

● **Homework #1 – Time Series**

**CSC 4260**

**Spring 2025**

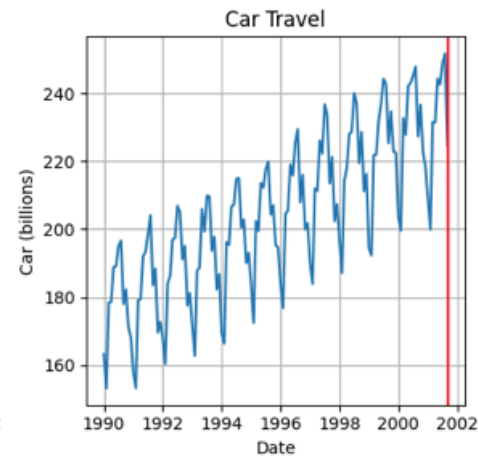
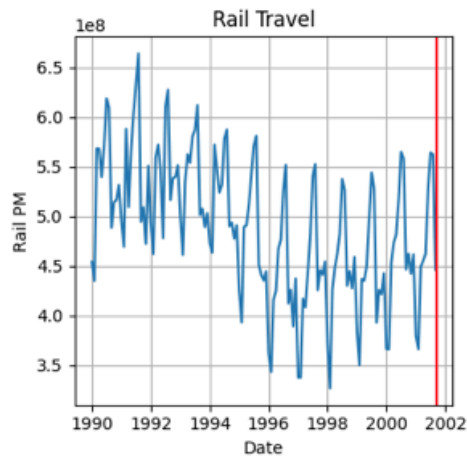
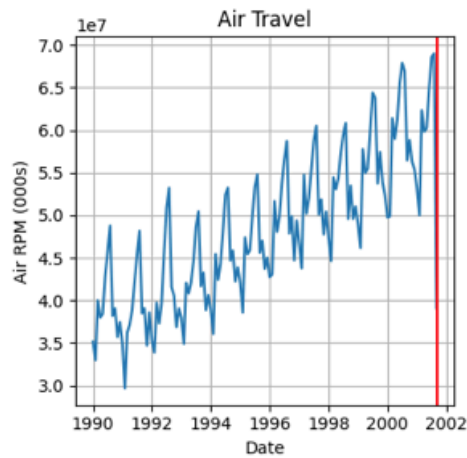
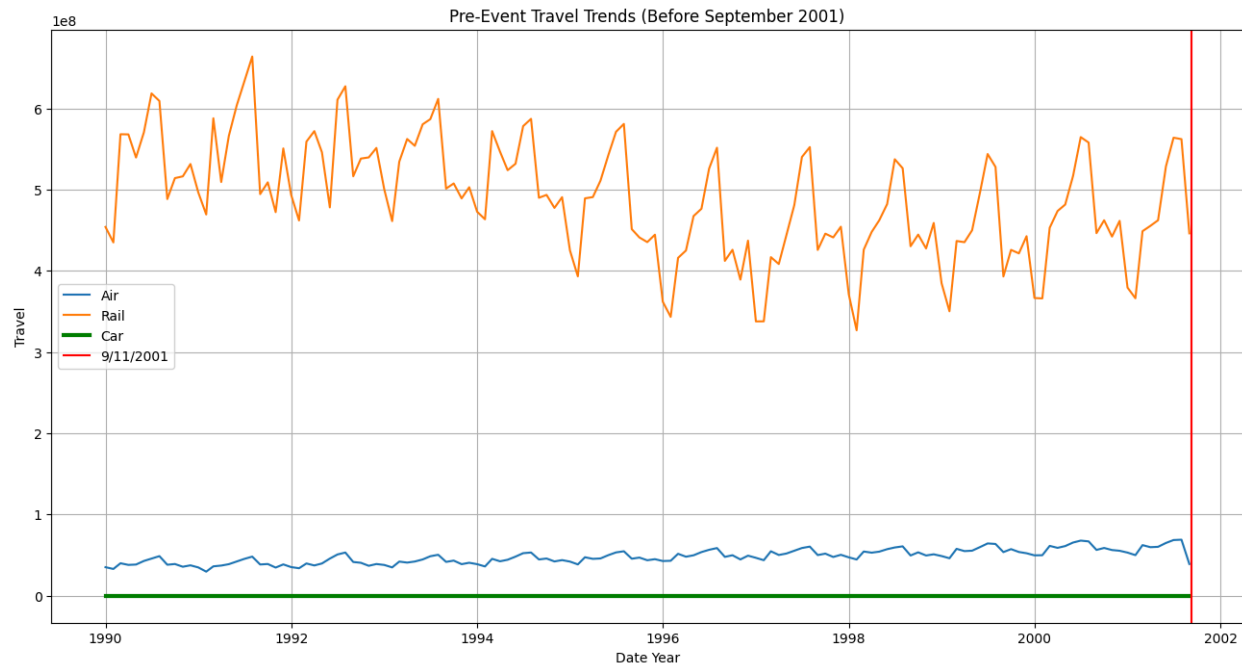
Name: Tania Perdomo Flores

