage of the relatively high levels of accessibility to Montgomery employment centers provided by interstate and state highway improvements. In 2000, the Montgomery metropolitan region had a population of roughly 300,000 and forecasts a population of roughly 410,000 in 2030.

The Montgomery Area MPO shares many characteristics with other small to medium sized metropolitan regions in the US, making it a suitable case study for this project. The agency’s annual operating budget (approximately US \$400,000), number of full-time planning staff (five), and metropolitan population are not atypical. The average household size (2.4 persons) and median household income (roughly US \$37,000) are also unexceptional. Economically, this region does not serve as a national port of entry and competes with the larger economies of Atlanta, Georgia to the east, Birmingham, Alabama to the north, and Mobile, Alabama to the south for new jobs and households. Manufacturing makes up a significant portion of the local economy.

Land Use Modeling Context

Fully integrated transportation/land use models are becoming more commonplace as computing power increases over time. Yet these models still remain more the exception than the rule at most MPOs. While there are many reasons MPOs do not implement such tools, perhaps one of the primary reasons

is concern over the schedule and cost requirements of obtaining the data typically needed to support such models.

The data requirements and development costs of integrated land use and transportation forecasting models can vary dramatically depending on complexity, geographic size and the availability and quality of existing data. Land use models follow one of the broad “schools” of model theory outlined as follows:

- Bid Rent- Analytical models based on real estate pricing, “willingness to pay”, and utility maximization theory.
- Input-Output- Analytical models based on economic flow theory (production/consumption of goods & services)
- Gravity/Logit- Analytical models founded on the concept of spatial separation or accessibility similar to a gravity model used in many four-step transportation models
- Microsimulation- Analytical models that use Monte Carlo and other simulation techniques to estimate choices at the individual agent level (like traffic simulation or activity-based models).
- Rule-Based- Those models that use rule-based decision trees. Sometimes referred to as “gaming models” or “what if” models where choice probabilities are asserted using a given set of rules, sometimes based on trend or historic observations.

In reality, no land use model belongs exclusively to one of these broad classes. Each incorporates concepts from the other; sub-models in each may use elements from the others (White, 2010).

There is another “non-model” school of land use forecasting worth noting. Delphi is the process of allocating expected growth based on the experiences and knowledge of professionals in the area. Delphi approaches typically employ information but not in a reproducible way. Most agencies use this approach to one degree or another. Some would not consider Delphi a “model” in the true sense of the word since the same exact inputs can give you different results “day-to-day”. Forecasts are quite often negotiated amongst those involved in the process.

Land use model development has been evolving over time. In the late 1960’s, Lowry (Lowry, 1967) documented 7 existing models at that time and noted that “*As the ease with which a model can be used for forecasting diminishes, its educational potential increases. This judgment must be qualified by an assessment in each case of the care with which the data are handled*”. In the case of land use models, this thought still holds merit.

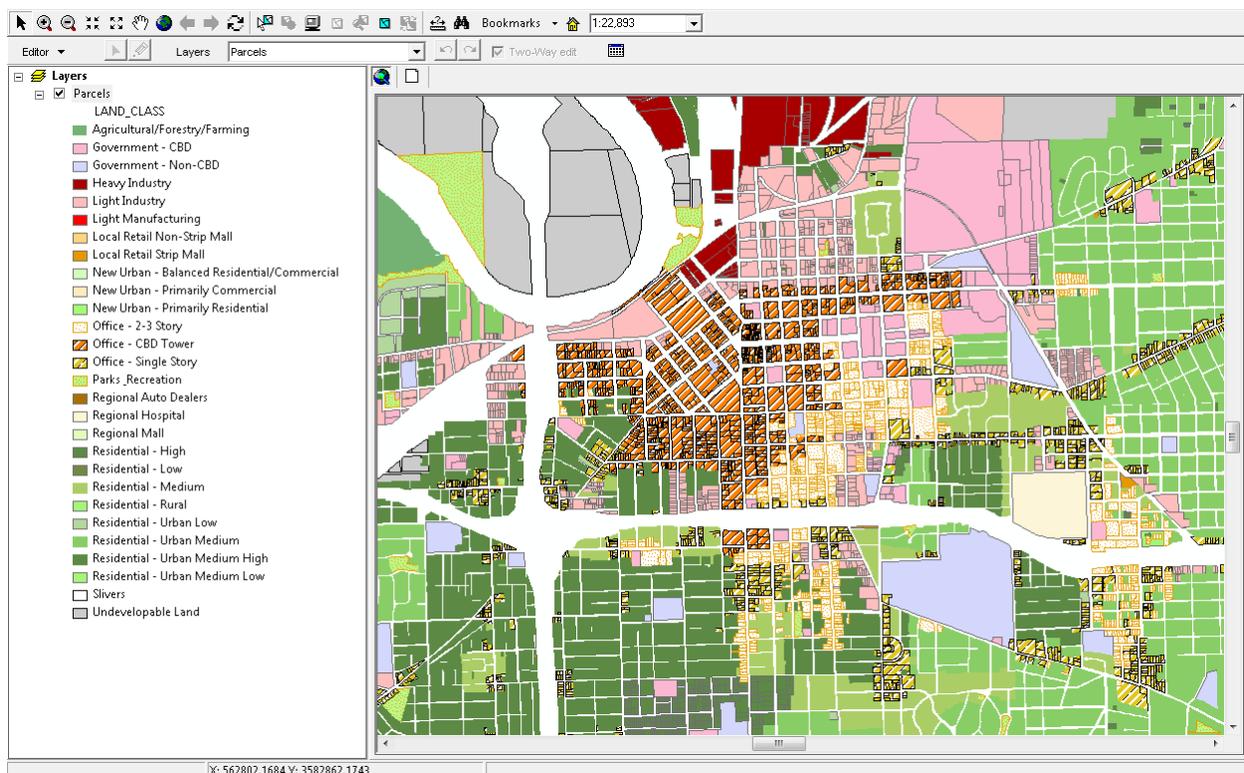
Integrated models often use a combination of parcel data, survey data, national data sources (e.g. US Census data) and transportation model derived data. Wang & Kockelman (Wang & Kockelman, 2008) document the need for information on the share of existing uses to estimate the model. Waddell documents more variables such as the presence/absence of children, real estate characteristics, neighborhood characteristics, policy constraints, site-specific characteristics (such as proximity to certain features) and a host of other variables needed to support the development and application of a land use model (Waddell, 2002).

In this “information age”, data to support land use model development still can be difficult and/or costly to obtain. A survey of agencies that have implemented land use models suggests development and implementation costs are the lowest for the rule-based class of models. Analytical models are the most

complex and can cost from \$100,000 to more than \$1,000,000 to develop for MPO efforts and from \$200,000 \$15,000,000 (White, 2010) for statewide efforts depending on the size of the study area, policy sensitivity requirements, data availability/quality and the duration of effort. In recent years, well-staffed agencies typically implement analytical models because of the policy sensitivities they afford. Some implement both rule-based and analytical models to meet a variety of needs that neither type can fully address independently. Even within the broad classes there is room for customization to meet a specific need. Data demands, development cost/schedule and total model run-times are therefore unique to each case (White, 2010).

All of the model types rely on data to drive their results. Rule-based models typically rely on parcel data, zoning, comprehensive plans, census and state or local data sources such (see **Exhibit 1**). Analytical models use the same data but typically require the use of additional disaggregate datasets to estimate model parameters that reflect choice and probability. In Montgomery’s case, this was the “Achilles heel” that made full model development difficult to realize.

Exhibit 1 Example of Parcel Classification Map



Data Development

Parcel data provides one source of information regarding the characteristics of location. While it is to face value disaggregate, it typically has certain “liabilities” when applying it to choice estimation; namely:

- Parcel data is developed for tax appraisal purposes. As such, the data typically reflects the quality, attributes and values necessary to assure taxation.
- Multi-tenant/single owner properties typically do not have information on specific uses. This makes sense from a tax appraisal perspective as knowing who owns a mall and how many square feet it is allows for taxation. Knowing how many separate suites or storefronts it is subdivided into does not change the taxation answer. The same applies for apartments.
- Knowing the characteristics of who occupies a space is as important as knowing of the space's existence from the integrated model development perspective. This is almost irrelevant from a taxation perspective.

Because of the need to know not only about the characteristics of space but the characteristics of the users of it, data development in the Montgomery case study focused on identifying low-cost, sufficiently reliable data to build a database for model estimation.

To support the development of Cube Land, it was felt that a disaggregate datasets of household and business location choice decisions would be helpful if not critical to the success of the project. In the Santiago case study, the University of Chile estimated the model based on a recently household travel survey which had information both about households and their locations. No such data was available for the Montgomery area. The time and cost necessary to develop a dataset through a household travel survey was simply not possible within the scope of the project. It was therefore necessary to come up with a “creative” solution to the problem.

Household Location Data Development

It is very important that accurate local data serve as the basis of any model forecast. In the Montgomery region, local agencies maintain a parcel-based land use inventory assembled by the local property tax appraiser's office. The property tax appraiser data contains information on a variety of property characteristics including:

- Taxable Value
- Market Value
- Property Size
- Floor Space
- Physical Street Address

On close examination it appeared that tax appraiser taxable and market values data, while reliable for taxation purposes, are unreliable for the estimation process. Taxable value reflects local policies, “grandfathering” and the sort. Market value varies based on the appraiser, their policies and is often calculated differently city-to-city and county-to-county. Further, for multi-tenant properties, these values have no nexus to how much a household pays to reside at a particular location. That said, property size and floor space are much more “concrete” and less subjective. Still, based on parcel data alone, there is no information about the characteristics of who occupies a particular property in the tax appraiser's records.

Commercially available dataset offered one possible solution to this shortcoming. After a review of available datasets, it was decided to purchase a commercially available dataset that would describe households by address, InfoUSA. InfoUSA collects information on households including several key variables necessary to the analysis:

- Date List Produced
- Physical Street Address, City, State, ZIP Code
- Age
- Income Range
- Residence Type
- Home Owner Status
- Home Value
- Location Type
- # of Units in building/complex (range only)
- HH Size

The physical street address provided the necessary nexus to tie parcel and household characteristics together. While InfoUSA offered datasets with a LAT/LONG coordinate, prior experience with the dataset suggested it would be better to match the household address records with the parcel data “in house” to assure quality control and to verify and if necessary, manually match the InfoUSA reported address to specific parcels. The total number of records purchased and the result of the address matching process is shown in **Exhibit 2** and **Exhibit 3** respectively.

Exhibit 2 InfoUSA Household Database Summary

Household Income	Number of Persons in Household					Total
	1	2	3	4	5+	
Under \$20,000	4,663	1,397	440	147	95	6,742
\$20,000 - \$29,999	2,383	859	284	98	66	3,690
\$30,000 - \$39,999	1,693	845	330	122	66	3,056
\$40,000 - \$49,999	1,387	919	366	130	81	2,883
\$50,000 - \$59,999	1,180	1,059	423	169	95	2,926
\$60,000 - \$69,999	1,083	953	440	170	112	2,758
\$70,000 - \$79,999	796	847	437	184	123	2,387
\$80,000 - \$89,999	592	867	429	186	131	2,205
\$90,000 - \$99,999	511	788	445	194	105	2,043
\$100,000 - \$124,999	798	1,649	865	396	275	3,983
\$125,000 - \$149,999	469	1,137	711	329	240	2,886
\$150,000 - \$174,999	257	696	457	246	143	1,799
\$175,000 - \$199,999	92	381	261	128	97	959
\$200,000 - \$249,999	75	269	205	128	92	769
\$250,000 - \$299,999	11	76	35	34	18	174
\$300,000 - \$399,999	11	34	32	18	19	114
\$400,000 - \$499,999	6	22	16	8	6	58
\$500,000 Plus	14	35	24	11	7	91
Total	16,021	12,833	6,200	2,698	1,771	39,523

Exhibit 3 InfoUSA Household Database Address Matched Record Summary

Household Income	Number of Persons in Household					Total
	1	2	3	4	5+	
UNDER 20,000	2,092	695	222	83	51	3,143

\$20,000 - \$29,999	1,178	469	159	60	38	1,904
\$30,000 - \$39,999	911	442	189	65	38	1,645
\$40,000 - \$49,999	837	472	177	75	44	1,605
\$50,000 - \$59,999	722	558	202	82	42	1,606
\$60,000 - \$69,999	712	538	234	88	66	1,638
\$70,000 - \$79,999	546	484	253	101	61	1,445
\$80,000 - \$89,999	401	561	249	110	67	1,388
\$90,000 - \$99,999	322	515	280	122	68	1,307
\$100,000 - \$124,999	534	1,145	609	276	185	2,749
\$125,000 - \$149,999	359	849	540	248	170	2,166
\$150,000 - \$174,999	187	510	375	195	112	1,379
\$175,000 - \$199,999	63	289	207	108	78	745
\$200,000 - \$249,999	54	194	156	103	76	583
\$250,000 - \$299,999	7	49	27	29	16	128
\$300,000 - \$399,999	6	22	23	17	16	84
\$400,000 - \$499,999	1	8	11	7	5	32
\$500,000 Plus	5	18	14	8	5	50
Total	8,937	7,818	3,927	1,777	1,138	23,597

The randomly selected sample (38%) of households from the three county MPO region was produced by InfoUSA less than 1 week after the order was placed. After about 1 day of automated and manual geocoding, approximately 60% of the InfoUSA records were matched to parcels yielding more than 23,000 usable parcel-specific records. The cost to purchase the InfoUSA dataset was less than \$1,500 yielding a per-record cost about \$0.07.

Business Location Data Development

Like households, disaggregate information about businesses can be difficult to come by. The InfoUSA Business Database offered a solution to this problem as well. There are many variations to the InfoUSA database but in an attempt to keep costs down, the data fields requested were kept to a minimum and included:

- Business Name, Street Address, City, State and Zip Code
- Primary Six-Digit SIC Code
- Employee Size Grouping
- Square Footage at Business Location Grouping

A similar exercise of matching the addresses to the parcel base map was undertaken involving automated and manual techniques. However, unlike the household data which was ~10% sample of households in the region, the employer database was comprised of all 12,278 employers in the region 40% of which were successfully address matched (**Exhibit 4** and **Exhibit 5**).

Exhibit 4 InfoUSA Business Database Summary

Employees	Space Square Footage				Grand Total
	0 - 2,499	2,500 - 9,999	10,000 - 39,999	40,000+	
1 to 4	3,348	2,512	970	77	6,907
5 to 9	563	1,163	634	10	2,370
10 to 19	27	905	481	6	1,419
20 to 49	2	533	298	78	911
50 to 99		114	29	190	333
100 to 249	1	10		139	150
250 to 499		2		46	48
500 to 999		1		15	16
1000 to 4999			1	9	10
5000 to 9999					
10000+				1	1
(blank)		30	38	45	113
Grand Total	3,941	5,270	2,451	616	12,278

Exhibit 5 InfoUSA Business Database Address Matched Record Summary

Employees	Space Square Footage				Grand Total
	0 - 2,499	2,500 - 9,999	10,000 - 39,999	40,000+	
1 to 4	1,293	969	393	43	2,698
5 to 9	193	481	266	2	942
10 to 19	9	389	193	1	592
20 to 49		264	145	35	444
50 to 99		57	15	72	144
100 to 249	1	5		57	63
250 to 499		2		44	46
500 to 999		1		15	16
1000 to 4999			1	8	9
5000 to 9999					
10000+				1	1
(blank)		5	7	10	22
Grand Total	1,496	2,173	1,020	288	4,977

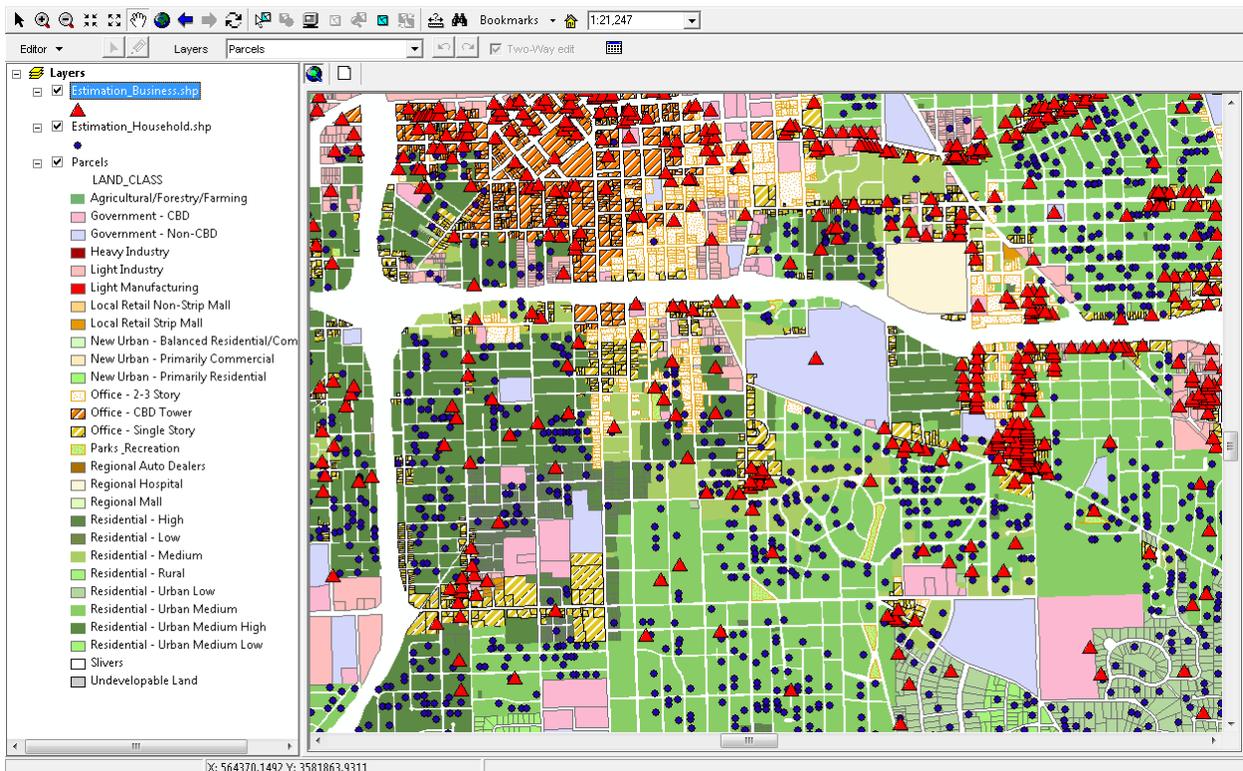
The cost of the business database was less than \$2,000 and almost 5,000 businesses were successfully address matched. This yielded a per-record cost of approximately \$0.40 for each successfully address-matched business. Cumulatively the cost of building the household and business disaggregate datasets

was \$3,500 in direct cost and approximately 4 staff days of time to address-match records to specific parcels.

Extending the Initial Databases into the Integrated Framework

Once the household and business databases were address matched, a point-coverage was created corresponding to each (Exhibit 6). With the point-coverage additional variables could be added to the records to establish datasets suitable for disaggregate model estimation including all parcel attributes. Variables that relate to other data sources (such as TAZ characteristics) could readily be attached to the overall database used both for model estimation and application.

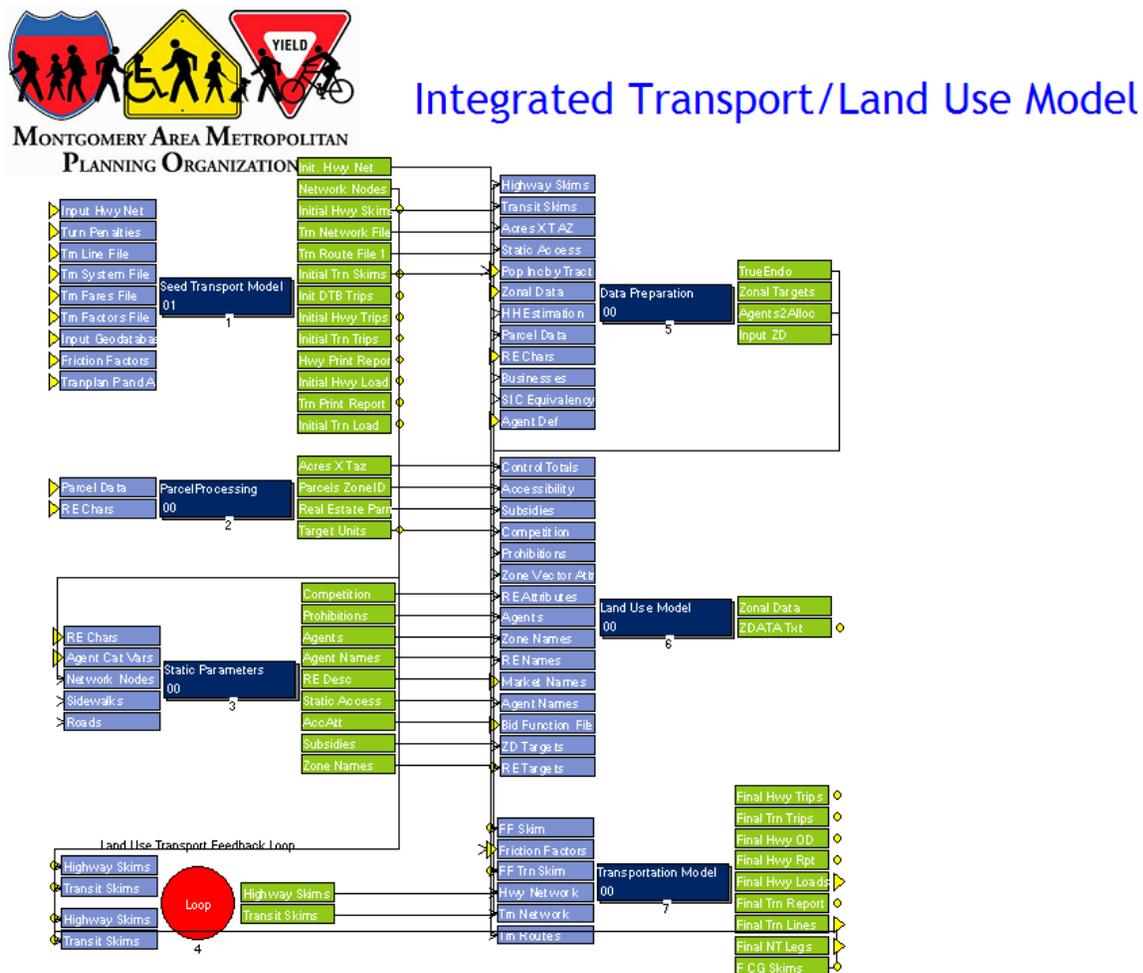
Exhibit 6 Parcel Map with InfoUSA Households and Firms Point Layer Added



The Cube Land model permits for the inclusion of endogenous variables or variable that change during the allocation process. Typically these might include accessibility to certain households or businesses. After creating the point-coverage, variables could be added based on any geography or TAZ structure. Automated scripting was developed in the Cube Voyager framework (**Exhibit 7**) that allowed the seamless addition of endogenous and exogenous variables for both model estimation and model application. Variables developed included:

- Household resides in a single-family home (binary flag)
- Business location is inside the Central Business District, CBD (binary flag)
- Accessibility to households of various income levels by auto
- Accessibility to jobs/employment of various types by auto
- Accessibility to households and jobs via transit
- Accessibility to interchanges
- Amount of roadway miles
- Percent of centerline miles with sidewalks

Exhibit 7 Montgomery Integrated Transportation / Land Use Model Data Flow



Conclusions

Data development and concern over what it might entail constrain many smaller and medium-sized MPOs' ambitions to develop an integrated transportation/land use modeling framework. Yet growing demands for more detailed answers to evolving questions that such frameworks can answer will likely only increase with time as local policymakers and federal requirements grow more demanding in the infrastructure selection and justification process.

The Montgomery MPO and the Alabama Department of Transportation recognize this need and have sponsored research to evaluate the viability of a complex integrated transportation/land use framework given limited data and resources. The research project has successfully demonstrated that a medium-sized MPO has most of the data to build such a model and that disaggregate data, normally cost prohibitive for such an agency, can be acquired and augmented for minimal cost. By reducing data development costs and schedule, opportunities exist for such agencies to address the complex interactions between land use policies and transportation infrastructure improvements over time and facilitate a more informed project selection process.

MODEL ESTIMATION PROCESS

Background

Model estimation is the process of identifying variables that affect location choice from available data as well as the magnitude of effects and interactions between the variables. Key questions that need to be answered during model estimation and design include:

- Are the data available to support the model design?
- Are the independent variables selected able to be forecasted readily?
- Is the model design explicable and statistically valid?
- Does the model design include key variables and exclude variables that might complicate the structure and forecast?
- Is the model design consistent with the transportation model's data (both input and output)?

On November 13, 2009 a meeting was held at the Montgomery MPO to discuss ideas for variables and available data. The meeting identified several key policies and variables that should be explored, tested if possible, and possibly result from the model estimation process:

- Connectivity/access
- 1 vs. 2 way streets
- Congestion
- Density, intensity & mix
- Access management
- Green space / Agriculture
- Price
- Transport Access (Road & Transit)
- Urban Form (Roadway density, sidewalks)
- Households/Employment
- Quality of Life
- Winner & Loser
- Flood Plain/ wetlands
- Storm water & management
- Urban services
- Schools location and Age
- Historic District Designation
- Quality of Roadway
- Capacity
- Toll
- Crimes
- Vacancy
- Infill subsidy policies
- Redevelopment
- TIF District subsidies or costs

In the discussions it was recognized that some of these variables are not available and some are almost impossible to forecast. A key criterion was that the model estimation process must achieve consistency with the inputs necessary for the transportation model and take advantage of its outputs. Key trip generation inputs used by the transportation model include households, retail employment and non-retail employment. Therefore these were selected beforehand to be the primary demand market

structure for the land use model. The following sections describe the model estimation process used for the Montgomery Integrated Transport/Land Use model.

Estimation Data Set Development

The development of the Montgomery land use model started with an assessment of available data. Prior experiences with this type of model used a combination of household survey data, parcel data and transportation model data. Data sources selected for the analysis included:

- Autauga, Elmore and Montgomery County property tax appraiser parcel data
- InfoUSA Household database
- InfoUSA Business database
- 2000 Census tract-level data

Household Market Segmentation

The Montgomery Transportation model uses total households as an independent variable for trip generation. Analysis of potential market segmentation explored variables that would be expected to affect location choice including household size and household income. A detailed assessment of the InfoUSA Household database indicated an adequate number of records would be available to estimate a model based on number of persons in the household (1,2 & 3+) and household income in quartiles. Income quartiles were established as follows:

- <\$25k/year
- \$25-\$75k/year
- \$75-\$125k/year
- >\$125k/year

The total number of records for each of these persons and income categories in the InfoUSA database are presented in **Exhibit 8**.

Exhibit 8: InfoUSA Database Total Records

Persons	Income Quartile				Total
	1	2	3	4	
1	7,046	6,139	190	935	14,310
2	2,256	4,623	3,304	2,650	12,833
3+	1,130	3,248	3,026	325	7,729
Total	10,432	14,010	6,520	3,910	34,872

The InfoUSA Household database purchased for the three county area was address matched to the region’s parcel base map resulting in more than 23,000 successful matches. The latitude and longitude of each parcel centroid was appended to the household database so that the database could be aligned to various zone structures and Census geographies as well as access additional variables contained in the parcel database. The total records matched by cell and percent match are presented in **Exhibit 9** and **Exhibit 10**.

