URP 6931 Group Project – Final Presentation

Understanding the impacts of the 2008 recession on the labor market geographies of Florida

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Introduction

- Financial crisis in 2008
- One of the most serious financial crises that happened in history
- Crisis is followed by a recession
- Influenced the labor market and increased the unemployment rate

- Commuting network
- A major aspect of daily urban rhythms.
- Important for urban economic and transportation development
- Crucial for public health institutions, policymakers, and urban planners
- Changes in labor market could influence workers' commutes

Literature

Understand the structure of commuting networks at multiple scales using network analysis.

Multiple metrics have been used before like average path length, diameter, clustering coefficient, and entropy [1-4].

Node properties like node degree and betweenness centrality can be used to understand urban hierarchy [5-6].

Apply community detection methods to delineate local labor market areas [7-9].

Recent studies focused on the socioeconomic dimensions of commuting patterns, such as gender, income, and ethnicity. [10-15]

Spatial segregations are spotted in the mobility network in multiple metropolitans in the US and some other countries [17-19].

Research Questions

- How the recession in 2008 influenced the geographies of local labor markets of the state of Florida?

- How these impacts vary across different income groups?

Data

- Working population gradually declined after 2007, but rebounded by 2011.
- Employment rate of the low- and medium-income population has decreased to different degrees, while the high-income group has received less impact.

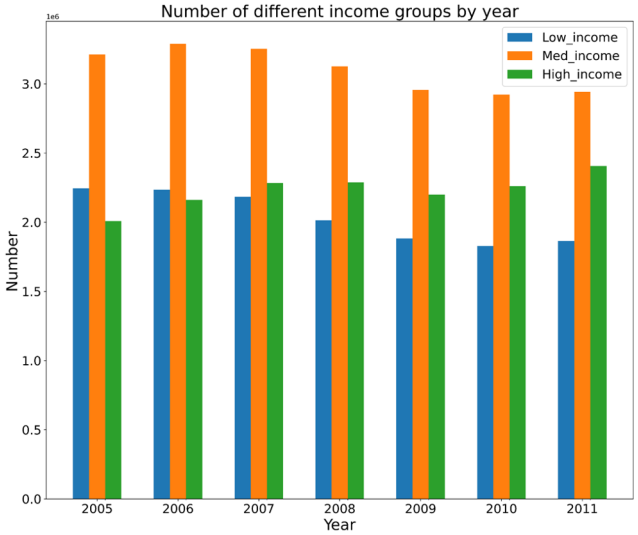


Fig. 1.

Table. 1.

Year	2005	2006	2007	2008	2009	2010	2011
Trips	7465702	7684443	7720619	7428443	7037227	7011303	7213642

otract	dtract	trtID_x	trtID_y	x_x	x_y	y_x	y_y	S000	SE01	SE02	SE03
12057011902	12065250101	1903	1038	352997.0135	223270.2730	3099959.942	3378798.410	1	1	0	0
12011050601	12051000100	509	2781	587289.6652	506598.5682	2896103.972	2959911.833	1	0	0	1
12011060112	12051000100	442	2781	573912.8280	506598.5682	2898158.392	2959911.833	1	1	0	0
12011060116	12051000100	40	2781	572375.9623	506598.5682	2894894.228	2959911.833	1	0	0	1
12011060118	12051000100	337	2781	569479.7187	506598.5682	2895237.335	2959911.833	1	0	0	1

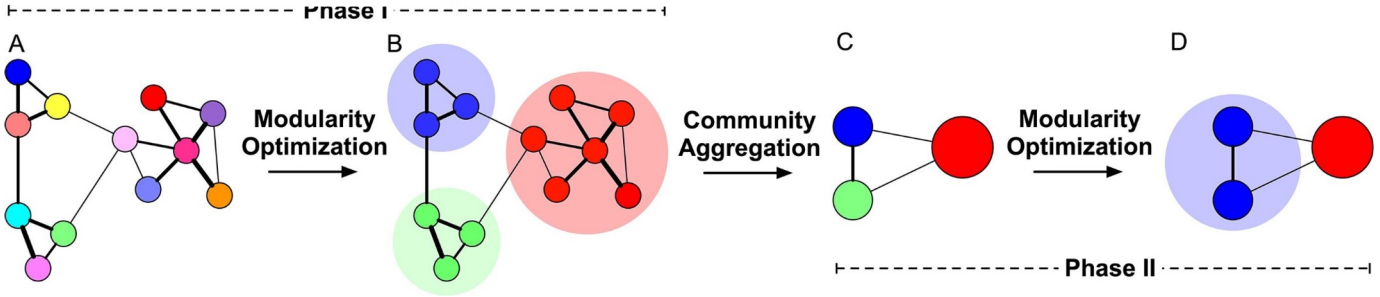
Fig. 2.

