

Competitive Factors of **St. Cloud** for Businesses

in Comparison with Comparable Upper Midwest Cities

STAT 381

Claude Lee | Hyesu Lee

St. Cloud Economic Development Authority (EDA)

First-stop for **business development** assistance

Dedicated to enhancing St. Cloud's **economic vitality** and expanding the city's tax and employment base

Project Goal

EDA's Economic Development Goal

Attract, retain, and grow business through
branding and **marketing**

Our Goal

Provide statistical evidence of competitive
factors of St. Cloud for business
establishments in comparison to other
comparable Upper Midwest cities

Research Question

Competitive Factors of St. Cloud for Businesses

- 1. Does St. Cloud offer better **Demographic** or **Economic** advantage for Businesses compared to similar upper Midwest cities?
- 2. What are some **Occupations** that present unique characteristics in St. Cloud compared to similar upper Midwest cities?

Comparable Upper Midwest Cities	
MN:	Rochester, Duluth, Mankato
ND:	Fargo, Grand Forks
WI:	Eau Claire, La Crosse
IA:	Dubuque, Cedar Rapids

Analysis Steps

01

Gather related data that can be classified into **metropolitan area**

02

Perform **statistical analysis** in each variable/factor

03

Identify **interesting factors** and their statistical & practical significance

04

Provide **descriptions** of competitive factors and its **relevance**

DATA

- Unit: Household/Person Yearly data
- City Area Approximate: Public Use Microdata Area (PUMA, \approx County level)
- Demographic

- Unit: Metropolitan Statistical Area, Monthly data (seasonally adjusted)
- Economic

- Unit: Metropolitan Statistical Area, Yearly data
- Occupation

Question #1

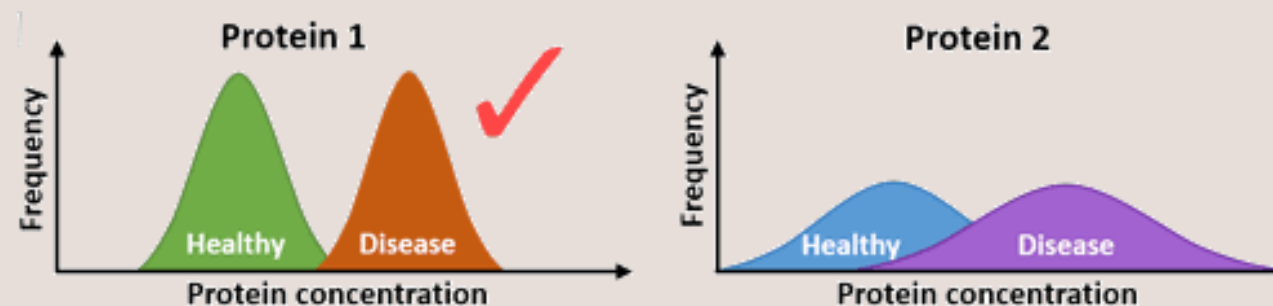
Does St. Cloud offer
better **Demographic** or **Economic
advantage** for Businesses
compared to similar upper Midwest cities?

Methodology – Statistical Method

One-Way Analysis of Variance (ANOVA)

Statistical method of **comparing** two or more **means** with respect to their variances

- **Significant Difference** in means
= The difference is extreme considering their variation
- **Less variant** samples → **More significantly different** in means



Question #1: Demographic and Economic Characteristics of St. Cloud for Businesses

Methodology – Application

IPUMS

- **One-Way ANOVA** with City Means per Year

- Variation: Household/Person*

*IPUMS specifies types of unit based on the nature of variable ex) Household income vs. Personal income

- **Years:** 2017-2019
- **Multiple comparisons** with St. Cloud → How different is St. Cloud from the other 9 cities?

LAUS

- **One-Way ANOVA** with City Means per Year
 - Variation: Seasonally adjusted 12 months
- **Years:** 2017-2020
- **Multiple comparisons** with St. Cloud (same as IPUMS)

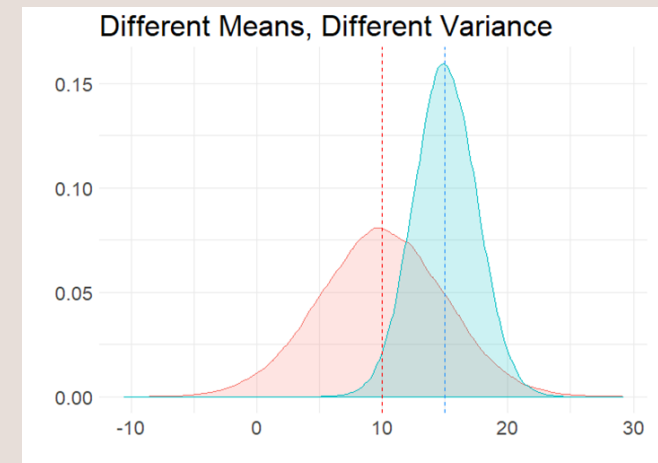
Question #1: Demographic and Economic Characteristics of St. Cloud for Businesses

Methodology – ANOVA

Multiple Comparison

ANOVA Procedure of **comparing** means in **pairs**

- Which city is significantly different from St. Cloud?
- Requires specification of **equal/unequal variance** between two groups



Question #1: Demographic and Economic Characteristics of St. Cloud for Businesses

Methodology – ANOVA

Levene's Test for Equal Variance

H_0 : All groups have equal variance

H_a : At least one of the group's variance is different

- Reject H_0 : Unequal Variance
 - ➔ **Dunnett's** Modified Tukey-Kramer Pairwise Multiple Comparison Test (**DTK**)
(May involve high error rate)
- Fail to reject H_0 : Equal Variance
 - ➔ **Tukey's** Honest Significant Difference (**HSD**)
(Very conservative error rate)

Question #1: Demographic and Economic Characteristics of St. Cloud for Businesses

Methodology – Identifying Significant Variables

Initial Variable Selection

- Generic characteristics
- Interpretable and related with EDA's goal

Significant Variable Selection

- Significant differences in **consistent direction** in **all years** with at least one city
- **Consistently significantly** low or high in all years

**The presentation only includes significant variables

Question #1: Demographic and Economic Characteristics of **St. Cloud** for Businesses

Demographic Characteristics with **IPUMS**

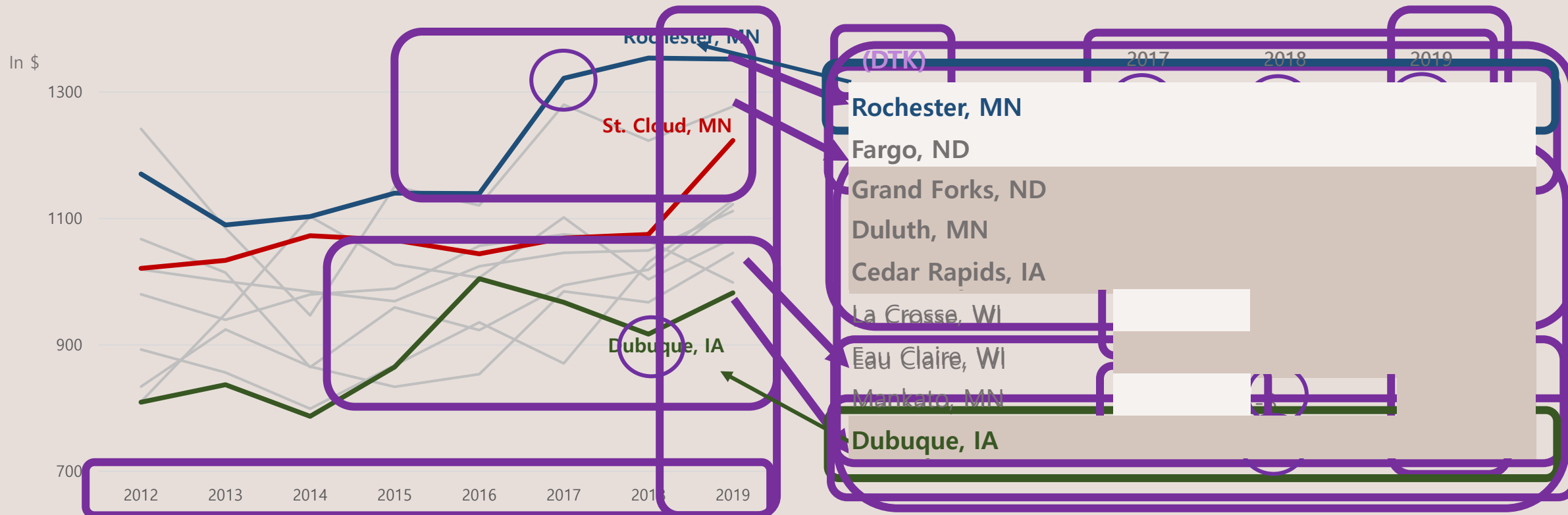
Average First Mortgage Payment



St. Cloud

One of the highest: significantly greater than the most cities

Significantly less than **Rochester, MN** & **Fargo, ND**

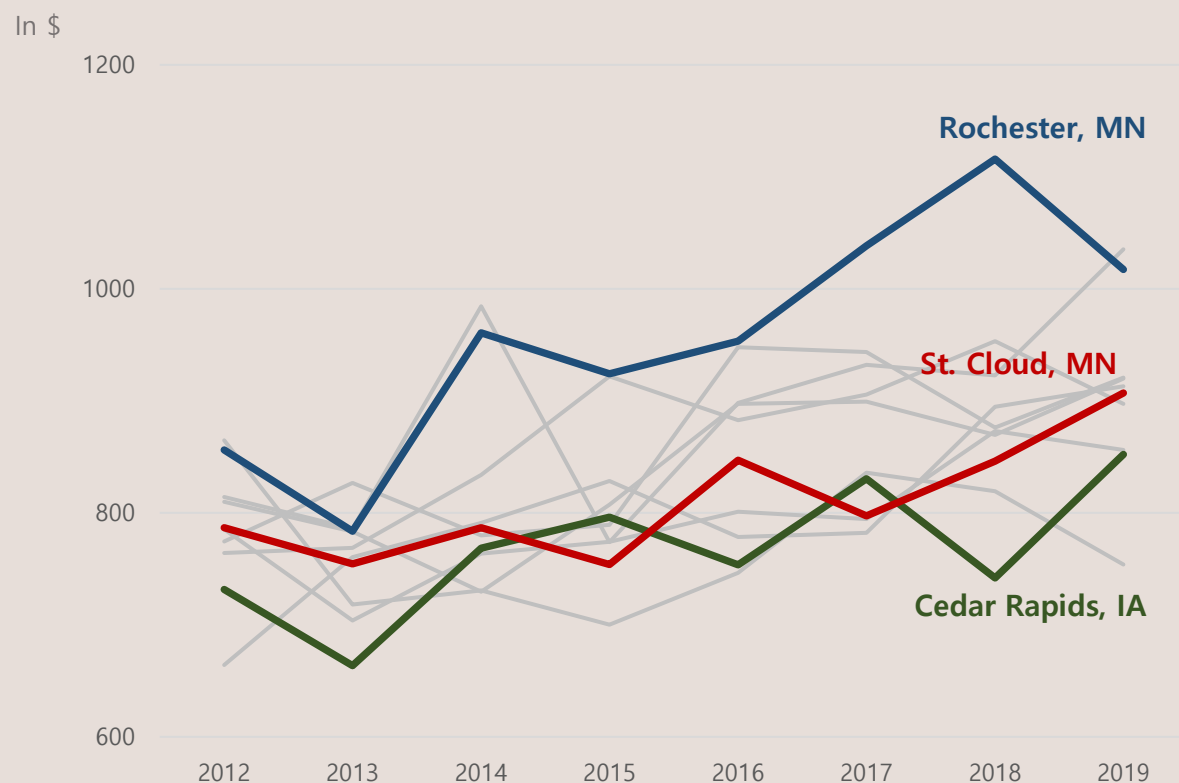


Average Gross Rent

● St. Cloud

Low to average: no significant difference with the most cities

Significantly less than **Rochester, MN, Fargo, ND, and Duluth, MN**



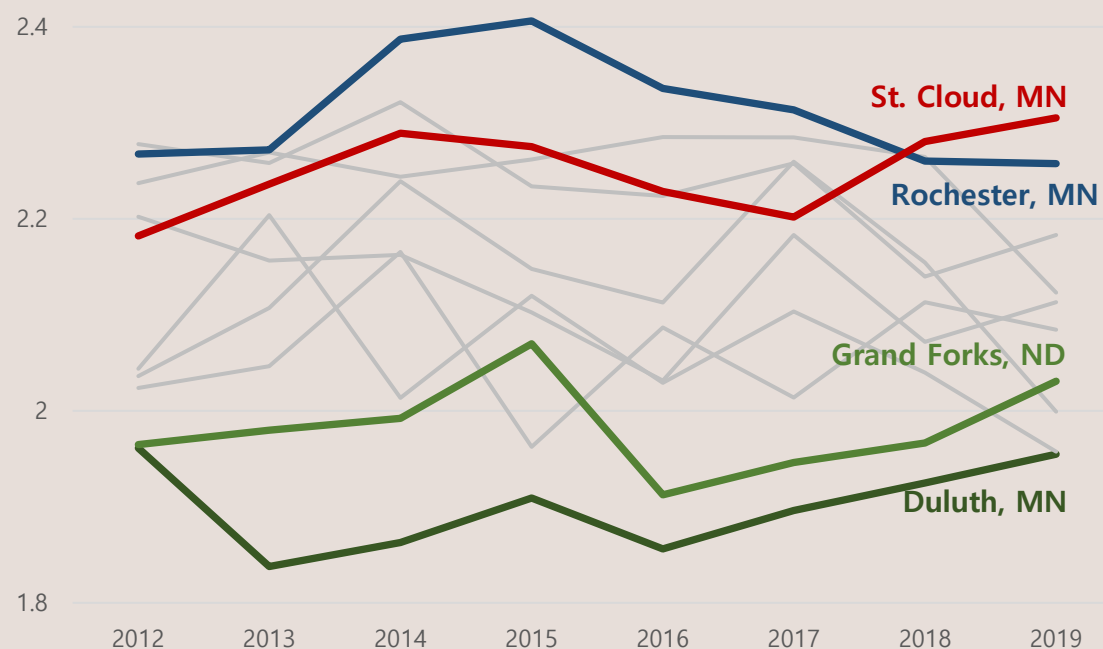
(DTK)	2017	2018	2019
Duluth, MN	+3*	+3*	+1*
Rochester, MN	+1*	+1*	+2*
Mankato, MN	+2*	+5*	+3
Fargo, ND	+5*	+7*	+4*
Grand Forks, ND	-9*	+4*	+5
La Crosse, WI	+4*	+2*	-6
Eau Claire, WI	-8	+6*	-7*
Cedar Rapids, IA	+7*	-9*	-8*
Dubuque, IA	+6*	-8*	-9*