Exhibit 9: InfoUSA Database Address Matched Records

Persons	Income Quartile				Total
	1	2	3	4	
1	3,270	3,720	1,253	680	8,923
2	1,165	2,493	2,212	1,928	7,798
3+	613	1,718	1,961	2,544	6,836
Total	5,048	7,931	5,426	5,152	23,557

Exhibit 10: Percent of InfoUSA Database Records Successfully Address Matched

Persons	Income Quartile				Total
	1	2	3	4	
1	46.4%	60.6%	65.9%	72.7%	55.7%
2	51.6%	53.9%	66.9%	72.8%	60.8%
3+	54.2%	52.9%	64.8%	77.9%	64.1%
Total	48.4%	56.6%	65.9%	75.2%	59.6%

Attributes from the InfoUSA database incorporated into the analysis process include household income, structure type (single-family vs. multi-family) and attributes that could be inferred from the spatial location.

Business Market Segmentation

The Montgomery Transportation model segregates employment into retail and non-retail. These two major employment categories provided the second level of the demand market segmentation. The InfoUSA database provided categorical information about the number of employees, the number of square feet and six digit SIC code. The first three digits of the SIC code were used to classify employers into categories that would nest within the transportation model’s structure yet would be expected to have differing location choice requirements.

- Local Retail
- Regional Retail
- Government Services
- Industrial
- Other Services

Furthermore employers were segmented based on the amount of space consumed:

- <2,500 square feet
- 2,500-10,000 square feet
- 10,000-40,000 square feet
- >40,000 square feet

Real Estate Market Segmentation

Real estate market segmentation established 21 “single use” parcel categories, four “shared” use parcel categories and three “unusable” categories based on the current use/zoning of parcels in the region. All parcels were classified into one of the following categories

- Residential
 - Single Family
 - RURAL DENSITY(<1 Unit/5 Acres)
 - URBAN LOW DENSITY (0.51-1.0 Units/Acre)
 - URBAN MED/LOW DENSITY (1.0-1.5 Units/Acre)
 - URBAN MEDIUM DENSITY (1.5-2.0 Units/Acre)
 - URBAN MEDIUM HIGH DENSITY (2.5-5.0 Units/Acre)
 - Multi-Family
 - LOW DENSITY (<8 Units/Acre)
 - MEDIUM DENSITY (8-20 Units/Acre)
 - HIGH DENSITY (> 20 Units/Acre)
- Retail
 - Local Retail
 - NON-STRIP
 - STRIP
 - Regional Retail
 - RETAIL
 - AUTO DEALER
- Non-Retail
 - Industrial
 - LIGHT INDUSTRY
 - LIGHT MANUFACTURING
 - HEAVY MANUFACTURING
 - Service
 - OFFICE- 1 STORY
 - OFFICE- 2-3 STORY
 - OFFICE- CBD STYLE TOWER
 - SERVICE- HOSPITAL
 - SERVICE- GOVERNMENT CBD
 - SERVICE- GOVERNMENT NON-CBD
- Mixed Use
 - New Urbanism Development
 - PRIMARILY RESIDENTIAL
 - BALANCED RESIDENTIAL/COMMERCIAL
 - PRIMARILY COMMERCIAL
 - Agriculture

- Undevelopable
 - PARKS & RECREATION
 - SLIVERS (PARCEL <0.05 ACRES)
 - OTHER UNDEVELOPABLE LAND (WETLANDS, ETC.)

Each parcel was further identified by TAZ (both 2000 and 2005), Census tract and wetlands data. Parcel attributes including the Parcel ID, size (acres), built area and total appraised value

TAZ and Network-based Attributes

Vectors of attributes were created for each TAZ that described location and accessibility. Variables created for each TAZ included:

- Auto Accessibility to Households by Household Size/Income Quartile
- Auto Accessibility to Employees by Type
- Auto Accessibility to Airports
- Auto Accessibility to Interchanges
- Transit Accessibility to Households
- Transit Accessibility to Jobs
- Share of Persons in a Zone as Residential, Retail Employment, Industrial Employment, Government Employment or Service Employment
- CBD Location Dummy
- Distance to CBD
- Sidewalk Coverage

Parcel-based Attributes

Vectors of attributes were created for each parcel that captured available data specific to the parcel, current development and potential development. Variables created for each parcel included:

- Value
- Floor Space
- Category of Use(s)
- Agricultural Designation
- Proportion of the Parcel in Wetlands (undevelopable)

Significant effort went into adding as many attributes as possible to the parcel base map to support the estimation process. Some attributes such as crime statistics were not added as they were not readily available and it was felt that they would not be a reliable variable in a 30 year forecast.

ESTIMATION RESULTS

The estimation process began by joining parcel and zone attributes to household and firm records. A flexible TAZ structure (both 2000 and 2005) keys were added to files to allow for testing of various transportation model structures. All data set development processes were automated in a Cube Voyager environment to allow for testing of various model forms and variable combinations.

Bid Function Estimation

The bid function is perhaps the most complex model form in Cube Land. It allows for a non-linear combination of variables that can vary by agent type, real estate type and zone.

$$\text{Bid}_{hvi} = \sum_{k=0}^n a_k x_k^{\exp X_k} y_k^{\exp Y_k}$$

where:

- h =agent class
- v =real estate type
- i =TAZ
- k =variable number
- X , Y and a are independent variables to be determined in estimation

The effects of various combinations of parameters were estimated using the R statistical package for each major category of residential (4 income quartiles), retail (local and regional) and non-retail (government, industrial service) demand.

The interactions of all major agent characteristics, zone characteristics and real estate characteristics were tested as a first step in the estimation process. Variables were then removed using a stepwise procedure.

Bid Function Findings

The InfoUSA data sets with the TAZ and parcel attributes added were tested for each major group of demand making for a total of 9 distinct market segments:

- Households in Income Quartile 1
- Households in Income Quartile 2
- Households in Income Quartile 3
- Households in Income Quartile 4
- Local Retail Employers
- Regional Retail Employers
- Government Employers
- Industrial Employers
- Service Employers

Households and businesses were evaluated against pairings of the following variables

- Number of Persons
- Auto Accessibility Measure to Airports
- Auto Accessibility Measure to Interchanges
- Auto Accessibility Measure to Households in Income Quartile 1
- Auto Accessibility Measure to Households in Income Quartile 2
- Auto Accessibility Measure to Households in Income Quartile 3
- Auto Accessibility Measure to Households in Income Quartile 4
- Auto Accessibility Measure to Employment in Agricultural Services
- Auto Accessibility Measure to Employment in Government Services
- Auto Accessibility Measure to Employment in Retail
- Auto Accessibility Measure to Employment in Services
- Transit Accessibility Measure to Total Households
- Transit Accessibility Measure to Total Employees
- Sidewalk Coverage in the TAZ
- Distance to the CBD
- Floor Space in Selected Unit
- Single-family Home (dummy/binary variable, households only)
- CBD Location Flag (dummy/binary variable, businesses only)

Employers were evaluated against a similar set of pairings with the Single-family home dummy being replaced by the CBD zone binary variable.

Results of the stepwise estimation process used to test the Cube Land model are presented in **Exhibit 11**, **Exhibit 12**, **Exhibit 13** and **Exhibit 14** for the residential agents. **Exhibit 15** and **Exhibit 16** show the bid functions for retail employer locations while **Exhibit 17**, **Exhibit 18** and **Exhibit 19** show the results for non-retail employers. **Exhibit 20** through **28** shows the standard error, t statistic and confidence of t for each of the estimated bid functions.

Exhibit 11: Residential Bid Function Income Quartile 1

Households Income Quartile 1				
X Variable	Y Variable	a	exp X	exp Y
Persons	Accessibility- Income Q2 Households	0.0001138	(0.0010896)	0.5379668
Persons	Share- Retail Employees	0.0002417	(0.0010896)	(0.0199401)
Persons	Share- Service Employees	0.0001629	(0.0010896)	0.3170170
Persons	Sidewalk Coverage	0.0000030	(0.0010896)	0.0009674
Accessibility- Airport	Accessibility- Interchange	0.0005243	(0.0255652)	0.0430187
Accessibility- Airport	Accessibility- Transit to Employment	0.0010991	(0.0255652)	(0.0906476)
Accessibility- Airport	Share- Agr. Employees	0.0005879	(0.0255652)	(0.0413255)
Accessibility- Airport	Share- Service Employees	0.0110440	(0.0255652)	0.3170170
Accessibility- Airport	Sidewalk Coverage	0.0000264	(0.0255652)	0.0009674
Accessibility- Airport	Accessibility- Distance to CBD	0.0008712	(0.0255652)	0.0206463

Households Income Quartile 1				
X Variable	Y Variable	a	exp X	exp Y
Accessibility- Airport	Floor Space	0.0000185	(0.0255652)	0.0045390
Accessibility- Interchange	Accessibility- Transit to Employment	0.0017094	0.0430187	(0.0906476)
Accessibility- Interchange	Accessibility- Income Q1 Households	0.0063454	0.0430187	(0.2150897)
Accessibility- Interchange	Accessibility- Income Q3 Households	0.0147089	0.0430187	(0.3573497)
Accessibility- Interchange	Share- Gov. Employees	0.0050247	0.0430187	(0.0707707)
Accessibility- Interchange	Share- Retail Employees	0.0052524	0.0430187	(0.0199401)
Accessibility- Transit to Households	Accessibility- Income Q3 Households	0.0144223	0.1110945	(0.3573497)
Accessibility- Transit to Households	Accessibility- Income Q4 Households	0.0030563	0.1110945	(0.2136567)
Accessibility- Transit to Households	Share- Agr. Employees	0.0156057	0.1110945	(0.0413255)
Accessibility- Transit to Households	Accessibility- Distance to CBD	0.0005818	0.1110945	0.0206463
Accessibility- Transit to Employment	Accessibility- Income Q2 Households	0.0081701	(0.0906476)	0.5379668
Accessibility- Transit to Employment	Share- Gov. Employees	0.0017888	(0.0906476)	(0.0707707)
Accessibility- Transit to Employment	Share- Service Employees	0.0136482	(0.0906476)	0.3170170
Accessibility- Transit to Employment	Floor Space	0.0001606	(0.0906476)	0.0045390
Accessibility- Income Q1 Households	Accessibility- Income Q2 Households	0.0162811	(0.2150897)	0.5379668
Accessibility- Income Q1 Households	Accessibility- Income Q3 Households	0.0059470	(0.2150897)	(0.3573497)
Accessibility- Income Q1 Households	Share- Service Employees	0.0464776	(0.2150897)	0.3170170
Accessibility- Income Q1 Households	Sidewalk Coverage	0.0002922	(0.2150897)	0.0009674
Accessibility- Income Q1 Households	Accessibility- Distance to CBD	0.0031790	(0.2150897)	0.0206463
Accessibility- Income Q1 Households	Floor Space	0.0000869	(0.2150897)	0.0045390
Accessibility- Income Q2 Households	Accessibility- Income Q3 Households	0.0039846	0.5379668	(0.3573497)
Accessibility- Income Q2 Households	Accessibility- Income Q4 Households	0.1005882	0.5379668	(0.2136567)
Accessibility- Income Q2 Households	Share- Agr. Employees	0.0230339	0.5379668	(0.0413255)
Accessibility- Income Q2 Households	Share- Gov. Employees	0.0357594	0.5379668	(0.0707707)
Accessibility- Income Q2 Households	Share- Retail Employees	0.0106970	0.5379668	(0.0199401)
Accessibility- Income Q2 Households	Dummy- Single Family Home	0.0006738	0.5379668	(0.0006150)
Accessibility- Income Q3 Households	Share- Service Employees	0.0975498	(0.3573497)	0.3170170
Accessibility- Income Q3 Households	Sidewalk Coverage	0.0010166	(0.3573497)	0.0009674
Accessibility- Income Q3 Households	Accessibility- Distance to CBD	0.0074761	(0.3573497)	0.0206463
Accessibility- Income Q4 Households	Share- Retail Employees	0.0065557	(0.2136567)	(0.0199401)
Accessibility- Income Q4 Households	Share- Service Employees	0.0164485	(0.2136567)	0.3170170
Accessibility- Income Q4 Households	Floor Space	0.0010461	(0.2136567)	0.0045390
Share- Agr. Employees	Share- Retail Employees	0.0036443	(0.0413255)	(0.0199401)
Share- Agr. Employees	Share- Service Employees	0.0011739	(0.0413255)	0.3170170
Share- Agr. Employees	Floor Space	0.0001074	(0.0413255)	0.0045390
Share- Gov. Employees	Share- Service Employees	0.0032403	(0.0707707)	0.3170170
Share- Gov. Employees	Sidewalk Coverage	0.0003336	(0.0707707)	0.0009674
Share- Gov. Employees	Accessibility- Distance to CBD	0.0016980	(0.0707707)	0.0206463
Share- Gov. Employees	Floor Space	0.0002172	(0.0707707)	0.0045390

Households Income Quartile 1				
X Variable	Y Variable	a	exp X	exp Y
Share- Retail Employees	Share- Service Employees	0.0057118	(0.0199401)	0.3170170
Share- Retail Employees	Accessibility- Distance to CBD	0.0024536	(0.0199401)	0.0206463
Share- Retail Employees	Dummy- Single Family Home	0.0005051	(0.0199401)	(0.0006150)

Exhibit 12: Residential Bid Function Income Quartile 2

Households Income Quartile 2				
X Variable	Y Variable	a	exp X	exp Y
Persons	Accessibility- Airport	0.0000146	(0.0005268)	(0.0390545)
Persons	Accessibility- Transit to Employment	0.0000210	(0.0005268)	0.0360594
Persons	Accessibility- Income Q3 Households	0.0003953	(0.0005268)	(0.3285753)
Persons	Share- Gov. Employees	0.0000610	(0.0005268)	(0.0889231)
Persons	Floor Space	0.0000123	(0.0005268)	0.0038093
Accessibility- Airport	Accessibility- Income Q2 Households	0.0015906	(0.0390545)	0.6730810
Accessibility- Airport	Accessibility- Income Q3 Households	0.0033051	(0.0390545)	(0.3285753)
Accessibility- Airport	Share- Agr. Employees	0.0002665	(0.0390545)	(0.0146725)
Accessibility- Airport	Share- Gov. Employees	0.0005834	(0.0390545)	(0.0889231)
Accessibility- Airport	Share- Retail Employees	0.0016864	(0.0390545)	(0.0930613)
Accessibility- Airport	Share- Service Employees	0.0141682	(0.0390545)	0.3211641
Accessibility- Airport	Sidewalk Coverage	0.0000117	(0.0390545)	0.0001763
Accessibility- Airport	Accessibility- Distance to CBD	0.0003696	(0.0390545)	0.0114640
Accessibility- Interchange	Accessibility- Transit to Employment	0.0032966	0.0454440	0.0360594
Accessibility- Interchange	Accessibility- Income Q1 Households	0.0150559	0.0454440	(0.3277722)
Accessibility- Interchange	Accessibility- Income Q3 Households	0.0249171	0.0454440	(0.3285753)
Accessibility- Interchange	Share- Gov. Employees	0.0045181	0.0454440	(0.0889231)
Accessibility- Interchange	Share- Retail Employees	0.0013297	0.0454440	(0.0930613)
Accessibility- Interchange	Dummy- Single Family Home	0.0000665	0.0454440	(0.0009986)
Accessibility- Transit to Households	Accessibility- Income Q1 Households	0.0074067	(0.0177457)	(0.3277722)
Accessibility- Transit to Households	Accessibility- Income Q3 Households	0.0049572	(0.0177457)	(0.3285753)
Accessibility- Transit to Households	Share- Gov. Employees	0.0026073	(0.0177457)	(0.0889231)
Accessibility- Transit to Households	Share- Retail Employees	0.0108952	(0.0177457)	(0.0930613)
Accessibility- Transit to Households	Accessibility- Distance to CBD	0.0009316	(0.0177457)	0.0114640
Accessibility- Transit to Households	Floor Space	0.0001779	(0.0177457)	0.0038093
Accessibility- Transit to Households	Dummy- Single Family Home	0.0002893	(0.0177457)	(0.0009986)
Accessibility- Transit to Employment	Accessibility- Income Q2 Households	0.0065253	0.0360594	0.6730810
Accessibility- Transit to Employment	Accessibility- Income Q4 Households	0.0110238	0.0360594	(0.1853648)
Accessibility- Transit to Employment	Share- Agr. Employees	0.0054135	0.0360594	(0.0146725)
Accessibility- Transit to Employment	Sidewalk Coverage	0.0002530	0.0360594	0.0001763
Accessibility- Income Q1 Households	Accessibility- Income Q2 Households	0.0181241	(0.3277722)	0.6730810

Households Income Quartile 2				
X Variable	Y Variable	a	exp X	exp Y
Accessibility- Income Q1 Households	Accessibility- Income Q3 Households	0.0222877	(0.3277722)	(0.3285753)
Accessibility- Income Q1 Households	Share- Service Employees	0.0659142	(0.3277722)	0.3211641
Accessibility- Income Q1 Households	Accessibility- Distance to CBD	0.0095678	(0.3277722)	0.0114640
Accessibility- Income Q1 Households	Floor Space	0.0004043	(0.3277722)	0.0038093
Accessibility- Income Q2 Households	Accessibility- Income Q4 Households	0.1526345	0.6730810	(0.1853648)
Accessibility- Income Q2 Households	Share- Agr. Employees	0.0189852	0.6730810	(0.0146725)
Accessibility- Income Q2 Households	Share- Gov. Employees	0.0272617	0.6730810	(0.0889231)
Accessibility- Income Q2 Households	Share- Retail Employees	0.0289234	0.6730810	(0.0930613)
Accessibility- Income Q2 Households	Sidewalk Coverage	0.0000924	0.6730810	0.0001763
Accessibility- Income Q2 Households	Dummy- Single Family Home	0.0003497	0.6730810	(0.0009986)
Accessibility- Income Q3 Households	Share- Service Employees	0.0970137	(0.3285753)	0.3211641
Accessibility- Income Q3 Households	Accessibility- Distance to CBD	0.0292910	(0.3285753)	0.0114640
Accessibility- Income Q4 Households	Share- Agr. Employees	0.0012288	(0.1853648)	(0.0146725)
Accessibility- Income Q4 Households	Sidewalk Coverage	0.0000896	(0.1853648)	0.0001763
Accessibility- Income Q4 Households	Floor Space	0.0006849	(0.1853648)	0.0038093
Share- Agr. Employees	Share- Retail Employees	0.0014255	(0.0146725)	(0.0930613)
Share- Agr. Employees	Floor Space	0.0001678	(0.0146725)	0.0038093
Share- Agr. Employees	Dummy- Single Family Home	0.0001148	(0.0146725)	(0.0009986)
Share- Gov. Employees	Share- Service Employees	0.0104550	(0.0889231)	0.3211641
Share- Gov. Employees	Sidewalk Coverage	0.0002149	(0.0889231)	0.0001763
Share- Gov. Employees	Accessibility- Distance to CBD	0.0028833	(0.0889231)	0.0114640
Share- Gov. Employees	Floor Space	0.0000733	(0.0889231)	0.0038093
Share- Retail Employees	Share- Service Employees	0.0271777	(0.0930613)	0.3211641
Share- Retail Employees	Accessibility- Distance to CBD	0.0008450	(0.0930613)	0.0114640
Share- Retail Employees	Floor Space	0.0003645	(0.0930613)	0.0038093
Share- Retail Employees	Dummy- Single Family Home	0.0001622	(0.0930613)	(0.0009986)
Share- Service Employees	Sidewalk Coverage	0.0001598	0.3211641	0.0001763
Share- Service Employees	Dummy- Single Family Home	0.0005147	0.3211641	(0.0009986)
Sidewalk Coverage	Accessibility- Distance to CBD	0.0000303	0.0001763	0.0114640
Sidewalk Coverage	Floor Space	0.0000037	0.0001763	0.0038093
Accessibility- Distance to CBD	Dummy- Single Family Home	0.0000344	0.0114640	(0.0009986)

Exhibit 13: Residential Bid Function Income Quartile 3

Households Income Quartile 3				
X Variable	Y Variable	a	exp X	exp Y
Persons	Accessibility- Interchange	0.0000582	(0.0009366)	0.0386655
Persons	Accessibility- Transit to Households	0.0000145	(0.0009366)	(0.1689725)
Persons	Accessibility- Income Q2 Households	0.0002190	(0.0009366)	0.5920909

Households Income Quartile 3				
X Variable	Y Variable	a	exp X	exp Y
Persons	Share- Service Employees	0.0001786	(0.0009366)	0.3114563
Persons	Accessibility- Distance to CBD	0.0000379	(0.0009366)	0.0081393
Accessibility- Airport	Accessibility- Transit to Households	0.0001267	(0.0477865)	(0.1689725)
Accessibility- Airport	Accessibility- Income Q2 Households	0.0242653	(0.0477865)	0.5920909
Accessibility- Airport	Share- Agr. Employees	0.0012389	(0.0477865)	(0.0271455)
Accessibility- Airport	Share- Gov. Employees	0.0020507	(0.0477865)	(0.0826502)
Accessibility- Airport	Share- Service Employees	0.0133862	(0.0477865)	0.3114563
Accessibility- Airport	Accessibility- Distance to CBD	0.0002790	(0.0477865)	0.0081393
Accessibility- Interchange	Accessibility- Transit to Employment	0.0059051	0.0386655	0.1970373
Accessibility- Interchange	Accessibility- Income Q1 Households	0.0154251	0.0386655	(0.2847621)
Accessibility- Interchange	Accessibility- Income Q3 Households	0.0210216	0.0386655	(0.2934792)
Accessibility- Interchange	Share- Gov. Employees	0.0028974	0.0386655	(0.0826502)
Accessibility- Interchange	Share- Retail Employees	0.0022439	0.0386655	(0.1031903)
Accessibility- Interchange	Sidewalk Coverage	0.0000534	0.0386655	0.0000008
Accessibility- Interchange	Dummy- Single Family Home	0.0001263	0.0386655	(0.0010025)
Accessibility- Transit to Households	Accessibility- Income Q1 Households	0.0395827	(0.1689725)	(0.2847621)
Accessibility- Transit to Households	Accessibility- Income Q3 Households	0.0354188	(0.1689725)	(0.2934792)
Accessibility- Transit to Households	Share- Gov. Employees	0.0111839	(0.1689725)	(0.0826502)
Accessibility- Transit to Households	Share- Retail Employees	0.0247114	(0.1689725)	(0.1031903)
Accessibility- Transit to Households	Share- Service Employees	0.0090893	(0.1689725)	0.3114563
Accessibility- Transit to Households	Floor Space	0.0006034	(0.1689725)	0.0027365
Accessibility- Transit to Employment	Accessibility- Income Q2 Households	0.0580354	0.1970373	0.5920909
Accessibility- Transit to Employment	Accessibility- Income Q4 Households	0.0384055	0.1970373	(0.1503242)
Accessibility- Transit to Employment	Share- Agr. Employees	0.0470548	0.1970373	(0.0271455)
Accessibility- Transit to Employment	Sidewalk Coverage	0.0005788	0.1970373	0.0000008
Accessibility- Transit to Employment	Accessibility- Distance to CBD	0.0077702	0.1970373	0.0081393
Accessibility- Income Q1 Households	Accessibility- Income Q2 Households	0.0063814	(0.2847621)	0.5920909
Accessibility- Income Q1 Households	Accessibility- Income Q3 Households	0.0199907	(0.2847621)	(0.2934792)
Accessibility- Income Q1 Households	Share- Service Employees	0.0738322	(0.2847621)	0.3114563
Accessibility- Income Q1 Households	Accessibility- Distance to CBD	0.0082086	(0.2847621)	0.0081393
Accessibility- Income Q2 Households	Accessibility- Income Q4 Households	0.1243184	0.5920909	(0.1503242)
Accessibility- Income Q2 Households	Share- Agr. Employees	0.0081202	0.5920909	(0.0271455)
Accessibility- Income Q2 Households	Share- Gov. Employees	0.0378098	0.5920909	(0.0826502)
Accessibility- Income Q2 Households	Share- Retail Employees	0.0356347	0.5920909	(0.1031903)
Accessibility- Income Q3 Households	Share- Agr. Employees	0.0049833	(0.2934792)	(0.0271455)
Accessibility- Income Q3 Households	Share- Service Employees	0.0942246	(0.2934792)	0.3114563
Accessibility- Income Q3 Households	Sidewalk Coverage	0.0001924	(0.2934792)	0.0000008
Accessibility- Income Q3 Households	Accessibility- Distance to CBD	0.0219668	(0.2934792)	0.0081393
Accessibility- Income Q4 Households	Floor Space	0.0004708	(0.1503242)	0.0027365

Households Income Quartile 3				
X Variable	Y Variable	a	exp X	exp Y
Share- Agr. Employees	Share- Retail Employees	0.0041583	(0.0271455)	(0.1031903)
Share- Agr. Employees	Sidewalk Coverage	0.0000217	(0.0271455)	0.0000008
Share- Agr. Employees	Floor Space	0.0000437	(0.0271455)	0.0027365
Share- Gov. Employees	Share- Service Employees	0.0091620	(0.0826502)	0.3114563
Share- Gov. Employees	Sidewalk Coverage	0.0001740	(0.0826502)	0.0000008
Share- Gov. Employees	Accessibility- Distance to CBD	0.0028562	(0.0826502)	0.0081393
Share- Gov. Employees	Floor Space	0.0001533	(0.0826502)	0.0027365
Share- Retail Employees	Share- Service Employees	0.0309634	(0.1031903)	0.3114563
Share- Retail Employees	Dummy- Single Family Home	0.0001371	(0.1031903)	(0.0010025)
Share- Service Employees	Sidewalk Coverage	0.0001330	0.3114563	0.0000008
Share- Service Employees	Dummy- Single Family Home	0.0001823	0.3114563	(0.0010025)
Sidewalk Coverage	Accessibility- Distance to CBD	0.0000744	0.0000008	0.0081393
Sidewalk Coverage	Dummy- Single Family Home	0.0000114	0.0000008	(0.0010025)
Accessibility- Distance to CBD	Dummy- Single Family Home	0.0000610	0.0081393	(0.0010025)

Exhibit 14: Residential Bid Function Income Quartile 4

Households Income Quartile 4				
X Variable	Y Variable	a	exp X	exp Y
Persons	Accessibility- Income Q2 Households	0.0003267	(0.0000216)	0.5736051
Persons	Accessibility- Income Q4 Households	0.0001027	(0.0000216)	(0.1352280)
Persons	Share- Agr. Employees	0.0000327	(0.0000216)	(0.0524712)
Persons	Sidewalk Coverage	0.0000023	(0.0000216)	0.0000457
Accessibility- Airport	Accessibility- Transit to Employment	0.0054386	(0.0391198)	0.2398630
Accessibility- Airport	Accessibility- Income Q2 Households	0.0131193	(0.0391198)	0.5736051
Accessibility- Airport	Share- Agr. Employees	0.0015246	(0.0391198)	(0.0524712)
Accessibility- Airport	Share- Service Employees	0.0179419	(0.0391198)	0.2923103
Accessibility- Airport	Floor Space	0.0000946	(0.0391198)	0.0004009
Accessibility- Interchange	Accessibility- Transit to Households	0.0003745	0.0351894	(0.2013414)
Accessibility- Interchange	Accessibility- Income Q1 Households	0.0105460	0.0351894	(0.2856545)
Accessibility- Interchange	Accessibility- Income Q3 Households	0.0155842	0.0351894	(0.2303348)
Accessibility- Interchange	Share- Gov. Employees	0.0037315	0.0351894	(0.0760441)
Accessibility- Interchange	Share- Retail Employees	0.0018109	0.0351894	(0.1382635)
Accessibility- Interchange	Sidewalk Coverage	0.0000157	0.0351894	0.0000457
Accessibility- Interchange	Floor Space	0.0000687	0.0351894	0.0004009
Accessibility- Transit to Households	Accessibility- Income Q1 Households	0.0999673	(0.2013414)	(0.2856545)
Accessibility- Transit to Households	Accessibility- Income Q3 Households	0.0806777	(0.2013414)	(0.2303348)
Accessibility- Transit to Households	Share- Gov. Employees	0.0255334	(0.2013414)	(0.0760441)
Accessibility- Transit to Households	Share- Retail Employees	0.0263775	(0.2013414)	(0.1382635)

