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Data Insights on Bourbon Shipments: Trends, Challenges, and Strategies

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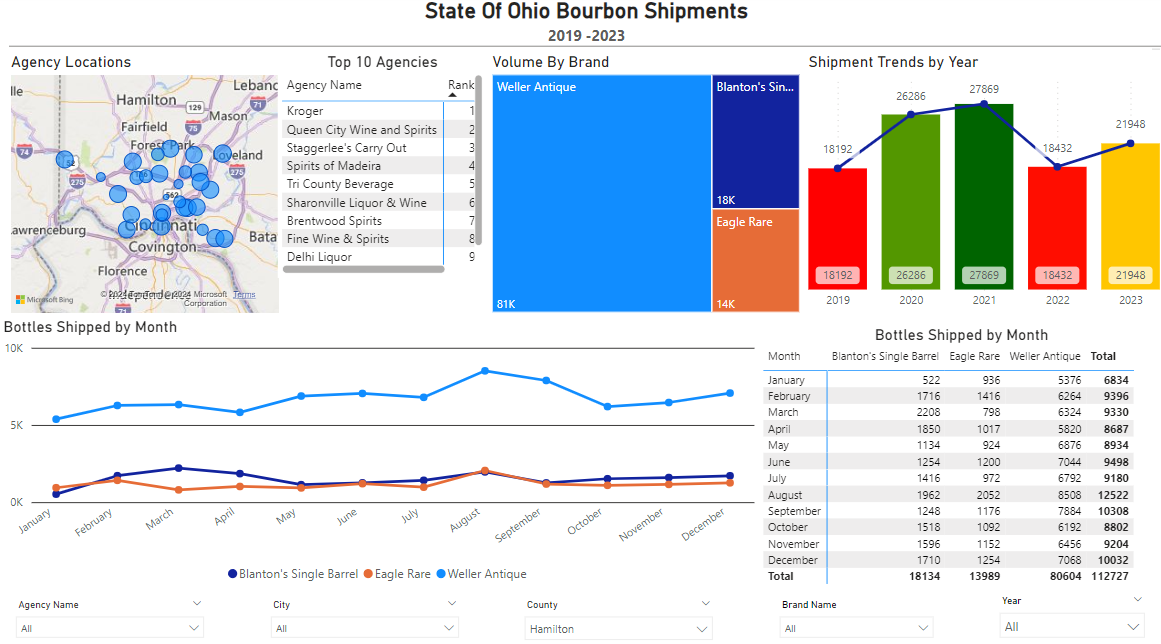
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# Introduction

The Ohio Bourbon Shipments report provides a comprehensive analysis of bourbon shipments from 2019 to 2023, focusing on the performance of leading brands, top agencies, shipment trends over time, and monthly patterns. Using a data-driven approach, this report seeks to understand key factors influencing the supply and demand for bourbon across the state of Ohio, aiming to optimize inventory management, strengthen agency relationships, and enhance decision-making for stakeholders. By identifying the business needs and exploring shipment metrics, the report uncovers trends and insights that can support strategic actions for improved business outcomes.

The analysis addresses core aspects such as brand performance, agency rankings, and seasonal fluctuations, presenting stakeholders with actionable recommendations. Through data validation, cleaning, and visualization, we ensure that the insights derived from the data are transparent, reliable, and representative of the business context. The final goal is to use these insights to inform decisions that will maximize efficiency, profitability, and customer satisfaction.

# Power BI Dashboard



# Business Problem (Need)

**Defining the Business Need:** The state of Ohio is monitoring bourbon shipments from 2019 to 2023 to assess distribution performance and understand how shipments are evolving over time. The business problem focuses on optimizing the supply chain and inventory management of bourbon across various agencies, ensuring that popular brands are adequately stocked while minimizing surplus and waste.

**Problem Statement:** Agencies may be facing challenges in predicting demand for different bourbon brands, potentially leading to understocking of popular items or overstocking of less-demanded brands. This can result in:

* Loss of sales opportunities due to insufficient stock of high-demand brands like *Weller Antique*.
* Excess inventory for lower-demand products, tying up capital in unsold stock.
* Shipment inefficiencies, with certain brands either over-shipped or under-shipped depending on regional demand.

**Objectives and Goals:**

* **Optimize Shipment Distribution:** To improve the accuracy of bourbon shipments to different agencies, ensuring the right amount of stock is available based on historical demand.
* **Demand Forecasting:** Establish data-driven demand forecasting for top-selling brands (*Weller Antique*, *Blanton's Single Barrel*, *Eagle Rare*) to align supply with customer preferences.
* **Agency Performance Evaluation:** Identify high-performing agencies (such as Kroger) and replicate successful strategies across other regions.
* **Improve Year-over-Year Shipment Trends:** Address the drop in shipments seen in 2022 and 2023 compared to 2020 and 2021, aiming for sustainable growth in future years.

By addressing these issues, the state can enhance the overall efficiency of its bourbon distribution network, increase sales, and improve customer satisfaction.

