Visualizing Economic Recessions

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Abstract

This paper examines the relationship between various economic variables and Gross Domestic Product (GDP) to gain insights into economic growth factors. The study draws upon a comprehensive dataset compiled from reputable sources, including the U.S. Bureau of Economic Analysis (BEA), Bureau of Labor Statistics (BLS), Federal Reserve Economic Data (FRED), and Congressional Budget Office (CBO). The analysis aims to uncover patterns, trends, and associations among the variables by applying correlation, descriptive statistics, and visualization techniques in Tableau. The paper begins with an introduction highlighting the significance of understanding the relationship between economic data and GDP. A literature review surveys existing scholarly works to provide a theoretical and empirical foundation for the research. The methodology section outlines the data collection process, data preprocessing techniques, and the statistical methods employed in the analysis. The analysis results offer valuable insights into the relationships between economic variables and GDP. The findings presented through narrative, tables, and visualizations shed light on the factors contributing to economic growth and their relative importance. These findings provide a basis for understanding the dynamics of the economy and inform policymakers, researchers, and practitioners in making informed decisions.

Keywords: Economic growth, Gross Domestic Product (GDP), Economic variables, Relationship analysis, Correlation, Descriptive statistics, Data visualization, Tableau, Data collection, Data preprocessing, Statistical analysis, Literature review, Economic indicators, Economic factors, Policy implications, Research methodology, U.S. Bureau of Economic Analysis (BEA), Bureau of Labor Statistics (BLS), Federal Reserve Economic Data (FRED), Congressional Budget Office (CBO), Economic dynamics, Decision-making, Economic insights, Empirical foundation.

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Introduction of Visualizing Economic Recessions

The present study delves into the intricate relationship between various economic variables and Gross Domestic Product (GDP) to gain profound insights into the factors that drive economic growth. A robust dataset, meticulously compiled from reputable sources such as the U.S. Bureau of Economic Analysis (BEA), Bureau of Labor Statistics (BLS), Federal Reserve Economic Data (FRED), and Congressional Budget Office (CBO), serves as the foundation for this analysis. They are leveraging correlation, descriptive statistics, and visualization techniques in Tableau,

the research endeavors to unearth patterns, trends, and associations among these economic variables. The significance of comprehending the intricate nexus between economic data and GDP is emphasized in the introduction, which sets the stage for the exploration. A thorough literature review contributes to establishing a solid theoretical and empirical framework. The methodology section thoroughly elucidates the data collection process, data preprocessing techniques, and the statistical methods applied for analysis. The ensuing analysis results offer valuable insights into the intricate relationships between various economic variables and GDP, revealing the contributing factors to economic growth and their relative importance. The findings are presented through a compelling narrative, well-structured tables, and illuminating visualizations, shedding light on the dynamics of the economy. Consequently, this research can inform and guide policymakers, researchers, and practitioners in making well-informed decisions to propel economic progress.

Overview of Visualizing Economic Recessions

Importance

This research paper delves into the crucial task of understanding the intricate relationship between Gross Domestic Product (GDP) and a set of pivotal economic indicators. Policymakers, economists, and businesses rely on such insights to make informed decisions. The study analyzes the interconnections between GDP and critical indicators, including Mortgage Delinquency, Unemployment Rate, Federal Debt, Federal Interest Rates, and the Manufacturing Purchasing Managers' Index for the United States (MSPUS). The paper aims to provide valuable insights into the dynamic interactions among these variables, facilitating predictive modeling and guiding strategic decision-making in economic scenarios.

