Power System Engineering, Inc.

PSE

Load Forecasting in a Severe Business Cycle

Long-run vs. Short-run Needs

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Who is PSE?

- Power System Engineering, Inc. (PSE) is a full service consulting firm for electric utilities.
- The professionals at PSE include engineers, IT and communication experts, utility strategy experts, economists, and financial analysts.
- Our team has extensive experience in all facets of the utility industry.

Company Background

- Established in 1974 to serve the engineering and technology needs of electric cooperatives.
- Have served more than 250 clients including distribution cooperatives, G&Ts, municipal utilities, and IOUs.
- 100 % employee owned and managed.
- About 55 employees with offices in Wisconsin, Ohio, Minnesota, and Indiana.

What does PSE do?

Resource Planning

- Demand Response Economics
  - Load Management
  - Critical Peak Pricing
  - TOU Rates
- Energy Efficiency Studies and DSM Evaluations
- Load Shape Estimation and Forecasting
- Load Forecasting
  - Econometric
  - End Use
- Power Supply Studies and Integrated Resource Plans
- Loss Reduction Studies
- Survey Research Services

Presentation Purpose

- To explain how to adapt load forecasts to meet both long- and short-run goals in times of severe business cycles.
  - Reason: Most forecasts are based on long-term trends which will not show the impact of a downturn. However, many decision makers want to know the impacts of downturn. This is one example of how to model a recession in a load forecast.

Presentation Overview

- Load forecasting methods
  - Short-term needs
  - Long-term needs
- Business cycle trends
- Economic data
  - Monthly vs. annual
  - Business cycles in economic data
- Incorporation of adjusted data into the forecasts
- Range scenarios for RDUP requirements

What is the Purpose of a Load Forecast?

- It's NOT to predict the future in an absolute sense rather it identifies primary growth influences and raises awareness of possible future outcomes
- Examples of these influences
  - Certain class of consumers
  - Economic factors
  - Weather trends & influences
  - Other impacts (large customer driving the load)

Load Forecast Roadmap

- Indentify the applications of the forecast
  - Short-run
  - Long-term
- What data influences drive the forecast?
  - Residential
  - Commercial and industrial
- How is the economy impacting your forecast?
  - Residential
  - Commercial and industrial
- How are these impacts represented in the data?

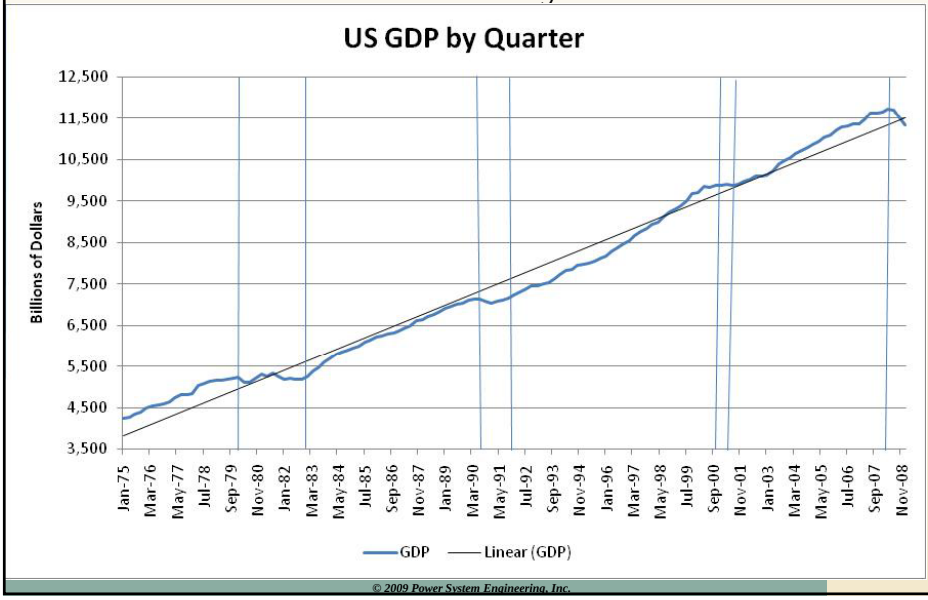
Short-run Needs (1-10 years)

- Financial forecasting
- Loan feasibility studies
- Analysis of marketing strategies
- Impact evaluations of future load management and energy conservation programs

Long-term Needs (10 years or longer)

- Integrated resource planning
- Long range distribution plans
- Transmission plans
- RDUP loan applications

Business Cycles



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Load Forecasts vs. Business Cycles

