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AFP ASSOCIATION FOR FINANCIAL PROFESSIONALS

Power BI Foundations for Finance

Table of Contents

1 Introduction 3

1.1 SWOT Analysis of a Typical Finance Team and Operations 3

1.2 Using Excel as an FP&A Tool 4

2 4 Stages of Business Analytics: 5

3 Leading Practices and Benchmarks 6

3.1 Why Choose Microsoft Power BI? 7

4 Power BI and the 4 Important Steps of Business Intelligence 8

5 Power BI Environments 9

6 Power BI Terminology 11

7 Key Power BI Tools 12

7.1 Power Query (M) – aka "Query Editor" 12

7.2 DAX – Data Analytical Expressions 12

7.3 Data Connection Methods 12

7.4 Tabular Model – the engine behind Power BI 13

8 Collaboration – A more in-depth look 14

8.1 Workspaces, Shared Datasets, and Power BI Apps 14

8.2 Power BI Apps 14

8.3 Shared and Certified Datasets 15

8.4 Certified Datasets Process 15

9 Process - Every Great Tool Needs a Great Process 16

9.1 Report Development Process 16

9.1.1 Requirements Gathering/Data Discovery: 16

9.1.2 Visualizations, Standards, and Consistency 17

9.2 Report Build Process Summed up from a 'Technical' Perspective 18

9.3 Power BI Develop, Test, Production Workspace Usage 18

10 WorkShop # 1 20

10.1 Business Scenario 20

10.2 Exercise 1.1: Connect to Data Sources 20

10.3 Exercise 1.2: Begin Building the Power BI Report 34

10.4 Exercise 1.3: Create Row-Level Security Rules 57

10.5 Exercise 1.4: Publish a Report to Power BI Service 60

11 Workshop # 2 66

11.1 Business Scenario 66

11.2 Exercise 2.1: Begin Data Exploration (Matrix Visualization) 67

11.3 Exercise 2.2: Creating Basic Financial Measures 80
11.4 Exercise 2.3: Rate / Volume Variance Calculations 91
11.5 Exercise 2.4: Create a Dashboard Using Power BI Visuals 96

1 Introduction

Welcome to our workshop *From Data to Reporting & Insights Through Power BI!* We hope you will find this topic as captivating and exciting as we do, and we are excited for the opportunity to learn and discuss together. There is a vast field of untapped potential and exciting opportunities just waiting to be discovered and it is our hope that this workshop is the beginning of a long and exciting adventure.

We will discuss our observations from decades of experience across a wide range of industries. We will also showcase a typical organization's key milestones on their journey to becoming a leader in the analytics field able to leverage their information systems as a source of competitive advantage. We will also share some of our thoughts benchmarking some of their key processes so you can compare with your own procedures and get a feel for how your organization compares. Most of our focus, however, will be spent with hands-on exercise so you can increase our comfort level with the Power BI toolset so you can begin exploring your own data in an entirely new way.

1.1 SWOT Analysis of a Typical Finance Team and Operations

A business case requiring investment will often begin with a SWOT analysis that considers an organization as a whole and how it fits in its environment. Below is a modified SWOT analysis that shows patterns and tendencies we have observed in many organizations. Take a moment and see how this applies to your organization:

	Helpful	Harmful
Internal: Attributes of the Team Members / Process	**Strengths** Staff is knowledgeable, educated in accounting principles High levels of professionalism Well-structured and defined Chart of Accounts and Bookkeeping Procedures	**Weaknesses** Too much time spent gathering / compiling data. This is especially true in Budget / Forecast cycles Poor quality control of internal spreadsheets Uneven levels of computer knowledge / literacy. Training investment usually minimal and inadequate systems or tools exist Some members of the team are resistant to change
External: (Attributes of the Organization)	**Opportunities** Vast potential for discovery of transformative business processes. Many of these are not even identified until an organization embraces their analytics processes.	**Threats** Key Processes often not documented and understood by only one team member. Therefore, staff turnover is very disruptive to operations Common view of Finance as a "Cost Center" leads to reduced investment in this area

The good news is that if you are here, you have already begun addressing the points covered in the Weaknesses section. Next steps will be to take steps to mitigate the Threats so we can leverage Strengths to exploit our Opportunities.

1.2 Using Excel as an FP&A Tool

A lot of organizations rely very heavily on Excel for their FP&A. This is often a symptom of organizations starting out relatively small and keeping existing processes that works "well enough" even as the organization's complexity grows.

But do they, though?

If you think you're the only one who has found the occasional embarrassing error in your Excel workbook, you're not alone. Surveys have found that[1]:

- **70 percent** of companies use spreadsheets across their planning processes
    - **35 percent** of those companies frequently finding data errors on important spreadsheets
- **93 percent** of finance managers are "drowning in spreadsheets"
- Nearly 1 in 5 large businesses have suffered direct financial loss due to poor spreadsheets**,** and 1/3 have made poor decisions due to spreadsheet problems.

The problem is not with Excel itself. Excel is a powerful software that, when wielded correctly, can be an effective tool. Excel's power and flexibility has made it a popular choice for a lot of organizations. The core problem is that many organizations' FP&A processes are complex, and manual processes that are often being done under time pressure will inevitably lead to mistakes being made. Organizations should aspire to finding a way to implement business processes which are structured enough to deliver predictable, repeatable results, while also flexible enough to quickly respond to most business challenges.



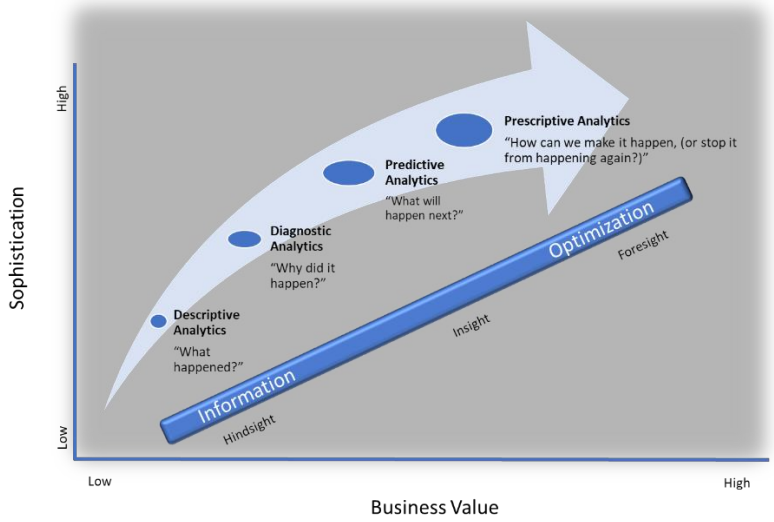
Source: https://dilbert.com/strip/2011-06-02

> The good news about computers is that they do what you tell them to do. The bad news is that they do what you tell them to do.
>
> Ted Nelson

[1] 1: http://www.oracle.com/us/solutions/cloud/oracle-accelerating-epm-deployment-2172092.pdf

2 4 Stages of Business Analytics:

Gartner breaks down a typical organization's progression towards data analysis along the following milestones:



Descriptive: "What happened?"

At this stage, organizations can gather and analyze a data set and describing its features and characteristics. This is mainly used to describe and characterize past events. Managers produce summary statements of these data sets.

Diagnostic: "Why did it happen?"

An organization may have the ability to focus on a known outcome determine the factors and events that contributed to that event. For example if the company's results are not in line with budget, they may be able to dive into their data to determine which products or customers may be underperforming, or if the issue is because of a variances in price of volume.

Predictive: *"What is likely to happen?"*

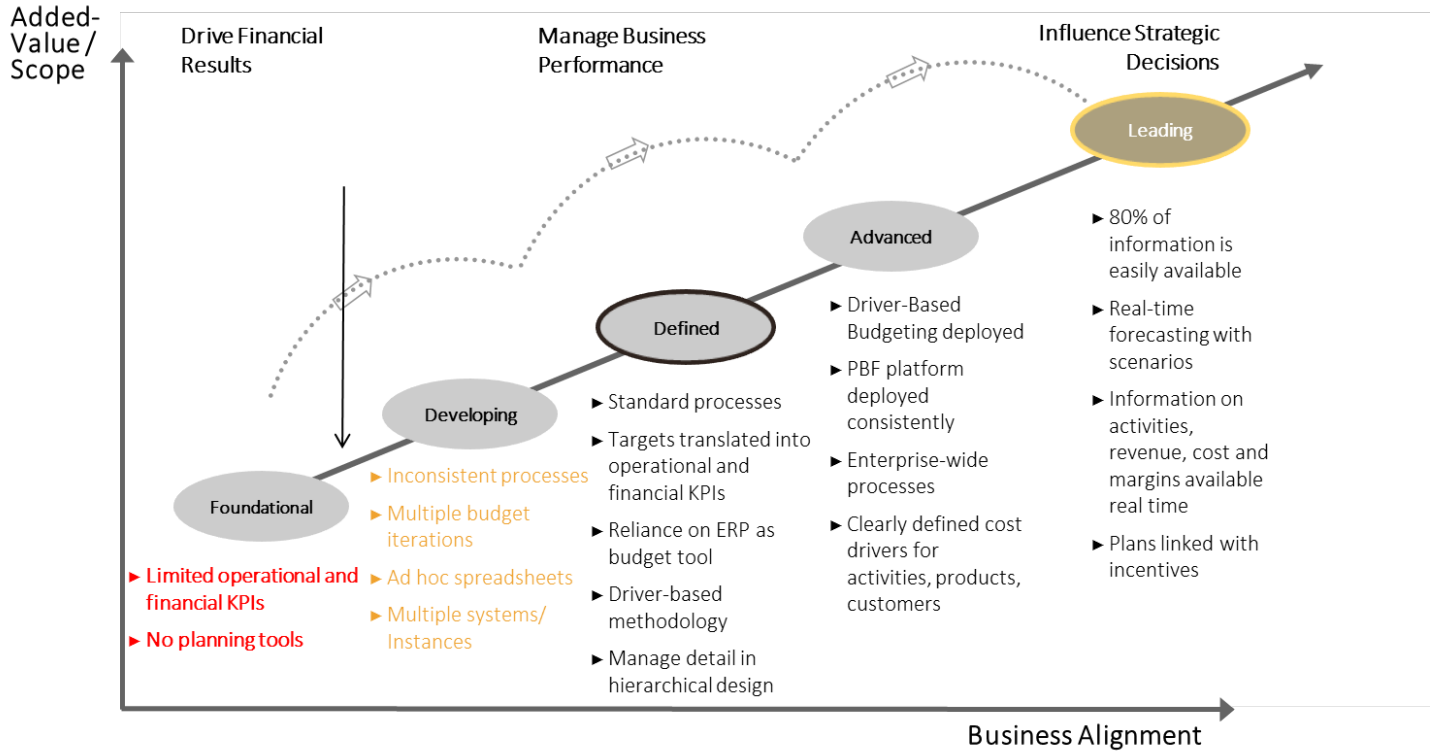
This type of analytics is about getting real insights to predict what will happen if you make a change or keep things the way they are. It's about using data from your database as well as elsewhere (perhaps information collected from social media) and detecting trends and patterns to help predict future outcomes.

Prescriptive: "How can we make it happen (or stop it from happening again?)"

Prescriptive analytics is what many companies, using BI, strive for. It's all about understanding what to do to maximize good outcomes and prevent bad ones from happening. Essentially, advanced BI technology is able to provide automated decisions, which are defined through the analytics process.

3 Leading Practices and Benchmarks

The following tables summarize some of our findings of leading practices and benchmarks to which organizations can aspire. How does your organization stack up?

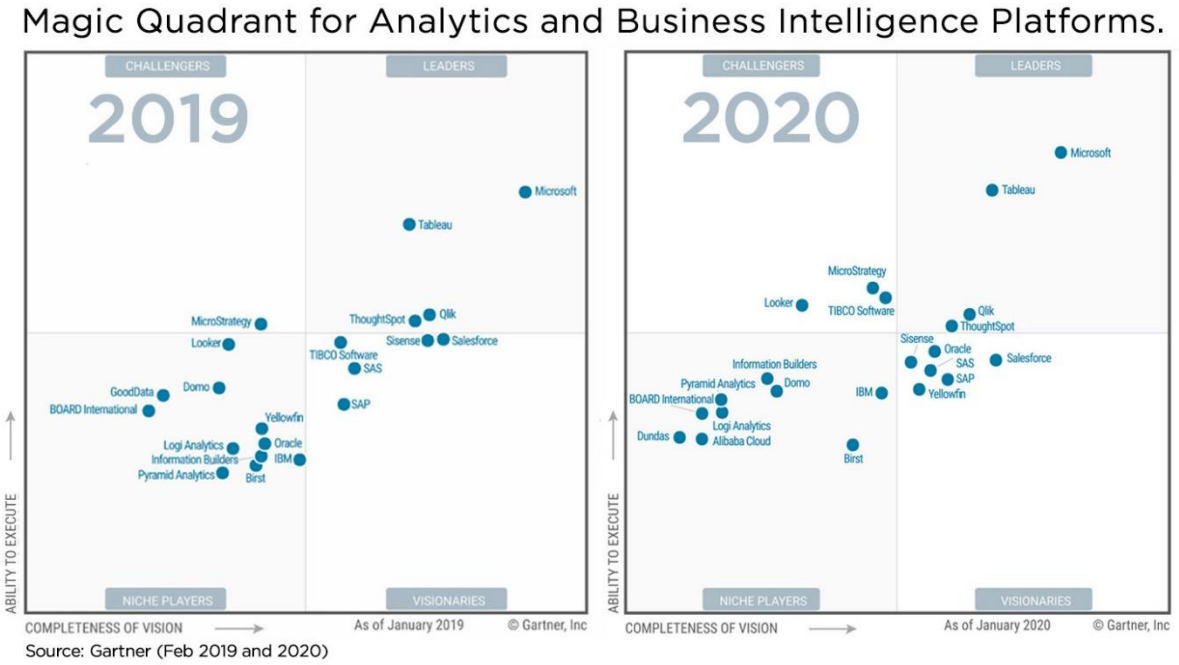


	Leading practice
Approach	Driver-based
Cascade of targets	Clearly communicated to planners
# of Plan Iterations	2
Cycle time for plan	6 to 8 weeks
Level of Detail	
- Accounts	125
- SG&A Accounts	35
- Revenue	3 levels above SKU
Plan Accuracy	+/- 2%
Technology	Integrated planning tool

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3.1 Why Choose Microsoft Power BI?

Every year, Gartner releases an annual report summarizing the key players in the Analytics / BI space according to their ability to execute and completeness of vision. Microsoft continues to enjoy a top ranking on both scales.



Source: Gartner (Feb 2019 and 2020)

The following is from Gartner's 2020 report:

Strengths

"Viral" spread: "…reference customers claimed more deployments with more than 1,000 users than those of any other vendor in this Magic Quadrant. Power BI is now almost always mentioned by users of Gartner client inquiry service who ask about ABI platform selection."

Product capabilities: with the releases in 2019, the Power BI Pro cloud service overtook most of its competitors in terms of functionality…tvast majority of Microsoft's surveyed reference customers would recommend Power BI without qualification.

Cautions

On-premises version: Compared with the Power BI Pro cloud service, Microsoft's on-premises offering has significant functional gaps, such as natural language Q&A, Quick Insights, and alerting. None of these functions are supported in Power BI Report Server.

Azure-only: Microsoft does not give customers the flexibility to choose a cloud IaaS offering. Its offering runs only in Azure.

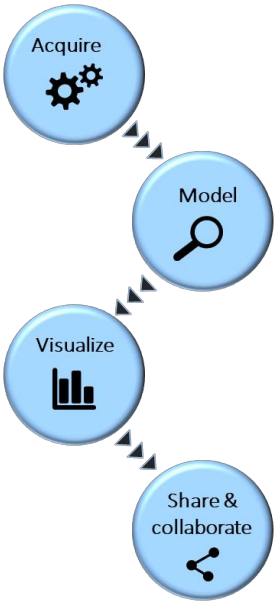
4 Power BI and the 4 Important Steps of Business Intelligence

Phase 1: Data Acquisition

Power BI enables end users to extract and load data from a multitude of sources. While other tools require custom integration, Power BI allows its end users to connect to a wide range of data sources with pre-built connectors. Some of these sources include, but are not limited to the following: Microsoft SQL, Oracle, SAP, Excel, CSV/Text, Dynamics 365 or Google Analytics. This wide variety of connectors will allow you to do things like pull SQL queries from your GL System and load competitor information from a manually compiled excel file and compare the data side by side.

Phase 2: Data Modeling and Transformation

Another great feature available in Power BI is the ability for end users to edit and transform the data imported into a Power BI Report. In many cases, data, when extracted from a source system, is never in a "clean" state for reporting. In the past, the cleanup and transformation of this data required advanced coding and specialized skills in order to present the data in a state worthy for reporting. However, Power BI has built-in data transformation and modeling tools (mentioned in more detail later in this documentation) that enable users without these specialized skills to transform their data through an easy to use user interface.



Phase 3: Visualization

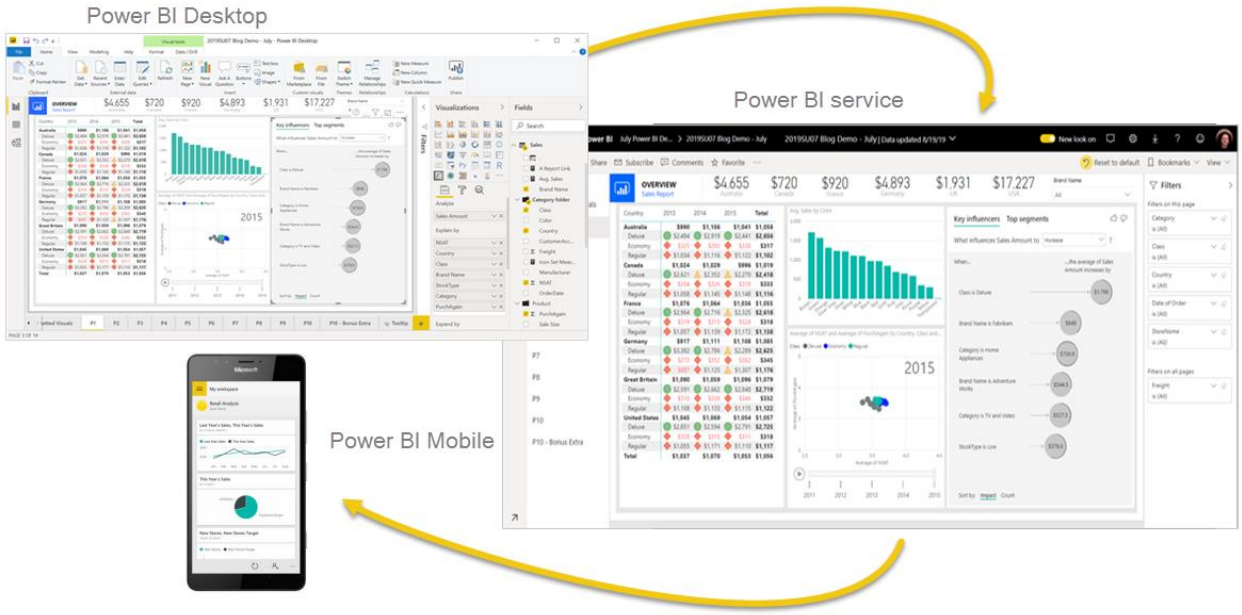
Once our data is in a state worthy of reporting, it is time to build our report in a meaningful way. Power BI's visualization capabilities allow end users to create meaningful stories with their data, via the use of dynamic built-in visualizations within the Power BI Desktop tool. Another added benefit is the ability to add in custom visuals to the Power BI Desktop platform for instances where the native visuals don't suffice.

Phase 4: Collaboration

The final piece to any BI report is the sharing and collaboration associated with the report. Power BI enables end users to take the report they have built and publish it the Power BI Service. Here end users can collaborate with their colleagues and customers on the report they have built, all while maintaining data governance and security.