# Data Requirement

**Key Data Attributes Required to Address the Business Problem:** To effectively solve the problem of optimizing bourbon distribution and improving demand forecasting, several key data attributes are essential:

* **Agency Data:** Information on the agencies handling bourbon shipments (location, ranking, and performance). This helps analyze which agencies are most effective and understand regional trends.
  + Agency name
  + Location (city, county)
  + Shipment volumes (monthly and annually)
  + Rank based on performance or sales
* **Product Data:** Shipment data for specific bourbon brands, including sales performance by product.
  + Brand name (e.g., *Weller Antique*, *Blanton’s Single Barrel*, *Eagle Rare*)
  + Volume shipped (per brand, per month, per year)
  + Product popularity trends
* **Time Periods:** Monthly and annual data from 2019 to 2023 to identify trends and patterns in shipment fluctuations.
  + Yearly shipment totals (to compare trends across years)
  + Monthly shipment breakdowns (to spot seasonal patterns or supply chain issues)
* **Shipment Metrics:** Total bottles shipped, which is crucial for demand forecasting and inventory management.
  + Monthly shipment totals
  + Agency-specific shipments
  + Brand-specific shipments

**Metrics and Parameters to Consider:** To effectively optimize shipments, the following metrics and parameters should be monitored:

* **Shipment Volume Trends:** Comparing year-on-year and month-on-month shipment volumes to detect growth or decline in specific periods.
* **Demand Forecasting Metrics:** Use historical data to predict future demand for top brands and ensure optimal stock levels at agencies.
  + Forecasted vs. actual shipment volumes
  + Growth rate by brand
* **Agency Performance Metrics:** Evaluating which agencies are receiving and selling the most bourbon. The goal is to identify successful strategies and transfer those to lower-performing regions.
  + Sales per agency
  + Ranking by total shipments
* **Customer Demand Indicators:** Customer preferences by analyzing shipment volume trends of different brands, allowing for better stocking decisions.
  + Popularity rankings for top brands (e.g., *Weller Antique*, *Blanton's Single Barrel*)
  + Monthly or seasonal demand fluctuations

# Data Collection and Data Understanding

**Source of Data:** The data for Ohio bourbon shipments comes from various internal and external sources, likely gathered from the state’s alcohol distribution network. Understanding where this data originates from is crucial for evaluating its reliability and ensuring all relevant factors are considered.

* **Internal Data Sources:** This includes transactional data from Ohio's internal systems that track shipments from suppliers to different agencies (e.g., retail outlets, liquor stores, distributors).
  + **Agency Transaction Data:** Shipment volumes recorded by each agency.
  + **Inventory Management Systems:** Data reflecting stock levels, sales, and restocking needs.
* **External Data Sources:** Data collected from third-party distributors, external suppliers, or publicly available sources like state alcohol regulatory agencies.
  + **Supplier Data:** Shipment records provided by bourbon suppliers or manufacturers such as distilleries.
  + **Market Research or Industry Reports:** External industry reports or insights that may help in demand forecasting and understanding broader market trends.
* **Potential Use of APIs or Web Data:** APIs or web scraping may be used to pull in data on competitor brands, national market trends, or even customer sentiment analysis, though this is less likely in this specific case but worth considering for future improvements.

**Characteristics of the Data:**

The data used in this analysis likely has several key characteristics that help define its quality and usability:

1. **Data Format:**
   * The shipment data likely exists in **structured formats**, such as **CSV, Excel, or SQL databases**, given its tabular nature (e.g., monthly shipment volumes, brand names, and agency details).
   * Visual elements like **maps and charts** in the dashboard may have been generated from this structured data, possibly through visualization tools like **Power BI**, **Tableau**, or similar.
2. **Volume:**
   * **Moderate Volume:** Given that the dataset spans five years (2019-2023) and includes multiple agencies, brands, and months, the volume of data could be sizable but manageable. For example:
     + Shipment data per agency per month across five years
     + Brand-level shipment data (such as *Weller Antique*, *Eagle Rare*, etc.) recorded monthly
     + Overall state-wide shipment trends by year
   * The data volume is likely within the range of **thousands of rows**, given that Ohio’s distribution network would involve numerous shipments per agency per month.
3. **Variety:**
   * **Variety in Data Types:** The dataset includes a variety of attributes:
     + **Quantitative Data:** Shipment volumes, number of bottles sold, shipment trends by month and year (numerical data)
     + **Categorical Data:** Brand names, agency names, location details (city, county, region)
     + **Geographical Data:** Location-based data used to map agency locations and understand regional performance.
   * The diversity in data allows for multi-dimensional analysis, including time series analysis (for trends over time) and geographical analysis (for agency performance by location).

**Understanding the Data:**

Once the data is collected, it is important to have a clear understanding of its structure and relationships to derive meaningful insights:

* **Time-Based Data:** The data is organized by time (monthly, yearly), allowing for trend analysis across different periods (e.g., 2019-2023). This is crucial for identifying shipment peaks (e.g., July, August) and yearly trends (e.g., drop in 2022 shipments).
* **Geographical Understanding:** With agency locations mapped geographically, it becomes easier to spot regional variations in bourbon consumption, potentially guiding more targeted distribution strategies.
* **Brand-Level Data:** The shipment volume by brand helps determine which products are in high demand (e.g., *Weller Antique* with 81K bottles shipped). Understanding brand-specific demand helps optimize stocking levels across agencies.

