

## **Nodaway County Economic Development Project**

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Industrial Sponsor: Nodaway County Economic Development, Mr. Josh McKim



This work is part of the PICMath program.

### **1. Statement of the problem**

The PicMath team from Northwest Missouri State University, advised by Dr. Brain Haile, worked with the Nodaway County Economic Development committee (NCED), that was represented by Mr. Josh McKim. The problem presented by Mr. McKim was to create a tool that predicts the effects of firms opening or closing within the local Nodaway County economy. Specifically attempting to predict the effects of firms on economic variables of interest such as tax revenues, per capita income within the economy and other businesses. Mr. McKim found this problem to be quite substantial to his work as he has no means to accurately predict economic development, although he shared that he has worked with software in the past that specifically solved this problem for larger economies.

## **2. Results**

Initially we hoped to create a model similar to RIMS-II but it was determined that this would not be possible. We then tried a more rudimentary approach by looking at business openings and closings in counties with similar demographics to Nodaway County, but the inability to collect enough data inevitable forced us in another direction. In our final approach we were able pull data from an appropriate number of counties and take manufacturing businesses, demographics of the county and per capita income to find a linear model with correlations and a multiplier. A couple of strong correlation presented themselves: (1) Number of Establishments vs. Annual Payroll and (2) Paid Employees vs. Annual Payroll. We were also able to establish certain multipliers using the increase in income per every manufacturing employee.

## **3. Approach to the Problem**

The process began with researching the software Mr. McKim spoke of, Remi and imPlan, and understanding how the software functioned. Remi, the first of the two software evaluated, uses a social accounting matrix to represent the flow of all economic transactions that take place within an economy whether it be regional or national. The matrix in itself is a representation of the national economy, thus assumes that the markets estimated are open. This is not the case to our market as we have a very small workforce, and are required to import many of the resources into our market. One of the recourses considered within Remi is labor, which is limited within our local economy as there is a small population over a large area, and Remi uses a

model that assumes a bottomless workforce. This is the main reason we realized we couldn't use a model similar to Remi [1],[2].

ImPlan the second model Mr. McKim discussed has very limited information on how the actual software functions as it is a private company, although we were able to reference the academic papers that are the foundation of imPlan, and we learned that imPlan at its original state functions much like Remi with a similar social accounting matrix, thus is a poor representation of our local economy [3]. While researching we came upon additional software called RIMS-II.

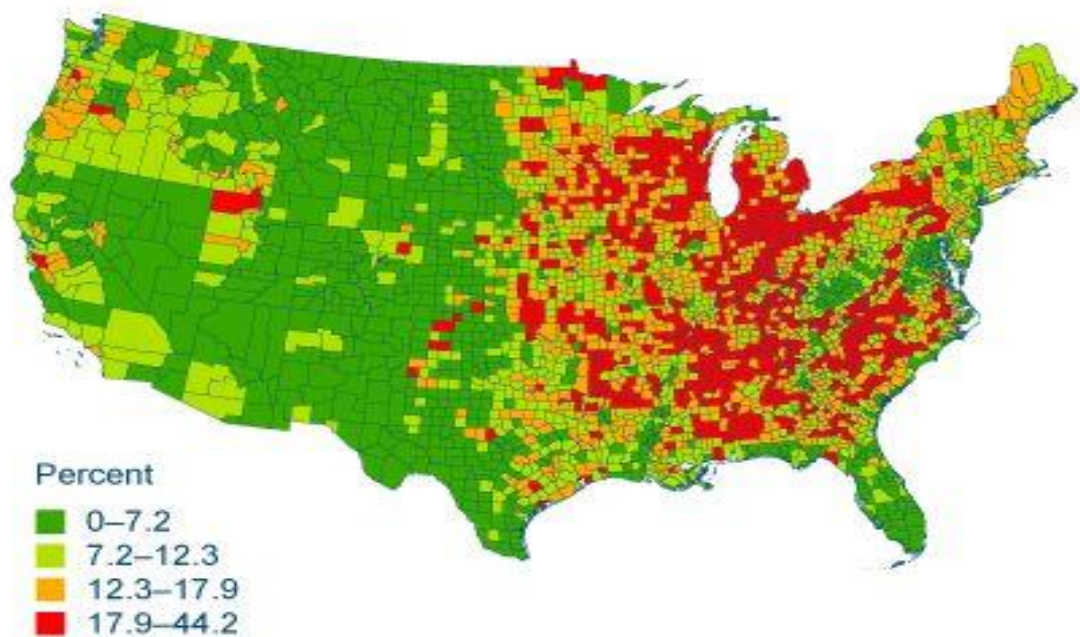
RIMS-II uses local economy estimates to build a similar input output model as Remi, but it evaluates locations based off smaller economies, oftentimes counties or large cities to estimate economies based off of their surroundings, building a model that is pieced together by county into regional areas, and then into the national economy. This works better for smaller economies although it still requires the assumption of a closed marketplace, and there are no time dimensions considered, thus it will not show you the effects of a firm entering or leaving within a specific time span [4],[5]. This is once again a reason Rims-II would not show the economic change that we looked for. A Rims-II –type model was still considered as a possible option because it works better than the other models for evaluation of local economies. Therefore research continued into rims-II on how one could allow for these assumptions to bend to fit our economy. At this point, data collection was just beginning and the issue of finding all of the data that is required to implement such a models multipliers became known.

