IMPROVING ACCURACY IN DEMOGRAPHIC ANALYSIS

Census Tract Income Analysis for Zip Code 53593 in Dane County, Wisconsin

Prepared for: *Educational Purposes*
Prepared by: *DemoAnalytics*
Date: *11/19/25*

Contents

Project Description

This project examines the difference between ZIP code–level and census tract–level demographic data using ZIP Code **53593** in Dane County, Wisconsin. ZIP codes are commonly used in nonprofit, planning, and community development work, but they are postal delivery zones—not statistical geographies. As a result, ZIP-level demographic summaries can mask substantial variation within the communities they represent.

Using American Community Survey (ACS) 2022 5-year data, this analysis compares the ZIP-level median household income for 53593 to the aggregated medians of the individual census tracts contained within the ZIP boundary. The results show a **significant 35% difference** between the ZIP median household income ($130,289) and the combined tract-level median ($85,377), with notable variation among individual tracts.

This report demonstrates why census tracts—designed specifically for demographic and socioeconomic analysis—provide more accurate neighborhood-level insight than ZIP codes. The findings support applications in planning, policy development, grant writing, public health, equity analysis, and community needs assessments.

All data and visualizations were prepared using R (tidycensus, tidyverse) and QGIS.
This repository includes the R code, source data references, charts, and maps used in the analysis.

1. Executive Summary

This analysis examines the difference between ZIP code–level and census tract–level median household income within ZIP Code **53593** in Dane County, Wisconsin. ZIP codes are frequently used in nonprofit, planning, and community development work, but they are postal delivery zones—not statistical geographies. As a result, they often mask significant variation within the communities they represent.

Using American Community Survey (ACS) 2022 5-year estimates, this project compares:

- **ZIP Code 53593 Median Household Income: $130,289**
- **Combined Census Tract Median Household Income: $85,377**

This represents a **35% difference** between the ZIP-level estimate and the aggregated tract-level median, with substantial variation among individual tracts.

The findings demonstrate that **census tracts offer more accurate and reliable neighborhood-scale insight** than ZIP codes. This is especially relevant for organizations engaged in planning, equity analysis, public health, housing, community development, or grant writing, where demographic accuracy is essential.

2. Data Sources

This analysis draws from publicly available datasets:

Primary Sources

- **American Community Survey (ACS) 2022 5-Year Estimates**
    - Median Household Income (Table B19013)
    - Census Tract Geography (Dane County, WI)
    - ZCTA-level estimates for ZIP Code 53593

Geographic Reference Layers

- Census Tracts (TIGER/Line Shapefiles)
- ZIP Code Tabulation Areas (ZCTAs)
- Administrative boundaries from the Census Bureau

Tools & Software

- **R** (tidycensus, tidyverse)
- **QGIS** for spatial visualization
- **GitHub** for report hosting
- **Word / PDF** for final document production

All datasets are publicly accessible through the U.S. Census Bureau.

3. Methods

3.1 Data Extraction

Data were obtained using R's **tidycensus** package.
Steps included:

1. Pull ACS 2022 5-year estimates for:
    - Census tracts within Dane County
    - ZCTA 53593
2. Extract the **Median Household Income** variable.
3. Convert estimates into a uniform data frame.

3.2 Geographic Alignment

ZIP Code 53593 overlaps several census tracts.
To avoid double counting, tracts were:

- Identified spatially
- Extracted based on overlap
- Aggregated using a **median of tract medians** (accurate for skewed distributions)

3.3 Visualization Production

Visuals include:

- Bar chart (ZIP vs combined tract median)
- Lollipop chart (variation across tracts)
- Boxplot (distribution within ZIP 53593)
- Tract-level QGIS income map

3.4 Statistical Considerations

- ACS margins of error were reviewed but not propagated
- Median of medians was used rather than weighted median due to data constraints
- Interpretation focuses on **relative differences**, not statistical significance

