



Modeling Data Issues in the Area of Resource Cost/Supply Petroleum Markets

Energy Analysis Collaborative Initiative Workshop

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Modeling and Analysis of Petroleum Markets

Three Areas to be addressed:

- Data and analysis of petroleum markets and supply disruptions.
- Understanding how petroleum markets affect Renewables and alternative fuels.
- Data sources and data gaps.
- Methods and models for analysis of short term supply, demand and prices.

Three Methods of Analyzing Data

- Introspection and the use of tabular and graphic display
- Econometric Modeling
- Statistical Analysis Techniques
 - Time Series
 - Linear Regression



Fundamental shift in analysis as a result of the explosion in data accessibility due to the advent of the Internet. Original source document can often now be directly accessed internationally. Time series can be directly downloaded into spreadsheet for analysis.

Bi-annual Short Term Energy Outlook

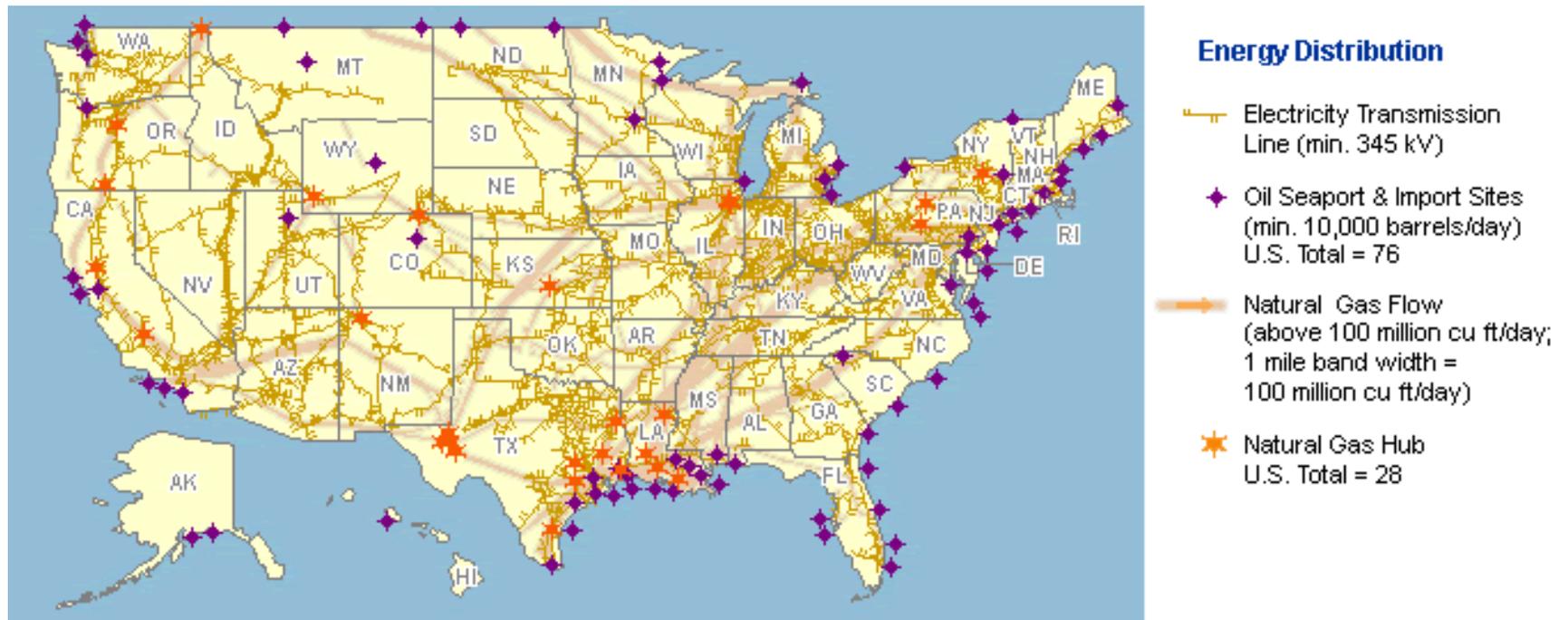


<http://www.dleg.state.mi.us/mpsc/reports/energy/>

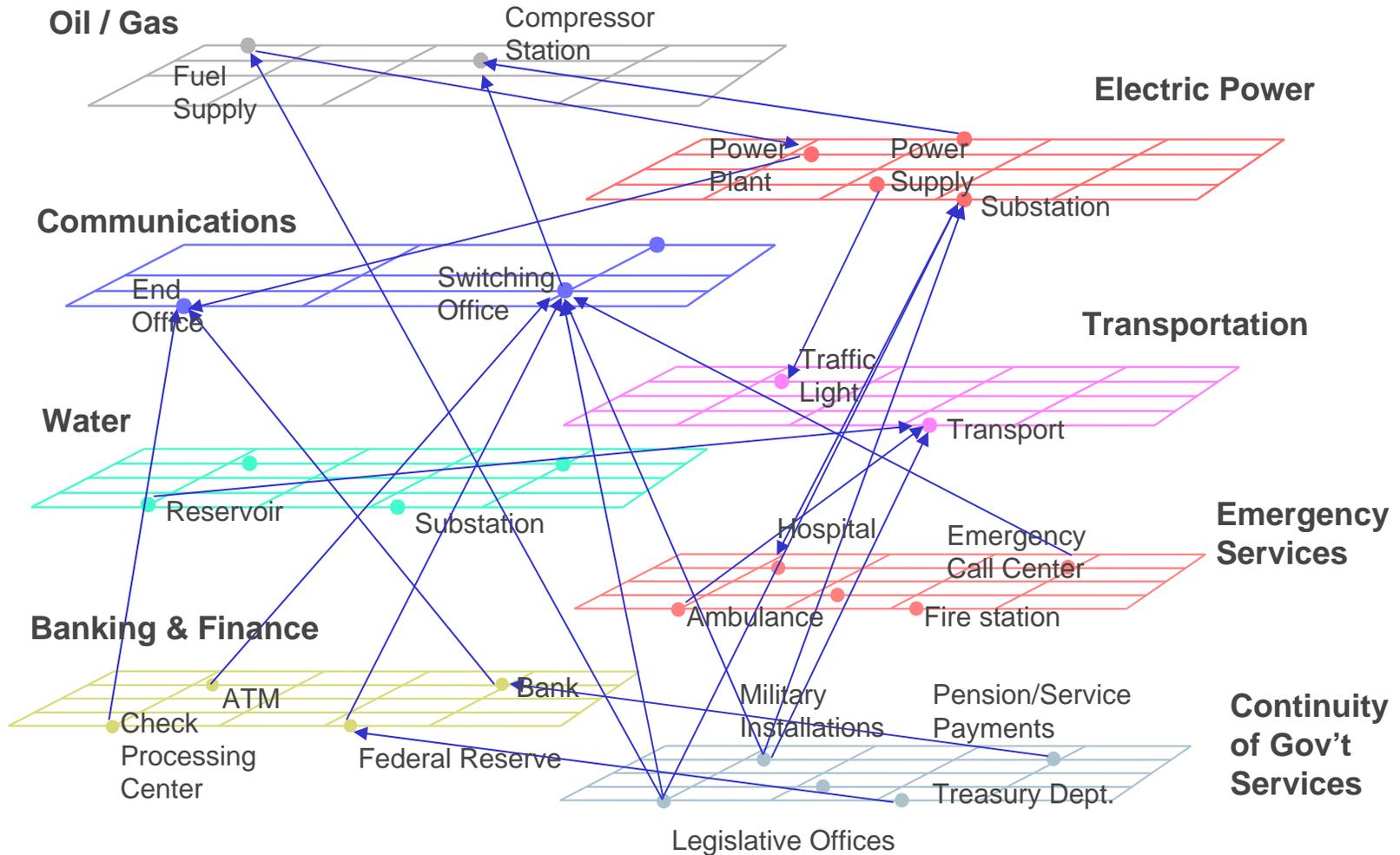
- Covers Natural Gas, Electricity and Petroleum.
- In production since 1978
- Used to benchmark supply, demand price trends and factors that influence them.
- Forecast extent 12 months
- Time Series analysis and multiple-linear regressions are used to produce the forecasts.
- Prices are not directly forecast.