At this point we set out to address the aforementioned issues using social accounting matrices. To do this, we planned to collect our own data on local economic conditions so that we could attempt to create a stochastic model that would accomplish our goal of forecasting local economic changes. Thus we encountered the problem of how to collect data. This issue was particularly exacerbated by the presence of Northwest Missouri State University and its seasonal effects within the local economy. We found this issue presented an unsurpassable obstacle on our ability to collect enough data to make short run economic forecasts. We elected to construct our forecast on the long run effects of economic changes, theoretically circumventing the issue with the university. We then progressed to collect data on similar, rural economy with a set geographic boundaries. We again ran into problems with data collection; there simply was not enough data available. Facing this issue, we hit a road block. After a period of research, we ended up consulting Dr. Abington in the Northwest Missouri State University Economics department, who gave us the idea of utilizing data collected at the county level by the US Census Bureau about changes in the levels of employment within the manufacturing industry.

#### **4. Detailed Presentation of the Results**

Using the data in figure 1 we chose ten states containing counties with a similar economic make-up to that of Nodaway County. These included Minnesota, Iowa, Nebraska, Kansas, Missouri, Illinois, Indiana, Kentucky, Tennessee, and Arkansas.

## Share of Manufacturing Employment



Source: American Community Survey (2005–2009 estimates).

Figure 1

Using this map an appropriate sampling of counties was selected with a predominately rural agricultural society yet relatively heavy in manufacturing similar to Nodaway County.

Once the data was assembled we began looking at correlation maps. In figure 2 we show the correlations involving all ten states and all counties.

