Energy Use Patterns According to Main and Subsidiary Activities:

Evidence from Buildings Housing Non-Food Retailers

Nigel Fish and Denise Young*

June 2006

CBEEDAC 2006–RP-02

* We are grateful to Samson Amusan for research assistance.

Executive Summary

Commercial buildings vary substantially in their degree of specialization, with some buildings housing a single activity, and others a variety of activities. To the extent that different commercial activities have differing energy requirements, it may be possible to manage energy use in a commercial building more effectively when it is used for a single main activity rather than when that same activity is only one of many undertaken within the confines of the building. Similarly, even if there is more than one commercial activity undertaken within a particular building, the larger the proportion of the building that is occupied by the principal activity, the more likely it may be that energy use in that building can be managed effectively. However, when a particular activity occupies only a small proportion of the space in a building, it may be less likely that energy use can be managed effectively, at least in terms of that activity.

In this study, we examine whether or not buildings that are more specialized in terms of activities are better able to use energy efficiently. The focus is on 608 buildings from the CIBEUS data set that house one or more non-food retailers. For the purposes of our analysis, this set of buildings is subdivided into four categories (exclusively retail, primarily retail, largely other, and primarily other). Average total energy usage and average electricity usage per square foot of building space (exclusive of indoor parking) is found to be lower in buildings that are exclusively or primarily retail compared to buildings that are primarily or largely dedicated to activities other than non-food retailing.

A regression model is developed that allows us to distinguish between the impact of increased specialization in retailing activity – measured as the percentage of building space dedicated to non-food retailing activities – and the impacts of other building characteristics on energy and electricity usage. Results from the regression analysis indicate that there is little, if anything, to be gained in terms of energy efficiency due to increased specialization of building activities within particular buildings. Differences in energy usage across buildings housing non-food retail activities appear to be driven more by other building characteristics, including the type of main activity housed in the building.

Table of Contents

Executive Summary …………………………………………………………………. i
List of Tables ……………………………………………………………………... iii

1. Introduction 1

2. An Overview of Building Characteristics 3

3. Energy Usage and Building Specialization: A Regression Framework 7

4. Summary and Conclusions 11

APPENDIX A: Variables used in Regression Models 12

APPENDIX B: Full Regression Results ….. 14

List of Tables

Table 1: Proportion of Space Dedicated to Retail Activities... 3

Table 2: Number of Retailers by Category.. 4

Table 3: Building Location.. 4

Table 4: Building Age.. 5

Table 5: Energy Usage by Building Category.. 6

Table 6: Impact of Retail% on Energy Use... 9

Table A1: Summary Statistics for Major Variables – Full Sample (N=608) ………….. 13

Table B1: Full Regression Results – Dependent Variable in Logarithms ……………... 14

1. Introduction

To the extent that different commercial activities have differing energy requirements, when a commercial building is used for a single main activity, it may be possible to manage energy use in that building more effectively than when that same activity is only one of many undertaken within the confines of the building. Similarly, even if there is more than one commercial activity undertaken within a particular building, the larger the proportion of the building that is occupied by the principal activity, the more likely it may be that energy use in that building can be managed effectively. However, when a particular activity occupies only a small proportion of the space in a building, it may be less likely that energy use can be managed effectively, at least in terms of that activity. If these hypotheses are correct, differences in the efficiency of energy use are likely to be observable across buildings in which differing proportions of floor space are allocated to a particular activity, at least once the effects of other potentially confounding factors – such as other activities in the building – are taken into account.

In this report, we examine total energy and electricity usage patterns for a set of Canadian commercial buildings that house non-food retail activities. The data that are used are obtained from the Commercial and Institutional Building Energy Use Survey (CIBEUS), which contains information on the physical characteristics, activities, and energy use for a set of Canadian commercial and institutional buildings for the year 2000. To ensure sufficient variation across regions, and enough observations where a particular activity is alternately the sole, main, or a minor activity in a building, the analysis in this paper focuses on non-food retail activities.