Average Family Size

● St. Cloud

High to average: no significant difference with the most cities

Significantly greater than **Grand Forks, ND & Duluth, MN**

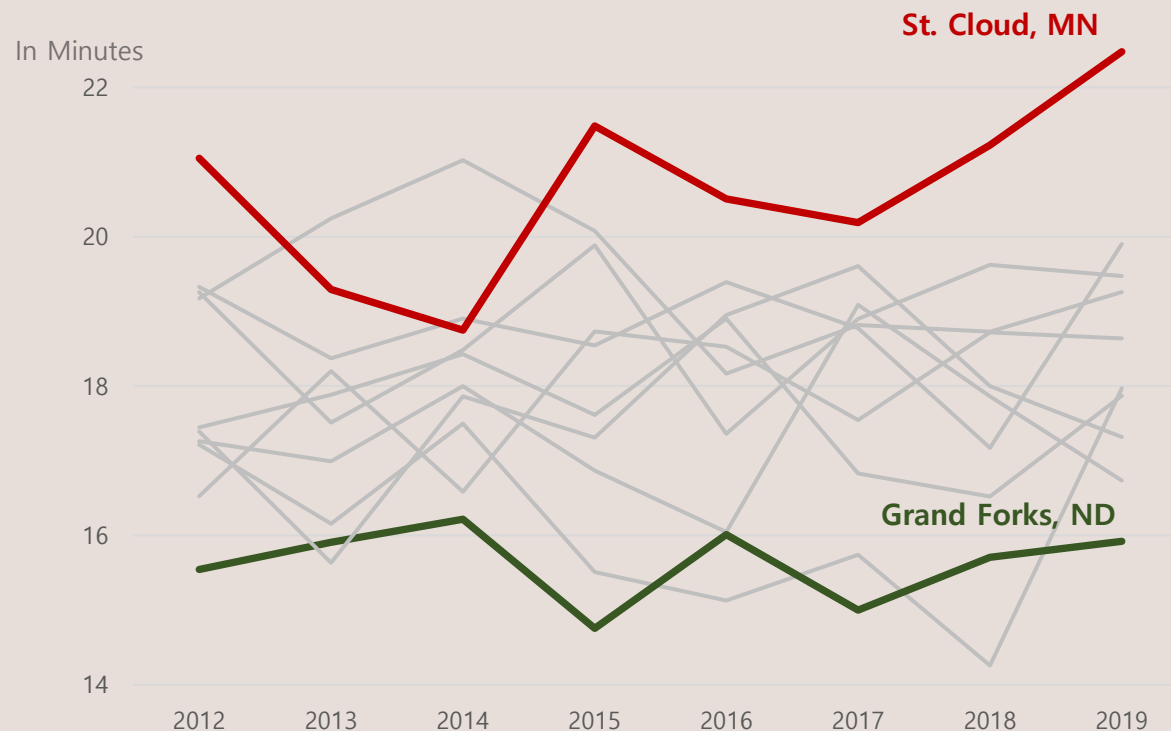


(HSD)	2017	2018	2019
Rochester, MN	+1	-2	-1
Cedar Rapids, IA	+4	-4	-2
Dubuque, IA	+2	-1	-3
Eau Claire, WI	-5	-6	-4
Mankato, MN	-7	-5	-5
Grand Forks, ND	-8*	-8*	-6*
Fargo, ND	+3	-3	-7*
La Crosse, WI	-6	-7	-8*
Duluth, MN	-9*	-9*	-9*

Average Travel Time to Work

● St. Cloud

The highest: significantly greater than all cities



(DTK)

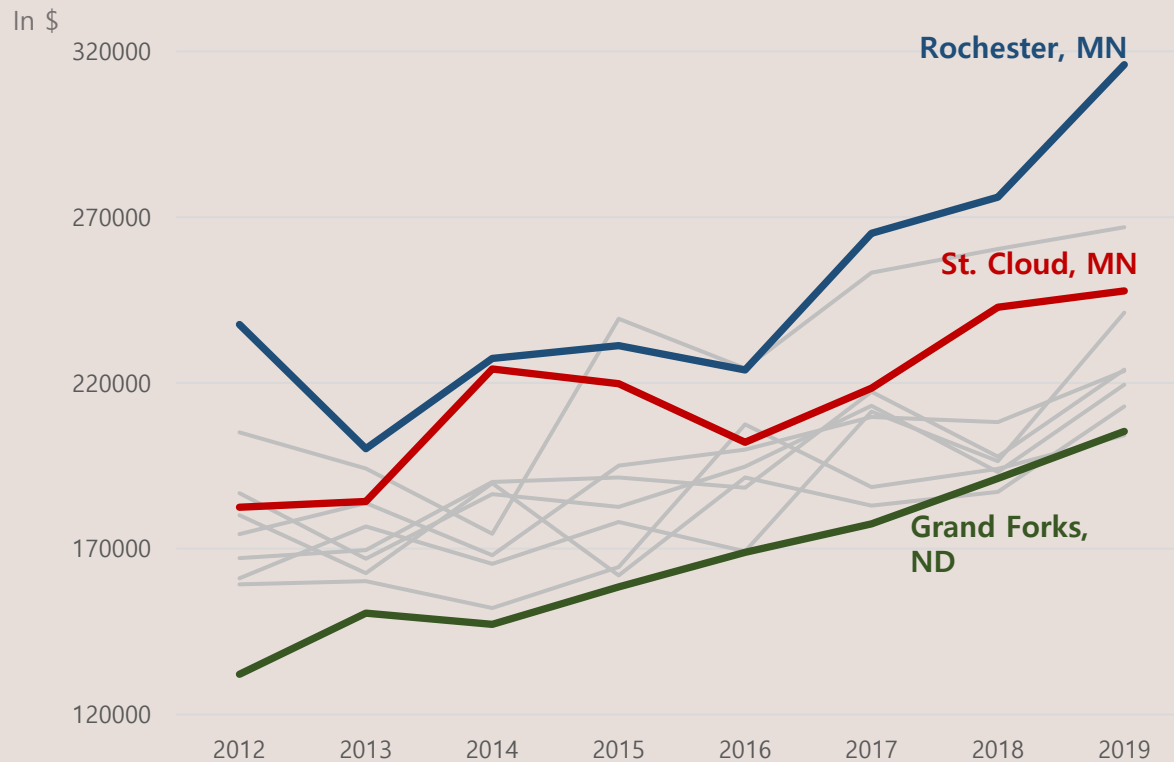
	2017	2018	2019
Cedar Rapids, IA	-5*	-6*	-1*
Dubuque, IA	-3*	-1*	-2*
Eau Claire, WI	-4*	-2*	-3*
Rochester, MN	-6*	-3*	-4*
Fargo, ND	-8*	-9*	-5*
La Crosse, WI	-7*	-7*	-6*
Mankato, MN	-1*	-4*	-7*
Duluth, MN	-2*	-5*	-8*
Grand Forks, ND	-9*	-8*	-9*

Average House Value

 **St. Cloud**

One of the highest: significantly greater than most cities

Significantly less than **Rochester, MN** & **Fargo, ND**



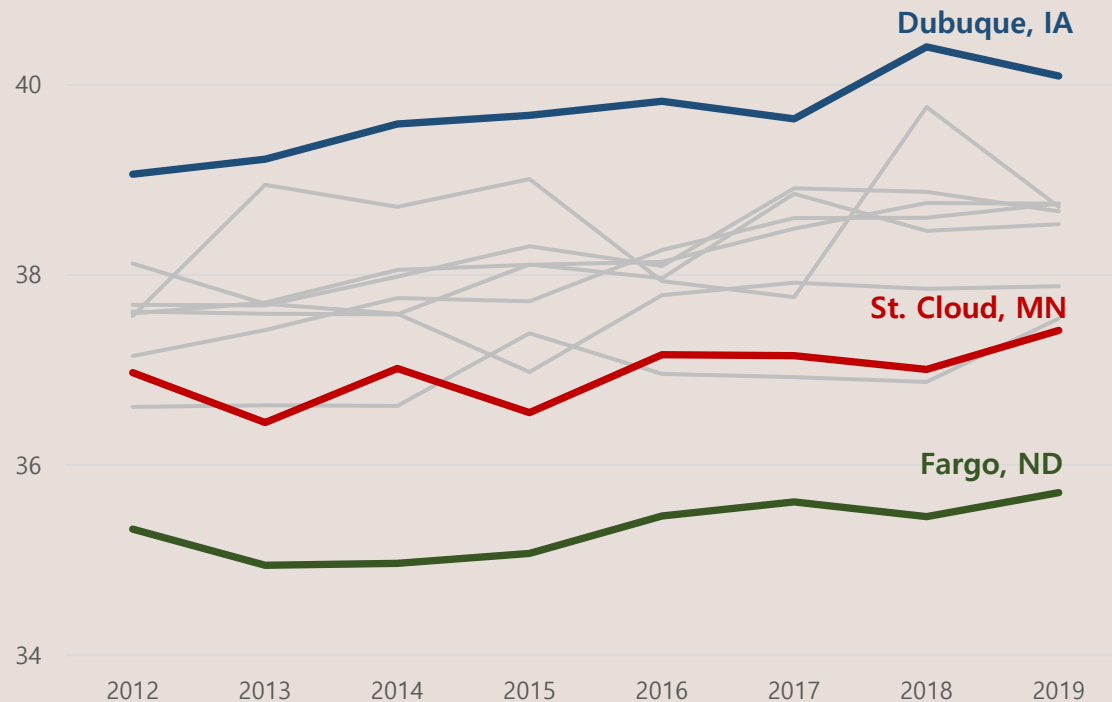
(DTK)	2017	2018	2019
Rochester, MN	+1*	+1*	+1*
Fargo, ND	+2*	+2*	+2*
Eau Claire, WI	-5*	-5*	-3*
La Crosse, WI	-3	-4*	-4*
Duluth, MN	-6*	-3*	-5*
Mankato, MN	-4*	-7*	-6*
Cedar Rapids, IA	-8*	-9*	-7*
Grand Forks, ND	-9*	-8*	-8*
Dubuque, IA	-7*	-6*	-9*

Average Age

● St. Cloud

One of the lowest: significantly less than the most cities

Significantly greater than **Fargo, ND**

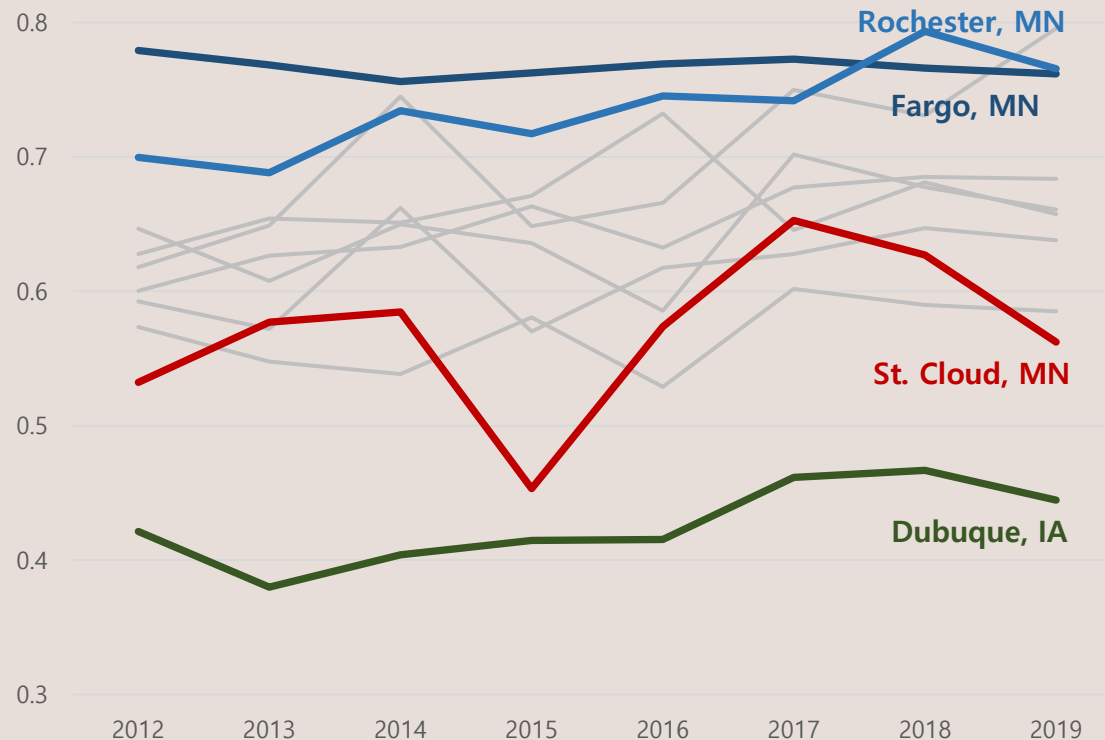


(DTK)	2017	2018	2019
Dubuque, IA	+1*	+1*	+1*
Rochester, MN	+4*	+5*	+2*
Cedar Rapids, IA	+5*	+4*	+3*
Duluth, MN	+7*	+2*	+4*
Eau Claire, WI	+2*	+3*	+5*
La Crosse, WI	+3*	+6*	+6*
Grand Forks, ND	+6*	+7*	+7*
Mankato, MN	-8	-8	+8
Fargo, ND	-9*	-9*	-9*