Method - Community Detection

Labor market: an economically integrated area where most individuals reside and work with few leaving it for employment

Louvain community detection method ((Blondel et al., 2008)

Modularity Q equals to: $$Q(G,S) = \frac{1}{2m}\sum_{z\in S}\sum_{i,j\in z}\left(A_{ij} - \frac{k_i k_j}{2m}\right)$$



Hu, Y., & Huang, J. , 2023)

This method starts from a network partition in which each node forms its own community (A). It then moves individual nodes from one community to another to find a partition leading to the greatest increase in modularity (B). Based on this partition, a new network is created by aggregating communities into nodes (C). The method then moves individual nodes in the new network to find a partition with the greatest modularity gain (D). These steps are repeated until the modularity cannot be increased further.

Method – Similarity Metric

Chamfer Discrepancy (Nguyen et al., 2021**)**

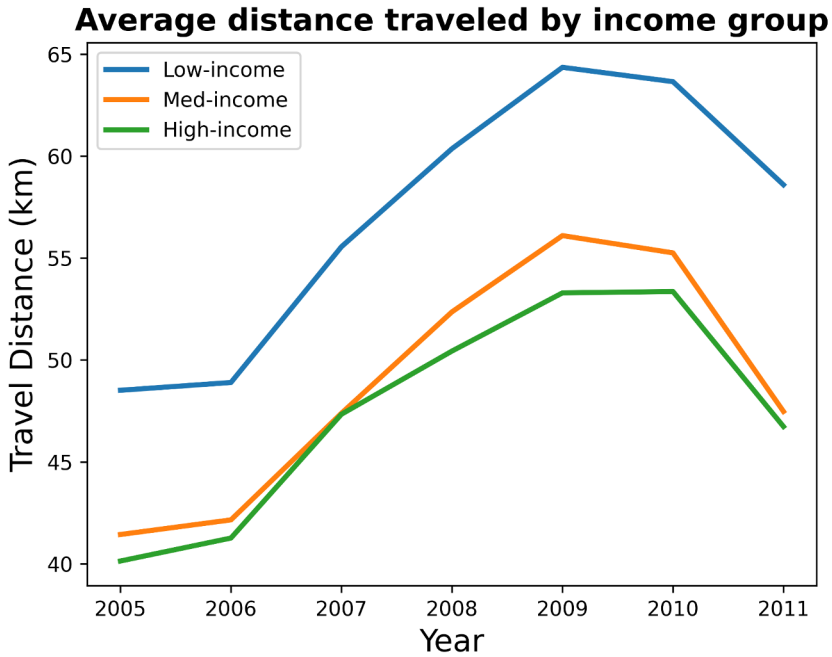
- Chamfer discrepancy is a measure of dissimilarity between two sets of points in a metric space.
- It is calculated by finding the minimum distance between each point in one set and its closest point in the other set, and then summing up these distances for all points in both sets.
- In our case, x,y represent the geographical centroids of communities, which are polygons.

$$d_{\mathrm{CD}}(P,Q) = \frac{1}{|P|}\sum_{x\in P}\min_{y\in Q}||x-y||_2^2 + \frac{1}{|Q|}\sum_{y\in Q}\min_{x\in P}||x-y||_2^2.$$

Results

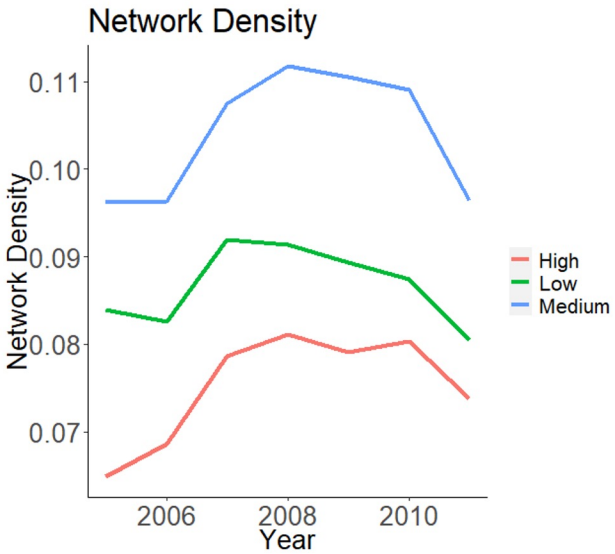
- The commuting distance of the three groups started to increase rapidly from 2007 and started to decrease in 2010.
- The average commuting distance generally increased by more than 10 km in 2009 compared to 2005.