The US Energy Infrastructure is Large and Complex

- 157,810 miles of Electrical Transmission lines
- 5,000 Power Plants; 800,000 Megawatts
- 2,000,000 miles of oil Pipelines
- 1,300,000 Miles of Gas Pipelines
- 2,000 Petroleum Terminals
- ~1,000,000 Wells
- Extensive Ports, Refineries, Transportation, and LNG Facilities



Understanding the Interdependent Infrastructures to assess consequences / cause and effects



Natural Gas Demand

- Demand is the sum of the projections by sector
 - Residential consumption by household as a function of Heating Degree Days (HDD) deviation from normal X total number of projected household and normal weather (HDD) is assumed in the forecast.
 - Commercial consumption by employee (Select SIC) as a function of HDD deviation from normal * total number of projected employees and normal weather (HDD) is assumed in the forecast.
 - Industrial consumption is primarily a function of the price of natural gas plus some influence from HHD.
 - Electric Generation use is based on the price of natural gas and deviation from normal for Cooling Degree days.

Natural Gas Supply

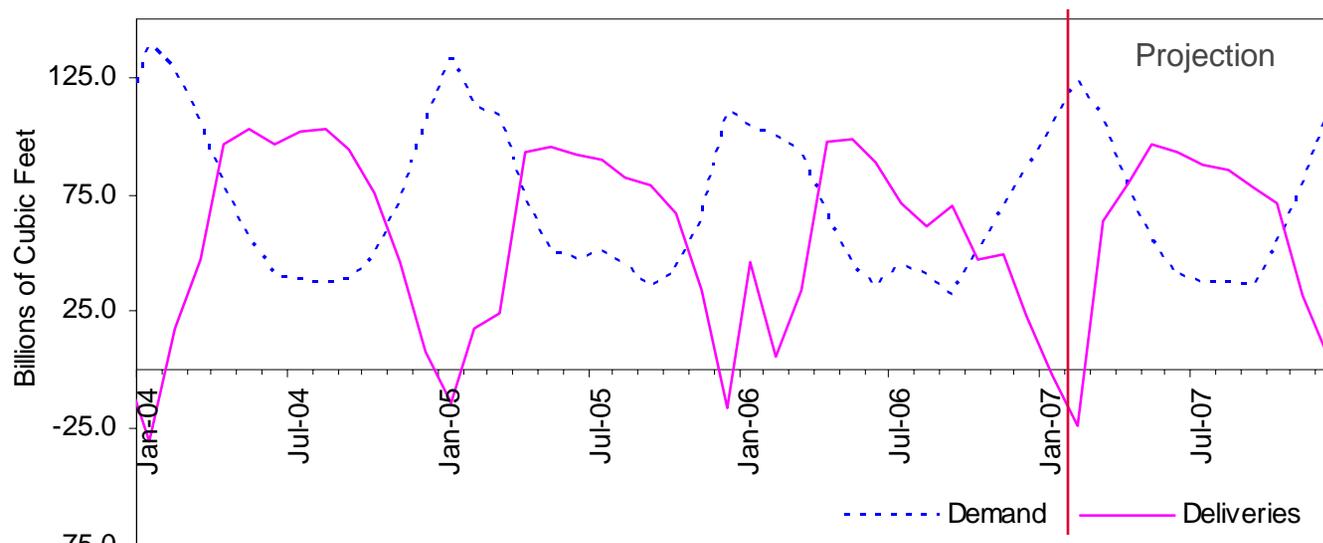


- Michigan Natural gas production has been declining linearly for a number of years at about a 5 percent rate and this is used as the projection.
- Changes in Storage levels is based on 5 year monthly average of working gas storage levels.
 - Once average levels are determined monthly changes in gas storage levels are applied to the most recent monthly figures publish by EIA and adjusted as needed by any near term extreme weather patterns.
 - Alternatively if the storage balance as near to or outside the five year range, Michigan working gas storage can be predicted by correlating this data with the national projection of working gas in storage published by EIA.
- Interstate deliveries are inferred as needed to balance supply and demand.

Data Inferences

Michigan's available underground natural gas storage is significant. With about 623 billion cubic feet of working gas capacity, Michigan has more storage than any other state.