Proportion of Finished Some College

● St. Cloud

One of the lowest: significantly less than **Rochester, MN, Fargo, ND, Duluth, MN, and Mankato, MN**
 Significantly greater than **Dubuque, IA**



(DTK)	2017	2018	2019
Duluth, MN	+1*	+3*	+1*
Rochester, MN	+3*	+1*	+2*
Fargo, ND	+2*	+2*	+3*
Grand Forks, ND	+5	+6*	+4*
Mankato, MN	+4*	+4*	+5*
La Crosse, WI	-6*	+5*	+6*
Cedar Rapids, IA	-8*	-7	+7*
Eau Claire, WI	-7*	-8*	+8*
Dubuque, IA	-9*	-9*	-9*

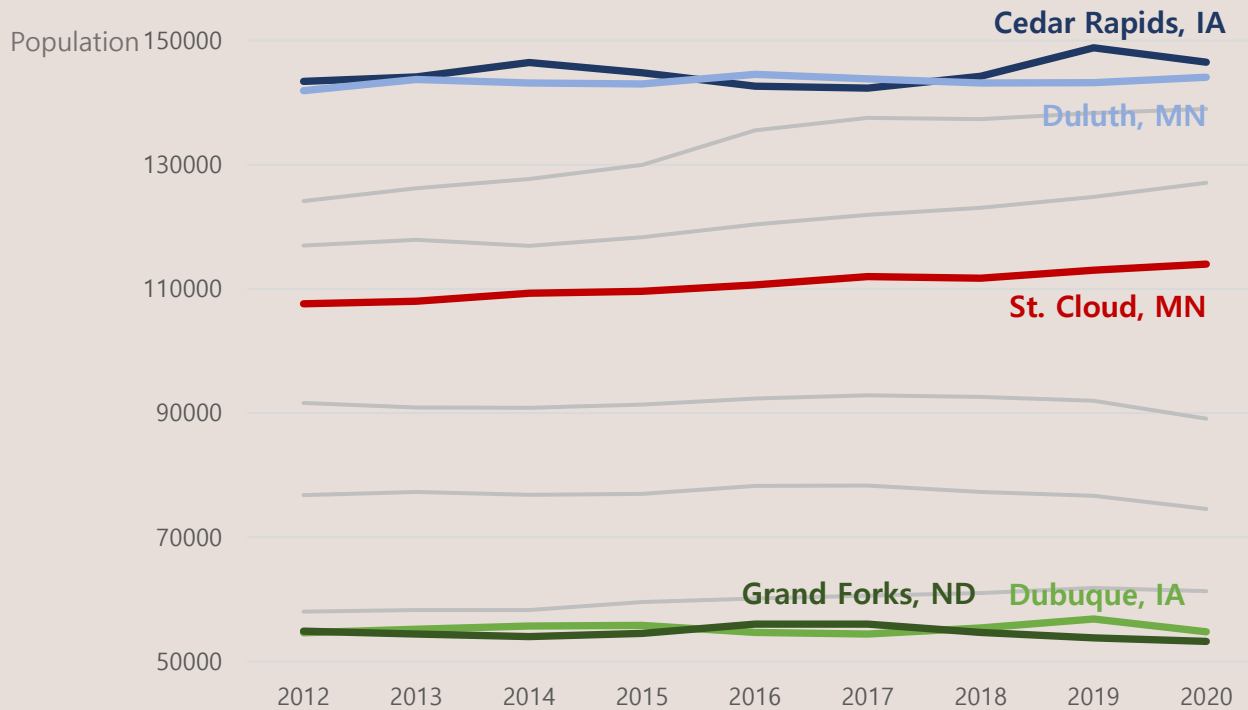
Question #1: Demographic and Economic Characteristics of St. Cloud for Businesses

Economic Characteristics with LAUS

Labor Force Participation

● St. Cloud

Around average: # of significantly greater cities \approx # of significantly less cities

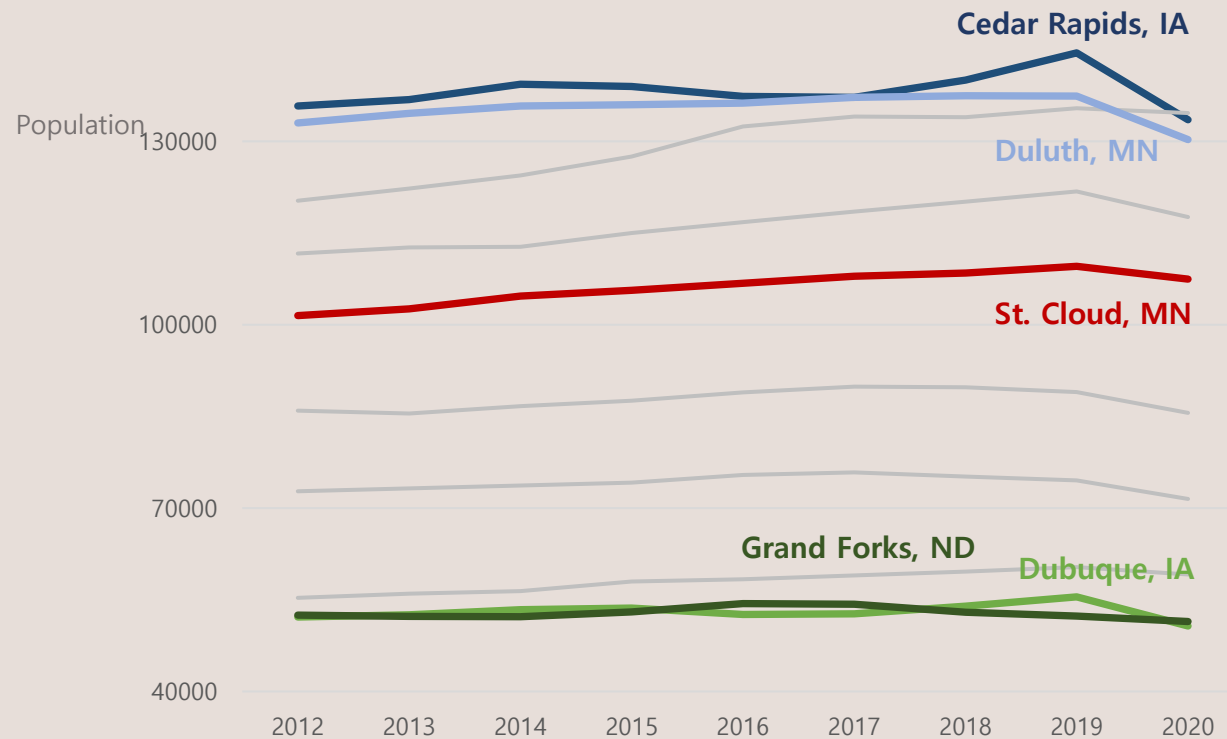


(DTK)	2017	2018	2019
Cedar Rapids, IA	+2*	+1*	+1*
Duluth, MN	+1*	+2*	+2*
Fargo, ND	+3*	+3*	+3*
Rochester, MN	+4*	+4*	+4*
Eau Claire, WI	-5*	-5*	-5*
La Crosse, WI	-6*	-6*	-6*
Mankato, MN	-7*	-7*	-7*
Dubuque, IA	-9*	-8*	-8*
Grand Forks, ND	-8*	-9*	-9*

Total Employment

 **St. Cloud**

Around average: same as Labor Force Participation



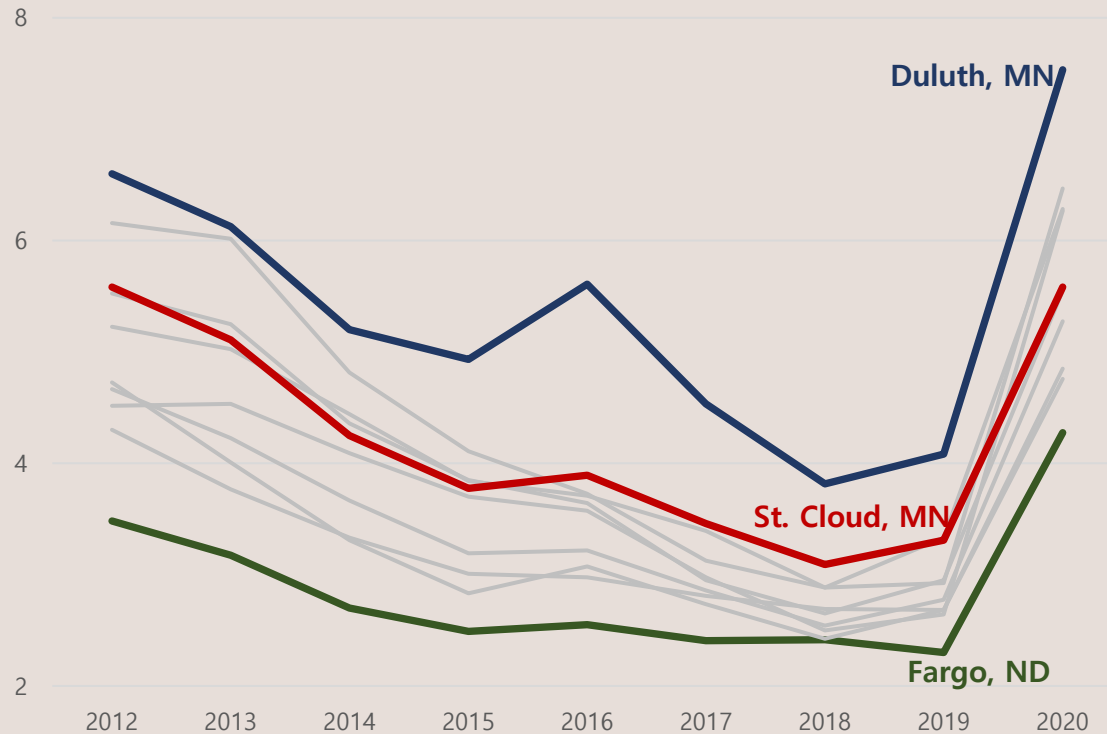
(DTK)	2017	2018	2019
Fargo, ND	+3*	+3*	+3*
Cedar Rapids, IA	+2*	+1*	+1*
Duluth, MN	+1*	+2*	+2*
Rochester, MN	+4*	+4*	+4*
Eau Claire, WI	-5*	-5*	-5*
La Crosse, WI	-6*	-6*	-6*
Mankato, MN	-7*	-7*	-7*
Grand Forks, ND	-8*	-9*	-9*
Dubuque, IA	-9*	-8*	-8*

Unemployment Rate

● St. Cloud

One of the highest: significantly greater than the most cities

Significantly less than **Duluth, MN**



(DTK)	2017	2018	2019
Duluth, MN	+1*	+1*	+1*
Cedar Rapids, IA	-2	-2*	-4*
Eau Claire, WI	-3*	-3*	+2
Dubuque, IA	-4*	-7*	-8*
La Crosse, MN	-5*	-5*	-3*
Rochester, MN	-6*	-6*	-5*
Mankato, MN	-8*	-8*	-7*
Grand Forks, ND	-7*	-4*	-6*
Fargo, ND	-9*	-9*	-9*

Question #1: Demographic and Economic Characteristics of St. Cloud for Businesses

Summary

Competitive Characteristics

- Gross Rent: low to average
- Age: **one of the lowest**

Unfavorable Characteristics

- First Mortgage Payment: **one of the highest**
- Value of House: **one of the highest**
- Finished Some College: **one of the lowest**

Questionable Characteristics

- Family size: high to average
- Travel Time to Work: **the highest**
- Total Employment & LF Participation : average
- Unemployment Rate: **one of the highest**

Question #2

What are some **Occupations** that present **unique characteristics** in St. Cloud compared to similar upper Midwest cities?

Methodology – Statistical Method

Wilcoxon Signed-Rank Test

Statistical method of **comparing** median of a group to a specific value

- Efficient for **small data** (nonparametric data)
- **Signed ranking** of values as variance
- **Significant Difference** in median
 - = The median is extremely different considering their variation
 - Direction (low/high) is not tested (find on the graph)

Question #2: Unique **Occupational** Characteristics of St. Cloud

Methodology – Application

Occupations in Major Classifications

- **Wilcoxon Signed-Rank Test** between St. Cloud and All 10 Cities (**Years:** 2017-2020)
 - H_0 : Median of all 10 cities = St. Cloud
 - H_a : Median of all 10 cities \neq St. Cloud
- Variable of Interest
 - Number of Employments per 1000 Jobs in the given city (**Employment Ratio**)
 - **Mean Annual Wage**

Noticeable Occupations in Subclassification

- One of the highest or lowest (St. Cloud ratio / US ratio) **Quotient**
- **Same testing** as above

Question #2: Unique **Occupational** Characteristics of **St. Cloud**

Methodology – Identifying Significant Occupations

Initial Occupation Selections

- Major classifications: all
- Detailed subclassifications: **Quotient** less than **lower quartile** & greater than **upper quartile**
 - w/ at least 0.1% of total employment of St. Cloud

Significant Occupation Selection

- **Consistently significantly** low or high in all years either in ratio or wage