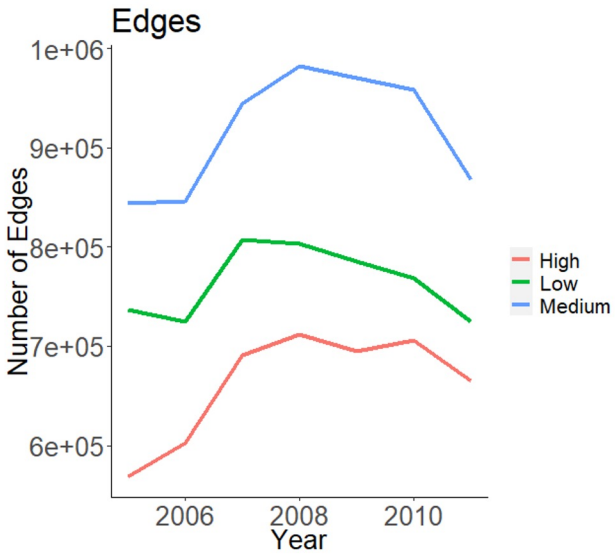
Income Group	Max Growth
Low-income	15.85
Mid-income	14.67
High-income	13.23

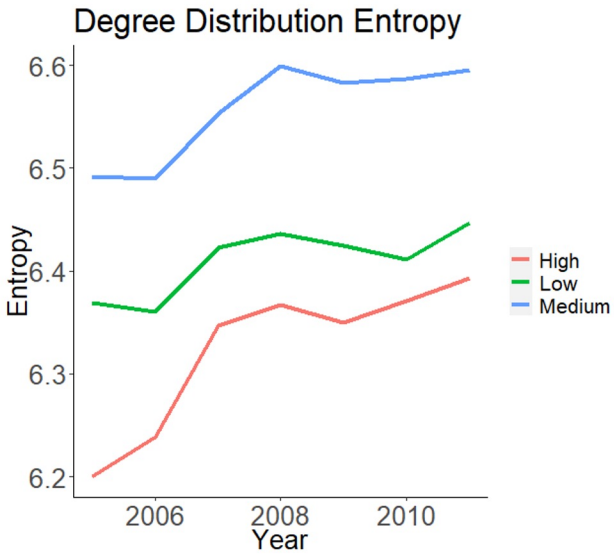


Results – Global Network Metrics

- High network density and number of edges around 2008, Medium > Low > High
- Entropy shows an overall increasing trend, 2008 is a high point, Medium > Low > High