5 Power BI Environments

Power BI users will interact with the data and reports in the following Environments:



1. **Power BI Desktop:** a free application you install on your local computer that lets you connect to, transform, and visualize your data. With Power BI Desktop, you can:
    - connect to multiple different sources of data
        - e.g. you may pull Summarized
    - combine data into a data model.
    - build visuals, and collections of visuals you can share as reports,
    - limited sharing with other people inside your organization.

    Most users who work on business intelligence projects use Power BI Desktop to create reports, and then use the Power BI service to share their reports with others.

2. **Power BI Service:** The Microsoft Power BI service (app.powerbi.com), sometimes referred to as Power BI online, is the SaaS (Software as a Service) part of Power BI. In the Power BI service:
    - Dashboards help you keep a finger on the pulse of your business.
    - Dashboards display tiles, which you can select to open reports for exploring further.
    - Dashboards and reports connect to datasets that bring all of the relevant data together in one place.
3. **Power BI Mobile:** Power BI offers a set of mobile apps for iOS, Android, and Windows 10 mobile devices. Allows you to connect to and interact with your cloud and on-premises data.

Typical flow is as follows:

1. Create reports in Power BI Desktop.
2. Create dashboards, and view dashboards and reports in the Power BI report service (https://powerbi.com).
3. View on-premises Power BI reports on Power BI Report Server.
4. All these reports and dashboards are available in the Power BI mobile apps, whether they're on premises or in the cloud. Try viewing and interacting with them on your mobile device, be it iOS (iPad, iPhone, iPod Touch, or Apple Watch), Android phone or tablet, or Windows 10 device.

6 Power BI Terminology

Visualizations

A visualization (aka visual) is a representation of data, such as a chart, a graph, a color-coded map, or other unique methods in which end users can represent their data.

Datasets

A dataset is a collection of data that Power BI uses to create its visualizations. These datasets are housed in something referred to as the Tabular Model (see Tabular Model section).

Reports

Power BI defines a report as a collection of visualizations that appear together on one or more pages. A report is built off a single dataset and stored in a .pbix file that is viewable in the Power BI Desktop application. It is important to note that a report may contain a page that looks like a "dashboard" but is not considered Power BI Dashboard.

Dashboards

A Power BI dashboard is a collection of visuals from multiple reports and/or report pages, all housed on one page. These visuals are 'Pinned' to a dedicated Dashboard housed within a Power BI workspace within the Power BI Service. It is important to note, that currently only visuals contained within the reports inside of the said workspace can be pinned to the dedicated dashboard (i.e. pinning visuals from other workspaces is not permitted). This will be demonstrated in your lab.

Workspaces/Apps

Power BI Workspaces are used for collaboration in Power BI ecosystem. This is where Power BI reports will live throughout their lifecycle, but not necessarily where end users will consume them, and therefore should not be made available to end consumers or business roles. The workspace should be used for design teams to collaborate on during development and testing circumstances in order to keep design standards in place through validation and best practices.

Power BI Apps are used by designers to distribute their reports, datasets, and Dashboards to end users. This is all managed within the Power BI Service within App Workspaces.

Apps make it easy and essential for end users to install and access reports from a single location. When utilizing apps, the designer has the ability to determine who can receive the app, automatically push release changes to the app users, and control how often the data is refreshed.

7 Key Power BI Tools

7.1 Power Query (M) – aka "Query Editor"

Power Query is the Microsoft Data Connectivity and Data Preparation technology that enables business users to seamlessly access data stored in hundreds of data sources and reshape it to fit their needs, with an easy to use, engaging, and no-code user experience.

The **Power Query Editor** is the primary data preparation experience, allowing users to apply numerous data transformations through a very self-intuitive user interface; while raw (M) coding is also an option for those who are more advanced. End Users can perform these data transformations across all data sources imported into Power BI, regardless of the underlying data source limitations.

In the FP&A world, many times our data is not in the format necessary when exported from our erp/accounting systems, or even when data has been auto extracted. That being said, we must perform countless repetitive tasks to transform and massage our data to get it in an acceptable reporting state. The Power Query/Query Editor component of Power BI provides end users with the tools to perform such tasks, while also automated them to eliminate the repetitive aspect of the reporting process.

7.2 DAX – Data Analytical Expressions

Data Analysis Expressions (DAX) is a library of functions and operators that can be combined to build formulas and expressions in Power BI Desktop, Azure Analysis Services, SQL Server Analysis Services, and Power Pivot in Excel.

Understanding the fundamentals of DAX is what will allow someone to unlock the analytical capabilities of PowerBI. Using PowerBI without knowing at least some DAX would be analogous to using Excel while only understanding the SUM function. Fortunately, there are wizards available ("Quick Measures") that allow us to quickly create many of the commonly needed DAX functions.

Though seeing DAX expressions for the first time may seem daunting, how many times have you opened an Excel workbook created by someone else and seen a multi-layered nested "IF" statement and wondered "How will I ever figure out what this is doing?"

7.3 Data Connection Methods

When building our Power BI report(s) we essentially have 3 methods of which we can connect to our data: Import, Direct Query/Live, or Composite

Import

> When we use 'import mode' while connecting to our datasets, we are basically making a copy of our desired dataset and importing it into the .pbix file. We can then transform and utilize this dataset in the

necessary fashion to facilitate the desired report. Note, this data will remain 'stale' until a connection is made back to the source and manually refreshed, or an auto-refresh schedule is established in the Power BI Service.

Direct Query/Live

The Direct Query/Live connection method is performed when needing to see near real time data. When we perform a DQ/Live connection, we are no longer able to create our tabular model or utilize the Query Editor in the .pbix file. This is because we are making a direct connection to the data source and utilizing the data in its raw form. This method is used when connecting to a certified tabular model dataset in the Power BI Service or Analysis Services, or when near live data is needed from a specified database. Its worth noting there are certain Power BI report design features that become unavailable when performing this method and, in some cases, can cause a lag in report response time.

Composite Model

A composite model allows end users to connect to their data in both methods: Import and Direct Query. Using composite models, end users can create many-to-many relationships between tables. Report builders can also specify which visuals query back-end data sources, and which are imported.

7.4 Tabular Model – the engine behind Power BI

Tabular models in Power BI are the engines behind your report. Depending upon how the model ("engine") is built, will determine how well a report renders and performs. On a technical basis, tabular models are databases that run in-memory or in DirectQuery mode, connecting to data directly from back-end relational data sources. Power BI takes advantage of state-of-the-art compression algorithms and multi-threaded query processor, via the Analysis Services Vertipaq analytics engine. This in turn delivers fast access to tabular model objects when building reports.

The use of a tabular model is imperative to the success of a Power BI reports. A tabular model consists of dimension and fact tables. Essentially, we will convert large flat files into a tabular model by sectioning them out into various dimensions and cubes (depending up the number of flat files and their relative size). The end goal is to create tables that are "tall and narrow" rather than "large and wide" (i.e. flat file). These new tables will be connected using a "one to many" relationship in the modelling view of Power BI. We will dive deeper into this concept in the Workshops later in this document.

8 Collaboration – A more in-depth look

8.1 Workspaces, Shared Datasets, and Power BI Apps

Once a report has been created, the next step is to publish this report to the Power BI Service. In order to do this, there must be an App Workspace available to publish the report to **App Workspaces:** App Workspaces are where Power BI reports 'live' so users can collaborate on said reports. With that said, below shows the number of ways end users can collaborate on published Power BI reports.

- Multiple users can work together to build one or more datasets, reports, dashboards, or Excel workbooks (collectively known as "content").
- One user can take over the design of content that was started by someone else.
- One user may work on the design of an imported dataset, while other users to build reports from that dataset using Power BI live connections in Power BI Desktop.
- Users may need to test (either in the formal IT development sense or perform an informal "sanity check") a report even if they are not the person who is building it.
- Members of the same team, department, project, or even company will not just view content but discuss what it shows, take action on information shown, and suggest changes to existing content or create new content as circumstances change.

The main point is collaboration involves a group of end users taking an active part in the report design process rather than being passive consumers of Power BI content. These end users all know each other and are likely to work on the same team – with the term "team" defined in the loose sense.

8.2 Power BI Apps

Power BI Apps are also another way to collaborate via reporting with end users of Power BI; however, with Power BI Apps, end users will be consuming/viewing the report instead of making modifications and re-publishing to an App Workspace. A Power BI App will consist of specified selected items from within one workspace (i.e. Dashboards, Reports, Datasets). Once this is determined, the author of the App will choose who has privileges to access the app, as well as the privileges to the data behind the reports within the app. Distribution of content using Apps is in many cases a better choice than sharing, or adding large numbers of users as members of an App Workspace, in an enterprise environment:

- An App allows for the distribution of multiple related reports, dashboards, and Excel workbooks rather than individual pieces of content, simplifying permissions management.

- Changes to content are only visible once the App is published or updated. This means that reports and dashboards can continue to be developed without affecting what is seen in the App. If an App Workspace is moved to a Premium capacity, then users who consume an App built from that App Workspace only need a Power BI Free license to do so. Power BI Free users cannot have direct access to an App Workspace in the Power BI Service, and although they can get access to content in an App Workspace stored in a Premium capacity that has been shared with them in other ways, an App is by far the easiest way to get the benefits of the Power BI Free license/Premium combination.

8.3 Shared and Certified Datasets

Once a report is published to a workspace, the dataset behind the report can be shared with other end users throughout the organization to create additional Power BI reports. This is a great feature offered by Power BI as it eliminates the need recreate some measures and tabular models for similar reports; hence, saving time and improving the report roll-out process. For example, if I build a Sales report and publish it to the 'Sales' App Workspace and enable it to be shared, my colleagues can then access this dataset and build their own reports without having to recreated complicated DAX measures or tabular data model. Business intelligence is a collaborative activity. It's important to establish standardized datasets that can be the 'single source of truth.' After this has been created, discovering and reusing those standardized datasets is key. When expert data modelers in an organization create and share optimized datasets, report creators can start with those datasets to build accurate reports. In doing so, the organization has consistent data for making decisions, and a healthy data culture.

8.4 Certified Datasets Process

When Power BI developers use the function of 'Getting Data' from a Power BI dataset, they see all datasets from all workspaces from which they have access. This concept can create some confusion as there can potentially be an abundant number of datasets shared in the end user's environment. That being said, End Users are presented with the following questions: Which dataset can I use? Which dataset is valid to use? Which dataset is reconciled and tested? Are they reliable?

A new labeling system has been added to the Power BI datasets that helps in this scenario. The labeling is consists of marking a dataset either certified or promoted. To clarify a dataset as being certified, there is an approval process in which organizations can assure the dataset passes their data standards. This can be accomplished through a unique labeling system, that indicates datasets that are viable to use and those that are not (i.e. building the concept of Gold, Silver, and Bronze datasets). Having gold datasets as datasets that are fully tested, and reconciled, and then down to other levels. Whereas the Bronze dataset is one that hasn't been undergone testing. Instead of having silos of Power BI reports and files scattered, Redwood Credit Union can build an architecture that

works best with multiple developers, less redundancy in data, as well as code/logic, and an easier maintenance approach.

9 Process - Every Great Tool Needs a Great Process

9.1 Report Development Process

We recommend a formal process around the implementation of Power BI, to improve and enhance an organization's reporting processes and provide the ability to maintain a "single version of the truth." By doing so, organizations can begin automating their business processes and improving efficiency across the enterprise. As a result, organizations will acquire many benefits. The below points depict key steps when developing Power BI reports.

9.1.1 Requirements Gathering/Data Discovery:

This step in the process focuses on Redwood Credit Union's requirements centered around the report building process. The best practice for this is accomplished by conducting a 'Discovery Session' between the business and the report author. The end result of this session is to accomplish the following:

What are the requirements of the report?

- Who is the report intended for? (i.e. Finance, Sales, Operations, Marketing)?
- What are the key metrics we will be looking at? (i.e. Gross Profit, YOY % Change, Total Sales)?
- How do we slice our data (aka filtering)? (i.e. Branch, Region, Sales Team, Managers, Dept.)?

Where does our data live?

- How many data sources do we need to pull from, in order to build the desired report?
- What does the ETL process for each data source consist of?
- What are the access restrictions to the data?
- Is it possible to setup auto-refresh with this data and at what frequency?

What end users will be accessing report?

- Do we need to apply Row Level Security on the data?
- What does the "Pie in the Sky"/ideal final report look like?

By answering these questions during our discovery session allows us to start constructing the report(s) in order to accommodate future enhancements that may not be available yet to represent in said report. We will accomplish all bulleted items mentioned above via the discovery session.

During this session it is also very common to reference existing or previous reports, to gain a full understanding of what the report deliverable will or could look like. After the discovery session we should be able to set a deliverable

timeline to achieve the end goal of the project. Without making a project visible to all team members, it has a greater chance of running behind schedule and allowing scope creep to occur.

9.1.2 Visualizations, Standards, and Consistency

Soon after the discovery session we will start building the Power BI report. However, when building the report, it is imperative the measures/metrics created, visualizations, and layouts of the report hold true to the organization's reporting standards in order to maintain consistency throughout the company. This could include proper documentation of measure creation, consistency of corporate colors, and/or commonly themed layouts for each report. The following outlines best visual design practices we take into account when building a report:

Layout of the Reporting Canvas
The canvas of the Power BI report has a finite amount of space. When building, we need to make sure we tailor the report to our specific audience, but also need to ensure the layout is consistent with other reports we have built (i.e. slicers are in the same location, look and feel is the same, etc.). This helps with report buy-in and improves report adoption time during roll-out.

Alignment, order, and proximity
The layout of your report elements impacts reader comprehension and guides them through the report page. How you place and position elements tells a story. The story might be "start here and then look here" or "these three elements are related to each other."

Reducing Clutter
A cluttered report page can leave end users confused and overwhelmed which can end up having a negative effect on report adoption. Reports need to convey the info as clearly, quickly, and cohesively as possible.

Color Consistency and Color Effectiveness
Color needs to be accounted for in two ways: Consistency and Effectiveness.

- ***Consistency***: When building reports, we are deliberate in our selection of colors in order to not detract our end user's ability to quickly understand the report.
- ***Effectiveness***: Each visual needs to utilize the right color in order to quickly portray the story. For Example, in finance we tend to stay with Black, Red, and Green in order to indicate how we are performing, while operations or sales may use other colors to analyze their data across various parameters.

Choosing the right visual
Just as it's important to plan out your report before you start building, each visual also requires planning. We ask the question, "What story am I trying to tell with this visual," and then choose the visual that depicts our story best.

Can the report tell a story at a glance?
The overall test should be that somebody without any prior knowledge can quickly understand the report without any explanation from anybody. With a quick glance, readers can see what the page is about and what each chart/table conveys.

With all of this said, each organization tends to have their own set of standards they apply to their reports, but the key is consistency.

9.2 Report Build Process Summed up from a 'Technical' Perspective

1. Data Gathering/Discovery
2. Pull in Data – 'Get Data'
3. Identify Metrics/Measures to be created
4. Create Relationships → Tabular model build
    a. Query Editor – transform our data
5. Build out Measures using DAX
6. Design Layout
7. Visualize Data
8. Create Workspace in Power BI Service
9. Publish Report
10. Power BI App Creation for Collaboration
    a. Share Reports, Add RLS, Permissions

9.3 Power BI Develop, Test, Production Workspace Usage

After completing a report, the next step is to test this report and ensure it operates as requested. With that said, before publishing the report to Production, we should publish it to a Dev/Test workspace and have other members on the team conduct UAT and data reconciliation on the report. Upon approval of the report, we can then publish it to the production workspace and distribute to the rest of the company; however, before we overwrite the existing report within the production workspace, we must save the existing Power BI file published and being utilized with some form of versioning control (i.e. PBI_report_v1.x, etc.). For Example: if we are replacing Executive_Scorecard.pbix in our prod workspace, we should make a copy of this report and label it Executive_Scorecard_vx.x, with the "x's" representing the latest version of the report. This will then allow us to reference back to a Power BI file that we know

worked before we overwrite the existing file in the production workspace in the instance that the report published to our end users deem to be faulty.

Keep in mind, this is only one method that can be used for a Power BI Development Lifecycle. Depending upon an organization's needs, this lifecycle can and should be adjusted in order to align with internal processes.

10 WorkShop # 1

10.1 Business Scenario

You are a senior analyst for “MicroSale, Inc.”, a manufacturer and seller of model vehicles and collectibles. Senior Management wants to gain a better understanding of performance and how it compares to the budget that was done before the current year began. You have been tasked with provide a dashboard that can be shared with the whole organization that will allow people to gain insights into sales performance.

You have been able to extract a set of files including a data dump of the sales transaction at the from the online ordering system. You would like to try to create a more interactive users experience for sharing and analysing data and have heard that Power BI and Power Query might be able to help with this task.

10.2 Exercise 1.1: Connect to Data Sources

In this exercise you will look at the data being used for our source files and load them into Power BI for further analysis.

We will be starting with a blank Power BI model, importing data, and building an automated report containing tables and other visualizations.

The data sources for this workshop are found in a single folder.

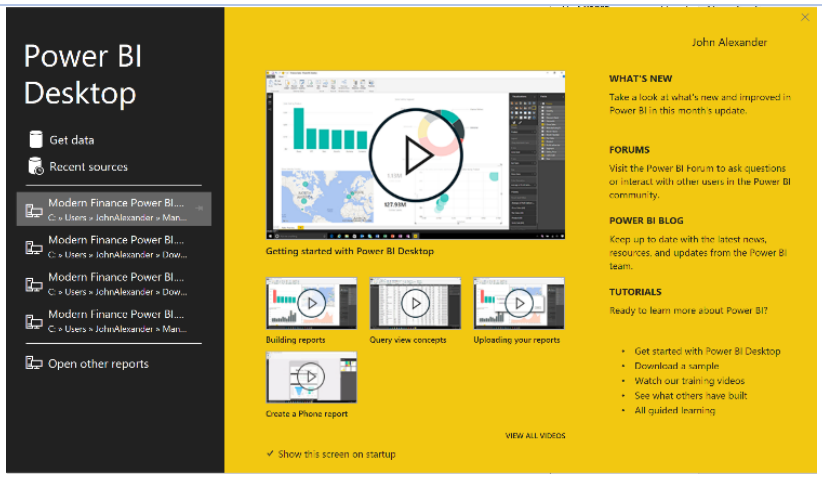
DimCalendar.xlsx	Calendar table. Allows us to define custom time calculations / settings
DimCustomer.xlsx	List of Customers with their location and phone number
DimProduct.xlsx	List of models mapped to Product Categories
FactSales.xlsx	Table of transaction detail from 2016-2018
FactBudget.csv	Table with monthly budget numbers from 2016-2018

Launch Power BI desktop

Select Already have a Power BI Account? Sign in option.

Sign in using your Power BI credentials.

Startup screen opens. Click on X on the top right corner of the dialog to close it.

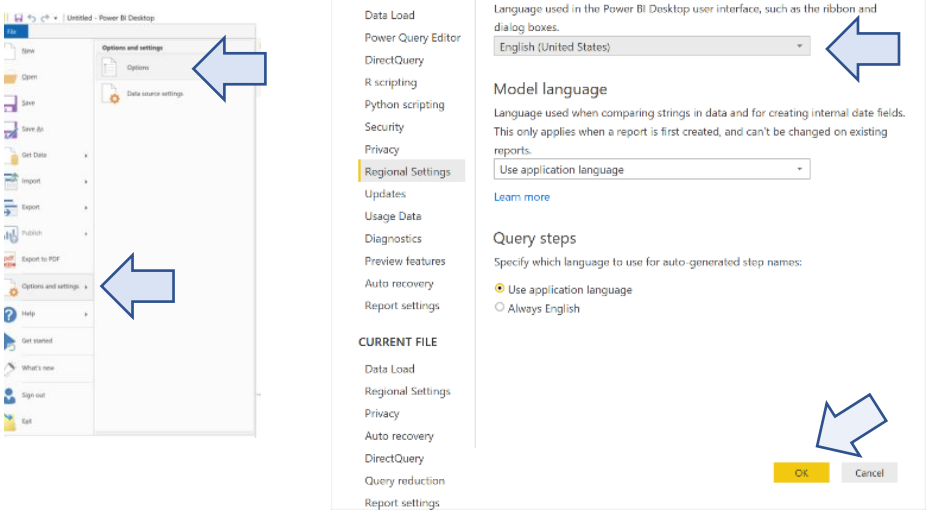


Let's set up the locale to US English, to make it convenient to go through the rest of this lab.