**Data Quality Considerations:**

* **Completeness:** Ensuring that no months or agencies are missing from the dataset is critical for accurate forecasting and analysis.
* **Accuracy:** Data should be verified against actual sales or shipment records to avoid discrepancies, especially in external data sourced from suppliers.
* **Consistency:** Data from different agencies and brands must follow the same reporting standards to ensure comparability (e.g., units of measurement, time intervals).

By understanding the sources and characteristics of the data, stakeholders can gain confidence in the results of the analysis and the recommendations derived from it. This ensures that the bourbon distribution strategy is optimized based on high-quality, reliable data.

# Data Validation (Bias/Transparency/Reliability)

To ensure that the analysis of Ohio Bourbon shipments is accurate, meaningful, and fair, it is important to validate the data by examining it for potential biases, checking its reliability, and assessing the transparency of the data collection process.

**1. Checking for Biases in Data:**

Data bias can skew the analysis and lead to misleading conclusions. There are several types of biases that need to be considered in this context:

* **Demographic Bias:**  
  Bourbon shipments could be influenced by demographic factors, such as preferences based on age, income, or region. If the data over-represents certain regions or customer profiles, this could create bias. For example:
  + The majority of shipments might be focused in affluent areas or regions where bourbon is particularly popular, such as urban centers. This could cause rural or underserved areas to be underrepresented in the data, leading to inaccurate conclusions about statewide demand.
  + **Mitigation:** Ensure that the data covers a diverse range of agencies and geographical areas across Ohio to avoid skewing results toward certain regions. The dashboard’s map view helps identify whether distribution is equally spread or clustered.
* **Temporal Bias:**  
  Temporal bias can occur if the data is unevenly distributed across time. For instance:
  + **Seasonality:** Bourbon shipments might naturally fluctuate across different months due to seasonal demands (e.g., holiday season spikes). If these seasonal patterns are not accounted for, it could distort year-over-year comparisons or trend analysis.
  + **Mitigation:** To reduce temporal bias, trends should be analyzed on both a monthly and annual basis, which has been done in the dashboard. Additionally, applying seasonality adjustments may be necessary to better understand underlying trends.
* **Sampling Bias:**  
  Sampling bias could occur if the dataset does not include all relevant agencies, brands, or time periods. This could happen if:
  + Certain small or rural agencies are not consistently tracked, leading to an overrepresentation of larger urban agencies in the analysis.
  + Only a subset of bourbon brands (e.g., *Weller Antique* or *Eagle Rare*) are included, while other lesser-known or smaller brands are excluded from the analysis.
  + **Mitigation:** It’s crucial to verify that all agencies and brands have been consistently represented in the data over time to avoid misrepresentations. Sampling should be random and inclusive to represent the entire bourbon shipment market.

**2. Assessing Data Reliability:**

Reliable data is essential to draw accurate conclusions. There are several key aspects of data reliability:

* **Source Validation:**  
  The data should be sourced from trusted and consistent systems, ensuring that all records are correctly logged and match real-world events. The dashboard likely pulls data from internal systems tracking shipments between suppliers and agencies. Reliability issues can occur if:
  + Data entry errors lead to incorrect shipment volumes being recorded.
  + External suppliers (e.g., distilleries or distributors) provide inaccurate shipment figures.
  + **Mitigation:** To improve reliability, it is important to cross-check the data from multiple sources, such as comparing agency-reported shipments with supplier records or sales data. Regular audits can help identify and rectify discrepancies.
* **Consistency of Reporting:**  
  Data reliability also depends on consistent reporting practices. If different agencies follow varying data entry protocols, the data could become unreliable. For example:
  + Agencies might report shipments on different time intervals (e.g., weekly vs. monthly) or in different units (cases vs. bottles).
  + **Mitigation:** A standard reporting framework should be enforced across all agencies and suppliers. Data standardization ensures that all parties report in the same format and timeframe, making it easier to analyze and compare trends.
* **Data Accuracy and Completeness:**  
  Incomplete data, such as missing months or agencies, would undermine the analysis. For example:
  + If some agencies fail to report shipments for a few months, it would create gaps in the time series data, distorting the trend analysis.
  + **Mitigation:** Ensuring that all required data points are present and complete is crucial. This can be achieved by implementing checks for missing values or gaps and filling in those gaps using interpolation techniques where appropriate.