**The presentation only includes significant occupations

Question #2: Unique **Occupational** Characteristics of **St. Cloud**

Unique Occupations in **Major** Classifications

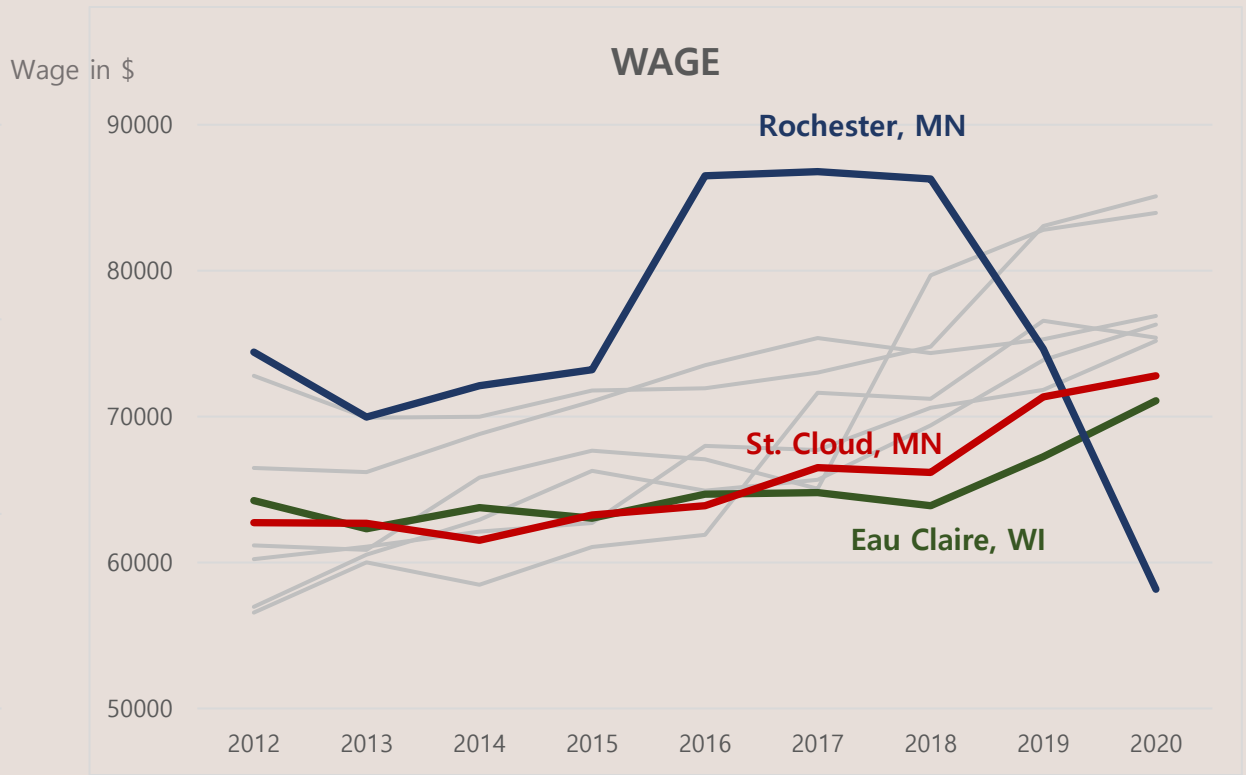
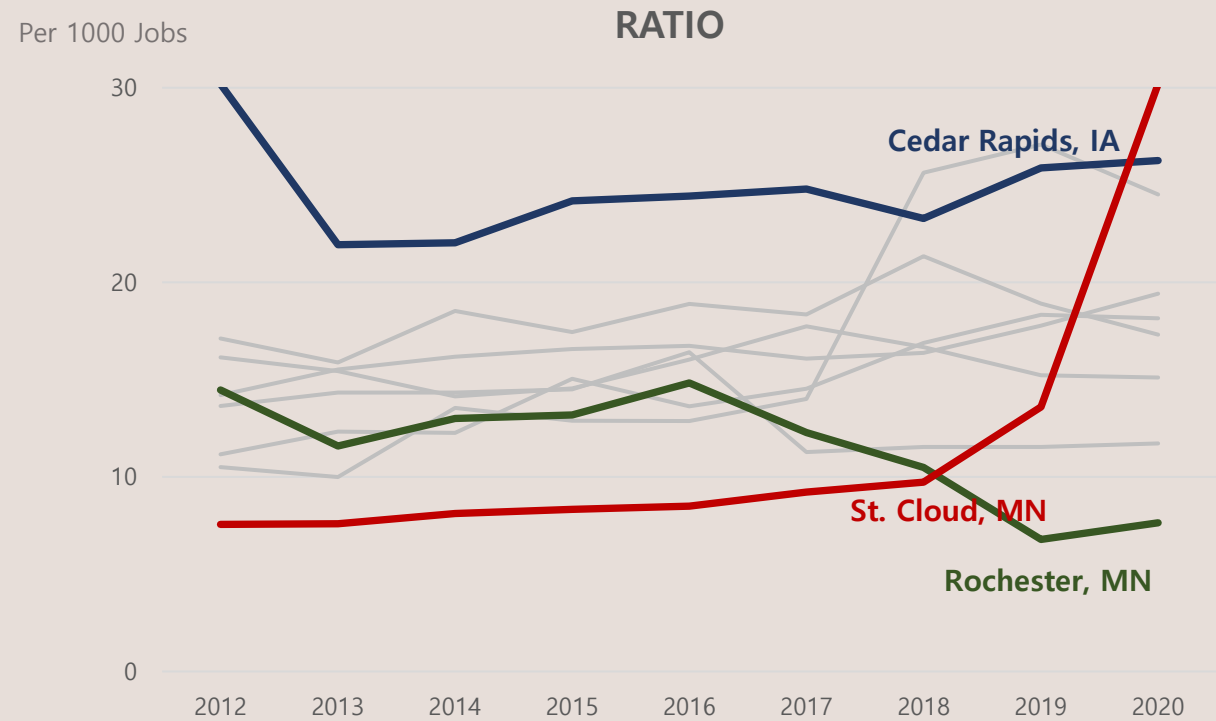
Architecture and Engineering

● St. Cloud

Lowest then sharp **increasing** in ratio

One of the lowest in wage

	2017	2018	2019	2020
Ratio	0.01562	0.01562	0.04688	0.125
Wage	0.01562	0.03125	0.01562	0.03125

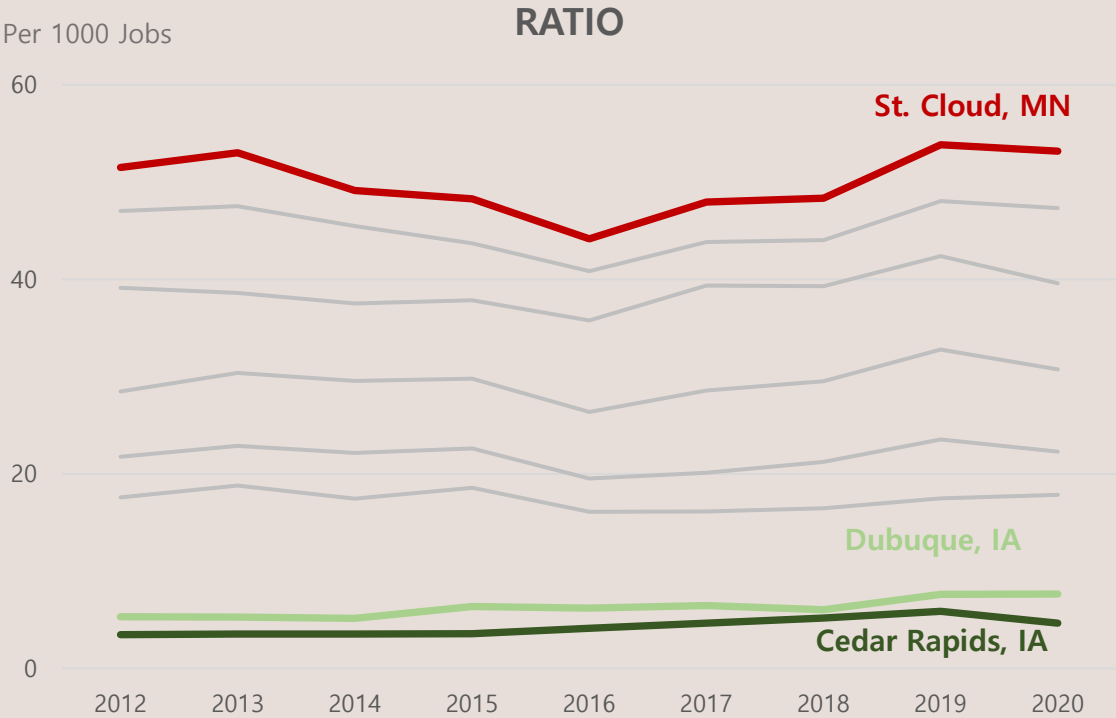


Life, Physical, and Social Science

 **St. Cloud**

The **highest** in ratio

	2017	2018	2019	2020
Ratio	0.03125	0.01562	0.04688	0.2812
Wage				



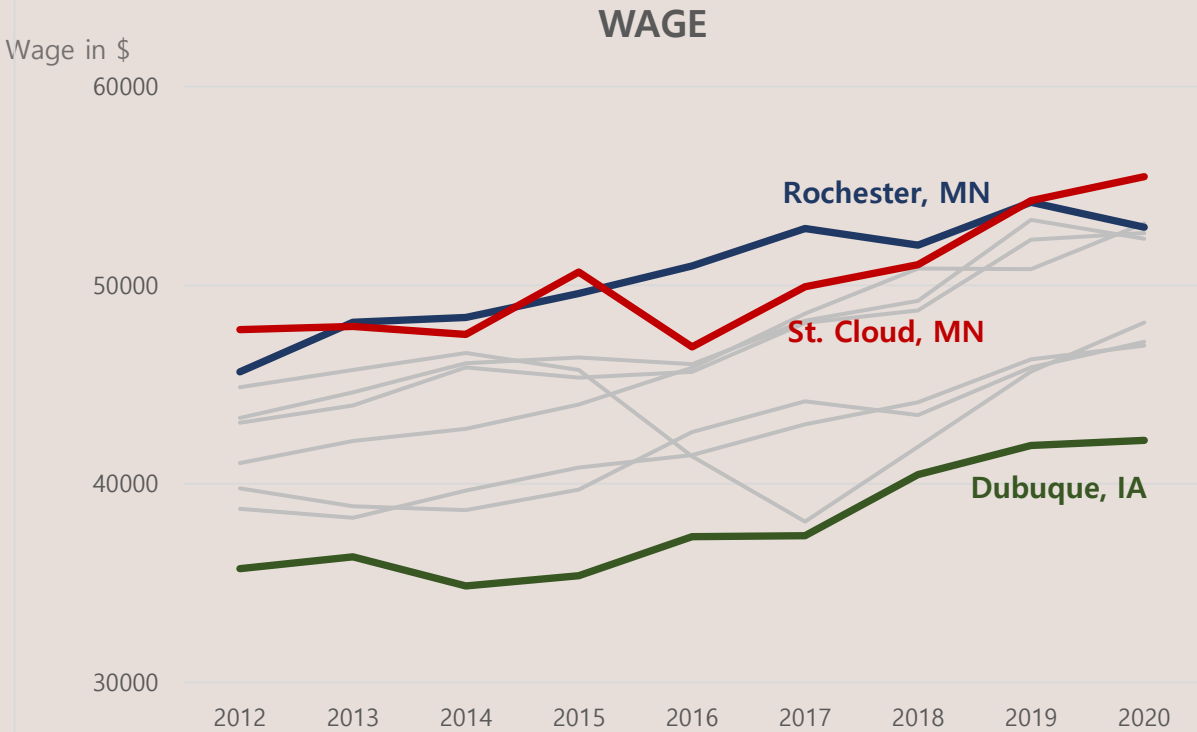
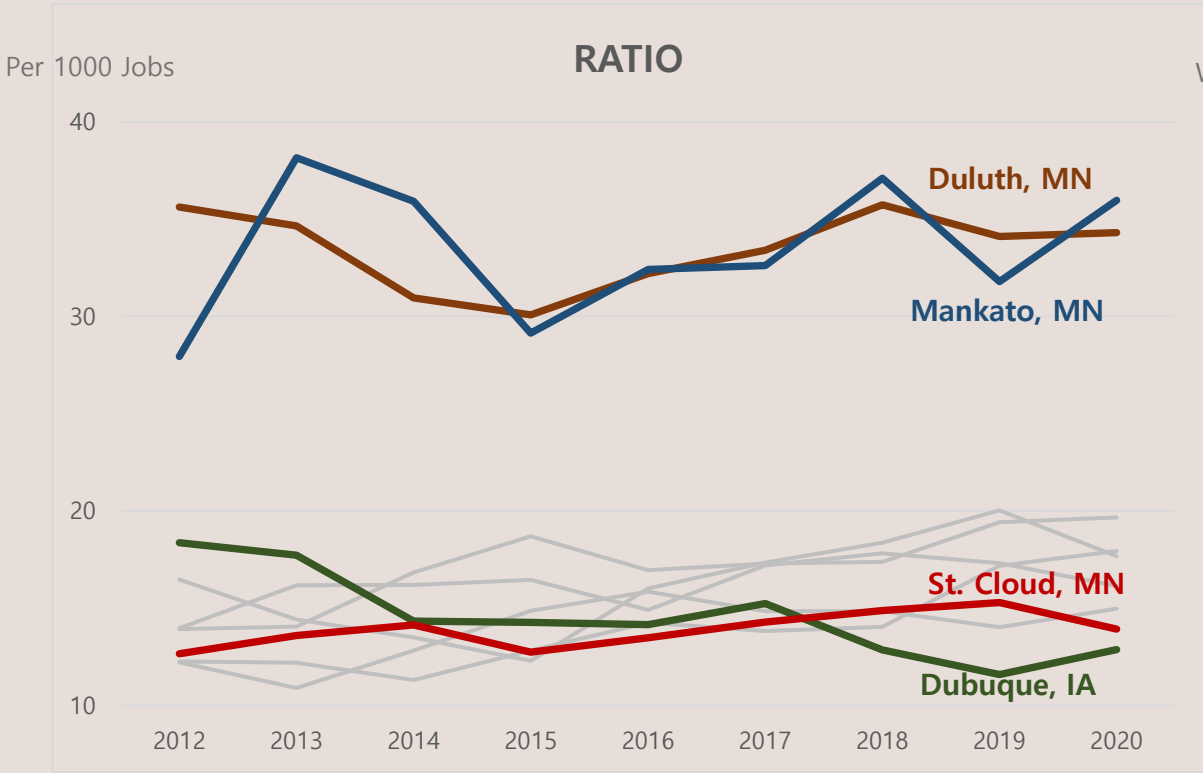
Community and Social Services

● St. Cloud

One of the lowest in ratio

One of the highest in wage

	2017	2018	2019	2020
Ratio	0.03125	0.09375	0.03125	0.01562
Wage	0.09375	0.04688	0.01562	0.01562