From the ribbon, select File -> Options and settings -> Options.
In the left panel of Options dialog, select Regional Settings.

From the Locale drop down select English (United States).

Select OK to close the dialog.



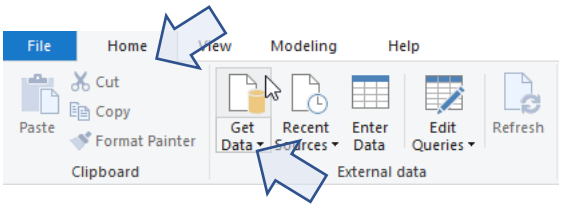
First step is to load data to Power BI Desktop.

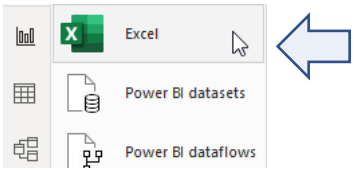
From the ribbon, select Home -> Get Data.

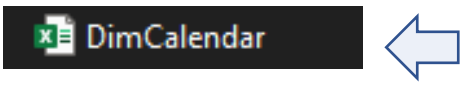
Select Excel

Note: Power BI Desktop has the capability to connect to 70+ data sources. We are using csv and excel data files in this lab for simplicity.

Choose the file DimCalendar.xlsx from the directory where the source files have been installed on your PC.







When Excel is the data source, you will have the option to choose your data range to be:

- Any sheet in the file
- Any named range in the file

Since our workbook only contains one sheet, we will select the checkbox next to DimCalendar.

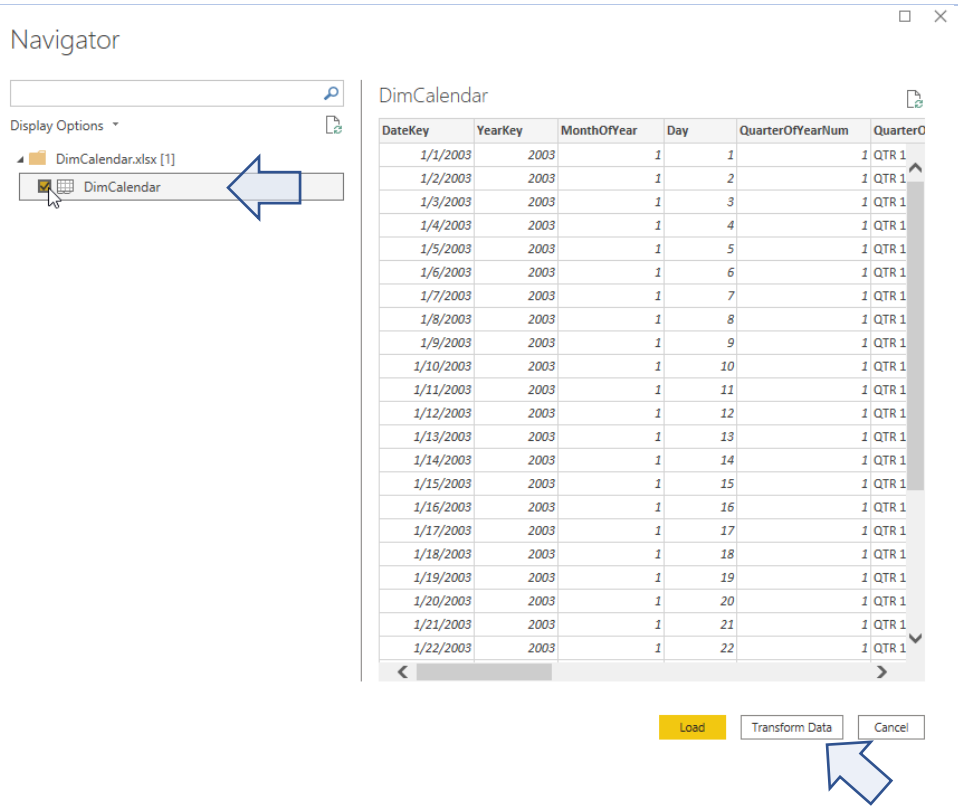
Power BI detects the data type of each column based on a preview of the data.

After completing your selection, you have three options – Load, Transform Data, or Cancel.

• Load, loads the data from the source into Power BI Desktop for you to start creating reports.

• Transform data allows you to perform data shaping operations such as merging columns, adding additional columns, changing data types of columns as well as bringing in additional data.

• Cancel gets you back to the main canvas.

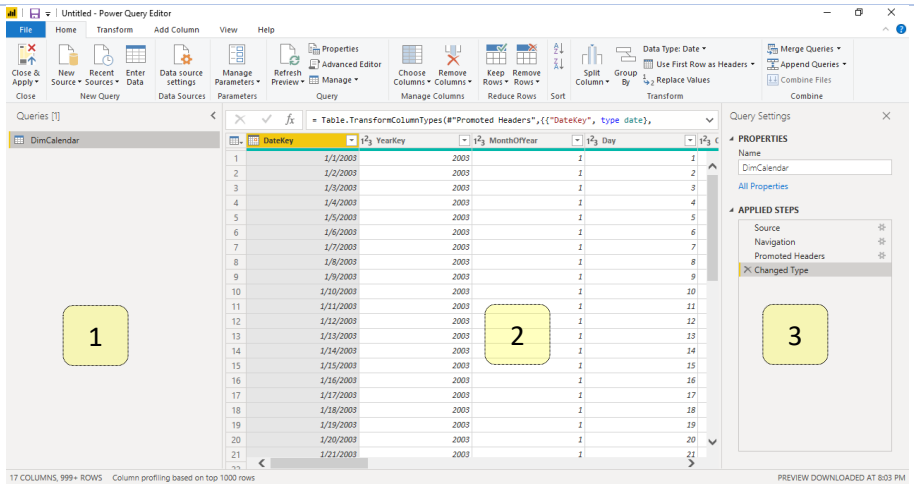


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Click [Transform Data] as shown in the screenshot. A new window opens.

This will bring you to the Query Editor window.

Query Editor is used to perform data shaping operations



1. Left hand side of your screen will display all the current queries in your model

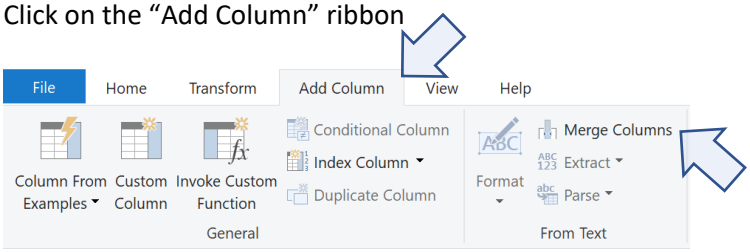
2. Main window will show all the fields that are part of your current query (including ones that we have created)

3. A history of all the applied steps for this query displays at the right. This represents the steps that will be done every time the data is refreshed

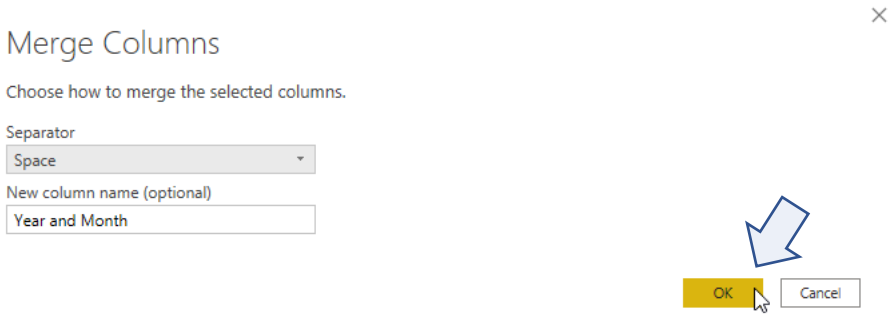
We wish to create a new column so we can connect with the budget data, which is at a monthly granularity. We will use the built-in tools in Power BI to concatenate these columns without needing to learn any scripting formulae

4. Click on the Column Headers [YearKey], [MonthOfYear]. Use the <shift> key on your keyboard to select multiple columns at the same time

5. Click on the "Add Column" ribbon

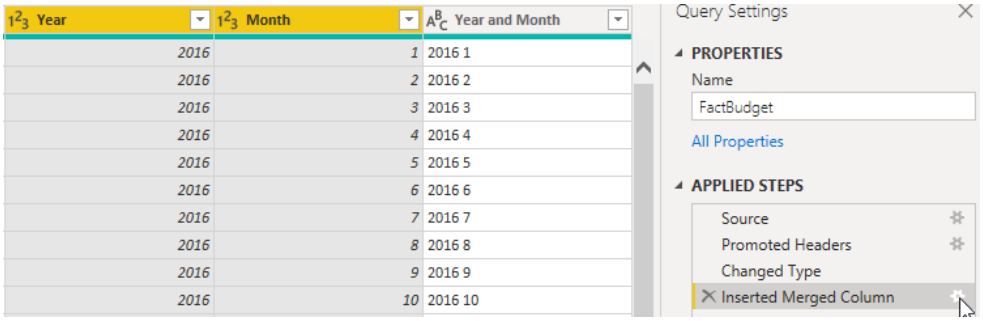


6. Click "Merge Columns", set the separator to Space and call the column Year and Month

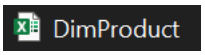


7. A new "Merged" column will be created

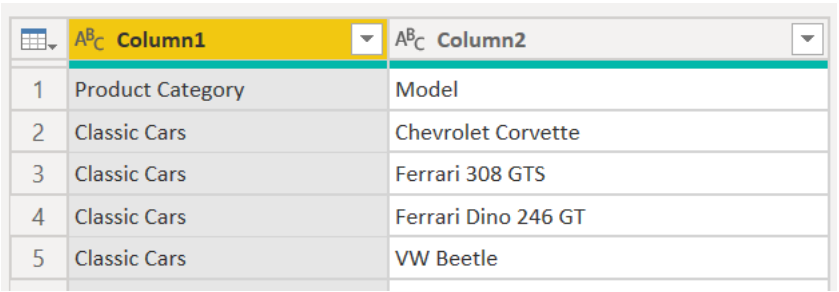
8. The steps to generate that formula are shown at the right hand side of the screen. If you click the gear icon, you can see the formula used to generate that column.



Next we can import our Product dimension. Repeat the data load process for DimProduct.

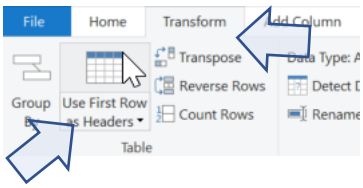


The first thing you will notice upon loading the data is that the column names are generic, and not labeled correctly. This issue can be easily remedied by promoting the first row to headers. Applying this transformation will create a new step in the data preparation process and correctly label the columns.



	Column1	Column2
1	Product Category	Model
2	Classic Cars	Chevrolet Corvette
3	Classic Cars	Ferrari 308 GTS
4	Classic Cars	Ferrari Dino 246 GT
5	Classic Cars	VW Beetle

9. Navigate to the Transform tab
10. Click “Use First Row as Headers”



Now the metadata has been properly formatted.

	Product Category	Model
1	Classic Cars	Chevrolet Corvette
2	Classic Cars	Ferrari 308 GTS
3	Classic Cars	Ferrari Dino 246 GT
4	Classic Cars	VW Beetle

Next, let's load DimCustomer.



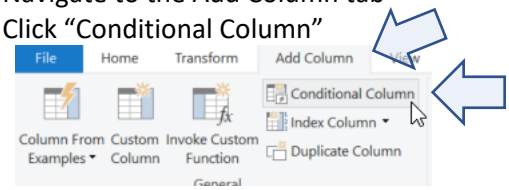
Immediately we notice the column names are inconsistent. Rename them so each word is capitalized and spaced properly.

11. Double click on a column heading to rename it
12. Change as follows:
    - "CUSTOMERNAME" to "Customer Name"
    - "PHONE" to "Phone"
    - "ADDRESSLINE1" to "Address Line 1"
    - "ADDRESSLINE2", "Address Line 2"
    - "CITY" to "City"
    - "STATE" to "State"
    - "POSTALCODE" to "Postal Code"
    - "COUNTRY" to"Country"
    - "TERRITORY" to "Territory".

	CUSTOMERNAME
1	Online Diecast Creations Co.
2	Blauer See Auto, Co.

We would like to look at some key data points by distinguishing between Domestic and Foreign markets. Currently, this is not a column that exists in our dataset.

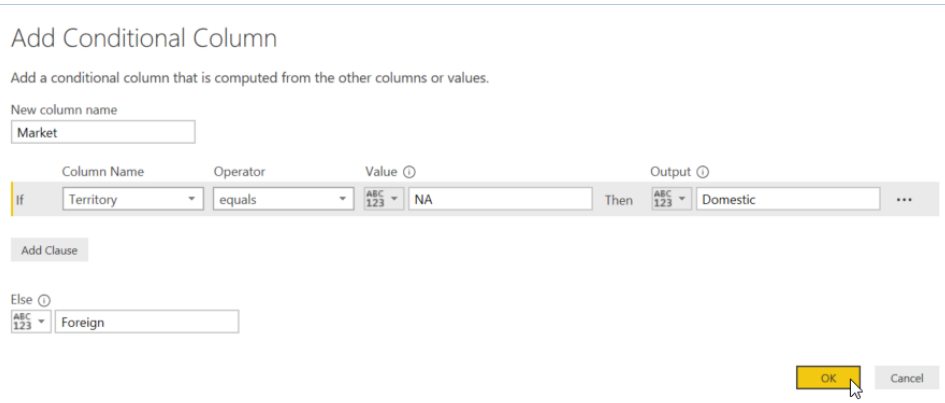
13. Navigate to the Add Column tab
14. Click "Conditional Column"



15. Name the column "Market"
16. Add a clause to the conditional column that makes any customer with the territory "NA" be considered "Domestic" market, and every other customer "Foreign".

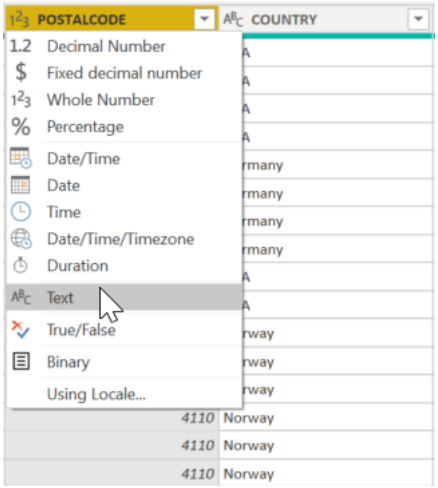
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The column names are cleaned up but there is some remaining work that needs to be done on our customer data before we can move on to our fact tables.



Next, let's check our column data types. Upon loading data, Power Query does its best job of detecting each column's data type but occasionally they need to be coerced into a different type depending on the business case.

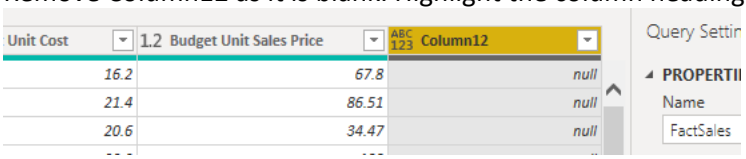
A great example is Postal Code. Power BI will detect this as an integer, and this could be problematic as it will automatically summarize the values in tables and charts. Postal codes are numbers but shouldn't be treated as such since there is no meaning when they are added together. We can change the data type to **Text**, so we don't run into these problems later. Click the data type symbol next to the column name and select **Text.**



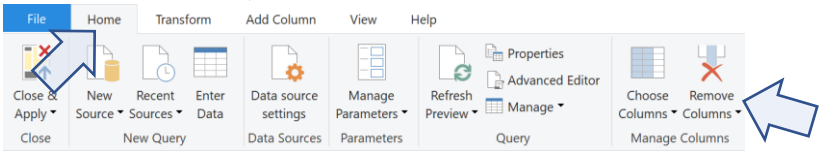
Next, let's import the fact tables. We'll start with FactSales, our transaction data.

FactSales

17. Remove Column12 as it is blank. Highlight the column heading.



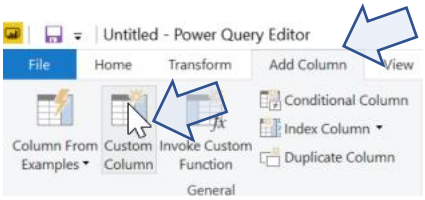
18. Under the Home tab, click "Remove Columns".



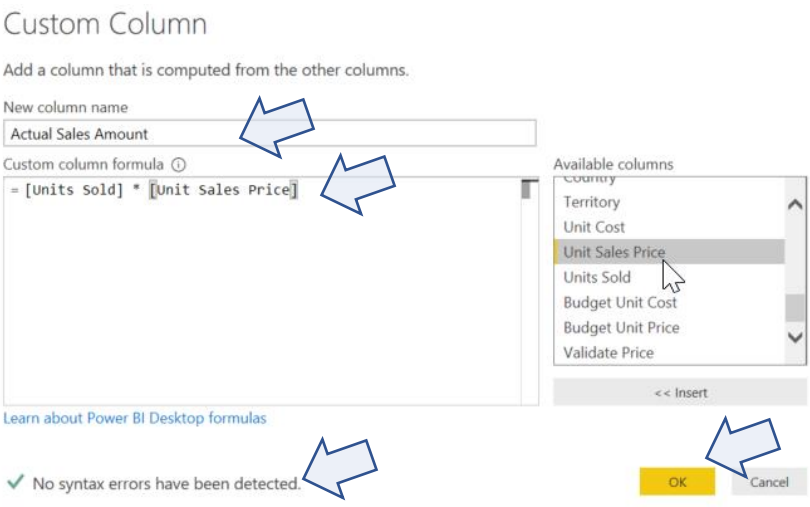
19. Rename columns the same way we did with DimCustomer. Change the following:
    - "ORDERDATE" to "Order Date"
    - "STATUS" to "Status"
    - "CUSTOMERNAME" to "Customer Name".

Now we want to create some columns that give us the full financial details of each transaction, such as actual sales amount and gross margin.