Key Concepts

1. **Mortgage Delinquency:** Mortgage delinquency refers to the failure of homeowners to make timely mortgage payments, leading to overdue or missed payments. It is a critical indicator of financial health in the housing market and reflects the number of homeowners experiencing difficulties meeting their mortgage obligations.
2. **Unemployment Rate:** The unemployment rate measures the percentage of the labor force that is unemployed and actively seeking employment. It provides insights into the health of the job market and the overall economic conditions, with higher unemployment rates typically indicating a slowdown or recession.
3. **Federal Debt:** Federal debt, also known as government debt or national debt, represents the total amount of money owed by a country's central government. It accumulates over time as the government borrows money to fund its expenses when its expenditures exceed its revenue. Federal debt levels are crucial for assessing a nation's fiscal sustainability and ability to meet its financial obligations.
4. **Federal Interest Rates:** Federal interest rates, also called central bank interest rates or policy rates, are set by a country's central bank (e.g., the Federal Reserve in the United States). These rates influence borrowing costs for banks and businesses and play a significant role in shaping economic activity. Lowering interest rates can stimulate borrowing and economic growth while raising rates can help control inflation.
5. **Manufacturing Purchasing Managers' Index for the United States (MSPUS)**: The Manufacturing Purchasing Managers' Index (PMI) is an economic indicator that provides insight into the manufacturing sector's health. It is based on a monthly survey of

purchasing managers in the manufacturing industry, and the MSPUS focuses explicitly on the United States. A PMI above 50 indicates expansion in the manufacturing sector, while below 50 suggests contraction.

6. **Quantitative Easing (QE):** QE is a monetary policy tool by central banks has become crucial to stimulate the economy and address recessions. Its primary objective is to combat economic downturns and prevent or mitigate recessions by injecting liquidity into the financial system. By purchasing government bonds and other financial assets, central banks increase the money supply and lower interest rates, encouraging lending, economic activity and stabilizing financial markets.

Literature Review

Great global financial recession (2008–2013)

The economic performance over different periods, showing growth between 1951-1970 and subsequent declines due to global crises. The growth cycle from 2000-2006 saw a significant increase in world GDP affected by the technology company crises and the 9/11 attacks. Globalization and integration of emerging economies limited inflation, but imbalances emerged, leading to the 2008 real estate and credit bubble burst, triggering the Great Recession. Swift actions by central banks mitigated the initial phase, but it revealed systemic issues caused by an out-of-control financial industry and unsustainable debt levels.

Does quantitative easing affect market liquidity?

The impact of Quantitative Easing (QE) on liquidity premiums in financial markets, mainly focusing on the Federal Reserve's QE2 program during the Great Recession. The study

suggests that QE can reduce liquidity premiums through a liquidity channel, making the market more efficient and stabilizing financial markets. The analysis finds significant effects on Treasury Inflation-Protected Securities (TIPS) and inflation swap contracts, supporting the view that QE improves market functioning and reduces priced frictions during its implementation. However, the liquidity channel's transmission seems limited to the securities targeted by the QE program, with no significant impact on other asset classes.

GROSS DOMESTIC PRODUCT: Financing & Investment Activities and State Expenditures

The factors influencing economic growth including economic and financial instruments like investment activities, banking financing, and state spending. The study uses a quantitative method called Vector Error Correction Model analysis to determine which model better influences economic growth with realistic data. The results suggest that state spending, investment activities, and bank financing influence economic growth in the short term. However, in the long term, state expenditure emerges as the only variable with a positive trend toward economic growth, as it significantly impacts the economic sector.

Methodology

Research Design and Data Collection

The data used in this project was sourced from reputable .gov resources, ensuring its credibility and accuracy. All datasets were downloaded in a standardized CSV file format, making them easily accessible for further processing. Before importing the data into Tableau for visualization and analysis, data wrangling was performed to prepare and refine the datasets. This

step involved various data manipulation techniques, such as cleaning and formatting, to ensure the data's compatibility with Tableau's data structures and visualization capabilities.

Additionally, the data was imported into Oracle for further wrangling and merging to enhance its suitability for analysis. Once the data was appropriately cleaned and merged, it was then imported into Tableau for advanced visualization and in-depth analysis. By meticulously preparing the data through data wrangling and employing reliable data from .gov resources, this research project establishes a solid foundation for accurate and meaningful insights. Using Tableau as a visualization tool enables data exploration and enables researchers to uncover valuable patterns and trends.