The non-food retail activities that are considered here include art dealerships, clothing stores, department stores, drugstores/pharmacies, furniture and home furnishings, building materials and hardware, motor vehicle parts and sales, electronics and appliances, optical equipment, camera equipment, and other non-food retail enterprises. Since the specialized food preparation and refrigeration needs of food retailers may necessitate much different energy usage patterns, these types of retail activity are excluded from our study. Similarly, given the substantially different building designs of enclosed and strip shopping malls, it is not appropriate to compare energy usage in these buildings to energy use in other buildings that house retail activities. Therefore, retail outlets that were part of an enclosed shopping mall or strip mall are not included in this study.

The plan of the remainder of this paper is as follows. In Section 2, the broad characteristics of the 608 buildings in the CIBEUS data set that house non-food retail activities are examined. In Section 3, a regression framework is used to determine the extent to which total energy usage and electricity usage are affected by the degree of activity specialization in these buildings. Section 4 contains conclusions and policy recommendations.

2. An Overview of Building Characteristics

Excluding shopping malls, there are 608 buildings in the CIBEUS data set that house non-food retail activities and have non-imputed values for energy use. In the remainder of the report, any reference to retail activities refers to non-food retail, unless otherwise noted. Tables 1 through 5 provide an overview of some of the major characteristics of these 608 buildings.

TABLE 1: Proportion of Space Dedicated to Retail Activities

Category	Proportion of Building that is Retail Space	Frequency	Percent
Exclusively Retail	100%	273	44.9
Primarily Retail	50% - 99%	128	21.1
Largely Other	25% - 49%	83	13.7
Primarily Other	0% - 25%	124	20.4

As Table 1 shows, there is a substantial amount of variation across buildings in terms of the percentage of floor space dedicated to retail activities. Almost one half (44.9%) of the buildings in the sample are completely specialized, or ***exclusively retail***. The remaining buildings have been categorized as being ***primarily retail*** (more than 50% of the building area dedicated to retail activities), ***largely other*** (25 to 49% of the building area dedicated to retail activities), or ***primarily other*** (less than 25% of the building area dedicated to retail activities), where the building area is exclusive of indoor parking. Of the 335 buildings that are not completely specialized, approximately one quarter fall into the *largely other* category, with the remaining buildings being almost evenly split across the *primarily retail* and *primarily other* categories.

Table 2 provides information on the number of separate retailers housed within the 608 buildings in the sample. The patterns are strikingly similar across the four categorizations. Buildings housing a single retailer are more common than those housing two or more separate retailers. In fact, most buildings in the sample house a single retail activity. The category with the highest percentage of buildings housing more than two separate retailers is the *largely other* category, and even then, fewer than 10% of these buildings house three or more separate retailers.

TABLE 2: Number of Retailers by Category

Type	Number of Retailers			
	1	2	3	>3
Exclusively Retail (100%)	91.6%	5.9%	1.8%	0.8%
Primarily Retail (50-99%)	83.6%	9.4%	3.1%	4.0%
Largely Other (25-49%)	73.5%	16.9%	6.0%	3.6%
Primarily Other (0-25%)	89.5%	5.6%	2.4%	2.4%

In terms of geographical coverage, as can be seen in Table 3, the buildings in the sample were located in 25 different cities across Canada. The percentage of buildings that are *exclusively retail* in the regional sub-samples vary somewhat, with the numbers for Atlantic Canada, Quebec and Ontario being very close to the 44.9% figure from the overall sample of 608 buildings, while the percentages are much higher on the Prairies (53.3%) and lower in B.C. (33%).

TABLE 3: Building Location

Region	Frequency	% Exclusively Retail
Atlantic Provinces	69 (7 cities)	43.5
Quebec	140 (3 cities)	45.0
Ontario	176 (8 cities)	44.9
Prairies	135 (5 cities)	53.3
B.C.	88 (2 cities)	33.0

Building ages, as can be seen in Table 4, also vary substantially across the sample, with approximately one fifth of the sample consisting of buildings constructed before 1940, while close to one quarter of the buildings were constructed during the 1990s. There are also many differences in terms of other physical building characteristics and occupancy characteristics. Although not broken down by region, a general picture of building characteristics across the sample of 608 buildings can be found in the table of summary statistics in Appendix A.

