



A Spatial Analysis of Commercialization and Child Care Facilities in Manhattan

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Introduction

- In New York City today, most parents with young children are engaged in paid work. Both parents are in the labor force in more than half of families with children under six, with even higher rates of labor force participation among single-parent households [\[1\]](#).
- Every day, these New Yorkers entrust other people to care for their children, make sure they are healthy and safe, and build a strong foundation for future learning. For thousands of families in New York City, child care is a basic need, but for many, and for families with low or moderate incomes in particular, the high cost of care creates a serious financial burden and leaves few preferred child care options, if any, without risking access to other essentials like housing, health care, food, and transportation.
- New York City has invested in universal pre-kindergarten for four-year-olds and taken steps to direct similar investments to three-year-olds, but solutions for addressing the affordability and availability of infant and toddler care remain urgently needed, as they are across the country [\[1\]](#).



Project Structure

This project is divided into 3 parts:

1. Assessing the commercialization of Manhattan over the last decade
2. Current State of Affairs - Relationship between the distribution of Child Care Facilities with median household Income and number of children below 5 years of age.
3. Why we need to increase child care facilities - Visualizing alleviating impact of new child care facilities on pre-existing ones.



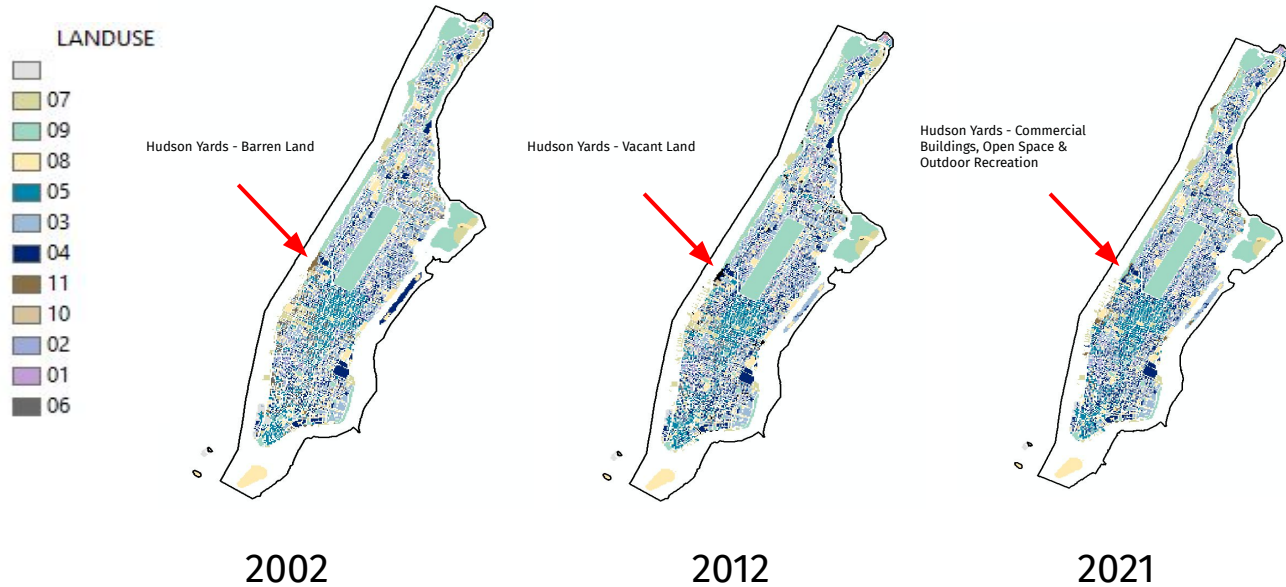
Datasets

- PLUTO Land Use Data - [PLUTO and MapPLUTO](#)
- ACS Tract Level Data
 - Number of Males below 5
 - Number of Females below 5
 - Day Care Centers
- Day Care Centers - [Day Care Center | NYC Open Data](#)



Commercialization
in Manhattan over
time (2000, 2012,
and 2021)