20. Navigate to the Add Column Tab
21. Click "Custom Column"

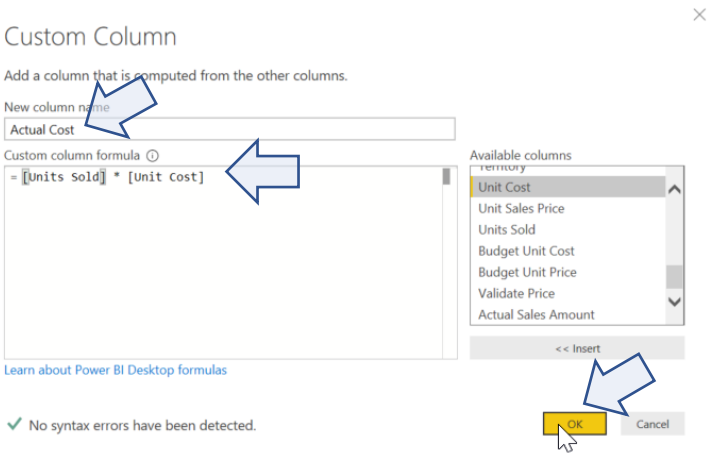


22. From here we can start by creating a column for Actual Sales Amount, which is defined as Units Sold * Unit Sales Price in this dataset. Double-click on a column from the *Available Columns* section to insert it into the formula, shown below:

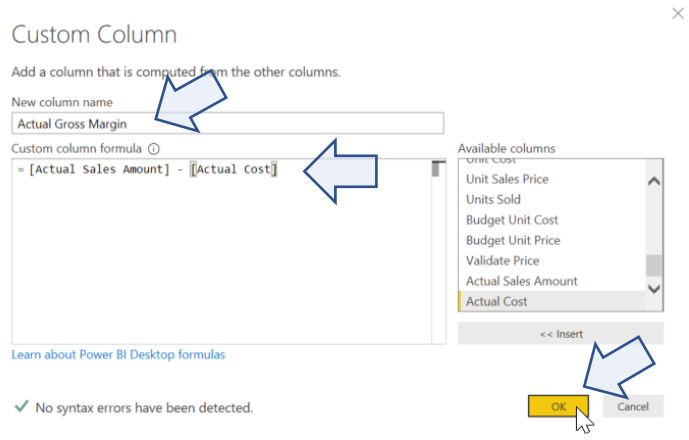


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23. Clicking “OK” will add the column to your dataset, which can now be referenced in new columns we create. We’ll do the same for Actual Cost.



24. Now utilize those two calculated columns to give us Actual Gross Margin.



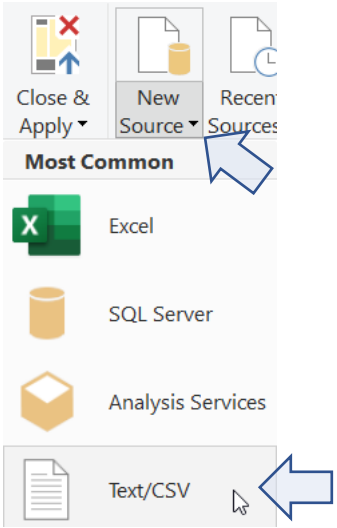
When a custom column is created in Power BI, it possesses data type *Any*. Switch the 3 new columns to type *Decimal*.

Actual Sales Amount	Actual Cost	Actual Gross Margin
3390	900	2490
1903.22	440	1463.22
1689.03	980	709.03
3000	1110	1890
2500	875	1625
2600	910	1690
2472.96	1242	1230.96
1404	1350	54
2055.74	1025	1030.74
3900	1170	2730

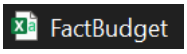
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Finally, we can import the FactBudget table. Since this is a CSV file, we will use a different connector to pull this in.

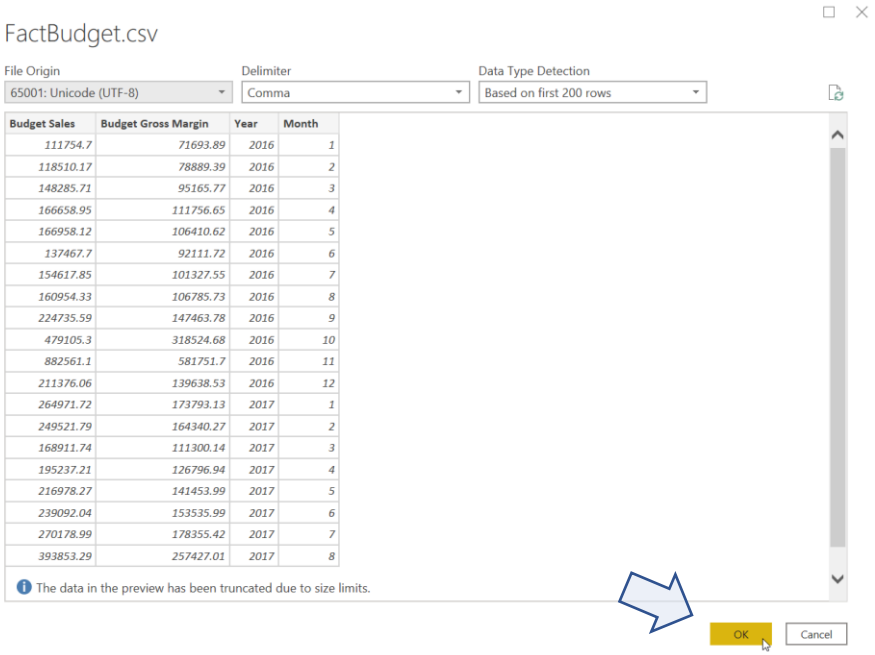
25. Navigate to the Home tab
26. Selct the New Source dropdown
27. Since this file is NOT an Excel file, click “Text/CSV”



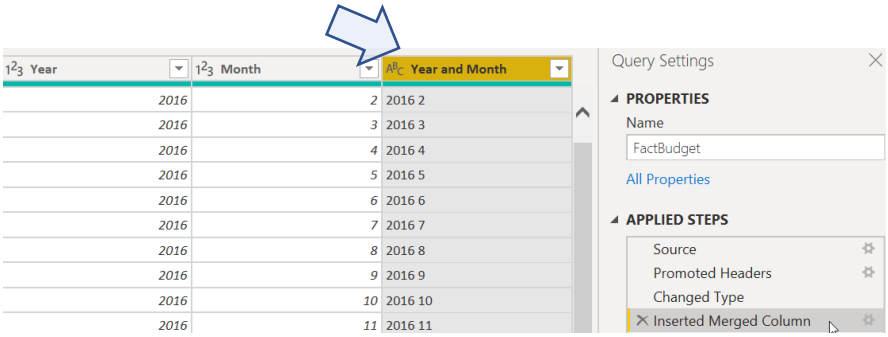
28. Select the FactBudget.csv file



29. Use the default load settings for FactBudget and click OK

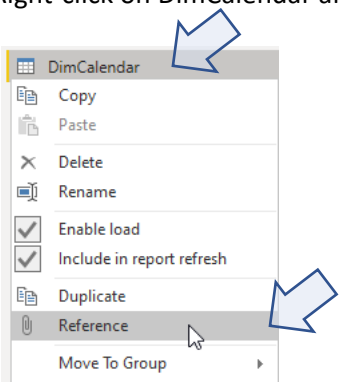


Create a Year and Month column in FactBudget the same way we did for DimCalendar, by merging the Year and Month columns.



Now, we see the importance of the Year and Month column we created in the calendar table earlier. We need a unique identifier for each row in the budget table.

30. Navigate back to DimCalendar in the Power Query editor
31. Right-click on DimCalendar and select "Reference"

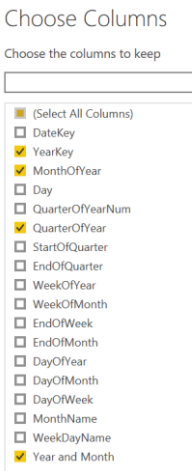


32. This will bring you to a duplicate of DimCalendar. Rename it to "DimMonth" by double-clicking on the query name

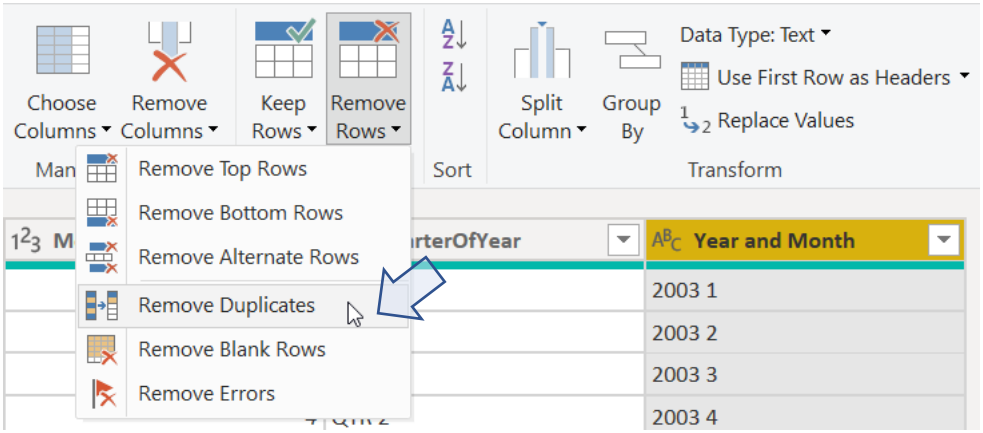


As with most projects where we are combining data from different sources, we have an issue with making a relating FactSales and FactBudget. Our sales data has *transactional* granularity while our budget data has *monthly* granularity. We will need an intermediary table to bridge this gap.

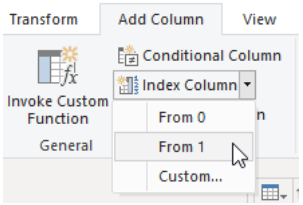
33. From the Home tab, click "Choose Columns", and only select YearKey, MonthOfYear, QuarterOfYear, and Year and Month. This will allow us to see actuals vs. budget data by year, quarter and month.



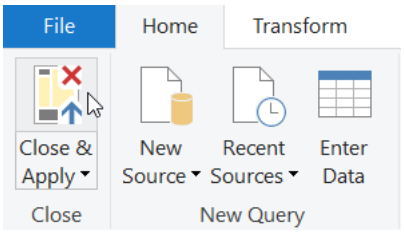
34. We now want to remove the duplicates in the Year and Month column to give us a table that contains *distinct* year/month combinations. (This will allow us to relate both FactBudget *and* DimCalendar to our new dimension, DimMonth. Without this intermediary table we would not be able to compare actual sales/margin values and budget sales/margin values). Select the Year and Month column, drop down the "Remove Rows" button and click "Remove Duplicates"



35. Lastly, we will want to see Year and Month sorted properly when we make visuals. Since this column is type *Text*, we will need a helper column to sort it for us. Power Query makes this easy by including the option to add "Index Column" under the Add Column tab.



36. Click "Close & Apply" from the Home Ribbon

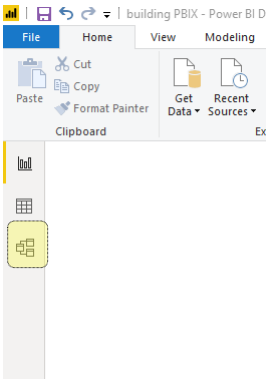


Congratulations! The data has been successfully pre-processed. Apply all transformations to the report.

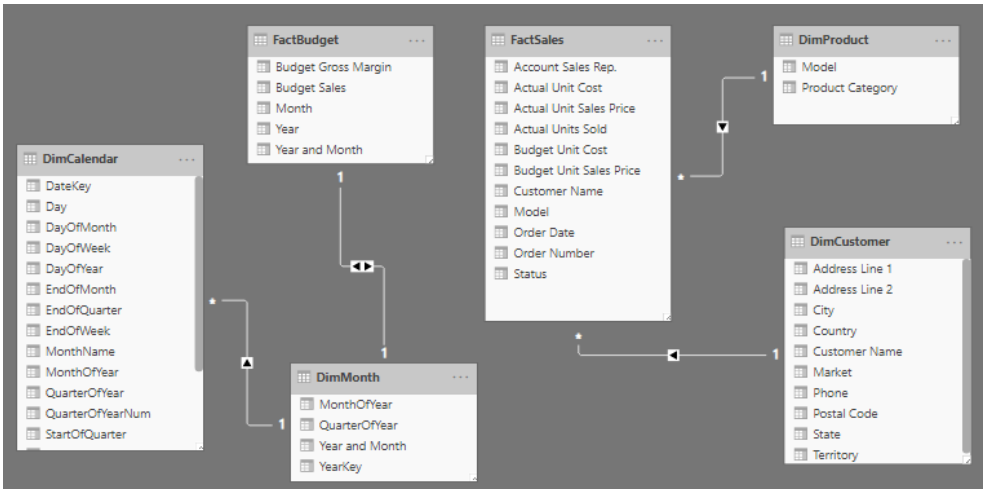
After all the tables have been loaded, we need to define how these tables are related.

We will do this in the model pane of our Power BI file.

37. Click on the “Model” button



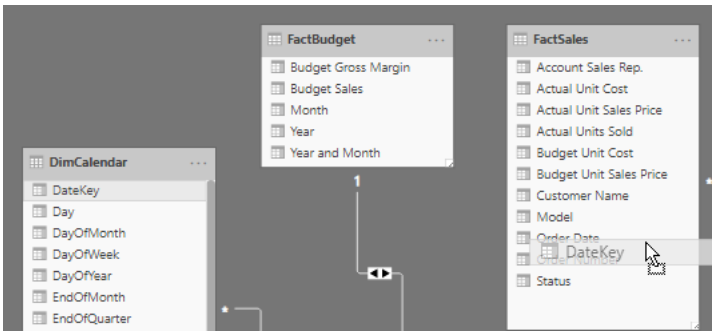
38. Arrange the tables on the platform that they appear something like the following:



Note the following:

- Each dimension table should be related to the central fact table [FactSales]
- There should be a [1] beside the [Dim] tables and an [*] next to [FactSales] for every relationship. This indcates that each item in the [Dim] table may have many records in the [FactSales] table (1 to Many Relationship).

39. To manually build the relationship, drag DateKey on top of Order Date



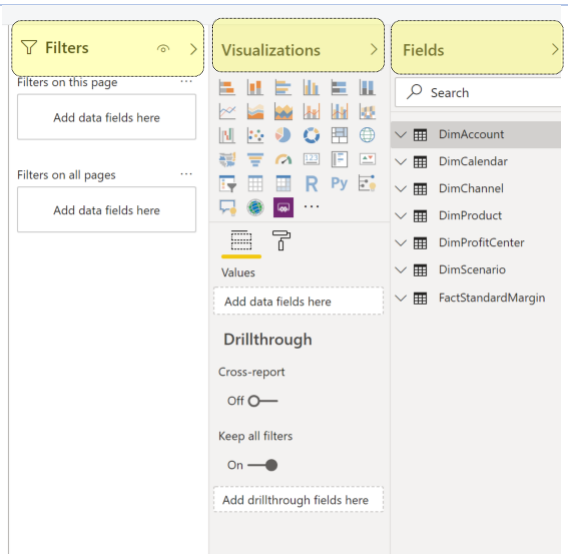
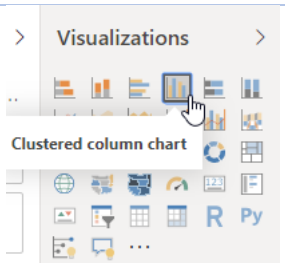
It becomes immediately apparent that Power BI did not auto-detect a relationship between [DimCalendar] and [FactSales]. This is because the key

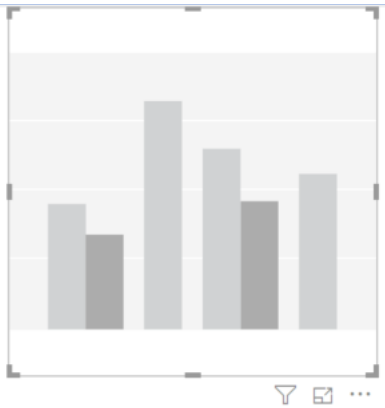
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column names are different.	40. A line will now appear between the two tables, signifying that the relationship was created successfully.
Save your Power BI Report	Save the file in a folder of your choice. Save as AFP.pbix

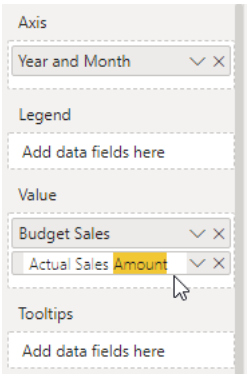
10.3 Exercise 1.2: Begin Building the Power BI Report

Now that we have all our data loaded into the Power BI model, we can begin building the report. First, we'll walk through the different sections Power BI desktop provides to help us build the report. Then we'll kick it off by creating a basic column chart to answer a basic question: "How are our sales stacking up against budget"?

First, let's explore the list of available Fields and Visualizations. In the same part of the window we can also quickly see any and all filters that are being used on any of our reports or visualizations **Fields:** Most fields are based on the entries we did in PowerQuery earlier. We will investigate adding new measures to our model later on **Visualizations:** Power BI comes with 30 different visualizations out of the box. More visualizations can be added via the marketplace or you can even extend the abilities of Power BI by adding your own custom visualizations **Filters:** Filters can be applied to either a single visual, an entire page, or all pages. More on this to come later	
Add a Clustered Column Chart Visualization onto the report by clicking on the icon shown. The new blank visualization will be added to the top left corner of the page.	

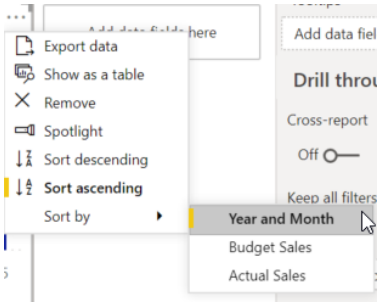


1. Under the Fields pane, drag Year and Month from DimMonth to the Axis slot in the Visualizations pane.
2. Also drag Budget Sales and Actual Sales Amount into the Value slot.
3. Double click on Actual Sales Amount and delete amount so it is renamed to Actual Sales within the visual. This does not affect the name of the column in this visual, only others.



Note: Power BI automatically summarizes these two numeric fields for each distinct Year and Month. This is useful if we want to make a quick visual, however creating Measures to put into our visual is generally best practice. We will cover that after we wrap up some formatting on this visual.

4. With the visual selected, click the three dots at the top right of the visual and sort by Year and Month *ascending*, shown below

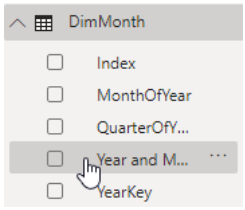


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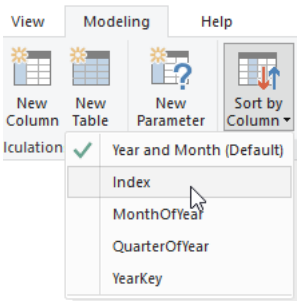
If we look at the visual now, we notice a problem. The two-digit month numbers are not sorting properly. Thankfully, we made an index column and can fix this issue with ease.



5. Select Year and Month in DimMonth under the Fields pane



6. Navigate to the Modeling tab at the top of the screen
7. Click “Sort by Column”, and select the Index field we created earlier.



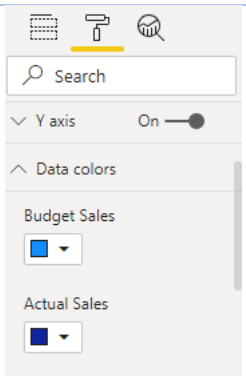
Now our Year and Month field is sorting properly. This sorting will apply to any other visual we create that utilizes the Year and Month column from the DimMonth table.



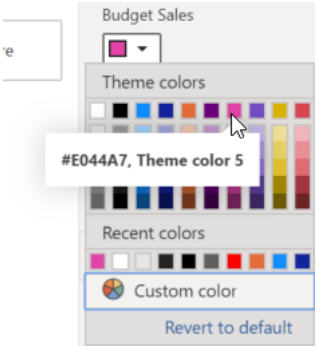
Let’s make a few more formatting changes to the visual in order to pretty it up.

1. Navigate to the formatting tab for our clustered column chart and expand “Data Colors”

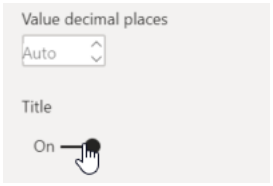
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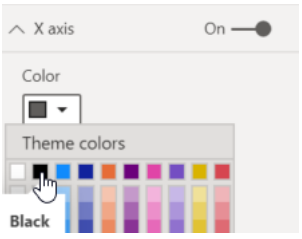
2. Click on Budget Sales, and change it's color to Theme Color 5, which better contrasts with the dark blue of Actual Sales.