- Load forecasts are based on long-term equilibrium trends that will not show business cycles.
- Impacts in the long run
  - Although cyclical, the economic trends are growing and upward
- Local business cycles can differ from national trends
  - Different local economic drivers can insulate or exaggerate local economic conditions
    - Agriculture
    - Manufacturing
    - Government

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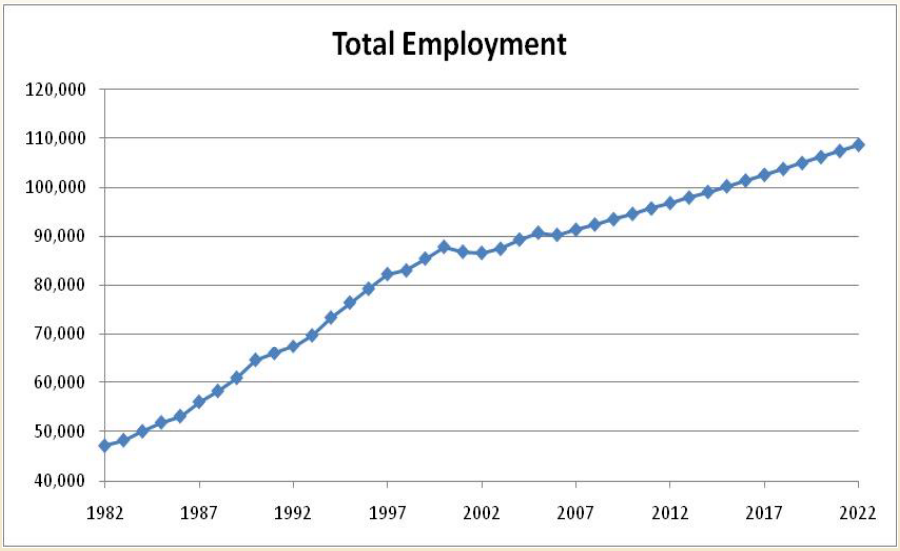
Methods Used to Develop Load Forecasts

- Historical trending
- ARIMA models
- End-use modeling
- Econometric modeling
- Neutral networks

Econometric Model

- Advantages
  - Relate consumption to variables such as income, weather, economic, demographic, and price as well as historical patterns.
  - Generally very good at predicting long-run patterns subject to accurate forecast of independent variables
- Disadvantages
  - Hard to capture market segmentation
  - Dependent on the frequency of independent data, typically annual
  - Dependent on accuracy of independent variables such as economic, price, and demographic indicators

Woods & Poole Long-term Trends



Economic Data Problems

- Based on data collected by different governmental agencies (such as Census Bureau, Labor Department, etc)
  - Typically updated on an annual basis
  - Can be based on a projection
- Business cycle trend may not appear in the data for several forecast cycles
  - Example of this is current recession is only now appearing in some of the government's updates and third-party data

Econometric Model Adaption

- The historical period for each of the individual load forecasts for usage and sales will be fitted to historical data. (Business as usual)
  - If consumer growth is believed to be influenced it can be adjusted as well.
- The forecast period for each of the individual independent variables will then be adjusted using the methodology defined in the rest of the slides.

History as a Guide

- Because turning points and lengths of business cycles are extremely hard to predict, history will be our guide
- This approximation will use real historical data
- This takes the guess work out of predicting the recession
- It may not be 100% accurate, but it provides a framework for future projections
- Past recessions will show how individual economic components are impacted by a business cycle
- One difficulty is that there are very few recessions from which to guide the process