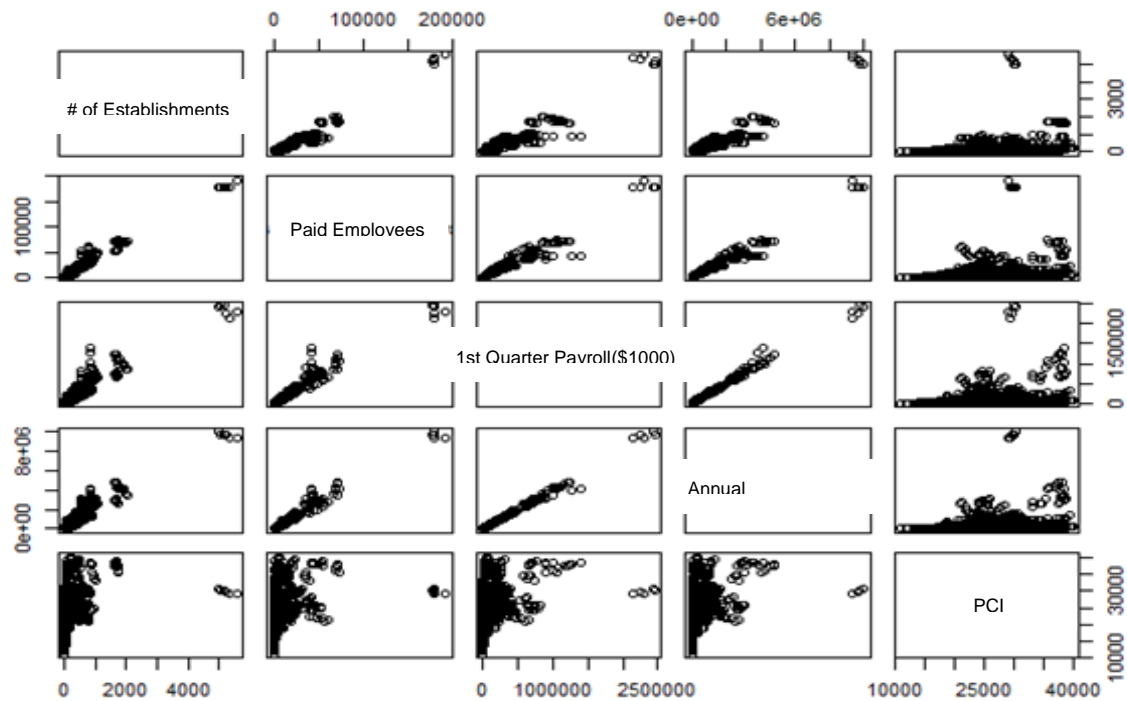


Figure 2

Here we noticed the correlation between the Number of Establishments and Annual Payroll is very high at 0.953832 but at the same time the correlation between the Number of Establishments and Per Capita Income is surprisingly low at 0.3004171. According to economic theory, we should have found a strong correlation between Per Capita Income and Annual Payroll, but we did not.

In figure 3 we looked at these same correlations involving counties from our ten state region with a number of manufacturing establishments less than 50. Nodaway County has 22 manufacturing establishments, so we hoped to remove some of the larger cities and more densely populated counties that might skew our data.

