Deloitte.

**Investment in the
Huntsville Region**
Estimated Social Impacts

DECEMBER 11, 2018

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INTRODUCTION

Background and Approach

The Social Impact Model (SIM) can help to elevate and communicate the strategic importance of recent investments in the Huntsville region
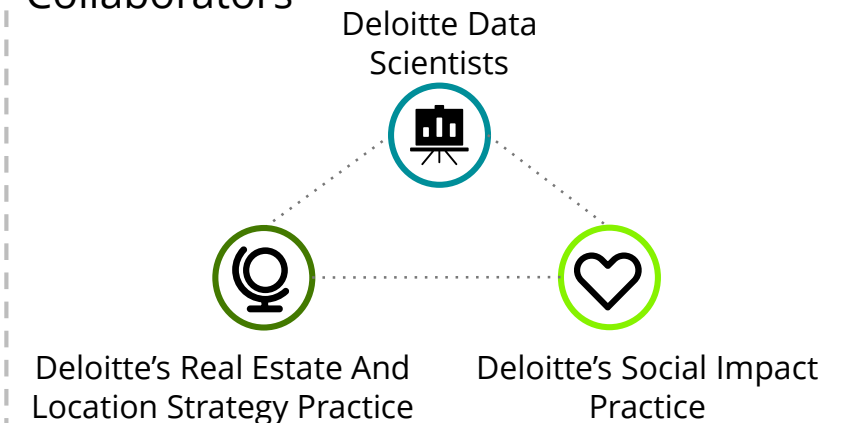
BACKGROUND

- Economic impact studies typically measure jobs, output, and income. However, they often **ignore important community-based metrics such as education proficiency and child poverty rates**

- Deloitte hence studied the correlation between corporate investments and geographically specific social-economic variables

- There appears to be **statistically-significant positive correlation** between corporate investments and improvements on a select set of socio-economic variables

OUR APPROACH TO SOCIAL IMPACT MODELING

Approach

1. Deloitte's proprietary SIM measures, analyzes, and projects the impact of corporate investments in a specified region

2. The SIM projects over a **four year period** the social impact of qualified investments through over **100 unique variables split across seven different social impact categories**

3. Based on the SIM findings, this report highlights the key callouts and takeaways for Huntsville to continue delivering positive social impact to the region

Collaborators

Deloitte Data Scientists

Deloitte's Real Estate And Location Strategy Practice

Deloitte's Social Impact Practice

The NASA Twin Study

Deloitte's SIM methodology was inspired by the NASA Twins Study where one identical twin was sent to space and the other was not, enabling NASA to study the effects of prolonged exposure to space

MATCHED PAIRS DESIGN

"The Kelly twins are the only identical twin astronauts in history. NASA scientists found this to be an opportunity for a nature versus nurture study, and designed the Twins Study.[1]" One brother goes to space, the other stays on Earth.

Method

This type of study is known as a **matched pairs design**. One twin is controlled and the other is dependent. It's a good design **for causal inference** which draws inference directly about the cause of an event rather than merely correlation to an event. It is more **powerful for drawing conclusions**.

Findings

After Scott Kelly spent a year in space, **many factors were measured for each twin individually** and then **studied to find differences**. Preliminary findings showed that long-term exposure to space causes changes in gene expression, which is how one's cells respond to a changing environment.

Scott Kelly and Mark Kelly

1 https://www.nasa.gov/feature/nasa-twins-study-investigators-to-release-integrated-paper-in-2018

SIM Methodology and Interpretation of Output

Similar to NASA's Twin Study, Deloitte's SIM methodology is designed for causal inference; it ensures that the model's output can at least be partially attributed to the specified investments
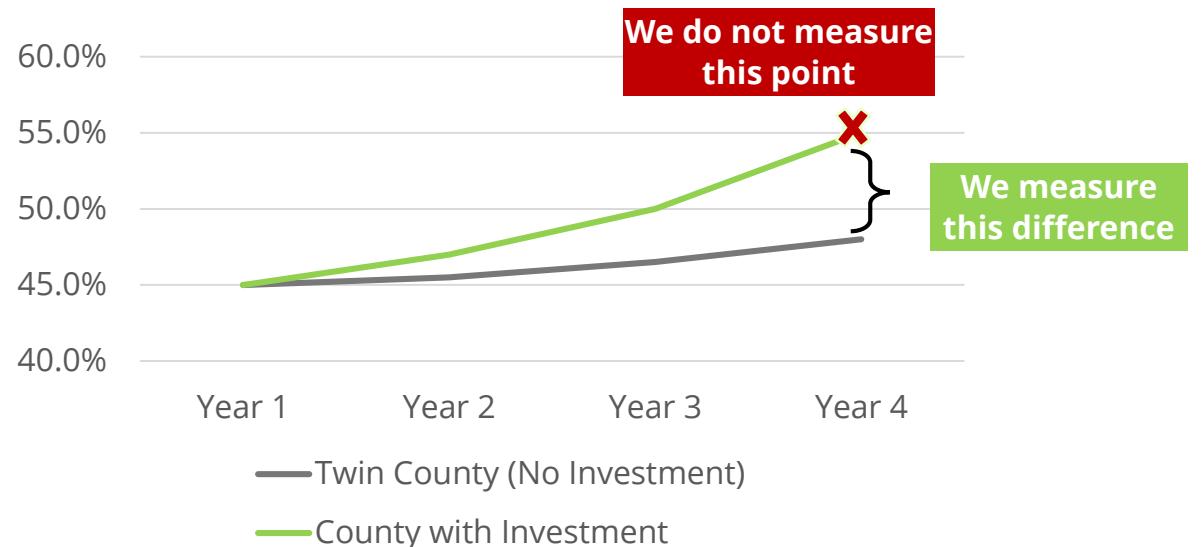
SIM METHODOLOGY

1. **Find Twin County:** identify a "twin county" to the county in question based on similar pre-investment metrics

2. **Input Investment Parameters:** input the specified investment parameters only into the county in question

3. **Run Model and Compare Twin Counties:** take each of the over 100 unique social impact variables and compare the differences between the twin counties

INTERPRETATION OF OUTPUT

- Metrics in each county are expected to change over time even without an investment

- It would therefore be inaccurate to just measure the projected metric at the end of Year 4

- The output is instead is the **difference in the changes** between the twin county without investment and the county with investment

National Percentile for Math Achievement (Illustrative)

We do not measure this point

We measure this difference

Twin County (No Investment)

County with Investment

Overview of the Social Impact Categories

7. Impact on Transportation

Investments may change the methods and vehicles used for transport by county residents.