Michigan Natural Gas Supply & Demand

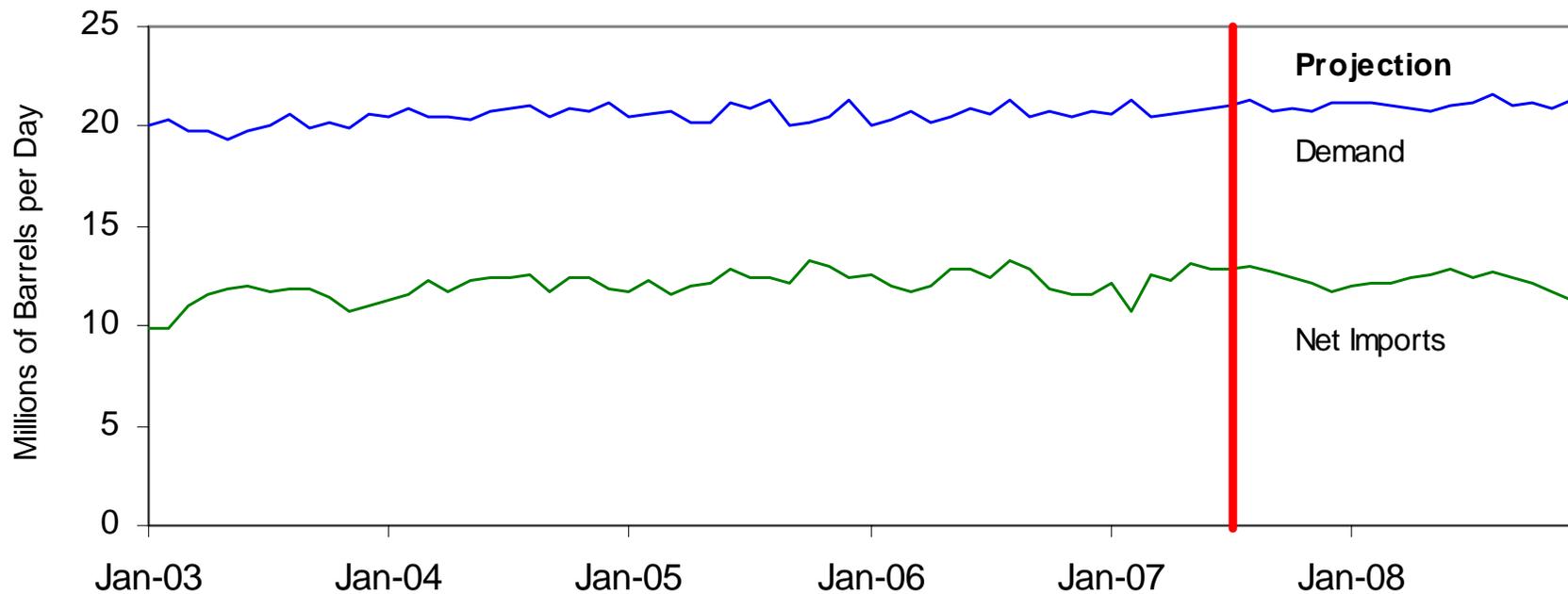


When demand is in excess of deliveries, the difference is w ithdraw als from storage

		Total	Net Interstate	Michigan	To (From)	Storage
		Demand	Deliveries	Production	Storage	Balance
2007	January	102.8	-1.9	14.3	-90.4	455.1
Projection	February	124.0	-24.9	12.8	-136.0	319.1
	March	105.8	62.5	14.2	-29.2	289.9

Petroleum Imports and Domestic Supply & Demand is the Starting Point

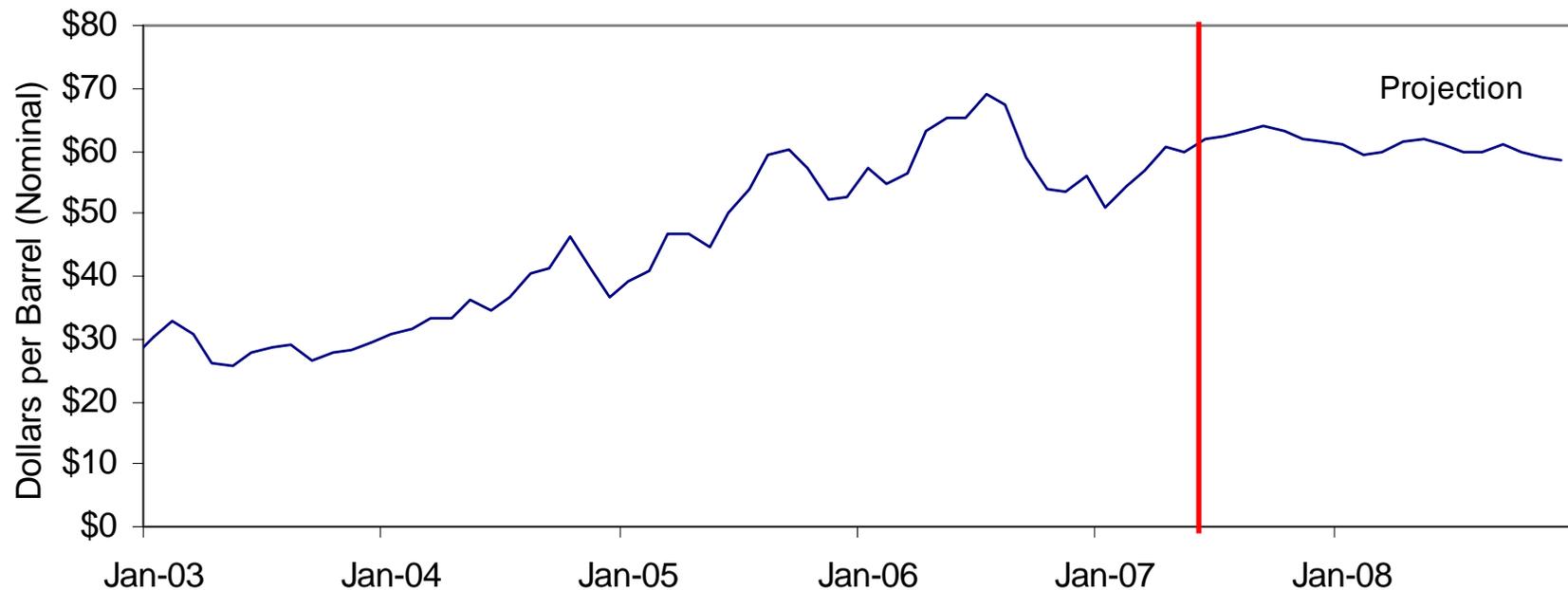
US Total Petroleum Demand and Net Imports



Source: EIA Short -Term Energy Outlook June 2007

Retail Petroleum Product Prices are a Function of Crude Oil Prices which is best Defined by RAC