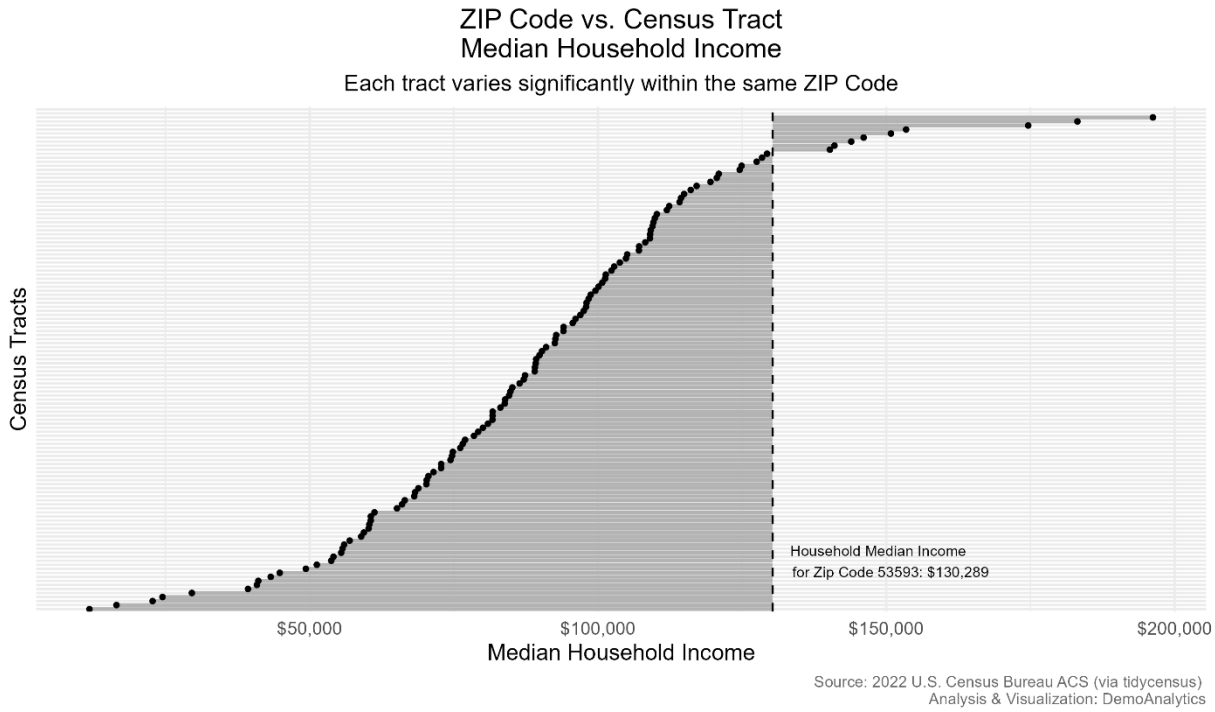
4. Visualizations

4.1 Zip Code vs. Tract

ZIP Code 53593 reports a median household income of $130,289.
The combined median across associated census tracts is $85,377.

4.2 Census Tract Median Household Incomes (Lollipop Plot)

FIGURE 1



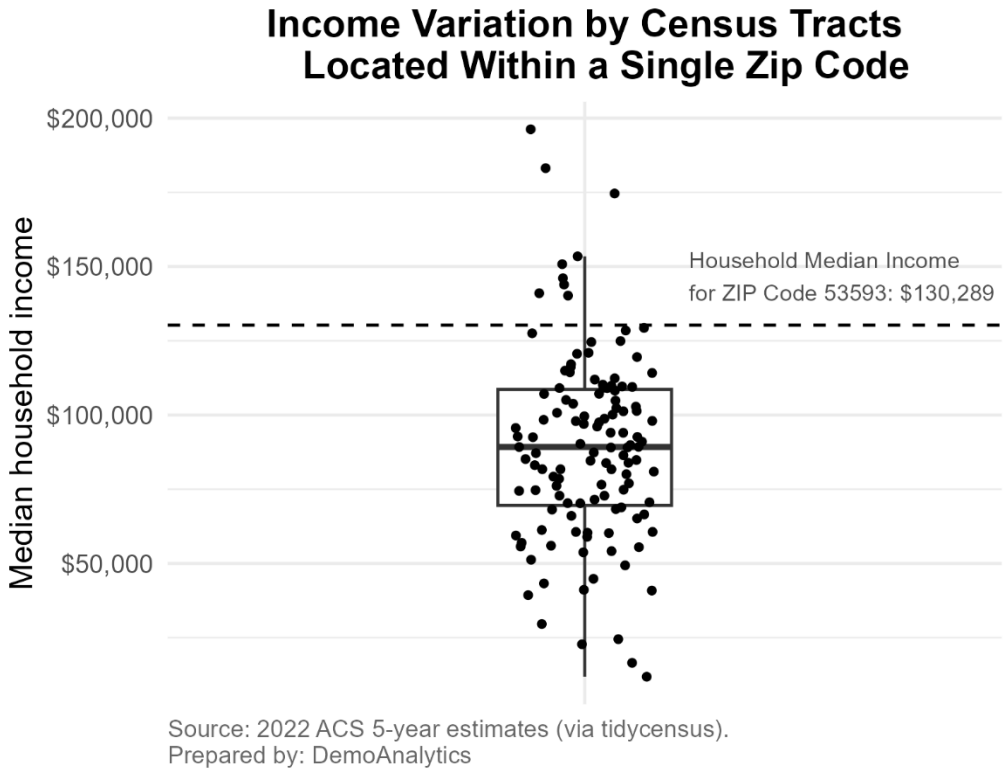
Census tract incomes within ZIP 53593 vary widely, illustrating why tract-level data is more reliable than ZIP summary values.