TABLE 4: Building Age

Year Built	Frequency	Percent
Pre-1940	131	21.5
1940-1969	129	21.2
1970-1979	96	15.8
1980-1999	112	18.4
1990-1999	140	23.0

The main variables of interest in this report are overall total energy use and electricity usage. Table 5 shows that total energy and electricity usages are dissimilar in buildings that have been categorized as *exclusively* or *primarily retail* compared to those which are *largely* or *primarily other*. The average value of total energy use (GJ) per square foot (where square footage excludes indoor parking) is approximately 0.11 for both *exclusively* or *primarily retail* buildings, but is much higher for buildings in the *largely* or *primarily other* categories, with values in the 0.14 to 0.16 range. Similar, but less pronounced, differences can be seen in the patterns of average electricity usage per square foot across the four categories of buildings with an average value of approximately 0.05 for buildings in the *exclusively* or *primarily retail* categories, 0.06 for *largely other* category, and 0.07 for buildings in the *primarily other* category.

TABLE 5: Energy Usage by Building Category

Proportion of Retail Space	Energy Use (GJ per square foot)	Electricity Use (GJ per square foot)
Exclusively Retail (100%)	Average 0.10827 Minimum 0.01352 Maximum 0.63501	Average 0.05041 Minimum 0.01016 Maximum 0.36089
Primarily Retail (50-99%)	Average 0.11415 Minimum 0.01565 Maximum 0.62662	Average 0.05479 Minimum 0.01110 Maximum 0.42855
Largely Other (25-49%)	Average 0.15842 Minimum 0.01566 Maximum 0.83277	Average 0.06325 Minimum 0.01064 Maximum 0.74956
Primarily Other (0-25%)	Average 0.14205 Minimum 0.01070 Maximum 1.19780	Average 0.07365 Minimum 0.01033 Maximum 0.65287

Whether or not there is a potential for improved energy management in specialized buildings cannot be determined from these snapshots of building characteristics and energy usage. In order to gauge the potential for energy management improvements in specialized commercial buildings, it is necessary to utilize a regression model where it is possible to control for major building characteristics in assessing the impact of specialization on the efficiency of energy usage.

3. Energy Usage and Building Specialization: A Regression Framework

In order to perform a statistical test of whether or not building specialization leads to improved management of energy usage, we adopt a regression model specification which controls for the effects of various other factors that may impact on energy consumption. Factors that are likely to have an impact on energy usage include such things as physical building characteristics, patterns of building use, climate, and general attitudes of building owners/managers towards energy efficiency (captured imperfectly through past histories of retrofits). Therefore, we consider models of the following type:

$$Y_i = \alpha \, RETAIL\%_i + (\beta_1 + \beta_2 X_{2i} + \cdots + \beta_k X_{ki}) + \varepsilon_i ,$$

where:

Y_i = a measure of total energy or electricity usage per square foot;
$RETAIL\%_i$ = % of building devoted to non-food retail activities;
α = parameter of interest;
$X_{2i}, \ldots, X_{ki}$ = control variables (other factors that may affect energy consumption);
$\beta_1, \beta_2, \ldots, \beta_k$ = coefficients on the constant and control variables;
ε_i = error term; and
the subscript *i* indexes the different buildings in the sample.

By specifying the model in this way, we control for a variety of building characteristics that are expected to influence energy use through the term $(\beta_1 + \beta_2 X_{2i} + \cdots + \beta_k X_{ki})$, and then determine if any of the remaining variation in energy usage can be explained by the degree of building specialization in retail activities, as captured through the coefficient α on the $RETAIL\%_i$ variable. A t-test, allowing for a heteroskedasticity correction on the standard error of the estimated coefficient, will allow us to formally determine whether or not there is evidence of improved energy efficiency in more specialized retail buildings.