Households Income Quartile 4				
X Variable	Y Variable	a	exp X	exp Y
Accessibility- Transit to Households	Share- Service Employees	0.0202760	(0.2013414)	0.2923103
Accessibility- Transit to Households	Dummy- Single Family Home	0.0009436	(0.2013414)	(0.0017933)
Accessibility- Transit to Employment	Accessibility- Income Q2 Households	0.1757626	0.2398630	0.5736051
Accessibility- Transit to Employment	Accessibility- Income Q4 Households	0.0473744	0.2398630	(0.1352280)
Accessibility- Transit to Employment	Share- Agr. Employees	0.0793359	0.2398630	(0.0524712)
Accessibility- Transit to Employment	Sidewalk Coverage	0.0002398	0.2398630	0.0000457
Accessibility- Transit to Employment	Accessibility- Distance to CBD	0.0110357	0.2398630	(0.0057364)
Accessibility- Transit to Employment	Floor Space	0.0007399	0.2398630	0.0004009
Accessibility- Income Q1 Households	Accessibility- Income Q2 Households	0.0068826	(0.2856545)	0.5736051
Accessibility- Income Q1 Households	Accessibility- Income Q3 Households	0.0087265	(0.2856545)	(0.2303348)
Accessibility- Income Q1 Households	Share- Service Employees	0.0824477	(0.2856545)	0.2923103
Accessibility- Income Q1 Households	Accessibility- Distance to CBD	0.0057076	(0.2856545)	(0.0057364)
Accessibility- Income Q1 Households	Floor Space	0.0008701	(0.2856545)	0.0004009
Accessibility- Income Q2 Households	Accessibility- Income Q4 Households	0.1244870	0.5736051	(0.1352280)
Accessibility- Income Q2 Households	Share- Agr. Employees	0.0185465	0.5736051	(0.0524712)
Accessibility- Income Q2 Households	Share- Gov. Employees	0.0381202	0.5736051	(0.0760441)
Accessibility- Income Q2 Households	Share- Retail Employees	0.0378772	0.5736051	(0.1382635)
Accessibility- Income Q2 Households	Dummy- Single Family Home	0.0026518	0.5736051	(0.0017933)
Accessibility- Income Q3 Households	Share- Service Employees	0.0974523	(0.2303348)	0.2923103
Accessibility- Income Q3 Households	Sidewalk Coverage	0.0000641	(0.2303348)	0.0000457
Accessibility- Income Q3 Households	Accessibility- Distance to CBD	0.0206304	(0.2303348)	(0.0057364)
Accessibility- Income Q4 Households	Floor Space	0.0000691	(0.1352280)	0.0004009
Accessibility- Income Q4 Households	Dummy- Single Family Home	0.0004384	(0.1352280)	(0.0017933)
Share- Agr. Employees	Share- Retail Employees	0.0046959	(0.0524712)	(0.1382635)
Share- Agr. Employees	Sidewalk Coverage	0.0000797	(0.0524712)	0.0000457
Share- Agr. Employees	Dummy- Single Family Home	0.0003867	(0.0524712)	(0.0017933)
Share- Gov. Employees	Share- Service Employees	0.0127281	(0.0760441)	0.2923103
Share- Gov. Employees	Sidewalk Coverage	0.0000617	(0.0760441)	0.0000457
Share- Gov. Employees	Accessibility- Distance to CBD	0.0013443	(0.0760441)	(0.0057364)
Share- Retail Employees	Share- Service Employees	0.0343350	(0.1382635)	0.2923103
Share- Retail Employees	Sidewalk Coverage	0.0001863	(0.1382635)	0.0000457
Share- Service Employees	Sidewalk Coverage	0.0000973	0.2923103	0.0000457
Share- Service Employees	Accessibility- Distance to CBD	0.0044736	0.2923103	(0.0057364)
Share- Service Employees	Dummy- Single Family Home	0.0004385	0.2923103	(0.0017933)
Sidewalk Coverage	Accessibility- Distance to CBD	0.0000221	0.0000457	(0.0057364)
Sidewalk Coverage	Dummy- Single Family Home	0.0000147	0.0000457	(0.0017933)
Accessibility- Distance to CBD	Floor Space	0.0001304	(0.0057364)	0.0004009
Floor Space	Dummy- Single Family Home	0.0000224	0.0004009	(0.0017933)

Exhibit 15: Local Retail Employer Bid Function

EMPLOYERS- LOCAL RETAIL				
X Variable	Y Variable	a	exp X	exp Y
Employees	Accessibility- Income Q2 Households	0.0002451	0.0004481	0.6792167
Employees	Accessibility- Income Q4 Households	0.0002007	0.0004481	(0.1839352)
Employees	Floor Space	0.0000066	0.0004481	0.0009360
Accessibility- Airport	Accessibility- Interchange	0.0005805	(0.0479372)	0.0475620
Accessibility- Airport	Accessibility- Transit to Households	0.0039886	(0.0479372)	(0.0821482)
Accessibility- Airport	Accessibility- Income Q2 Households	0.0092397	(0.0479372)	0.6792167
Accessibility- Airport	Share- Agr. Employees	0.0008647	(0.0479372)	(0.0296399)
Accessibility- Airport	Share- Retail Employees	0.0015604	(0.0479372)	(0.0248851)
Accessibility- Airport	Share- Service Employees	0.0129752	(0.0479372)	0.2947210
Accessibility- Airport	Sidewalk Coverage	0.0000492	(0.0479372)	0.0024913
Accessibility- Airport	Accessibility- Distance to CBD	0.0011977	(0.0479372)	0.0125524
Accessibility- Interchange	Accessibility- Income Q1 Households	0.0094899	0.0475620	(0.2801326)
Accessibility- Interchange	Accessibility- Income Q3 Households	0.0282112	0.0475620	(0.4029880)
Accessibility- Interchange	Share- Gov. Employees	0.0057771	0.0475620	(0.0892772)
Accessibility- Transit to Households	Accessibility- Income Q2 Households	0.0215498	(0.0821482)	0.6792167
Accessibility- Transit to Households	Share- Gov. Employees	0.0069204	(0.0821482)	(0.0892772)
Accessibility- Transit to Households	Share- Retail Employees	0.0167392	(0.0821482)	(0.0248851)
Accessibility- Transit to Households	Sidewalk Coverage	0.0002481	(0.0821482)	0.0024913
Accessibility- Transit to Employment	Accessibility- Income Q1 Households	0.0095876	0.0870350	(0.2801326)
Accessibility- Transit to Employment	Accessibility- Income Q3 Households	0.0297477	0.0870350	(0.4029880)
Accessibility- Transit to Employment	Share- Agr. Employees	0.0148330	0.0870350	(0.0296399)
Accessibility- Income Q1 Households	Accessibility- Income Q2 Households	0.0170743	(0.2801326)	0.6792167
Accessibility- Income Q1 Households	Accessibility- Income Q3 Households	0.0218028	(0.2801326)	(0.4029880)
Accessibility- Income Q1 Households	Share- Service Employees	0.0486935	(0.2801326)	0.2947210
Accessibility- Income Q1 Households	Accessibility- Distance to CBD	0.0028224	(0.2801326)	0.0125524
Accessibility- Income Q1 Households	Floor Space	0.0003541	(0.2801326)	0.0009360
Accessibility- Income Q1 Households	Dummy- CBD Location	0.0155600	(0.2801326)	0.0964460
Accessibility- Income Q2 Households	Accessibility- Income Q4 Households	0.1492590	0.6792167	(0.1839352)
Accessibility- Income Q2 Households	Share- Agr. Employees	0.0222462	0.6792167	(0.0296399)
Accessibility- Income Q2 Households	Share- Gov. Employees	0.0335980	0.6792167	(0.0892772)
Accessibility- Income Q2 Households	Sidewalk Coverage	0.0006592	0.6792167	0.0024913
Accessibility- Income Q3 Households	Share- Retail Employees	0.0043185	(0.4029880)	(0.0248851)
Accessibility- Income Q3 Households	Share- Service Employees	0.0795576	(0.4029880)	0.2947210
Accessibility- Income Q3 Households	Accessibility- Distance to CBD	0.0203393	(0.4029880)	0.0125524
Accessibility- Income Q3 Households	Floor Space	0.0005940	(0.4029880)	0.0009360
Accessibility- Income Q4 Households	Share- Service Employees	0.0115179	(0.1839352)	0.2947210
Accessibility- Income Q4 Households	Sidewalk Coverage	0.0005364	(0.1839352)	0.0024913
Share- Agr. Employees	Share- Service Employees	0.0078282	(0.0296399)	0.2947210

EMPLOYERS- LOCAL RETAIL				
X Variable	Y Variable	a	exp X	exp Y
Share- Agr. Employees	Sidewalk Coverage	0.0000924	(0.0296399)	0.0024913
Share- Gov. Employees	Share- Service Employees	0.0083891	(0.0892772)	0.2947210
Share- Gov. Employees	Sidewalk Coverage	0.0007726	(0.0892772)	0.0024913
Share- Gov. Employees	Accessibility- Distance to CBD	0.0020970	(0.0892772)	0.0125524
Share- Retail Employees	Share- Service Employees	0.0177807	(0.0248851)	0.2947210
Share- Retail Employees	Sidewalk Coverage	0.0002907	(0.0248851)	0.0024913
Share- Service Employees	Accessibility- Distance to CBD	0.0016140	0.2947210	0.0125524

Exhibit 16: Regional Retail Employer Bid Function

EMPLOYERS- REGIONAL RETAIL				
X Variable	Y Variable	a	exp X	exp Y
Employees	Accessibility- Transit to Households	0.0001263	0.0005399	(0.1398747)
Employees	Accessibility- Income Q4 Households	0.0001390	0.0005399	(0.1729506)
Employees	Share- Agr. Employees	0.0000328	0.0005399	(0.0061722)
Accessibility- Airport	Accessibility- Transit to Employment	0.0027983	(0.0580279)	0.1469568
Accessibility- Airport	Accessibility- Income Q2 Households	0.0160885	(0.0580279)	0.5576868
Accessibility- Airport	Share- Service Employees	0.0158561	(0.0580279)	0.3135911
Accessibility- Airport	Sidewalk Coverage	0.0000490	(0.0580279)	0.0014719
Accessibility- Airport	Floor Space	0.0000155	(0.0580279)	(0.0000179)
Accessibility- Airport	Dummy- CBD Location	0.0432763	(0.0580279)	(0.0086515)
Accessibility- Interchange	Accessibility- Income Q1 Households	0.0098832	0.0599513	(0.1989346)
Accessibility- Interchange	Accessibility- Income Q3 Households	0.0165065	0.0599513	(0.4064885)
Accessibility- Interchange	Accessibility- Income Q4 Households	0.0037488	0.0599513	(0.1729506)
Accessibility- Interchange	Share- Gov. Employees	0.0048136	0.0599513	(0.1342587)
Accessibility- Interchange	Share- Retail Employees	0.0022373	0.0599513	(0.0284151)
Accessibility- Interchange	Sidewalk Coverage	0.0000952	0.0599513	0.0014719
Accessibility- Interchange	Floor Space	0.0000257	0.0599513	(0.0000179)
Accessibility- Transit to Households	Accessibility- Income Q2 Households	0.0903675	(0.1398747)	0.5576868
Accessibility- Transit to Households	Share- Agr. Employees	0.0143341	(0.1398747)	(0.0061722)
Accessibility- Transit to Households	Share- Service Employees	0.0283902	(0.1398747)	0.3135911
Accessibility- Transit to Households	Dummy- CBD Location	0.0125161	(0.1398747)	(0.0086515)
Accessibility- Transit to Employment	Accessibility- Income Q1 Households	0.0419301	0.1469568	(0.1989346)
Accessibility- Transit to Employment	Accessibility- Income Q3 Households	0.0324325	0.1469568	(0.4064885)
Accessibility- Transit to Employment	Accessibility- Income Q4 Households	0.0268096	0.1469568	(0.1729506)
Accessibility- Transit to Employment	Share- Gov. Employees	0.0194401	0.1469568	(0.1342587)
Accessibility- Transit to Employment	Sidewalk Coverage	0.0007056	0.1469568	0.0014719
Accessibility- Income Q1 Households	Accessibility- Income Q2 Households	0.0287587	(0.1989346)	0.5576868
Accessibility- Income Q1 Households	Share- Service Employees	0.0146206	(0.1989346)	0.3135911

EMPLOYERS- REGIONAL RETAIL				
X Variable	Y Variable	a	exp X	exp Y
Accessibility- Income Q1 Households	Accessibility- Distance to CBD	0.0034064	(0.1989346)	0.0066482
Accessibility- Income Q1 Households	Floor Space	0.0001996	(0.1989346)	(0.0000179)
Accessibility- Income Q2 Households	Accessibility- Income Q4 Households	0.1067428	0.5576868	(0.1729506)
Accessibility- Income Q2 Households	Share- Agr. Employees	0.0109074	0.5576868	(0.0061722)
Accessibility- Income Q2 Households	Share- Gov. Employees	0.0315578	0.5576868	(0.1342587)
Accessibility- Income Q3 Households	Share- Service Employees	0.0810543	(0.4064885)	0.3135911
Accessibility- Income Q3 Households	Accessibility- Distance to CBD	0.0080891	(0.4064885)	0.0066482
Accessibility- Income Q3 Households	Floor Space	0.0004566	(0.4064885)	(0.0000179)
Accessibility- Income Q4 Households	Share- Agr. Employees	0.0077789	(0.1729506)	(0.0061722)
Accessibility- Income Q4 Households	Share- Service Employees	0.0226978	(0.1729506)	0.3135911
Accessibility- Income Q4 Households	Sidewalk Coverage	0.0004085	(0.1729506)	0.0014719
Share- Agr. Employees	Share- Service Employees	0.0026863	(0.0061722)	0.3135911
Share- Agr. Employees	Sidewalk Coverage	0.0000390	(0.0061722)	0.0014719
Share- Gov. Employees	Share- Service Employees	0.0144732	(0.1342587)	0.3135911
Share- Gov. Employees	Sidewalk Coverage	0.0002247	(0.1342587)	0.0014719
Share- Gov. Employees	Accessibility- Distance to CBD	0.0030786	(0.1342587)	0.0066482
Share- Retail Employees	Share- Service Employees	0.0151401	(0.0284151)	0.3135911
Share- Retail Employees	Accessibility- Distance to CBD	0.0038115	(0.0284151)	0.0066482
Sidewalk Coverage	Accessibility- Distance to CBD	0.0000701	0.0014719	0.0066482

Exhibit 17: Government Employer Bid Function

EMPLOYERS- GOVERNMENT				
X Variable	Y Variable	a	exp X	exp Y
Accessibility- Airport	Accessibility- Transit to Employment	0.0795581	0.0967401	1.0601449
Accessibility- Airport	Accessibility- Income Q1 Households	0.1814282	0.0967401	0.2667404
Accessibility- Airport	Accessibility- Income Q3 Households	0.2218094	0.0967401	1.4536199
Accessibility- Airport	Share- Gov. Employees	0.0253251	0.0967401	0.2200108
Accessibility- Airport	Share- Service Employees	0.0768945	0.0967401	0.9501791
Accessibility- Airport	Accessibility- Distance to CBD	0.0170213	0.0967401	0.2413362
Accessibility- Interchange	Accessibility- Transit to Employment	0.0784515	(0.3752671)	1.0601449
Accessibility- Interchange	Accessibility- Income Q1 Households	0.0282484	(0.3752671)	0.2667404
Accessibility- Interchange	Accessibility- Income Q2 Households	0.0311776	(0.3752671)	(1.4750309)
Accessibility- Interchange	Accessibility- Income Q3 Households	0.1065518	(0.3752671)	1.4536199
Accessibility- Interchange	Share- Gov. Employees	0.0170074	(0.3752671)	0.2200108
Accessibility- Interchange	Share- Retail Employees	0.0585128	(0.3752671)	(0.2185370)
Accessibility- Interchange	Share- Service Employees	0.0287733	(0.3752671)	0.9501791
Accessibility- Interchange	Sidewalk Coverage	0.0005116	(0.3752671)	(0.0152192)
Accessibility- Interchange	Accessibility- Distance to CBD	0.0047545	(0.3752671)	0.2413362

EMPLOYERS- GOVERNMENT				
X Variable	Y Variable	a	exp X	exp Y
Accessibility- Interchange	Dummy- CBD Location	0.1236238	(0.3752671)	(0.5534254)
Accessibility- Transit to Households	Accessibility- Income Q2 Households	0.9452185	(0.8253528)	(1.4750309)
Accessibility- Transit to Households	Accessibility- Income Q4 Households	0.5974662	(0.8253528)	(1.2463351)
Accessibility- Transit to Households	Share- Retail Employees	0.0037377	(0.8253528)	(0.2185370)
Accessibility- Transit to Households	Sidewalk Coverage	0.0018175	(0.8253528)	(0.0152192)
Accessibility- Transit to Employment	Accessibility- Income Q1 Households	0.0830262	1.0601449	0.2667404
Accessibility- Transit to Employment	Accessibility- Income Q3 Households	1.1446509	1.0601449	1.4536199

Exhibit 18: Industrial Employer Bid Function

EMPLOYERS- INDUSTRIAL				
X Variable	Y Variable	a	exp X	exp Y
Employees	Accessibility- Income Q1 Households	0.0001148	0.0004634	(0.2300155)
Employees	Accessibility- Income Q3 Households	0.0001396	0.0004634	(0.3142470)
Employees	Share- Retail Employees	0.0001078	0.0004634	(0.0877968)
Accessibility- Airport	Accessibility- Interchange	0.0007688	(0.0440536)	0.0673764
Accessibility- Airport	Accessibility- Transit to Households	0.0032739	(0.0440536)	(0.0637134)
Accessibility- Airport	Accessibility- Income Q2 Households	0.0098035	(0.0440536)	0.6167043
Accessibility- Airport	Share- Retail Employees	0.0021445	(0.0440536)	(0.0877968)
Accessibility- Airport	Share- Service Employees	0.0089647	(0.0440536)	0.2668593
Accessibility- Airport	Accessibility- Distance to CBD	0.0011714	(0.0440536)	0.0206769
Accessibility- Airport	Dummy- CBD Location	3.2388559	(0.0440536)	11.4213772
Accessibility- Interchange	Accessibility- Transit to Households	0.0033478	0.0673764	(0.0637134)
Accessibility- Interchange	Accessibility- Income Q1 Households	0.0093008	0.0673764	(0.2300155)
Accessibility- Interchange	Accessibility- Income Q3 Households	0.0294392	0.0673764	(0.3142470)
Accessibility- Interchange	Share- Gov. Employees	0.0064201	0.0673764	(0.0782422)
Accessibility- Interchange	Share- Retail Employees	0.0025364	0.0673764	(0.0877968)
Accessibility- Interchange	Sidewalk Coverage	0.0000730	0.0673764	0.0015915
Accessibility- Transit to Households	Accessibility- Income Q2 Households	0.0283551	(0.0637134)	0.6167043
Accessibility- Transit to Households	Share- Gov. Employees	0.0041213	(0.0637134)	(0.0782422)
Accessibility- Transit to Households	Share- Retail Employees	0.0100622	(0.0637134)	(0.0877968)
Accessibility- Transit to Households	Accessibility- Distance to CBD	0.0049806	(0.0637134)	0.0206769
Accessibility- Transit to Employment	Accessibility- Income Q1 Households	0.0010798	0.0821529	(0.2300155)
Accessibility- Transit to Employment	Accessibility- Income Q3 Households	0.0120934	0.0821529	(0.3142470)
Accessibility- Transit to Employment	Accessibility- Income Q4 Households	0.0180855	0.0821529	(0.1975547)
Accessibility- Transit to Employment	Share- Agr. Employees	0.0056984	0.0821529	(0.0292889)
Accessibility- Transit to Employment	Floor Space	0.0000178	0.0821529	0.0002610
Accessibility- Transit to Employment	Dummy- CBD Location	0.1909724	0.0821529	11.4213772
Accessibility- Income Q1 Households	Accessibility- Income Q3 Households	0.0273928	(0.2300155)	(0.3142470)

EMPLOYERS- INDUSTRIAL				
X Variable	Y Variable	a	exp X	exp Y
Accessibility- Income Q1 Households	Share- Service Employees	0.0355888	(0.2300155)	0.2668593
Accessibility- Income Q1 Households	Accessibility- Distance to CBD	0.0019074	(0.2300155)	0.0206769
Accessibility- Income Q2 Households	Accessibility- Income Q4 Households	0.1303226	0.6167043	(0.1975547)
Accessibility- Income Q2 Households	Share- Agr. Employees	0.0153811	0.6167043	(0.0292889)
Accessibility- Income Q2 Households	Share- Gov. Employees	0.0342418	0.6167043	(0.0782422)
Accessibility- Income Q3 Households	Share- Service Employees	0.0542743	(0.3142470)	0.2668593
Accessibility- Income Q3 Households	Sidewalk Coverage	0.0006801	(0.3142470)	0.0015915
Accessibility- Income Q3 Households	Accessibility- Distance to CBD	0.0167476	(0.3142470)	0.0206769
Accessibility- Income Q3 Households	Floor Space	0.0001485	(0.3142470)	0.0002610
Accessibility- Income Q4 Households	Share- Service Employees	0.0139092	(0.1975547)	0.2668593
Share- Agr. Employees	Share- Service Employees	0.0060044	(0.0292889)	0.2668593
Share- Gov. Employees	Share- Service Employees	0.0051444	(0.0782422)	0.2668593
Share- Gov. Employees	Sidewalk Coverage	0.0003262	(0.0782422)	0.0015915
Share- Gov. Employees	Accessibility- Distance to CBD	0.0041976	(0.0782422)	0.0206769
Share- Retail Employees	Share- Service Employees	0.0261986	(0.0877968)	0.2668593
Share- Retail Employees	Accessibility- Distance to CBD	0.0043920	(0.0877968)	0.0206769

Exhibit 19: Service and Other Employer Bid Function

EMPLOYERS- OTHER SERVICES				
X Variable	Y Variable	a	exp X	exp Y
Employees	Accessibility- Transit to Employment	0.0000060	(0.0000613)	0.0698673
Accessibility- Airport	Accessibility- Interchange	0.0008670	(0.0499817)	0.0489369
Accessibility- Airport	Accessibility- Transit to Households	0.0025426	(0.0499817)	(0.0548686)
Accessibility- Airport	Accessibility- Income Q2 Households	0.0029524	(0.0499817)	0.6238054
Accessibility- Airport	Share- Agr. Employees	0.0003418	(0.0499817)	(0.0331701)
Accessibility- Airport	Share- Service Employees	0.0160560	(0.0499817)	0.2903356
Accessibility- Airport	Accessibility- Distance to CBD	0.0011645	(0.0499817)	0.0092394
Accessibility- Interchange	Accessibility- Transit to Households	0.0001598	0.0489369	(0.0548686)
Accessibility- Interchange	Accessibility- Income Q1 Households	0.0049247	0.0489369	(0.2486025)
Accessibility- Interchange	Accessibility- Income Q3 Households	0.0189290	0.0489369	(0.3334452)
Accessibility- Interchange	Share- Gov. Employees	0.0054448	0.0489369	(0.0957803)
Accessibility- Interchange	Share- Retail Employees	0.0011107	0.0489369	(0.0769166)
Accessibility- Interchange	Dummy- CBD Location	0.0546372	0.0489369	(0.1199048)
Accessibility- Transit to Households	Accessibility- Income Q2 Households	0.0164294	(0.0548686)	0.6238054
Accessibility- Transit to Households	Accessibility- Income Q3 Households	0.0048820	(0.0548686)	(0.3334452)
Accessibility- Transit to Households	Share- Gov. Employees	0.0005420	(0.0548686)	(0.0957803)
Accessibility- Transit to Households	Share- Retail Employees	0.0086170	(0.0548686)	(0.0769166)
Accessibility- Transit to Households	Dummy- CBD Location	0.0153339	(0.0548686)	(0.1199048)

EMPLOYERS- OTHER SERVICES				
X Variable	Y Variable	a	exp X	exp Y
Accessibility- Transit to Employment	Accessibility- Income Q1 Households	0.0060050	0.0698673	(0.2486025)
Accessibility- Transit to Employment	Accessibility- Income Q4 Households	0.0175422	0.0698673	(0.1834158)
Accessibility- Transit to Employment	Share- Agr. Employees	0.0072972	0.0698673	(0.0331701)
Accessibility- Transit to Employment	Sidewalk Coverage	0.0001844	0.0698673	0.0014300
Accessibility- Transit to Employment	Accessibility- Distance to CBD	0.0006724	0.0698673	0.0092394
Accessibility- Transit to Employment	Floor Space	0.0001254	0.0698673	0.0000166
Accessibility- Income Q1 Households	Accessibility- Income Q2 Households	0.0124423	(0.2486025)	0.6238054
Accessibility- Income Q1 Households	Share- Service Employees	0.0493128	(0.2486025)	0.2903356
Accessibility- Income Q1 Households	Sidewalk Coverage	0.0002969	(0.2486025)	0.0014300
Accessibility- Income Q1 Households	Accessibility- Distance to CBD	0.0032817	(0.2486025)	0.0092394
Accessibility- Income Q1 Households	Floor Space	0.0001254	(0.2486025)	0.0000166
Accessibility- Income Q1 Households	Dummy- CBD Location	0.0706816	(0.2486025)	(0.1199048)
Accessibility- Income Q2 Households	Accessibility- Income Q4 Households	0.1285128	0.6238054	(0.1834158)
Accessibility- Income Q2 Households	Share- Agr. Employees	0.0226954	0.6238054	(0.0331701)
Accessibility- Income Q2 Households	Share- Gov. Employees	0.0356426	0.6238054	(0.0957803)
Accessibility- Income Q3 Households	Share- Service Employees	0.0770435	(0.3334452)	0.2903356
Accessibility- Income Q3 Households	Sidewalk Coverage	0.0002934	(0.3334452)	0.0014300
Accessibility- Income Q3 Households	Accessibility- Distance to CBD	0.0137983	(0.3334452)	0.0092394
Accessibility- Income Q3 Households	Dummy- CBD Location	0.6382078	(0.3334452)	(0.1199048)
Accessibility- Income Q4 Households	Share- Service Employees	0.0054182	(0.1834158)	0.2903356
Accessibility- Income Q4 Households	Sidewalk Coverage	0.0001413	(0.1834158)	0.0014300
Share- Agr. Employees	Share- Service Employees	0.0044393	(0.0331701)	0.2903356
Share- Gov. Employees	Share- Service Employees	0.0033139	(0.0957803)	0.2903356
Share- Gov. Employees	Sidewalk Coverage	0.0002338	(0.0957803)	0.0014300
Share- Gov. Employees	Accessibility- Distance to CBD	0.0006953	(0.0957803)	0.0092394
Share- Retail Employees	Share- Service Employees	0.0248835	(0.0769166)	0.2903356
Share- Retail Employees	Accessibility- Distance to CBD	0.0012679	(0.0769166)	0.0092394
Share- Service Employees	Accessibility- Distance to CBD	0.0009004	0.2903356	0.0092394
Sidewalk Coverage	Accessibility- Distance to CBD	0.0000579	0.0014300	0.0092394
Accessibility- Distance to CBD	Floor Space	0.0000155	0.0092394	0.0000166

Exhibit 20: Residential Bid Function Income Quartile 1 Dispersion Statistics

Deviance Residuals:

Min	1Q	Median	3Q	Max
-8.276e-04	-3.965e-05	-7.271e-07	3.874e-05	7.930e-04

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
log(PERSONS)	-1.089e-03	2.590e-04	-4.206	2.64e-05	***
log(ACCAIRPORT)	-2.556e-02	9.942e-04	-25.703	< 2e-16	***
log(ACCINTRCHG)	4.300e-02	1.116e-03	38.536	< 2e-16	***
log(TACCHSNG)	1.111e-01	6.336e-03	17.541	< 2e-16	***
log(TACCJOBS)	-9.068e-02	5.955e-03	-15.227	< 2e-16	***
log(ACCINC1)	-2.151e-01	4.320e-03	-49.787	< 2e-16	***
log(ACCINC2)	5.379e-01	6.604e-03	81.456	< 2e-16	***
log(ACCINC3)	-3.573e-01	6.242e-03	-57.237	< 2e-16	***
log(ACCINC4)	-2.137e-01	2.766e-03	-77.260	< 2e-16	***
log(EMAG)	-4.141e-02	1.547e-03	-26.760	< 2e-16	***
log(EMGV)	-7.074e-02	1.454e-03	-48.637	< 2e-16	***
log(EMRT)	-1.990e-02	4.638e-03	-4.290	1.82e-05	***
log(EMSV)	3.170e-01	3.453e-03	91.786	< 2e-16	***
log(SIDEWKCVRG)	9.668e-04	1.179e-04	8.199	3.07e-16	***
log(DIST2CBD)	2.064e-02	7.244e-04	28.486	< 2e-16	***
log(FS_UNIT)	4.537e-03	2.647e-04	17.143	< 2e-16	***
DHOUSE	-6.147e-04	2.802e-04	-2.194	0.028290	*
log(PERSONS):log(ACCINTRCHG)	-4.372e-05	1.410e-05	-3.100	0.001945	**
log(PERSONS):log(ACCINC2)	1.137e-04	7.722e-05	1.473	0.140826	
log(PERSONS):log(ACCINC4)	-3.734e-04	7.061e-05	-5.288	1.29e-07	***
log(PERSONS):log(EMAG)	-3.640e-05	1.578e-05	-2.306	0.021144	*
log(PERSONS):log(EMGV)	-1.160e-04	2.585e-05	-4.487	7.39e-06	***
log(PERSONS):log(EMRT)	2.417e-04	5.936e-05	4.073	4.72e-05	***
log(PERSONS):log(EMSV)	1.629e-04	9.566e-05	1.703	0.088658	.
log(PERSONS):log(SIDEWKCVRG)	3.000e-06	1.920e-06	1.562	0.118256	
log(PERSONS):log(DIST2CBD)	-2.113e-05	1.447e-05	-1.461	0.144188	
log(ACCAIRPORT):log(ACCINTRCHG)	5.240e-04	4.890e-05	10.717	< 2e-16	***
log(ACCAIRPORT):log(TACCHSNG)	-1.114e-03	2.227e-04	-5.000	5.93e-07	***
log(ACCAIRPORT):log(TACCJOBS)	1.099e-03	2.118e-04	5.190	2.18e-07	***
log(ACCAIRPORT):log(ACCINC1)	-2.948e-03	2.248e-04	-13.112	< 2e-16	***
log(ACCAIRPORT):log(ACCINC3)	-2.833e-03	4.429e-04	-6.396	1.74e-10	***
log(ACCAIRPORT):log(ACCINC4)	-3.899e-03	4.165e-04	-9.362	< 2e-16	***
log(ACCAIRPORT):log(EMAG)	5.888e-04	6.749e-05	8.725	< 2e-16	***
log(ACCAIRPORT):log(EMGV)	-2.051e-03	1.465e-04	-14.003	< 2e-16	***
log(ACCAIRPORT):log(EMSV)	1.104e-02	3.714e-04	29.730	< 2e-16	***
log(ACCAIRPORT):log(SIDEWKCVRG)	2.640e-05	4.330e-06	6.097	1.16e-09	***
log(ACCAIRPORT):log(DIST2CBD)	8.709e-04	4.936e-05	17.644	< 2e-16	***
log(ACCAIRPORT):log(FS_UNIT)	1.851e-05	8.593e-06	2.154	0.031257	*
log(ACCINTRCHG):log(TACCHSNG)	-1.678e-03	2.633e-04	-6.375	2.00e-10	***
log(ACCINTRCHG):log(TACCJOBS)	1.709e-03	2.547e-04	6.708	2.20e-11	***
log(ACCINTRCHG):log(ACCINC1)	6.344e-03	2.380e-04	26.653	< 2e-16	***
log(ACCINTRCHG):log(ACCINC2)	-1.630e-02	5.509e-04	-29.582	< 2e-16	***
log(ACCINTRCHG):log(ACCINC3)	1.470e-02	5.638e-04	26.076	< 2e-16	***

log(ACCINTRCHG):log(EMAG)	-9.960e-04	8.766e-05	-11.361	< 2e-16	***
log(ACCINTRCHG):log(EMGV)	5.023e-03	1.536e-04	32.697	< 2e-16	***
log(ACCINTRCHG):log(EMRT)	5.253e-03	3.148e-04	16.687	< 2e-16	***
log(ACCINTRCHG):log(EMSV)	-1.392e-02	3.520e-04	-39.542	< 2e-16	***
log(ACCINTRCHG):log(SIDEWKCVRG)	-3.292e-05	7.432e-06	-4.430	9.62e-06	***
log(ACCINTRCHG):log(DIST2CBD)	-3.779e-04	3.670e-05	-10.297	< 2e-16	***
log(TACCHSNG):log(TACCJOBS)	-5.498e-04	2.289e-05	-24.018	< 2e-16	***
log(TACCHSNG):log(ACCINC2)	-3.865e-03	1.607e-03	-2.405	0.016197	*
log(TACCHSNG):log(ACCINC3)	1.442e-02	1.399e-03	10.309	< 2e-16	***
log(TACCHSNG):log(ACCINC4)	3.055e-03	2.375e-04	12.866	< 2e-16	***
log(TACCHSNG):log(EMAG)	1.562e-02	1.198e-03	13.038	< 2e-16	***
log(TACCHSNG):log(EMGV)	-2.005e-03	6.593e-04	-3.040	0.002375	**
log(TACCHSNG):log(EMSV)	-1.769e-02	1.405e-03	-12.595	< 2e-16	***
log(TACCHSNG):log(DIST2CBD)	5.807e-04	2.550e-04	2.277	0.022840	*
log(TACCHSNG):log(FS_UNIT)	-2.165e-04	7.825e-05	-2.767	0.005684	**
log(TACCJOBS):log(ACCINC1)	-1.591e-03	1.523e-04	-10.447	< 2e-16	***
log(TACCJOBS):log(ACCINC2)	8.174e-03	1.579e-03	5.177	2.34e-07	***
log(TACCJOBS):log(ACCINC3)	-1.679e-02	1.277e-03	-13.146	< 2e-16	***
log(TACCJOBS):log(EMAG)	-1.384e-02	1.128e-03	-12.267	< 2e-16	***
log(TACCJOBS):log(EMGV)	1.791e-03	6.154e-04	2.910	0.003630	**
log(TACCJOBS):log(EMSV)	1.366e-02	1.342e-03	10.176	< 2e-16	***
log(TACCJOBS):log(SIDEWKCVRG)	-5.140e-05	3.817e-06	-13.466	< 2e-16	***
log(TACCJOBS):log(DIST2CBD)	-1.018e-03	2.406e-04	-4.232	2.36e-05	***
log(TACCJOBS):log(FS_UNIT)	1.605e-04	7.641e-05	2.101	0.035703	*
log(TACCJOBS):DHOUSE	-6.118e-05	1.103e-05	-5.548	3.04e-08	***
log(ACCINC1):log(ACCINC2)	1.627e-02	1.088e-03	14.958	< 2e-16	***
log(ACCINC1):log(ACCINC3)	5.947e-03	1.948e-03	3.053	0.002279	**
log(ACCINC1):log(ACCINC4)	-4.619e-02	1.550e-03	-29.803	< 2e-16	***
log(ACCINC1):log(EMAG)	-1.103e-02	4.036e-04	-27.327	< 2e-16	***
log(ACCINC1):log(EMGV)	-9.935e-03	4.750e-04	-20.916	< 2e-16	***
log(ACCINC1):log(EMRT)	-1.350e-02	1.317e-03	-10.251	< 2e-16	***
log(ACCINC1):log(EMSV)	4.647e-02	1.522e-03	30.537	< 2e-16	***
log(ACCINC1):log(SIDEWKCVRG)	2.921e-04	3.674e-05	7.952	2.26e-15	***
log(ACCINC1):log(DIST2CBD)	3.176e-03	2.469e-04	12.863	< 2e-16	***
log(ACCINC1):log(FS_UNIT)	8.681e-05	5.100e-05	1.702	0.088803	.
log(ACCINC1):DHOUSE	-4.565e-04	7.459e-05	-6.120	1.01e-09	***
log(ACCINC2):log(ACCINC3)	3.987e-03	1.681e-03	2.371	0.017768	*
log(ACCINC2):log(ACCINC4)	1.006e-01	2.044e-03	49.188	< 2e-16	***
log(ACCINC2):log(EMAG)	2.307e-02	7.748e-04	29.777	< 2e-16	***
log(ACCINC2):log(EMGV)	3.575e-02	1.106e-03	32.334	< 2e-16	***
log(ACCINC2):log(EMRT)	1.066e-02	2.383e-03	4.475	7.82e-06	***
log(ACCINC2):log(EMSV)	-1.613e-01	2.585e-03	-62.402	< 2e-16	***
log(ACCINC2):log(SIDEWKCVRG)	-5.512e-04	7.744e-05	-7.117	1.26e-12	***
log(ACCINC2):log(DIST2CBD)	-1.103e-02	5.588e-04	-19.735	< 2e-16	***
log(ACCINC2):log(FS_UNIT)	-1.938e-04	9.242e-05	-2.097	0.036085	*
log(ACCINC2):DHOUSE	6.739e-04	2.012e-04	3.349	0.000818	***
log(ACCINC3):log(ACCINC4)	-7.428e-02	1.134e-03	-65.520	< 2e-16	***
log(ACCINC3):log(EMAG)	-1.265e-02	6.399e-04	-19.767	< 2e-16	***
log(ACCINC3):log(EMGV)	-2.620e-02	1.219e-03	-21.504	< 2e-16	***

log(ACCINC3):log(EMRT)	-1.309e-02	1.822e-03	-7.188	7.58e-13	***
log(ACCINC3):log(EMSV)	9.752e-02	3.524e-03	27.672	< 2e-16	***
log(ACCINC3):log(SIDEWKCVRG)	1.017e-03	9.530e-05	10.669	< 2e-16	***
log(ACCINC3):log(DIST2CBD)	7.465e-03	7.436e-04	10.039	< 2e-16	***
log(ACCINC3):DHOUSE	-6.148e-04	1.595e-04	-3.854	0.000118	***
log(ACCINC4):log(EMAG)	-5.053e-03	5.975e-04	-8.456	< 2e-16	***
log(ACCINC4):log(EMGV)	-2.184e-03	7.200e-04	-3.033	0.002435	**
log(ACCINC4):log(EMRT)	6.548e-03	1.378e-03	4.752	2.07e-06	***
log(ACCINC4):log(EMSV)	1.645e-02	1.492e-03	11.028	< 2e-16	***
log(ACCINC4):log(SIDEWKCVRG)	-4.799e-04	5.396e-05	-8.894	< 2e-16	***
log(ACCINC4):log(DIST2CBD)	-1.112e-03	3.573e-04	-3.114	0.001858	**
log(ACCINC4):log(FS_UNIT)	1.046e-03	6.596e-05	15.852	< 2e-16	***
log(EMAG):log(EMRT)	3.649e-03	3.920e-04	9.307	< 2e-16	***
log(EMAG):log(EMSV)	1.178e-03	5.715e-04	2.060	0.039412	*
log(EMAG):log(SIDEWKCVRG)	-2.063e-04	1.342e-05	-15.365	< 2e-16	***
log(EMAG):log(DIST2CBD)	-5.694e-04	1.015e-04	-5.612	2.11e-08	***
log(EMAG):log(FS_UNIT)	1.075e-04	1.814e-05	5.926	3.32e-09	***
log(EMGV):log(EMRT)	-2.032e-03	5.510e-04	-3.688	0.000229	***
log(EMGV):log(EMSV)	3.235e-03	5.437e-04	5.951	2.85e-09	***
log(EMGV):log(SIDEWKCVRG)	3.336e-04	1.333e-05	25.036	< 2e-16	***
log(EMGV):log(DIST2CBD)	1.697e-03	1.138e-04	14.916	< 2e-16	***
log(EMGV):log(FS_UNIT)	2.172e-04	3.110e-05	6.984	3.25e-12	***
log(EMGV):DHOUSE	-8.783e-05	3.135e-05	-2.802	0.005101	**
log(EMRT):log(EMSV)	5.713e-03	1.638e-03	3.488	0.000492	***
log(EMRT):log(SIDEWKCVRG)	-1.013e-04	2.876e-05	-3.523	0.000430	***
log(EMRT):log(DIST2CBD)	2.456e-03	2.766e-04	8.879	< 2e-16	***
log(EMRT):DHOUSE	5.047e-04	7.958e-05	6.343	2.46e-10	***
log(EMSV):log(SIDEWKCVRG)	-2.690e-04	3.202e-05	-8.401	< 2e-16	***
log(EMSV):log(DIST2CBD)	-1.783e-03	1.332e-04	-13.391	< 2e-16	***
log(EMSV):log(FS_UNIT)	-1.198e-03	8.085e-05	-14.822	< 2e-16	***
log(SIDEWKCVRG):log(FS_UNIT)	-1.073e-05	2.195e-06	-4.889	1.04e-06	***
log(SIDEWKCVRG):DHOUSE	-8.712e-06	2.510e-06	-3.471	0.000523	***
log(DIST2CBD):log(FS_UNIT)	-1.018e-04	1.216e-05	-8.368	< 2e-16	***
log(DIST2CBD):DHOUSE	-4.083e-05	1.381e-05	-2.956	0.003132	**

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for gaussian family taken to be 6.886993e-09)

Null deviance: 5.0480e+03 on 5048 degrees of freedom

Residual deviance: 3.3898e-05 on 4922 degrees of freedom

AIC: -80418

Exhibit 21: Residential Bid Function Income Quartile 2 Dispersion Statistics

Deviance Residuals:

Min	1Q	Median	3Q	Max
-7.227e-04	-4.690e-05	-6.434e-07	4.617e-05	5.397e-04

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
log(PERSONS)	-5.266e-04	1.149e-04	-4.585	4.61e-06	***
log(ACCAIRPORT)	-3.906e-02	1.058e-03	-36.923	< 2e-16	***
log(ACCINTRCHG)	4.542e-02	8.793e-04	51.653	< 2e-16	***
log(TACCHSNG)	-1.782e-02	4.422e-03	-4.030	5.64e-05	***
log(TACCJOBS)	3.613e-02	4.286e-03	8.430	< 2e-16	***
log(ACCINC1)	-3.277e-01	4.199e-03	-78.026	< 2e-16	***
log(ACCINC2)	6.730e-01	4.727e-03	142.355	< 2e-16	***
log(ACCINC3)	-3.284e-01	4.522e-03	-72.628	< 2e-16	***
log(ACCINC4)	-1.854e-01	2.413e-03	-76.842	< 2e-16	***
log(EMAG)	-1.473e-02	1.231e-03	-11.969	< 2e-16	***
log(EMGV)	-8.890e-02	1.338e-03	-66.452	< 2e-16	***
log(EMRT)	-9.302e-02	3.153e-03	-29.502	< 2e-16	***
log(EMSV)	3.211e-01	2.187e-03	146.816	< 2e-16	***
log(SIDEWKCVRG)	1.768e-04	8.334e-05	2.121	0.033913	*
log(DIST2CBD)	1.146e-02	5.910e-04	19.383	< 2e-16	***
log(FS_UNIT)	3.809e-03	2.485e-04	15.329	< 2e-16	***
DHOUSE	-9.981e-04	3.317e-04	-3.009	0.002628	**
log(PERSONS):log(ACCAIRPORT)	1.458e-05	7.350e-06	1.983	0.047399	*
log(PERSONS):log(ACCINTRCHG)	-5.608e-05	1.664e-05	-3.370	0.000757	***
log(PERSONS):log(TACCJOBS)	2.105e-05	6.922e-06	3.040	0.002372	**
log(PERSONS):log(ACCINC3)	3.950e-04	6.893e-05	5.731	1.03e-08	***
log(PERSONS):log(ACCINC4)	-2.497e-04	4.489e-05	-5.562	2.75e-08	***
log(PERSONS):log(EMAG)	-1.167e-04	1.521e-05	-7.674	1.87e-14	***
log(PERSONS):log(EMGV)	6.105e-05	1.932e-05	3.160	0.001583	**
log(PERSONS):log(EMRT)	-1.095e-04	3.971e-05	-2.756	0.005859	**
log(PERSONS):log(DIST2CBD)	-2.332e-05	1.280e-05	-1.822	0.068441	.
log(PERSONS):log(FS_UNIT)	1.234e-05	6.962e-06	1.772	0.076433	.
log(PERSONS):DHOUSE	-3.400e-05	8.201e-06	-4.146	3.42e-05	***
log(ACCAIRPORT):log(ACCINC1)	-7.892e-03	3.493e-04	-22.598	< 2e-16	***
log(ACCAIRPORT):log(ACCINC2)	1.593e-03	8.008e-04	1.989	0.046712	*
log(ACCAIRPORT):log(ACCINC3)	3.301e-03	9.498e-04	3.476	0.000513	***
log(ACCAIRPORT):log(ACCINC4)	-1.388e-02	4.578e-04	-30.315	< 2e-16	***
log(ACCAIRPORT):log(EMAG)	2.666e-04	8.426e-05	3.163	0.001566	**
log(ACCAIRPORT):log(EMGV)	5.836e-04	1.477e-04	3.953	7.80e-05	***
log(ACCAIRPORT):log(EMRT)	1.687e-03	2.637e-04	6.398	1.67e-10	***
log(ACCAIRPORT):log(EMSV)	1.417e-02	3.162e-04	44.806	< 2e-16	***
log(ACCAIRPORT):log(SIDEWKCVRG)	1.166e-05	4.665e-06	2.499	0.012476	*
log(ACCAIRPORT):log(DIST2CBD)	3.697e-04	3.490e-05	10.593	< 2e-16	***
log(ACCINTRCHG):log(TACCHSNG)	-4.073e-03	3.044e-04	-13.378	< 2e-16	***
log(ACCINTRCHG):log(TACCJOBS)	3.297e-03	2.848e-04	11.579	< 2e-16	***
log(ACCINTRCHG):log(ACCINC1)	1.505e-02	3.927e-04	38.328	< 2e-16	***
log(ACCINTRCHG):log(ACCINC2)	-1.880e-02	7.627e-04	-24.645	< 2e-16	***
log(ACCINTRCHG):log(ACCINC3)	2.491e-02	8.386e-04	29.701	< 2e-16	***

log(ACCINTRCHG):log(ACCINC4)	-4.129e-03	3.921e-04	-10.528	< 2e-16	***
log(ACCINTRCHG):log(EMAG)	-3.785e-03	1.160e-04	-32.627	< 2e-16	***
log(ACCINTRCHG):log(EMGV)	4.516e-03	1.336e-04	33.808	< 2e-16	***
log(ACCINTRCHG):log(EMRT)	1.331e-03	1.846e-04	7.208	6.23e-13	***
log(ACCINTRCHG):log(EMSV)	-1.840e-02	2.938e-04	-62.623	< 2e-16	***
log(ACCINTRCHG):log(DIST2CBD)	-5.048e-04	2.990e-05	-16.884	< 2e-16	***
log(ACCINTRCHG):DHOUSE	6.654e-05	2.892e-05	2.301	0.021429	*
log(TACCHSNG):log(TACCJOBS)	-2.351e-04	2.108e-05	-11.154	< 2e-16	***
log(TACCHSNG):log(ACCINC1)	7.413e-03	1.081e-03	6.855	7.67e-12	***
log(TACCHSNG):log(ACCINC2)	-9.697e-03	1.791e-03	-5.414	6.35e-08	***
log(TACCHSNG):log(ACCINC3)	4.954e-03	2.454e-04	20.189	< 2e-16	***
log(TACCHSNG):log(ACCINC4)	-1.180e-02	9.107e-04	-12.954	< 2e-16	***
log(TACCHSNG):log(EMAG)	-4.584e-03	1.028e-03	-4.461	8.26e-06	***
log(TACCHSNG):log(EMGV)	2.609e-03	6.444e-04	4.048	5.22e-05	***
log(TACCHSNG):log(EMRT)	1.090e-02	6.883e-04	15.842	< 2e-16	***
log(TACCHSNG):log(SIDEWKCVRG)	-2.765e-04	2.776e-05	-9.962	< 2e-16	***
log(TACCHSNG):log(DIST2CBD)	9.280e-04	2.850e-04	3.256	0.001133	**
log(TACCHSNG):log(FS_UNIT)	1.780e-04	8.264e-05	2.154	0.031249	*
log(TACCHSNG):DHOUSE	2.893e-04	8.844e-05	3.271	0.001076	**
log(TACCJOBS):log(ACCINC1)	-5.937e-03	9.993e-04	-5.941	2.96e-09	***
log(TACCJOBS):log(ACCINC2)	6.529e-03	1.703e-03	3.833	0.000128	***
log(TACCJOBS):log(ACCINC4)	1.103e-02	8.700e-04	12.678	< 2e-16	***
log(TACCJOBS):log(EMAG)	5.433e-03	9.732e-04	5.583	2.45e-08	***
log(TACCJOBS):log(EMGV)	-2.440e-03	6.137e-04	-3.976	7.07e-05	***
log(TACCJOBS):log(EMRT)	-1.023e-02	6.574e-04	-15.567	< 2e-16	***
log(TACCJOBS):log(EMSV)	-3.250e-03	1.483e-04	-21.915	< 2e-16	***
log(TACCJOBS):log(SIDEWKCVRG)	2.531e-04	2.721e-05	9.300	< 2e-16	***
log(TACCJOBS):log(DIST2CBD)	-1.452e-03	2.573e-04	-5.645	1.71e-08	***
log(TACCJOBS):log(FS_UNIT)	-1.967e-04	8.020e-05	-2.453	0.014189	*
log(TACCJOBS):DHOUSE	-3.128e-04	8.805e-05	-3.553	0.000383	***
log(ACCINC1):log(ACCINC2)	1.812e-02	8.719e-04	20.779	< 2e-16	***
log(ACCINC1):log(ACCINC3)	2.229e-02	1.594e-03	13.979	< 2e-16	***
log(ACCINC1):log(ACCINC4)	-6.825e-02	1.275e-03	-53.542	< 2e-16	***
log(ACCINC1):log(EMAG)	-1.296e-02	4.073e-04	-31.809	< 2e-16	***
log(ACCINC1):log(EMGV)	-8.548e-03	6.311e-04	-13.545	< 2e-16	***
log(ACCINC1):log(EMRT)	-2.960e-02	1.360e-03	-21.775	< 2e-16	***
log(ACCINC1):log(EMSV)	6.590e-02	1.204e-03	54.716	< 2e-16	***
log(ACCINC1):log(SIDEWKCVRG)	-2.968e-04	2.523e-05	-11.762	< 2e-16	***
log(ACCINC1):log(DIST2CBD)	9.567e-03	2.753e-04	34.758	< 2e-16	***
log(ACCINC1):log(FS_UNIT)	4.042e-04	6.424e-05	6.292	3.29e-10	***
log(ACCINC1):DHOUSE	-4.156e-04	1.179e-04	-3.523	0.000429	***
log(ACCINC2):log(ACCINC3)	-3.861e-02	1.347e-03	-28.653	< 2e-16	***
log(ACCINC2):log(ACCINC4)	1.526e-01	1.603e-03	95.181	< 2e-16	***
log(ACCINC2):log(EMAG)	1.901e-02	7.126e-04	26.675	< 2e-16	***
log(ACCINC2):log(EMGV)	2.725e-02	1.103e-03	24.699	< 2e-16	***
log(ACCINC2):log(EMRT)	2.890e-02	1.670e-03	17.308	< 2e-16	***
log(ACCINC2):log(EMSV)	-1.895e-01	1.791e-03	-105.775	< 2e-16	***
log(ACCINC2):log(SIDEWKCVRG)	9.264e-05	2.935e-05	3.156	0.001604	**
log(ACCINC2):log(DIST2CBD)	-2.373e-02	5.636e-04	-42.103	< 2e-16	***

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log(ACCINC2):log(FS_UNIT)      -8.287e-04  9.771e-05  -8.481 < 2e-16 ***
log(ACCINC2):DHOUSE           3.505e-04  1.938e-04   1.809 0.070557 .
log(ACCINC3):log(ACCINC4)     -6.245e-02  6.955e-04 -89.787 < 2e-16 ***
log(ACCINC3):log(EMAG)        -3.473e-03  4.964e-04  -6.997 2.84e-12 ***
log(ACCINC3):log(EMGV)        -4.579e-03  1.124e-03  -4.074 4.67e-05 ***
log(ACCINC3):log(EMRT)        -1.949e-02  1.339e-03 -14.558 < 2e-16 ***
log(ACCINC3):log(EMSV)        9.700e-02  1.120e-03  86.572 < 2e-16 ***
log(ACCINC3):log(DIST2CBD)    2.929e-02  7.446e-04  39.332 < 2e-16 ***
log(ACCINC3):DHOUSE          -3.635e-04  1.663e-04  -2.185 0.028914 *
log(ACCINC4):log(EMAG)        1.213e-03  4.163e-04   2.913 0.003590 **
log(ACCINC4):log(EMGV)        -1.681e-02  6.588e-04 -25.511 < 2e-16 ***
log(ACCINC4):log(EMRT)        -7.233e-03  8.353e-04  -8.660 < 2e-16 ***
log(ACCINC4):log(SIDEWKCVRG)  8.986e-05  1.833e-05   4.903 9.61e-07 ***
log(ACCINC4):log(DIST2CBD)    -1.488e-02  3.472e-04 -42.841 < 2e-16 ***
log(ACCINC4):log(FS_UNIT)     6.848e-04  5.504e-05  12.440 < 2e-16 ***
log(ACCINC4):DHOUSE          -2.993e-04  9.246e-05  -3.237 0.001214 **
log(EMAG):log(EMGV)          -3.615e-03  1.770e-04 -20.421 < 2e-16 ***
log(EMAG):log(EMRT)          1.426e-03  2.565e-04   5.558 2.82e-08 ***
log(EMAG):log(EMSV)          -1.332e-03  3.384e-04  -3.935 8.40e-05 ***
log(EMAG):log(DIST2CBD)      -3.647e-03  1.037e-04 -35.182 < 2e-16 ***
log(EMAG):log(FS_UNIT)       1.680e-04  1.908e-05   8.807 < 2e-16 ***
log(EMAG):DHOUSE             1.151e-04  3.042e-05   3.783 0.000156 ***
log(EMGV):log(EMRT)          -5.459e-03  4.133e-04 -13.210 < 2e-16 ***
log(EMGV):log(EMSV)          1.045e-02  4.438e-04  23.558 < 2e-16 ***
log(EMGV):log(SIDEWKCVRG)    2.151e-04  1.179e-05  18.246 < 2e-16 ***
log(EMGV):log(DIST2CBD)      2.884e-03  1.012e-04  28.504 < 2e-16 ***
log(EMGV):log(FS_UNIT)       7.324e-05  2.880e-05   2.543 0.010996 *
log(EMGV):DHOUSE            -7.667e-05  4.417e-05  -1.736 0.082614 .
log(EMRT):log(EMSV)          2.717e-02  1.024e-03  26.526 < 2e-16 ***
log(EMRT):log(SIDEWKCVRG)    -2.103e-04  1.694e-05 -12.415 < 2e-16 ***
log(EMRT):log(DIST2CBD)      8.464e-04  2.112e-04   4.008 6.18e-05 ***
log(EMRT):log(FS_UNIT)       3.643e-04  4.633e-05   7.862 4.29e-15 ***
log(EMRT):DHOUSE            1.623e-04  5.321e-05   3.051 0.002291 **
log(EMSV):log(SIDEWKCVRG)    1.594e-04  3.432e-05   4.646 3.44e-06 ***
log(EMSV):log(FS_UNIT)      -8.427e-04  8.276e-05 -10.183 < 2e-16 ***
log(EMSV):DHOUSE            5.146e-04  1.078e-04   4.775 1.83e-06 ***
log(SIDEWKCVRG):log(DIST2CBD) 3.030e-05  5.490e-06   5.519 3.51e-08 ***
log(SIDEWKCVRG):log(FS_UNIT) 3.697e-06  2.050e-06   1.803 0.071355 .
log(DIST2CBD):log(FS_UNIT)   -6.039e-05  1.111e-05  -5.436 5.62e-08 ***
log(DIST2CBD):DHOUSE         3.441e-05  2.239e-05   1.537 0.124388
log(FS_UNIT):DHOUSE          -3.389e-05  7.962e-06  -4.257 2.10e-05 ***
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Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
(Dispersion parameter for gaussian family taken to be 7.731092e-09)
Null deviance: 7.9310e+03 on 7931 degrees of freedom
Residual deviance: 6.0287e-05 on 7798 degrees of freedom
AIC: -125494