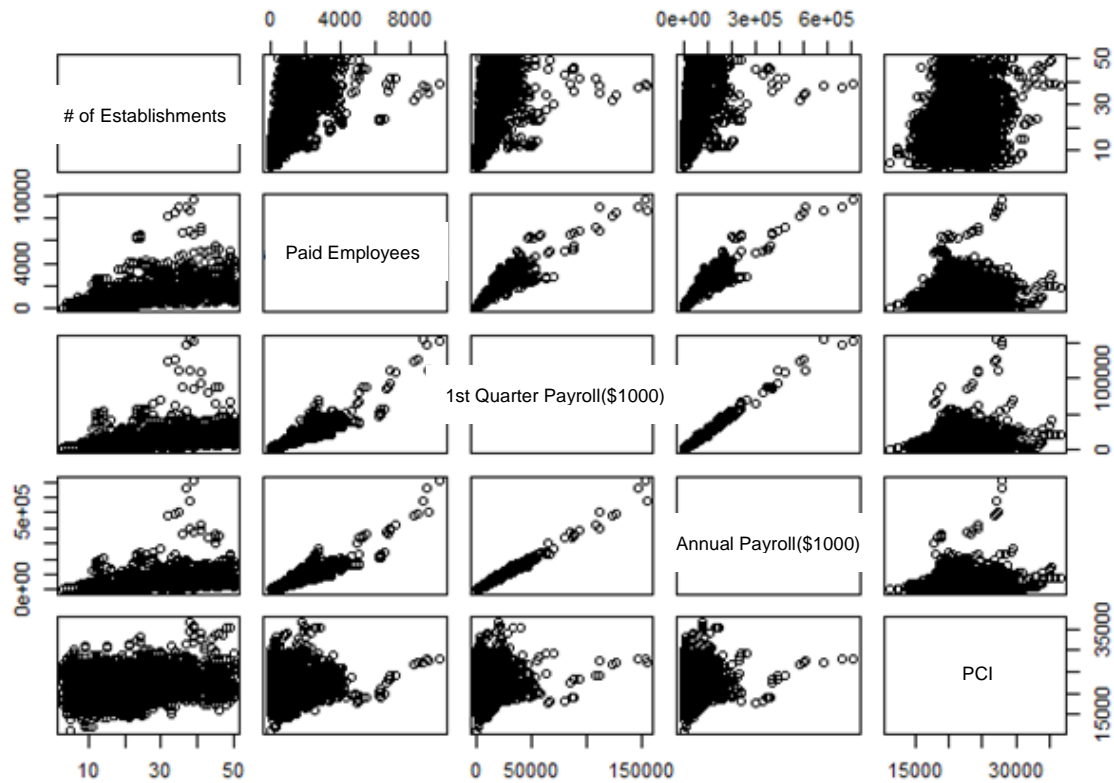


Figure 3

In this data we noticed that the only high correlation existed between Paid Employees and Annual Payroll at 0.940989. The correlation between the Number of Establishments and Annual Payroll is 0.523133 and, once again, the correlation between the Number of Establishments and Per Capita Income is very low at 0.167883.

In figure 4 we look at a similar correlation map, but filtered down to include all counties only from the state of Missouri. Similar to all counties in the ten state region, the correlation between the Number of Establishments and Annual Payroll is very high at 0.972263 but at the same time the correlation between the Number of Establishments and Per Capita Income remained low at 0.535294.

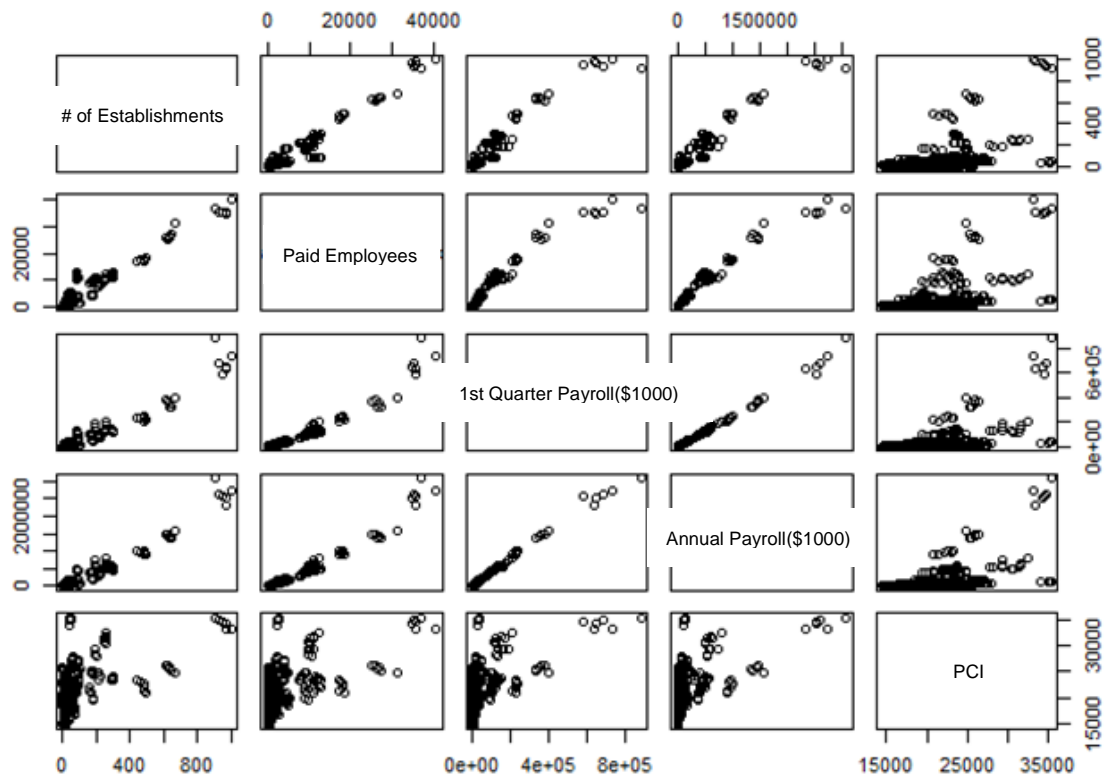


Figure 4

Going further, in figure 5 we take a look at a correlation map using only counties in Missouri with a number of manufacturing establishments less than 50. This is perhaps the counties most similar to Nodaway County. Once again, and not surprisingly, we noticed that the only high correlation existed between Paid Employees and Annual Payroll at 0.974816. However, the correlation between the Number of Establishments and Per Capita Income remained low at 0.207131 and the correlation between Paid Employees and Per Capita Income is also low at 0.201456.