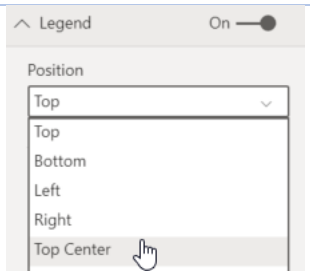
3. Next, find Y-Axis in the formatting tab and remove the Title from the Y-Axis



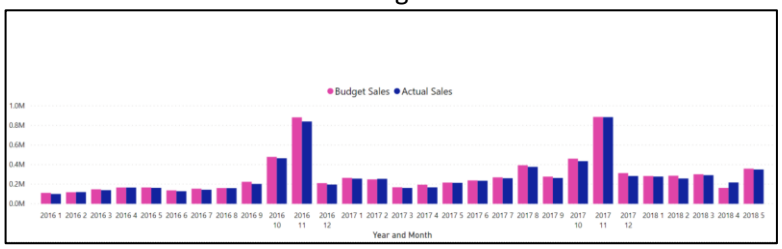
4. Make the X-Axis, Y-Axis, and Legend color Black. X-axis example shown below



5. With the Legend tab expanded, move it's position to Top Center and increase it's text size to 12



6. Since the X-axis has a clear title and the Legend is accomplishing what the title is doing rather redundantly, we can turn the title off for the visual by finding “Title” under the formatting pange and flipping the switch from On to Off.
7. Move and stretch the visual across the bottom third of the report. Your visual should look something like this:



Great work! Your first Power BI visual has been built.

Feel free to explore the other formatting options for each visual, as Power BI allows for countless possible visuals to be created,

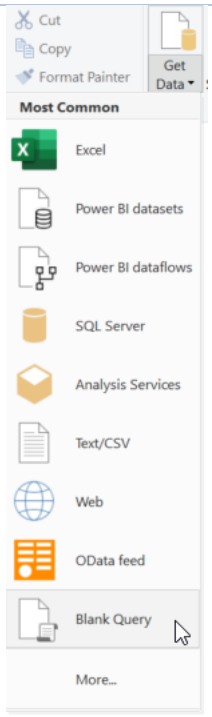
Let’s move on to creating DAX measures.

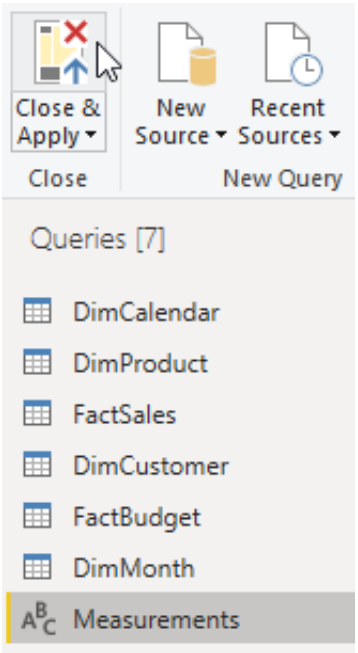
What we have done so far has been useful for being able to explore our data in its raw form. However, we need to be able to create additional metrics in order to perform meaningful analysis.

Specifically, we will create some measures for simple aggregations, calculating filtered totals, as well as some basic variance analysis.

Before we begin building measures, it is important to note that keeping measures separated from our columns is generally considered to be best practice. We will create a grouping dimension to keep the measures separate, and therefore, easy to locate and manage.

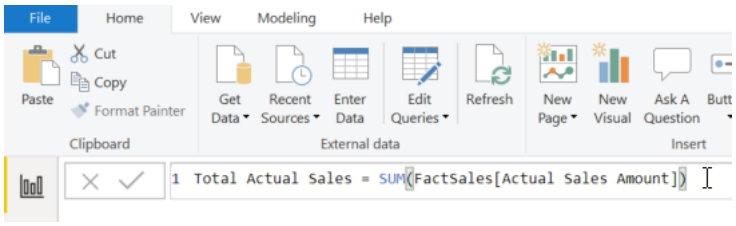
Under Get Data, select Blank Query. This will take you back to Power Query. Rename "Query1" to "Measurements", and hit close & apply to load this new dimension.





DAX could be a lesson as its own course, for today we will stick with very basic formulae.

8. Now that it's been loaded, right click on the Measurements table and click "New Measure".
9. A formula box will appear at the top of the report. Begin by creating a basic aggregation measure, "Total Actual Sales", defined as such:



10. Hit enter and the measure will now appear in the Measurements table. This measure can be used in any visual in the report, and can also be referenced by other measures. Let's make a few more measures. Repeat the previous steps for the next four measures by using the following screenshots for guidance:

```
1 Total Actual Cost = SUM(FactSales[Actual Cost])
```

```
1 Total Actual Gross Margin = SUM(FactSales[Actual Gross Margin])
```

```
1 Actual Gross Margin % = [Total Actual Gross Margin] / [Total Actual Sales]
```

```
1 Total Units Sold = SUM(FactSales[Units Sold])
```

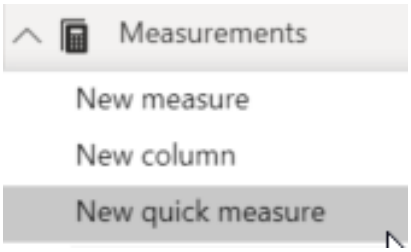
CALCULATE() is a very useful, must-know function. It takes two arguments, an expression and a filter.

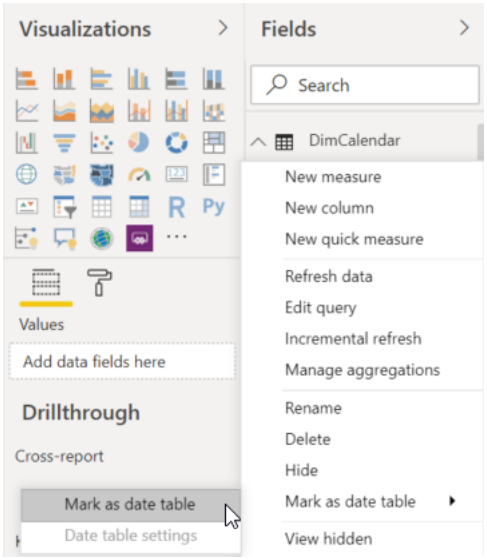
```
1 Jaguar E-Type Sales =
2 CALCULATE(
3     [Total Actual Sales],
4     FactSales[Model] = "Jaguar E-Type"
5 )
```


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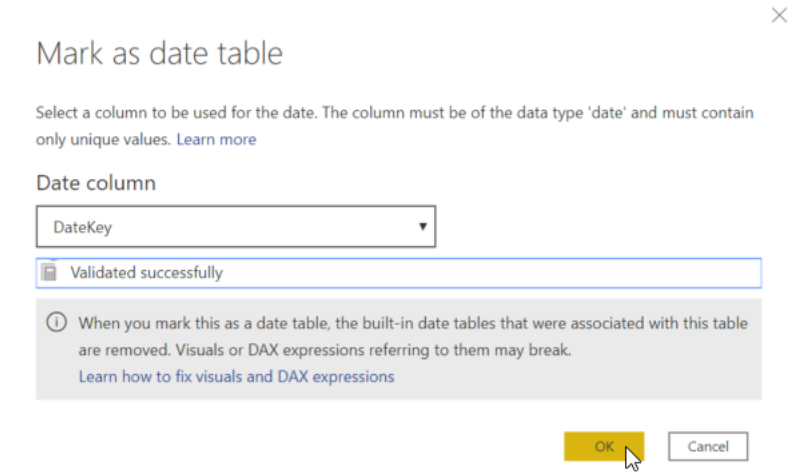
Measures can also be created with the helpful “New Quick Measure” functionality, which can be accessed by right clicking a table in the Fields pane.

41. Create the example measure shown above, which gives Total Actual Sales for the Jaguar E-Type model.

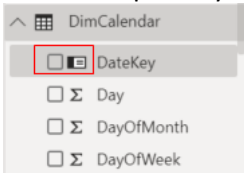




Before we create a quick measure, we need to mark DimCalendar as our date table so Power BI can perform time intelligence calculations.



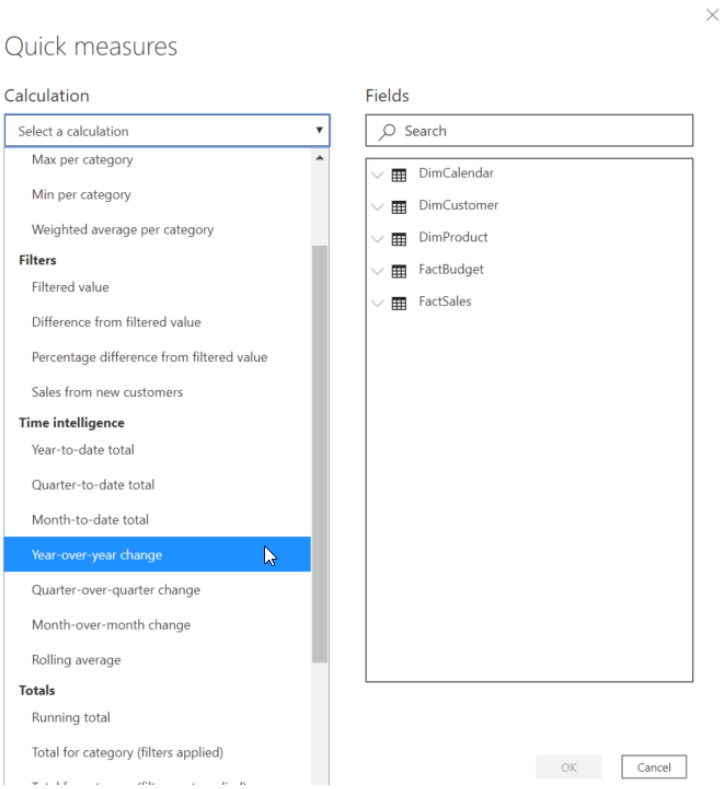
Note: After clicking OK, the icon for DateKey will change to denote that it is now the primary date column of the report.



Now we can perform a Year-over-Year growth calculation.

Right-click on the Measurements dimension and select “New Quick Measure” as shown before.

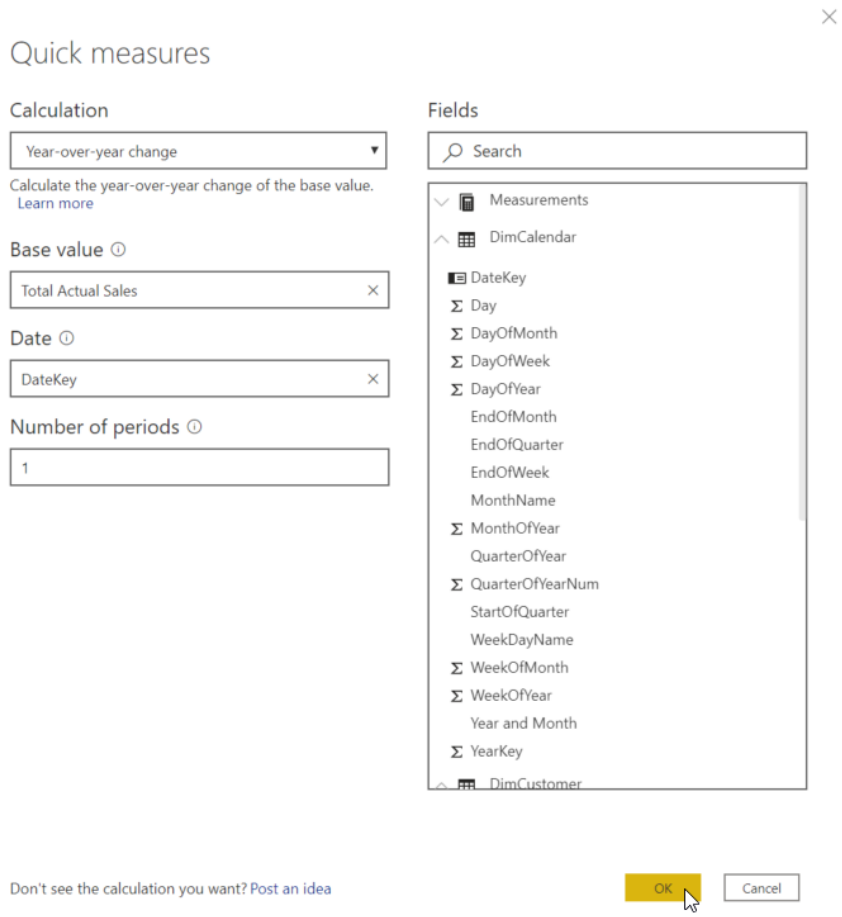
Select Year-over-Year change from the calculation dropdown.



Fill in the three arguments for the quick measure with the previously created Total Actual Sales measure, DateKey from DimCalendar and leave the Number of Periods argument as 1. Click OK to create the quick measure.

When you’re done, take a moment to peruse the various calculation types to see which ones look promising for using in your organization. More information is available on quick measures here:

https://docs.microsoft.com/en-us/power-bi/desktop-quick-measures

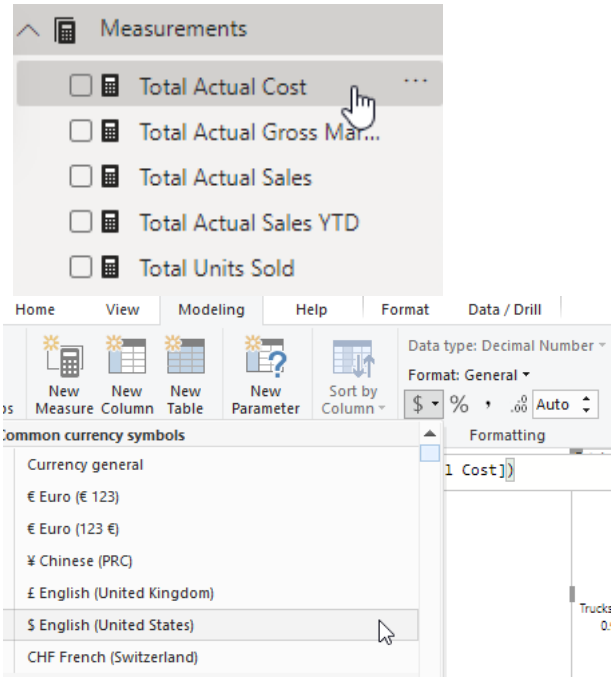


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```
1 Total Actual Sales YoY% =
2 VAR __PREV_YEAR = CALCULATE([Total Actual Sales], DATEADD('DimCalendar'[DateKey], -1, YEAR))
3 RETURN
4     DIVIDE([Total Actual Sales] - __PREV_YEAR, __PREV_YEAR)
```

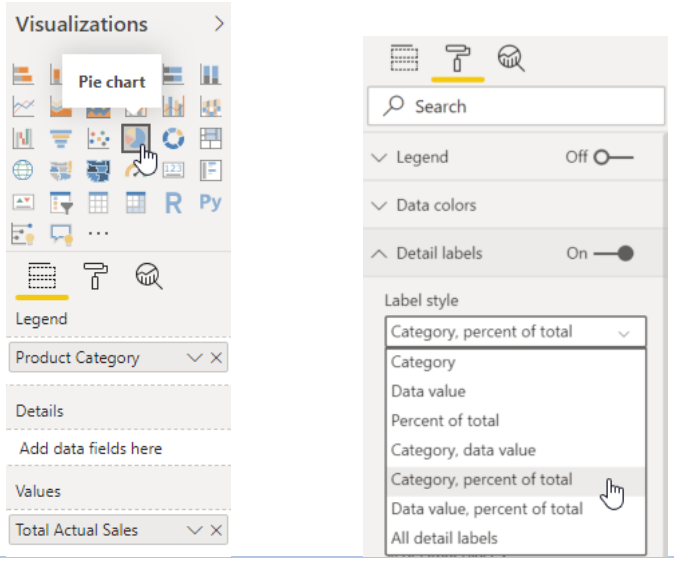
Since we want all the measures that we created which represent dollars to display in dollars, click on each measure, navigate to the modeling tab and change the display to $ as demonstrated on the right.

42. The formula bar for the quick measure will pop up. Rename the measure to YoY Sales Growth.
43. Repeat this process except for Total Actual Gross Margin. Rename the quick measure to YoY Gross Margin Growth. We will use these measures a bit later.



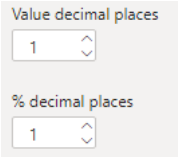
Let's get back to building out the report. So far, we have a nice comparison visual of Actual Sales vs. Budget Sales and a bunch of unused measures.

44. Create a pie chart of Total Actual Sales (using the measure we created) by Product Category (coming from our DimProduct table)

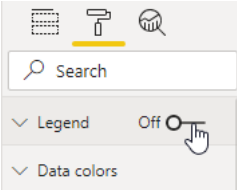


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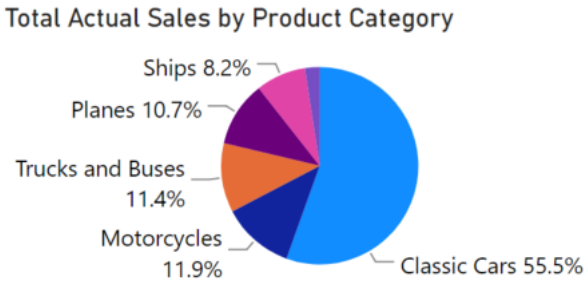
45. Navigate to the formatting tab for the visual, expand “Detail Labels” and change the Label style to “Category, percent of total” so we can see what percent of sales are contributed by each product category.
46. Within the Detail Labels dropdown, change the value decimal places and % decimal places to 1 so the visual doesn’t become too crowded



47. Turn the legend off since the detail labels display what category each slice of the pie represents

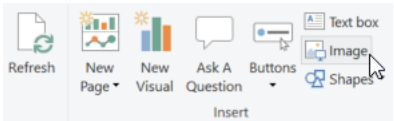


The pie chart should look similar to this:



Next let’s add the AFP logo to the top left of the page. You can find it in the downloaded course material.

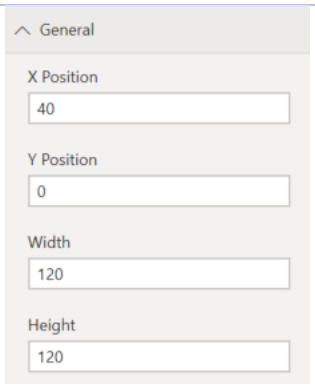
48. Under the home tab click “Image”, located in the Insert section



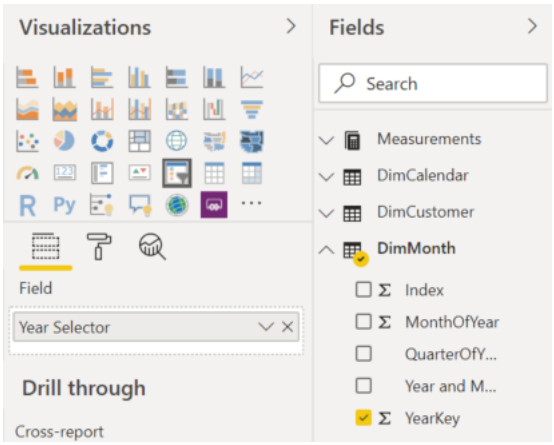
49. Load the AFP Logo 

50. Select the image, navigate to it’s formatting pane and set the position to the coordinates / size shown below

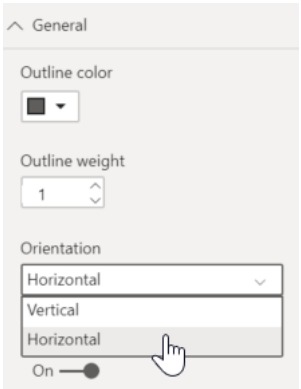
We can also add a slicer, which is a visual that allows the user to dynamically filter the page. Since we are creating a high-level overview page, we can create a Year slicer which allows the user to see the overview for whichever year they choose.

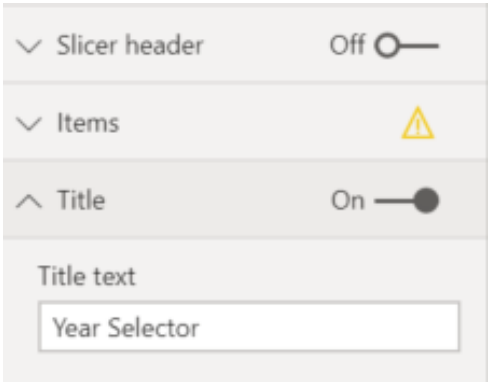


51. Create a new visual by selecting the slicer icon and dragging YearKey from DimMonth into the Field slot



52. In the formatting pane, switch the Orientation to Horizontal, turn the Slicer Header off, and make the title of the visual Year Selector



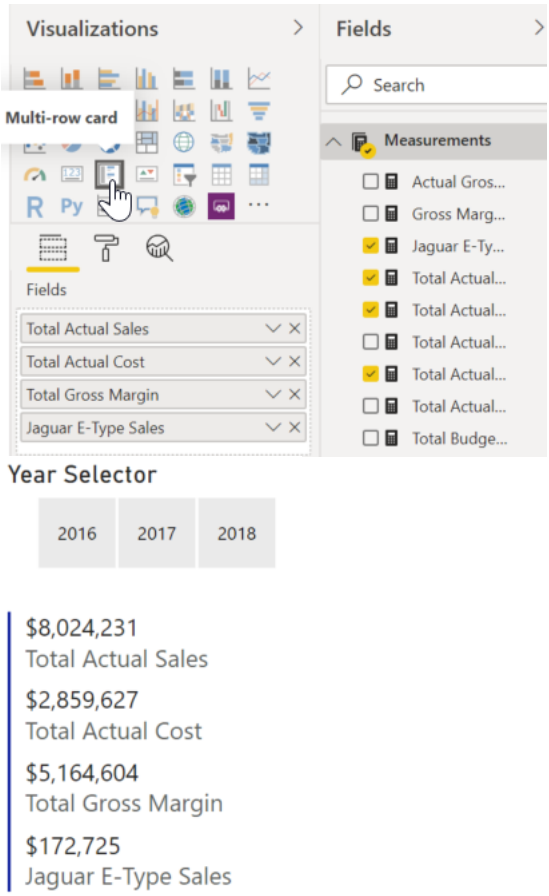




53. Place the slicer under the AFP logo

A Multi-Row Card is great for calling out a few key summary metrics.

Create one by utilizing the measures we created earlier and place it under the Year Selector.



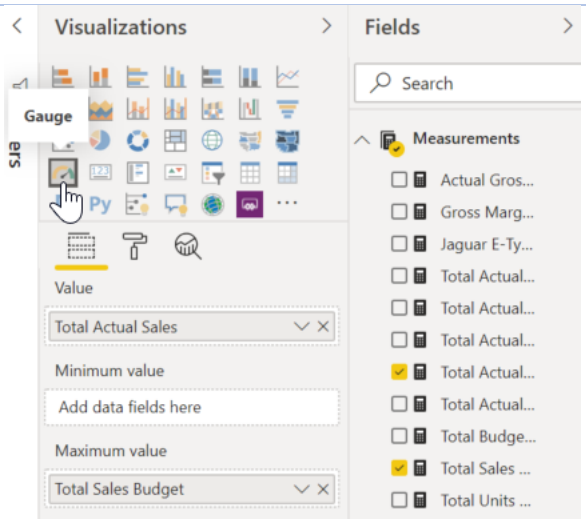
54. Create a new measure, Total Sales Budget