Details, including summary statistics, of the variables included in the control variables are provided in Appendix A. These control variables include several continuous variables: building area (square footage exclusive of indoor parking), number of floors, building age, window-to-wall ratio, cooling degree days for the city where the building is located, heating degree days for the city where the building is located, hours of operation, and the number of occupants during the main shift. Also included in the set of controls are several dummy variables used to capture effects related to: the region where the building is located, ownership type (private versus government), the presence of air-conditioning, the presence of heated indoor parking, whether or not the building is subject to seasonal activity, window features, HVAC features, heating fuel and equipment choices, whether or not any of a large variety retrofits had been undertaken in the recent past, and the main activity classification for the building.

Since no particular functional form is implicit in the model, we opt for a very general non-linear specification. The dependent variable, Y_i, is specified as the natural logarithm of total energy or total electricity usage per square foot (where the area excludes parking). All strictly positive continuous variables in the set of control variables are entered in natural logarithmic form, while all other variables are entered linearly. We allow for additional flexibility in the specification of the functional form through the inclusion of the squares and cross-products of all variables entered in logarithmic form.

The results of the full regression analysis for the set of 608 buildings in the sample are presented in the first two columns of parameter estimates in Table B1 in Appendix B. These models are estimated using Ordinary Least Squares with a heteroskedasticity correction for the standard errors. RESET tests are conducted to check for the appropriateness of the selected functional form of the model. There is no evidence of misspecification of the functional form for the electricity equation, while the specification for the total energy use equation may be too linear. In both cases, a significant amount of the variation in energy usage is being driven by the variety of main activities that can be found across the buildings.

In order to minimize the influence of other major activities in the building on energy and electricity usage in our results, the model is also estimated using only those buildings which are exclusively or primarily retail. For these results, the main activity classification dummy variables are omitted. These results are listed in the remaining two columns of Table B1 in Appendix B. In this case there is no evidence of functional misspecification with either the full sample or the sample or the smaller sample of primarily retail buildings.

In view of the large number of parameter estimates in Table B1, the results for the coefficients of interest along with the RESET misspecification test results and the R-squared goodness of fit measures are reproduced below in Table 6.

TABLE 6: Impact of Retail% on Energy Use

	Full Sample (608 Buildings)		**Exclusively or Primarily Retail (401 Buildings)**	
	Total Energy per square foot	**Electricity per square foot**	**Total Energy per square foot**	**Electricity per square foot**
Coefficient on RETAIL%	-0.0018	0.0007	-0.0032	-0.0012
p-value	0.242	0.454	0.092	0.545
Estimated elasticity at means	-0.1205	0.0439	-0.2896	-0.1086
Reset tests (of functional misspecification)	RESET(2)= 5.94 RESET(3)= 5.85 RESET(4)= 4.21	RESET(2)= 1.08 RESET(3)= 1.02 RESET(4)= 0.85	RESET(2)= 0.09 RESET(3)= 0.16 RESET(4)= 0.97	RESET(2)= 2.47 RESET(3)= 1.98 RESET(4)= 1.61
R-squared	0.4416	0.3386	0.4410	0.3206

In terms of the coefficient of interest, as can be seen in Table 6, there is little evidence that increased building specialization, at least for non-food retailing, might lead to improvements in energy efficiency. As shown by the corresponding p-values which all exceed 0.10, for the full sample, the coefficient on *RETAIL%* is insignificant for both the total energy and electricity specifications. For the sample of buildings that are primarily or exclusively retail – that is buildings that might be expected to be less ‘diverse’ in terms of energy needs – there is some evidence, albeit only at a 10% significance level, that more specialization leads to improved efficiency in terms of total energy usage.

To provide a measure that is easier to interpret than the coefficients themselves, the estimated elasticities of energy or electricity use per square foot with respect to percentage of the building that is retail, are also presented in Table 6. These elasticities, evaluated at the mean values of the variables, show the proportional effect on energy or electricity use per square foot of a 1% increase in percentage of the building that is occupied by non-food retail activities. For buildings that are already exclusively or primarily retail, the elasticity for total energy use per square foot with respect to *%RETAIL* indicates that there might be savings available from improved efficiency in the use of total energy from housing a more homogenous group of activities within a building. However, it should be noted that this result is only applicable to buildings that are already quite specialized, and there is quite a large degree of uncertainty associated with it, as the underlying coefficient is only significant at the 10% level.