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Exhibit 22: Residential Bid Function Income Quartile 3 Dispersion Statistics

Deviance Residuals:

Min	1Q	Median	3Q	Max
-5.556e-04	-2.979e-05	-6.259e-06	3.079e-05	7.123e-04

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
log(PERSONS)	-9.357e-04	1.498e-04	-6.246	4.54e-10	***
log(ACCAIRPORT)	-4.780e-02	1.495e-03	-31.972	< 2e-16	***
log(ACCINTRCHG)	3.862e-02	1.201e-03	32.147	< 2e-16	***
log(TACCHSNG)	-1.695e-01	9.542e-03	-17.765	< 2e-16	***
log(TACCJOBS)	1.976e-01	9.045e-03	21.842	< 2e-16	***
log(ACCINC1)	-2.845e-01	6.030e-03	-47.186	< 2e-16	***
log(ACCINC2)	5.918e-01	6.728e-03	87.974	< 2e-16	***
log(ACCINC3)	-2.933e-01	4.860e-03	-60.353	< 2e-16	***
log(ACCINC4)	-1.504e-01	2.874e-03	-52.338	< 2e-16	***
log(EMAG)	-2.727e-02	1.556e-03	-17.523	< 2e-16	***
log(EMGV)	-8.261e-02	1.474e-03	-56.036	< 2e-16	***
log(EMRT)	-1.031e-01	3.130e-03	-32.935	< 2e-16	***
log(EMSV)	3.114e-01	3.220e-03	96.698	< 2e-16	***
log(SIDEWKCVRG)	1.760e-06	1.108e-04	0.016	0.987330	
log(DIST2CBD)	8.116e-03	9.279e-04	8.747	< 2e-16	***
log(FS_UNIT)	2.733e-03	2.522e-04	10.839	< 2e-16	***
DHOUSE	-1.002e-03	1.685e-04	-5.949	2.86e-09	***
log(PERSONS):log(ACCINTRCHG)	5.809e-05	1.687e-05	3.444	0.000578	***
log(PERSONS):log(TACCHSNG)	1.445e-05	7.447e-06	1.941	0.052334	.
log(PERSONS):log(ACCINC1)	-1.472e-04	6.054e-05	-2.432	0.015067	*
log(PERSONS):log(ACCINC2)	2.186e-04	7.261e-05	3.010	0.002623	**
log(PERSONS):log(ACCINC4)	-1.757e-04	2.915e-05	-6.028	1.77e-09	***
log(PERSONS):log(EMRT)	-8.793e-05	3.281e-05	-2.680	0.007391	**
log(PERSONS):log(EMSV)	1.786e-04	5.767e-05	3.096	0.001969	**
log(PERSONS):log(DIST2CBD)	3.789e-05	1.376e-05	2.753	0.005931	**
log(ACCAIRPORT):log(TACCHSNG)	1.257e-04	3.105e-05	4.049	5.21e-05	***
log(ACCAIRPORT):log(ACCINC1)	-1.887e-02	6.500e-04	-29.035	< 2e-16	***
log(ACCAIRPORT):log(ACCINC2)	2.427e-02	1.390e-03	17.463	< 2e-16	***
log(ACCAIRPORT):log(ACCINC3)	-1.742e-02	1.294e-03	-13.457	< 2e-16	***
log(ACCAIRPORT):log(ACCINC4)	-2.921e-03	5.585e-04	-5.231	1.75e-07	***
log(ACCAIRPORT):log(EMAG)	1.242e-03	1.155e-04	10.750	< 2e-16	***
log(ACCAIRPORT):log(EMGV)	2.047e-03	2.264e-04	9.039	< 2e-16	***
log(ACCAIRPORT):log(EMRT)	-1.943e-03	3.439e-04	-5.651	1.68e-08	***
log(ACCAIRPORT):log(EMSV)	1.340e-02	5.234e-04	25.596	< 2e-16	***
log(ACCAIRPORT):log(DIST2CBD)	2.788e-04	4.085e-05	6.824	9.85e-12	***
log(ACCINTRCHG):log(TACCHSNG)	-6.394e-03	6.788e-04	-9.419	< 2e-16	***
log(ACCINTRCHG):log(TACCJOBS)	5.901e-03	6.498e-04	9.081	< 2e-16	***
log(ACCINTRCHG):log(ACCINC1)	1.541e-02	6.042e-04	25.502	< 2e-16	***
log(ACCINTRCHG):log(ACCINC2)	-1.901e-02	1.089e-03	-17.452	< 2e-16	***
log(ACCINTRCHG):log(ACCINC3)	2.099e-02	1.084e-03	19.353	< 2e-16	***
log(ACCINTRCHG):log(ACCINC4)	-2.930e-03	4.509e-04	-6.499	8.84e-11	***
log(ACCINTRCHG):log(EMAG)	-3.271e-03	1.394e-04	-23.457	< 2e-16	***
log(ACCINTRCHG):log(EMGV)	2.895e-03	2.146e-04	13.489	< 2e-16	***

log(ACCINTRCHG):log(EMRT)	2.247e-03	2.004e-04	11.213	< 2e-16	***
log(ACCINTRCHG):log(EMSV)	-1.589e-02	3.730e-04	-42.610	< 2e-16	***
log(ACCINTRCHG):log(SIDEWKCVRG)	5.355e-05	8.632e-06	6.204	5.94e-10	***
log(ACCINTRCHG):log(DIST2CBD)	-4.330e-04	3.352e-05	-12.916	< 2e-16	***
log(ACCINTRCHG):log(FS_UNIT)	-7.226e-05	1.741e-05	-4.151	3.36e-05	***
log(ACCINTRCHG):DHOUSE	1.262e-04	2.292e-05	5.506	3.84e-08	***
log(TACCHSNG):log(TACCJOBS)	-3.609e-04	2.864e-05	-12.600	< 2e-16	***
log(TACCHSNG):log(ACCINC1)	3.959e-02	3.138e-03	12.616	< 2e-16	***
log(TACCHSNG):log(ACCINC2)	-6.110e-02	5.663e-03	-10.790	< 2e-16	***
log(TACCHSNG):log(ACCINC3)	3.537e-02	4.585e-03	7.714	1.45e-14	***
log(TACCHSNG):log(ACCINC4)	-4.000e-02	2.052e-03	-19.491	< 2e-16	***
log(TACCHSNG):log(EMAG)	-4.577e-02	1.713e-03	-26.722	< 2e-16	***
log(TACCHSNG):log(EMGV)	1.120e-02	1.104e-03	10.146	< 2e-16	***
log(TACCHSNG):log(EMRT)	2.475e-02	1.218e-03	20.326	< 2e-16	***
log(TACCHSNG):log(EMSV)	9.175e-03	3.086e-03	2.974	0.002955	**
log(TACCHSNG):log(SIDEWKCVRG)	-5.718e-04	4.466e-05	-12.802	< 2e-16	***
log(TACCHSNG):log(DIST2CBD)	-8.420e-03	5.836e-04	-14.427	< 2e-16	***
log(TACCHSNG):log(FS_UNIT)	6.029e-04	1.341e-04	4.495	7.10e-06	***
log(TACCJOBS):log(ACCINC1)	-3.759e-02	2.968e-03	-12.668	< 2e-16	***
log(TACCJOBS):log(ACCINC2)	5.806e-02	5.383e-03	10.787	< 2e-16	***
log(TACCJOBS):log(ACCINC3)	-2.863e-02	4.295e-03	-6.667	2.87e-11	***
log(TACCJOBS):log(ACCINC4)	3.843e-02	1.954e-03	19.666	< 2e-16	***
log(TACCJOBS):log(EMAG)	4.718e-02	1.658e-03	28.455	< 2e-16	***
log(TACCJOBS):log(EMGV)	-1.004e-02	1.050e-03	-9.563	< 2e-16	***
log(TACCJOBS):log(EMRT)	-2.330e-02	1.197e-03	-19.463	< 2e-16	***
log(TACCJOBS):log(EMSV)	-1.653e-02	2.892e-03	-5.716	1.15e-08	***
log(TACCJOBS):log(SIDEWKCVRG)	5.787e-04	4.308e-05	13.434	< 2e-16	***
log(TACCJOBS):log(DIST2CBD)	7.778e-03	5.459e-04	14.248	< 2e-16	***
log(TACCJOBS):log(FS_UNIT)	-6.425e-04	1.309e-04	-4.907	9.52e-07	***
log(ACCINC1):log(ACCINC2)	6.378e-03	1.736e-03	3.674	0.000241	***
log(ACCINC1):log(ACCINC3)	1.998e-02	2.434e-03	8.209	2.77e-16	***
log(ACCINC1):log(ACCINC4)	-5.474e-02	1.495e-03	-36.610	< 2e-16	***
log(ACCINC1):log(EMAG)	-5.381e-03	4.728e-04	-11.380	< 2e-16	***
log(ACCINC1):log(EMGV)	-1.469e-02	9.634e-04	-15.250	< 2e-16	***
log(ACCINC1):log(EMRT)	-2.861e-02	1.721e-03	-16.623	< 2e-16	***
log(ACCINC1):log(EMSV)	7.378e-02	2.187e-03	33.739	< 2e-16	***
log(ACCINC1):log(SIDEWKCVRG)	-6.925e-05	4.054e-05	-1.708	0.087686	.
log(ACCINC1):log(DIST2CBD)	8.197e-03	4.236e-04	19.352	< 2e-16	***
log(ACCINC2):log(ACCINC3)	-2.660e-02	1.818e-03	-14.628	< 2e-16	***
log(ACCINC2):log(ACCINC4)	1.243e-01	2.001e-03	62.141	< 2e-16	***
log(ACCINC2):log(EMAG)	8.156e-03	9.704e-04	8.405	< 2e-16	***
log(ACCINC2):log(EMGV)	3.779e-02	1.404e-03	26.925	< 2e-16	***
log(ACCINC2):log(EMRT)	3.558e-02	2.149e-03	16.556	< 2e-16	***
log(ACCINC2):log(EMSV)	-1.860e-01	3.570e-03	-52.108	< 2e-16	***
log(ACCINC2):log(SIDEWKCVRG)	-2.664e-04	5.671e-05	-4.698	2.70e-06	***
log(ACCINC2):log(DIST2CBD)	-1.896e-02	8.400e-04	-22.574	< 2e-16	***
log(ACCINC3):log(ACCINC4)	-4.692e-02	6.822e-04	-68.771	< 2e-16	***
log(ACCINC3):log(EMAG)	4.988e-03	6.434e-04	7.751	1.08e-14	***
log(ACCINC3):log(EMGV)	-9.410e-03	1.235e-03	-7.620	3.00e-14	***

log(ACCINC3):log(EMRT)	-3.157e-02	1.863e-03	-16.942	< 2e-16	***
log(ACCINC3):log(EMSV)	9.423e-02	2.934e-03	32.114	< 2e-16	***
log(ACCINC3):log(SIDEWKCVRG)	1.929e-04	4.209e-05	4.582	4.71e-06	***
log(ACCINC3):log(DIST2CBD)	2.194e-02	8.829e-04	24.850	< 2e-16	***
log(ACCINC4):log(EMAG)	-4.961e-03	4.243e-04	-11.692	< 2e-16	***
log(ACCINC4):log(EMGV)	-1.021e-02	6.847e-04	-14.906	< 2e-16	***
log(ACCINC4):log(EMRT)	-3.215e-03	8.762e-04	-3.669	0.000246	***
log(ACCINC4):log(EMSV)	-9.608e-03	1.381e-03	-6.958	3.87e-12	***
log(ACCINC4):log(DIST2CBD)	-1.039e-02	4.101e-04	-25.337	< 2e-16	***
log(ACCINC4):log(FS_UNIT)	4.702e-04	4.915e-05	9.566	< 2e-16	***
log(ACCINC4):DHOUSE	-3.263e-04	3.989e-05	-8.181	3.48e-16	***
log(EMAG):log(EMGV)	-3.023e-03	2.439e-04	-12.394	< 2e-16	***
log(EMAG):log(EMRT)	4.160e-03	3.406e-04	12.214	< 2e-16	***
log(EMAG):log(EMSV)	-4.508e-03	6.015e-04	-7.495	7.74e-14	***
log(EMAG):log(SIDEWKCVRG)	2.170e-05	7.401e-06	2.932	0.003378	**
log(EMAG):log(DIST2CBD)	-3.260e-03	1.410e-04	-23.124	< 2e-16	***
log(EMAG):log(FS_UNIT)	4.367e-05	1.332e-05	3.280	0.001044	**
log(EMGV):log(EMRT)	-1.041e-02	4.219e-04	-24.668	< 2e-16	***
log(EMGV):log(EMSV)	9.168e-03	5.336e-04	17.182	< 2e-16	***
log(EMGV):log(SIDEWKCVRG)	1.743e-04	1.624e-05	10.734	< 2e-16	***
log(EMGV):log(DIST2CBD)	2.858e-03	1.720e-04	16.613	< 2e-16	***
log(EMGV):log(FS_UNIT)	1.530e-04	3.019e-05	5.069	4.13e-07	***
log(EMRT):log(EMSV)	3.094e-02	1.182e-03	26.169	< 2e-16	***
log(EMRT):log(SIDEWKCVRG)	-1.375e-04	1.961e-05	-7.013	2.63e-12	***
log(EMRT):DHOUSE	1.371e-04	3.834e-05	3.575	0.000353	***
log(EMSV):log(SIDEWKCVRG)	1.321e-04	4.199e-05	3.146	0.001663	**
log(EMSV):log(FS_UNIT)	-6.265e-04	6.708e-05	-9.341	< 2e-16	***
log(EMSV):DHOUSE	1.823e-04	5.910e-05	3.085	0.002047	**
log(SIDEWKCVRG):log(DIST2CBD)	7.441e-05	8.143e-06	9.138	< 2e-16	***
log(SIDEWKCVRG):DHOUSE	1.139e-05	2.986e-06	3.813	0.000139	***
log(DIST2CBD):log(FS_UNIT)	-1.047e-04	1.656e-05	-6.324	2.76e-10	***
log(DIST2CBD):DHOUSE	6.095e-05	1.666e-05	3.657	0.000257	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for gaussian family taken to be 3.874561e-09)

Null deviance: 5.4260e+03 on 5426 degrees of freedom

Residual deviance: 2.0543e-05 on 5302 degrees of freedom

AIC: -89572

Exhibit 23: Residential Bid Function Income Quartile 4 Dispersion Statistics

Deviance Residuals:

Min	1Q	Median	3Q	Max
-3.971e-04	-1.617e-05	-6.084e-07	9.820e-06	4.520e-04

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
log(PERSONS)	-2.175e-05	1.072e-04	-0.203	0.839292	
log(ACCAIRPORT)	-3.909e-02	2.376e-03	-16.455	< 2e-16	***
log(ACCINTRCHG)	3.513e-02	1.330e-03	26.416	< 2e-16	***
log(TACCHSNG)	-2.026e-01	1.320e-02	-15.342	< 2e-16	***
log(TACCJOBS)	2.410e-01	1.241e-02	19.428	< 2e-16	***
log(ACCINC1)	-2.849e-01	7.193e-03	-39.614	< 2e-16	***
log(ACCINC2)	5.728e-01	7.469e-03	76.695	< 2e-16	***
log(ACCINC3)	-2.301e-01	5.317e-03	-43.269	< 2e-16	***
log(ACCINC4)	-1.353e-01	2.618e-03	-51.676	< 2e-16	***
log(EMAG)	-5.278e-02	2.547e-03	-20.719	< 2e-16	***
log(EMGV)	-7.587e-02	2.272e-03	-33.398	< 2e-16	***
log(EMRT)	-1.382e-01	2.734e-03	-50.528	< 2e-16	***
log(EMSV)	2.923e-01	3.642e-03	80.258	< 2e-16	***
log(SIDEWKCVRG)	4.385e-05	9.048e-05	0.485	0.627937	
log(DIST2CBD)	-5.696e-03	1.780e-03	-3.200	0.001385	**
log(FS_UNIT)	3.986e-04	1.622e-04	2.458	0.014024	*
DHOUSE	-1.790e-03	3.410e-04	-5.249	1.59e-07	***
log(PERSONS):log(TACCJOBS)	-1.729e-05	6.365e-06	-2.715	0.006641	**
log(PERSONS):log(ACCINC1)	-1.482e-04	8.938e-05	-1.658	0.097385	.
log(PERSONS):log(ACCINC2)	3.273e-04	1.344e-04	2.436	0.014876	*
log(PERSONS):log(ACCINC3)	-3.016e-04	9.716e-05	-3.104	0.001921	**
log(PERSONS):log(ACCINC4)	1.028e-04	4.168e-05	2.467	0.013659	*
log(PERSONS):log(EMAG)	3.280e-05	1.607e-05	2.041	0.041319	*
log(PERSONS):log(SIDEWKCVRG)	2.276e-06	1.377e-06	1.653	0.098414	.
log(PERSONS):log(DIST2CBD)	-9.379e-06	6.157e-06	-1.523	0.127752	
log(ACCAIRPORT):log(ACCINTRCHG)	-6.380e-04	9.884e-05	-6.455	1.19e-10	***
log(ACCAIRPORT):log(TACCHSNG)	-5.524e-03	8.111e-04	-6.810	1.09e-11	***
log(ACCAIRPORT):log(TACCJOBS)	5.410e-03	8.127e-04	6.657	3.09e-11	***
log(ACCAIRPORT):log(ACCINC1)	-1.267e-02	1.191e-03	-10.636	< 2e-16	***
log(ACCAIRPORT):log(ACCINC2)	1.312e-02	2.350e-03	5.585	2.46e-08	***
log(ACCAIRPORT):log(ACCINC3)	-7.493e-03	1.894e-03	-3.957	7.70e-05	***
log(ACCAIRPORT):log(ACCINC4)	-1.841e-03	7.208e-04	-2.554	0.010672	*
log(ACCAIRPORT):log(EMAG)	1.524e-03	1.538e-04	9.906	< 2e-16	***
log(ACCAIRPORT):log(EMGV)	-2.170e-03	2.359e-04	-9.198	< 2e-16	***
log(ACCAIRPORT):log(EMRT)	-8.465e-03	5.181e-04	-16.340	< 2e-16	***
log(ACCAIRPORT):log(EMSV)	1.793e-02	5.791e-04	30.967	< 2e-16	***
log(ACCAIRPORT):log(SIDEWKCVRG)	-3.254e-05	1.812e-05	-1.796	0.072625	.
log(ACCAIRPORT):log(DIST2CBD)	-2.532e-04	6.451e-05	-3.926	8.76e-05	***
log(ACCAIRPORT):log(FS_UNIT)	9.420e-05	2.205e-05	4.271	1.98e-05	***
log(ACCAIRPORT):DHOUSE	-1.754e-04	6.053e-05	-2.898	0.003768	**
log(ACCINTRCHG):log(TACCHSNG)	3.790e-04	6.644e-05	5.705	1.23e-08	***
log(ACCINTRCHG):log(ACCINC1)	1.051e-02	8.465e-04	12.410	< 2e-16	***
log(ACCINTRCHG):log(ACCINC2)	-1.503e-02	9.478e-04	-15.861	< 2e-16	***

log(ACCINTRCHG):log(ACCINC3)	1.558e-02	4.655e-04	33.463	< 2e-16	***
log(ACCINTRCHG):log(EMAG)	-1.784e-03	1.017e-04	-17.541	< 2e-16	***
log(ACCINTRCHG):log(EMGV)	3.734e-03	2.759e-04	13.536	< 2e-16	***
log(ACCINTRCHG):log(EMRT)	1.813e-03	2.110e-04	8.592	< 2e-16	***
log(ACCINTRCHG):log(EMSV)	-1.493e-02	4.300e-04	-34.730	< 2e-16	***
log(ACCINTRCHG):log(SIDEWKCVRG)	1.580e-05	8.103e-06	1.950	0.051277	.
log(ACCINTRCHG):log(DIST2CBD)	-4.995e-04	4.442e-05	-11.244	< 2e-16	***
log(ACCINTRCHG):log(FS_UNIT)	6.856e-05	1.731e-05	3.961	7.56e-05	***
log(ACCINTRCHG):DHOUSE	-1.161e-04	3.079e-05	-3.770	0.000165	***
log(TACCHSNG):log(TACCJOBS)	-5.330e-04	3.032e-05	-17.580	< 2e-16	***
log(TACCHSNG):log(ACCINC1)	9.992e-02	5.664e-03	17.640	< 2e-16	***
log(TACCHSNG):log(ACCINC2)	-1.830e-01	8.188e-03	-22.354	< 2e-16	***
log(TACCHSNG):log(ACCINC3)	8.043e-02	5.882e-03	13.675	< 2e-16	***
log(TACCHSNG):log(ACCINC4)	-4.781e-02	2.544e-03	-18.791	< 2e-16	***
log(TACCHSNG):log(EMAG)	-7.665e-02	2.367e-03	-32.391	< 2e-16	***
log(TACCHSNG):log(EMGV)	2.562e-02	1.680e-03	15.245	< 2e-16	***
log(TACCHSNG):log(EMRT)	2.650e-02	1.401e-03	18.917	< 2e-16	***
log(TACCHSNG):log(EMSV)	2.042e-02	3.857e-03	5.293	1.25e-07	***
log(TACCHSNG):log(SIDEWKCVRG)	-1.866e-04	6.323e-05	-2.951	0.003184	**
log(TACCHSNG):log(DIST2CBD)	-1.107e-02	7.417e-04	-14.930	< 2e-16	***
log(TACCHSNG):log(FS_UNIT)	-8.103e-04	1.454e-04	-5.571	2.66e-08	***
log(TACCHSNG):DHOUSE	9.403e-04	2.208e-04	4.259	2.09e-05	***
log(TACCJOBS):log(ACCINC1)	-9.699e-02	5.427e-03	-17.872	< 2e-16	***
log(TACCJOBS):log(ACCINC2)	1.757e-01	7.856e-03	22.369	< 2e-16	***
log(TACCJOBS):log(ACCINC3)	-7.490e-02	5.619e-03	-13.330	< 2e-16	***
log(TACCJOBS):log(ACCINC4)	4.738e-02	2.428e-03	19.519	< 2e-16	***
log(TACCJOBS):log(EMAG)	7.961e-02	2.371e-03	33.577	< 2e-16	***
log(TACCJOBS):log(EMGV)	-2.364e-02	1.643e-03	-14.392	< 2e-16	***
log(TACCJOBS):log(EMRT)	-2.415e-02	1.393e-03	-17.342	< 2e-16	***
log(TACCJOBS):log(EMSV)	-2.781e-02	3.587e-03	-7.752	1.09e-14	***
log(TACCJOBS):log(SIDEWKCVRG)	2.409e-04	6.096e-05	3.951	7.88e-05	***
log(TACCJOBS):log(DIST2CBD)	1.105e-02	7.158e-04	15.439	< 2e-16	***
log(TACCJOBS):log(FS_UNIT)	7.401e-04	1.391e-04	5.321	1.07e-07	***
log(TACCJOBS):DHOUSE	-8.666e-04	2.121e-04	-4.086	4.46e-05	***
log(ACCINC1):log(ACCINC2)	6.799e-03	1.935e-03	3.513	0.000447	***
log(ACCINC1):log(ACCINC3)	8.763e-03	2.736e-03	3.203	0.001370	**
log(ACCINC1):log(ACCINC4)	-5.443e-02	1.746e-03	-31.181	< 2e-16	***
log(ACCINC1):log(EMAG)	-9.680e-03	5.728e-04	-16.899	< 2e-16	***
log(ACCINC1):log(EMGV)	-2.274e-02	9.428e-04	-24.121	< 2e-16	***
log(ACCINC1):log(EMRT)	-1.490e-02	1.935e-03	-7.698	1.65e-14	***
log(ACCINC1):log(EMSV)	8.236e-02	2.310e-03	35.658	< 2e-16	***
log(ACCINC1):log(DIST2CBD)	5.700e-03	7.681e-04	7.422	1.35e-13	***
log(ACCINC1):log(FS_UNIT)	8.686e-04	9.928e-05	8.749	< 2e-16	***
log(ACCINC1):DHOUSE	-2.369e-03	2.778e-04	-8.528	< 2e-16	***
log(ACCINC2):log(ACCINC3)	-2.963e-02	2.167e-03	-13.674	< 2e-16	***
log(ACCINC2):log(ACCINC4)	1.244e-01	1.838e-03	67.661	< 2e-16	***
log(ACCINC2):log(EMAG)	1.858e-02	9.578e-04	19.393	< 2e-16	***
log(ACCINC2):log(EMGV)	3.809e-02	1.109e-03	34.339	< 2e-16	***
log(ACCINC2):log(EMRT)	3.786e-02	2.227e-03	17.004	< 2e-16	***

log(ACCINC2):log(EMSV)	-1.923e-01	3.797e-03	-50.636	< 2e-16	***
log(ACCINC2):log(SIDEWKCVRG)	-4.612e-04	4.475e-05	-10.305	< 2e-16	***
log(ACCINC2):log(DIST2CBD)	-1.725e-02	1.241e-03	-13.903	< 2e-16	***
log(ACCINC2):log(FS_UNIT)	-3.835e-04	8.627e-05	-4.445	8.97e-06	***
log(ACCINC2):DHOUSE	2.648e-03	3.699e-04	7.159	9.30e-13	***
log(ACCINC3):log(ACCINC4)	-3.586e-02	6.439e-04	-55.701	< 2e-16	***
log(ACCINC3):log(EMAG)	-2.954e-03	7.711e-04	-3.831	0.000129	***
log(ACCINC3):log(EMRT)	-3.451e-02	1.905e-03	-18.110	< 2e-16	***
log(ACCINC3):log(EMSV)	9.739e-02	3.076e-03	31.660	< 2e-16	***
log(ACCINC3):log(SIDEWKCVRG)	6.342e-05	3.526e-05	1.799	0.072095	.
log(ACCINC3):log(DIST2CBD)	2.063e-02	1.112e-03	18.561	< 2e-16	***
log(ACCINC3):DHOUSE	-1.491e-03	2.583e-04	-5.771	8.37e-09	***
log(ACCINC4):log(EMAG)	-2.607e-03	4.704e-04	-5.543	3.12e-08	***
log(ACCINC4):log(EMGV)	-9.324e-03	4.092e-04	-22.785	< 2e-16	***
log(ACCINC4):log(EMRT)	-8.711e-03	8.586e-04	-10.145	< 2e-16	***
log(ACCINC4):log(EMSV)	-1.933e-02	1.374e-03	-14.065	< 2e-16	***
log(ACCINC4):log(DIST2CBD)	-9.135e-03	4.622e-04	-19.766	< 2e-16	***
log(ACCINC4):log(FS_UNIT)	6.887e-05	3.138e-05	2.195	0.028242	*
log(ACCINC4):DHOUSE	4.382e-04	9.654e-05	4.539	5.78e-06	***
log(EMAG):log(EMRT)	4.704e-03	4.205e-04	11.187	< 2e-16	***
log(EMAG):log(EMSV)	-9.287e-03	7.106e-04	-13.069	< 2e-16	***
log(EMAG):log(SIDEWKCVRG)	8.016e-05	1.111e-05	7.217	6.10e-13	***
log(EMAG):log(DIST2CBD)	-2.653e-03	1.661e-04	-15.970	< 2e-16	***
log(EMAG):log(FS_UNIT)	-1.601e-04	2.174e-05	-7.366	2.04e-13	***
log(EMAG):DHOUSE	3.869e-04	4.809e-05	8.045	1.07e-15	***
log(EMGV):log(EMRT)	-1.993e-02	5.885e-04	-33.863	< 2e-16	***
log(EMGV):log(EMSV)	1.272e-02	6.375e-04	19.956	< 2e-16	***
log(EMGV):log(SIDEWKCVRG)	6.083e-05	2.095e-05	2.903	0.003712	**
log(EMGV):log(DIST2CBD)	1.357e-03	2.170e-04	6.254	4.34e-10	***
log(EMGV):DHOUSE	-9.888e-05	4.892e-05	-2.021	0.043304	*
log(EMRT):log(EMSV)	3.432e-02	1.212e-03	28.309	< 2e-16	***
log(EMRT):log(SIDEWKCVRG)	1.857e-04	2.049e-05	9.063	< 2e-16	***
log(EMRT):log(DIST2CBD)	-3.152e-03	3.742e-04	-8.423	< 2e-16	***
log(EMSV):log(SIDEWKCVRG)	9.759e-05	3.252e-05	3.001	0.002703	**
log(EMSV):log(DIST2CBD)	4.462e-03	3.369e-04	13.244	< 2e-16	***
log(EMSV):log(FS_UNIT)	-3.488e-04	7.536e-05	-4.628	3.78e-06	***
log(EMSV):DHOUSE	4.377e-04	7.793e-05	5.617	2.05e-08	***
log(SIDEWKCVRG):log(DIST2CBD)	2.168e-05	1.287e-05	1.685	0.092131	.
log(SIDEWKCVRG):DHOUSE	1.464e-05	2.164e-06	6.766	1.47e-11	***
log(DIST2CBD):log(FS_UNIT)	1.301e-04	2.079e-05	6.257	4.24e-10	***
log(DIST2CBD):DHOUSE	-2.959e-04	4.601e-05	-6.431	1.38e-10	***
log(FS_UNIT):DHOUSE	2.233e-05	6.572e-06	3.399	0.000682	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for gaussian family taken to be 1.768819e-09)