Manhattan Land Use

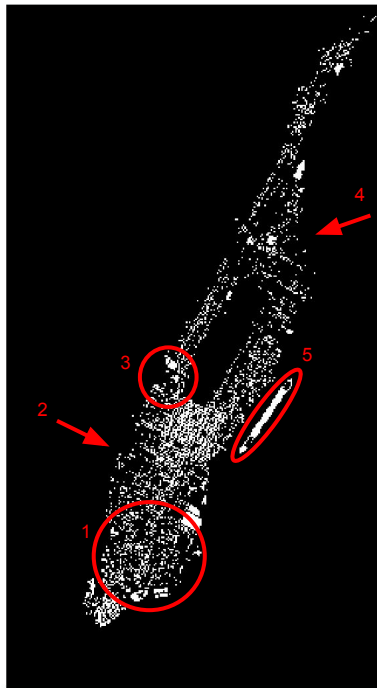


CODES	DECODES
01	One & Two Family Buildings
02	Multi-Family Walk-Up Buildings
03	Multi-Family Elevator Buildings
04	Mixed Residential & Commercial Buildings
05	Commercial & Office Buildings
06	Industrial & Manufacturing
07	Transportation & Utility
08	Public Facilities & Institutions
09	Open Space & Outdoor Recreation
10	Parking Facilities
11	Vacant Land

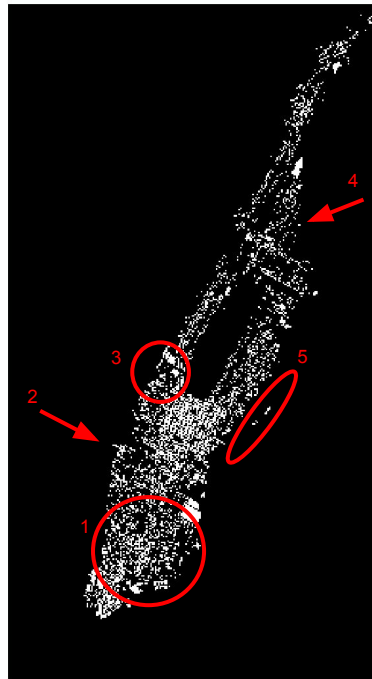
<https://www1.nyc.gov/site/planning/data-maps/open-data/dwn-pluto-mappluto.page>