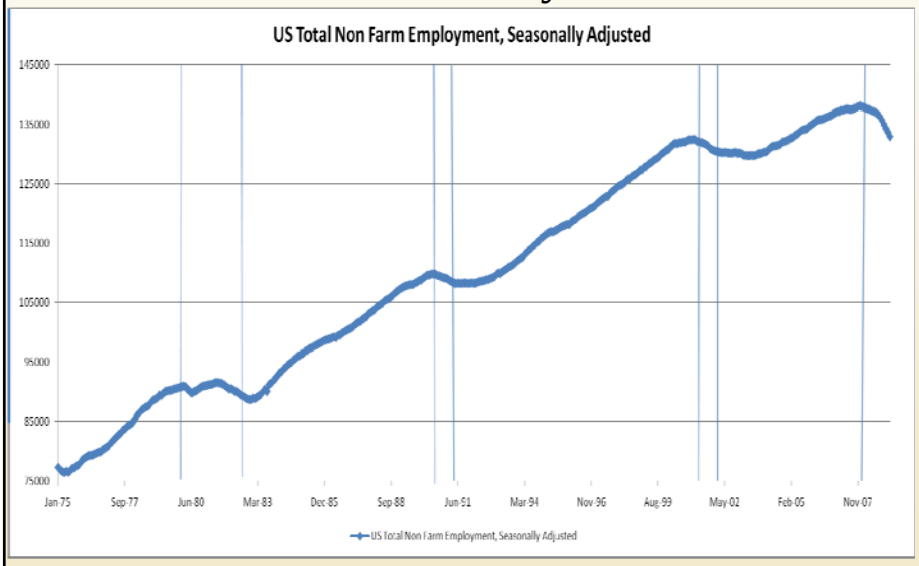
Recessions of the Past Thirty Years

Recent US Recessions	
Time	Length
1/1980 to 11/1982	23 months
7/1990 to 3/1991	8 months
3/2001 to 11/2001	8 months
12/2007 to present	18 months +

Impacts on Individual Economic Variables

- Different variables are impacted in unique ways
  - Leading vs. Lagging indicators
- Employment variables are lagging indicators
  - Traditionally, they fall after a recession has hit and take longer to improve in a recovery
  - Employment variables influence many cooperative sales and usage forecasts
  - Thus, they will be used as the example today

Business Cycles



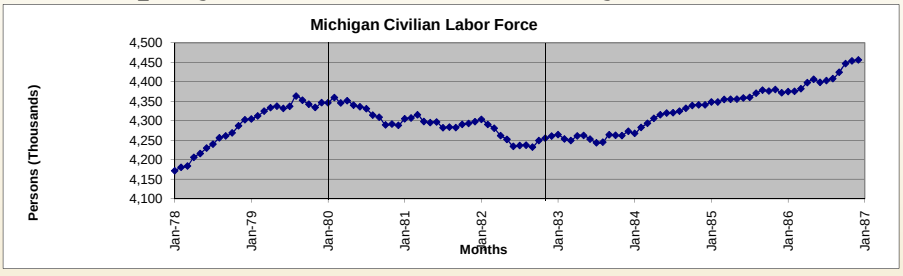
Annual vs. Monthly Data

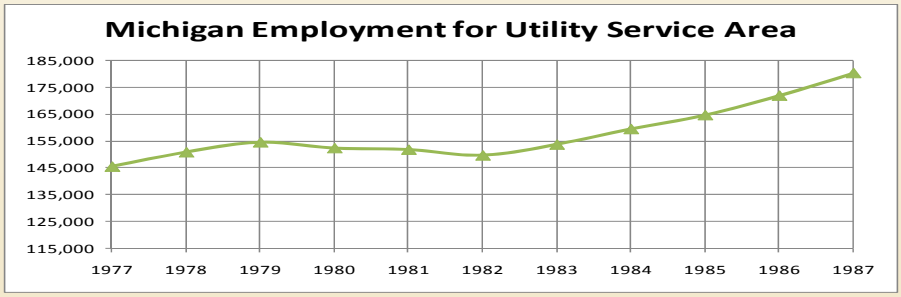
- Because business cycle downturns have been so short in the past thirty years, it is important to look at monthly data to get a sense of the trends
  - Most econometric load forecasts are based on annual data
- Monthly data is extremely useful to indentify the business cycle that best reflects the current trends
  - This can then be applied to annual data

Incorporation of Data into Models

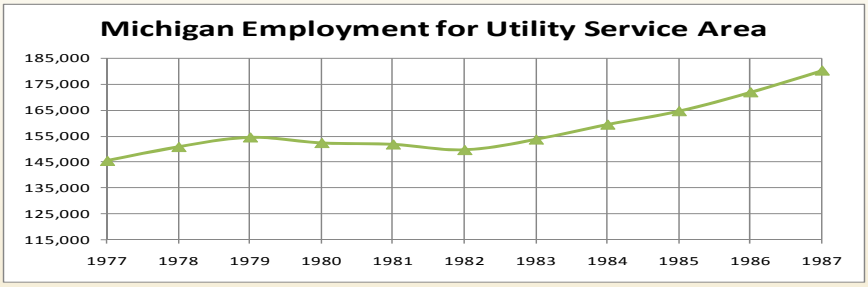
- Looking at past business cycles to find similar trends
  - Early 1980s recession has a similar time span
  - Housing slowed down, although for different reasons
  - Unemployment was also relatively high
- Specific variables may have separate trends to compare
  - Example of this may be agriculture data