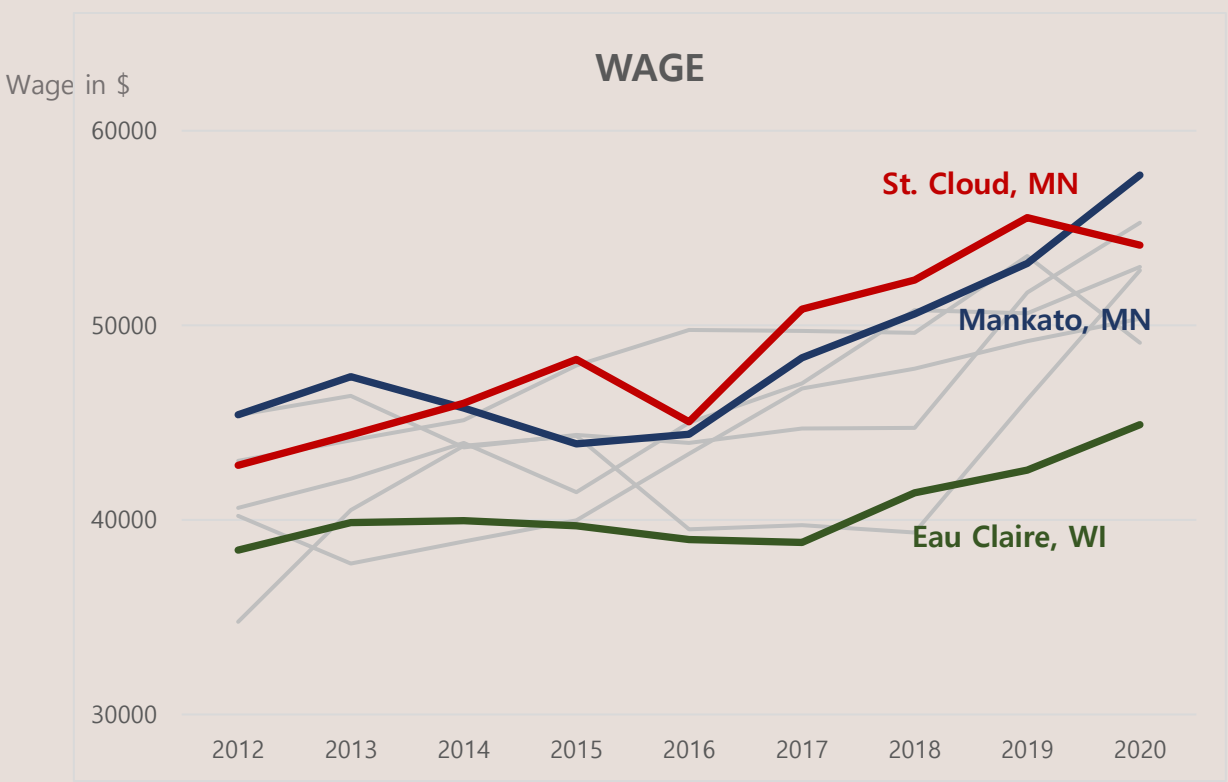
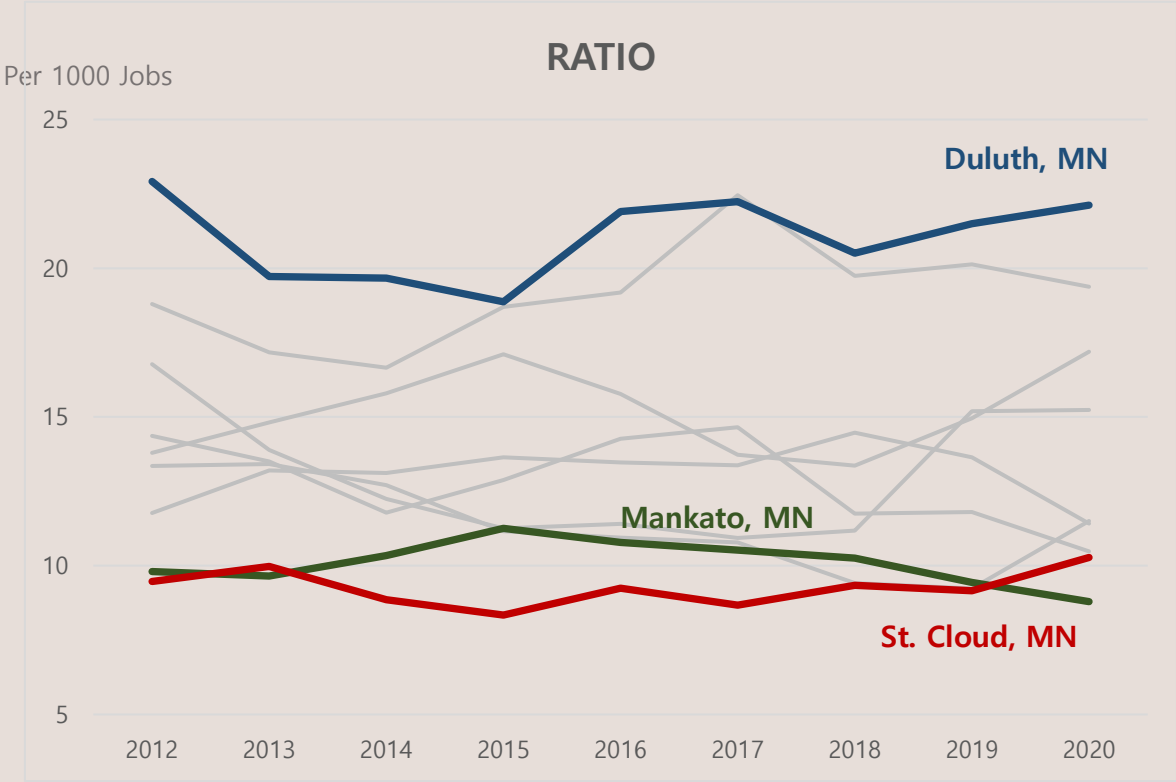
Protective Service

 **St. Cloud**

The lowest in ratio; steady then **slight increase** in 2020

One of the highest in wage; increasing then **slight decrease** in 2020

	2017	2018	2019	2020
Ratio	0.01562	0.01562	0.01562	0.09375
Wage	0.01562	0.01562	0.01562	0.1719



Food Preparation and Servicing Related

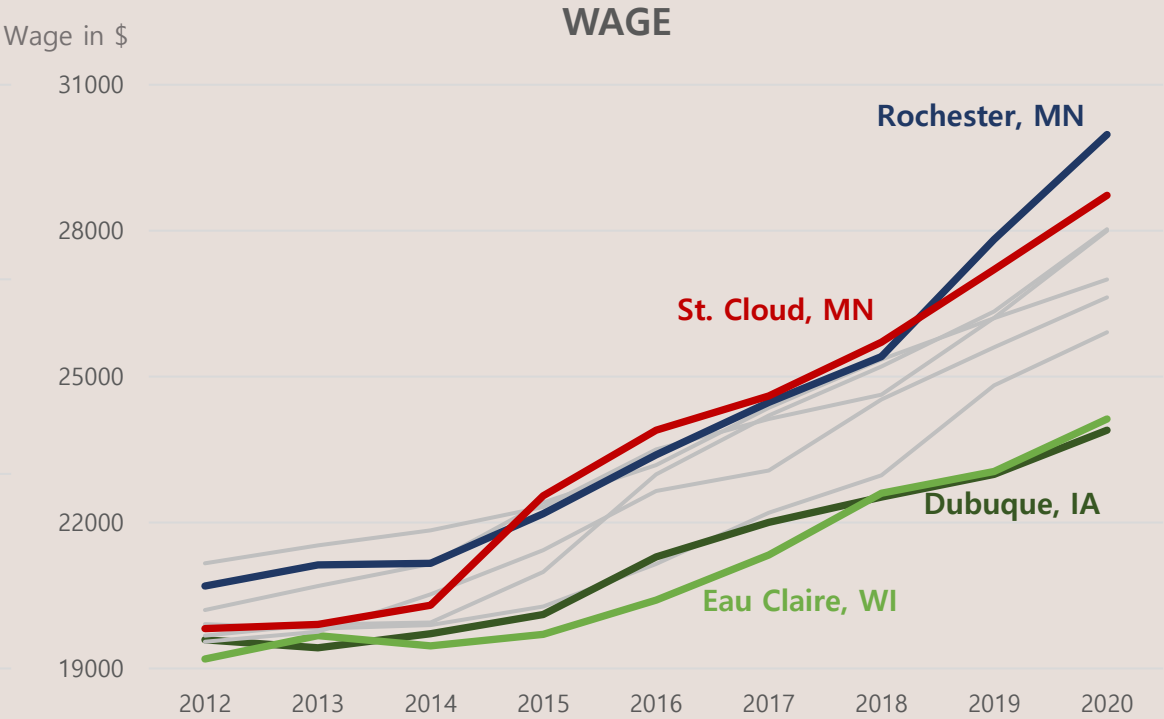
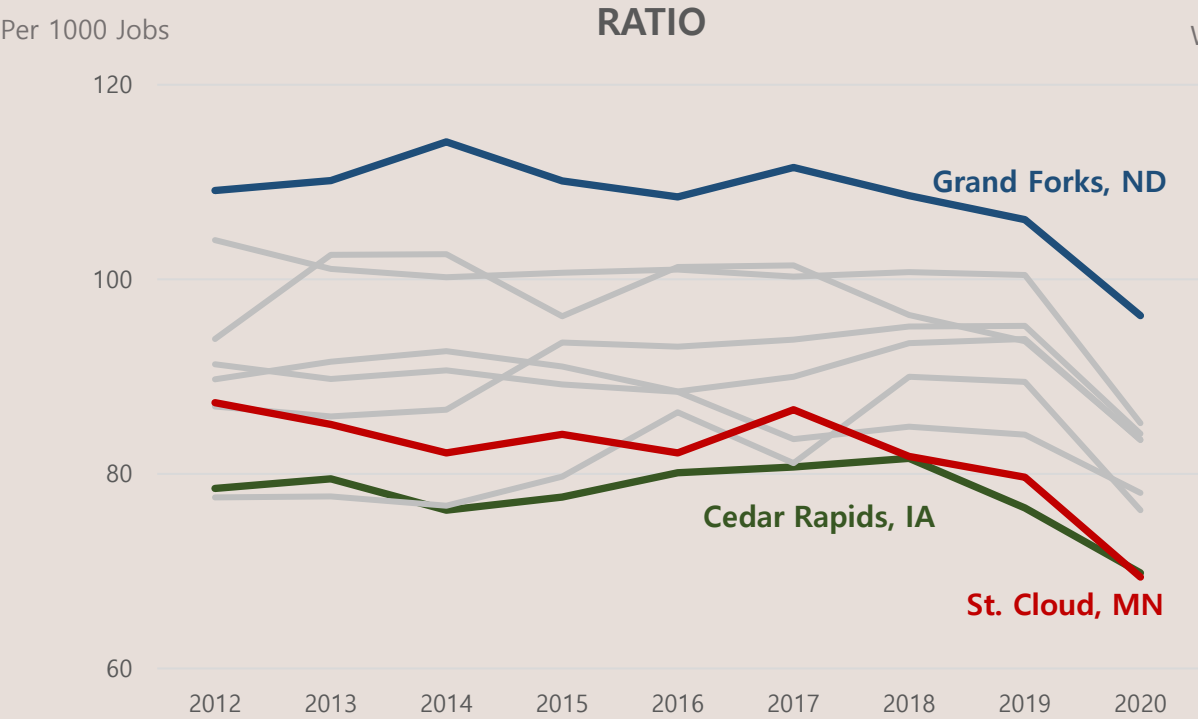


St. Cloud

One of the lowest in ratio

One of the highest in wage

	2017	2018	2019	2020
Ratio	0.125	0.01562	0.01562	0.01562
Wage	0.01562	0.01562	0.03125	0.0625