Refiner Acquisition Cost (RAC) of Crude Oil



Source: EIA Short -Term Energy Outlook June 2007

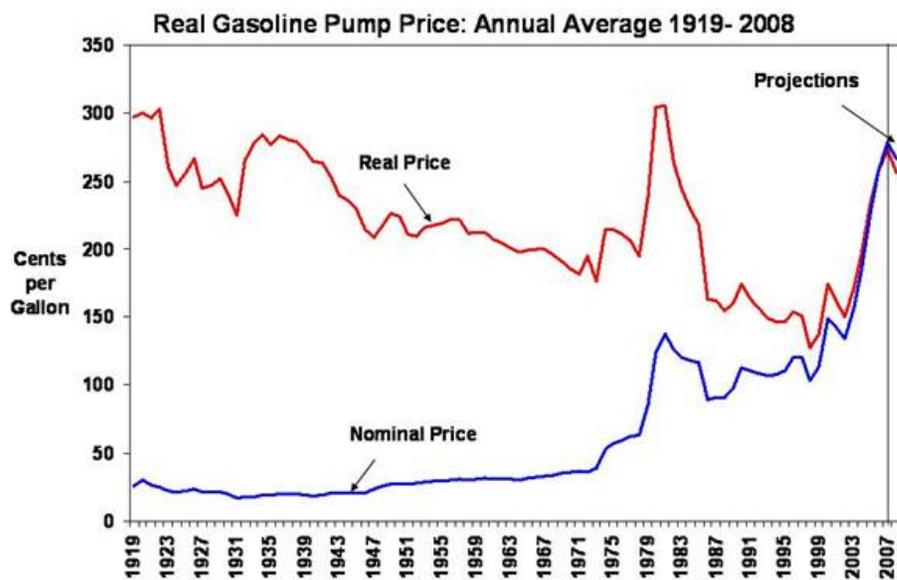
Crude Oil Supply Disrupted

Loss of power to operated pumping stations

Capline which supplies 1.2 million Barrels of Crude oil per day to Midwest refineries was totally shut down for five days in the week prior to the 2005 Labor Day weekend due to Hurricane Katrina. This caused the loss of nearly 6 million barrels of crude oil input to refineries and a number of refineries were forced to curtail production.



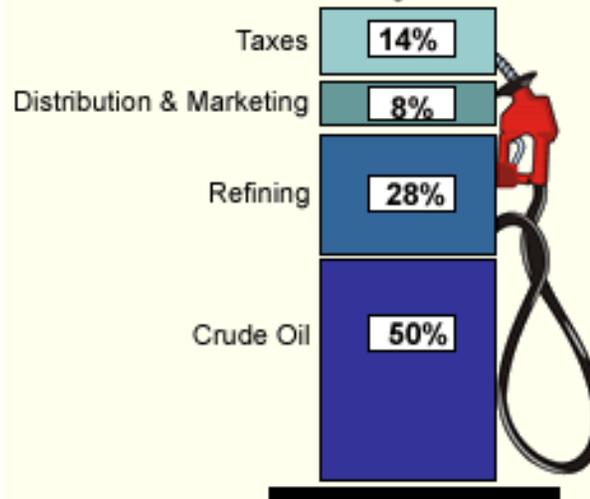
Gasoline Prices



Short-Term Energy Outlook, June 2007

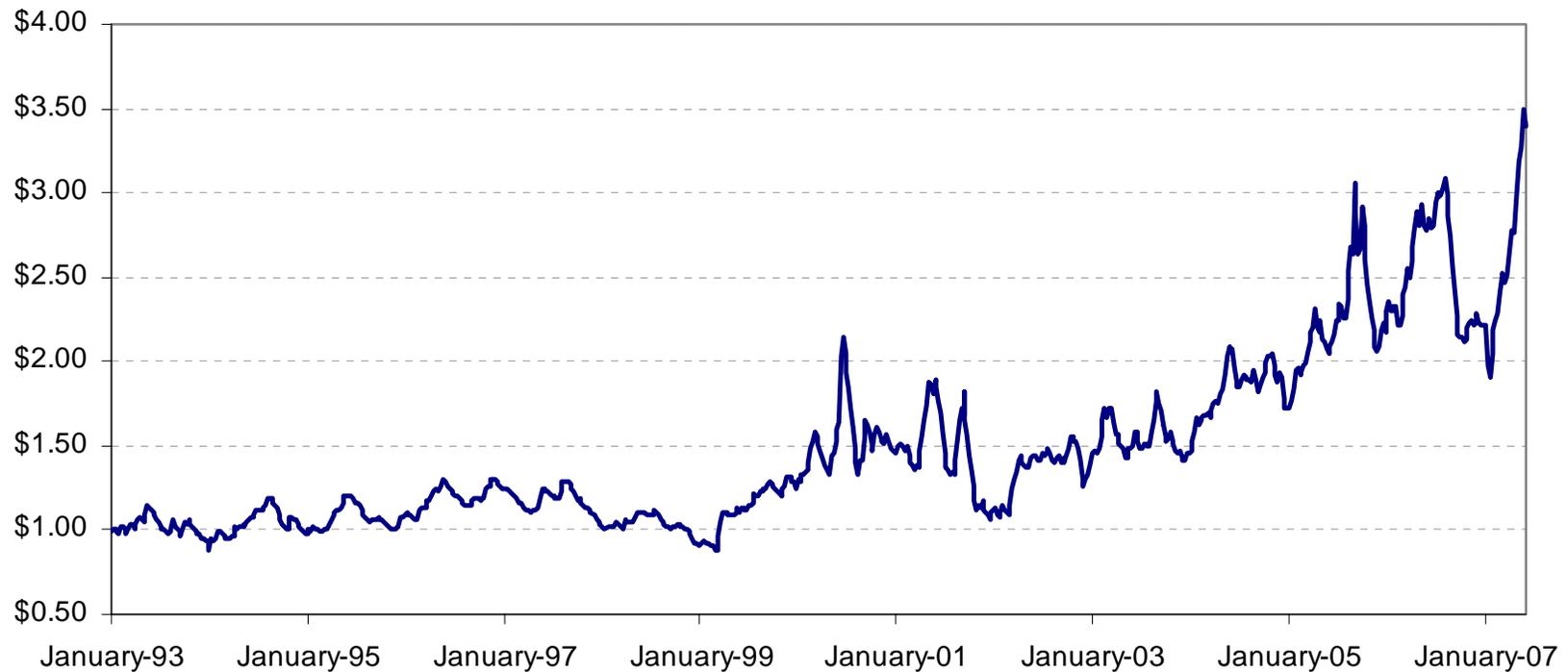


What We Pay For In A Gallon Of Regular Gasoline (April 2007)
Retail Price: \$2.85/gallon