**3. Assessing Transparency:**

Transparency in data collection and reporting ensures that the process is well-understood by stakeholders and that any limitations or assumptions in the data are clearly communicated:

* **Transparency of Data Collection Processes:**  
  It is essential to document how the data was collected and who was responsible for the collection at each stage. This involves:
  + Ensuring that all involved parties (agencies, suppliers, distributors) are aware of and follow the established reporting protocols.
  + Clearly outlining the methods used to gather and report shipment data.
  + **Mitigation:** Full transparency about the data collection process should be maintained to allow stakeholders to assess its validity. If there are any known limitations (e.g., data from certain months or agencies being unavailable), they should be communicated upfront.
* **Clear Communication of Assumptions and Limitations:**  
  Transparency also involves disclosing any assumptions made during the analysis. For instance:
  + If seasonal factors are assumed to influence shipment volumes, this should be clearly stated.
  + If the analysis focuses on only the top-performing brands (e.g., *Weller Antique*), the exclusion of other brands should be acknowledged.
  + **Mitigation:** Any assumptions, exclusions, or data processing steps should be well-documented so that the results can be properly interpreted by all stakeholders.

By addressing these factors, the data used for analyzing Ohio bourbon shipments can be validated to ensure it is free from significant biases, reliable in terms of accuracy and completeness, and transparent enough for stakeholders to trust the analysis. Reliable and unbiased data leads to more accurate business insights, allowing for informed decisions on improving bourbon distribution efficiency.

# Data Cleaning (EDA)

Data cleaning and exploratory data analysis (EDA) are essential processes for preparing the dataset and uncovering valuable insights. Before diving into the actual analysis of Ohio Bourbon shipments, it is crucial to address issues related to data quality and structure, ensuring the dataset is clean, consistent, and suitable for further analysis.

**1. Preprocessing Techniques:**

Data preprocessing involves identifying and resolving issues like missing values, outliers, and inconsistencies that could negatively affect the analysis.

* **Handling Missing Values:** Missing data is a common issue, and its presence can distort analysis and lead to inaccurate conclusions. In the case of Ohio Bourbon shipment data, missing values could occur if certain agencies, months, or brands fail to report their shipment data.
  + **Identifying Missing Data:**  
    Use tools like Power BI's data view or Python libraries (such as pandas) to identify any gaps in the dataset. Missing data can be detected by scanning for NULL values or blanks in key columns like "Shipment Volumes" or "Agency Reports."
  + **Filling or Imputing Missing Values:**  
    Once identified, the missing values can be handled in several ways:
    - **Mean/Median Imputation:** For missing shipment values, you could impute the missing data with the average volume for similar months, years, or agencies. For example, if April shipment data for *Eagle Rare* is missing, you could use the average shipments for that brand over the previous or next few months.
    - **Forward/Backward Fill:** When dealing with time series data (e.g., monthly shipments), you could fill missing values by propagating the previous month’s data forward (forward fill) or using the next available value (backward fill).
    - **Removing Rows with Missing Values:** If the missing data is too extensive or critical for analysis, it might be best to remove those rows or agencies, ensuring that analysis is only performed on complete, reliable data points.
* **Handling Outliers:** Outliers are unusually high or low data points that can skew trends and mislead interpretations. In this context, outliers could represent abnormally high or low shipment volumes, potentially caused by one-time events (e.g., special promotions, supply chain disruptions).
  + **Identifying Outliers:**  
    Outliers can be detected through statistical methods like the **IQR (Interquartile Range)** or by visualizing the data using box plots and line charts. For instance, if shipments for *Blanton’s Single Barrel* suddenly spike in a particular month, it could indicate an outlier.
  + **Handling Outliers:**  
    Once outliers are identified, it’s important to decide whether to remove them or adjust the analysis:
    - **Exclusion:** If an outlier is due to data entry errors or exceptional circumstances, it might be best to exclude that data point.
    - **Analysis with and without Outliers:** In some cases, it can be useful to conduct parallel analyses—one including the outliers and another excluding them. This helps in understanding how much the outliers are impacting the overall trend.
* **Ensuring Data Consistency:** Data consistency refers to ensuring that values are entered in a uniform format. In the bourbon shipment data:
  + **Standardizing Units:** If shipment volumes are reported in different units (e.g., bottles vs. cases), you would need to convert them to a single standard unit (e.g., bottles) before analysis.
  + **Correcting Typographical Errors:** Misspelled agency names, city names, or brand names can cause duplication and inaccuracies. For instance, if “Sharonville Liquor & Wine” is entered as “Sharonville Liquor Wine,” it could split shipment data between two different entities, affecting overall trends.
  + **Ensuring Uniform Date Formats:** Shipment dates should be consistently formatted to enable accurate trend analysis. If some entries use different formats (e.g., "MM/DD/YYYY" vs. "YYYY-MM-DD"), they should be standardized.

**2. Exploratory Data Analysis (EDA):**

Once the data is clean and preprocessed, EDA is used to uncover patterns, trends, and insights from the data. This stage helps understand the data better and highlights key areas of interest for further analysis.