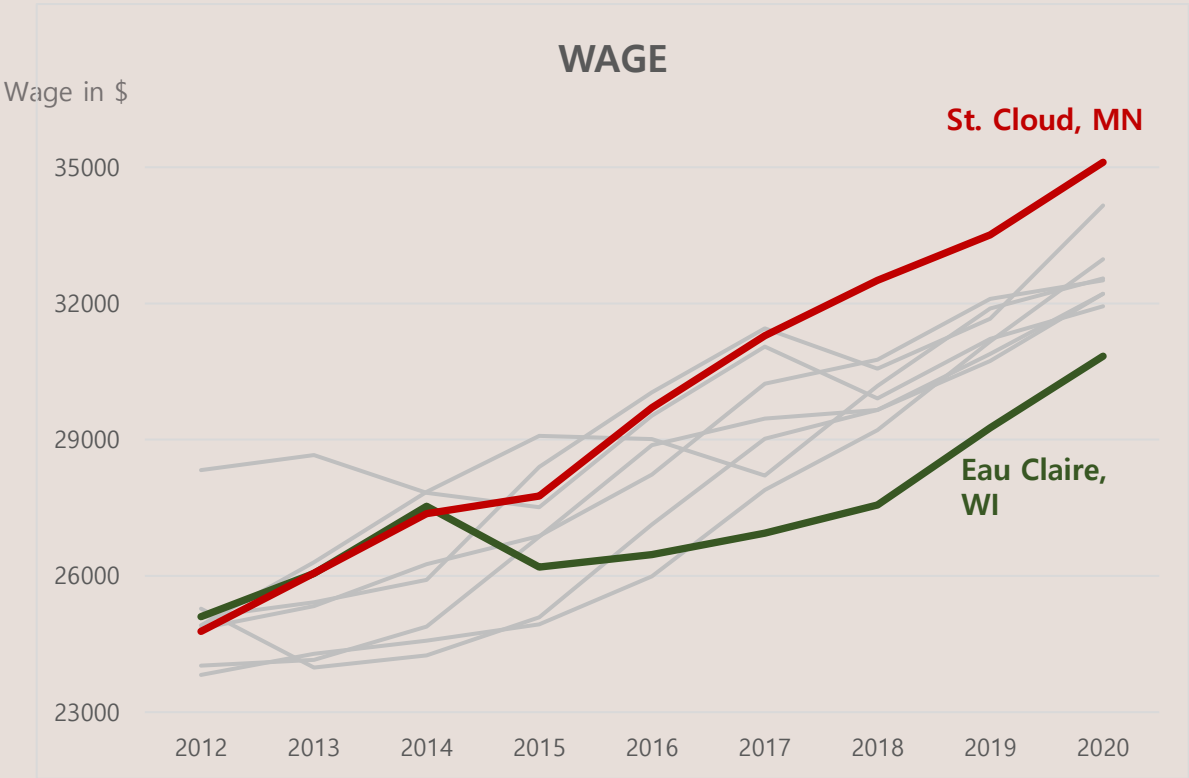


Building and Grounds Cleaning and Maintenance

● St. Cloud

The highest in wage

	2017	2018	2019	2020
Ratio				
Wage	0.03125	0.01562	0.01562	0.01562

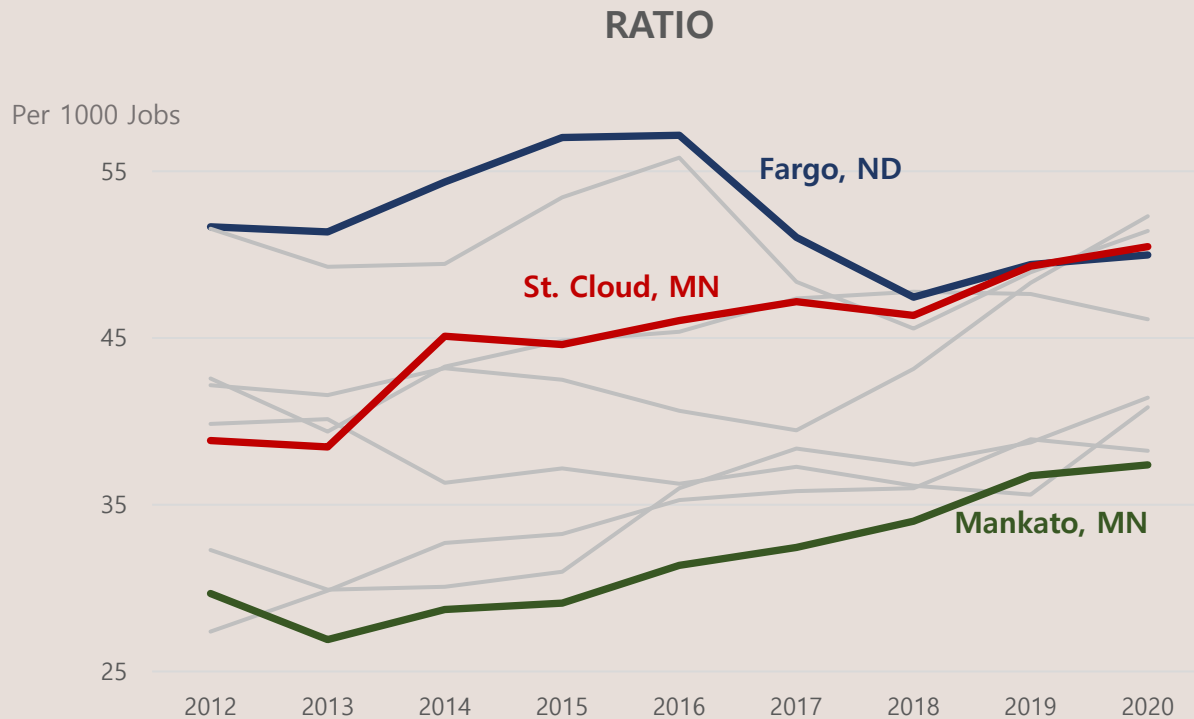


Construction and Extraction

 **St. Cloud**

One of the highest in ratio

	2017	2018	2019	2020
Ratio	0.09375	0.04688	0.03125	0.1719
Wage				

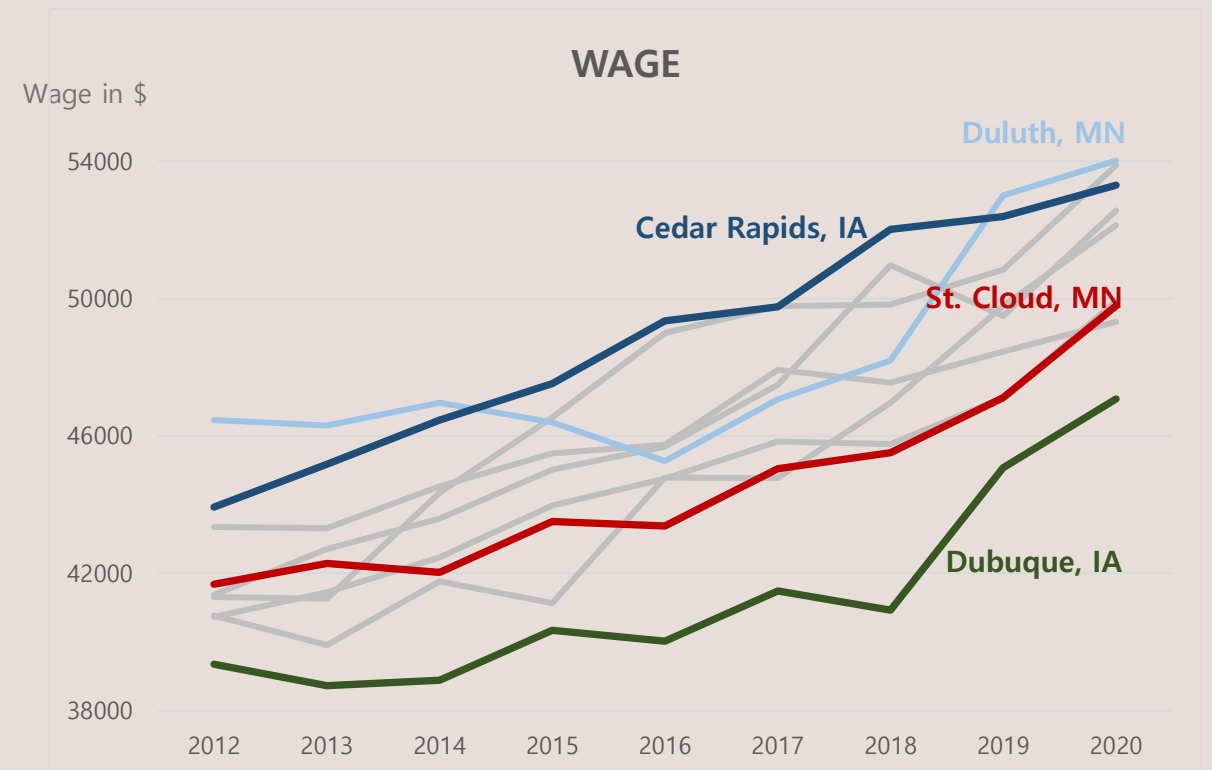


Installation, Maintenance, and Repair

● St. Cloud

One of the lowest

	2017	2018	2019	2020
Ratio				
Wage	0.03125	0.01562	0.03125	0.04688

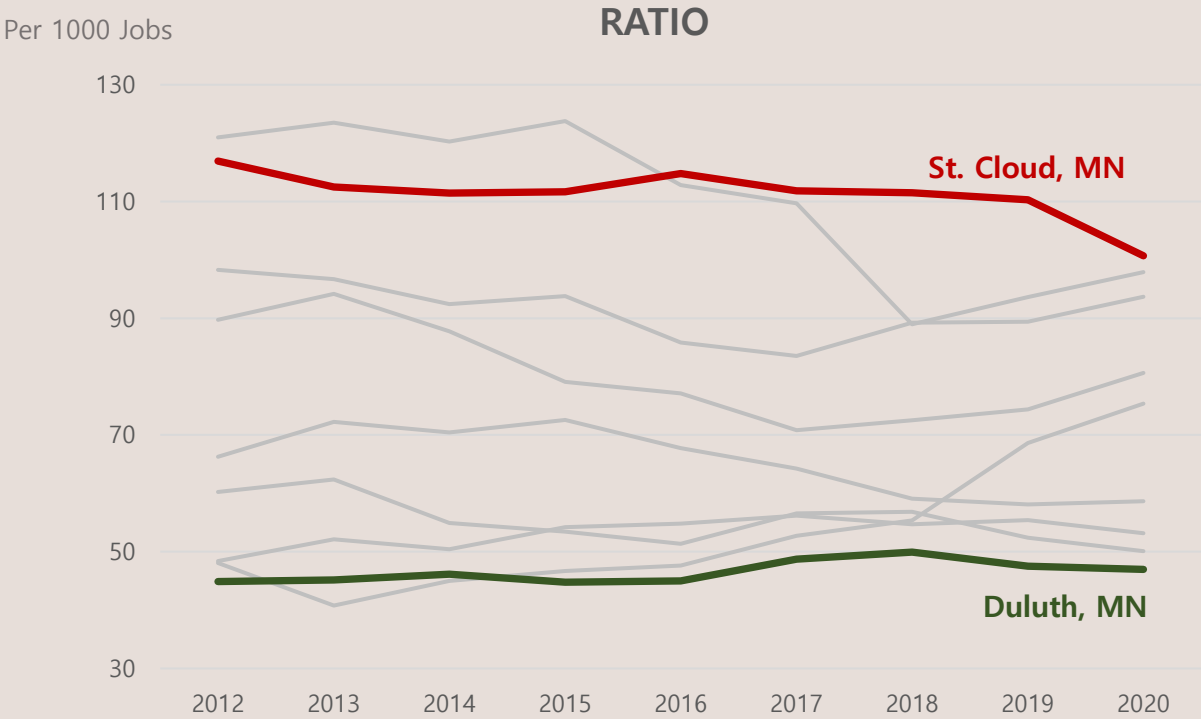


Production

 **St. Cloud**

The highest in ratio

	2017	2018	2019	2020
Ratio	0.01562	0.01562	0.01562	0.01562
Wage				

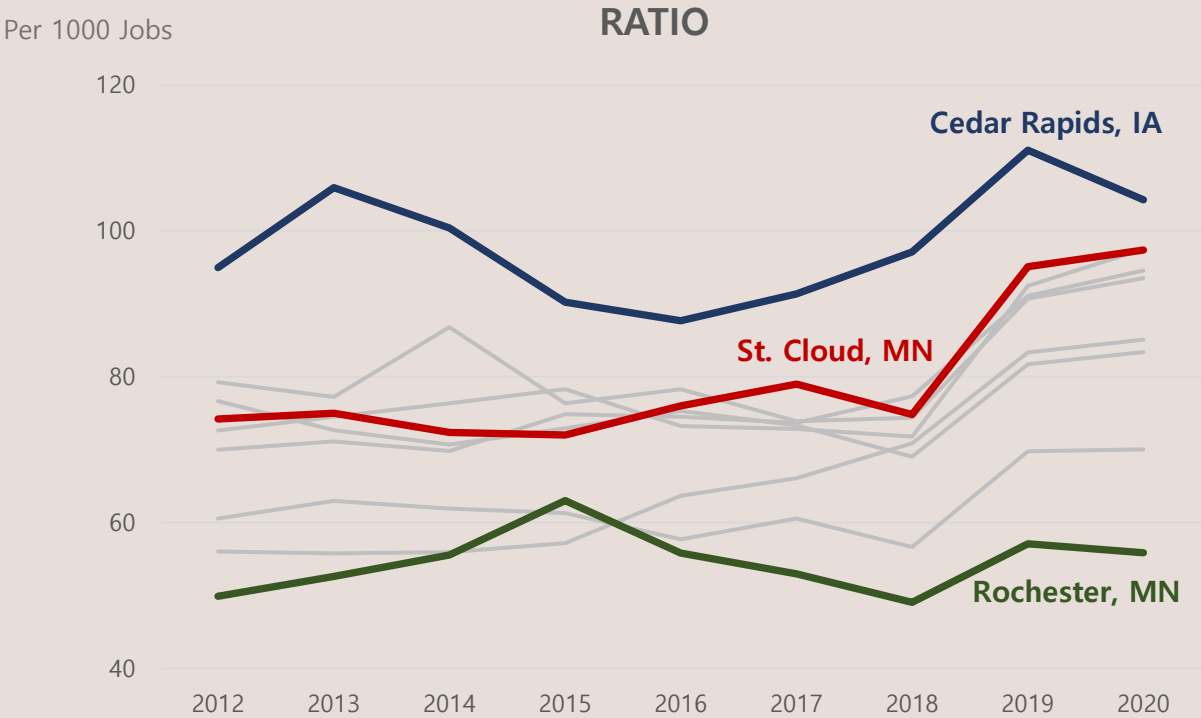


Transportation and Material Moving

 **St. Cloud**

The second highest in ratio

	2017	2018	2019	2020
Ratio	0.01562	0.03125	0.01562	0.03125
Wage				



Question #2: Unique **Occupational** Characteristics of **St. Cloud**

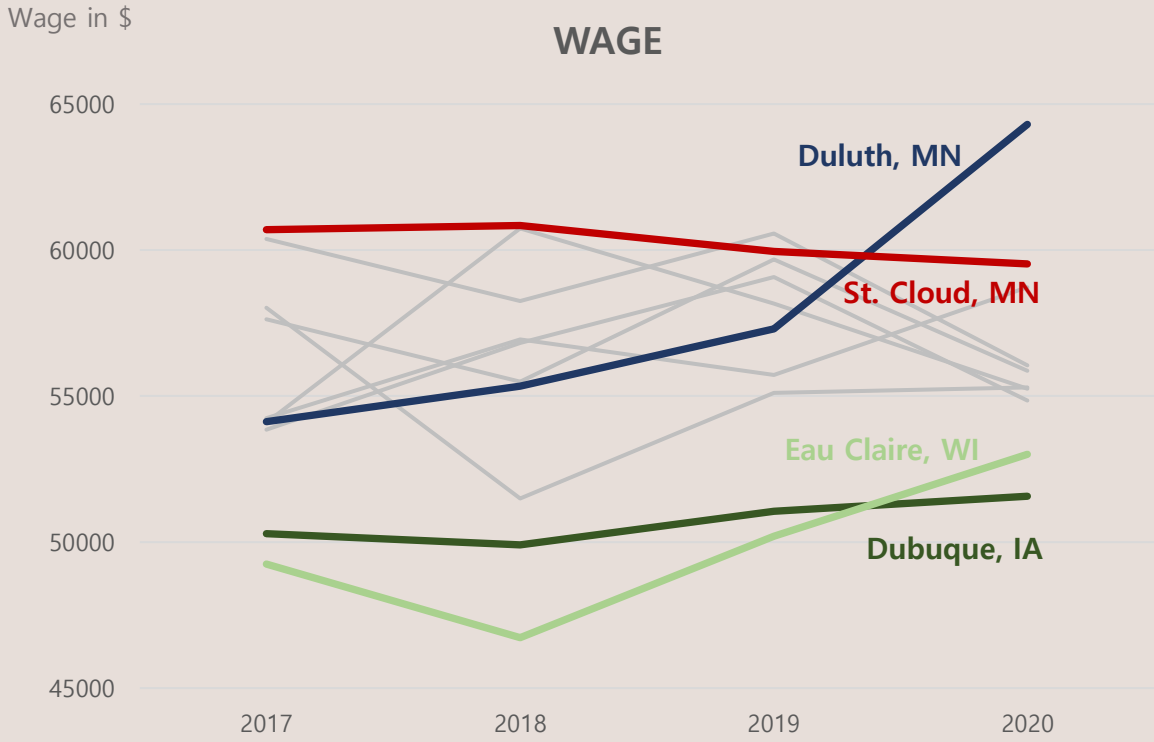
Occupations in
Subclassifications with
Lower Quartile
Ratio Quotient