Commercialization in Manhattan

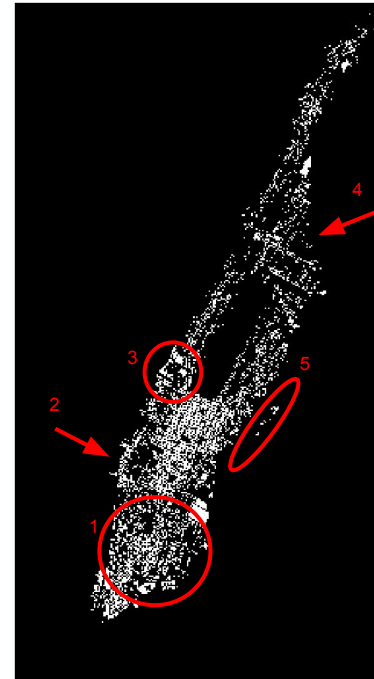
LANDUSE
■ Not Commercial
□ Commercial



2002

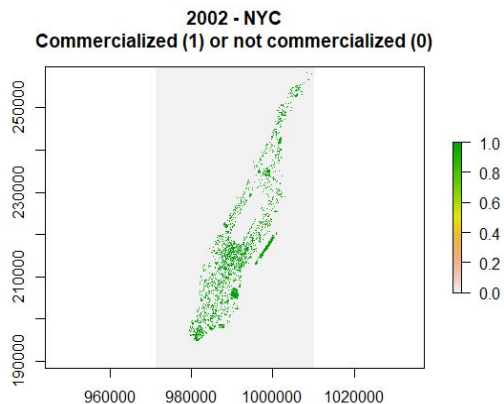


2012



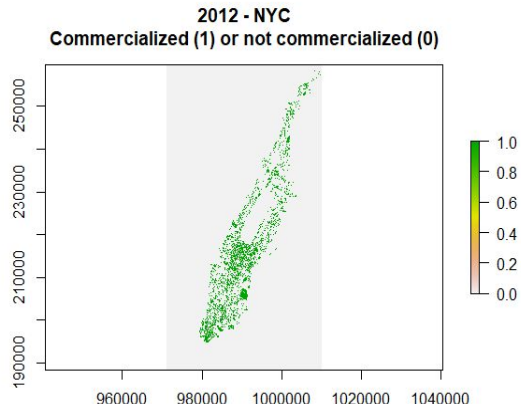
2021

Fractal Dimension of Commercial Areas in Manhattan



```
# A tibble: 2 x 6
  layer level class    id metric value
  <int> <chr> <int> <int> <chr> <dbl>
1     1     1 class     0    NA frac_mn 1.03
2     1     1 class     1    NA frac_mn 1.04
```

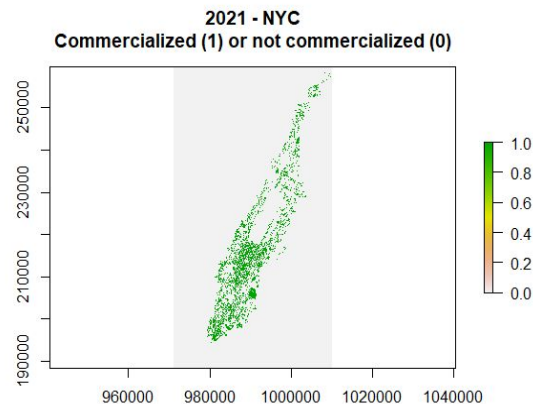
2002



```
# A tibble: 2 x 6
  layer level class    id metric value
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2     1     1 class     1    NA frac_mn 1.04
```

2012

Decrease in Non-Commercial Area



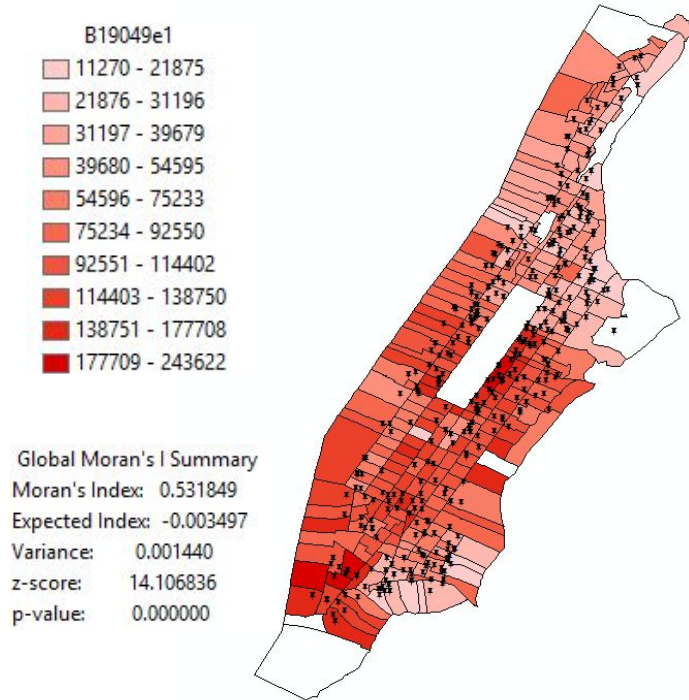
```
# A tibble: 2 x 6
  layer level class    id metric value
  <int> <chr> <int> <int> <chr> <dbl>
1     1     1 class     0    NA frac_mn 1.03
2     1     1 class     1    NA frac_mn 1.04
```