Data Collection and Preparation

Most of the work was manually downloading each dataset individually for each topic. For example, the GDP dataset has many columns related to GPD, like GDP Value, GDP Per Capita, and Value of US Hh Debt. These are all separate datasets combined into one GDP table using SQL and then exported into a GDP dataset. This process was repeated for each of the eight datasets. More time was needed to be more time to perform serious analysis, but this sets an excellent foundation for research in the future. Mortgage Delinquency had a custom VBA script to convert the data into a tabular format for each region type.

GDP Dataset and Other Datasets :

- Manually downloaded multiple GDP-related datasets, such as GDP Value, GDP Per Capita, and Value of US Hh Debt.
- Combined the separate datasets into one comprehensive GDP table using SQL.
- Exported the merged GDP table to create a consolidated GDP dataset.

Mortgage Delinquency Dataset:

- Utilized a custom VBA script to convert the data into a tabular format for each region type.
- The script automated extracting and organizing data, ensuring consistency and accuracy.

The data collection process involved considerable manual effort, and the datasets were tailored and transformed to make them suitable for analysis. Combining and preparing the data has laid a solid foundation for future research, enabling more in-depth analysis and insights into the relationships between GDP and other key economic indicators.

Results

Reporting, Modeling, and Storytelling

Using Quantitative Easing (QE) as a monetary policy tool by central banks has become crucial to stimulate the economy and address recessions. Its primary objective is to combat economic downturns and prevent or mitigate recessions by injecting liquidity into the financial system. By purchasing government bonds and other financial assets, central banks increase the money supply and lower interest rates, encouraging lending, economic activity and stabilizing financial markets.

The results of QE implementation have shown several positive impacts in mitigating recessions and supporting economic recovery:

Liquidity Injection and Crisis Mitigation: QE provides a vital source of liquidity during times of economic crisis, preventing liquidity shortages and financial market disruptions. This helps stabilize the banking sector and ensures the smooth functioning of financial markets.

Reduced Borrowing Costs: Lowering interest rates through QE makes borrowing more affordable for businesses and consumers. This increased affordability can incentivize borrowing, increasing investment and consumption and stimulating economic growth.

Encouraging Investment and Consumption: By increasing the money supply and making credit more accessible, QE can encourage businesses to undertake investments and consumers to increase spending. This boost in economic activity contributes to economic recovery.

However, it is essential to acknowledge that the effectiveness of QE and its potential long-term consequences depend on various factors:

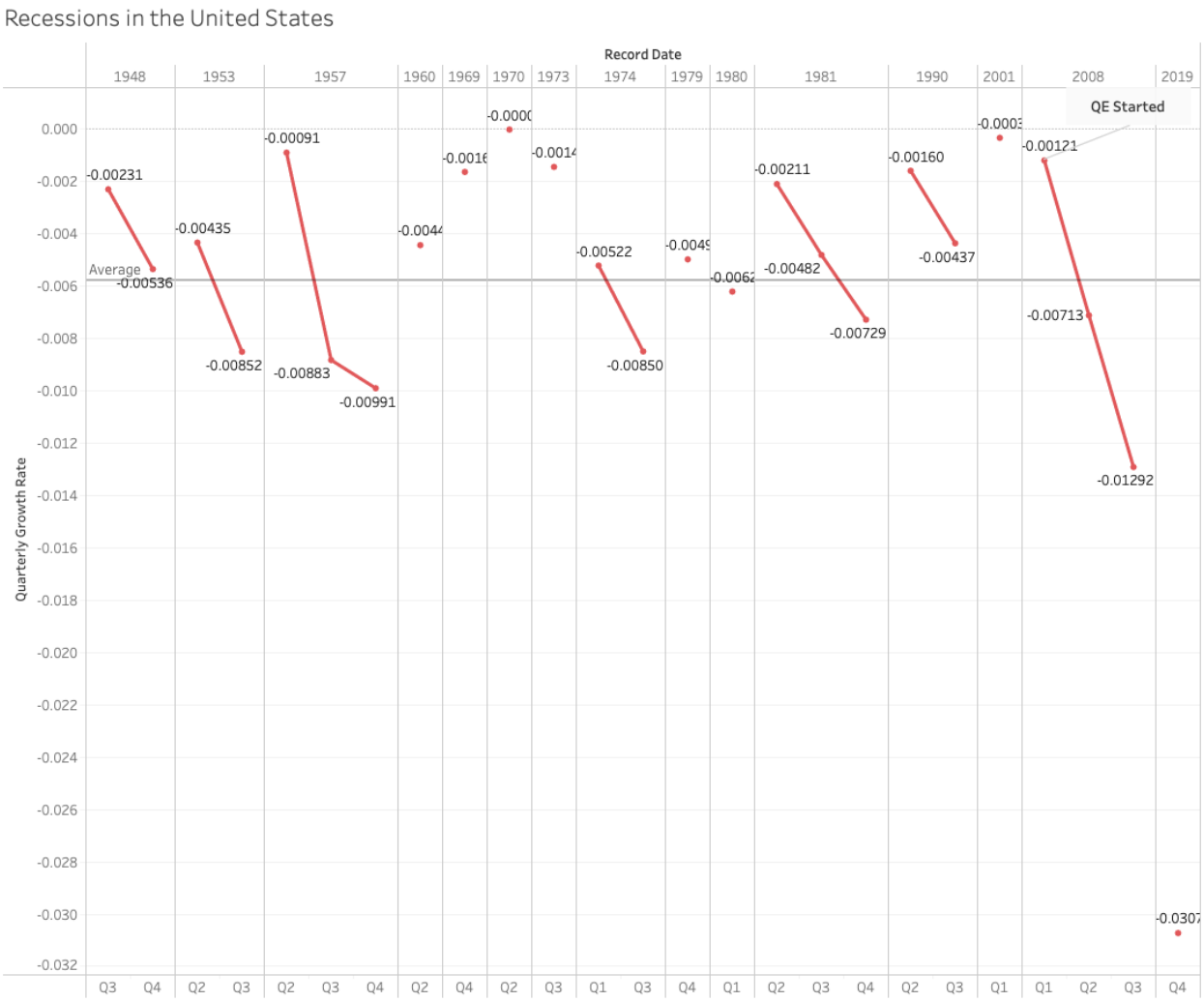
Economic Conditions: The effectiveness of QE can vary based on the prevailing economic conditions at the time of its implementation. In more robust economies, the impact of QE may be less pronounced, while in severe downturns, it may play a more significant role in supporting recovery.

Scale and Duration of QE: The scale and duration of the QE program can influence its impact on the economy. More considerable and prolonged QE interventions may have a more substantial effect on stimulating economic activity.

Overall Policy Framework: The success of QE is interconnected with other fiscal and monetary policies in place. Coordinated efforts between fiscal and monetary authorities can enhance the effectiveness of QE.