**The Impact of September 11 on Air Travel in the U.S. {60 points}**

In 2006, the Bureau of Transportation Statistics conducted a study to evaluate the impacts of the September 11, 2001 terrorist attack on U.S. transportation. The goal of the study was to provide a greater understanding of the passenger travel behavior patterns of persons making long-distance trips before and after 9/11. Data on three monthly time series are given in the file *Sept11Travel.xls* for this period.

- Actual Airline Reservations (Air)
- Rail passenger miles (Rail), and
- Vehicle miles traveled (Car)

**1. Plot each of the three pre-event series (Air, Rail, Car). {20 points}**



**2. What type of trends appear? Explain. {20 points}**

The graphs illustrate clear trends in travel behavior across three modes of transportation: rail, air, and car. Rail travel exhibits notable seasonal fluctuations, which likely correspond to peak travel periods such as holidays or vacation times. These fluctuations are more pronounced than in other modes of transport, suggesting that people may prefer rail travel during specific times of the year.

Air travel remains relatively stable over the years, with only minor variations. This stability indicates that air travel is consistently in demand, showing fewer extremes or abrupt changes, and might be less affected by seasonal factors compared to rail travel.

Car travel, on the other hand, shows a consistent low level throughout the observed period. This pattern suggests that car travel did not experience significant growth or decline during this time, possibly because it was already a common mode of transport or because the observed period was before any significant shifts in the automobile industry or road infrastructure.

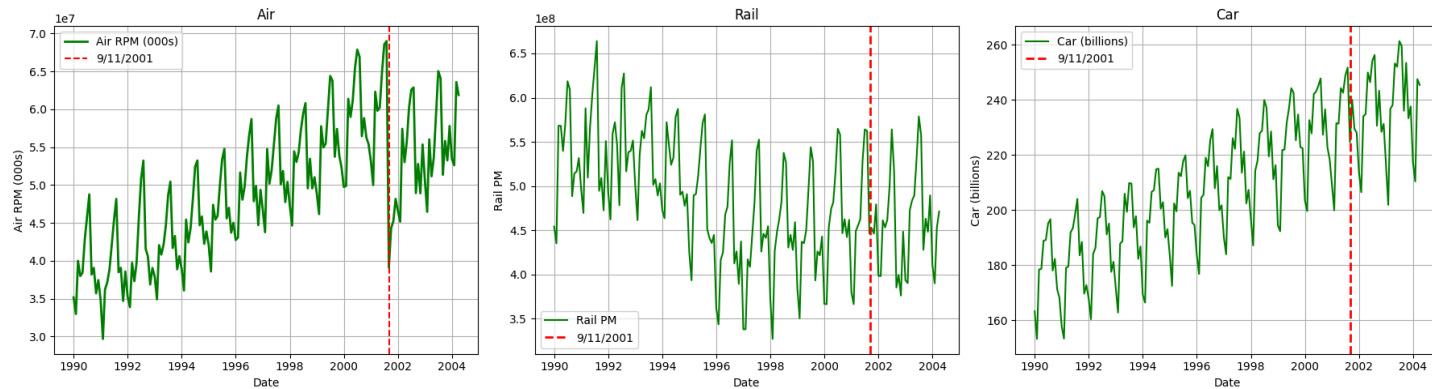
A sharp decline in all three types of travel is noticeable on the day of the 9/11 tragedy, marked by a solid red line on the graphs. This day stands out as a significant anomaly, with all travel modes experiencing a drastic drop in activity. This decline is likely a reflection of the immediate aftermath of the events, when safety concerns and travel disruptions caused a temporary halt in transportation across the U.S.