2021

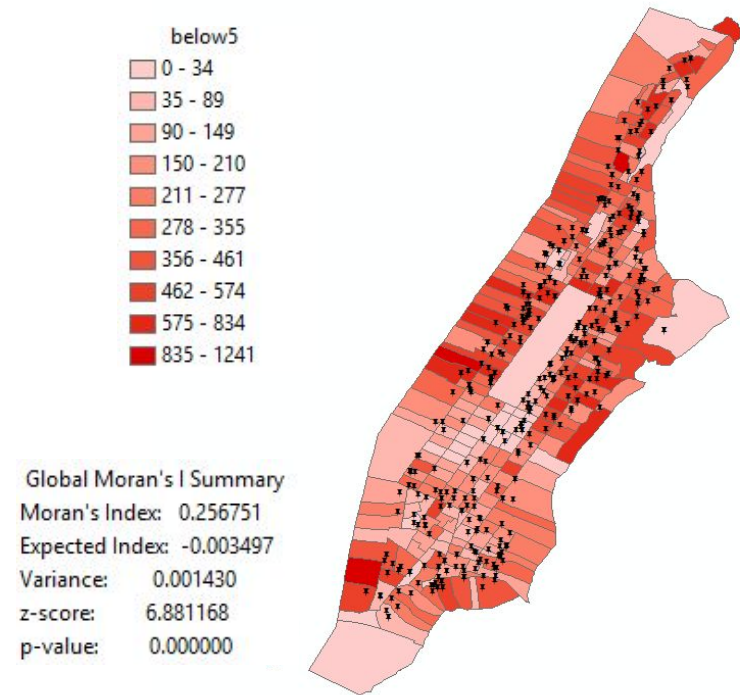
Current State of
Affairs - Childcare,
Income, and
Children



Childcare facilities, Household Income, and Children

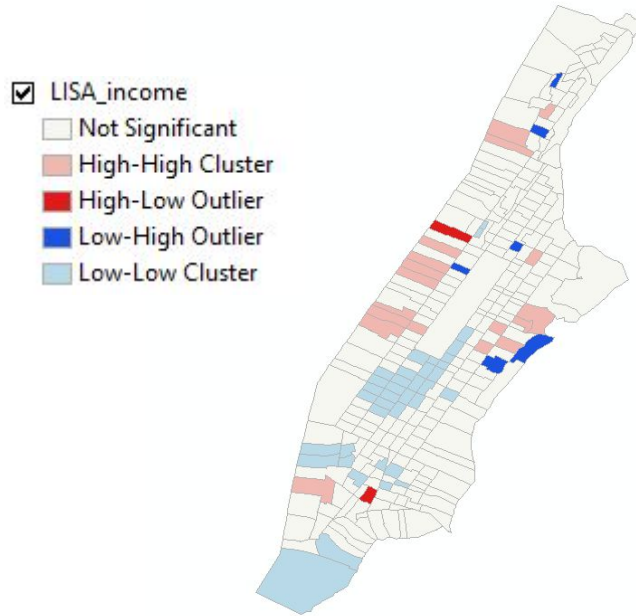


Median Household Income

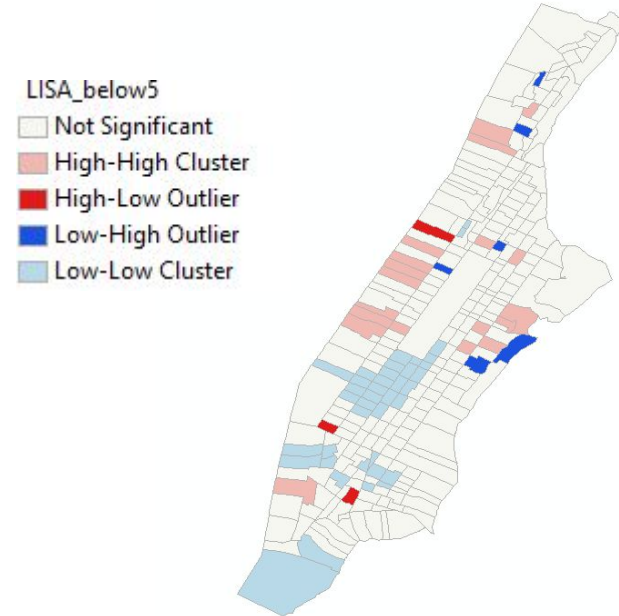


Number of Children Below 5 years

Looking for Local Spatial Autocorrelation - Mapping Clusters using LISA



Median Household Income



Number of Children Below 5 years

Is Income a Predictor of the Number of Children Below 5 in a Census Tract?