Sample variable: Average commuting time

1. Income and Employment

Investments typically increase employment opportunities, lowering the unemployment rate and increasing median income.

Sample variable: Unemployment rate

6. Education

Investment increases both the quality and availability of education, which contributes to an increase in social mobility.

Sample variable: National percentile for educational achievement

2. Types of Jobs Available

Investments may change the percent mixture of the types of jobs available in the area.

Sample variable: % of population working in Manufacturing

5. Housing

Investments may improve the overall quality and value of houses within the county, raising the quantity of available housing.

Sample variable: Median house value

7 Social Impact Categories

3. Family and Migration

Migration of employees from other counties increases the total number of residents, raising the tax base of the county.

Sample variable: % of families with children

4. Socio-Economics

Investments may decrease the percentage of individuals living below the poverty line, reducing the reliance on welfare programs.

*Sample variable: % of individuals living below poverty line*

Capital Investments and Geographic Scope of Assessment

Since 2015, Huntsville has closed on eight projects totaling almost $3B of capital investments, bringing both economic benefits, as well as stimulating and advancing social impact

STUDY AREA

Social impact analysis was completed separately for investments made in Madison, Limestone, and Morgan County
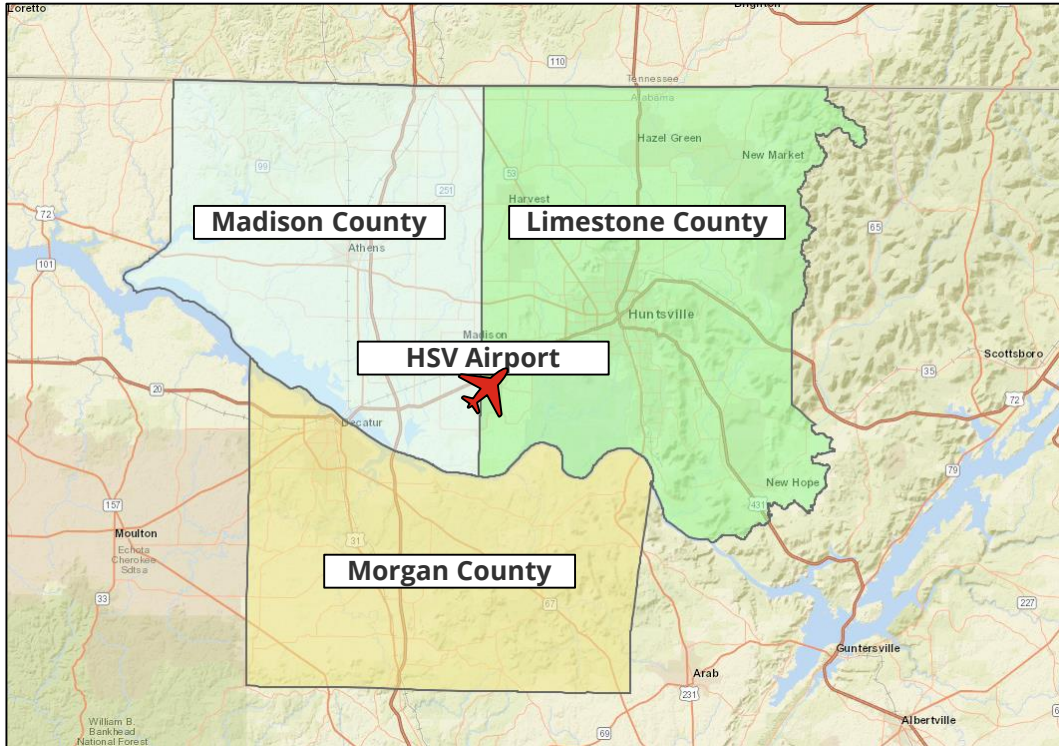
CAPITAL INVESTMENT IN SCOPE

Company	Description	CapEx	Jobs	Year
Madison County ($990M, 1,247 jobs)				
Facebook	Data center	$750M	100	2018
Blue Origin	Rocket manufacturing facility to produce engines	$200M	342	2017
Aerojet Rocketdyne	Defense advanced manufacturing facility	$30.3M	200	2017
Aerojet Rocketdyne	Defense HQ	$9.4M	605	2017
Limestone County ($2.34B, 6,300 jobs)				
Mazda-Toyota	Joint Venture to manufacture automotive vehicles	$2,000M	4,000	2018
GE Aviation	Manufacturing facility for aerospace parts	$200M	300	2015
Polaris Industries	Manufacturing facility for electric vehicles (snowmobiles and ATV's)	$142M	2,000	2015
Morgan County ($30.6M, 100 jobs)				
RUAG	Manufacturing space products	$30.6M	100	2015

EXECUTIVE SUMMARY

Executive Summary

For Madison and Limestone County, there appears to be a statistically-significant positive correlation between investments and improvements on our social impact categories

- The level of investment in Morgan County is too low to estimate social impact at a statistically significant level

- In Madison County and Limestone County, output from the SIM projects positive social impact across a variety of social impact categories as a result of recent corporate investments. These are highlighted below:

Madison County Highlights

Predicted **increase in median household income**, especially in the proportion of the population earning $60K-$100K per year