4. Summary and Conclusions

The types of activities that a building houses is one of several factors that have impacts on energy usage. Our examination of the extent to which building specialization may lead to better overall energy management shows that there are not likely to be significant gains in energy efficiency that would accrue from increased retail specialization in buildings that house retail activities. This does not necessarily imply that increased specialization will have no impact in other types of buildings. However, given our results for non-food retail activities, and since there appears to be relatively little scope for policy initiatives to impact on the distribution of activities within or across buildings, other avenues for achieving energy efficiency are more likely to have a significant pay-off than will encouraging increased specialization of activities within a commercial building.

APPENDIX A: Variables used in Regression Models

CONTINUOUS VARIABLES

RETAIL%	= percentage of building area devoted to non-food retail activities
AGE	= building age (in years)
AREA	= building area (square footage exclusive of indoor parking)
CDD	= cooling degree days for the city where the building is located
FLOORS	= number of floors in building
HDD	= heating degree days for the city where the building is located
HOURS	= hours of operation per week
NHVAC	= number of HVAC energy-saving features installed
NSTORES	= number of retail outlets in building
OCC	= number of occupants during the main shift
WTW	= building's window-to-wall ratio

BINARY (DUMMY) VARIABLES

AB	= 1 if windows have awnings/blinds
EQTF	= 1 if the main heating equipment is a standard furnace
EQTHP	= 1 if the main heating equipment is a heat pump
EQTISH	= 1 if the main heating equipment is individual space heaters
EQTPHU	= 1 if the main heating equipment is packaged heat units
HEATELEC	= 1 if the main heating fuel is electricity
HEATFO	= 1 if the main heating fuel is fuel oil
HEATNG	= 1 if the main heating fuel is natural gas
INPARK	= 1 if the building has heated indoor parking
NOAC	= 1 if the building is not air-conditioned
PRIV	= 1 if the building is privately owned
REG1	= 1 if the building was located in Québec
REG2	= 1 if the building was located in Ontario
REG3	= 1 if the building was located in the Prairies
REG4	= 1 if the building had located in British Columbia
RETL	= 1 if the building had previous lighting retrofits
RETH	= 1 if the building had previous heating retrofits
RETRI	= 1 if the building had previous roof insulation retrofits
RETWI	= 1 if the building had previous wall insulation retrofits
RETWS	= 1 if the building had previous wall siding retrofits
RETV	= 1 if the building had previous ventilation/ac retrofits
RS	= 1 if windows have reflective shading
SEASDUM	= 1 if the building is subject to seasonal use
SG	= 1 if the building has single-glazed windows

TABLE A1: Summary Statistics for Major Variables – Full Sample (N=608)