```
1 Total Sales Budget = SUM(FactBudget[Budget Sales])
```

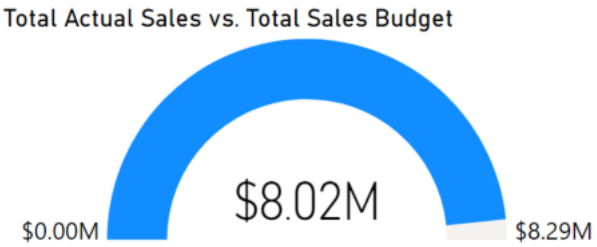
55. Repeat step 1 for Gross Margin Budget, title the measure Total Gross Margin Budget
56. Create a gauge visual, with the Maximum Value being Total Sales Budget and the Value being Total Actual Sales

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Now let's add a gauge that aggregates the bottom Actual Sales vs. Budget Sales into a single, concise visual that will adapt to the timeframe the user selects.



57. Change all of the font colors (Title, Callout Value, Data Labels) to black. The visual should look like this



58. Right-click on DimCustomer and hit "New Column". This will allows us to write DAX to create a new column. This functionality is very similar to creating a new column in Power Query. Different situations call for either of these options to be used.

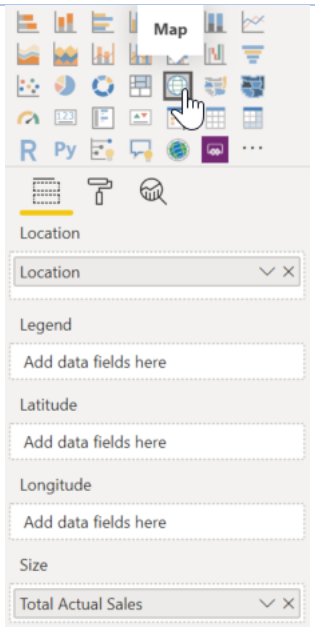


59. Create a "Location" column that reads similarly to a mailing address. This will help the map visual be as precise as possible when plotting the customer's locations. Write the following DAX so the column will read like Online Diecasts Creation Co. shown below.

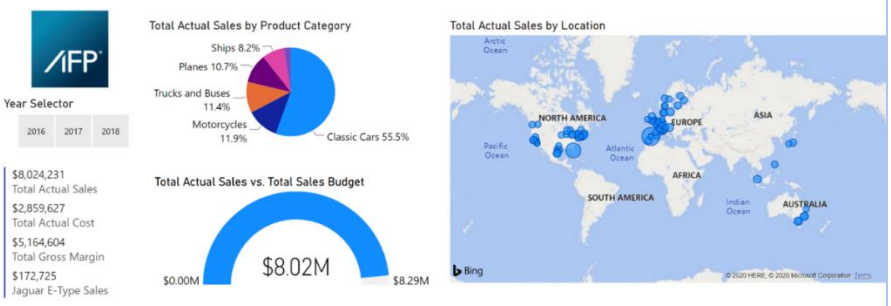


60. Insert a map visual with the new "Location" field in the Location slot and Total Actual Sales in the Size slot.

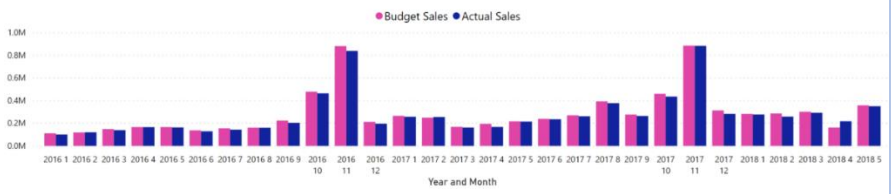
Power BI can take location data in almost any format and map it. Let's give that a try.



Once you're done creating the map visual, rearrange all the visuals we've created so they look like the template shown on the right.

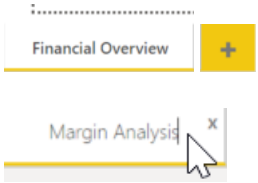


Voila! You've created your first report page.



Be sure to add the finishing touch of renaming "Page 1" to "Financial Overview"

Click the + button next to Financial Overview so we may begin creating a more detailed page. Rename the new page "Margin Analysis".



The first page of the report served well as a high-level overview that gave you some experience with the basic

61. Begin by copying the AFP logo, Year Selector and Multi-Row Card from Financial Overview, and paste it onto the Margin Analysis so they land in the same spot as the first page and provide the report with a clean, familiar look. Select all three visuals by holding down Ctrl and clicking each of them.

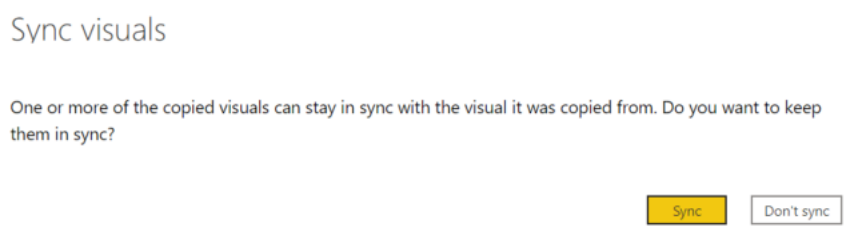
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visual functionalities of Power BI.

Margin Analysis will be more numbers driven and provide the user with the means to take a deeper dive into the data and find out why Models Inc. isn't hitting their margin budget.



62. A dialog box will pop up asking if you want to sync the visuals you copied. The pop-up is referring to the slicer you copied. Hit "Sync", as this will allow the user to make a year selection on the Financial Overview, and upon switching to Margin Analysis, that selection will carry over.

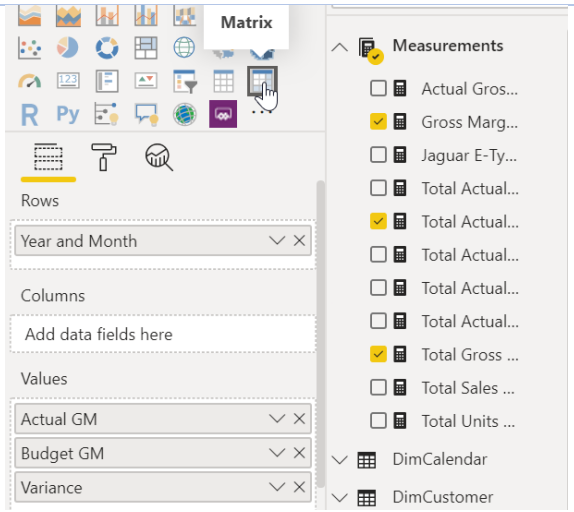


63. Next we will want to create another key measure that will help us support our Margin Analysis, which is Gross Margin Variance. Leverage the two gross margin measures we created earlier in a new DAX measure.