Estimated **higher level of disposable income** leads to the creation of ancillary jobs in the service industry

Lower projected poverty rate, especially for children in poverty

Predicted **higher test scores** in schools, especially in Math achievement

Home values projected to increase

Limestone County Highlights

Lower projected unemployment rate and estimated **increase in median household income** as a result of new jobs in the county

Estimated increase in the proportion of **families with children** in the county

Lower projected poverty rate, where these individuals are likely lifted to be within 200% of the poverty line

Predicted **higher test scores** in schools, especially in Math achievement

Home ownership projected to increase

MADISON COUNTY

|

The Projected Social Impact Story in Madison County

Investment in Madison County is estimated to result in positive social impact in terms of income levels, employment rates, poverty rates, and educational achievement

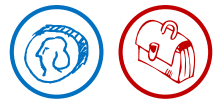$990M Investment; 1,247 Jobs Created

4 years later...

Investment creates production, manufacturing, and professional jobs, likely leading to an increase in ancillary jobs in the service industry

The proportion of middle to upper income households ($60-100K/ year) is expected to increase because of these jobs

The proportion of young, working aged individuals is estimated to increase to fill these jobs, while poverty rates are projected to decrease due to more job opportunities in the county

Due to the projected larger proportion of young, working individuals. It is likely that more of the population will rent their homes and live in apartment buildings

A more stable and employed population is projected. This likely leads to a reduction in childhood poverty rates and an increased emphasis on education. School test scores are projected to improve as a result
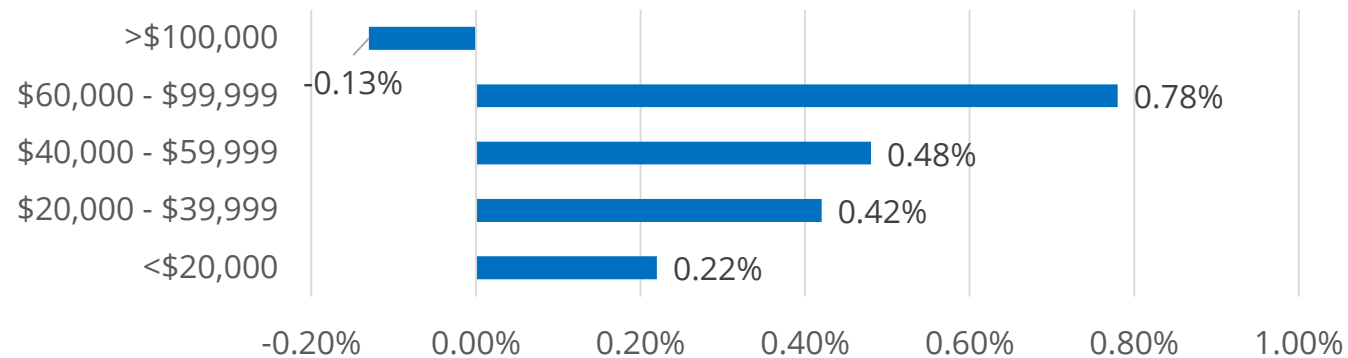
Madison County: Estimated Income Distribution and Job Landscape

The SIM estimates an increase in the proportion of middle income households in Madison County, likely driven by a larger proportion of production, manufacturing, and professional jobs
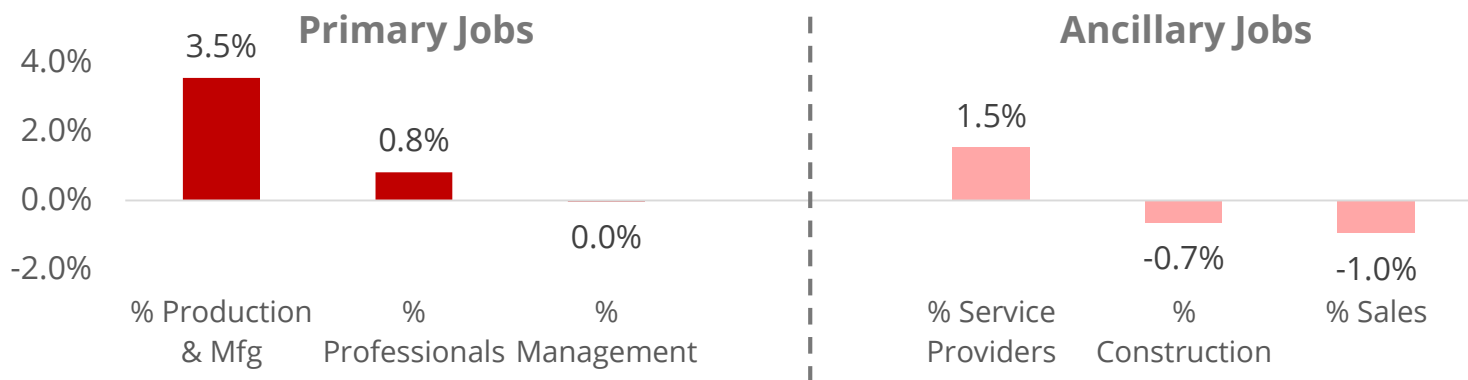
INCOME DISTRIBUTION

Difference in Income Distribution from Twin County

Income Bracket	Difference
>$100,000	-0.13%
$60,000 - $99,999	0.78%
$40,000 - $59,999	0.48%
$20,000 - $39,999	0.42%
<$20,000	0.22%

JOB LANDSCAPE

Difference in Job Landscape from Twin County

Primary Jobs

Category	Difference
% Production & Mfg	3.5%
% Professionals	0.8%
% Management	0.0%

Ancillary Jobs

Category	Difference
% Service Providers	1.5%
% Construction	-0.7%
% Sales	-1.0%

- There is an estimated **increase in middle income households**, with the $60k to $100k segment most affected

- This increase is likely driven by a larger proportion of **production and manufacturing** as well as **professional jobs** in Madison County