Ordinary Least Squares Regression

OLS Diagnostics

Input Features:	Export_Output1	Dependent Variable:	B19049E1
Number of Observations:	287	Akaike's Information Criterion (AICc) [d]:	6976.881145
Multiple R-Squared [d]:	0.003414	Adjusted R-Squared [d]:	-0.000082
Joint F-Statistic [e]:	0.976419	Prob(>F), (1,285) degrees of freedom:	0.323923
Joint Wald Statistic [e]:	0.753732	Prob(>chi-squared), (1) degrees of freedom:	0.385297
Koenker (BP) Statistic [f]:	0.097650	Prob(>chi-squared), (1) degrees of freedom:	0.754669
Jarque-Bera Statistic [g]:	20.952602	Prob(>chi-squared), (2) degrees of freedom:	0.000028*

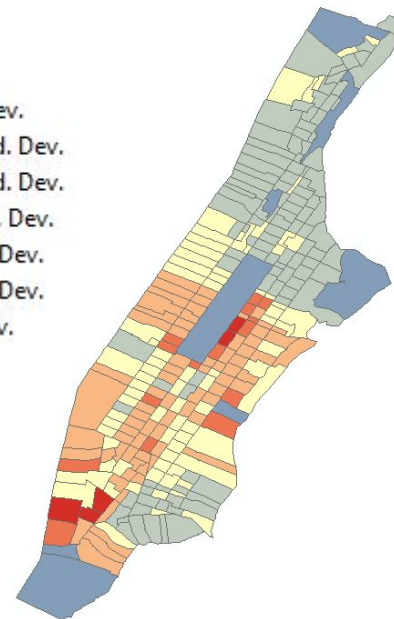
Summary of OLS Results

Variable	Coefficient [a]	StdError	t-Statistic	Probability [b]	Robust_SE	Robust_t	Robust_Pr [b]
Intercept	79027.737645	4378.157940	18.050454	0.000000*	4811.566602	16.424534	0.000000*
BELOW5	-12.342949	12.491104	-0.988139	0.323912	14.217084	-0.868177	0.386016

□ OLS

StdResid

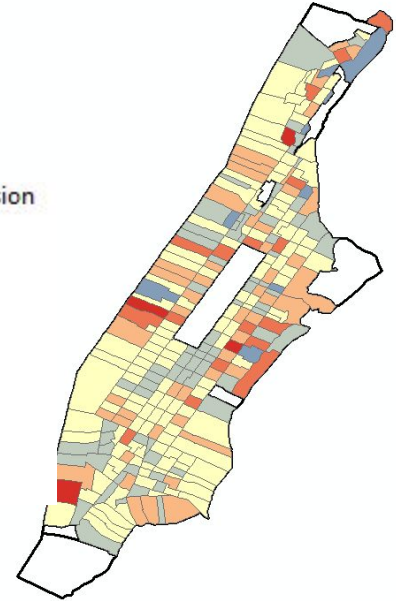
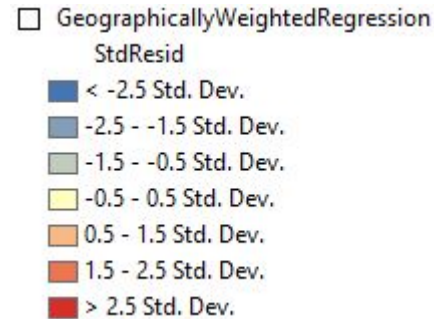
< -2.5 Std. Dev.
 -2.5 - -1.5 Std. Dev.
 -1.5 - -0.5 Std. Dev.
 -0.5 - 0.5 Std. Dev.
 0.5 - 1.5 Std. Dev.
 1.5 - 2.5 Std. Dev.
 > 2.5 Std. Dev.