```
1 Gross Margin Variance = [Total Actual Gross Margin] - [Total Gross Margin Budget]
```

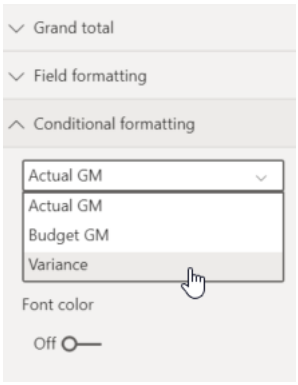
64. Now create a matrix visual that runs along the right side of the report which gives Total Actual Gross Margin, Total Gross Margin Budget, and Gross Margin Variance by Year and Month (from DimMonth). Rename the fields within the visual to Actual GM, Budget GM, and Variance (in the interest of conserving space).

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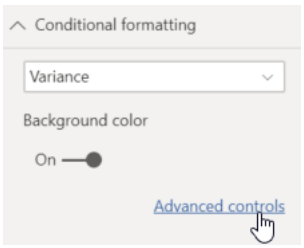


We have the matrix built, now let's apply some conditional formatting to make the months with a negative variance and positive variance contrast heavily.

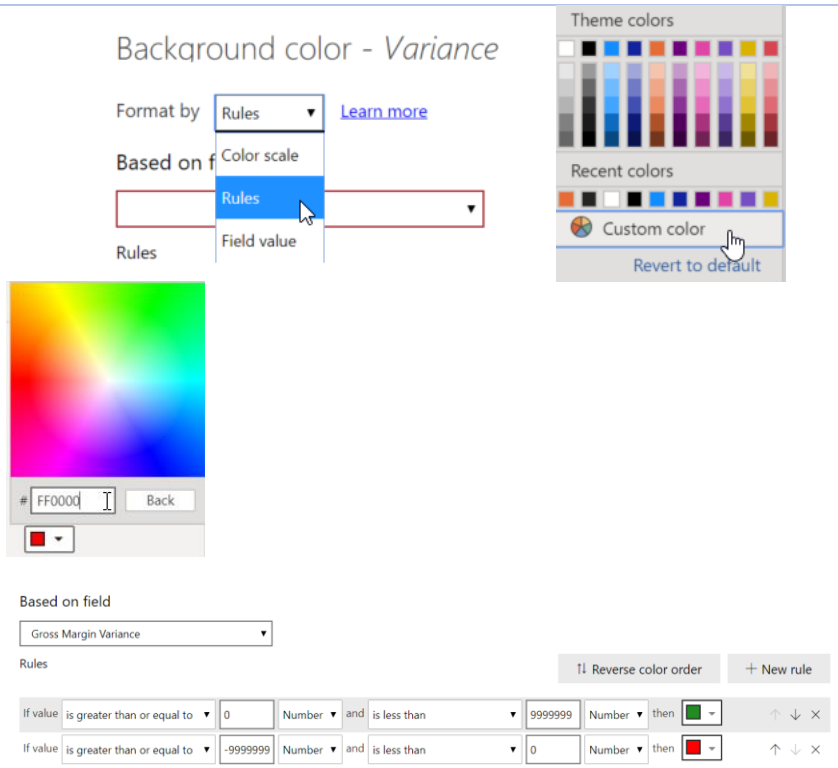
65. In the formatting pane, find "Conditional Formatting", and click Variance in the dropdown.



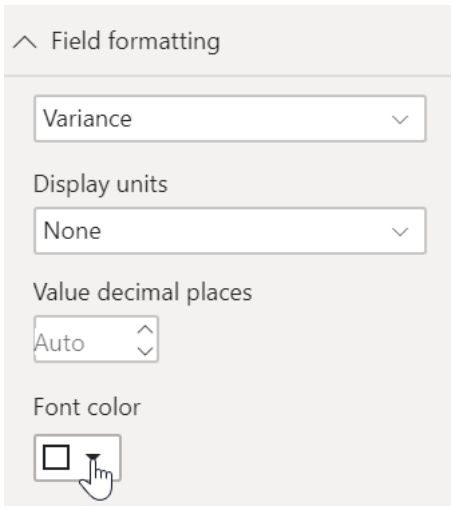
66. Turn Background Color on and hit Advanced Controls



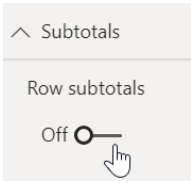
67. Let's keep this example simple and format the background of the Variance field by two rules: If Variance is positive, make the background green. If Variance is negative, make the background red. You can set custom colors for the rules by clicking Custom color in the boxes shown after "the" and picking one from a display or typing in hex codes. The hex code for red is FF0000 (as shown below) and the hex code for forest green is 228B22.

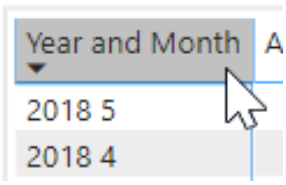


68. Since the Variance values are a bit difficult to see with the background colors we've chose, navigate to Field Formatting and make the font color for Variance white.



69. Finally, remove the row subtotals under "Subtotals" in the formatting pane and click the Year and Month field in the visual to sort it descending, so we see the most recent month in our dataset at the top.



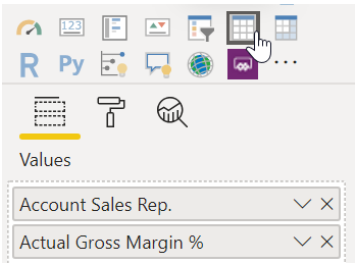


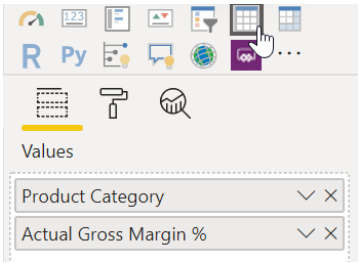
The matrix should look like this, running along the right side of the report page.

Year and Month	Actual GM	Budget GM	Variance
2018 5	$227,995	$237,165.48	-9,170.34
2018 4	$145,323	$104,936.09	40,386.54
2018 3	$183,350	$196,988.51	-13,638.52
2018 2	$158,466	$187,965.06	-29,498.78
2018 1	$179,830	$186,939.04	-7,108.69
2017 12	$173,399	$202,051.09	-28,652.46
2017 11	$574,398	$575,424.56	-1,026.76
2017 10	$275,237	$300,379.89	-25,142.99
2017 9	$170,662	$179,956.58	-9,294.32
2017 8	$244,172	$257,427.01	-13,254.91
2017 7	$169,504	$178,355.42	-8,851.51
2017 6	$147,126	$153,535.99	-6,410.09
2017 5	$136,902	$141,453.99	-4,552.05
2017 4	$106,921	$126,796.94	-19,876.42
2017 3	$104,333	$111,300.14	-6,967.53
2017 2	$165,544	$164,340.27	1,203.38
2017 1	$164,487	$173,793.13	-9,306.45
2016 12	$123,770	$139,638.53	-15,868.12
2016 11	$550,384	$581,751.70	-31,368.12
2016 10	$308,061	$318,524.68	-10,463.19
2016 9	$130,491	$147,463.78	-16,973.06
2016 8	$105,399	$106,785.73	-1,387.18
2016 7	$92,225	$101,327.55	-9,102.78
2016 6	$83,198	$92,111.72	-8,914.00
2016 5	$102,588	$106,410.62	-3,822.50
2016 4	$110,716	$111,756.65	-1,040.47
2016 3	$88,463	$95,165.77	-6,703.15
2016 2	$80,664	$78,889.39	1,774.41
2016 1	$60,999	$71,693.89	-10,694.89

Next, let's create some more tables that give us supplementary information on gross margin % broken out by different dimensions.

Create two tables, Actual Gross Margin % by Product Category (from DimProduct) and by Account Sales Rep (from FactSales).





Shorten the titles to Actual GM % by _____ and abbreviate the measure names to GM%. Place the two tables next to each other in the middle of the page.

Actual GM% by Product Category

Product Category	GM%
Ships	69.26%
Motorcycles	66.33%
Classic Cars	63.81%
Trucks and Buses	63.34%
Trains	62.84%
Planes	62.71%

Actual GM% by Account Sales Rep

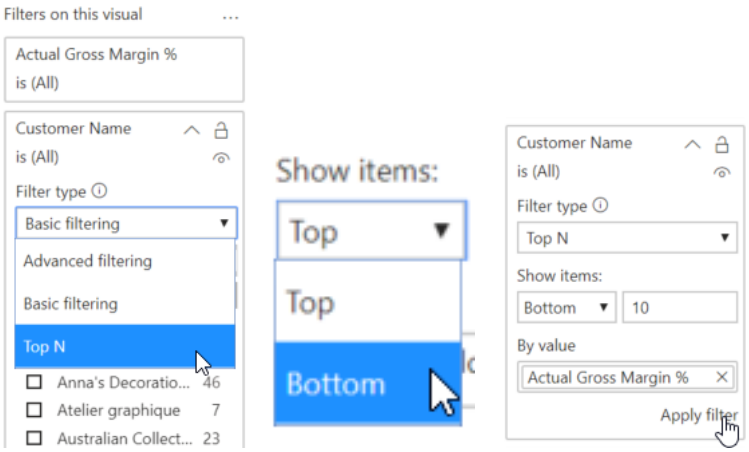
Account Sales Rep.	GM%
Husband	66.66%
Soriano	65.63%
Barch	64.75%
Schiz	64.60%
Pim	64.51%
Pearson	62.77%
Boyle	62.51%

Repeat this process for GM% by Model and by Customer.

70. Create the tables in the same fashion as the two tables above.
71. Expand the filter pane for the GM% by Customer table

You'll notice that there are a lot more models and customers than there are sales reps and product categories. To focus the user on the problem areas, we will limit these two tables to the bottom 10 by using a filter.

72. Switch the Customer Name filter from "Basic filtering" to "Top N"



73. Switch the Show items dropdown from "Top" to "Bottom"
74. Filter to show only the bottom 10 customers
75. Slide our Actual Gross Margin % measure into the "By value" slot
76. Go to the field formatting for the visual and change the font color for Actual Gross Margin % to red.
77. Repeat these steps for the table that gives GM% by Model. Name the two visuals "Bottom 10 Models by GM%" and "Bottom 10 Customers by GM%"

Place the two new tables above the Category and Sales Rep tables. They should look like the screenshot on the right:

Bottom 10 Models by GM%

Model	GM%
Triumph Rocket III	24.39%
Vintage Jeep	35.14%
Shelby 427 Cobra	35.17%
Freightmaster	39.65%
Iron Horse	42.26%
Cadillac Series 62 Coupe de Ville	42.43%
Boeing 777	45.15%
Corsair Birdcage	46.40%
VW T1 Panel Van	47.00%
CADILLAC V-16	48.62%

Bottom 10 Customers by GM%

Customer Name	GM%
Euro Shopping Channel	56.52%
Mini Gifts Distributors Ltd.	59.96%
Microscale Inc.	60.01%
Cambridge Collectables Co.	60.14%
Auto Assoc. & Cie.	60.23%
West Coast Collectables Co.	60.34%
Australian Collectables, Ltd	60.38%
AV Stores, Co.	61.03%
Corrida Auto Replicas, Ltd	61.62%
Osaka Souveniers Co.	61.62%

Actual GM% by Product Category

Product Category	GM%
Ships	69.26%
Motorcycles	66.33%
Classic Cars	63.81%
Trucks and Buses	63.34%
Trains	62.84%
Planes	62.71%

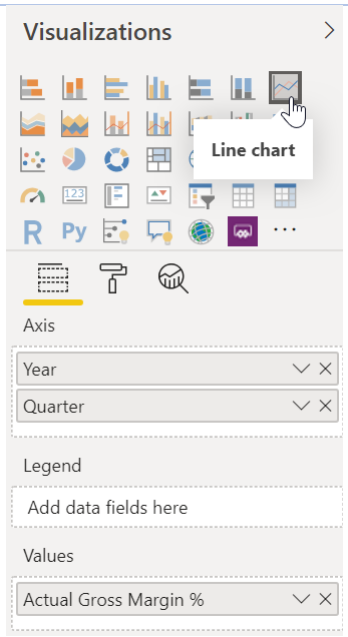
Actual GM% by Account Sales Rep

Account Sales Rep.	GM%
Husband	66.66%
Soriano	65.63%
Barch	64.75%
Schiz	64.60%
Pim	64.51%
Pearson	62.77%
Boyle	62.51%

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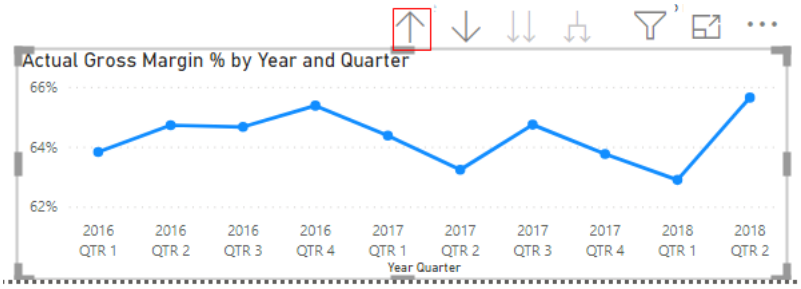
Under these four tables, create a line chart that gives Actual GM% by Year and Quarter.

Putting multiple fields in the axis slot of a visual will allow you the ability to drill from the top of the hierarchy to the bottom of the hierarchy using the arrow buttons shown when the visual is selected.



Feel free to play around with the drill functionality and experiment with different hierarchies.





We can create a matrix that contains similar drill functionality using one of our measures we created earlier, YoY Gross Margin Growth.

YoY GM Growth by Market / Territory

Market	2017	2018
Foreign	**30.31%**	**-62.37%**
EMEA	38.06%	-62.49%
APAC	-16.15%	-54.95%
Japan	97.38%	-75.66%
Domestic	**35.82%**	**-64.50%**
NA	35.82%	-64.50%
Total	**32.43%**	**-63.21%**

Add a matrix visual to the page and try to make this

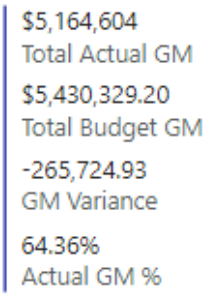
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visual, without the help of this guide.

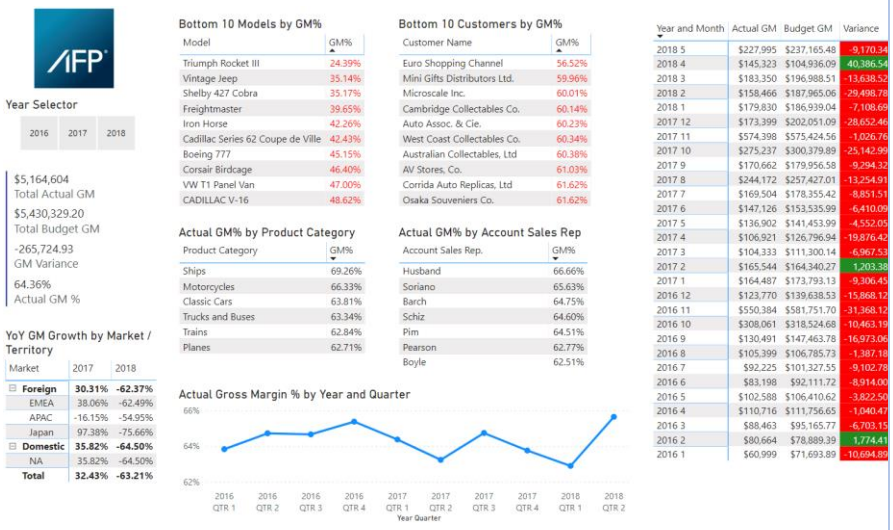
Hint: 2019 will need to be filtered out of the visual since we don't have transactional or budget data for 2019.

Lastly, let's replace a couple of the measures in the multi-row card with ones more pertinent to analyzing margin.

78. Switch out Total Actual Sales for Total Actual GM
79. Switch out Total Actual Cost for Budget GM
80. Switch out Total Gross Margin for GM Variance
81. Switch out Jaguar E-Type Sales for Actual GM%

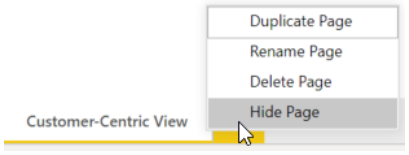


*G*reat work! Now we have an interactive and informative page that allows the user to dig deeper into where and why Models Inc. is missing their margin number.

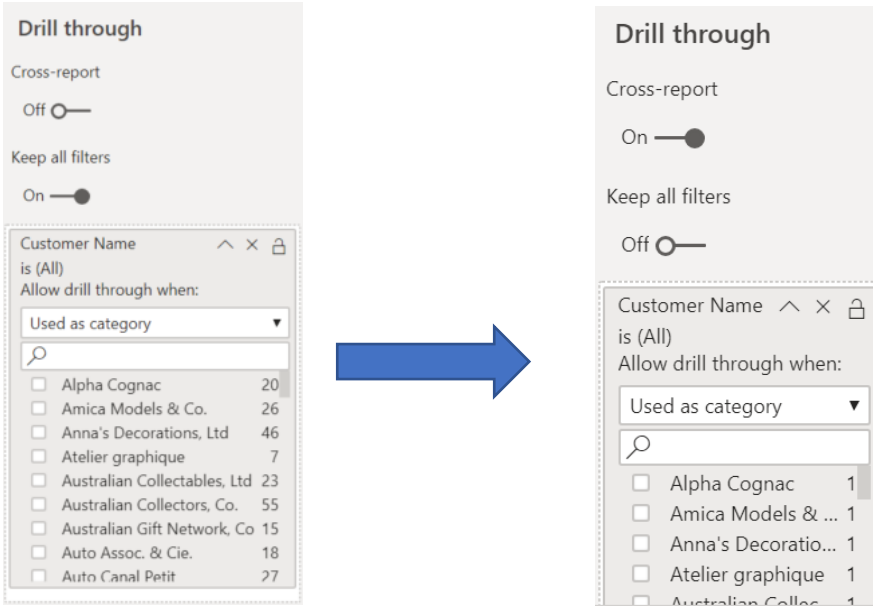


Users will often want to look closer into the details and story behind the sales numbers of a given category value in our data, in this example, customer. This next section will demonstrate how to create a **Drill-Through** page that lets the user see visuals and data points related to a specific customer.

82. Create a new page and title it "Customer-Centric View".
83. Copy and paste the AFP logo, year slicer, and multi-row card from the Financial Overview page the same way we did for Margin Analysis
84. Next, let's hide the page (right-click page title). This will restrict the user's ability to access it when the report is published, as they will have to drill into a particular customer of their choosing to see this page, as we want it focused on only one customer at a time.

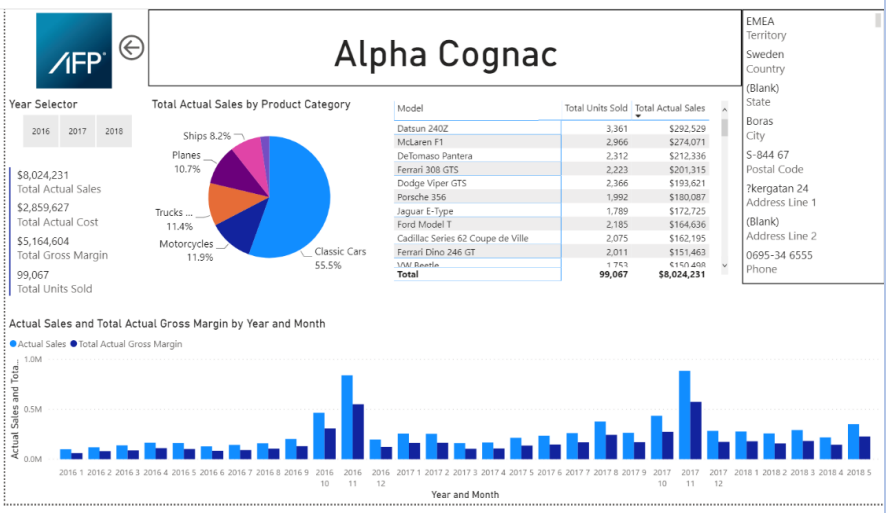


85. Now we need to tell Power BI what category this will drill from. In this case, we will use Customer Name from DimCustomer, which is the same column used in the Bottom 10 Customers by GM% table on the Margin Analysis page. Drag this field from the Fields tab into the area in the Visualizations tab called “Drill through”



86. You’ll notice that there are two toggles above where we placed Customer Name, “Cross-report” and “Keep all filters”. **Cross-report** lets this page be used by other reports as a drill-through target, so we will want to turn this *on*. **Keep all filters** dictates whether or not every filter that was applied from the source page carries over into this page. We will turn this one *off*.
87. You will also notice that a back button appears on screen, which allows the user to return to the source page. Place it to the right of the AFP logo.

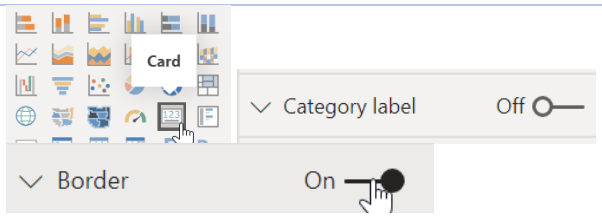
Try to emulate the screenshot on the right and finish this page on your own. It borrows a lot of visuals and measures we’ve already covered from the other pages.



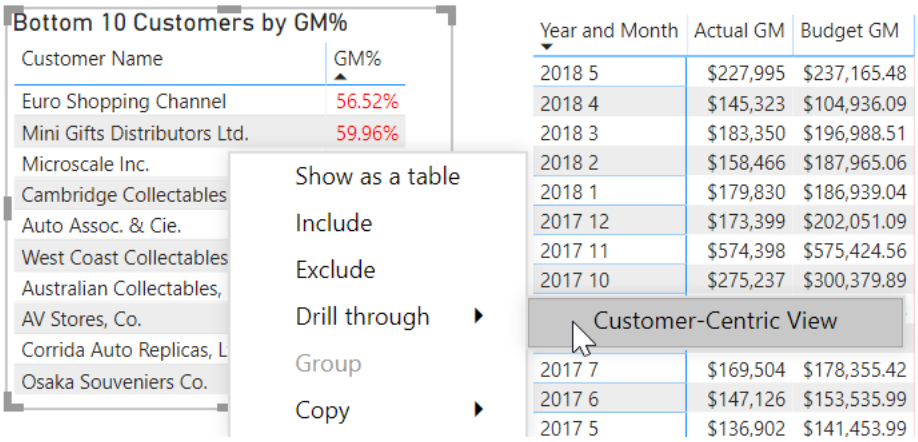
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The only visual we *haven't* covered is the Card at the top. Select the Card visual and slide Customer Name from DimCustomer into it. Turning Category labels off and the Border on can be found in the formatting pane for the visual.

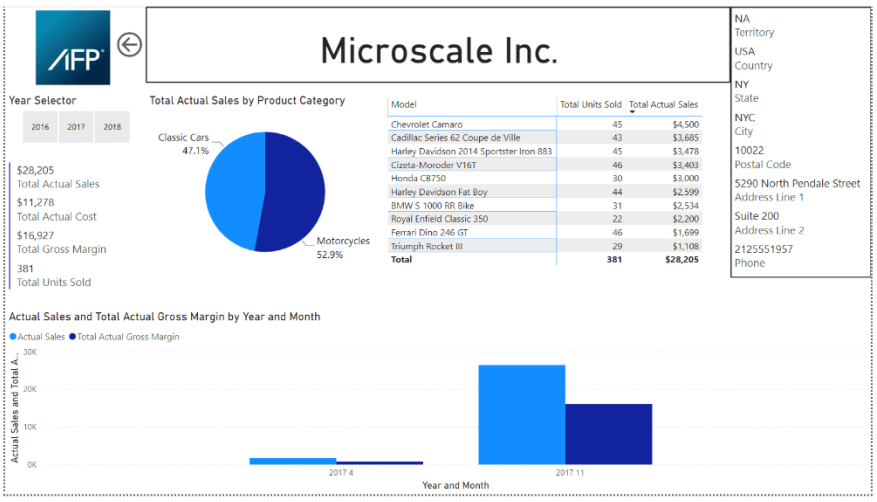
Once the page is built, it is obvious to see that the multi row card in the top right corner has a scroll bar and Power BI arbitrarily places the first customer in the card at the top. That's because this page wasn't meant to be viewed without a filter applied. We'll cover the drill through functionality here.



88. Return to "Margin Analysis"
89. Pick a customer from the list of customers in the "Bottom 10 Customers by GM%" visual and right click on their name