4.3 Income Distribution Across Census Tracts (Boxplot)

This boxplot illustrates how relying on ZIP Code–level median household income can conceal substantial socioeconomic variation within the ZIP Code itself. The dashed horizontal line represents the ZIP Code's median household income. The box, which captures the middle 50% of tract-level incomes (the interquartile range), sits entirely below the ZIP Code median. This indicates that most census tracts within the ZIP Code have household incomes significantly lower than the ZIP-level figure.

In other words, the ZIP Code median income does not reflect the economic conditions experienced by the majority of neighborhoods within that ZIP. When tract-level incomes cluster below the ZIP Code median, it shows how ZIP Code statistics can overstate economic well-being and mask local disparities. This demonstrates why census tracts are the more reliable and nuanced geography for understanding socioeconomic differences.

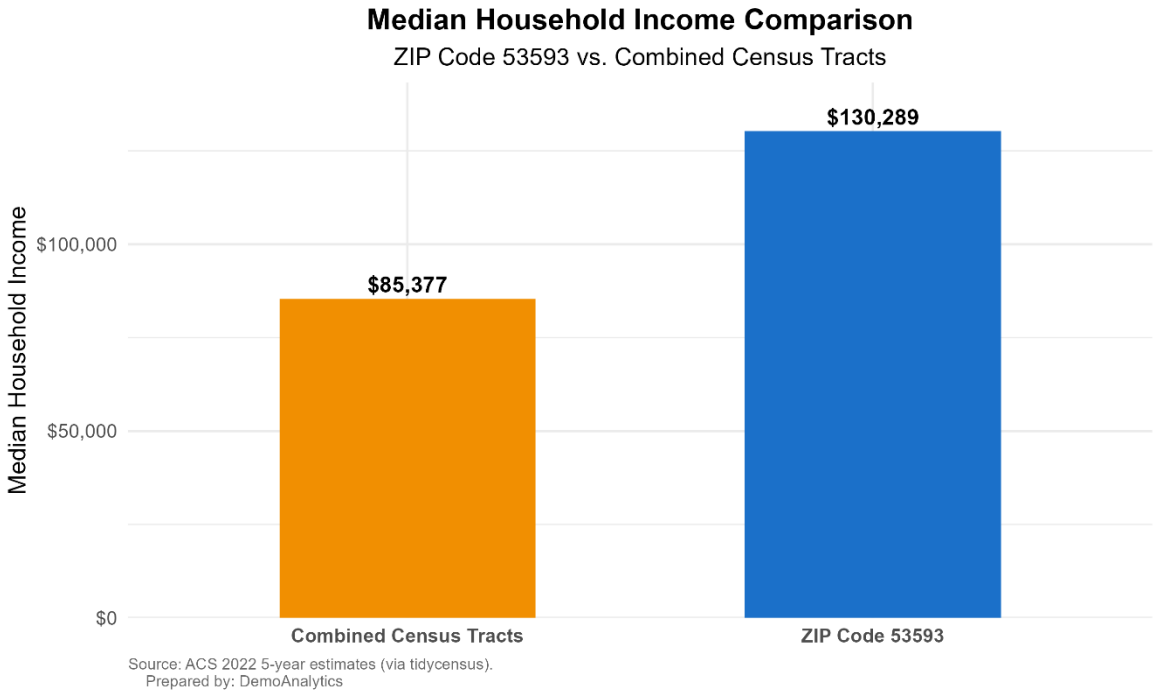
FIGURE 2



4.4 Combined Median Household Income Comparison

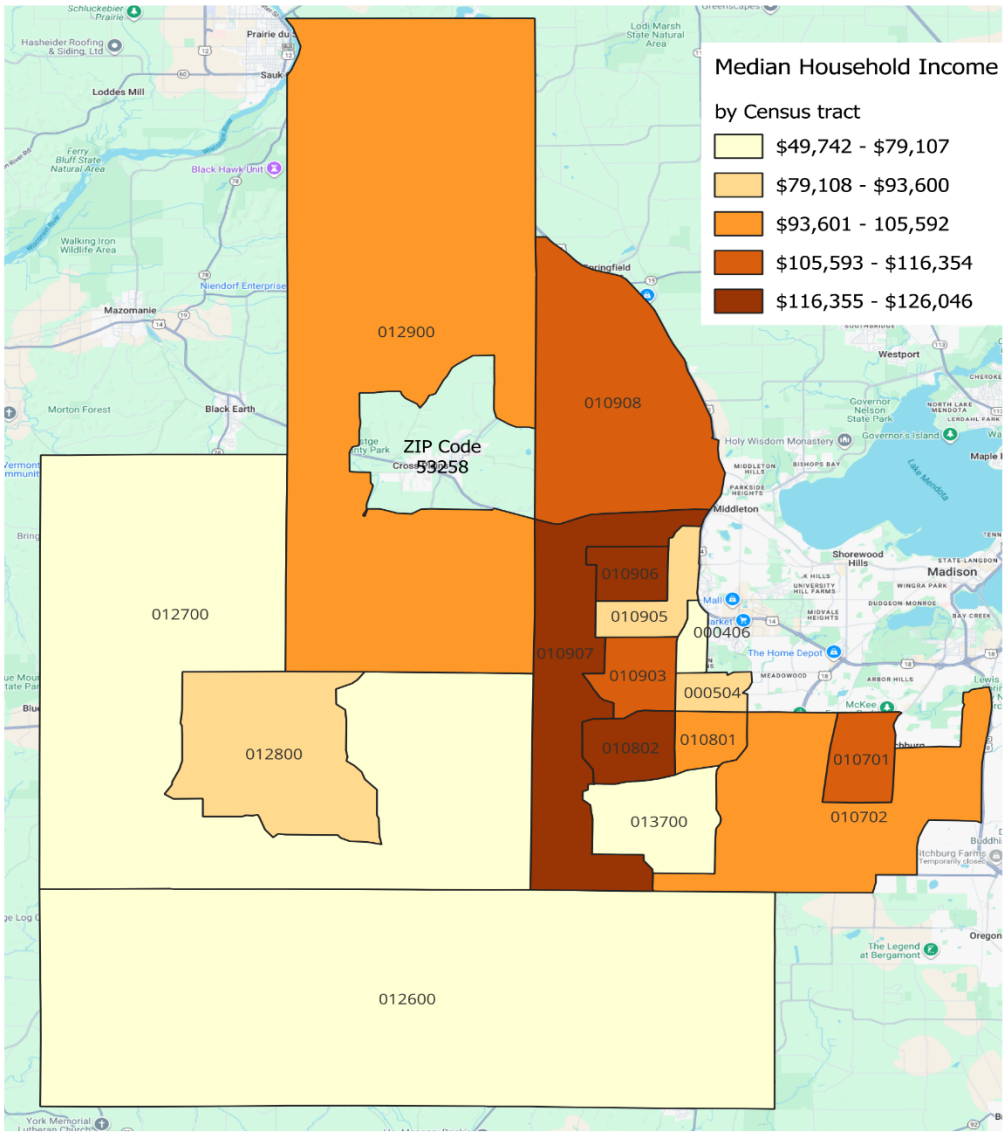
This chart compares two measures of median household income for the same geographic area. The ZIP Code 53593 median income is $130,289, but when we aggregate the individual census tracts inside the ZIP, the combined median income is only $85,377. This difference—over $44,000—demonstrates how ZIP-level statistics can obscure important socioeconomic variation within a community. ZIP codes are large, heterogeneous areas, and their medians reflect broad averages that can hide lower-income neighborhoods. Census tracts provide a more accurate, neighborhood-level understanding of economic conditions.