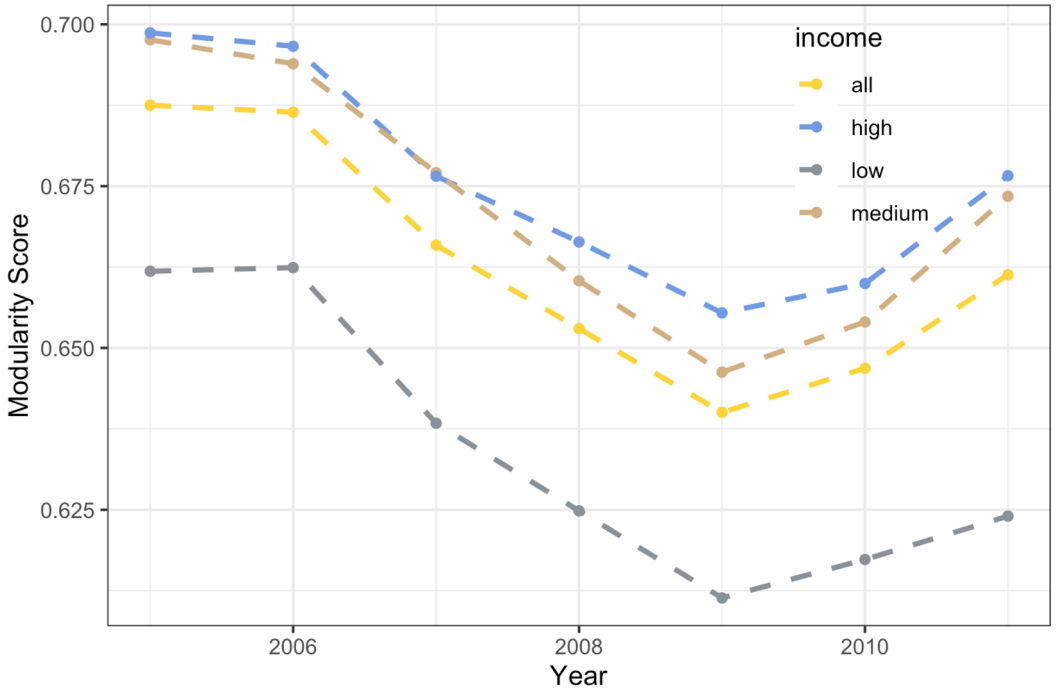




Results – Community Detection

Changes of the modularity scores

- The modularity score ranges from 0.6-0.7 across years,indicating significant community structure.
- High>Medium>Low
- Drop between 2006-2009, increase since 2009

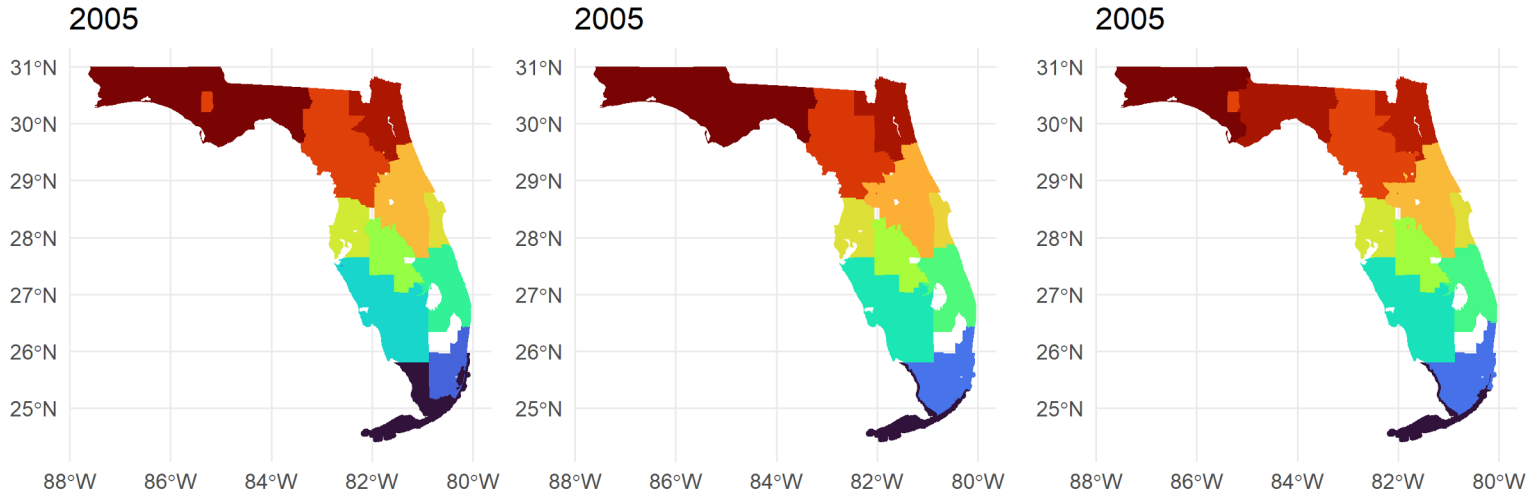


Changes of the modularity scores (2005-2011)

Results – Community Detection

Mapping Community Structure

- Despite community detection not accounting for spatial interactions between census tracts, it is observed that a majority of tracts within the same community tend to remain spatially contiguous.
- No visually discernible differences found in the detected communities across various income groups.