- **Unemployment rate** is projected to only decrease slightly by 0.06%. Some of the new jobs may be offset by new migrants into the area

- The projected increase in the proportion of service providers speak to the higher levels of **advanced industry** in the County as well as **disposable income** amongst the population
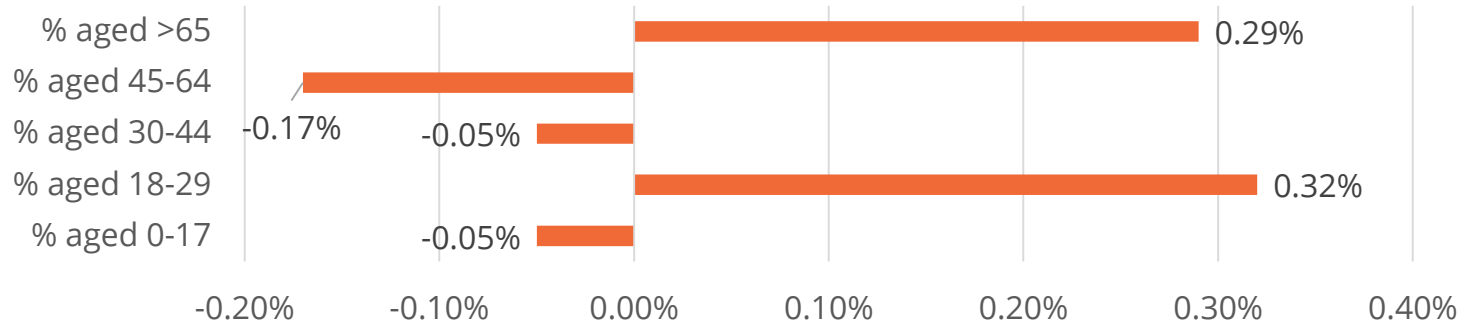
Madison County: Estimated Age Distribution and Socio-Economic Impact

The SIM estimates an increase in the proportion of 18-29 year old individuals and a reduction in poverty in Madison County

AGE DISTRIBUTION

Difference in Age Distribution from Twin County

Age Group	Difference
% aged >65	0.29%
% aged 45-64	-0.17%
% aged 30-44	-0.05%
% aged 18-29	0.32%
% aged 0-17	-0.05%

SELECT FAMILY & SOCIO-ECONOMIC METRICS

Difference from Twin County

Family Metrics

⊖	**- 0.44%**	% Families with children
⊕	**-2.70%**	% Children in Poverty

Socio-Economic Metrics

⊖	**-0.19%**	% Moved in Last 5 Years
⊕	**-0.37%**	% in Poverty
⟷	**-0.03%**	Income inequality (Gini Coefficient)

- The population is estimated to have a **larger proportion of 18-29 and above 65 year old** individuals

- This could be driven by a combination of an **aging population** and **in-migration** of young, working aged individuals looking to fill the new jobs

- A projected larger proportion of 18-29 year old individuals may explain the decrease in proportion of families with children

- The **population is estimated to be more stable**, with less moving in or out of the county in the last 5 years

- New investment and jobs are projected to have a **positive influence on both overall and childhood poverty**

- Investment is projected to have little effect on Income inequality
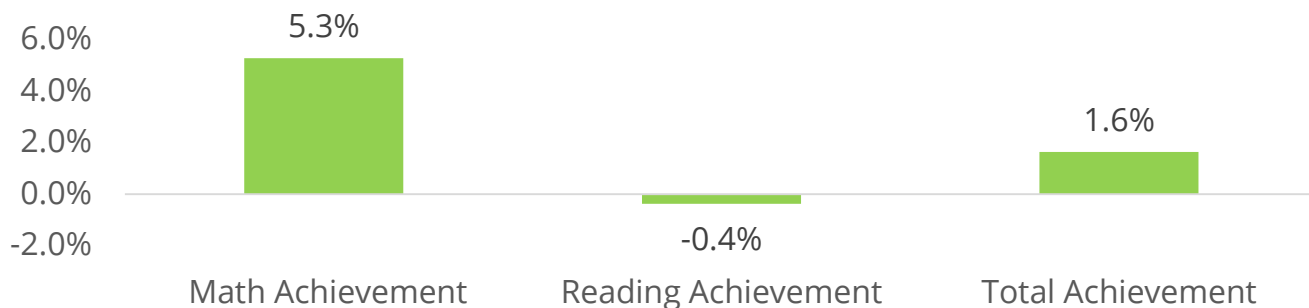
Madison County: Estimated Education and Housing Impact

The SIM estimates an increase in educational achievement while a larger proportion of the population will rent their homes and live in apartments
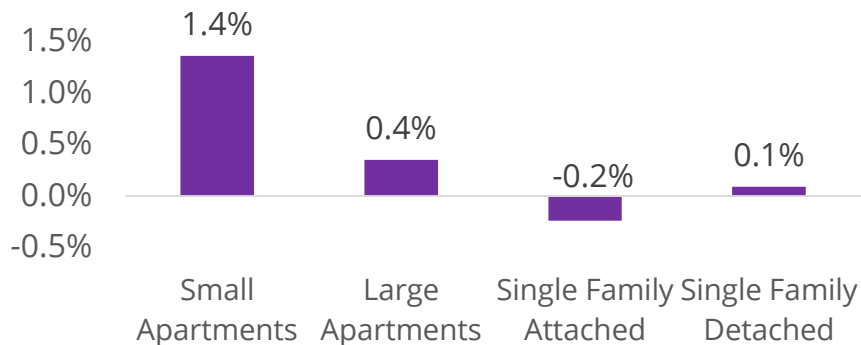
SELECT EDUCATION METRICS

Difference in national percentile of test scores from Twin County

- Math Achievement: 5.3%
- Reading Achievement: -0.4%
- Total Achievement: 1.6%

(Chart y-axis: -2.0%, 0.0%, 2.0%, 4.0%, 6.0%)