Null deviance: 5.152e+03 on 5152 degrees of freedom
Residual deviance: 8.876e-06 on 5018 degrees of freedom
AIC: -89073

Exhibit 24: Local Retail Employer Bid Function Dispersion Statistics

Deviance Residuals:

Min	1Q	Median	3Q	Max
-4.938e-04	-3.822e-05	-1.300e-07	2.764e-05	3.881e-04

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
log(PERSONS)	4.481e-04	1.693e-04	2.647	0.008427	**
log(ACCAIRPORT)	-4.794e-02	4.271e-03	-11.223	< 2e-16	***
log(ACCINTRCHG)	4.756e-02	3.905e-03	12.180	< 2e-16	***
log(TACCHSNG)	-8.215e-02	1.451e-02	-5.663	2.79e-08	***
log(TACCJOBS)	8.704e-02	1.317e-02	6.608	1.20e-10	***
log(ACCINC1)	-2.801e-01	1.473e-02	-19.013	< 2e-16	***
log(ACCINC2)	6.792e-01	1.777e-02	38.216	< 2e-16	***
log(ACCINC3)	-4.030e-01	1.718e-02	-23.462	< 2e-16	***
log(ACCINC4)	-1.839e-01	8.207e-03	-22.412	< 2e-16	***
log(EMAG)	-2.964e-02	4.222e-03	-7.020	9.13e-12	***
log(EMGV)	-8.928e-02	3.472e-03	-25.713	< 2e-16	***
log(EMRT)	-2.489e-02	9.061e-03	-2.747	0.006286	**
log(EMSV)	2.947e-01	6.819e-03	43.220	< 2e-16	***
log(SIDEWKCVRG)	2.491e-03	6.346e-04	3.926	0.000101	***
log(DIST2CBD)	1.255e-02	1.974e-03	6.360	5.34e-10	***
log(FS_UNIT)	9.360e-04	2.936e-04	3.188	0.001539	**
CBDFLAG	9.645e-02	1.517e-02	6.357	5.44e-10	***
log(PERSONS):log(ACCINTRCHG)	-3.595e-05	1.765e-05	-2.037	0.042279	*
log(PERSONS):log(ACCINC2)	2.451e-04	8.943e-05	2.741	0.006386	**
log(PERSONS):log(ACCINC3)	-1.702e-04	1.039e-04	-1.638	0.102207	
log(PERSONS):log(ACCINC4)	2.006e-04	6.228e-05	3.222	0.001375	**
log(PERSONS):log(EMSV)	-2.724e-04	8.691e-05	-3.134	0.001844	**
log(PERSONS):log(DIST2CBD)	-4.927e-05	1.480e-05	-3.329	0.000950	***
log(PERSONS):log(FS_UNIT)	6.619e-06	4.017e-06	1.648	0.100198	
log(ACCAIRPORT):log(ACCINTRCHG)	5.805e-04	2.272e-04	2.555	0.010980	*
log(ACCAIRPORT):log(TACCHSNG)	3.989e-03	1.159e-03	3.442	0.000637	***
log(ACCAIRPORT):log(TACCJOBS)	-3.578e-03	1.092e-03	-3.276	0.001140	**
log(ACCAIRPORT):log(ACCINC1)	-6.513e-03	1.303e-03	-4.999	8.52e-07	***
log(ACCAIRPORT):log(ACCINC2)	9.240e-03	2.972e-03	3.109	0.002007	**
log(ACCAIRPORT):log(ACCINC3)	-9.417e-03	3.770e-03	-2.498	0.012882	*
log(ACCAIRPORT):log(ACCINC4)	-9.279e-03	2.150e-03	-4.316	1.99e-05	***
log(ACCAIRPORT):log(EMAG)	8.647e-04	3.642e-04	2.374	0.018031	*
log(ACCAIRPORT):log(EMRT)	1.560e-03	1.025e-03	1.522	0.128750	
log(ACCAIRPORT):log(EMSV)	1.298e-02	1.352e-03	9.599	< 2e-16	***
log(ACCAIRPORT):log(SIDEWKCVRG)	4.919e-05	2.342e-05	2.100	0.036311	*
log(ACCAIRPORT):log(DIST2CBD)	1.198e-03	2.269e-04	5.279	2.10e-07	***
log(ACCINTRCHG):log(ACCINC1)	9.490e-03	1.395e-03	6.805	3.56e-11	***
log(ACCINTRCHG):log(ACCINC2)	-2.108e-02	2.527e-03	-8.344	1.08e-15	***
log(ACCINTRCHG):log(ACCINC3)	2.821e-02	2.407e-03	11.722	< 2e-16	***
log(ACCINTRCHG):log(ACCINC4)	-5.743e-03	1.201e-03	-4.780	2.44e-06	***
log(ACCINTRCHG):log(EMAG)	-1.759e-03	3.482e-04	-5.050	6.63e-07	***
log(ACCINTRCHG):log(EMGV)	5.777e-03	4.558e-04	12.674	< 2e-16	***
log(ACCINTRCHG):log(EMSV)	-1.442e-02	1.031e-03	-13.990	< 2e-16	***

log(ACCINTRCHG):log(DIST2CBD)	-3.349e-04	1.057e-04	-3.167	0.001654	**
log(ACCINTRCHG):CBDFLAG	-7.113e-03	2.298e-03	-3.095	0.002104	**
log(TACCHSNG):log(TACCJOBS)	-3.784e-04	8.641e-05	-4.379	1.51e-05	***
log(TACCHSNG):log(ACCINC1)	-1.073e-02	4.999e-03	-2.147	0.032349	*
log(TACCHSNG):log(ACCINC2)	2.155e-02	1.109e-02	1.943	0.052705	.
log(TACCHSNG):log(ACCINC3)	-2.646e-02	7.633e-03	-3.467	0.000581	***
log(TACCHSNG):log(ACCINC4)	-9.311e-04	5.143e-04	-1.810	0.070949	.
log(TACCHSNG):log(EMAG)	-1.536e-02	4.519e-03	-3.399	0.000742	***
log(TACCHSNG):log(EMGV)	6.920e-03	2.908e-03	2.380	0.017769	*
log(TACCHSNG):log(EMRT)	1.674e-02	2.541e-03	6.588	1.36e-10	***
log(TACCHSNG):log(SIDEWKCVRG)	2.481e-04	1.531e-04	1.621	0.105834	.
log(TACCHSNG):log(DIST2CBD)	-4.951e-04	9.123e-05	-5.427	9.78e-08	***
log(TACCJOBS):log(ACCINC1)	9.588e-03	4.751e-03	2.018	0.044220	*
log(TACCJOBS):log(ACCINC2)	-2.169e-02	1.055e-02	-2.056	0.040408	*
log(TACCJOBS):log(ACCINC3)	2.975e-02	7.093e-03	4.194	3.35e-05	***
log(TACCJOBS):log(EMAG)	1.483e-02	4.233e-03	3.505	0.000507	***
log(TACCJOBS):log(EMGV)	-7.175e-03	2.703e-03	-2.655	0.008243	**
log(TACCJOBS):log(EMRT)	-1.767e-02	2.527e-03	-6.993	1.08e-11	***
log(TACCJOBS):log(SIDEWKCVRG)	-2.205e-04	1.430e-04	-1.542	0.123833	.
log(TACCJOBS):CBDFLAG	-9.145e-03	1.412e-03	-6.479	2.63e-10	***
log(ACCINC1):log(ACCINC2)	1.707e-02	3.549e-03	4.810	2.11e-06	***
log(ACCINC1):log(ACCINC3)	2.180e-02	7.486e-03	2.912	0.003781	**
log(ACCINC1):log(ACCINC4)	-6.035e-02	5.257e-03	-11.479	< 2e-16	***
log(ACCINC1):log(EMAG)	-1.585e-02	1.347e-03	-11.768	< 2e-16	***
log(ACCINC1):log(EMGV)	-1.118e-02	1.668e-03	-6.701	6.80e-11	***
log(ACCINC1):log(EMRT)	-1.674e-02	2.345e-03	-7.138	4.28e-12	***
log(ACCINC1):log(EMSV)	4.869e-02	4.415e-03	11.028	< 2e-16	***
log(ACCINC1):log(SIDEWKCVRG)	-6.927e-04	1.322e-04	-5.240	2.56e-07	***
log(ACCINC1):log(DIST2CBD)	2.822e-03	5.739e-04	4.917	1.27e-06	***
log(ACCINC1):log(FS_UNIT)	3.541e-04	9.707e-05	3.648	0.000298	***
log(ACCINC1):CBDFLAG	1.556e-02	4.370e-03	3.561	0.000413	***
log(ACCINC2):log(ACCINC3)	-2.856e-02	5.051e-03	-5.655	2.91e-08	***
log(ACCINC2):log(ACCINC4)	1.493e-01	5.863e-03	25.458	< 2e-16	***
log(ACCINC2):log(EMAG)	2.225e-02	2.497e-03	8.908	< 2e-16	***
log(ACCINC2):log(EMGV)	3.360e-02	3.399e-03	9.885	< 2e-16	***
log(ACCINC2):log(EMSV)	-1.656e-01	6.752e-03	-24.528	< 2e-16	***
log(ACCINC2):log(SIDEWKCVRG)	6.592e-04	2.812e-04	2.345	0.019521	*
log(ACCINC2):log(DIST2CBD)	-1.513e-02	1.597e-03	-9.476	< 2e-16	***
log(ACCINC2):log(FS_UNIT)	-5.090e-04	2.168e-04	-2.348	0.019344	*
log(ACCINC3):log(ACCINC4)	-7.648e-02	1.951e-03	-39.192	< 2e-16	***
log(ACCINC3):log(EMAG)	-6.465e-03	1.563e-03	-4.136	4.29e-05	***
log(ACCINC3):log(EMGV)	-1.269e-02	3.282e-03	-3.867	0.000128	***
log(ACCINC3):log(EMRT)	4.318e-03	2.952e-03	1.463	0.144210	.
log(ACCINC3):log(EMSV)	7.956e-02	7.464e-03	10.658	< 2e-16	***
log(ACCINC3):log(SIDEWKCVRG)	-5.794e-04	2.697e-04	-2.148	0.032269	*
log(ACCINC3):log(DIST2CBD)	2.034e-02	2.016e-03	10.091	< 2e-16	***
log(ACCINC3):log(FS_UNIT)	5.940e-04	2.000e-04	2.971	0.003145	**
log(ACCINC4):log(EMGV)	-1.582e-02	1.882e-03	-8.408	6.80e-16	***
log(ACCINC4):log(EMRT)	-5.196e-03	3.439e-03	-1.511	0.131528	.

log(ACCINC4):log(EMSV)	1.152e-02	3.972e-03	2.900	0.003936	**
log(ACCINC4):log(SIDEWKCVRG)	5.364e-04	1.820e-04	2.948	0.003384	**
log(ACCINC4):log(DIST2CBD)	-1.007e-02	1.048e-03	-9.606	< 2e-16	***
log(ACCINC4):log(FS_UNIT)	-1.639e-04	8.872e-05	-1.847	0.065482	.
log(EMAG):log(EMGV)	-3.337e-03	6.634e-04	-5.030	7.33e-07	***
log(EMAG):log(EMRT)	-3.174e-03	9.563e-04	-3.319	0.000983	***
log(EMAG):log(EMSV)	7.828e-03	1.722e-03	4.545	7.22e-06	***
log(EMAG):log(SIDEWKCVRG)	9.241e-05	4.309e-05	2.145	0.032574	*
log(EMAG):log(DIST2CBD)	-1.156e-03	1.807e-04	-6.397	4.28e-10	***
log(EMGV):log(EMSV)	8.389e-03	1.498e-03	5.600	3.92e-08	***
log(EMGV):log(SIDEWKCVRG)	7.726e-04	6.457e-05	11.966	< 2e-16	***
log(EMSV):log(FS_UNIT)	-2.701e-04	1.185e-04	-2.279	0.023173	*
log(EMGV):log(DIST2CBD)	2.097e-03	2.837e-04	7.393	8.04e-13	***
log(EMRT):log(EMSV)	1.778e-02	2.688e-03	6.616	1.15e-10	***
log(EMRT):log(SIDEWKCVRG)	2.907e-04	7.144e-05	4.070	5.63e-05	***
log(EMSV):log(SIDEWKCVRG)	-1.015e-03	1.628e-04	-6.237	1.10e-09	***
log(EMSV):log(DIST2CBD)	1.614e-03	3.465e-04	4.658	4.30e-06	***
log(DIST2CBD):log(FS_UNIT)	-2.490e-05	1.913e-05	-1.302	0.193768	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for gaussian family taken to be 7.568329e-09)

Null deviance: 5.2400e+02 on 524 degrees of freedom

Residual deviance: 3.1333e-06 on 414 degrees of freedom

AIC: -8212.9

Exhibit 25: Regional Retail Employer Bid Function Dispersion Statistics

Deviance Residuals:

Min	1Q	Median	3Q	Max
-2.877e-04	-1.784e-05	2.634e-06	1.491e-05	1.982e-04

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
log(PERSONS)	5.399e-04	1.897e-04	2.846	0.004699	**
log(ACCAIRPORT)	-5.803e-02	4.011e-03	-14.468	< 2e-16	***
log(ACCINTRCHG)	5.995e-02	3.803e-03	15.766	< 2e-16	***
log(TACCHSNG)	-1.399e-01	2.682e-02	-5.216	3.21e-07	***
log(TACCJOBS)	1.470e-01	2.555e-02	5.753	1.98e-08	***
log(ACCINC1)	-1.989e-01	1.658e-02	-12.001	< 2e-16	***
log(ACCINC2)	5.577e-01	2.121e-02	26.291	< 2e-16	***
log(ACCINC3)	-4.065e-01	1.055e-02	-38.536	< 2e-16	***
log(ACCINC4)	-1.730e-01	5.530e-03	-31.272	< 2e-16	***
log(EMAG)	-6.172e-03	4.111e-03	-1.501	0.134236	
log(EMGV)	-1.343e-01	5.680e-03	-23.635	< 2e-16	***
log(EMRT)	-2.842e-02	4.653e-03	-6.107	2.80e-09	***
log(EMSV)	3.136e-01	6.293e-03	49.834	< 2e-16	***
log(SIDEWKCVRG)	1.472e-03	3.868e-04	3.805	0.000168	***
log(DIST2CBD)	6.648e-03	2.078e-03	3.199	0.001511	**
log(FS_UNIT)	-1.792e-05	1.737e-04	-0.103	0.917898	
CBDFLAG	-8.652e-03	1.008e-02	-0.858	0.391469	
log(PERSONS):log(TACCHSNG)	1.263e-04	6.533e-05	1.933	0.054051	.
log(PERSONS):log(TACCJOBS)	-1.225e-04	6.475e-05	-1.892	0.059417	.
log(PERSONS):log(ACCINC2)	-1.515e-04	5.597e-05	-2.707	0.007135	**
log(PERSONS):log(ACCINC4)	1.390e-04	5.008e-05	2.776	0.005810	**
log(PERSONS):log(EMAG)	3.284e-05	1.500e-05	2.189	0.029315	*
log(PERSONS):log(FS_UNIT)	-2.715e-06	1.902e-06	-1.427	0.154452	
log(ACCAIRPORT):log(ACCINTRCHG)	-7.002e-04	1.902e-04	-3.681	0.000271	***
log(ACCAIRPORT):log(TACCHSNG)	-2.698e-03	1.797e-03	-1.502	0.134141	
log(ACCAIRPORT):log(TACCJOBS)	2.798e-03	1.704e-03	1.642	0.101584	
log(ACCAIRPORT):log(ACCINC1)	-1.001e-02	1.059e-03	-9.457	< 2e-16	***
log(ACCAIRPORT):log(ACCINC2)	1.609e-02	2.043e-03	7.876	4.73e-14	***
log(ACCAIRPORT):log(ACCINC3)	-1.146e-02	2.359e-03	-4.858	1.82e-06	***
log(ACCAIRPORT):log(ACCINC4)	-8.205e-03	1.134e-03	-7.237	3.13e-12	***
log(ACCAIRPORT):log(EMGV)	-1.673e-03	5.818e-04	-2.876	0.004289	**
log(ACCAIRPORT):log(EMRT)	-1.491e-03	7.373e-04	-2.023	0.043893	*
log(ACCAIRPORT):log(EMSV)	1.586e-02	1.413e-03	11.221	< 2e-16	***
log(ACCAIRPORT):log(SIDEWKCVRG)	4.902e-05	1.398e-05	3.506	0.000516	***
log(ACCAIRPORT):log(FS_UNIT)	1.547e-05	1.031e-05	1.501	0.134227	
log(ACCAIRPORT):CBDFLAG	4.328e-02	7.198e-03	6.012	4.78e-09	***
log(ACCINTRCHG):log(ACCINC1)	9.883e-03	1.415e-03	6.984	1.54e-11	***
log(ACCINTRCHG):log(ACCINC2)	-1.321e-02	2.437e-03	-5.418	1.15e-07	***
log(ACCINTRCHG):log(ACCINC3)	1.651e-02	2.207e-03	7.481	6.52e-13	***
log(ACCINTRCHG):log(ACCINC4)	3.749e-03	1.275e-03	2.940	0.003512	**
log(ACCINTRCHG):log(EMAG)	-9.523e-04	4.162e-04	-2.288	0.022749	*
log(ACCINTRCHG):log(EMGV)	4.814e-03	4.849e-04	9.926	< 2e-16	***
log(ACCINTRCHG):log(EMRT)	2.237e-03	5.119e-04	4.370	1.66e-05	***

log(ACCINTRCHG):log(EMSV)	-2.183e-02	1.003e-03	-21.774	< 2e-16	***
log(ACCINTRCHG):log(SIDEWKCVRG)	9.519e-05	2.789e-05	3.413	0.000720	***
log(ACCINTRCHG):log(DIST2CBD)	-1.749e-03	1.960e-04	-8.923	< 2e-16	***
log(ACCINTRCHG):log(FS_UNIT)	2.568e-05	1.667e-05	1.541	0.124253	
log(TACCHSNG):log(TACCJOBS)	-3.588e-04	7.644e-05	-4.693	3.92e-06	***
log(TACCHSNG):log(ACCINC1)	-4.405e-02	8.317e-03	-5.297	2.14e-07	***
log(TACCHSNG):log(ACCINC2)	9.037e-02	1.315e-02	6.870	3.11e-11	***
log(TACCHSNG):log(ACCINC3)	-2.803e-02	1.029e-02	-2.725	0.006770	**
log(TACCHSNG):log(ACCINC4)	-2.908e-02	7.164e-03	-4.059	6.13e-05	***
log(TACCHSNG):log(EMAG)	1.433e-02	5.515e-03	2.599	0.009760	**
log(TACCHSNG):log(EMGV)	-2.019e-02	4.037e-03	-5.001	9.23e-07	***
log(TACCHSNG):log(EMRT)	-1.533e-03	1.902e-04	-8.059	1.36e-14	***
log(TACCHSNG):log(EMSV)	2.839e-02	6.691e-03	4.243	2.85e-05	***
log(TACCHSNG):log(SIDEWKCVRG)	-7.373e-04	1.031e-04	-7.154	5.30e-12	***
log(TACCHSNG):CBDFLAG	1.252e-02	2.631e-03	4.757	2.92e-06	***
log(TACCJOBS):log(ACCINC1)	4.193e-02	7.897e-03	5.310	2.00e-07	***
log(TACCJOBS):log(ACCINC2)	-8.962e-02	1.240e-02	-7.226	3.36e-12	***
log(TACCJOBS):log(ACCINC3)	3.243e-02	9.515e-03	3.409	0.000732	***
log(TACCJOBS):log(ACCINC4)	2.681e-02	6.669e-03	4.020	7.18e-05	***
log(TACCJOBS):log(EMAG)	-1.310e-02	5.287e-03	-2.477	0.013730	*
log(TACCJOBS):log(EMGV)	1.944e-02	3.847e-03	5.054	7.13e-07	***
log(TACCJOBS):log(EMSV)	-2.703e-02	6.396e-03	-4.227	3.06e-05	***
log(TACCJOBS):log(SIDEWKCVRG)	7.056e-04	1.016e-04	6.943	1.99e-11	***
log(TACCJOBS):log(FS_UNIT)	-1.204e-05	9.206e-06	-1.308	0.191770	
log(ACCINC1):log(ACCINC2)	2.876e-02	2.585e-03	11.124	< 2e-16	***
log(ACCINC1):log(ACCINC4)	-3.913e-02	3.795e-03	-10.312	< 2e-16	***
log(ACCINC1):log(EMAG)	-7.709e-03	1.307e-03	-5.896	9.06e-09	***
log(ACCINC1):log(EMGV)	-5.237e-03	2.627e-03	-1.993	0.047016	*
log(ACCINC1):log(EMSV)	1.462e-02	5.348e-03	2.734	0.006594	**
log(ACCINC1):log(DIST2CBD)	3.406e-03	7.362e-04	4.627	5.30e-06	***
log(ACCINC1):log(FS_UNIT)	1.996e-04	9.988e-05	1.998	0.046512	*
log(ACCINC2):log(ACCINC3)	-1.073e-02	4.238e-03	-2.533	0.011778	*
log(ACCINC2):log(ACCINC4)	1.067e-01	6.197e-03	17.226	< 2e-16	***
log(ACCINC2):log(EMAG)	1.091e-02	2.067e-03	5.278	2.35e-07	***
log(ACCINC2):log(EMGV)	3.156e-02	3.905e-03	8.081	1.17e-14	***
log(ACCINC2):log(EMRT)	-5.268e-03	1.984e-03	-2.655	0.008307	**
log(ACCINC2):log(EMSV)	-1.365e-01	7.838e-03	-17.415	< 2e-16	***
log(ACCINC2):log(DIST2CBD)	-8.227e-03	1.463e-03	-5.623	3.94e-08	***
log(ACCINC2):log(FS_UNIT)	-3.360e-04	1.716e-04	-1.959	0.050983	.
log(ACCINC3):log(ACCINC4)	-6.956e-02	1.790e-03	-38.867	< 2e-16	***
log(ACCINC3):log(EMAG)	-9.669e-03	1.706e-03	-5.669	3.10e-08	***
log(ACCINC3):log(EMGV)	-1.831e-02	3.480e-03	-5.261	2.55e-07	***
log(ACCINC3):log(EMSV)	8.105e-02	6.370e-03	12.724	< 2e-16	***
log(ACCINC3):log(DIST2CBD)	8.089e-03	1.695e-03	4.771	2.74e-06	***
log(ACCINC3):log(FS_UNIT)	4.566e-04	1.688e-04	2.704	0.007192	**
log(ACCINC4):log(EMAG)	7.779e-03	1.936e-03	4.018	7.24e-05	***
log(ACCINC4):log(EMGV)	-2.301e-02	2.782e-03	-8.271	3.14e-15	***
log(ACCINC4):log(EMRT)	-7.661e-03	1.411e-03	-5.429	1.09e-07	***
log(ACCINC4):log(EMSV)	2.270e-02	3.361e-03	6.753	6.36e-11	***

log(ACCINC4):log(SIDEWKCVRG)	4.085e-04	7.614e-05	5.365	1.51e-07	***
log(ACCINC4):log(DIST2CBD)	-4.696e-03	9.536e-04	-4.924	1.33e-06	***
log(ACCINC4):log(FS_UNIT)	-2.806e-04	9.773e-05	-2.871	0.004351	**
log(EMAG):log(EMGV)	-4.232e-03	7.342e-04	-5.765	1.86e-08	***
log(EMAG):log(EMSV)	2.686e-03	1.455e-03	1.847	0.065667	.
log(EMAG):log(SIDEWKCVRG)	3.897e-05	2.221e-05	1.754	0.080324	.
log(EMAG):log(FS_UNIT)	-5.720e-05	2.800e-05	-2.043	0.041813	*
log(EMAG):log(DIST2CBD)	-2.150e-03	3.231e-04	-6.656	1.15e-10	***
log(EMGV):log(EMSV)	1.447e-02	1.833e-03	7.898	4.07e-14	***
log(EMGV):log(SIDEWKCVRG)	2.247e-04	4.822e-05	4.659	4.59e-06	***
log(EMGV):log(DIST2CBD)	3.079e-03	3.008e-04	10.233	< 2e-16	***
log(EMRT):log(EMSV)	1.514e-02	2.228e-03	6.794	4.98e-11	***
log(EMRT):log(SIDEWKCVRG)	-1.354e-04	3.817e-05	-3.548	0.000443	***
log(EMRT):log(DIST2CBD)	3.811e-03	5.194e-04	7.338	1.64e-12	***
log(EMSV):log(SIDEWKCVRG)	-4.681e-04	1.219e-04	-3.839	0.000148	***
log(EMSV):log(DIST2CBD)	-1.732e-03	3.684e-04	-4.703	3.76e-06	***
log(SIDEWKCVRG):log(DIST2CBD)	7.014e-05	1.734e-05	4.045	6.49e-05	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for gaussian family taken to be 3.192997e-09)