Spatially Autocorrelated Residuals

Geographically Weighted Regression to Account for Spatial Autocorrelation

Bandwidth : 0.012093750735954341
ResidualSquares : 7476179.233883868
EffectiveNumber : 45.624894281525528
Sigma : 178.98333187530929
AICc : 3712.6123258026173
R2 : 0.41267865778345447
R2Adjusted : 0.30037382250546341
Succeeded at Wed Mar 9 09:10:33 2022 (Elapsed Time: 3.92 seconds)



Residuals are not spatially
autocorrelated

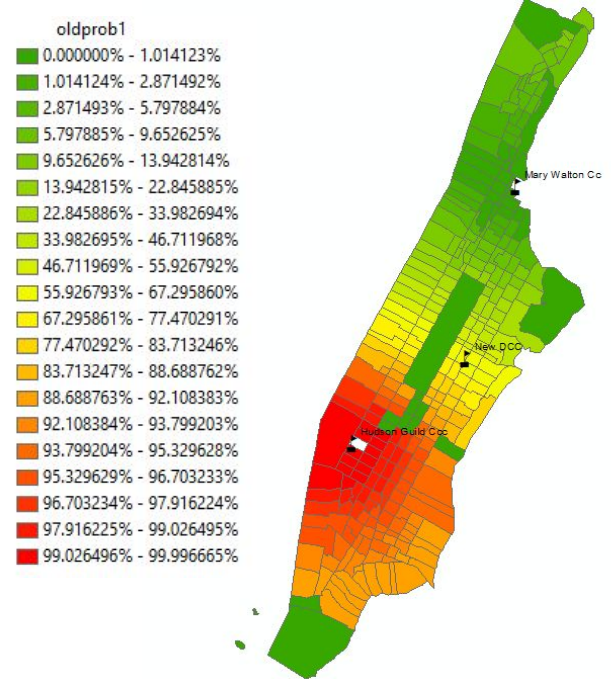
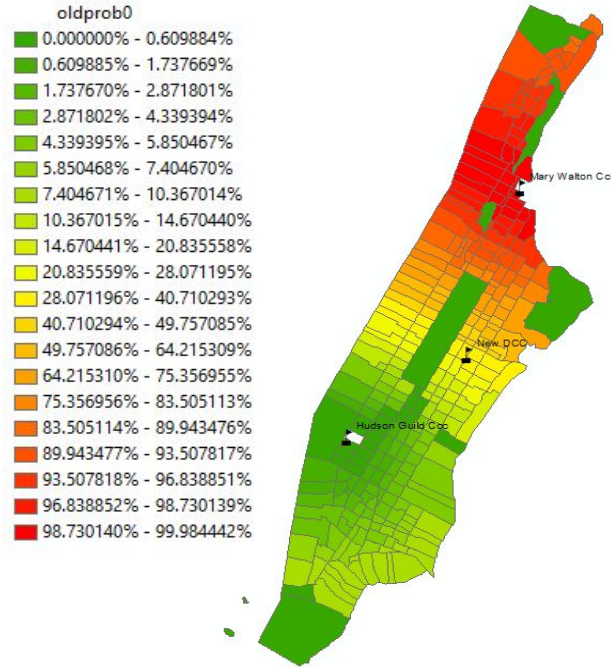