SELECT HOUSING METRICS

Difference from Twin County

% Living in Various Types of Housing

- Small Apartments: 1.4%
- Large Apartments: 0.4%
- Single Family Attached: -0.2%
- Single Family Detached: 0.1%

(Chart y-axis: -0.5%, 0.0%, 0.5%, 1.0%, 1.5%)

Cost / Value of Housing

➕	**0.80%**	Median Home Value
➕	**-0.45%**	Median Rent to Income
➖	**-0.11%**	% Owner Occupied

- Test scores in schools are estimated to perform better than the twin county, especially **in math achievement**

- Minimal projected impact in the proportion of population with college or advanced degrees

- More of the population is estimated to **rent their homes** and **live in apartments**. This could be due to a larger proportion of 18-29 year-olds

- **Home values are predicted to increase** while **rent becomes more affordable** given the new levels of income in the County

- Minimal estimated impact on commute times or other transportation metrics
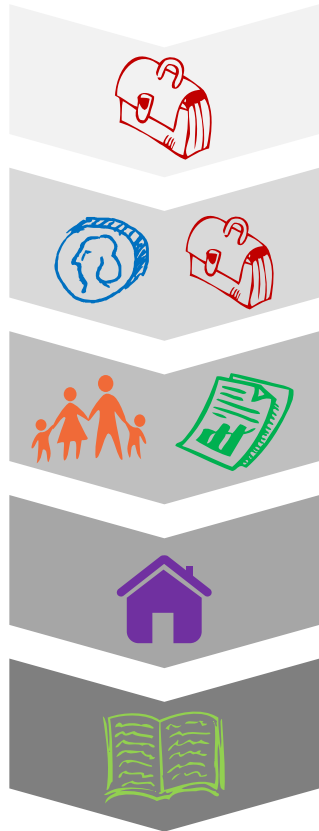
LIMESTONE COUNTY

The Projected Social Impact Story in Limestone County

Investment in Limestone County is estimated to result in positive social impact in terms of employment rates, poverty rates, and educational achievement

$2.34B Investment; 6,300 Jobs Created
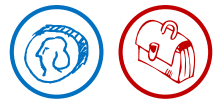
4 years later...

Investment in Limestone County is projected to create a large influx of production and manufacturing jobs at the expense of professional jobs

Unemployment rate is projected to go down but the proportion of lower income households ($0-40K/ year) is estimated to increase. Less disposable income likely results in less ancillary jobs being created

Working aged individuals are projected to move into the county to fill the new jobs, while higher income households move out. More jobs will likely move those in poverty towards within 200% of the poverty level

Due to a projected larger proportion of families with stable incomes, more of the population will likely own their homes and live in detached houses or large apartments

A more stable and employed population is projected. This likely leads to a reduction in childhood poverty rates and an increased emphasis on education. School test scores are projected to improve as a result
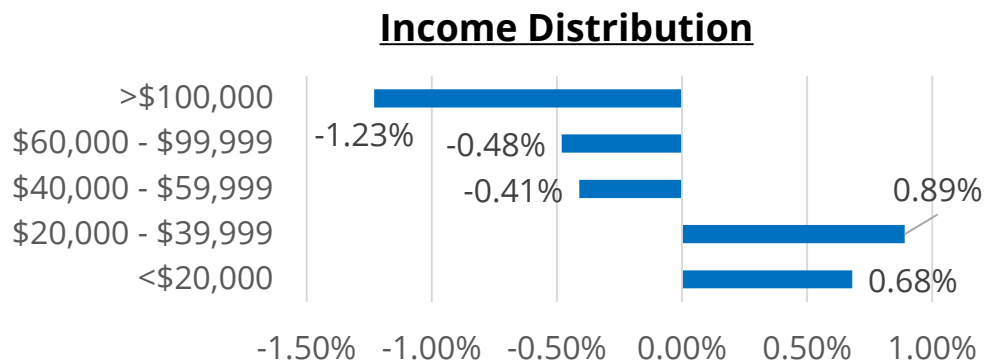
Limestone County: Estimated Income Distribution and Job Landscape

The SIM estimates an influx of production and manufacturing jobs in Limestone County that will decrease the unemployment rate, but result in a larger proportion of the population earning below $40K per year

INCOME DISTRIBUTION
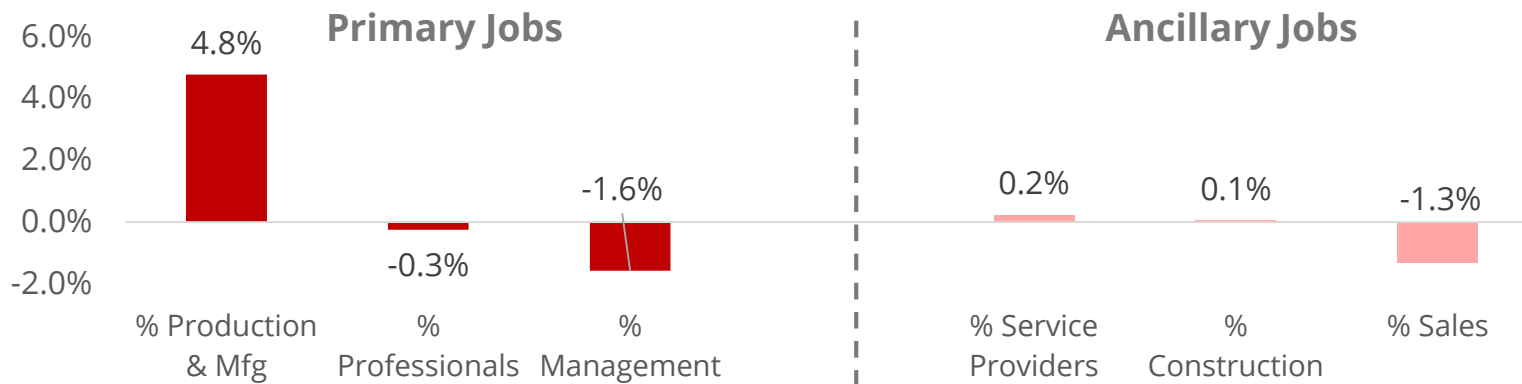
Difference from Twin County