Null deviance: 4.4500e+02 on 445 degrees of freedom

Residual deviance: 1.0728e-06 on 336 degrees of freedom

AIC: -7347.4

Exhibit 26: Government Employer Bid Function Dispersion Statistics

Deviance Residuals:

Min	1Q	Median	3Q	Max
-2.065e-14	-1.554e-15	-4.441e-16	7.772e-16	5.218e-15

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
log(PERSONS)	1.353e-13	3.227e-13	4.190e-01	0.677
log(ACCAIRPORT)	9.674e-02	1.211e-10	7.991e+08	<2e-16 ***
log(ACCINTRCHG)	-3.753e-01	5.600e-10	-6.701e+08	<2e-16 ***
log(TACCHSNG)	-8.254e-01	1.218e-09	-6.779e+08	<2e-16 ***
log(TACCJOBS)	1.060e+00	1.311e-09	8.088e+08	<2e-16 ***
log(ACCINC1)	2.667e-01	4.406e-10	6.054e+08	<2e-16 ***
log(ACCINC2)	-1.475e+00	2.680e-09	-5.504e+08	<2e-16 ***
log(ACCINC3)	1.454e+00	2.128e-09	6.831e+08	<2e-16 ***
log(ACCINC4)	-1.246e+00	1.556e-09	-8.011e+08	<2e-16 ***
log(EMAG)	1.633e-01	3.352e-10	4.871e+08	<2e-16 ***
log(EMGV)	2.200e-01	3.152e-10	6.979e+08	<2e-16 ***
log(EMRT)	-2.185e-01	2.141e-10	-1.021e+09	<2e-16 ***
log(EMSV)	9.502e-01	1.563e-09	6.079e+08	<2e-16 ***
log(SIDEWKCVRG)	-1.522e-02	2.495e-11	-6.099e+08	<2e-16 ***
log(DIST2CBD)	2.413e-01	3.287e-10	7.342e+08	<2e-16 ***
log(FS_UNIT)	4.753e-14	1.797e-12	2.600e-02	0.979
CBDFLAG	-5.534e-01	1.474e-09	-3.753e+08	<2e-16 ***
log(PERSONS):log(ACCAIRPORT)	3.104e-15	1.745e-14	1.780e-01	0.860
log(PERSONS):log(ACCINTRCHG)	8.029e-15	1.296e-13	6.200e-02	0.951
log(PERSONS):log(TACCHSNG)	-3.663e-14	2.645e-13	-1.380e-01	0.891
log(PERSONS):log(TACCJOBS)	4.006e-14	2.727e-13	1.470e-01	0.884
log(PERSONS):log(ACCINC1)	6.085e-14	3.385e-13	1.800e-01	0.858
log(PERSONS):log(ACCINC2)	-2.396e-13	1.507e-12	-1.590e-01	0.875
log(PERSONS):log(ACCINC3)	2.350e-13	1.553e-12	1.510e-01	0.881
log(PERSONS):log(ACCINC4)	-8.322e-14	7.845e-13	-1.060e-01	0.916
log(PERSONS):log(EMAG)	-2.709e-16	2.945e-14	-9.000e-03	0.993
log(PERSONS):log(EMGV)	-3.477e-15	1.162e-14	-2.990e-01	0.766
log(PERSONS):log(EMRT)	1.341e-14	3.115e-13	4.300e-02	0.966
log(PERSONS):log(EMSV)	-3.628e-15	7.137e-14	-5.100e-02	0.960
log(PERSONS):log(SIDEWKCVRG)	-2.512e-16	7.373e-15	-3.400e-02	0.973
log(PERSONS):log(DIST2CBD)	-1.616e-15	6.098e-15	-2.650e-01	0.792
log(PERSONS):log(FS_UNIT)	-7.614e-17	1.321e-15	-5.800e-02	0.954
log(ACCAIRPORT):log(ACCINTRCHG)	-7.442e-03	2.323e-11	-3.203e+08	<2e-16 ***
log(ACCAIRPORT):log(TACCHSNG)	-9.569e-02	8.393e-11	-1.140e+09	<2e-16 ***
log(ACCAIRPORT):log(TACCJOBS)	7.956e-02	6.110e-11	1.302e+09	<2e-16 ***
log(ACCAIRPORT):log(ACCINC1)	1.814e-01	2.460e-10	7.376e+08	<2e-16 ***
log(ACCAIRPORT):log(ACCINC2)	-3.099e-01	3.526e-10	-8.788e+08	<2e-16 ***
log(ACCAIRPORT):log(ACCINC3)	2.218e-01	1.796e-10	1.235e+09	<2e-16 ***
log(ACCAIRPORT):log(ACCINC4)	-1.331e-01	1.242e-10	-1.071e+09	<2e-16 ***
log(ACCAIRPORT):log(EMAG)	-1.269e-02	1.183e-11	-1.073e+09	<2e-16 ***
log(ACCAIRPORT):log(EMGV)	2.533e-02	2.013e-11	1.258e+09	<2e-16 ***
log(ACCAIRPORT):log(EMRT)	-5.001e-02	7.660e-11	-6.529e+08	<2e-16 ***
log(ACCAIRPORT):log(EMSV)	7.689e-02	1.391e-10	5.526e+08	<2e-16 ***

log(ACCAIRPORT):log(SIDEWKCVRG)	-1.457e-03	2.640e-12	-5.518e+08	<2e-16	***
log(ACCAIRPORT):log(DIST2CBD)	1.702e-02	2.337e-11	7.285e+08	<2e-16	***
log(ACCAIRPORT):log(FS_UNIT)	-7.558e-15	1.194e-13	-6.300e-02	0.950	
log(ACCAIRPORT):CBDFLAG	-1.606e-01	3.773e-10	-4.256e+08	<2e-16	***
log(ACCINTRCHG):log(TACCHSNG)	-1.060e-01	1.218e-10	-8.701e+08	<2e-16	***
log(ACCINTRCHG):log(TACCJOBS)	7.845e-02	1.114e-10	7.043e+08	<2e-16	***
log(ACCINTRCHG):log(ACCINC1)	2.825e-02	1.227e-10	2.302e+08	<2e-16	***
log(ACCINTRCHG):log(ACCINC2)	3.118e-02	2.315e-10	1.347e+08	<2e-16	***
log(ACCINTRCHG):log(ACCINC3)	1.066e-01	3.664e-10	2.908e+08	<2e-16	***
log(ACCINTRCHG):log(ACCINC4)	-2.696e-01	4.826e-10	-5.586e+08	<2e-16	***
log(ACCINTRCHG):log(EMAG)	-1.555e-02	2.943e-11	-5.284e+08	<2e-16	***
log(ACCINTRCHG):log(EMGV)	1.701e-02	4.258e-11	3.994e+08	<2e-16	***
log(ACCINTRCHG):log(EMRT)	5.851e-02	1.514e-10	3.865e+08	<2e-16	***
log(ACCINTRCHG):log(EMSV)	2.877e-02	3.303e-11	8.710e+08	<2e-16	***
log(ACCINTRCHG):log(SIDEWKCVRG)	5.116e-04	7.677e-13	6.664e+08	<2e-16	***
log(ACCINTRCHG):log(DIST2CBD)	4.754e-03	1.447e-11	3.286e+08	<2e-16	***
log(ACCINTRCHG):log(FS_UNIT)	1.373e-13	1.795e-12	7.600e-02	0.939	
log(ACCINTRCHG):CBDFLAG	1.236e-01	2.642e-10	4.680e+08	<2e-16	***
log(TACCHSNG):log(TACCJOBS)	-5.425e-03	1.030e-11	-5.268e+08	<2e-16	***
log(TACCHSNG):log(ACCINC1)	-9.289e-02	1.612e-10	-5.763e+08	<2e-16	***
log(TACCHSNG):log(ACCINC2)	9.452e-01	1.201e-09	7.867e+08	<2e-16	***
log(TACCHSNG):log(ACCINC3)	-1.439e+00	1.387e-09	-1.038e+09	<2e-16	***
log(TACCHSNG):log(ACCINC4)	5.975e-01	4.305e-10	1.388e+09	<2e-16	***
log(TACCHSNG):log(EMAG)	-2.115e-02	4.062e-11	-5.208e+08	<2e-16	***
log(TACCHSNG):log(EMGV)	-2.860e-02	5.107e-11	-5.600e+08	<2e-16	***
log(TACCHSNG):log(EMRT)	3.738e-03	2.824e-11	1.324e+08	<2e-16	***
log(TACCHSNG):log(EMSV)	-1.230e-01	1.947e-10	-6.318e+08	<2e-16	***
log(TACCHSNG):log(SIDEWKCVRG)	1.817e-03	2.887e-12	6.296e+08	<2e-16	***
log(TACCHSNG):log(DIST2CBD)	-3.062e-02	4.415e-11	-6.936e+08	<2e-16	***
log(TACCHSNG):log(FS_UNIT)	-3.804e-14	5.757e-13	-6.600e-02	0.948	
log(TACCHSNG):CBDFLAG	-4.387e-03	2.256e-11	-1.945e+08	<2e-16	***
log(TACCJOBS):log(ACCINC1)	8.303e-02	1.113e-10	7.460e+08	<2e-16	***
log(TACCJOBS):log(ACCINC2)	-7.490e-01	7.682e-10	-9.749e+08	<2e-16	***
log(TACCJOBS):log(ACCINC3)	1.145e+00	9.350e-10	1.224e+09	<2e-16	***
log(TACCJOBS):log(ACCINC4)	-3.442e-01	1.089e-10	-3.161e+09	<2e-16	***
log(TACCJOBS):log(FS_UNIT)	5.267e-14	8.376e-13	6.300e-02	0.950	
log(ACCINC1):log(FS_UNIT)	2.061e-13	3.299e-12	6.200e-02	0.951	
log(ACCINC2):log(FS_UNIT)	-1.050e-12	1.564e-11	-6.700e-02	0.947	
log(ACCINC3):log(FS_UNIT)	1.695e-12	2.392e-11	7.100e-02	0.944	
log(ACCINC4):log(FS_UNIT)	-9.091e-13	1.242e-11	-7.300e-02	0.942	
log(EMAG):log(FS_UNIT)	-7.684e-16	4.801e-14	-1.600e-02	0.987	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
(Dispersion parameter for gaussian family taken to be 2.666752e-29)

Null deviance: 1.2200e+02 on 122 degrees of freedom

Residual deviance: 1.0134e-27 on 38 degrees of freedom

AIC: -7653

Exhibit 27: Industrial Employer Bid Function Dispersion Statistics

Deviance Residuals:

Min	1Q	Median	3Q	Max
-7.654e-04	-4.036e-05	3.787e-07	3.828e-05	3.567e-04

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
log(PERSONS)	4.634e-04	1.624e-04	2.853	0.004447	**
log(ACCAIRPORT)	-4.405e-02	2.556e-03	-17.234	< 2e-16	***
log(ACCINTRCHG)	6.738e-02	2.892e-03	23.299	< 2e-16	***
log(TACCHSNG)	-6.371e-02	1.402e-02	-4.544	6.43e-06	***
log(TACCJOBS)	8.215e-02	1.363e-02	6.028	2.61e-09	***
log(ACCINC1)	-2.300e-01	1.103e-02	-20.851	< 2e-16	***
log(ACCINC2)	6.167e-01	1.292e-02	47.716	< 2e-16	***
log(ACCINC3)	-3.142e-01	9.759e-03	-32.199	< 2e-16	***
log(ACCINC4)	-1.976e-01	4.849e-03	-40.740	< 2e-16	***
log(EMAG)	-2.929e-02	3.118e-03	-9.394	< 2e-16	***
log(EMGV)	-7.824e-02	2.805e-03	-27.896	< 2e-16	***
log(EMRT)	-8.780e-02	7.991e-03	-10.987	< 2e-16	***
log(EMSV)	2.669e-01	5.602e-03	47.634	< 2e-16	***
log(SIDEWKCVRG)	1.591e-03	1.593e-04	9.988	< 2e-16	***
log(DIST2CBD)	2.068e-02	1.864e-03	11.090	< 2e-16	***
log(FS_UNIT)	2.610e-04	1.669e-04	1.564	0.118224	
CBDFLAG	1.142e+01	7.007e-01	16.300	< 2e-16	***
log(PERSONS):log(ACCINTRCHG)	-4.673e-05	1.558e-05	-2.999	0.002795	**
log(PERSONS):log(ACCINC1)	1.148e-04	5.416e-05	2.119	0.034412	*
log(PERSONS):log(ACCINC2)	-3.604e-04	1.354e-04	-2.662	0.007940	**
log(PERSONS):log(ACCINC3)	1.396e-04	7.927e-05	1.761	0.078584	.
log(PERSONS):log(EMRT)	1.078e-04	4.703e-05	2.291	0.022212	*
log(PERSONS):log(DIST2CBD)	-1.554e-05	9.520e-06	-1.632	0.103093	
log(ACCAIRPORT):log(ACCINTRCHG)	7.688e-04	1.345e-04	5.715	1.58e-08	***
log(ACCAIRPORT):log(TACCHSNG)	3.274e-03	6.766e-04	4.839	1.59e-06	***
log(ACCAIRPORT):log(TACCJOBS)	-3.092e-03	6.399e-04	-4.832	1.64e-06	***
log(ACCAIRPORT):log(ACCINC1)	-2.911e-03	8.021e-04	-3.630	0.000303	***
log(ACCAIRPORT):log(ACCINC2)	9.803e-03	1.553e-03	6.314	4.68e-10	***
log(ACCAIRPORT):log(ACCINC3)	-9.637e-03	1.834e-03	-5.255	1.93e-07	***
log(ACCAIRPORT):log(ACCINC4)	-6.753e-03	1.055e-03	-6.399	2.75e-10	***
log(ACCAIRPORT):log(EMAG)	-3.072e-04	1.883e-04	-1.631	0.103250	
log(ACCAIRPORT):log(EMGV)	-1.788e-03	4.099e-04	-4.363	1.46e-05	***
log(ACCAIRPORT):log(EMRT)	2.145e-03	5.650e-04	3.796	0.000159	***
log(ACCAIRPORT):log(EMSV)	8.965e-03	8.510e-04	10.534	< 2e-16	***
log(ACCAIRPORT):log(DIST2CBD)	1.171e-03	1.292e-04	9.066	< 2e-16	***
log(ACCAIRPORT):CBDFLAG	3.239e+00	2.000e-01	16.192	< 2e-16	***
log(ACCINTRCHG):log(TACCHSNG)	3.348e-03	1.173e-03	2.853	0.004452	**
log(ACCINTRCHG):log(TACCJOBS)	-3.231e-03	1.115e-03	-2.897	0.003877	**
log(ACCINTRCHG):log(ACCINC1)	9.301e-03	1.075e-03	8.650	< 2e-16	***
log(ACCINTRCHG):log(ACCINC2)	-2.911e-02	1.952e-03	-14.911	< 2e-16	***
log(ACCINTRCHG):log(ACCINC3)	2.944e-02	1.973e-03	14.924	< 2e-16	***
log(ACCINTRCHG):log(ACCINC4)	-1.557e-03	1.005e-03	-1.550	0.121666	
log(ACCINTRCHG):log(EMAG)	-1.084e-03	3.248e-04	-3.338	0.000886	***

log(ACCINTRCHG):log(EMGV)	6.420e-03	4.121e-04	15.580	< 2e-16	***
log(ACCINTRCHG):log(EMRT)	2.536e-03	4.869e-04	5.209	2.45e-07	***
log(ACCINTRCHG):log(EMSV)	-1.564e-02	8.259e-04	-18.935	< 2e-16	***
log(ACCINTRCHG):log(SIDEWKCVRG)	7.299e-05	2.081e-05	3.508	0.000478	***
log(ACCINTRCHG):log(DIST2CBD)	-5.262e-04	7.870e-05	-6.686	4.49e-11	***
log(ACCINTRCHG):log(FS_UNIT)	-2.234e-05	1.689e-05	-1.323	0.186391	
log(ACCINTRCHG):CBDFLAG	-1.700e+00	1.050e-01	-16.187	< 2e-16	***
log(TACCHSNG):log(TACCJOBS)	-6.062e-04	7.366e-05	-8.229	8.36e-16	***
log(TACCHSNG):log(ACCINC2)	2.836e-02	3.838e-03	7.388	4.00e-13	***
log(TACCHSNG):log(ACCINC3)	-8.809e-03	6.469e-03	-1.362	0.173737	
log(TACCHSNG):log(ACCINC4)	-1.790e-02	4.062e-03	-4.406	1.21e-05	***
log(TACCHSNG):log(EMAG)	-5.785e-03	3.099e-03	-1.867	0.062290	.
log(TACCHSNG):log(EMGV)	4.121e-03	2.122e-03	1.942	0.052477	.
log(TACCHSNG):log(EMRT)	1.006e-02	1.966e-03	5.118	3.93e-07	***
log(TACCHSNG):log(EMSV)	-3.514e-03	4.113e-04	-8.544	< 2e-16	***
log(TACCHSNG):log(DIST2CBD)	4.981e-03	9.300e-04	5.355	1.14e-07	***
log(TACCHSNG):CBDFLAG	-4.056e-01	2.390e-02	-16.969	< 2e-16	***
log(TACCJOBS):log(ACCINC1)	1.080e-03	3.850e-04	2.805	0.005166	**
log(TACCJOBS):log(ACCINC2)	-2.979e-02	3.771e-03	-7.901	9.93e-15	***
log(TACCJOBS):log(ACCINC3)	1.209e-02	6.079e-03	1.989	0.047022	*
log(TACCJOBS):log(ACCINC4)	1.809e-02	3.826e-03	4.727	2.72e-06	***
log(TACCJOBS):log(EMAG)	5.698e-03	2.917e-03	1.954	0.051128	.
log(TACCJOBS):log(EMGV)	-2.650e-03	2.000e-03	-1.325	0.185597	
log(TACCJOBS):log(EMRT)	-1.020e-02	1.884e-03	-5.413	8.34e-08	***
log(TACCJOBS):log(SIDEWKCVRG)	-3.455e-05	8.981e-06	-3.847	0.000130	***
log(TACCJOBS):log(DIST2CBD)	-4.883e-03	8.603e-04	-5.676	1.98e-08	***
log(TACCJOBS):log(FS_UNIT)	1.776e-05	6.948e-06	2.556	0.010771	*
log(TACCJOBS):CBDFLAG	1.910e-01	1.133e-02	16.858	< 2e-16	***
log(ACCINC1):log(ACCINC3)	2.739e-02	5.252e-03	5.216	2.37e-07	***
log(ACCINC1):log(ACCINC4)	-6.013e-02	4.102e-03	-14.660	< 2e-16	***
log(ACCINC1):log(EMAG)	-1.147e-02	1.003e-03	-11.433	< 2e-16	***
log(ACCINC1):log(EMGV)	-9.742e-03	1.251e-03	-7.787	2.30e-14	***
log(ACCINC1):log(EMSV)	3.559e-02	3.464e-03	10.273	< 2e-16	***
log(ACCINC1):log(DIST2CBD)	1.907e-03	5.872e-04	3.249	0.001212	**
log(ACCINC2):log(ACCINC3)	-1.894e-02	3.237e-03	-5.851	7.31e-09	***
log(ACCINC2):log(ACCINC4)	1.303e-01	4.252e-03	30.651	< 2e-16	***
log(ACCINC2):log(EMAG)	1.538e-02	1.379e-03	11.153	< 2e-16	***
log(ACCINC2):log(EMGV)	3.424e-02	2.521e-03	13.585	< 2e-16	***
log(ACCINC2):log(EMSV)	-1.322e-01	4.394e-03	-30.081	< 2e-16	***
log(ACCINC2):log(SIDEWKCVRG)	-4.838e-04	8.843e-05	-5.471	6.12e-08	***
log(ACCINC2):log(DIST2CBD)	-1.785e-02	1.183e-03	-15.089	< 2e-16	***
log(ACCINC3):log(ACCINC4)	-5.822e-02	1.602e-03	-36.341	< 2e-16	***
log(ACCINC3):log(EMGV)	-2.078e-02	2.887e-03	-7.197	1.50e-12	***
log(ACCINC3):log(EMSV)	5.427e-02	5.053e-03	10.742	< 2e-16	***
log(ACCINC3):log(SIDEWKCVRG)	6.801e-04	6.987e-05	9.733	< 2e-16	***
log(ACCINC3):log(DIST2CBD)	1.675e-02	1.651e-03	10.143	< 2e-16	***
log(ACCINC3):log(FS_UNIT)	1.485e-04	6.496e-05	2.285	0.022573	*
log(ACCINC4):log(EMAG)	-6.434e-03	9.457e-04	-6.804	2.09e-11	***
log(ACCINC4):log(EMGV)	-2.711e-03	1.771e-03	-1.530	0.126375	

log(ACCINC4):log(EMRT)	-1.902e-02	1.635e-03	-11.635	< 2e-16	***
log(ACCINC4):log(EMSV)	1.391e-02	3.018e-03	4.609	4.76e-06	***
log(ACCINC4):log(DIST2CBD)	-6.569e-03	8.751e-04	-7.506	1.74e-13	***
log(EMAG):log(EMRT)	-3.712e-03	6.105e-04	-6.081	1.91e-09	***
log(EMAG):log(EMSV)	6.004e-03	1.292e-03	4.647	3.97e-06	***
log(EMAG):log(SIDEWKCVRG)	-2.148e-05	1.421e-05	-1.512	0.130886	
log(EMAG):log(DIST2CBD)	-1.394e-03	2.354e-04	-5.922	4.86e-09	***
log(EMGV):log(EMRT)	-5.431e-03	1.257e-03	-4.322	1.75e-05	***
log(EMGV):log(EMSV)	5.144e-03	1.057e-03	4.866	1.39e-06	***
log(EMGV):log(SIDEWKCVRG)	3.262e-04	3.207e-05	10.171	< 2e-16	***
log(EMSV):log(FS_UNIT)	-1.545e-04	6.536e-05	-2.363	0.018376	*
log(EMGV):log(DIST2CBD)	4.198e-03	2.860e-04	14.679	< 2e-16	***
log(EMRT):log(EMSV)	2.620e-02	2.289e-03	11.444	< 2e-16	***
log(EMRT):log(SIDEWKCVRG)	-2.616e-04	4.723e-05	-5.538	4.24e-08	***
log(EMRT):log(DIST2CBD)	4.392e-03	5.749e-04	7.639	6.72e-14	***
log(EMSV):log(SIDEWKCVRG)	-2.292e-04	6.667e-05	-3.438	0.000618	***
log(EMSV):log(DIST2CBD)	-1.501e-03	3.924e-04	-3.825	0.000142	***
log(DIST2CBD):log(FS_UNIT)	-3.134e-05	1.728e-05	-1.813	0.070174	.

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for gaussian family taken to be 7.517816e-09)

Null deviance: 8.5700e+02 on 857 degrees of freedom

Residual deviance: 5.6158e-06 on 747 degrees of freedom

AIC: -13495

Exhibit 28: Service & Other Employer Bid Function Dispersion Statistics

Deviance Residuals:

Min	1Q	Median	3Q	Max
-1.124e-03	-4.814e-05	-2.922e-06	4.604e-05	6.625e-04

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
log(PERSONS)	-6.127e-05	2.134e-05	-2.871	0.004128	**
log(ACCAIRPORT)	-4.998e-02	1.440e-03	-34.721	< 2e-16	***
log(ACCINTRCHG)	4.894e-02	1.464e-03	33.420	< 2e-16	***
log(TACCHSNG)	-5.487e-02	6.094e-03	-9.003	< 2e-16	***
log(TACCJOBS)	6.987e-02	5.778e-03	12.093	< 2e-16	***
log(ACCINC1)	-2.486e-01	6.182e-03	-40.216	< 2e-16	***
log(ACCINC2)	6.238e-01	7.238e-03	86.183	< 2e-16	***
log(ACCINC3)	-3.334e-01	4.779e-03	-69.774	< 2e-16	***
log(ACCINC4)	-1.834e-01	2.427e-03	-75.560	< 2e-16	***
log(EMAG)	-3.317e-02	1.383e-03	-23.983	< 2e-16	***
log(EMGV)	-9.578e-02	1.752e-03	-54.675	< 2e-16	***
log(EMRT)	-7.692e-02	4.153e-03	-18.522	< 2e-16	***
log(EMSV)	2.903e-01	2.469e-03	117.600	< 2e-16	***
log(SIDEWKCVRG)	1.430e-03	1.796e-04	7.964	2.47e-15	***
log(DIST2CBD)	9.239e-03	9.383e-04	9.847	< 2e-16	***
log(FS_UNIT)	1.655e-05	4.656e-05	0.356	0.722232	
CBDFLAG	-1.199e-01	4.263e-02	-2.813	0.004945	**
log(PERSONS):log(ACCAIRPORT)	-1.378e-05	4.532e-06	-3.040	0.002386	**
log(PERSONS):log(ACCINTRCHG)	-8.352e-06	4.864e-06	-1.717	0.086058	.
log(PERSONS):log(TACCJOBS)	5.973e-06	2.459e-06	2.429	0.015197	*
log(ACCAIRPORT):log(ACCINTRCHG)	8.670e-04	8.968e-05	9.668	< 2e-16	***
log(ACCAIRPORT):log(TACCHSNG)	2.543e-03	3.450e-04	7.370	2.27e-13	***
log(ACCAIRPORT):log(TACCJOBS)	-2.270e-03	3.294e-04	-6.892	6.86e-12	***
log(ACCAIRPORT):log(ACCINC1)	-4.706e-03	4.125e-04	-11.408	< 2e-16	***
log(ACCAIRPORT):log(ACCINC2)	2.952e-03	5.690e-04	5.189	2.28e-07	***
log(ACCAIRPORT):log(ACCINC4)	-1.311e-02	3.958e-04	-33.138	< 2e-16	***
log(ACCAIRPORT):log(EMAG)	3.418e-04	1.062e-04	3.219	0.001304	**
log(ACCAIRPORT):log(EMGV)	-1.989e-03	2.319e-04	-8.579	< 2e-16	***
log(ACCAIRPORT):log(EMSV)	1.606e-02	4.753e-04	33.780	< 2e-16	***
log(ACCAIRPORT):log(DIST2CBD)	1.165e-03	8.183e-05	14.231	< 2e-16	***
log(ACCAIRPORT):log(FS_UNIT)	-1.982e-05	6.963e-06	-2.846	0.004463	**
log(ACCAIRPORT):CBDFLAG	-1.223e-01	1.383e-02	-8.844	< 2e-16	***
log(ACCINTRCHG):log(TACCHSNG)	1.598e-04	6.039e-05	2.647	0.008172	**
log(ACCINTRCHG):log(ACCINC1)	4.925e-03	3.879e-04	12.696	< 2e-16	***
log(ACCINTRCHG):log(ACCINC2)	-1.374e-02	7.792e-04	-17.641	< 2e-16	***
log(ACCINTRCHG):log(ACCINC3)	1.893e-02	5.901e-04	32.079	< 2e-16	***
log(ACCINTRCHG):log(EMAG)	-8.360e-04	1.061e-04	-7.882	4.69e-15	***
log(ACCINTRCHG):log(EMGV)	5.445e-03	2.039e-04	26.709	< 2e-16	***
log(ACCINTRCHG):log(EMRT)	1.111e-03	2.585e-04	4.297	1.80e-05	***
log(ACCINTRCHG):log(EMSV)	-1.541e-02	3.756e-04	-41.031	< 2e-16	***
log(ACCINTRCHG):log(DIST2CBD)	-6.515e-04	4.372e-05	-14.900	< 2e-16	***
log(ACCINTRCHG):CBDFLAG	5.464e-02	7.364e-03	7.419	1.59e-13	***
log(TACCHSNG):log(TACCJOBS)	-2.901e-04	3.415e-05	-8.493	< 2e-16	***