Spatial Interaction Model
of Day Care Facilities in
Manhattan

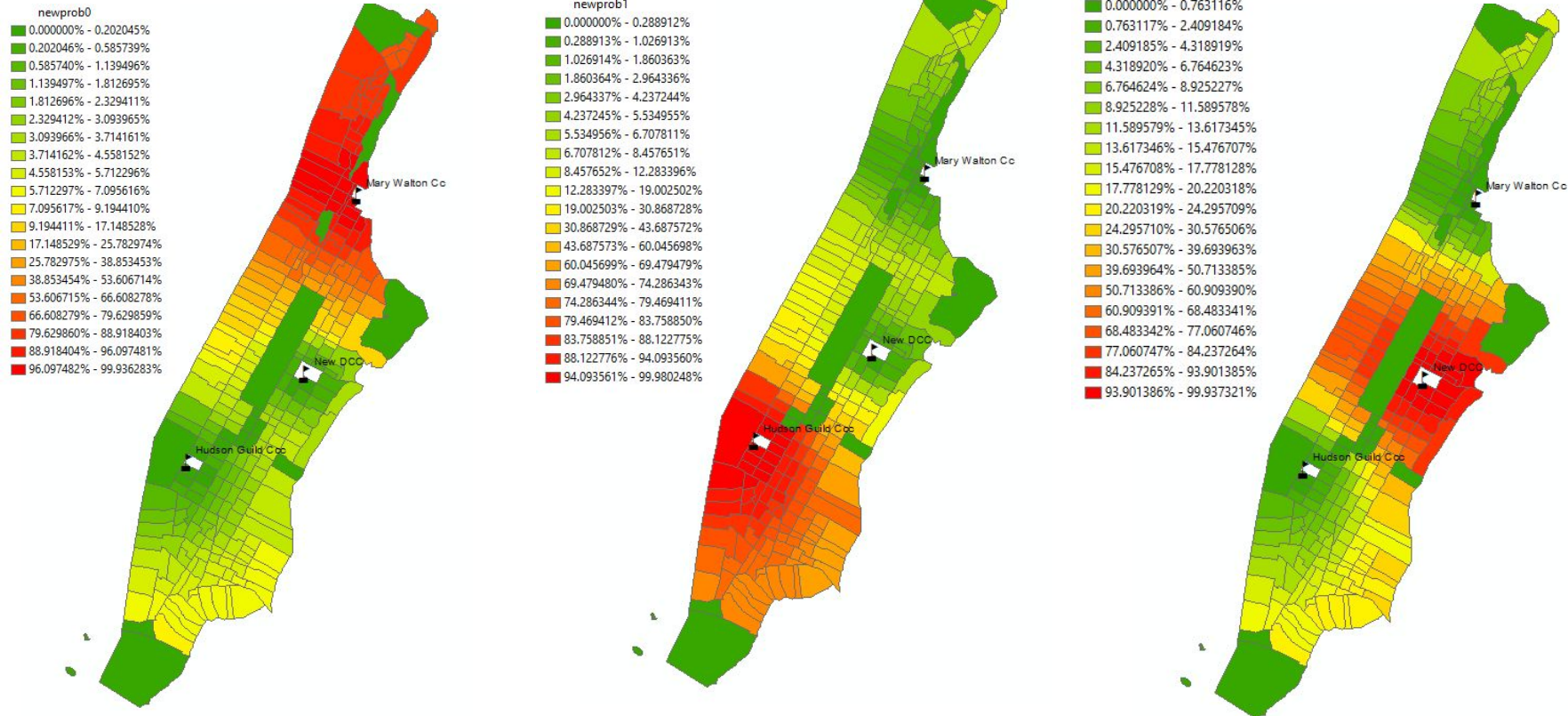
Selected Day Care Facilities in Manhattan



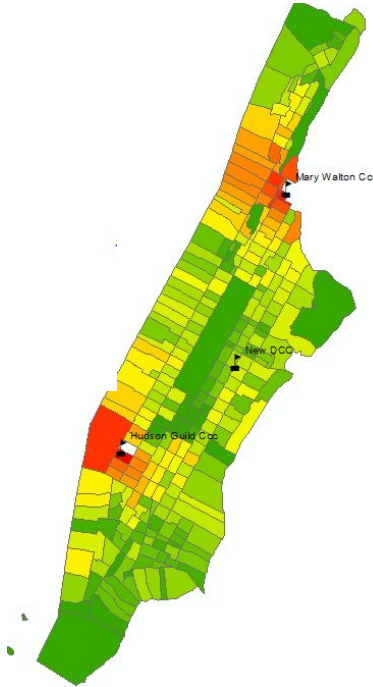
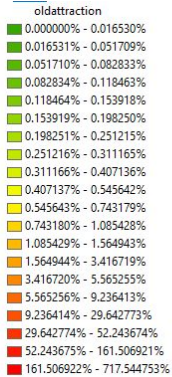
Proximity to Selected Child-Cares (Without Including New CCF)