Income Distribution

Bracket	Difference
>$100,000	-1.23%
$60,000 - $99,999	-0.48%
$40,000 - $59,999	-0.41%
$20,000 - $39,999	0.89%
<$20,000	0.68%

(axis: -1.50%, -1.00%, -0.50%, 0.00%, 0.50%, 1.00%)

Employment

➕ **-2.10%** % Unemployed

➕ **0.15%** Median Household Income

- There is an estimated **increase in lower income households** that is offset by a **decrease in higher income households**, especially those earning >$100K

- This shift is likely **not due to a lack of jobs** as shown by decreasing unemployment rate and increasing median household income

- Instead, it is likely driven by a larger proportion of **lower paying production and manufacturing** at the expense of professional and management jobs

- The estimated lack of ancillary job creation may be explained by a **lack of disposable income** from households in Limestone County

JOB LANDSCAPE

Difference in Job Landscape from Twin County

Primary Jobs

Category	Difference
% Production & Mfg	4.8%
% Professionals	-0.3%
% Management	-1.6%

Ancillary Jobs

| Category	Difference
% Service Providers	0.2%
% Construction	0.1%
% Sales	-1.3%

(axis: 6.0%, 4.0%, 2.0%, 0.0%, -2.0%)

Limestone County: Estimated Age Distribution and Socio-Economic Impact

The SIM estimates an increase in the proportion of the working aged population in Limestone County, and a positive movement of those in poverty towards within 200% of the poverty level

AGE DISTRIBUTION

Difference in Age Distribution from Twin County

% aged >65	-0.13%
% aged 45-64	0.32%
% aged 30-44	-0.22%
% aged 18-29	0.07%
% aged 0-17	-0.27%
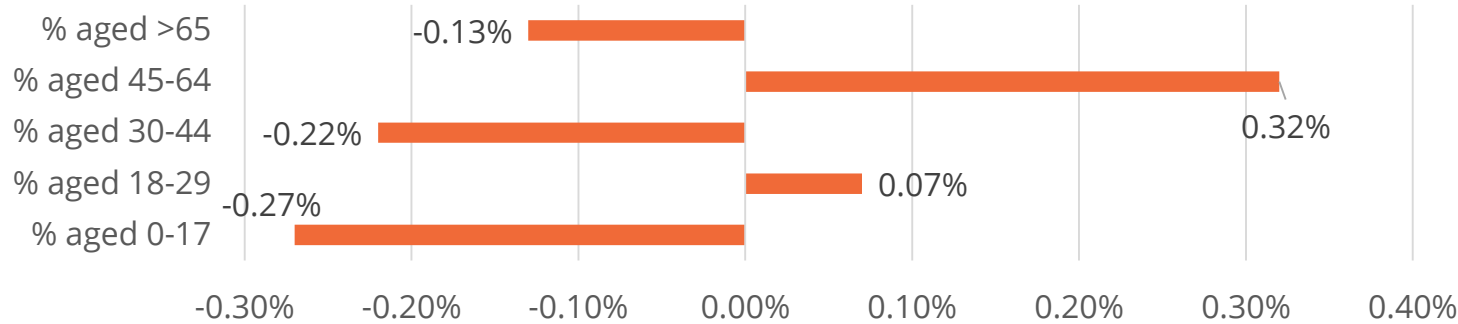
SELECT FAMILY & SOCIO-ECONOMIC METRICS

Difference from Twin County

Family Metrics

➕	0.29%	% Families with children
➕	-2.43%	% Children in Poverty

Socio-Economic Metrics

➕	0.46%	% Moved in Last 5 Years
➕	-0.70%	% in Poverty
➖	1.31%	% Within 200% of Poverty

- The population is estimated to have a **larger proportion of 18-29 and 45-64 year old** individuals

- This could be driven by **in-migration** of working aged individuals looking to fill the new manufacturing jobs

- An estimated larger proportion of 45-64 year old individuals may explain the increase in proportion of families with children

- The **population is likely more mobile**, with more moving in or out of the county – these could both be wealthier households moving out and new labor moving in

- New investment and jobs are projected to move some of the population **out of poverty but many still remain within 200% of the poverty level**
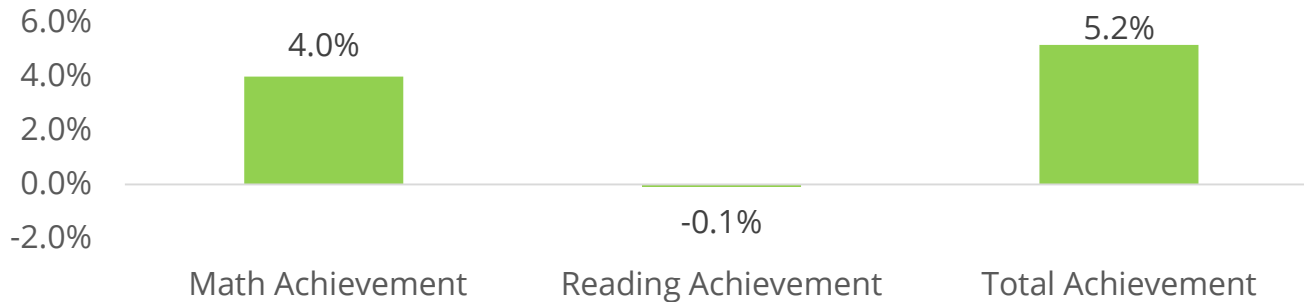
Limestone County: Estimated Education and Housing Impact