log(TACCHSNG):log(ACCINC1)	-6.123e-03	1.683e-03	-3.637	0.000281	***
log(TACCHSNG):log(ACCINC2)	1.643e-02	2.492e-03	6.593	5.21e-11	***
log(TACCHSNG):log(ACCINC3)	4.882e-03	3.930e-04	12.423	< 2e-16	***
log(TACCHSNG):log(ACCINC4)	-1.823e-02	1.197e-03	-15.223	< 2e-16	***
log(TACCHSNG):log(EMAG)	-6.825e-03	1.063e-03	-6.423	1.58e-10	***
log(TACCHSNG):log(EMGV)	5.420e-04	1.007e-04	5.384	7.94e-08	***
log(TACCHSNG):log(EMRT)	8.617e-03	9.631e-04	8.947	< 2e-16	***
log(TACCHSNG):log(EMSV)	-3.252e-03	2.270e-04	-14.321	< 2e-16	***
log(TACCHSNG):log(SIDEWKCVRG)	-2.122e-04	4.755e-05	-4.462	8.46e-06	***
log(TACCHSNG):log(DIST2CBD)	-1.063e-03	3.677e-04	-2.892	0.003861	**
log(TACCHSNG):log(FS_UNIT)	-1.307e-04	4.538e-05	-2.880	0.004003	**
log(TACCHSNG):CBDFLAG	1.533e-02	1.937e-03	7.915	3.63e-15	***
log(TACCJOBS):log(ACCINC1)	6.005e-03	1.572e-03	3.821	0.000136	***
log(TACCJOBS):log(ACCINC2)	-1.789e-02	2.363e-03	-7.571	5.11e-14	***
log(TACCJOBS):log(ACCINC4)	1.754e-02	1.127e-03	15.562	< 2e-16	***
log(TACCJOBS):log(EMAG)	7.297e-03	1.005e-03	7.260	5.08e-13	***
log(TACCJOBS):log(EMRT)	-8.556e-03	9.440e-04	-9.064	< 2e-16	***
log(TACCJOBS):log(SIDEWKCVRG)	1.844e-04	4.592e-05	4.016	6.10e-05	***
log(TACCJOBS):log(DIST2CBD)	6.724e-04	3.404e-04	1.975	0.048351	*
log(TACCJOBS):log(FS_UNIT)	1.254e-04	4.421e-05	2.837	0.004588	**
log(TACCJOBS):CBDFLAG	-9.849e-03	1.299e-03	-7.580	4.76e-14	***
log(ACCINC1):log(ACCINC2)	1.244e-02	1.186e-03	10.487	< 2e-16	***
log(ACCINC1):log(ACCINC3)	-1.326e-02	2.604e-03	-5.091	3.82e-07	***
log(ACCINC1):log(ACCINC4)	-3.891e-02	1.917e-03	-20.295	< 2e-16	***
log(ACCINC1):log(EMAG)	-1.333e-02	5.409e-04	-24.653	< 2e-16	***
log(ACCINC1):log(EMGV)	-8.769e-03	8.651e-04	-10.137	< 2e-16	***
log(ACCINC1):log(EMRT)	-5.581e-03	8.815e-04	-6.331	2.86e-10	***
log(ACCINC1):log(EMSV)	4.931e-02	1.834e-03	26.884	< 2e-16	***
log(ACCINC1):log(SIDEWKCVRG)	2.969e-04	5.497e-05	5.401	7.21e-08	***
log(ACCINC1):log(DIST2CBD)	3.282e-03	2.694e-04	12.183	< 2e-16	***
log(ACCINC1):log(FS_UNIT)	1.254e-04	3.242e-05	3.869	0.000112	***
log(ACCINC1):CBDFLAG	7.068e-02	7.785e-03	9.079	< 2e-16	***
log(ACCINC2):log(ACCINC3)	-1.124e-02	1.563e-03	-7.194	8.19e-13	***
log(ACCINC2):log(ACCINC4)	1.285e-01	2.157e-03	59.580	< 2e-16	***
log(ACCINC2):log(EMAG)	2.270e-02	8.429e-04	26.927	< 2e-16	***
log(ACCINC2):log(EMGV)	3.564e-02	1.635e-03	21.804	< 2e-16	***
log(ACCINC2):log(EMSV)	-1.546e-01	2.569e-03	-60.173	< 2e-16	***
log(ACCINC2):log(SIDEWKCVRG)	-6.151e-04	1.116e-04	-5.514	3.86e-08	***
log(ACCINC2):log(DIST2CBD)	-1.124e-02	6.650e-04	-16.904	< 2e-16	***
log(ACCINC2):log(FS_UNIT)	-1.179e-04	3.246e-05	-3.632	0.000287	***
log(ACCINC2):CBDFLAG	-3.422e-01	3.221e-02	-10.623	< 2e-16	***
log(ACCINC3):log(ACCINC4)	-6.135e-02	8.530e-04	-71.920	< 2e-16	***
log(ACCINC3):log(EMAG)	-6.671e-03	5.198e-04	-12.834	< 2e-16	***
log(ACCINC3):log(EMGV)	-7.694e-03	1.577e-03	-4.878	1.14e-06	***
log(ACCINC3):log(EMSV)	7.704e-02	2.480e-03	31.061	< 2e-16	***
log(ACCINC3):log(SIDEWKCVRG)	2.934e-04	1.117e-04	2.626	0.008700	**
log(ACCINC3):log(DIST2CBD)	1.380e-02	7.926e-04	17.408	< 2e-16	***
log(ACCINC3):CBDFLAG	6.382e-01	5.782e-02	11.038	< 2e-16	***
log(ACCINC4):log(EMGV)	-1.637e-02	8.549e-04	-19.144	< 2e-16	***

log(ACCINC4):log(EMRT)	-1.459e-02	8.722e-04	-16.730	< 2e-16	***
log(ACCINC4):log(EMSV)	5.418e-03	1.328e-03	4.081	4.61e-05	***
log(ACCINC4):log(SIDEWKCVRG)	1.413e-04	6.498e-05	2.175	0.029749	*
log(ACCINC4):log(DIST2CBD)	-7.440e-03	3.578e-04	-20.795	< 2e-16	***
log(ACCINC4):CBDFLAG	-3.142e-01	2.862e-02	-10.976	< 2e-16	***
log(EMAG):log(EMGV)	-3.348e-03	2.720e-04	-12.311	< 2e-16	***
log(EMAG):log(EMRT)	-2.966e-03	3.232e-04	-9.178	< 2e-16	***
log(EMAG):log(EMSV)	4.439e-03	5.848e-04	7.591	4.41e-14	***
log(EMAG):log(SIDEWKCVRG)	-2.901e-05	1.701e-05	-1.705	0.088254	.
log(EMAG):log(DIST2CBD)	-7.682e-04	7.134e-05	-10.768	< 2e-16	***
log(EMGV):log(EMRT)	-5.243e-03	6.551e-04	-8.004	1.80e-15	***
log(EMGV):log(EMSV)	3.314e-03	5.756e-04	5.758	9.53e-09	***
log(EMGV):log(SIDEWKCVRG)	2.338e-04	2.163e-05	10.811	< 2e-16	***
log(EMGV):log(DIST2CBD)	6.953e-04	1.324e-04	5.252	1.63e-07	***
log(EMRT):log(EMSV)	2.488e-02	1.181e-03	21.067	< 2e-16	***
log(EMRT):log(SIDEWKCVRG)	-5.465e-05	2.847e-05	-1.919	0.055060	.
log(EMRT):log(DIST2CBD)	1.268e-03	1.867e-04	6.790	1.39e-11	***
log(EMSV):log(SIDEWKCVRG)	-1.743e-04	5.708e-05	-3.054	0.002281	**
log(EMSV):log(DIST2CBD)	9.004e-04	1.413e-04	6.372	2.19e-10	***
log(SIDEWKCVRG):log(DIST2CBD)	5.788e-05	8.675e-06	6.672	3.07e-11	***
log(SIDEWKCVRG):CBDFLAG	-1.225e-04	3.493e-05	-3.506	0.000462	***
log(DIST2CBD):log(FS_UNIT)	1.546e-05	3.567e-06	4.334	1.52e-05	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for gaussian family taken to be 9.599614e-09)

Null deviance: 2.7140e+03 on 2714 degrees of freedom

Residual deviance: 2.4959e-05 on 2600 degrees of freedom

AIC: -42289

Rent and Cost Functions

Rent and Cost functions are simplified / asserted in this first model due to data limitations and are a function of floor space and land area. Their values are calibrated automatically during the model's auto calibration procedures. Model sensitivity tests performed in coming months will explore ways to further refine their values and improve the model's performance.

MODEL CALIBRATION AND VALIDATION

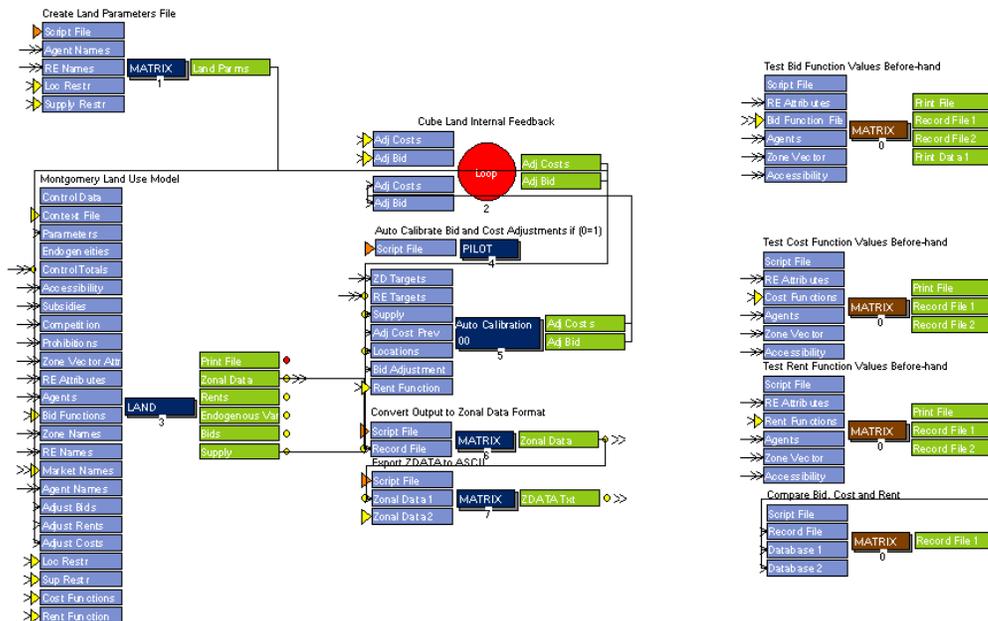
While model estimation is the process of estimating the core relationships and elasticities of variables used in a model, calibration and validation are the processes of adjusting model parameters so that the model better matches observed conditions both in the validation year (calibration) and in the forecast year (validation). There are tradeoffs between validation and calibration whereas some accuracy must be surrendered so that the model's performance is appropriate for forecast purposes.

The process used to calibrate the 2005 model was somewhat iterative due to the relationship between endogenous model variables that are calculated and updated after the transportation model is run. As such, it was most effective to develop an optionally run auto calibration routine (**Exhibit 29**) that could be executed to adjust bid, rent and cost functions as appropriate to insure the land use model could match zone-level totals.

Exhibit 29 Land Use Model Auto Calibration Process



Integrated Transport/Land Use Model

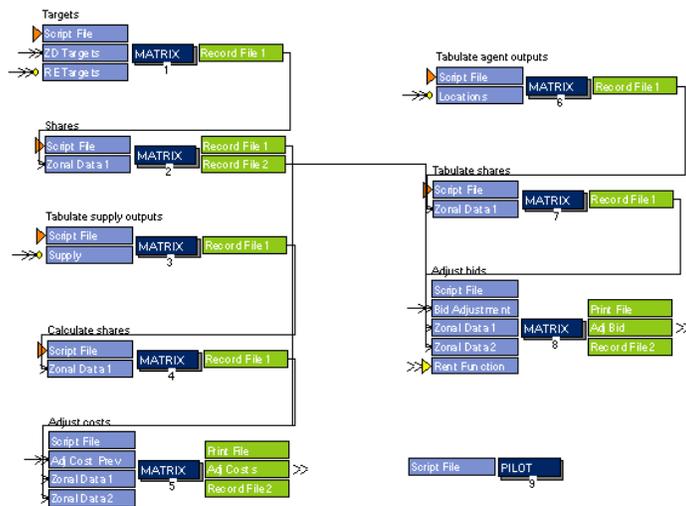


The auto calibration process (**Exhibit 30**) starts by examining the total number of dwelling units or employees in the base year (2005) zonal data file. It then adjusts the functions' constant terms to match the total units in each of the trip generation model's three categories (households, retail employment and non-retail employment). Because it operates at the highest level to match the model's inputs, it does not rely on any estimated further disaggregation of the datasets. Ideally this process would have detailed targets for each of the real estate and agent types but in lieu of not having that available for the region, adjustments are performed for all households, retail jobs and non-retail jobs for all real estate types uniformly in a zone.

Exhibit 30 Land Use Model Auto Calibration Steps



Integrated Transport/Land Use Model



This same process could be used to develop a baseline set of adjustments for any given forecast year as well. However, it should be used sparingly as the data used in the land use model, particularly the parcel-based zoning attributes, will need to be updated to reflect the same conditions assumed in the forecast. The auto calibration process takes approximately 2 hours to execute 99 iterations.

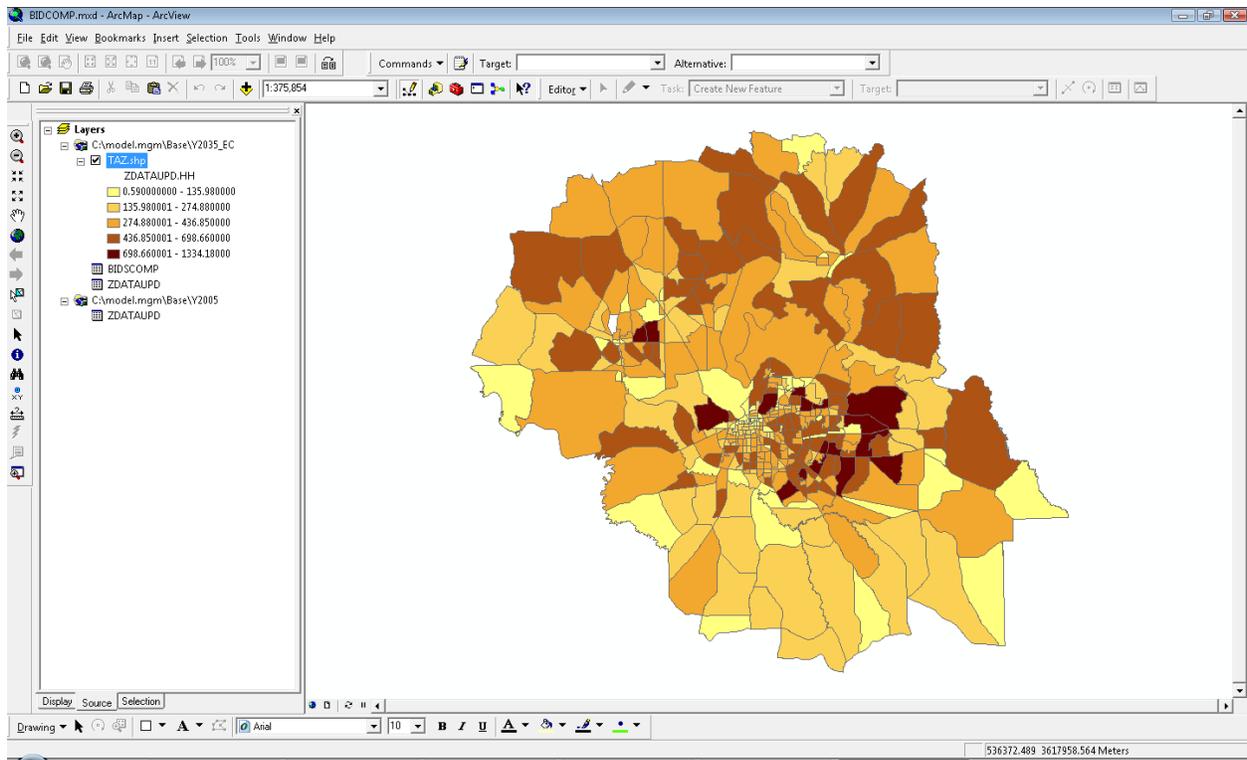
2005 Base Year

In the overall model's feedback process between transportation and land use, convergence is achieved when the maximum absolute land use difference for all zones is 1 unit in households, 1 retail employee and 1 non-retail employee or the land use / transportation model iterate 10 times.

Convergence using this criteria is relatively quick (2 iterations) and provides stable results for the transportation model. By giving a relatively simple but strict test (not different by more than 1 "unit" of any predicted variable), the transportation model is also stable for convergence purposes.

The auto calibration routines in the model allow it to match exactly (+/- 1) the total number of households or jobs in any given zone (**Exhibit 31**).

Exhibit 31 Year 2005 Households



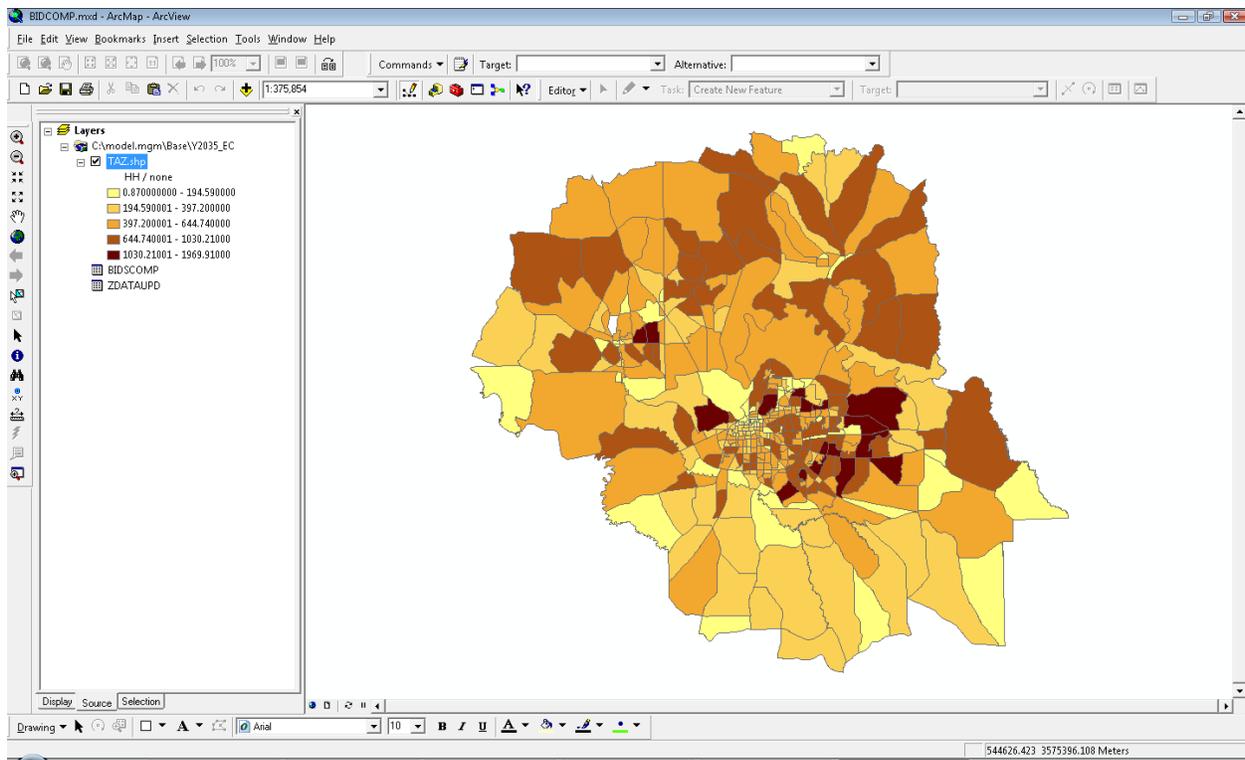
2035 Forecast Year

For the current model setup, the 2035 transportation model was imported into the Cube Geodatabase framework. Parcel policies have not been updated to reflect future year zonal data assumptions as this will be accomplished by the MPO staff during model testing. Year 2035 demographics (**Exhibit 32**) have been incorporated into the model using the same disaggregation procedures used in the 2005 base year. An example of the allocation results for households is shown in **Exhibit 33**.

Exhibit 32 2005 and 2035 Zonal Data Control Totals

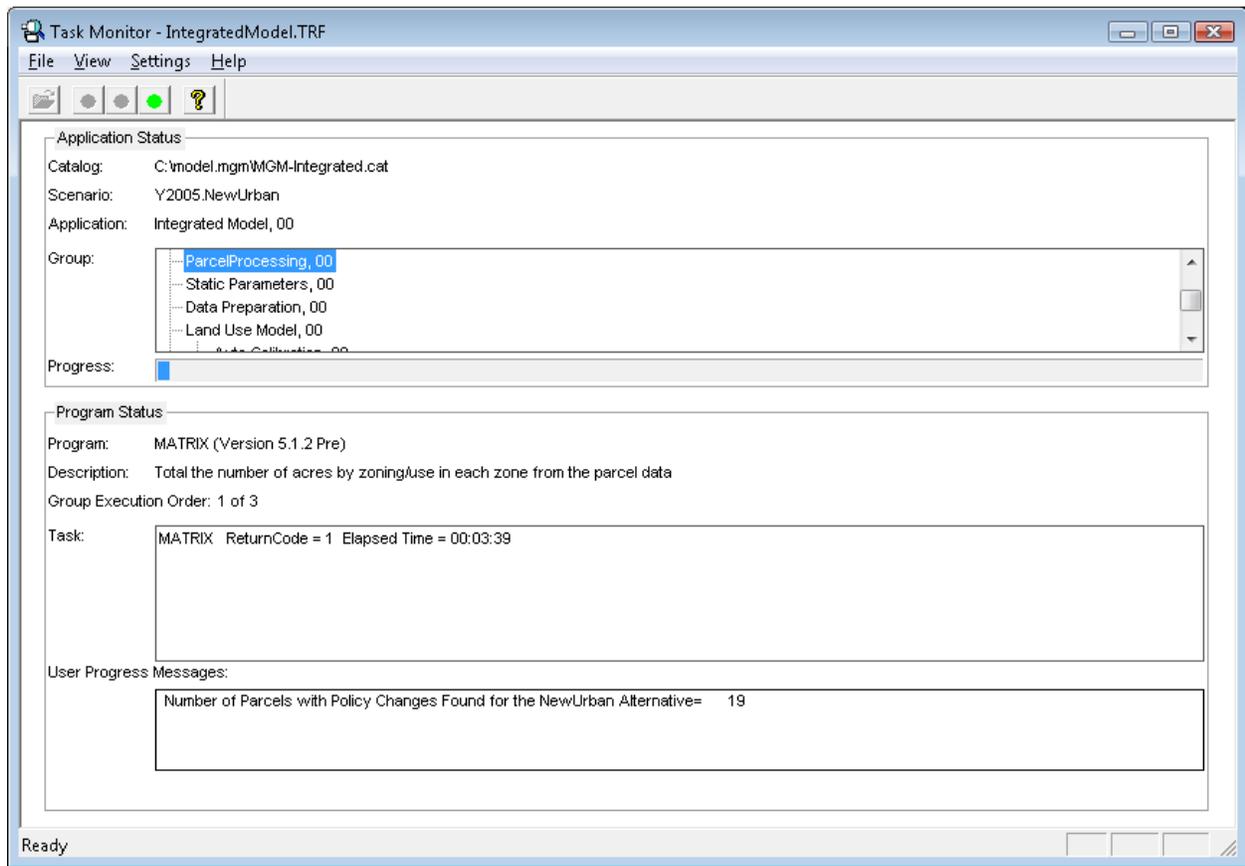
Variable	Year 2005 Total	Year 2035 Total
Households	123,686	182,593
Retail Jobs	33,269	49,530
Non-Retail Jobs	157,016	221,762

Exhibit 33 Year 2035 Household Distribution



As shown in **Exhibit 34**, the model can accommodate changes to parcel-specific land use designations and policies. Future year zoning / policies should be checked thoroughly before the model is put into day-to-day production.

Exhibit 34 Example of Model Execution with Updated Land Use Policies



CONCLUSIONS AND FURTHER RESEARCH

This effort represents the first attempt to develop a Cube Land Model for application in the United States. The exploratory nature of the study sought to see if there were sufficient data and tools available to implement an integrated framework in a small to medium-sized urban area. Results are promising. While data development comprised the largest portion of the effort, automation of key model development and validation processes made the process relatively simple to refine and transfer to other areas. At approximately 15 minutes, model run times are modest enough to allow for the testing and evaluation of a range of variables, structures and policies.

Beyond this study additional efforts should focus on a detailed assessment of the bid functions used in the model to see if they can be further simplified. Conversely, rent and cost functions are simple and should be explored to see if more refinements are sustainable given data limitations.

In the coming months detailed “real-world” testing should bear out any additional limitations of the model. It is reasonable to expect that additional refinements will further improve model results and performance.

Known Model Limitations

In the testing completed so far, limitations have been observed that may affect performance:

- Parcel data attributes for future year- because the model uses parcel-based data to develop observed densities and limits for development, particular care will be necessary to update a baseline set of future year policies for the parcel base map. Zoning policies are inputs to the model and as such should reflect similar assumptions used to develop future year demographic control totals and networks.
- Reliance on synthetic targets for some steps of the model- unfortunately detailed information on “who occupies” land use was not available for this study. As a result, a combination of parcel, census and InfoUSA databases was used to estimate coefficients of the model. By itself, this does not present any difficulties. However, for calibration purposes, that data is not entirely sufficient. It would be better to have a full zone-specific inventory of agents and real estate so that a detailed adjustment of the model’s functions could be achieved. This becomes more important to develop future year target values as the model currently relies on 2000 Census data /InfoUSA to establish target control totals for anything but the highest level aggregation.

Suggested Further Refinements

While it is early in the application phase of the model’s testing, a few opportunities to improve or verify the performance have been identified. These include:

- Testing of sensitivities of all input variables- the model includes many different variables that could affect its outcomes. As “real world” policy testing occurs, it is expected that some

variables, while statistically valid, may not have a strong enough effect between alternatives to merit maintaining in a zone-based model. As those variables are identified, they may be dropped from the model process to streamline data development / management and structure.

- Rent and cost functions- The lack of data to develop detailed rent and cost functions mandated that these functions be simplified and asserted. A detailed assessment of these functions and data will likely further improve model performance and improve sensitivities.
- Incorporating congestion into the travel demand model- The current Montgomery Travel Demand Model does not incorporate Congestion for trip distribution or transit path building purposes. It is worth exploring this so that the land use and transportation models use a similar set of impedances throughout the integrated model.
- Detailed diagnostics- The Cube Land model provides basic reporting but does not seem to provide detailed reporting of endogenous variables that are updated during the model's execution. Having detailed reporting available would greatly simplify debugging and the testing of various model parameters, data, etc.

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