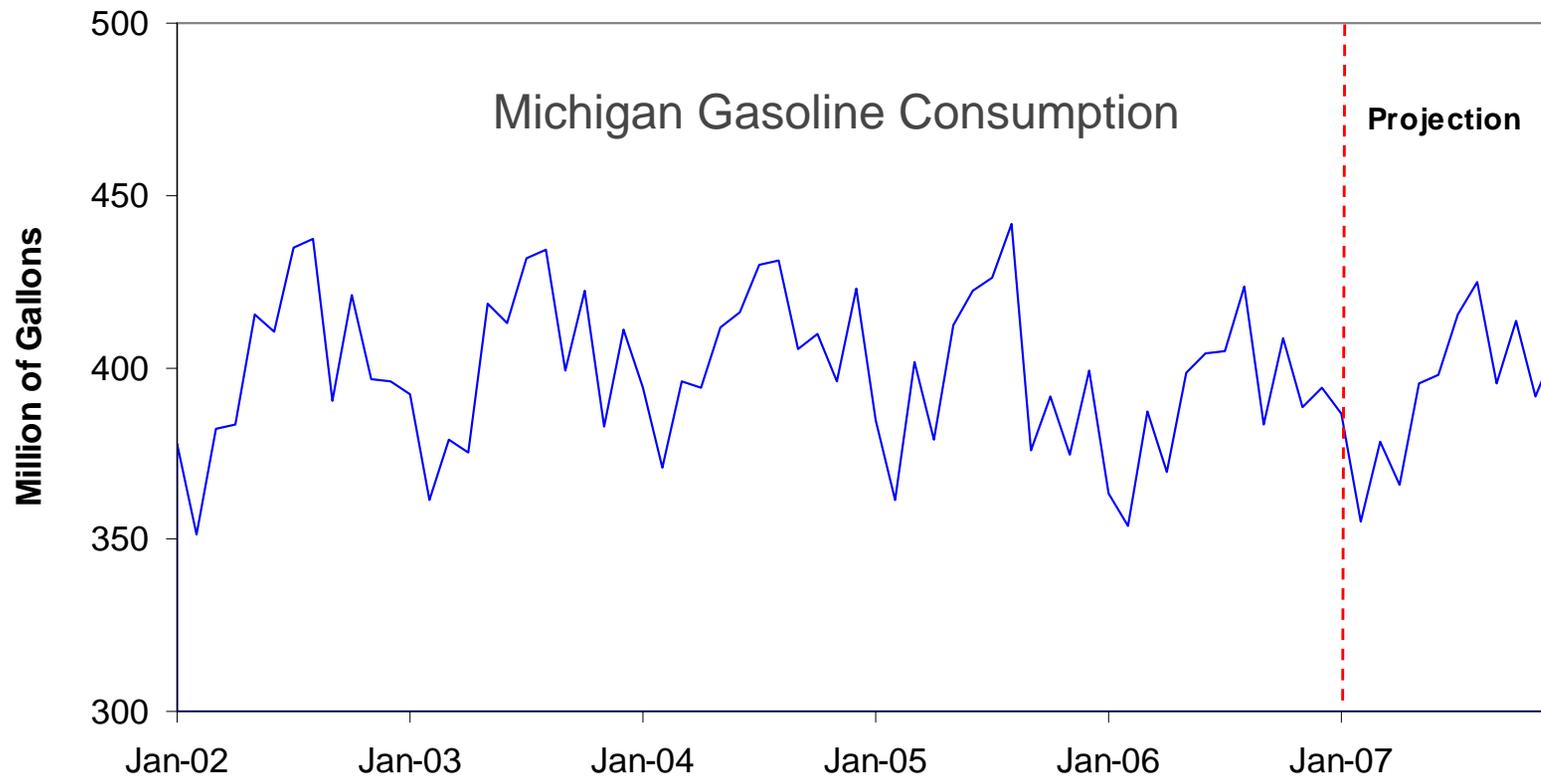


To Understand this Graph you need to Understand Events which occurred

**Self-Serve Unleaded Gasoline Prices, Detroit Metro Area
Weekly Prices - January 1993 to June 4th 2007**



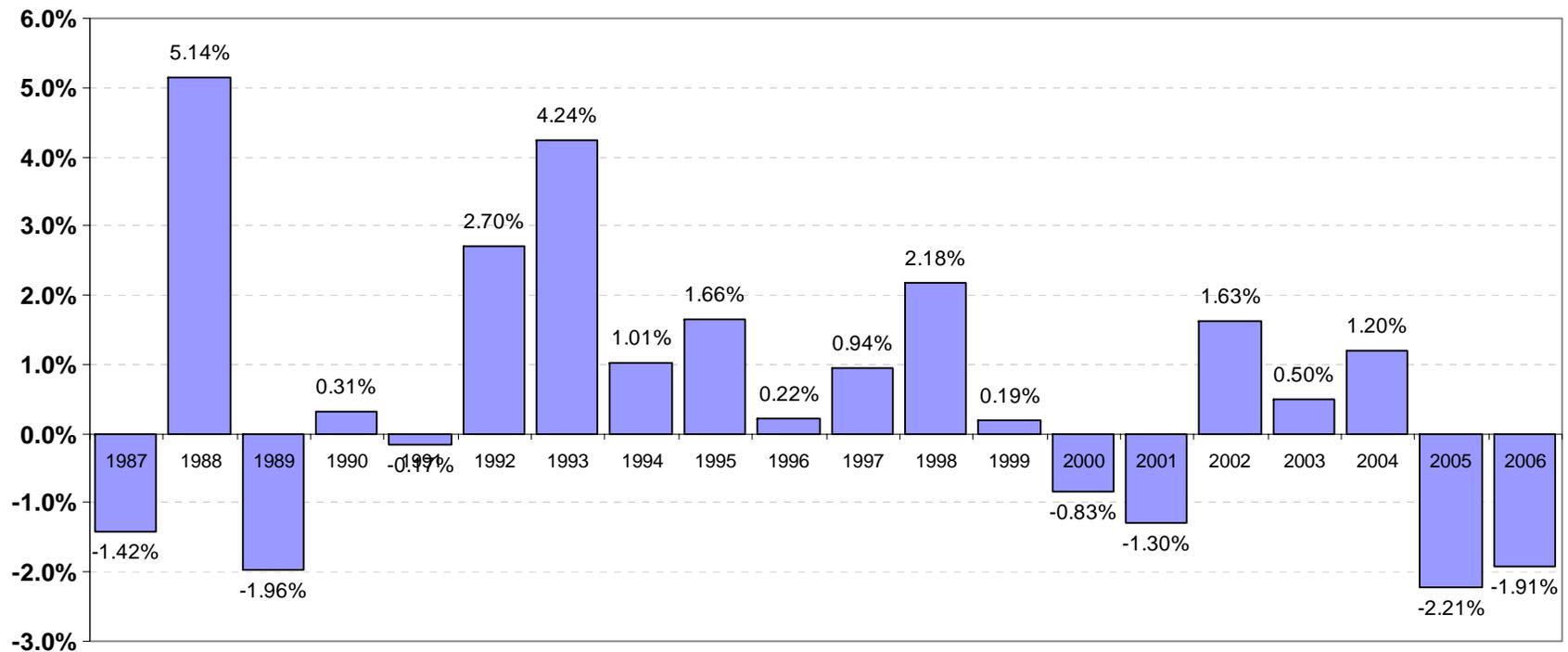
Source: EIA 782c Form -- Deliveries to States for Final Consumption