Variable	Mean	Standard Deviation	Minimum	Maximum
CONTINUOUS VARIABLES				
RETAIL%	66.173	36.230	0.30000	100.00
AGE	36.673	34.152	1.0000	310.00
AREA	28096.	74417.	1000.0	1239200.
CDD	151.28	109.17	13.300	393.80
FLOORS	2.3191	2.0839	1.0000	28.000
HDD	4260.8	945.97	2865.7	5950.6
HOURS	66.555	25.187	7.0000	168.00
NHVAC	2.1891	1.7092	0.0000	6.0000
NSTORES	1.2204	0.70590	1.0000	8.0000
OCC	48.510	204.46	1.0000	4500.0
WTW	22.887	19.076	0.0000	100.00
Binary (Dummy) Variables				
AB	0.46382	0.49910	0.0000	1.0000
EQTF	0.32072	0.46714	0.0000	1.0000
EQTHP	0.04934	0.21676	0.0000	1.0000
EQTISH	0.16612	0.37249	0.0000	1.0000
EQTPHU	0.26480	0.44159	0.0000	1.0000
HEATELEC	0.30592	0.46118	0.0000	1.0000
HEATFO	0.08388	0.27744	0.0000	1.0000
HEATNG	0.58882	0.49245	0.0000	1.0000
INPARK	0.02632	0.16020	0.0000	1.0000
NOAC	0.18914	0.39195	0.0000	1.0000
PRIV	0.98355	0.12729	0.0000	1.0000
REG1	0.23026	0.42135	0.0000	1.0000
REG2	0.28947	0.45389	0.0000	1.0000
REG3	0.22204	0.41596	0.0000	1.0000
REG4	0.14474	0.35213	0.0000	1.0000
RETL	0.11842	0.32337	0.0000	1.0000
RETH	0.12171	0.32722	0.0000	1.0000
RETRI	0.06579	0.24812	0.0000	1.0000
RETWI	0.05263	0.22348	0.0000	1.0000
RETWS	0.04934	0.21676	0.0000	1.0000
RETV	0.07072	0.25657	0.0000	1.0000
RS	0.25329	0.43525	0.0000	1.0000
SEASDUM	0.08059	0.27243	0.0000	1.0000
SG	0.22204	0.41596	0.0000	1.0000

Summary Statistics for the 37 “Main Activity” Dummy Variables are omitted.