FIGURE 3



4.5 Census Tracts and ZIP Code 53593

Census Tracts Contained Within and Intersecting
Dane County WI ZIP Code 53593



Source: U.S. Census Bureau, American Community Survey 2022 5-Year Estimates.
Data processed in RStudio using tidycensus and tidyverse.
Prepared by: DemoAnalytics

5. Interpretation

The analysis reveals a **major discrepancy** between ZIP-level and tract-level estimates:

- ZIP estimates **oversimplify** neighborhood patterns
- Tract data exposes **meaningful internal variation**
- Income differences between tracts exceeded **$40,000–$60,000**
- Relying on ZIP-level data could lead to incorrect:
    - Needs assessments
    - Grant narratives
    - Program targeting
    - Planning decisions
    - Public health evaluations

This demonstrates why ZIP codes are **insufficient** for demographic analysis.

6. Conclusion

ZIP codes are convenient but unreliable for demographic analysis.
They are designed for mail delivery, not socioeconomic measurement, and they frequently conceal variation within communities.

Census tracts, by contrast:

- Represent stable, bounded neighborhoods
- Are built specifically for statistical purposes
- Provide higher resolution and accuracy
- Support data-driven planning and funding decisions

For organizations that require reliable demographic data—nonprofits, governments, planners, and foundations—**tract-level analysis is recommended whenever possible.**