Gasoline demand is forecast using a two step process. First, vehicle miles traveled in Michigan are projected based on Michigan real disposable income and real gasoline prices in the US. Second, demand is projected using vehicle miles traveled and real gasoline prices in the US

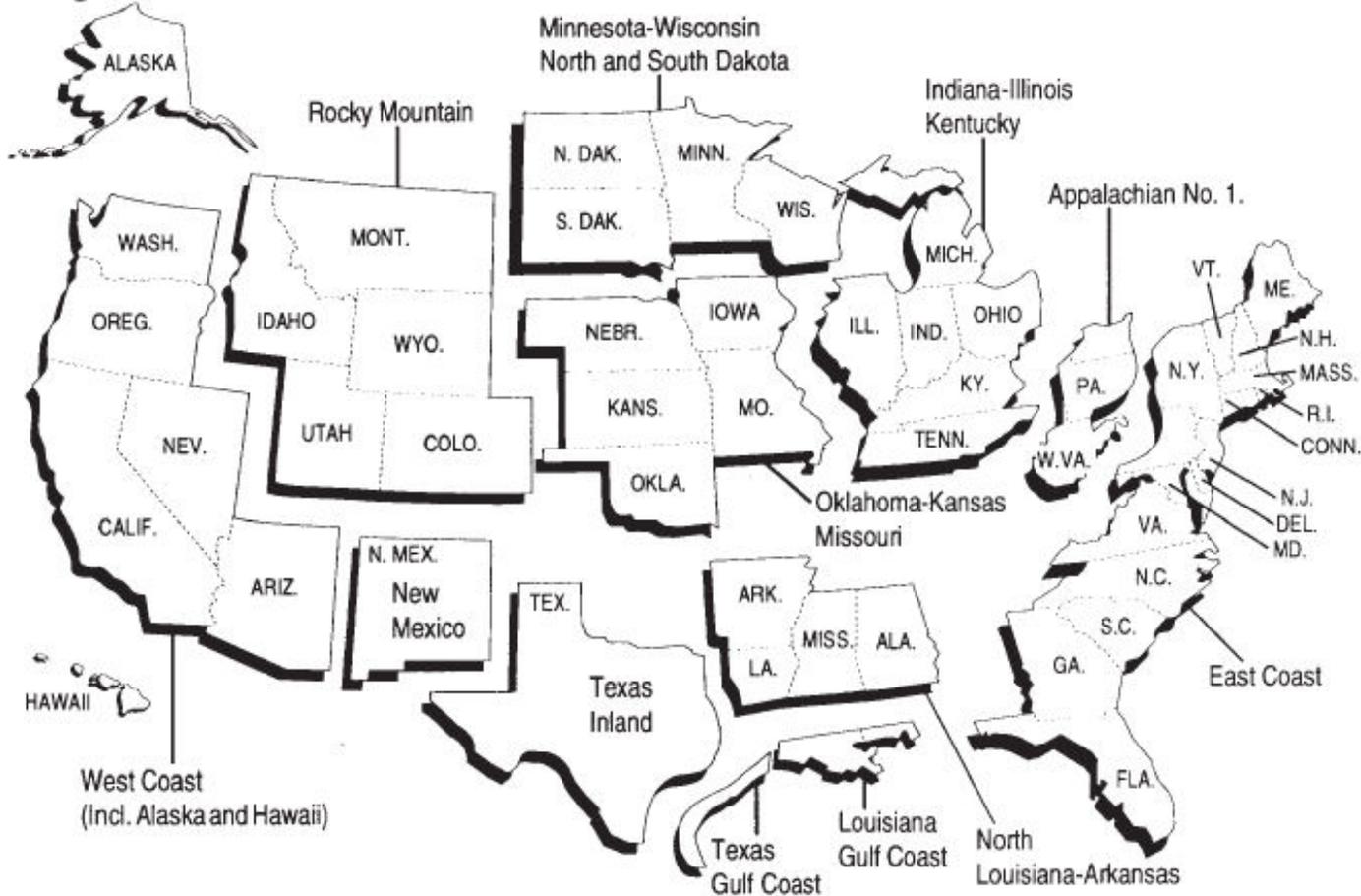
Understanding Changes in Demand

Percent Change in Michigan Gasoline Use



Consider the Regional Nature of the Supply and Distribution Network and How Data is Collected Geographically