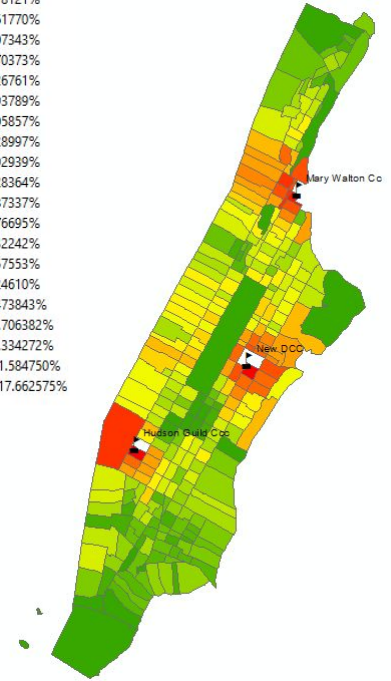
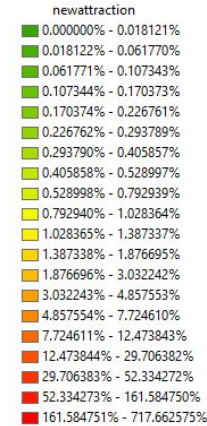
Proximity to Selected Day-Cares (Including New CCF)



Attraction of Census Tracts to Selected Childcare Facilities

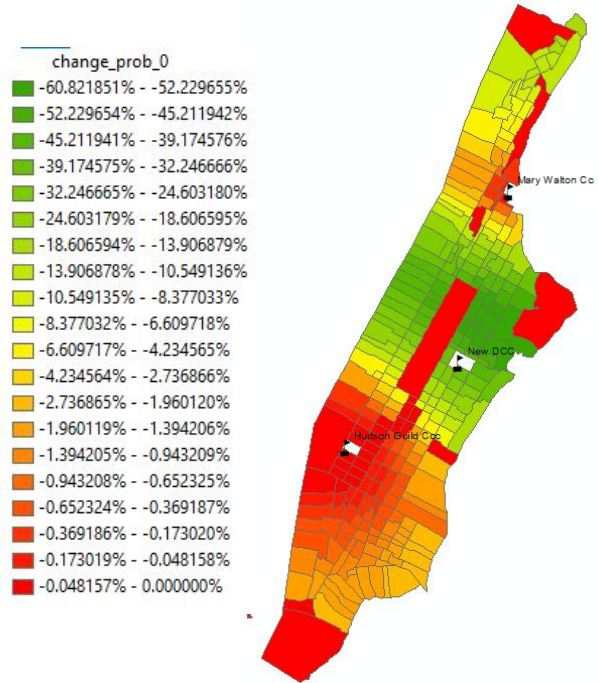


Old

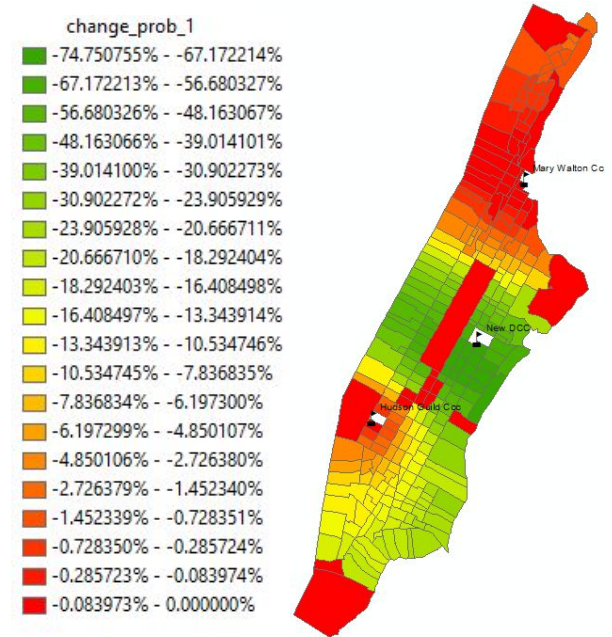


New

Change in probability of a child going to any of the selected Child-Cares



For DCC 0: Mary Walton CC



For DCC 1: Hudson Guild CC

Observations

- There is a need for childcare facilities in low income areas where there are more children.
- There are more children facilities in high income areas.
- LISA clusters for both number of children below 5 and income are found to be very similar.
- The impact of number of children below 5 years in the spatial interaction model is sometimes overpowered by that of distance.
- More variables are needed to estimate the number of children in a census tract, apart from the median household income in that tract.
- Median household income and number of children below 5 years of age in a census tract are both spatially autocorrelated.