* **Identifying Trends:** EDA involves visualizing and analyzing the cleaned data to identify shipment trends across different time frames, brands, and agencies.
  + **Monthly and Yearly Trends:**  
    By examining the time series data for bourbon shipments, you can observe how shipment volumes fluctuate month-over-month or year-over-year. The dashboard already shows:
    - **Seasonal Patterns:** Peaks in shipment volumes, such as the spike in *Blanton's Single Barrel* shipments in the summer months or holiday season, can indicate seasonality trends.
    - **Yearly Trends:** The bar chart for shipment trends by year shows an overall rise in shipments from 2019 to 2021, followed by a decline in 2022. This helps pinpoint any potential disruptions or changing demand patterns over time.
  + **Brand and Product Performance:**  
    By conducting a breakdown of shipments by brand, you can identify top-performing products. For instance:
    - *Weller Antique* is the highest-shipped brand (81,000 bottles), followed by *Blanton's Single Barrel* (18,000 bottles), and *Eagle Rare* (14,000 bottles).
    - EDA can reveal if certain brands experience growth or decline in popularity over time, enabling businesses to adjust their inventory and marketing strategies accordingly.
  + **Agency Performance:**  
    Another useful aspect of EDA is analyzing shipment data by agencies. The dashboard shows the top 10 agencies, with Kroger ranking first. Further EDA can explore:
    - Whether there are performance gaps between different agencies.
    - If specific regions (based on the map) are experiencing higher shipment volumes than others.
* **Uncovering Patterns:** EDA also helps to identify underlying patterns in the dataset that may not be immediately obvious.
  + **Correlation Analysis:**  
    EDA can reveal correlations between variables, such as whether certain brands tend to have higher shipments during specific months or whether shipment volumes are correlated with the size of the agency.
  + **Segmenting Data:**  
    By breaking down the data into segments (e.g., by city, county, or time period), EDA can uncover patterns specific to different geographic regions or time frames. This allows the business to tailor strategies based on local demand or seasonal patterns.
* **Visualization of Data:** Visualization is a critical part of EDA, helping to make trends and patterns more understandable.
  + **Line Charts and Bar Graphs:**  
    Visual tools like line charts (e.g., bottles shipped by month) or bar graphs (e.g., yearly shipment trends) help in visualizing how key metrics evolve over time and across categories.
  + **Heatmaps:**  
    In more complex analyses, heatmaps can be used to identify areas of high and low shipment volumes geographically, helping to focus on underperforming areas or opportunities for growth.

By conducting thorough data cleaning and EDA, you can ensure that the dataset is clean, reliable, and ready for in-depth analysis. Preprocessing techniques like handling missing values and outliers prevent inaccuracies, while EDA provides insights into shipment patterns, enabling businesses to make more informed decisions regarding distribution and sales strategies.

# Graphs (Univariate, Bivariate, Multivariate)

Visualizing data through different types of graphs is an essential aspect of analyzing and interpreting datasets. Each type of analysis—univariate, bivariate, and multivariate—helps uncover different layers of insights from the data, whether by examining single variables or by exploring the relationships between multiple variables. For the Ohio Bourbon shipments dataset, these graphical representations will enable a deeper understanding of shipment patterns, trends, and correlations across various dimensions, such as time, brand, and agency.

**1. Univariate Analysis (Distribution and Frequency Analysis):**

Univariate analysis examines a single variable at a time. The goal is to understand the distribution, central tendency, and variability of that variable. In the context of bourbon shipments, univariate analysis can help identify trends for individual variables such as shipment volume by month, by brand, or by agency.

* **Distribution of Bourbon Shipments by Brand:**
  + A bar chart or histogram can be used to show the distribution of shipment volumes for different bourbon brands. For instance, the dashboard shows that *Weller Antique* dominates shipments with 81,000 bottles, while *Eagle Rare* and *Blanton's Single Barrel* have significantly lower volumes.
  + Understanding the distribution across brands helps assess which products are driving sales and which might require more marketing support or inventory adjustments.
* **Frequency Analysis of Monthly Shipments:**
  + A line chart showing "Bottles Shipped by Month" can be used to analyze how frequently shipments occur and whether there are peak months for shipping.
  + From the dashboard, it’s evident that there are shipment peaks during certain months like July and August, potentially due to higher consumer demand or promotional events. Analyzing these trends helps forecast future shipments and optimize the supply chain.
* **Distribution of Shipments Across Agencies:**
  + A frequency chart showing how shipments are distributed across the top 10 agencies, such as Kroger or Queen City Wine and Spirits, can reveal the most active distributors. This helps target high-performing agencies for further business collaborations.

**Key Graphs for Univariate Analysis:**

* **Histograms:** Show the distribution of a single variable, such as the volume of shipments per brand.
* **Line Charts:** Used to track the changes in a single variable over time, such as shipments by month.
* **Bar Charts:** Help in comparing the frequency of different categories, such as the number of shipments per agency.

**2. Bivariate Analysis (Correlations, Scatter Plots, etc.):**

Bivariate analysis looks at the relationship between two variables to determine if they are correlated or how one might affect the other. For bourbon shipments, bivariate analysis can help understand relationships between variables like shipment volume and time, shipment volume and brand, or shipment volume and agency.