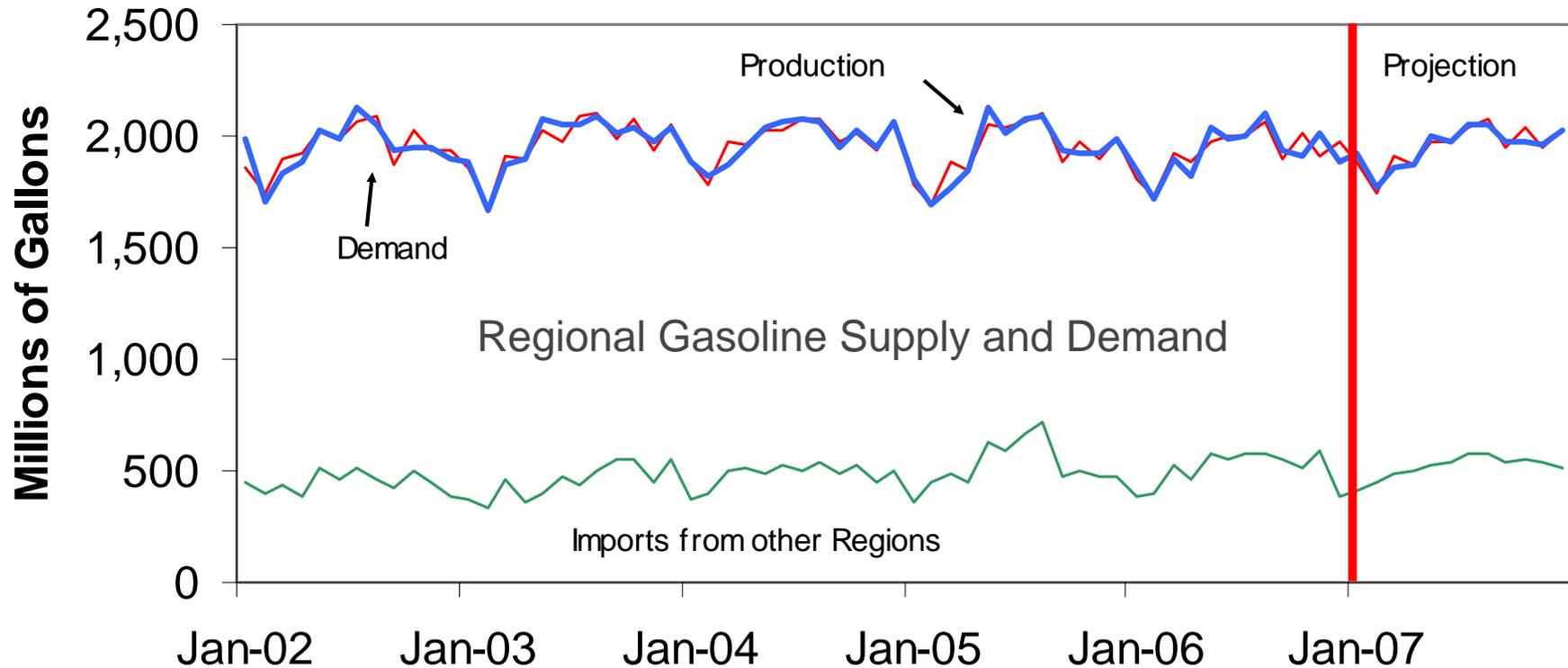
Refining Districts



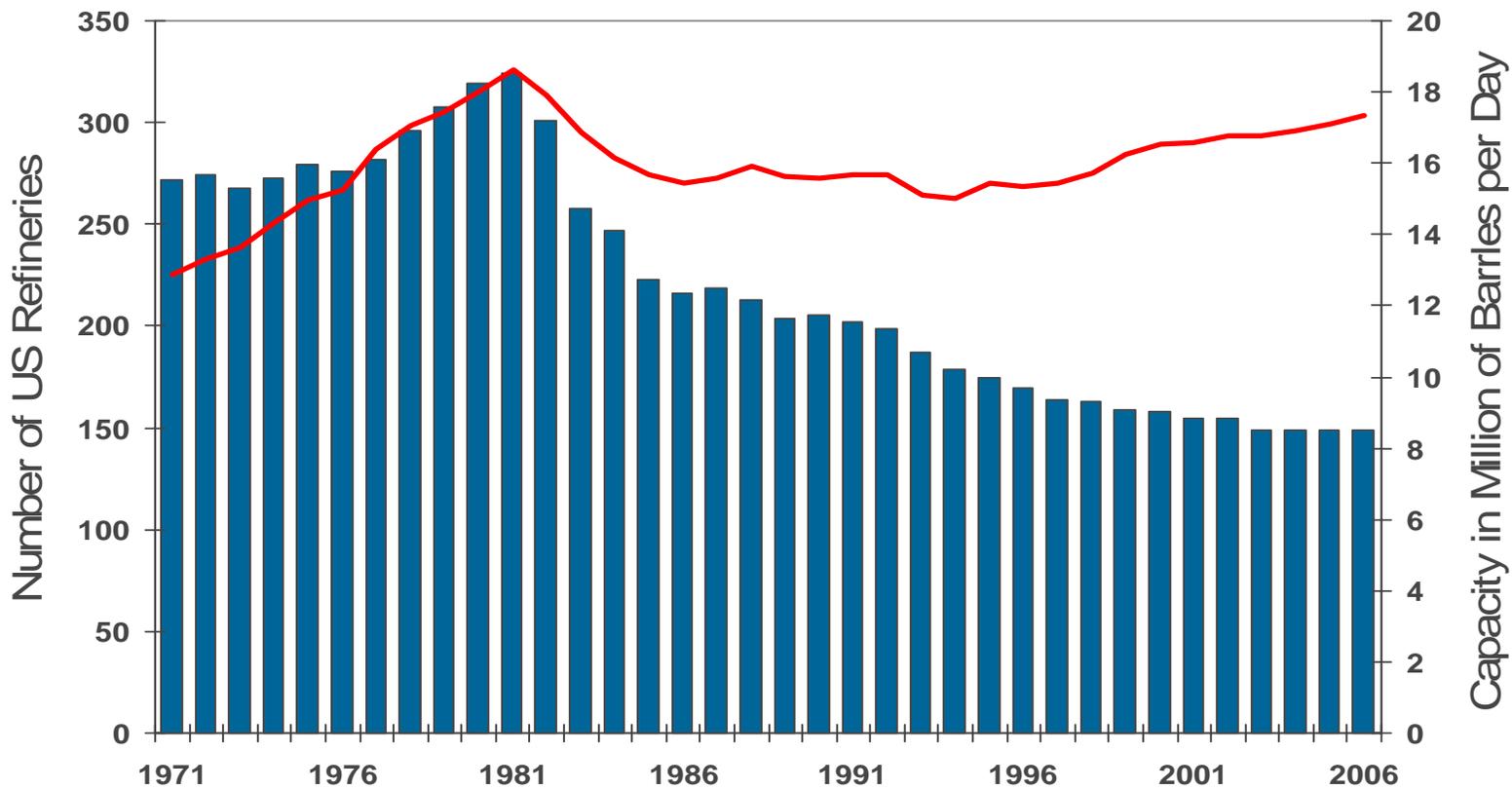
Regional Gasoline Supply

- Regional demand is the sum of the sales in the states in the Indiana, Illinois, Kentucky Refinery District fitted to a projection of vehicle miles traveled based on East North Central Region disposable income and real US gasoline prices. *(This works well for Michigan but may not for some other states.)*
- Regional Refinery Production is based on US refinery input of gasoline blend stocks, the inflation adjusted ratio of US wholesale gasoline prices to wholesale distillate prices and the ratio of US gasoline stock to distillate stocks.
- Imports to the region are inferred as needed to balance supply and demand