Looking at longer-term trends, both air and car travel show upward trajectories over the years. The increase in air travel can be attributed to factors such as improvements in airline services, more affordable fares, and the growing convenience of flying. Similarly, car travel likely grew in popularity due to increased accessibility, affordability, and the expansion of road networks.

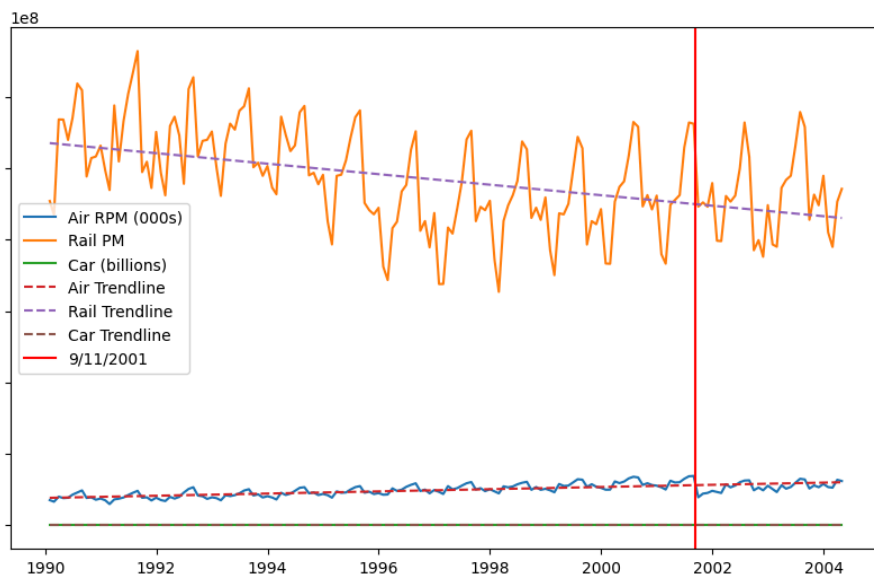
In contrast, rail travel saw a decline over the years. While rail travel was more popular in earlier years, this trend reversed as air and car travel became more competitive options. The increased use of air and car travel, combined with factors like the expansion of airports and road systems, could explain the reduction in rail travel's market share.

In summary, while rail travel showed significant seasonal fluctuations, air and car travel exhibited more stable trends, with air travel rising steadily due to factors like lower costs and improved service. The drastic dip in all travel categories on the day of 9/11 is a clear outlier, signaling the immediate impact of the tragic event on travel methods.

**3. Change the scale of the series and add trendlines. Do you notice any new trends? If so, explain.**  
**{20 points}**