* **Correlation Between Shipments and Time:**
  + By plotting shipment volumes against time (months or years), a **line chart** can show whether there is a positive or negative trend over time. For example, the bar chart in the dashboard reveals that shipments increased from 2019 to 2021 and then declined in 2022. This kind of analysis helps in predicting future demand and understanding the impact of external factors like holidays or market shifts on shipment volumes.
* **Scatter Plot of Shipments by Brand and Agency:**
  + A **scatter plot** can be used to analyze the relationship between shipments by brand and shipments by agency. This could reveal which agencies are more likely to ship larger quantities of premium brands like *Blanton's Single Barrel* or *Eagle Rare*. This helps in targeting marketing and sales efforts more effectively toward high-performing agencies.
* **Correlation Analysis:**
  + By performing correlation analysis, you can determine how strongly related two variables are. For example, you might discover that certain brands have a strong correlation with higher sales volumes during specific months, helping inform marketing strategies for seasonal campaigns.

**Key Graphs for Bivariate Analysis:**

* **Scatter Plots:** Help visualize relationships between two variables, such as shipment volume by brand and by agency.
* **Line Charts:** Show trends over time for two variables, such as shipment volume over months.
* **Correlation Matrix:** Displays the correlation coefficients between multiple pairs of variables, useful for identifying strong relationships between variables.

**3. Multivariate Analysis (Heatmaps, PCA Visuals, etc.):**

Multivariate analysis explores the relationships between three or more variables simultaneously. This type of analysis is more complex but allows for a deeper understanding of how different factors interact to influence bourbon shipments.

* **Heatmaps for Shipment Volumes:**
  + A **heatmap** can show the interaction between different variables, such as month, brand, and agency, allowing you to visualize areas with high or low shipment volumes. For example, a heatmap might highlight that *Weller Antique* shipments peak in the summer months, particularly for agencies in urban areas like Cincinnati.
  + Heatmaps can also help identify correlations across multiple dimensions at once, making it easier to spot patterns that would be difficult to detect using simple bar charts or scatter plots.
* **Principal Component Analysis (PCA):**
  + **PCA** is a dimensionality reduction technique used to simplify the complexity of multivariate data while retaining as much information as possible. It creates visuals that highlight the most important variables contributing to variance in the dataset.
  + For the bourbon shipments data, PCA can help identify which factors (such as specific agencies, months, or brands) are most strongly associated with changes in shipment volumes. This reduces the complexity of managing and analyzing large datasets with multiple interacting variables.
* **3D Scatter Plots:**
  + In more advanced scenarios, a **3D scatter plot** can be used to visualize three variables at once. For example, you might plot agency, shipment volume, and month on three axes to explore how these factors interact to influence total shipments.
  + This kind of visualization allows for spotting clusters or patterns in the data, helping to identify which combinations of factors lead to higher shipment volumes.

**Key Graphs for Multivariate Analysis:**

* **Heatmaps:** Used to visualize correlations between multiple variables and highlight areas of high/low activity.
* **3D Scatter Plots:** Help in visualizing relationships between three variables, offering more context on how different factors interplay.
* **PCA Plots:** Used for dimensionality reduction to focus on the most significant variables affecting shipment patterns.

# Dashboard

A well-designed dashboard serves as an interactive tool to visualize key metrics and insights, offering stakeholders a clear, concise summary of critical data points. In the case of the Ohio Bourbon Shipments dashboard, the focus is on providing a holistic view of bourbon shipment patterns across brands, agencies, and time periods. It highlights essential metrics that can help businesses and decision-makers quickly assess performance, identify trends, and make informed decisions.

**Dashboard Design and Structure**

The Ohio Bourbon Shipments dashboard uses a combination of different visual elements to offer insights into bourbon shipments across the state from 2019 to 2023. It includes interactive charts, graphs, and tables, designed to facilitate easy navigation and exploration of the data.

1. **Map Visualization:**
   * The map displays the **Agency Locations** across Ohio, which helps users visually understand the geographic distribution of bourbon shipments. By hovering over the different points on the map, users can identify specific agencies and their shipment activity.
   * This offers a spatial dimension to the data, helping identify regions with the highest activity, as well as potential areas for expansion or targeted marketing efforts.
2. **Top Agencies Table:**
   * The **Top 10 Agencies** table shows the agencies ranked by shipment volumes, with *Kroger* leading the list. This table is a valuable tool for identifying the most significant distribution partners, which helps prioritize business relationships and optimize supply chain logistics.
   * Each agency's shipment rank provides an indication of its performance relative to others, which could guide decisions about marketing, stock levels, or distribution agreements.
3. **Volume by Brand (Treemap):**
   * The **Treemap** presents the total volume of shipments for key bourbon brands, with *Weller Antique* dominating the market at 81,000 bottles. This visual representation emphasizes which brands are performing best in terms of shipments, helping sales teams focus on high-performing products.
   * The size of each rectangle represents the shipment volume, offering an at-a-glance view of which brands contribute the most to overall sales.
4. **Shipment Trends by Year (Bar Chart):**
   * The **Shipment Trends by Year** bar chart shows annual shipment volumes from 2019 to 2023, clearly depicting a rise in shipments from 2019 (18,192 bottles) to a peak in 2021 (27,869 bottles) before a slight dip in 2022 and a rebound in 2023.
   * This trend analysis helps businesses understand shipment dynamics over the years, correlating them with external factors like market demand, marketing campaigns, or economic changes. The trend highlights the need to analyze why 2022 experienced a decline and what strategies led to the recovery in 2023.
5. **Bottles Shipped by Month (Line Chart):**
   * The **Bottles Shipped by Month** line chart tracks shipments for three popular brands—*Blanton's Single Barrel*, *Eagle Rare*, and *Weller Antique*—over the course of a year. This visual helps stakeholders understand seasonal variations in shipments, such as increased shipments during peak months like July and August.
   * The chart can assist in planning production and inventory management by highlighting months of high demand, ensuring sufficient stock levels during peak times.
6. **Monthly Shipment Data Table:**
   * The **Bottles Shipped by Month** table breaks down monthly shipment volumes for each brand, giving a detailed view of how shipments vary month-to-month and contributing to more granular insights for operations teams.
   * The totals provide a quick summary of the cumulative shipment volumes, which can be used to assess overall performance and compare it to historical data.