APPENDIX B: Full Regression Results

TABLE B1: Full Regression Results – Dependent Variable in Logarithms*

	Full Sample		Exclusively Retail or Primarily Retail Only	
	Total Energy	**Electricity**	**Total Energy**	**Electricity**
Coefficients for CONTINUOUS VARIABLES (Standard errors in parentheses)				
CONSTANT	-12.069 (268.8)	-298.52 (308.0)	114.21 (303.5)	-73.005 (340.6)
RETAIL%	-0.0018 (0.015)	0.0007 (0.001)	-0.0032 (0.002)	-0.0012 (0.002)
LAGE	1.3199 (1.209)	1.6178 (1.328)	1.1404 (1.810)	4.8193 (2.054)
LAREA	2.4546 (1.884)	-0.5851 (2.154)	-0.1246 (2.335)	-1.5084 (2.638)
LCDD	6.9000 (7.260)	-6.5926 (7.259)	2.8332 (7.825)	-10.878 (8.344)
LFLOORS	-1.1981 (3.085)	-0.2534 (3.196)	-3.0120 (4.052)	-4.4435 (4.629)
LHDD	-6.0357 (62.09)	74.498 (72.11)	-27.774 (69.90)	22.679 (79.24)
LHOURS	4.7004 (3.711)	-0.2018 (4.026)	-2.6815 (5.270)	1.2130 (5.338)
NHVAC	-0.0125 (0.020)	-0.0062 (0.021)	-0.0208 (0.023)	-0.0135 (0.026)
LNSTORES	1.3583 (3.364)	2.7532 (3.243)	-2.3659 (4.741)	1.8153 (4.295)
LOCC	-2.2606 (1.446)	1.2009 (1.550)	1.8898 (1.950)	4.2347 (1.839)
WTW	0.0020 (0.001)	0.0017 (0.002)	0.0032 (0.002)	0.0037 (0.002)
LAGE*LAGE	-0.0062 (0.022)	-0.0273 (0.020)	-0.0167 (0.024)	-0.0389 (0.024)
LAREA*LAREA	0.1717 (0.0334)	0.1572 (0.034)	0.2068 (0.045)	0.1967 (0.047)
LCDD*LCDD	-0.1152 (0.145)	0.1350 (0.169)	-0.1190 (0.147)	0.0506 (0.175)
LFLOORS*LFLOORS	-0.1695 (0.095)	-0.1553 (0.095)	0.0369 (0.183)	-0.0352 (0.179)
LHDD*LHDD	0.7904 (3.596)	-4.5646 (4.226)	1.6594 (4.041)	-1.6112 (4.628)
LHOURS*LHOURS	-0.0010 (0.105)	0.2734 (0.116)	0.0024 (0.193)	0.3270 (0.248)
LNSTORES*LNSTORES	0.3160 (0.177)	-0.0059 (0.206)	0.6247 (0.248)	0.1876 (0.252)
LOCC*LOCC	0.0693 (0.035)	0.0698 (0.035)	0.1162 (0.046)	0.1119 (0.044)
LAGE*LAREA	0.0535 (0.035)	0.0218 (0.037)	0.0612 (0.047)	-0.0038 (0.052)
LAGE*LCDD	-0.0051 (0.026)	0.0013 (0.028)	0.0239 (0.033)	0.0079 (0.037)
LAGE*LFLOORS	-0.1063 (0.072)	-0.0319 (0.065)	-0.0244 (0.088)	-0.0110 (0.918)
LAGE*LHDD	-0.0140 (0.128)	-0.1022 (0.135)	-0.0749 (0.182)	-0.4219 (0.210)
LAGE*LHOURS	-0.3510 (0.096)	-0.1743 (0.104)	-0.1912 (0.132)	-0.2158 (0.155)
LAGE*LNSTORES	-0.1563 (0.100)	-0.0665 (0.095)	-0.2537 (0.142)	-0.2943 (0.132)
LAGE*LOCC	-0.0222 (0.035)	-0.0497 (0.038)	-0.0923 (0.048)	-0.0867 (0.053)
LAREA*LCDD	0.0058 (0.040)	0.0127 (0.464)	-0.0139 (0.049)	-0.0762 (0.058)
LAREA*LFLOORS	-0.2103 (0.076)	-0.1842 (0.085)	-0.3429 (0.099)	-0.1941 (0.117)
LAREA*LHDD	-0.5170 (0.199)	-0.2036 (0.227)	-0.2906 (0.244)	-0.1582 (0.273)
LAREA*LHOURS	-0.2626 (0.108)	-0.0642 (0.109)	-0.1806 (0.163)	0.0574 (0.166)
LAREA*LNSTORES	-0.0288 (0.123)	0.0516 (0.125)	-0.2953 (0.166)	-0.2248 (0.157)
LAREA*LOCC	-0.1807 (0.058)	-0.2009 (0.060)	-0.2596 (0.078)	-0.2915 (0.083)
LCDD*LFLOORS	-0.0998 (0.064)	-0.0428 (0.064)	-0.1204 (0.082)	-0.0046 (0.095)
LCDD*LHDD	-0.6934 (0.762)	0.6861 (0.761)	-0.2453 (0.839)	1.3335 (0.871)
LCDD*LHOURS	-0.0304 (0.085)	-0.1108 (0.097)	0.0131 (0.157)	-0.1523 (0.180)
LCDD*LNSTORES	-0.0509 (0.072)	-0.0485 (0.072)	0.0379 (0.092)	0.1095 (0.092)
LCDD*LOCC	-0.0071 (0.033)	-0.0121 (0.036)	0.0614 (0.041)	0.1070 (0.042)
LFLOORS*LHDD	0.3196 (0.341)	0.1948 (0.347)	0.5319 (0.413)	0.6088 (0.482)
LFLOORS*LHOURS	0.2301 (0.184)	0.0884 (0.181)	0.3654 (0.293)	0.1655 (0.338)
LFLOORS*LNSTORES	0.1877 (0.225)	-0.1116 (0.225)	0.1125 (0.255)	-0.0102 (0.238)
LFLOORS*LOCC	0.2002 (0.064)	0.2247 (0.072)	0.3370 (0.097)	0.2755 (0.107)