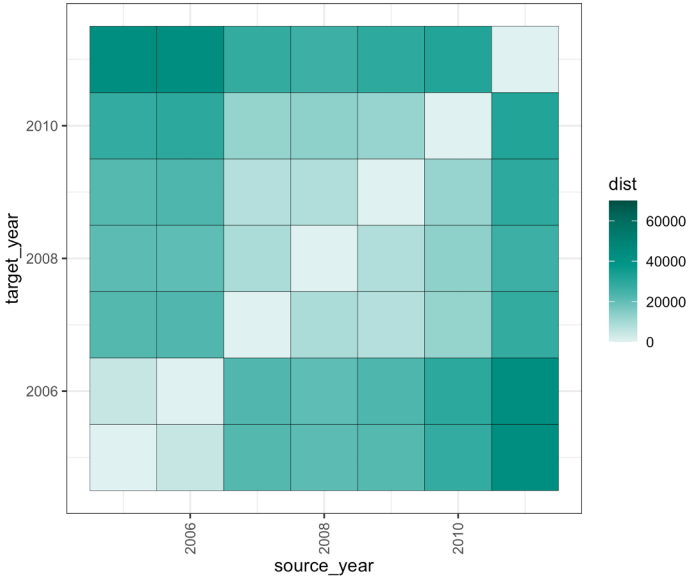


Lower Income | Medium Income | Higher Income

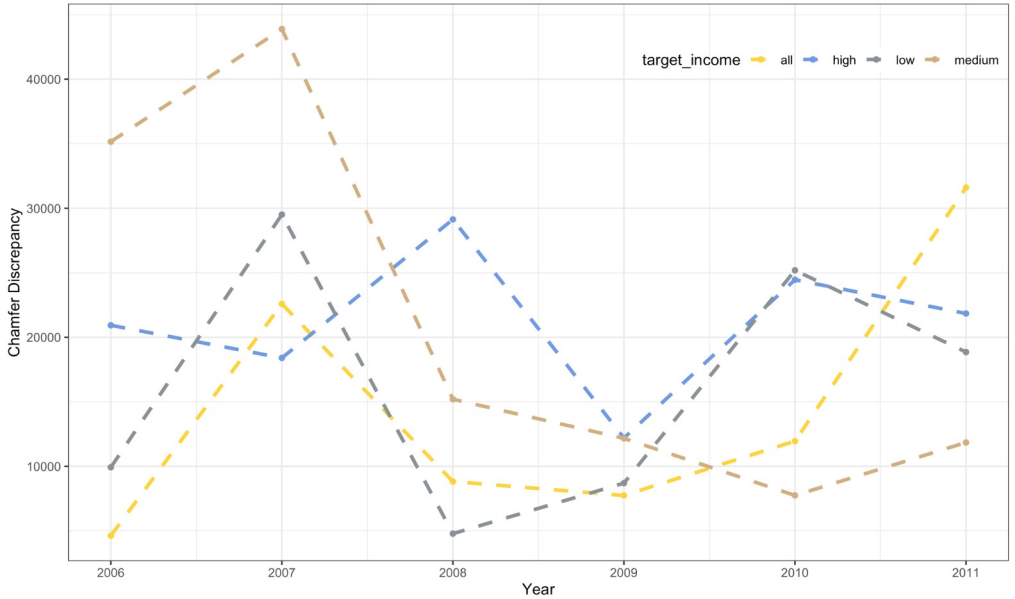
Results – Chamfer Discrepancy

Temporal Variations

- The community structures of 2005, 2006 and 2011 are quite distinct from those of other years.
- The community partition is more stable for medium income group.



Chamfer Discrepancy Matrix (All flows)

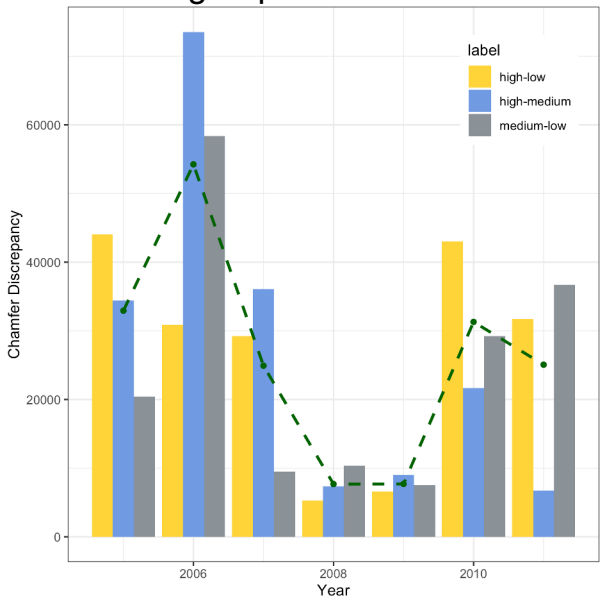


Temporal variations in the chamfer discrepancy between the community structure between two consecutive years