The SIM estimates an increase in educational achievement while a larger proportion of the population will own their homes and live in either large apartments or single family detached houses

SELECT EDUCATION METRICS

Difference in national percentile of test scores from Twin County

Bar chart showing:
- Math Achievement: 4.0%
- Reading Achievement: -0.1%
- Total Achievement: 5.2%

SELECT HOUSING METRICS

Difference from Twin County

% Living in Various Types of Housing

Bar chart showing:
- Small Apartments: 0.8%
- Large Apartments: 1.5%
- Single Family Attached: -2.8%
- Single Family Detached: 0.3%
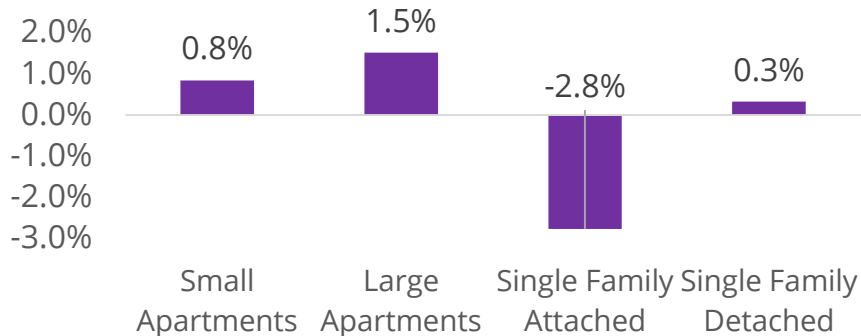
Cost / Value of Housing

⊕	**0.48%**	Median Home Value
⊕	**-1.69%**	Median Rent to Income
⊕	**0.48%**	% Owner Occupied

- Test scores in schools are estimated to perform better than the twin county, especially **in math achievement**

- More of the population is estimated to **own their homes** and live in either **large apartments or detached homes**. This may be attributed to more families in the county and stable income to afford home ownership

- For those that rent, **rent is also projected to become more affordable** with less of the population predicted to be unemployed and more earning a stable wage

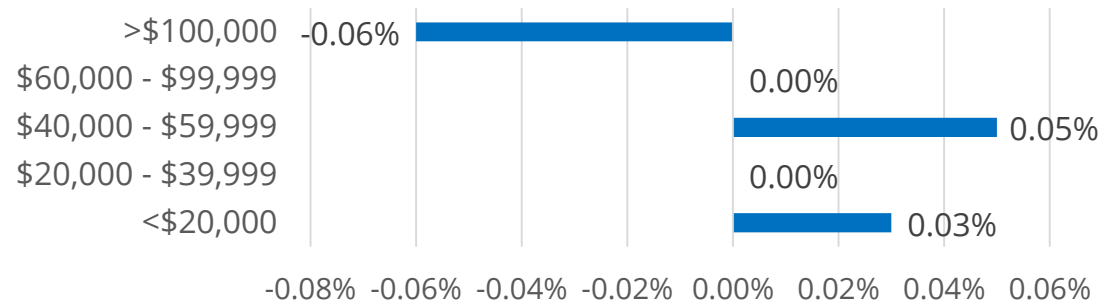- Minimal estimated impact on commute times or other transportation metrics

MORGAN COUNTY

Projected Social Impact in Morgan County

The level of investment in Morgan County is too low to predict an accurate picture of social impact. Below, we showcase a few metrics with the greatest projected movement
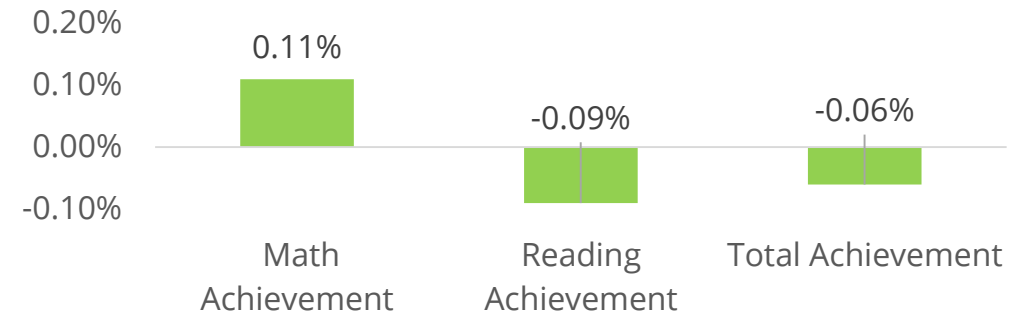
INCOME DISTRIBUTION
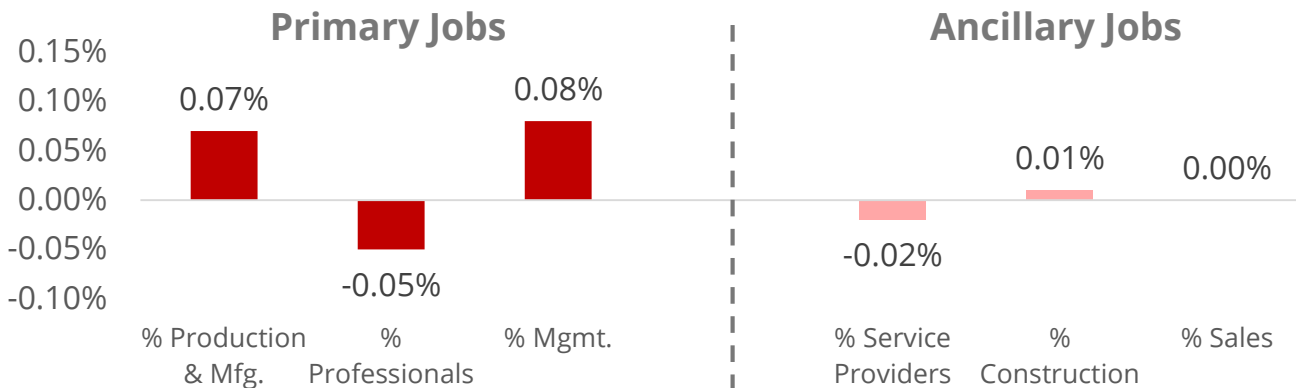
Difference in Income Distribution from Twin County