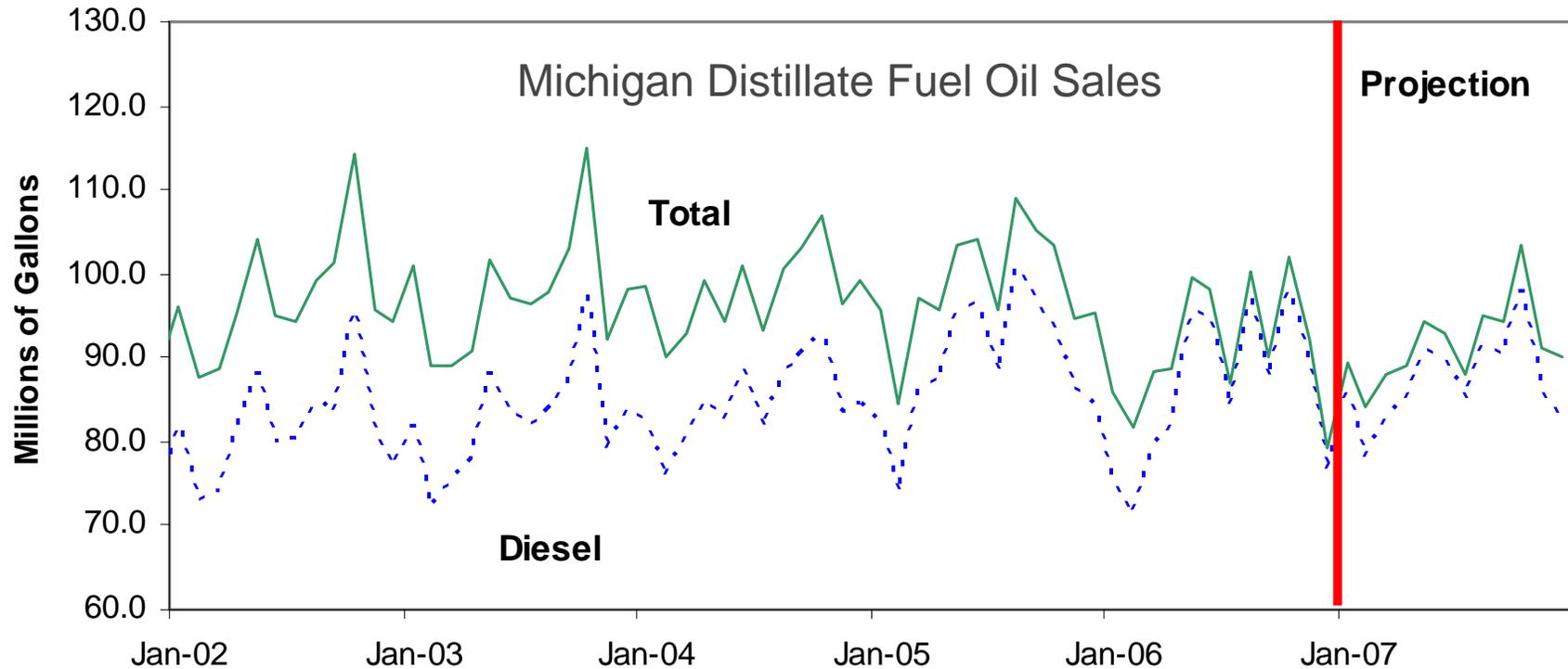
Forecasting Regional Supply/Demand



Refinery and Capacity

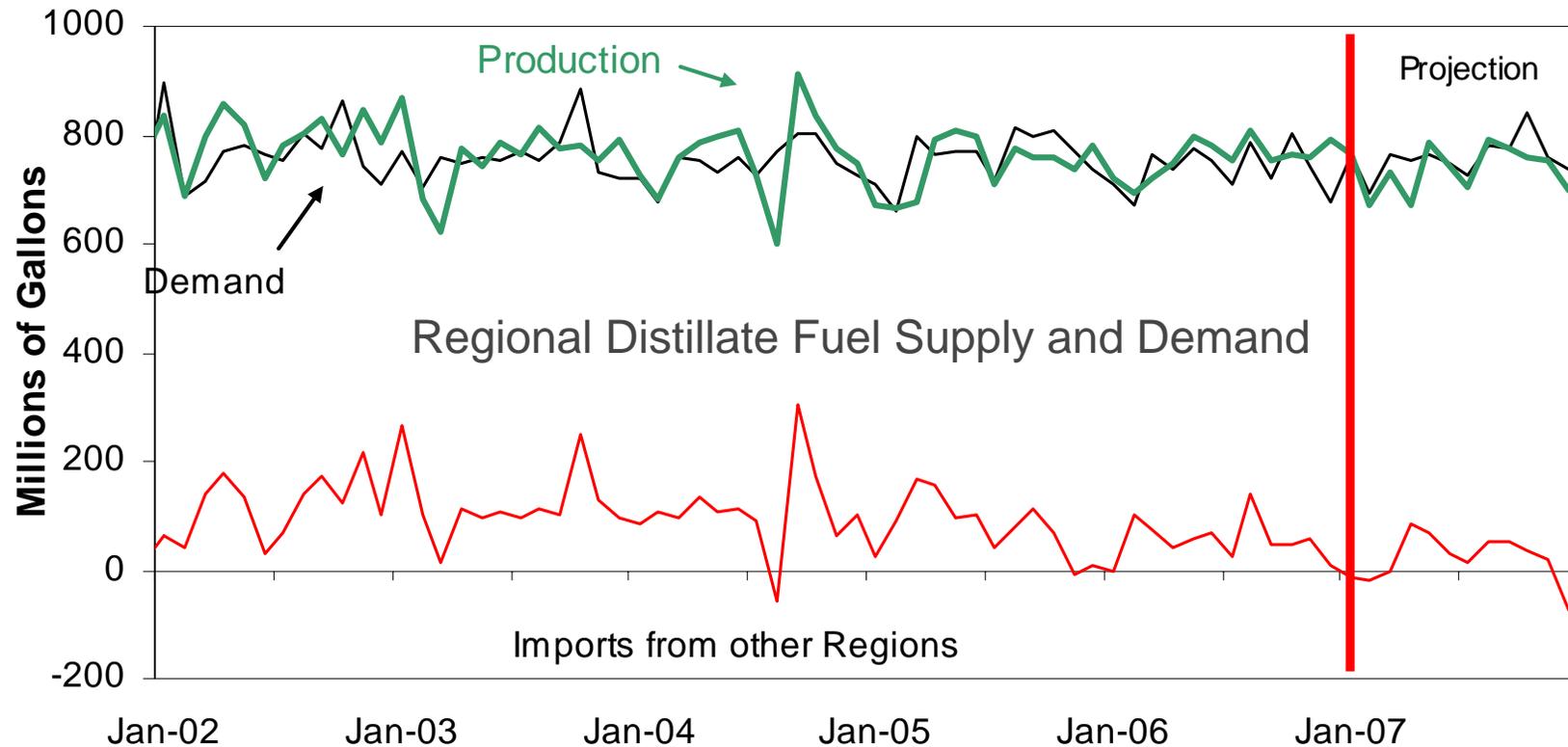


Note the Convergence of Diesel and Total



The forecast is based on the level of economic activity in the state as measured by the Michigan Industrial Production index and the real producer price of diesel fuel.

Forecasting Regional Supply/Demand



Same method is used as the regional gasoline supply projection except that refinery inputs of crude oil are used in place of gasoline blend stocks



Questions?

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Some Thoughts for Discussion

- Is there an adequate understanding of the data?
- What data is missing and is needed to have a more complete picture?
- Have you encountered serious data issues related to quality and validity of the data, significant departures between preliminary and final data?
- What additional explanatory economic data would be useful?
- Do we have the infrastructure data needed, i.e. capacity and throughput?
- How important is timeliness?
- What geographic breakdowns are important?
- Do we need to improve our ability to use different methods and models.
- Visual Display of Quantitative Information (E. Tufte)