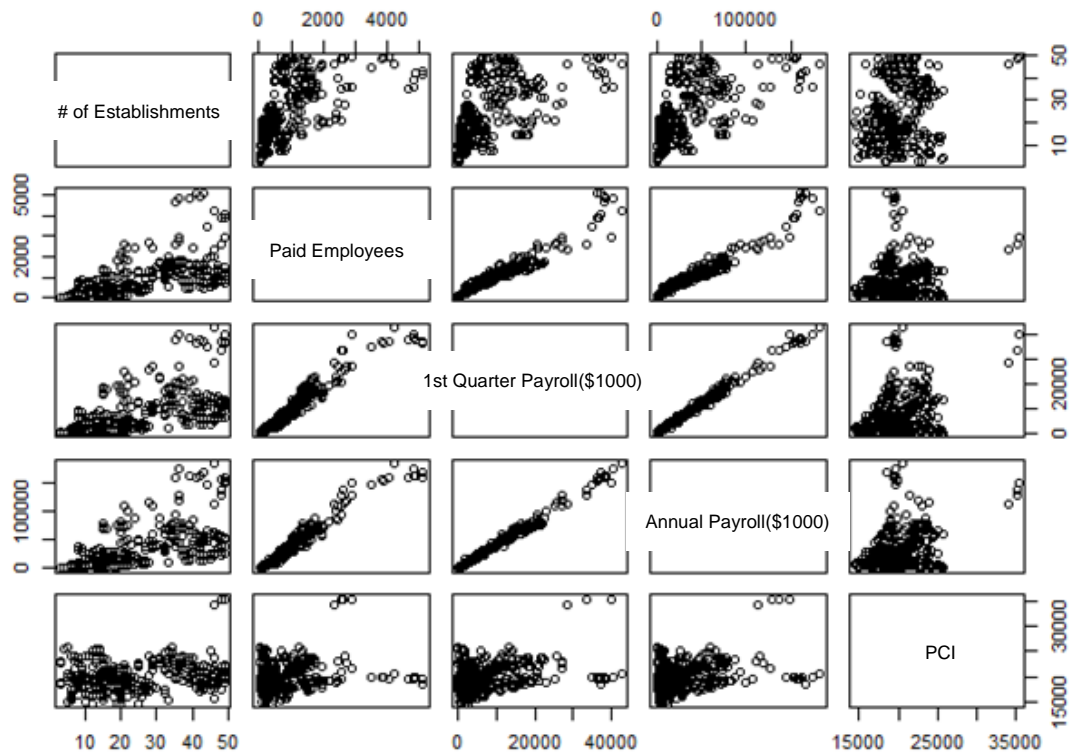


Figure 5

## 5. Conclusions with implications & suggestions for future work

It is not surprising at all to find a high correlation between Paid Employees and Annual Payroll among the data, however we remain very surprised at the very low correlation existing between Per Capita Income and Annual Payroll. Nevertheless we have been able to establish a few trends among the data.

### Nodaway County:

For every additional manufacturing employee, the annual income is increased by \$41,774.

### Missouri:

For every additional manufacturing employee, the annual income is increased by \$38,528.

**All States:**  
For every additional manufacturing employee, the  
annual income is increased by \$42,128.

\*Figures are calculated from counties with less than 50 manufacturing establishments.

At this point we feel that the data and limited analysis only raise more questions than have been answered. Certainly there are implications for an economy the size of Nodaway County when manufacturing jobs are gained or lost, but the true nature of those implications remain to be fleshed out.

Many avenues exist for further investigation. Ultimately, in our study we only looked at data associated with manufacturing so a logical next step would be a study that included companies or businesses outside of manufacturing. Certainly one should examine the correlations among other variables such as population, tax revenues, unemployment rates, etc. Now, despite the apparent difficulty, further investigations should explore the effects a university and agriculture have on the Nodaway County economy.

## **6. Acknowledgements.**

Many thanks go to Mr. Josh McKim for the project and the time he spent in meetings (some at odd times) answering our many questions. The opportunity to work on this project was made possible by



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