Income Range	Difference
>$100,000	-0.06%
$60,000 - $99,999	0.00%
$40,000 - $59,999	0.05%
$20,000 - $39,999	0.00%
<$20,000	0.03%

SCHOOL ACHIEVEMENT SCORES

Difference in national percentile of test scores from Twin County

Math Achievement: 0.11%
Reading Achievement: -0.09%
Total Achievement: -0.06%

JOB LANDSCAPE

Difference in Job Landscape from Twin County

Primary Jobs

% Production & Mfg.: 0.07%
% Professionals: -0.05%
% Mgmt.: 0.08%

Ancillary Jobs

% Service Providers: -0.02%
% Construction: 0.01%
% Sales: 0.00%

EMPLOYMENT

Employment

-0.08% % Unemployed

0% Median Household Income
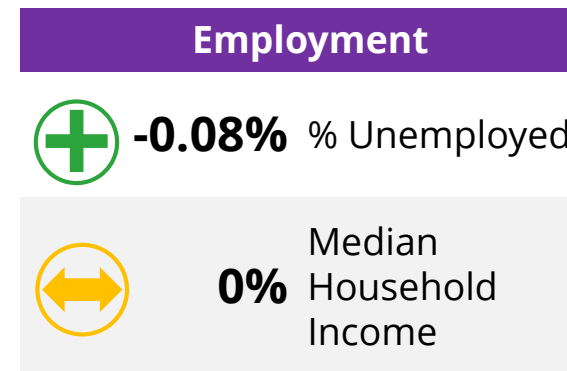
CONCLUSION

Conclusion

Investment in both Madison and Limestone County are projected to generally impact the community positively, especially around the variables that signal upward mobility of the population

KEY FINDINGS AND CONCLUSIONS

- Social impact variables that signal **upward mobility**, such as education scores and employment rates, were predicted to be **positively impacted by the investments** made in Madison and Limestone County

- Apart from the magnitude of investment and jobs created, the **industry of the investment and type of jobs created** were also important determinants of the predicted social impact:

    - In Madison County, a mix of manufacturing, data center, and headquarter investments will likely result in a higher income population with more disposable income to spend on the service industry. Additionally, higher incomes may also attract young, higher skilled labor into the area who are more likely to rent apartments than own homes

    - In Limestone County, predominantly manufacturing investments are projected to result in stable low to middle income jobs for the local population. This community is likely able to afford homes but do not have much disposable income to spend on the service industry

- Ultimately there are certain **trade-offs between attracting 'middle sector' or higher income jobs** to the county:

    - Middle sector jobs are projected to provide stability for the local population and reduce the local poverty rate, however the lack of disposable income may not create many ancillary jobs in the county

    - Higher income jobs are more likely to attract higher-skilled migrants into the area and the unemployment rate may not drop as a result. However, more disposable income may create more ancillary jobs around retail and the service industry

APPENDIX

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Limitations of the Social Impact Model (SIM)

- The main challenge, in attributing changes within each county's socio-econometric metrics to investment in that county, is that we only observe a single outcome for each county. For example, we can only know the socio-economic level of any given county in 2017 if it receives an investment in 2014, or if it does not receive an investment in 2014, but not simultaneously both. This is known as the fundamental problem of causal inference. In a hypothetical world where all potential outcomes can be known, then truly causal relationships can be established. However, since we never actually observe all potential outcomes, we turn to a statistical approach for assessing causation in observational data, known as the Rubin Causal Model. This model estimates the casual impact of corporate investments through the following steps:

- First finding pairs of counties that match each other exactly based on a pre-defined set of variables (covariates), such that one member of each pair receives an investment, while the other member does not

- Attributing the difference in socio-economic outcomes within each pair solely to the investment, similar to typical A/B tests

- In our study, as well as in practice, exact matches based on continuous variables, such as median household income are rare and highly improbable. Instead the nearest matches are found, which necessitates statistically adjusting for differences in the covariate values within each county pair before attributing differences in outcomes to corporate investments.

Social Impact Model (SIM) Assumptions

We had to assign an industry to each investment as part of calibrating the SIM for this assessment

- There were no matched counties available for Defense Manufacturing and Aerospace Manufacturing, so Industrial Manufacturing is used as a proxy

Company	Description	Industry in SIM	County	CapEx	Jobs
Facebook	Data center	Data Center	Madison	$750M	100
Blue Origin	Rocket manufacturing facility to produce engines	Industrial Manufacturing	Madison	$200M	342
Aerojet Rocketdyne	Defense advanced manufacturing facility	Industrial Manufacturing	Madison	$30.3M	200
Aerojet Rocketdyne	Defense HQ	Industrial Manufacturing	Madison	$9.4M	605
Mazda-Toyota	Joint Venture to manufacture automotive vehicles	Automotive Manufacturing	Limestone	$2,000M	4,000
GE Aviation	Manufacturing facility for aerospace parts	Industrial Manufacturing	Limestone	$200M	300
Polaris Industries	Manufacturing facility for electric vehicles (snowmobiles and ATV's)	Retail Manufacturing	Limestone	$142M	2,000
RUAG	Manufacturing space products	Industrial Manufacturing	Morgan	$30.6M	100

Project Team

Our team is comprised of location strategists and a data scientist, and is supported by leaders from Monitor Institute by Deloitte, which is focused on social impact strategy, measurement and evaluation

Core Team

Darin Buelow
Principal
Location Strategy

Lara Wigmore
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Location Strategy

Steven Ellis
Data Scientist
Monitor Institute

Jeremy Seah
Consultant
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Monitor Institute

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