Results – Chamfer Discrepancy

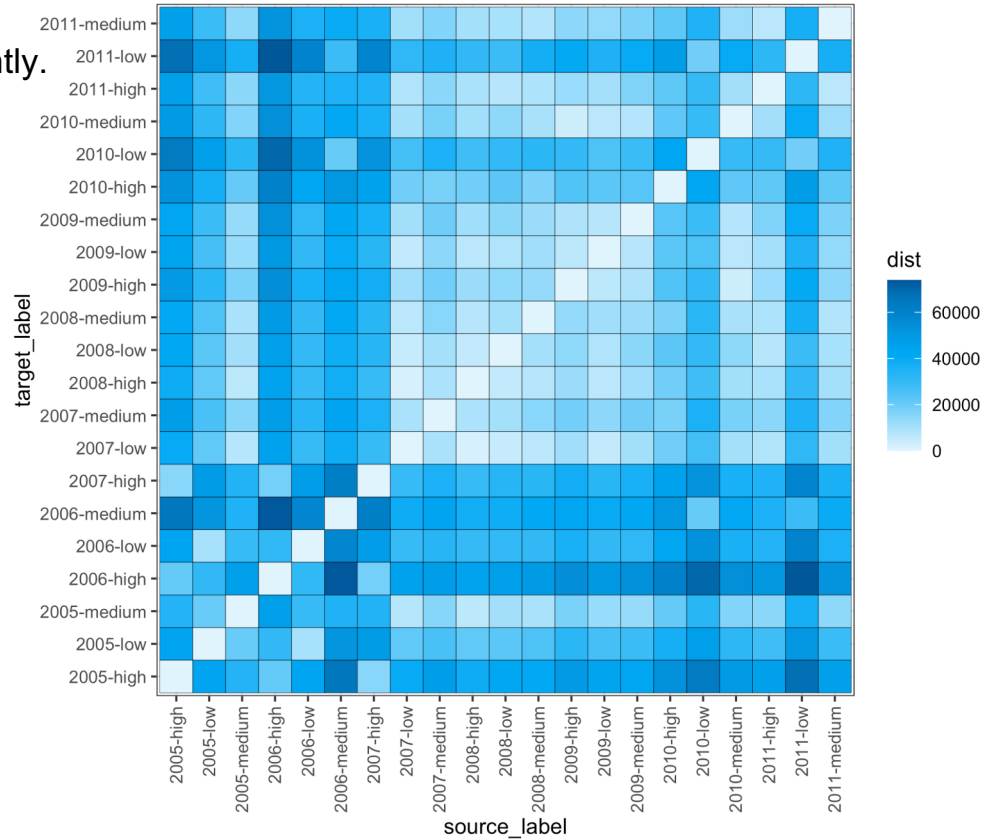
Differences across income groups

- In 2008,2009 the disparity decreases significantly. The discrepancy between lower income group and other groups increases after 2010



Chamfer discrepancy between the community structure of different income groups across years

Chamfer Discrepancy Matrix



Conclusion and Discussion

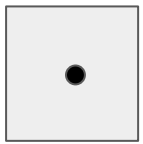
Conclusions

- **The 2008 financial crisis has significant impact on the labor market of Florida**:
  - The working populations declined after 2007 but rebounded in 2011.
  - The average commuting distance has increased significantly after 2008, especially for the lower income groups.
  - The size and connectivity of commuting network decreased after 2008.
- **It has observed significant spatially embedded commuting structure in the commuting network of Florida.**
- **There are slight changes in the community structure of the commuting network of Florida across years:**
  - The discrepancy between the community structures of 2007-2009 is less significant.
  - The community partition is more stable for medium income groups
- **The disparity of labor market division across different income groups decreased remarkably in 2008 but increased after 2010.**

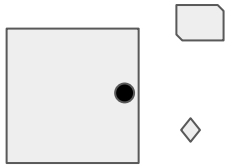
Conclusion and Discussion

Discussions

- **Methodology**
  - We use the geographical centroids of the community, which is a polygon, to calculate the chamfer distance.
  - While most of the communities are spatially contiguous, there are still some “enclaves” in the community partition, which might influence the accuracy of the metric。



Spatially contiguous community



Non-contiguous community

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