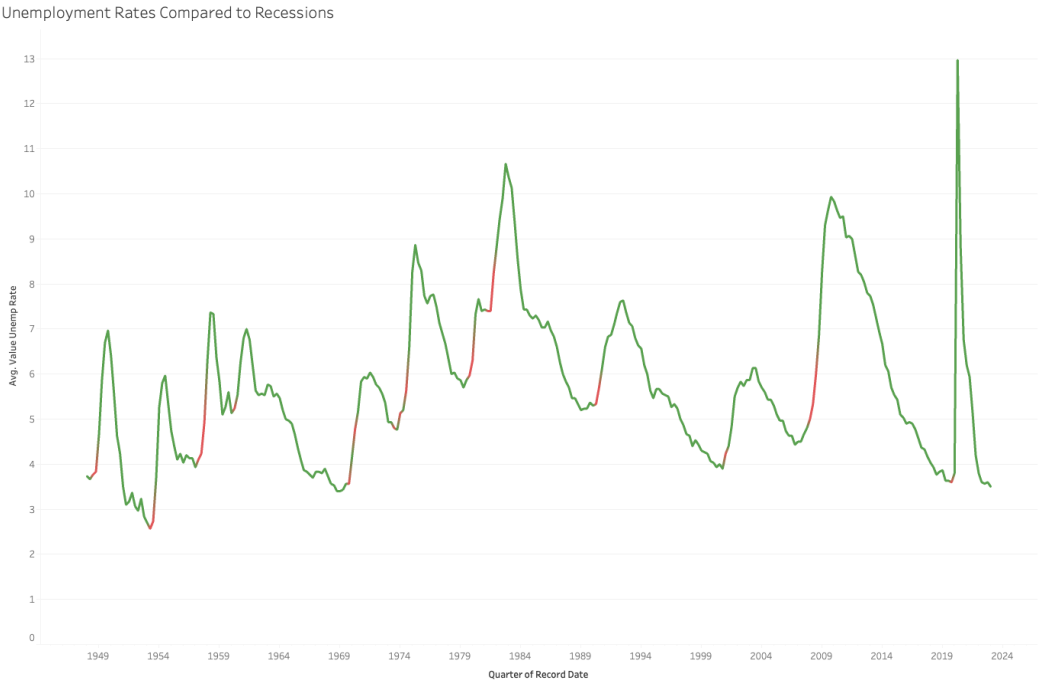
The history of the US economy has shown that recessions have occurred roughly every five years, except after QE started. This raises a critical and ongoing debate among economists: Is QE preventing the inevitable economic cycles while potentially increasing inflation, or are these liquidity injections necessary to survive and thrive in a globalized economy?

Visualizing Economic Recessions



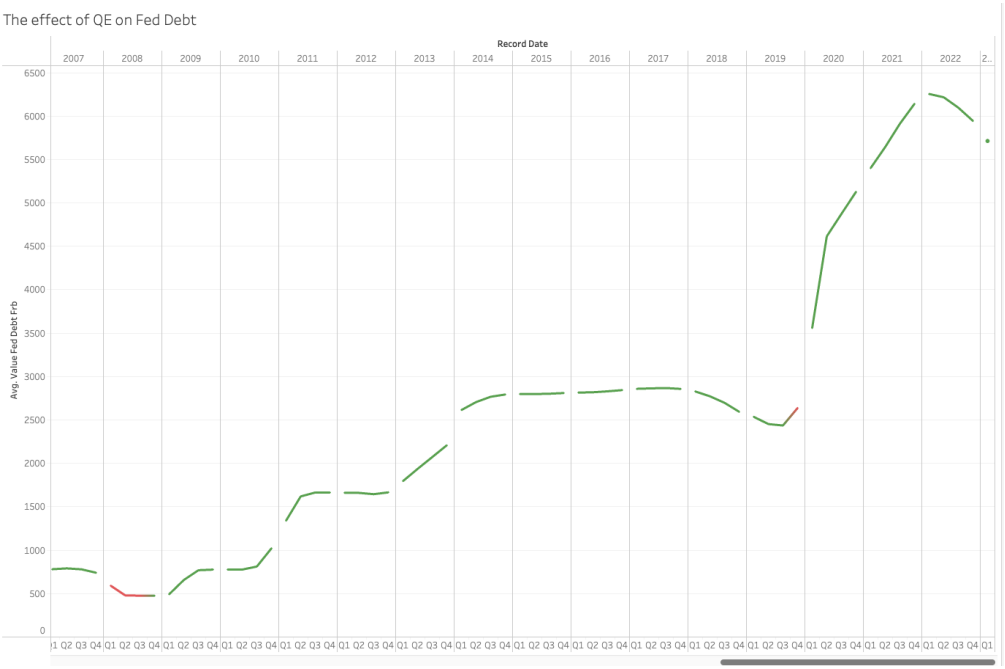
During the initial stages of a recession, businesses often adopt strategies to retain their workforce as much as possible. Measures like reducing working hours, implementing temporary furloughs, and other cost-cutting measures are preferred over layoffs. This approach stems from the optimism that economic conditions will improve, leading to increased demand and a chance to keep skilled employees without the expenses of hiring and training new staff when the recovery starts. However, as the recession continues and economic conditions deteriorate further, businesses may face challenges maintaining their existing workforce. Decreased demand for goods and services can lead to decreased revenues and profitability. Eventually, businesses may be compelled to lay off workers to cut costs and align with the lower economic activity.