First-Line Supervisors of Transportation & Material Moving Workers, Except Aircraft Cargo Handling Supervisors

 **St. Cloud**

One of the highest in wage; slightly decreasing

Under protective service				
	2017	2018	2019	2020
Ratio				
Wage	0.01562	0.01562	0.04688	0.1719



Landscaping and Groundskeeping Workers

Under Building and Grounds Cleaning and Maintenance

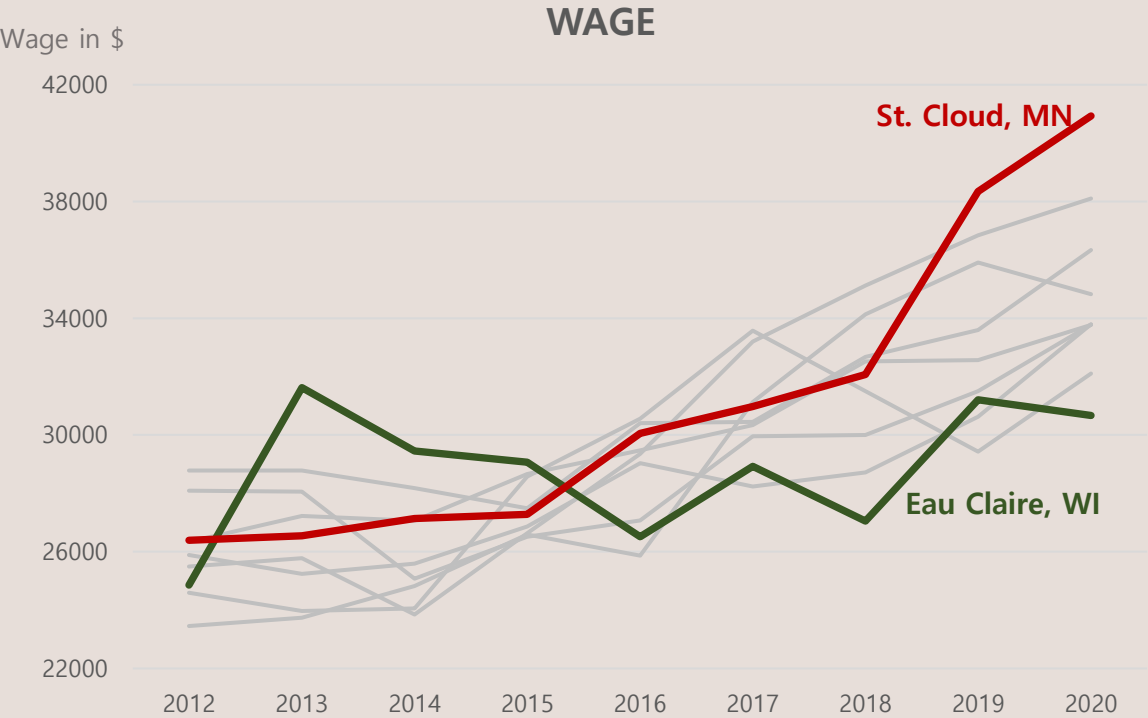
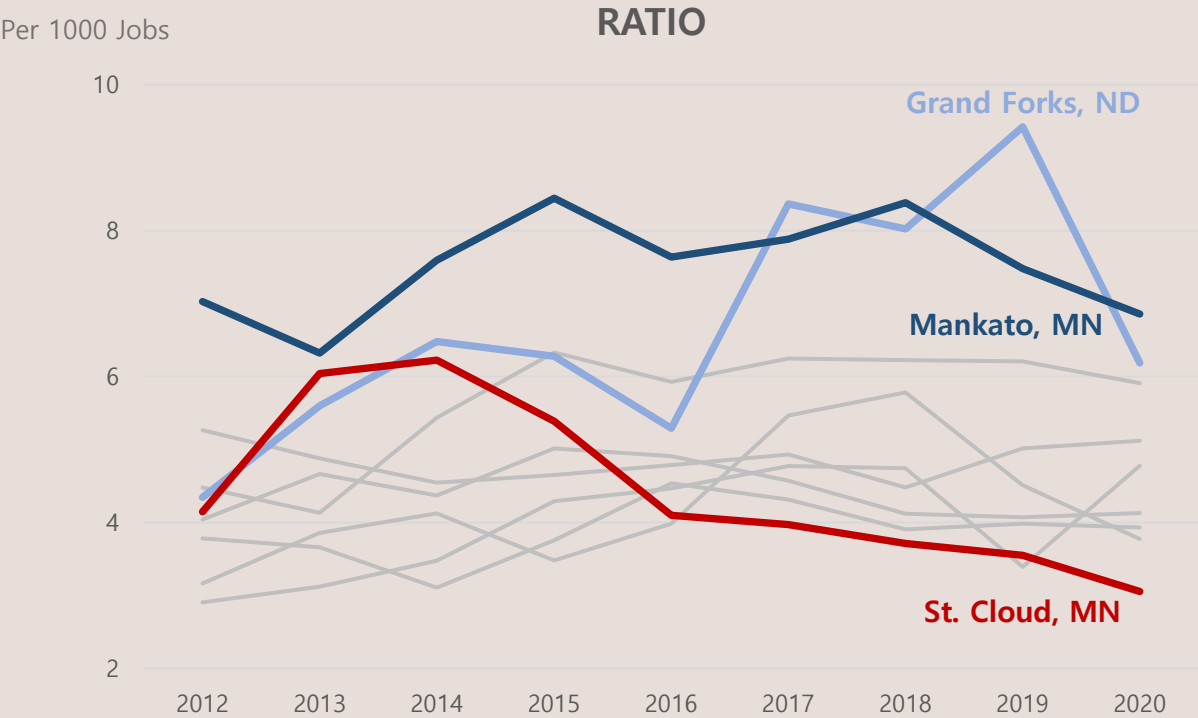


St. Cloud

One of the lowest in ratio

One of the highest in wage; sharply increasing

	2017	2018	2019	2020
Ratio	0.01562	0.01562	0.09375	0.01562
Wage	0.4219	0.2812	0.01562	0.01562



Question #2: Unique **Occupational** Characteristics of **St. Cloud**

Occupations in
Subclassifications with
Upper Quartile
Ratio Quotient

Bartenders

Under Food Preparation and Serving Related

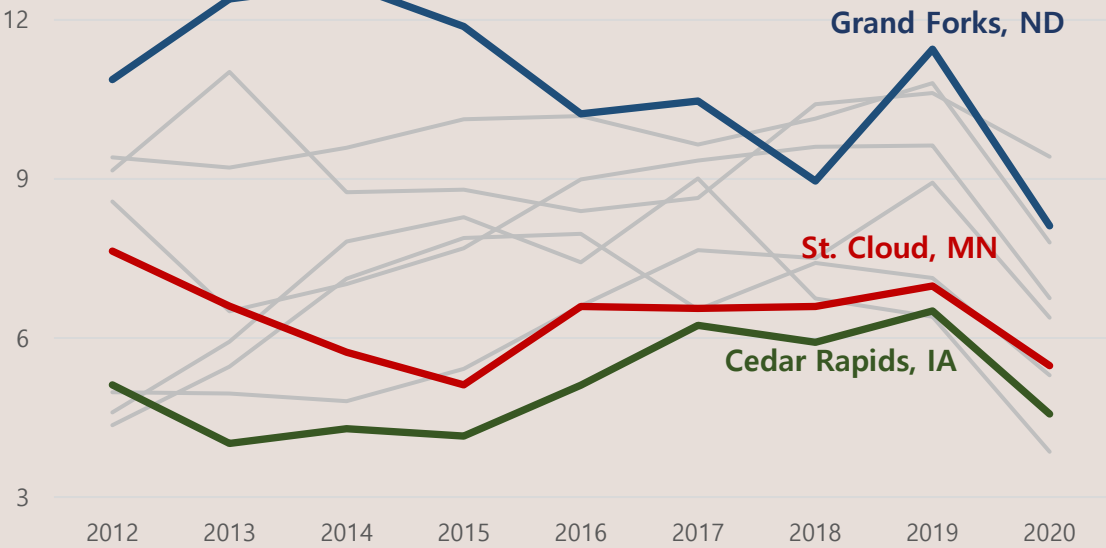
 **St. Cloud**

One of the lowest in ratio

	2017	2018	2019	2020
Ratio	0.03125	0.01562	0.04688	0.125
Wage				

RATIO

Per 1000 Jobs



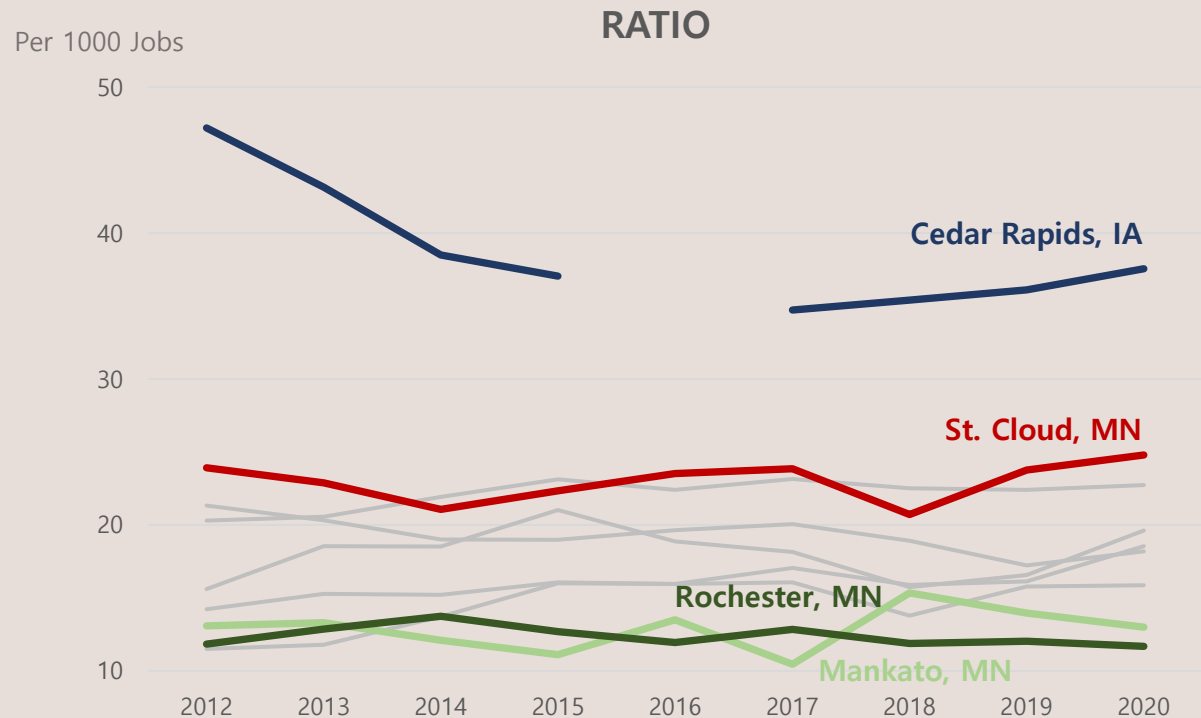
Heavy and Tractor – Trailer Truck Drivers