LHDD*LHOURS	-0.1271 (0.398)	0.0199 (0.419)	0.6318 (0.580)	-0.2003 (0.600)
LHDD*LNSTORES	-0.1247 (0.376)	-0.1412 (0.360)	0.3926 (0.517)	0.0863 (0.464)
LHDD*LOCC	0.4020 (0.152)	0.0955 (0.168)	0.0366 (0.212)	-0.1354 (0.196)
LHOURS*LNSTORES	0.0757 (0.266)	-0.4804 (0.271)	0.4002 (0.310)	-0.1860 (0.314)
LHOURS*LOCC	0.0804 (0.092)	-0.0780 (0.096)	-0.1035 (0.140)	-0.3065 (0.167)
LNSTORES*LOCC	-0.0378 (0.097)	0.1243 (0.099)	0.0088 (0.110)	0.1622 (0.111)
Coefficients for Binary (Dummy) Variables (Main Activity Dummies not shown)				
AB	-0.0194 (0.055)	-0.0293 (0.061)	0.0240 (0.060)	0.0458 (0.069)
EQTF	-0.0873 (0.071)	0.0836 (0.078)	-0.1088 (0.084)	0.1081 (0.093)
EQTHP	0.0067 (0.160)	0.2135 (0.168)	0.0124 (0.176)	0.1536 (0.181)
EQTISH	-0.1597 (0.103)	0.0501 (0.110)	-0.1145 (0.120)	0.1148 (0.126)
EQTPHU	-0.0348 (0.083)	0.1989 (0.094)	-0.0167 (0.109)	0.2386 (0.115)
HEATELEC	-0.1918 (0.197)	0.0499 (0.207)	-0.1195 (0.194)	0.0088 (0.205)
HEATFO	0.1225 (0.208)	-0.2652 (0.214)	0.3041 (0.201)	-0.1640 (0.200)
HEATNG	0.3204 (0.189)	-0.0703 (0.202)	0.4794 (0.190)	-0.0018 (0.202)
INPARK	0.2633 (0.177)	0.4220 (0.170)	0.2105 (0.177)	0.1334 (0.142)
NOAC	-0.0718 (0.086)	-0.1359 (0.082)	-0.1444 (0.088)	-0.1664 (0.089)
PRIV	-0.1951 (0.336)	-0.5437 (0.343)	0.3934 (0.215)	-0.1587 (0.222)
REG1	0.2000 (0.276)	-0.0513 (0.318)	0.1092 (0.286)	0.0675 (0.308)
REG2	0.3187 (0.251)	0.1878 (0.285)	0.2563 (0.268)	0.2843 (0.292)
REG3	0.4034 (0.278)	0.6594 (0.323)	0.5418 (0.317)	0.6786 (0.383)
REG4	0.4981 (1.230)	0.0478 (1.289)	-0.4199 (1.394)	-1.544 (1.438)
RETL	-0.0642 (0.113)	-0.0312 (0.105)	0.0416 (0.130)	0.0873 (0.124)
RETH	0.0734 (0.098)	0.0951 (0.120)	0.1497 (0.108)	0.1624 (0.130)
RETRI	-0.1857 (0.133)	-0.1368 (0.156)	-0.3055 (0.171)	-0.1945 (0.187)
RETV	-0.1308 (0.124)	-0.1401 (0.127)	-0.0143 (0.152)	0.0437 (0.150)
RETWI	0.0946 (0.147)	-0.0020 (0.158)	0.2193 (0.171)	0.0961 (0.178)
RETWS	-0.0120 (0.149)	0.0014 (0.155)	-0.1647 (0.166)	-0.1670 (0.147)
RS	0.1221 (0.061)	0.0216 (0.067)	0.1527 (0.071)	0.1121 (0.078)
SEASDUM	0.0262 (0.103)	-0.1185 (0.116)	0.1722 (0.120)	-0.0230 (0.143)
SG	-0.0556 (0.075)	0.0273 (0.078)	-0.0405 (0.076)	0.0340 (0.080)
N	608	608	401	401
R-square	0.4416	0.3386	0.4410	0.3206
F-test for 36 Main Activity Dummies	14.17	9.46	--	--
Reset tests for functional form	RESET(2)= 5.94 RESET(3)= 5.85 RESET(4)= 4.21	RESET(2)= 1.08 RESET(3)= 1.02 RESET(4)= 0.85	RESET(2)= 0.09 RESET(3)= 0.15 RESET(4)= 0.97	RESET(2)= 2.47 RESET(3)= 1.98 RESET(4)= 1.61

* An “L” at the beginning of a variable name indicates an explanatory variable appears in natural logarithmic form in the regression.