Consequently, unemployment tends to peak later in the recession or during the early recovery phase. This delay in the peak unemployment rate reflects the collective impact of businesses' decisions to lay off employees after attempting to retain them during the initial downturn.



Quantitative easing (QE) by the central bank involves purchasing government bonds and financial assets from commercial banks and financial institutions. This injection of money into the economy aims to stimulate lending and spending. Consequently, the federal debt can increase as the government issues more debt to finance its spending or to accommodate the central bank's asset purchases. The relationship between QE and the federal debt is intricate. QE is often employed to respond to economic downturns or financial crises, leading to reduced tax revenues and higher government spending on stimulus initiatives. These factors can independently contribute to a rise in federal debt. The impact of QE on the federal debt hinges on several factors, such as the size and duration of the QE program, the pace of bond purchases, and the government's fiscal policies. If the intended outcome of QE is achieved, with increased economic

activity and higher tax revenues, it can help alleviate the long-term impact on the federal debt. However, managing the complexities of the relationship between QE and federal debt requires careful consideration of economic conditions and appropriate policy measures.



Conclusion

Key Findings

In this project, the analysis of various economic indicators has led to several principal findings:

1. Correlations: Uncovered meaningful correlations among the economic indicators through rigorous exploration. Notably, identified a moderately strong negative correlation between unemployment and Federal Interest rates. This relationship sheds light on the intricate interplay between unemployment and monetary policy. Additionally, observed a weak negative correlation between unemployment rates and the median sales price of houses sold, highlighting the subtle impact of unemployment on the housing market.

2. Pre-aggregation Benefits: Our decision to pre-aggregate data quarterly proved to be a strategic move. Organizing the data into meaningful intervals experienced significant improvements in the performance of our analytical queries. The pre-aggregated tables facilitated smoother calculations and allowed us to conduct temporal analysis and efficiently identify trends over extended periods.

The results of this project provide valuable insights into the relationships between key economic indicators and demonstrate the importance of proper data preparation for practical analysis.

Implications for Visualizing Economic Recessions

Based on our findings, there are several implications for Economic Data Analysis and research:

1. Future projects should explore advanced time series analysis techniques like ARIMA (AutoRegressive Integrated Moving Average), VAR (Vector Autoregression), and state-space models to capture the temporal dependencies and relationships between GDP and the chosen economic indicators.
2. Address the possibility of structural breaks and regime shifts in the economy. Techniques like Chow tests or change-point analysis could be applied to identify significant changes in economic conditions, allowing us to adapt our analysis accordingly and understand how these shifts impact GDP behavior.
3. Recognizing the complexity of economic dynamics, employing non-linear modeling approaches such as artificial neural networks, support vector machines, or random forests.

4. Incorporate external factors and events to understand the factors influencing GDP fluctuations comprehensively. These may include government policies, global economic events, or natural disasters by examining the impact of such events on GDP dynamics to comprehend better the economy's resilience and vulnerability to external shocks.

Adopting this comprehensive approach can create valuable insights to economic analysis and support evidence-based decision-making for policymakers and businesses. The interplay of various economic indicators, advanced modeling techniques, and external factors will shed light on the intricacies of economic behavior and enable a deeper understanding of the economic landscape on a global scale.

Github Project Code

https://github.com/andersonbdalton/ISM6419_DataViz_Vizing_Recessions

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