**Key Performance Indicators (KPIs) and Metrics**

KPIs are central to monitoring business performance and identifying areas for improvement. The Ohio Bourbon Shipments dashboard highlights several key performance indicators:

1. **Total Shipments by Brand:**
   * The treemap showing shipment volumes by brand provides a clear understanding of which products are most in demand. For example, *Weller Antique* shipped 81,000 bottles, making it the leading product. Monitoring this KPI helps focus marketing efforts on high-performing brands while identifying underperforming products for strategic improvement.
2. **Top 10 Agencies:**
   * The ranked list of agencies provides insight into which distributors are handling the largest shipment volumes. This KPI is essential for assessing agency performance and determining which partnerships are most critical for distribution. Kroger, ranked 1st, leads in shipments, indicating it should be a priority for business relationships and negotiations.
3. **Shipment Trends Over Time:**
   * The year-on-year shipment trends give insight into how shipments have changed across the 5-year span from 2019 to 2023. Understanding this KPI helps businesses adapt their strategies based on market changes or external factors that have caused dips or spikes in shipments.
4. **Monthly Shipment Volumes:**
   * The line chart and table showing **Bottles Shipped by Month** give a detailed breakdown of shipment volumes across the year. This KPI is useful for operations and inventory planning, especially to anticipate high-demand periods and ensure adequate stock availability.
5. **Regional Distribution:**
   * The map of agency locations is a key visual for understanding the geographic distribution of bourbon shipments. This metric helps assess which areas are receiving the most shipments and whether there are regions with untapped potential that could be explored for market expansion.

**Insights Gained from the Dashboard**

1. **Brand Performance Insights:**
   * *Weller Antique* is clearly the most popular brand, shipping significantly higher volumes than competitors like *Blanton's Single Barrel* and *Eagle Rare*. This suggests that the brand has strong customer demand, and efforts should be made to maintain or increase its availability in key regions.
2. **Agency-Specific Insights:**
   * The performance of agencies like *Kroger* shows that large retail chains are driving a substantial portion of shipments. Partnering with such agencies for marketing campaigns or special promotions could yield significant returns.
3. **Seasonal Shipment Insights:**
   * There is a notable increase in shipments during the summer months, particularly in July and August. This seasonal pattern indicates the need for businesses to prepare for peak demand during these months, ensuring supply chains are optimized to handle the increased volume.
4. **Annual Shipment Trends:**
   * Shipments have fluctuated over the years, with a significant peak in 2021 followed by a dip in 2022 and recovery in 2023. These trends warrant further investigation to understand the factors behind these shifts, such as changes in consumer behavior, economic conditions, or supply chain disruptions.

# Storytelling (Business Impact)

In data-driven decision-making, storytelling plays a crucial role in connecting analytical insights with actionable business outcomes. By presenting key findings in a compelling narrative, stakeholders can understand not only what the data says but also how it impacts the business and informs future strategies. For the Ohio Bourbon Shipments report, storytelling will focus on the interpretation of shipment trends, brand performance, and agency involvement, followed by recommendations based on these insights.