Employment Data - Monthly vs. Annual



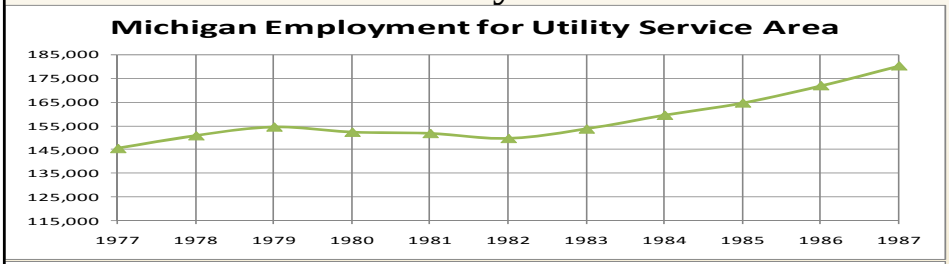


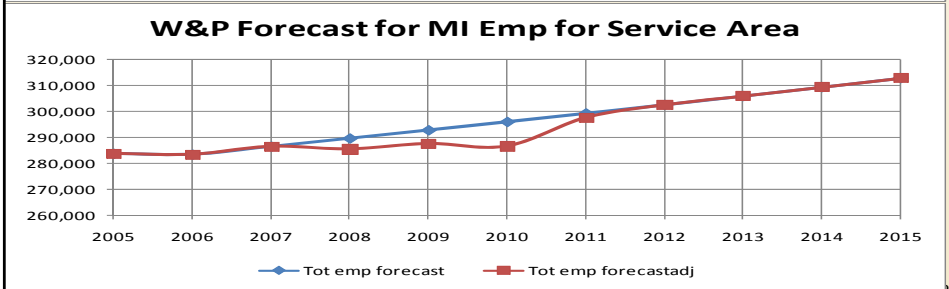
Model Projection



- These trends then can be incorporated in the forecasted data by taking the start of the historic recession and calculating the degree of contraction from the end of the recession
- This can then be imposed on the forecasted data
- This will produce a business cycle impact in the forecasted data

Total Employment Adjusted for Business Cycle Trend





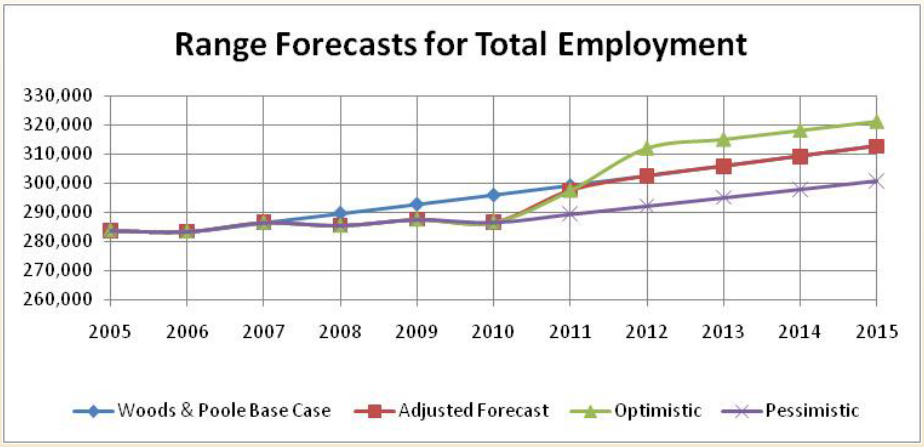
Model Advantages and Disadvantages

- Advantages
  - Incorporates historical business cycle trends into load forecasts
  - Addresses the need for short-term planners to see an impact in the load
  - Maintains long-term growth trends
  - Shows a possible acceleration out of the downturn
- Disadvantages
  - Assumes recession impact is identical to the past recession

Range Forecast Assumptions

- Optimistic: Follows the base case and returns to normal growth in 2011. However, it also follow the expansion trend seen after the first year of the 1980s recession. At that point, it uses the base case growth rate.
- Pessimistic: Reflects an assumption that the current economic distress is not actually a cyclical event but rather a fundamental shift to a new equilibrium growth path.
  - Total employment will not return to the anticipated long run equilibrium level and growth will proceed from current levels but never at the accelerated rates needed to return to the base case forecast.

Employment Ranges



- Total employment is adjusted for several different scenarios

Conclusions

- This method assumes that this business cycle downturn will be the same as the early 1980s
- It can be an effective tool that will help utility planners recognize the impacts of the downturn in the short-term.
- It follows long-run trends that the economy has return to in past recessions
- Range scenarios allow for different economic possibilities to happen.

Thank You:

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