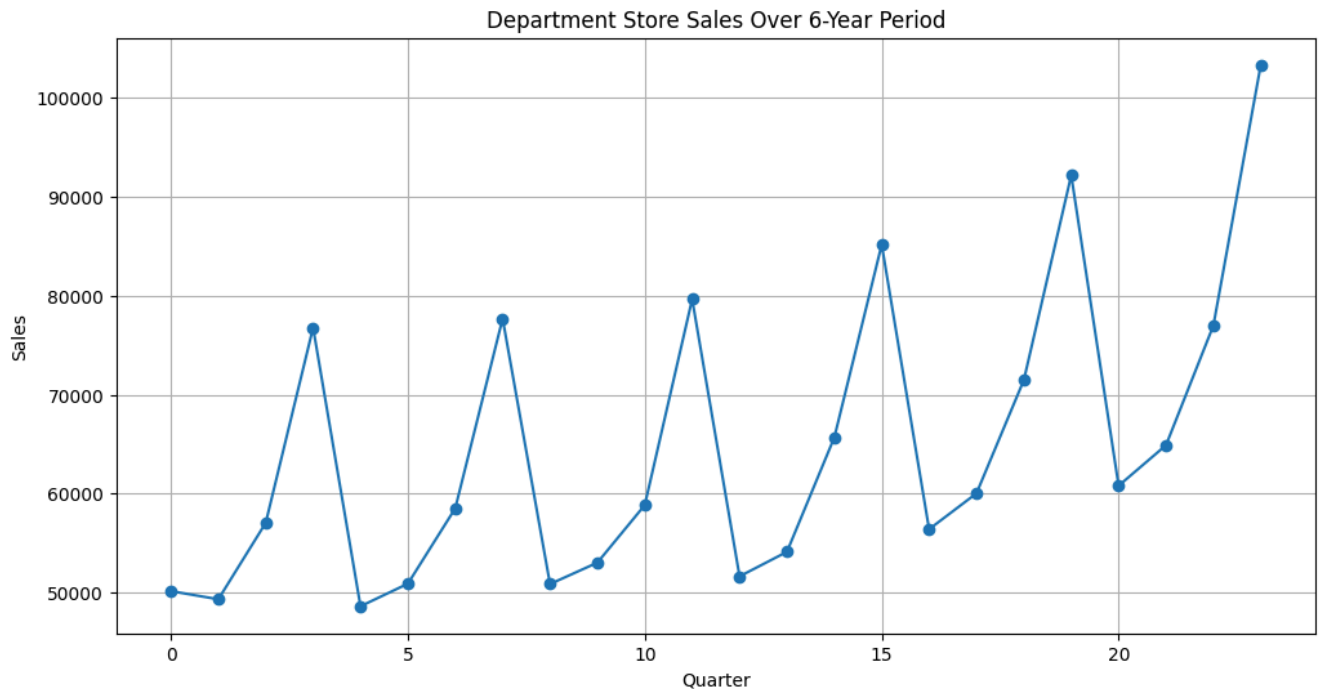
The travel data shows significant trends across air, rail, and car transportation before and after 9/11. In the Air RPM data, there was a significant drop in travel on and after 9/11, which aligns with the grounding of flights after the attacks. However, if you look closely at the data leading up to the event, there's already a slight decline in air travel. This could be attributed to seasonal variations, as air travel often experiences these fluctuations throughout the year, with periods of increase and decrease. The Rail PM data shows that travel was slowly increasing before 9/11, but the overall trend remained relatively stable. This suggests that the 9/11 attacks had minimal impact on rail travel compared to air and car travel. The rail system did not experience the same sharp disruptions, indicating that it was less affected by the events. In the Car data, travel trends were steadily rising prior to 9/11. However, like air and rail, there was a noticeable drop in car travel on the day of the attacks and in the immediate aftermath. Despite this dip, car travel quickly resumed its upward trajectory in the years that followed, continuing the consistent growth seen before the event. Overall, while 9/11 had a clear impact on air and car travel, rail travel showed minimal disruption and continued its trends with less fluctuation.



## Forecasting Department Store Sales {40 points}

The file *DepartmentStoresSales.csv* contains data on the quarterly sales for a department store over a 6-year period.

### 1. Create a well-formatted time plot of the data. {20 points}



### 2. Which of the following components – trend, seasonality, and noise – seem to be present in this series. Explain. {20 points}

The data reveals clear patterns of seasonality, with sales steadily increasing as the quarters progress. Each cycle follows a predictable pattern: sales start to rise, reach a peak, then drop in the second-to-last quarter, followed by a slight recovery toward the end. These fluctuations suggest that the sales are influenced by seasonal factors, which could be related to factors like consumer behavior, holidays, or other periodic events.

For example, between quarters 5 and 10, there's a gradual increase in sales from quarter 5 to 6. The rise from quarter 6 to 7 is even more pronounced, indicating a stronger push in sales during this period.

However, from quarter 7 to 8, there's a sharp decline in sales, which could be due to seasonal lulls or external factors affecting demand. After this dip, sales begin to recover, showing a slight increase leading into quarter 10.

This pattern repeats through the remaining quarters, where the same rhythm of rise, peak, decline, and slight recovery plays out, but with an overall upward trend in sales over time. The consistency of this cycle across multiple quarters points to a steady seasonality effect that's superimposed on a broader growth trend, indicating that while there are regular fluctuations, the overall trajectory is one of gradual improvement in sales.