**Key Findings and Their Implications**

1. **Brand Performance:**
   * *Weller Antique* leads with 81,000 bottles shipped, followed by *Blanton’s Single Barrel* (18,000 bottles) and *Eagle Rare* (14,000 bottles).
   * **Implication:** The dominance of *Weller Antique* in the market indicates strong customer demand. This brand should be a key focus for inventory management, ensuring sufficient stock to meet demand, especially during high-demand periods.
   * Stakeholders can also explore opportunities to promote *Blanton's Single Barrel* and *Eagle Rare*, either through marketing campaigns or discounts, to boost their share in the market.
2. **Shipment Trends Over Time:**
   * Shipments increased consistently from 2019 (18,192 bottles) to 2021 (27,869 bottles), reaching a peak, before dropping in 2022 (18,432 bottles) and rebounding in 2023 (21,948 bottles).
   * **Implication:** The peak in 2021 may have been driven by economic factors or specific events that led to higher demand for bourbon. The decline in 2022 warrants further investigation, as it may indicate either market saturation or supply chain issues. The recovery in 2023 shows resilience, but stakeholders need to analyze both internal and external factors to sustain growth.
   * Recommendations can include increasing marketing efforts during leaner periods to maintain consistent demand and identifying the reasons behind the dip in 2022 to mitigate similar issues in the future.
3. **Top Agencies and Their Role:**
   * *Kroger* ranks first among agencies, followed by *Queen City Wine and Spirits* and *Staggerlee’s Carry Out*. These top agencies are responsible for handling a significant portion of the total shipments.
   * **Implication:** The performance of these agencies highlights key partners in the bourbon supply chain. Kroger, being the leader, should continue to receive special attention in terms of stock allocation, marketing collaborations, and promotional activities.
   * Strengthening relationships with the top agencies will ensure smooth distribution, and expanding the network to include emerging agencies can help grow the business in underserved areas.
4. **Seasonal Patterns and Monthly Trends:**
   * There is a clear seasonal uptick in shipments during the summer months, particularly July and August, as indicated by the line chart and monthly data.
   * **Implication:** Understanding the seasonal demand cycle is critical for inventory planning and ensuring that stock levels are adequate during peak times. Bottlenecks in supply during these months could lead to missed sales opportunities, so ensuring efficient logistics is essential.
   * Stakeholders could explore promotions and marketing campaigns ahead of peak months to capitalize on the increased demand, potentially increasing revenues during these periods.

**Recommendations and Action Plans for Stakeholders**

1. **Focus on High-Performing Brands:**
   * Action: Prioritize the distribution of *Weller Antique* given its high shipment volume and market demand. Ensure this brand remains well-stocked across all key agencies, particularly during peak months.
   * Recommendation: Explore opportunities for cross-promotions with *Blanton's Single Barrel* and *Eagle Rare* to diversify sales across multiple brands and boost their presence.
2. **Mitigate Future Declines in Shipments:**
   * Action: Investigate the causes behind the dip in shipments in 2022 to prevent a recurrence of similar declines. Analyze external factors (e.g., supply chain disruptions, market conditions) and internal issues (e.g., stock shortages) that might have contributed to the drop.
   * Recommendation: Based on the findings, stakeholders should develop contingency plans for any disruptions, including diversifying the supplier base and increasing buffer stock for high-demand periods.
3. **Leverage Top Agency Partnerships:**
   * Action: Strengthen relationships with top-performing agencies like *Kroger* and *Queen City Wine and Spirits* by offering exclusive deals, loyalty programs, or co-branded marketing initiatives. These agencies are critical for driving volume, and maintaining a strong partnership ensures sustained growth.
   * Recommendation: Explore partnerships with emerging agencies or those ranked lower in the top 10 to diversify the distribution network, particularly in regions with untapped demand.
4. **Prepare for Seasonal Peaks:**
   * Action: Increase production and stock levels in anticipation of the summer months, particularly July and August, when shipment volumes peak. Ensure smooth logistics and distribution to avoid stockouts or delays.
   * Recommendation: Launch marketing campaigns targeted at consumers during these months, encouraging increased sales of bourbon brands, especially those with lower market shares. Utilizing seasonal promotions can help capture consumer attention and boost overall sales.
5. **Improve Forecasting and Inventory Management:**
   * Action: Use historical shipment data to build predictive models that forecast demand based on seasonality, brand popularity, and regional distribution. This will help optimize inventory levels and reduce costs related to overstocking or stockouts.
   * Recommendation: Invest in advanced analytics and AI-driven forecasting tools that allow for real-time adjustments to production and shipment schedules, ensuring that supply meets demand efficiently throughout the year.

The business impact of the Ohio Bourbon Shipments analysis reveals clear insights into brand performance, shipment trends, and seasonal patterns. By leveraging the findings from this report, stakeholders can make informed decisions about inventory management, marketing strategies, and distribution partnerships. The recommendations provided aim to optimize operations, sustain growth, and ensure that the business continues to meet market demand effectively.

In summary, understanding shipment dynamics across brands, agencies, and time periods allows businesses to take targeted actions that drive profitability and market share. Clear storytelling that highlights these insights ensures that stakeholders not only understand the data but also see the tangible impact on business outcomes.

# Conclusion

In conclusion, the Ohio Bourbon Shipments report reveals significant insights that can drive operational and strategic improvements within the bourbon distribution network. The dominance of brands like *Weller Antique* highlights the importance of managing top-performing products, while seasonal shipment patterns point to the need for better forecasting and inventory planning. The analysis also identifies key agency partnerships that should be strengthened to ensure consistent and efficient distribution across the state.

By acting on the recommendations provided—such as leveraging seasonal peaks, improving forecasting models, and strengthening top agency relationships—stakeholders can optimize inventory levels, enhance customer satisfaction, and ensure sustainable growth in the bourbon market. The insights derived from this analysis provide a clear pathway for data-driven decision-making, ensuring that the business continues to meet market demands and adapt to changing conditions effectively.