Under Transportation and Material Moving

 **St. Cloud**

One of the lowest in ratio

	2017	2018	2019	2020
Ratio	0.01562	0.04688	0.01562	0.04688
Wage				



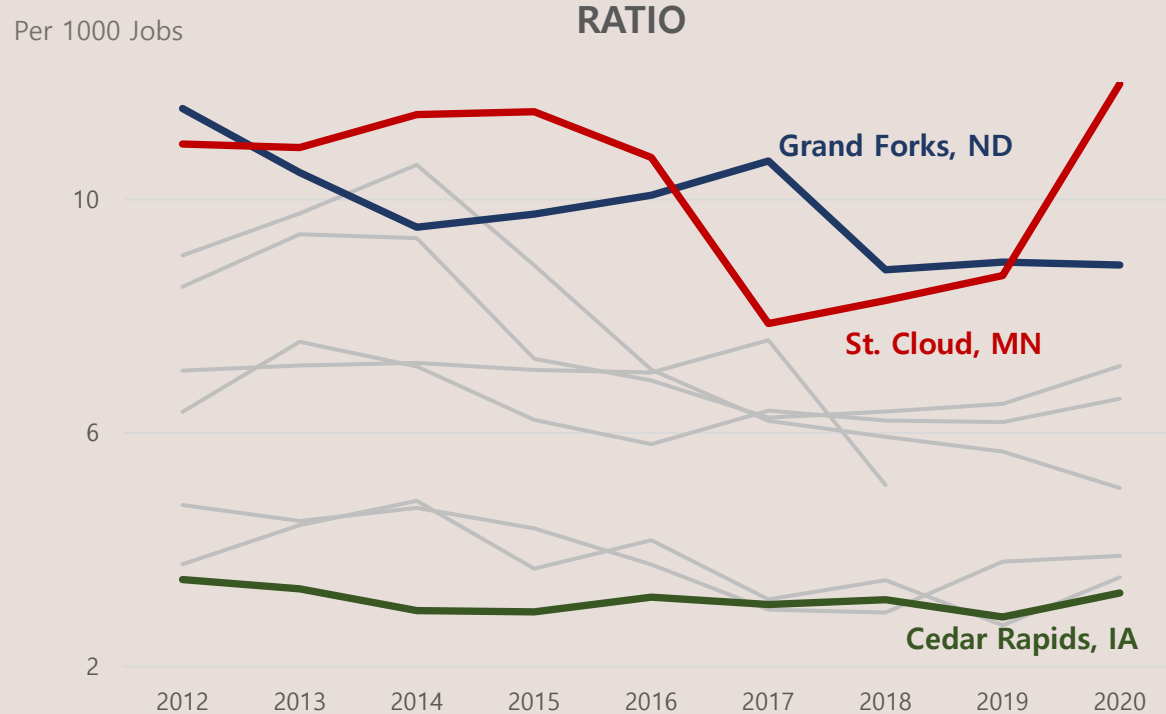
Licensed Practical & Licensed Vocational Nurses

Under Healthcare Practitioners and Technical

 **St. Cloud**

One of the highest in ratio; increasing

	2017	2018	2019	2020
Ratio	0.125	0.03125	0.0625	0.03125
Wage				



Operating Engineers & Other Construction Equipment Operators

Under Construction and Extraction

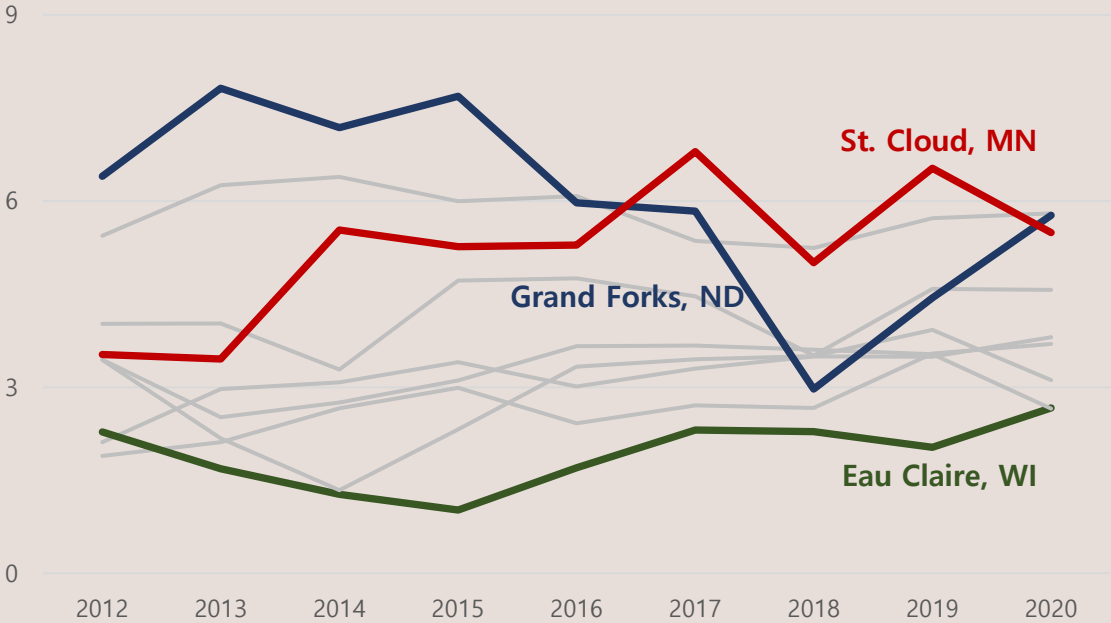
 **St. Cloud**

One of the highest in ratio

	2017	2018	2019	2020
Ratio	0.01562	0.03125	0.01562	0.09375
Wage				

Per 1000 Jobs

RATIO



Plumbers, Pipefitters, & Steamfitters

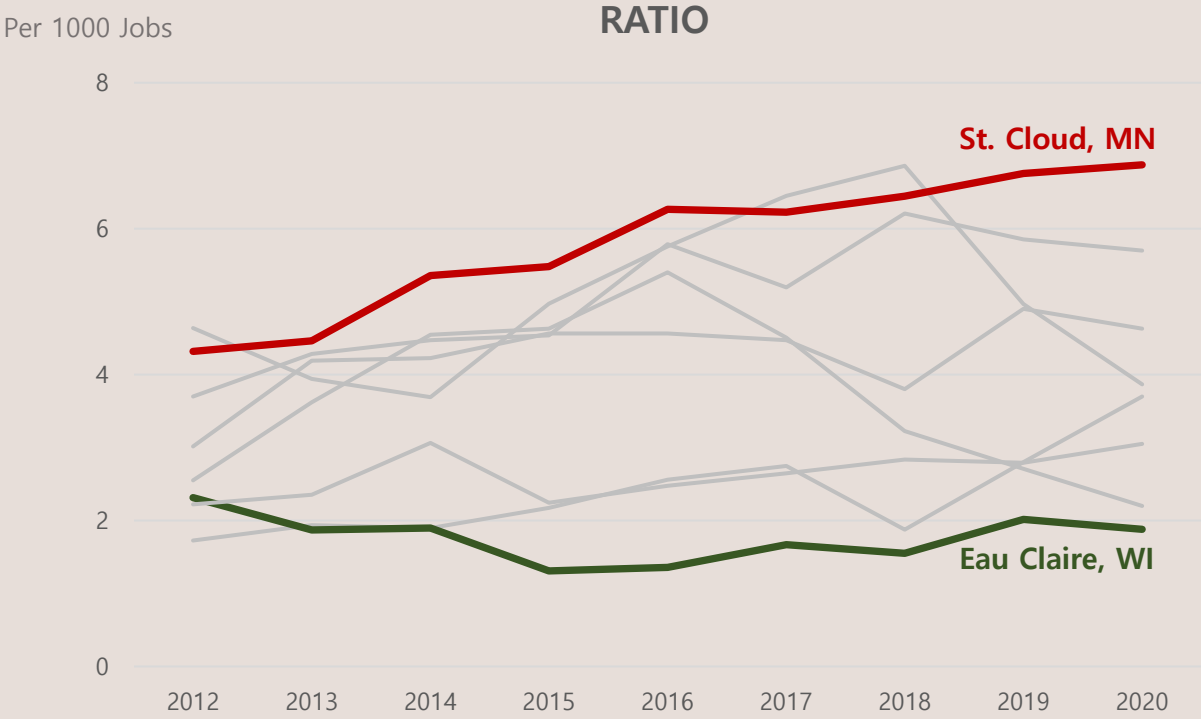
Under Construction and Extraction



St. Cloud

One of the highest in ratio

	2017	2018	2019	2020
Ratio	0.01562	0.01562	0.01562	0.01562
Wage				



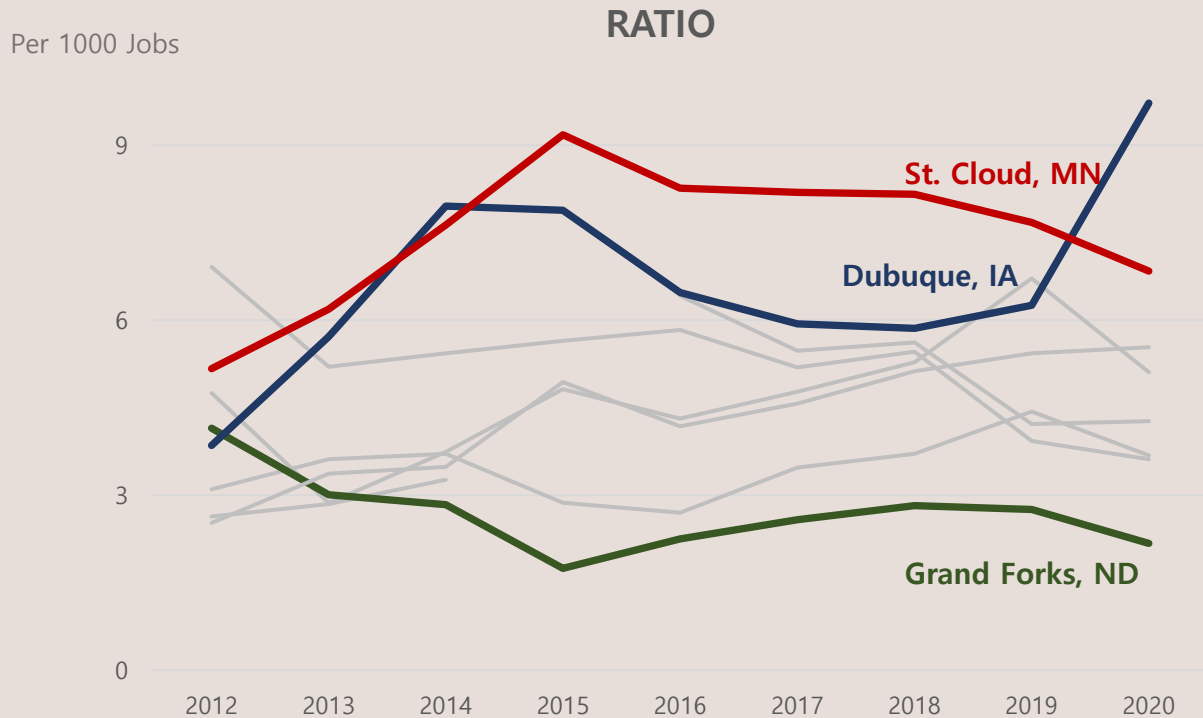
Welders, Cutters, Solderers, and Brazers

Under Production

 **St. Cloud**

One of the highest in ratio; decreasing

	2017	2018	2019	2020
Ratio	0.01562	0.01562	0.01562	0.01562
Wage				



Question #2: Unique **Occupational** Characteristics of **St. Cloud**

Summary – Major Classifications

	Job Ratio	Annual Mean Wage
High	<div>Life, Physical, and Social Science – <u>highest</u></div> <div>Production – <u>highest</u></div> <div>Transportation and Material Moving – second highest</div> <div>Construction and Extraction – <u>3 high quotients</u></div>	<div>Building and Grounds Cleaning and Maintenance – highest, 3 low quotients</div> <div>Protective Service</div> <div>Community and Social Services</div> <div>Food Preparation and Servicing Related</div>
Low	<div>Protective Service – <u>lowest</u></div> <div>Community and Social Services</div> <div>Food Preparation and Servicing Related</div>	<div>Installation, Maintenance, and Repair</div> <div>Architecture and Engineering</div>
Interesting Pattern	<div>Architecture and Engineering – <u>sharp increase</u></div>	

Question #2: Unique **Occupational** Characteristics of **St. Cloud**

Summary – Subclassifications Upper/Lower Quartile Quotient

	Job Ratio	Annual Mean Wage
High	<p>High Quotient</p> <ul style="list-style-type: none">• Construction and Extraction <p>Operating Engineers & Other Construction Equipment Operators Plumbers, Pipefitters, & Steamfitters Welders, Cutters, Solderers, and Brazers</p> <p>Low Quotient</p> <ul style="list-style-type: none">• Healthcare Practitioners and Technical <p>Licensed Practical & Licensed Vocational Nurses</p>	<p>Low Quotient</p> <ul style="list-style-type: none">• Building and Grounds Cleaning and Maintenance <p>First-Line Supervisors of Transportation & Material Moving Workers, Except Aircraft Cargo Handling Supervisors Landscaping and Groundskeeping Workers</p>
Low	<p>High Quotient</p> <ul style="list-style-type: none">• Transportation and Material Moving <p>Heavy and Tractor – Trailer Truck Drivers</p> <ul style="list-style-type: none">• Food Preparation and Servicing Related <p>Bartenders</p> <p>Low Quotient</p> <ul style="list-style-type: none">• Building and Grounds Cleaning and Maintenance <p>Landscaping and Groundskeeping Workers</p>	

Key Insights

Demographic and Economic

- **High family size** with the **lowest population age**, but **low college** education attainment
- **High house and mortgage values** but **low rent**
- The **highest travel time** to work
- The **highest unemployment** rate

Key Insights Occupations

- **Low # jobs high wage:**
 - Protective Service
 - Community and Social Services
 - Food Preparation and Servicing Related
 - Landscaping and Groundskeeping Workers
- Architecture and engineering: **sharp increase of # jobs but low wage**
 - Sharp drop in Rochester's wage
- **High # jobs in industrial manual labors:**
 - Construction and Extractions, Production, Transportation and Material Moving

Suggestions for **Future Analysis**

Why is **travel time to work** in St. Cloud so high?

- Due to better job opportunities in the twin cities?
- Where do people go to work?

What causes **high unemployment rate** in St. Cloud?

- Lack of job opportunities vs. Unwillingness to work

Why is the **college education attainment** is so **low** in St. Cloud?

- The lowest population age, but low college graduate proportions

Suggestions for **Future Analysis**

Why some occupations have low # of jobs but high wage?

- Protective Service, Community and Social Services, Food Preparation and Servicing Related, Landscaping and Groundskeeping Workers

What happened to **Architecture and Engineering industry** in MN?

- Sharp increase of # of jobs
- Sudden drop of wage in Rochester

What sources high # of **Manual Labor jobs** in St. Cloud

- High # of manual labor jobs

Limitation

- Control of DTK error rate (Conservative Tukey's HSD)
- IPUMS's city areas (PUMA) do not match LAUS/OEWS's
Metropolitan Statistical Areas (MSA)
- Unable to test for all years (2012-2020)