90. Find "Drill through" and after hovering over it you will see the name of the hidden page we created just a bit ago, "Customer-Centric View".



91. Clicking on this link will bring the user to the hidden Customer-Centric View page, but filtered only on the customer selected. Microscale Inc. is used as the guinea pig for the next screenshot. Now we have a page with all of the information relevant to understanding our business with Microscale Inc. We can return to Margin Analysis at any time by clicking the back button.



Our report is complete! Let's put a few final touches like Row-Level Security on it before we publish it the Power BI Service.

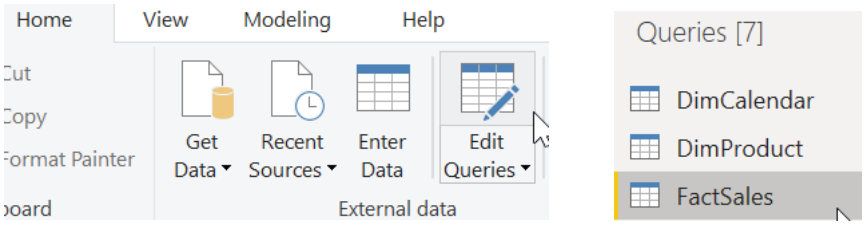
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10.4 Exercise 1.3: Create Row-Level Security Rules

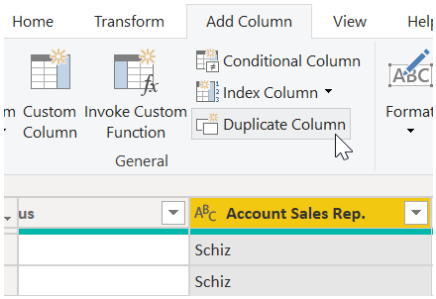
Our report has been created, and we are ready to roll it out to C-level executives. However, we may want to limit the data that sales reps see to only their data. We can create Row-Level Security (RLS) to accomplish this.

In order to build dynamic row-level security for every Sales Rep under the employ of Models Inc., we need to create a field with their email so the Power BI Service can detect their email upon logging in and return only sales data related to them.

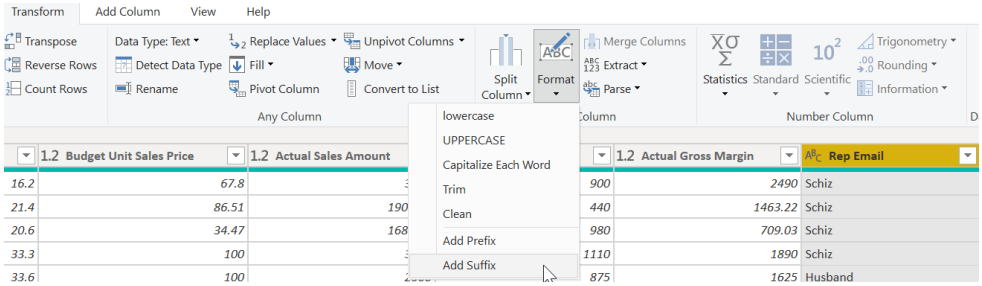
1. Start by re-opening the Power Query editor and opening the FactSales query.



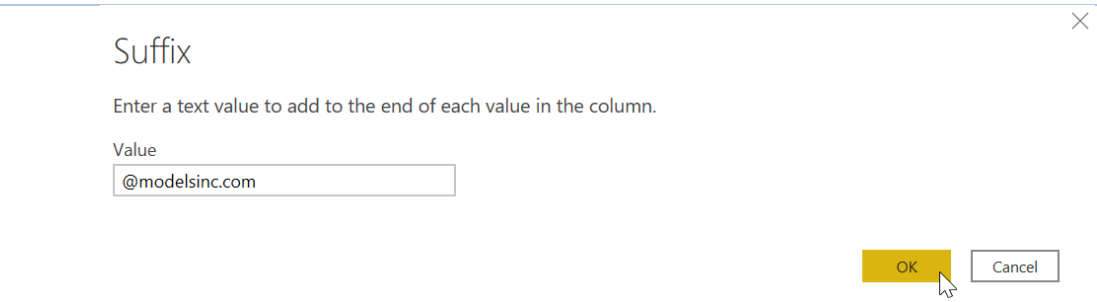
2. Select the Account Sales Rep. column and duplicate it using the Duplicate Column button under the Add Column tab. We will use this duplicate column to build a Rep Email field.



3. Select the new duplicate column (Account Sales Rep. – Copy) and rename it to “Rep Email”
4. With the Rep Email column still selected, switch to the Transform tab and click Format -> Add Suffix

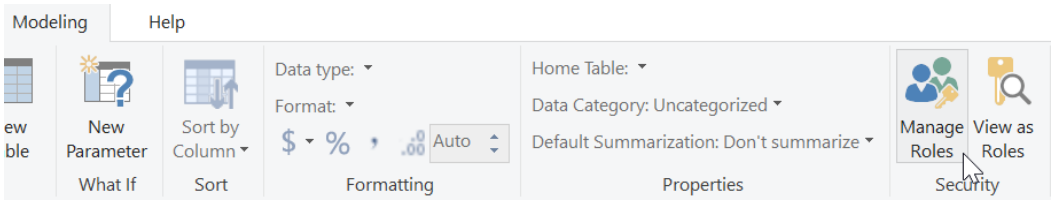


5. Make the suffix @modelsinc.com to format the field into an email. This concept can be applied to any dataset that contains names which can be formatted into an email address. In this case, we will assume Models Inc. employees are given emails in the format of LastName@modelsinc.com

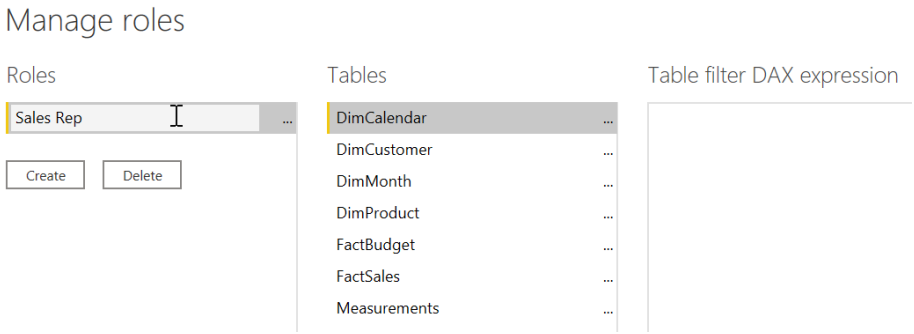


6. Close & Apply so the new column loads to the Power BI model

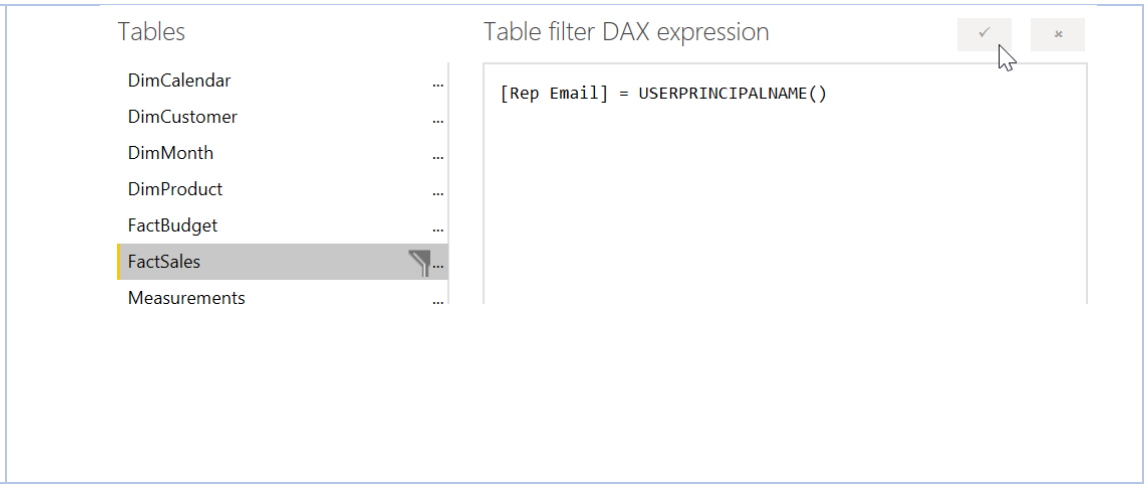
7. Under the modeling tab, click “Manage Roles” in the Security section. This will allow us to build groups with filter rules applied to them. We can manage who gets included in RLS groups in the Power BI Service online.



8. Create a new role and title it “Sales Rep”. A list of our tables appears to the right. We can write DAX filter expressions on any of the tables to filter what people in this role can see.



9. Select FactSales as the table, and input the following DAX filter expression into the text box. The **USERPRINCIPALNAME()** function returns the email of the user that is viewing the report. By utilizing this function, we can match the email of the sales rep when they log into Power BI to the email in our FactSales table. This will then only show them transactions where they were the sales rep. Click the check mark at the top right to validate the expression and check for errors. If there are no errors, click “Save” at the bottom right.

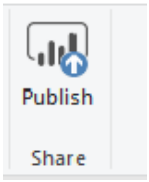

Tables
DimCalendar
DimCustomer
DimMonth
DimProduct
FactBudget
FactSales
Measurements
Table filter DAX expression
[Rep Email] = USERPRINCIPALNAME()

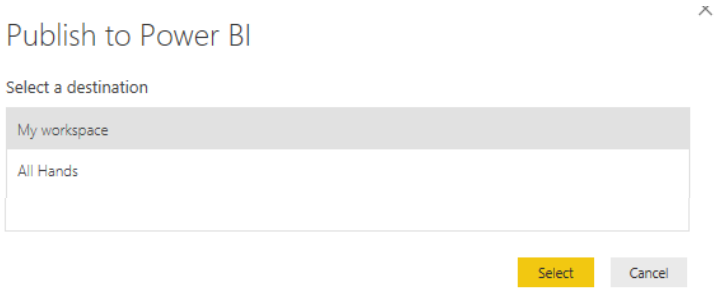
10.5 Exercise 1.4: Publish a Report to Power BI Service

Now that we have created our first report in Power BI Desktop, let's explore how to extend this out with the Power BI Service.

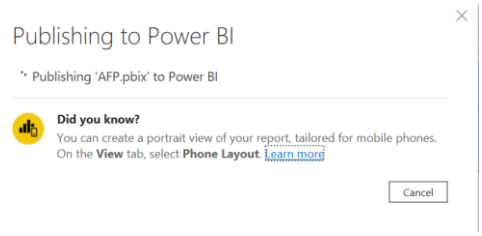
After you've created your reports, you can save them to a ***workspace*** in the Power BI service, where you and your colleagues collaborate. You build ***dashboards*** on top of those reports. Then, you share those dashboards and reports with report consumers inside and outside your organization. Your report consumers view them in the Power BI service in a *Reading view*, not Editing view. They don't have access to all the features available to report creators.

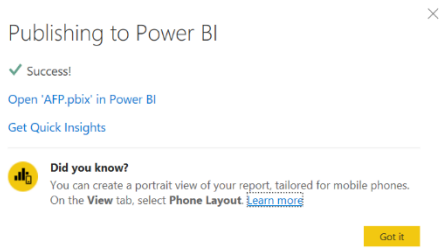
1. Start by clicking the "Publish" button from the Home Ribbon.





2. Choose "My Workspace" and click the Select button. Power BI will publish your report.

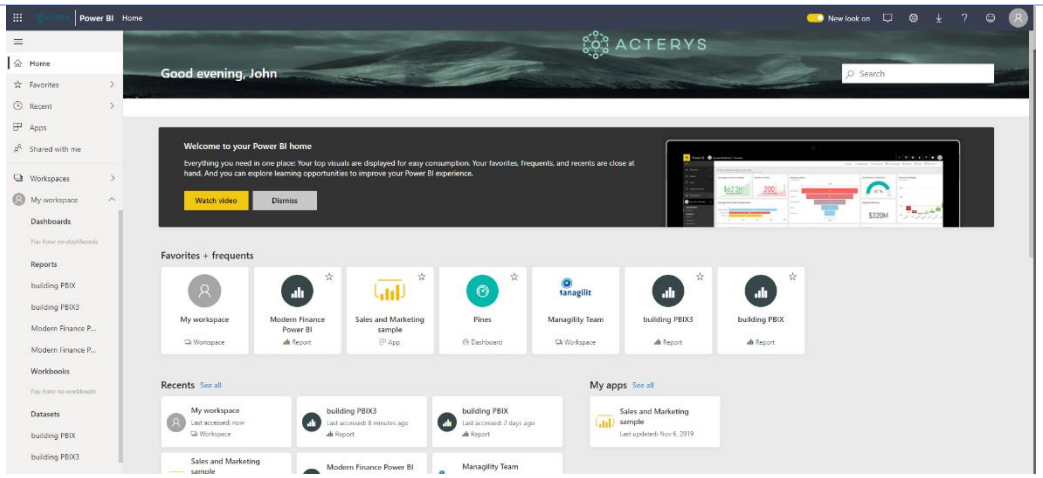




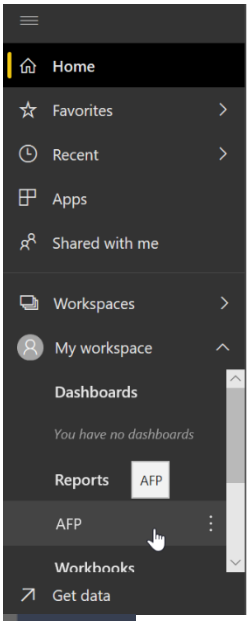
After the report publish is complete, it is available in Power BI.

3. Log in to http://app.Power BI.com to see your report

   You will see your home screen as follows (yours may appear without company branding)

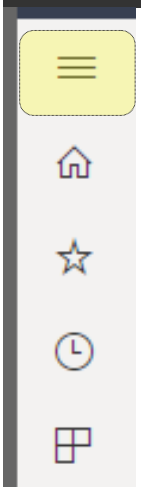


4. Click on “My workspace” in the navigation pane on the left. Under “Reports”, you will find the Power BI report we have just published.



5. Click on the Harmburger menu at the top left to collapse the navigation pane

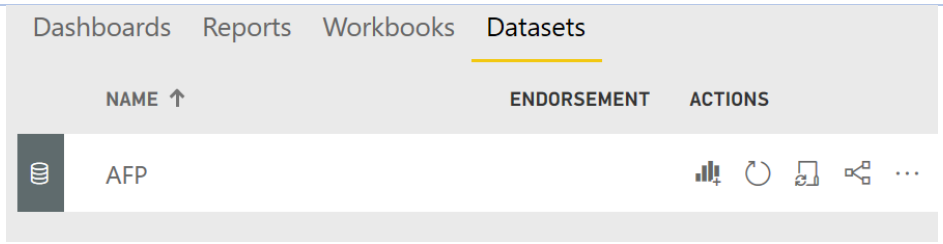
   This allows more of your screen real estate to be focused on your data.



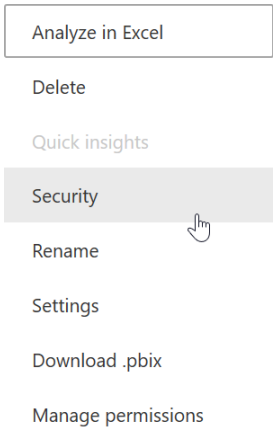
Your report will now appear in Power BI in the main window. Feel free to experiment with the different controls and navigation.

As mentioned previously, we need to manage who is in the RLS groups in the Power BI service.

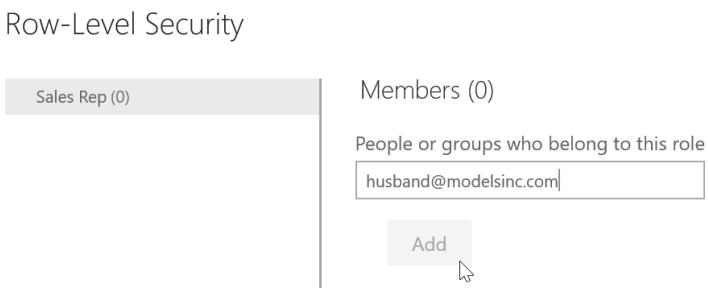
Maintained and Produced by Colletiv LLC © 2020



10. Click on My workspace and navigate to the “Datasets” section
11. Next to AFP, click the 3 dots under “Actions” and hit “Security”



12. From this screen, we can add the sales reps to the “Sales Rep” role. Note that the “Add” button is grayed out since the email address is not part of your organization, as it is just for demonstration purposes. Anyone in a security group will be limited to what the DAX expression lets them see, whereas viewers that are not in a group can see everything.

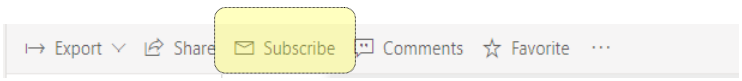


Let’s explore some other functionalities, starting with subscribing to a Power BI Report.

Power BI can automatically send you a copy of your report on an hourly,

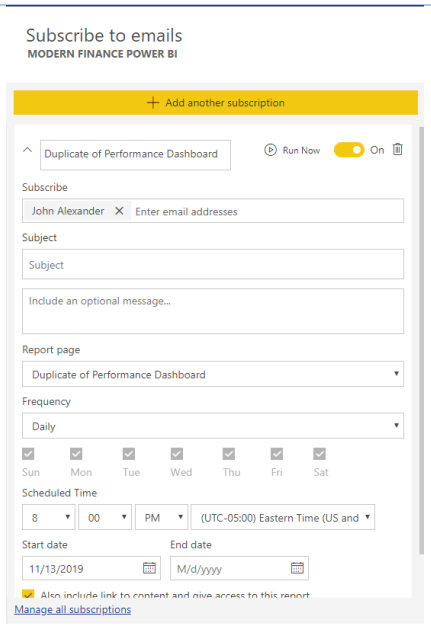
Sometimes you may wish for a report to be delivered to you on a schedule (e.g. a daily sales report).

13. To subscribe to a report, click the “Subscribe” button in the toolbar

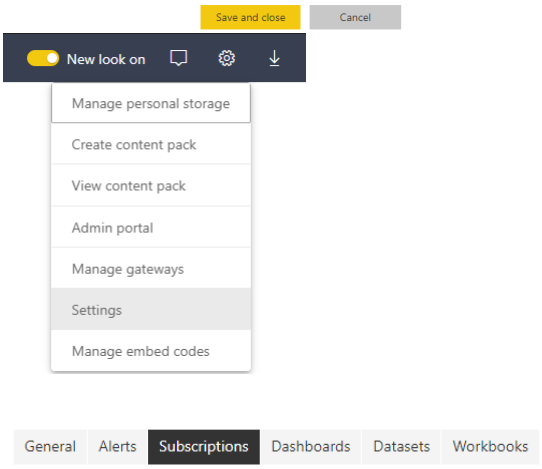


daily, weekly, or monthly bais. A copy can also be sent up to once per day on data refresh.

14. Fill out the subscription options in the window on the right. Then lick “Save and Close”



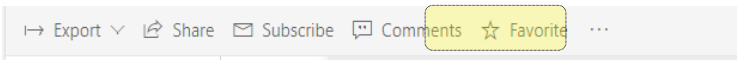
15. To see a list of all your subscriptions at any point, click on the gear icon in the toolbar > Settings > Subscriptions



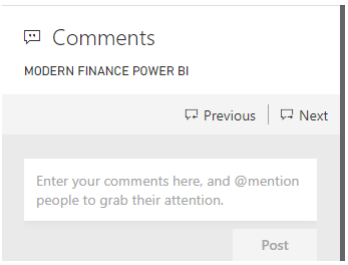
Add comments to a PowerBI Report

Comments allow users to share an ongoing chats with their observations about the data through their explorations. When people insert a comment to the Report, Power BI will automatically create a bookmark based on whatever filters were applied, so when users read those comments, they can see exactly

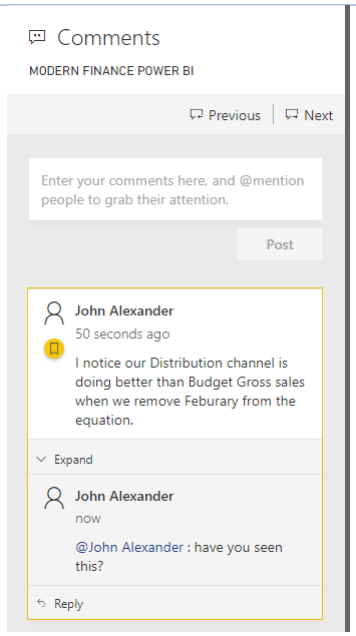
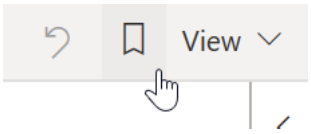
16. Click the “Comments” button in the toolbar at the top of the screen

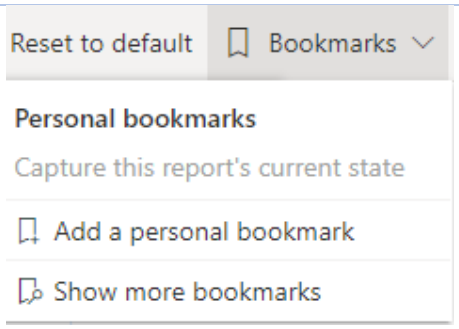


Type your comment based on what you see in the pane at the right:

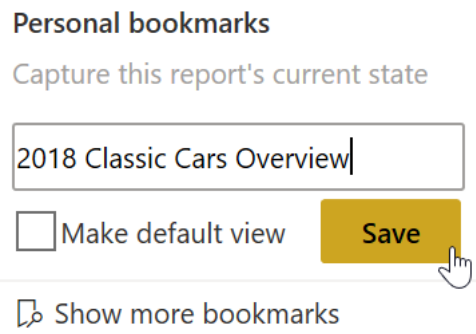


Click “Post”

what that person was looking at when the comment was posted	17. Earlier comments will appear below. Clicking on the comment will apply any filters that were on when the comment was made. If you wish to alert someone, add the @ symbol in front of their name. To Delete a comment, hover over it and click the trash can icon in the comment 
Explore Creating Bookmarks in your PowerBI Report. Bookmarks allow you to create pre-defined selections in your reports. This is useful if you wish to tell a story during a presentation or board meeting	One of the most ways of communicating information in a board meeting is to do the following: 1. Analysts spend a lot of time compiling data into excel charts, tables, graphs. 2. Excel data is then copied / pasted into Powerpoint 3. Powerpoint slides are presented during board meeting 4. Steps 1-3 are repeated for every meeting (monthly, quarterly, annual) With PowerBI, we can streamline this process by using bookmarks to help guide us through the story we wish to tell during our meeting. For example: 18. Go to Page 1 (Financial Overview) of our report. Select 2018 for the year and click the Classic Cars slice of the pie chart. 19. Click on the Bookmarks tab in the toolbar  20. Click “Add a Personal Bookmark”.

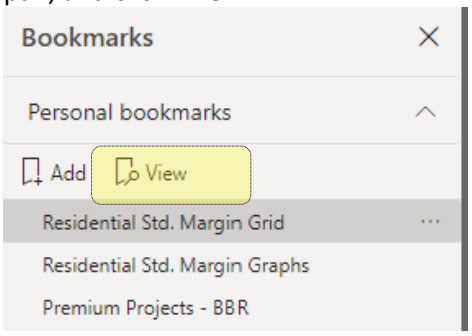


21. Name the bookmark “2018 Classic Cars Overview”, Click “Save”



22. Click on Page 2
23. Drill down on Residential on the clustered bar chart in the bottom right corder
24. Create a new bookmark called “Residential Std. Margin Graphs”
25. Create a few more different drill reports if desired and bookmark each one.

When it is time to present your findings in a meeting, simply click on the Bookmarks pan, and click “View”



The first bookmark will be presented in a slideshow type view.

When it is time for the next meeting, the bookmarks will still be there, and the time spent preparing the material will be cut dramatically!!

11 Workshop # 2

11.1 Business Scenario

You are a senior analyst for “May the Floors Be With You”, a manufacturer and seller of flooring products. Senior Management wants to gain a better understanding of Year to Date performance and how the most recent forecast compares to the budget that was done before the current year began. You have been tasked with provide:

- A simple standard margin statement that shows:
  - P&L Lines, with Vales and YTD Values for Actuals, Forecast, and Budget
  - Report must show P&L Values, as well as a Rate per Units sold (square feet) for each P&L Line

- Additionally, senior management is asking for Insights about how the business is performing by:
  - Product
  - Profit Center
  - Sales Channel

It is known that the business is not performing up to expectations. Part of the issue is explained by a warehouse fire in February that affected sales dramatically. Management would also like to know if that one-time event had not happened, would we be on track to meet or beat our budget.

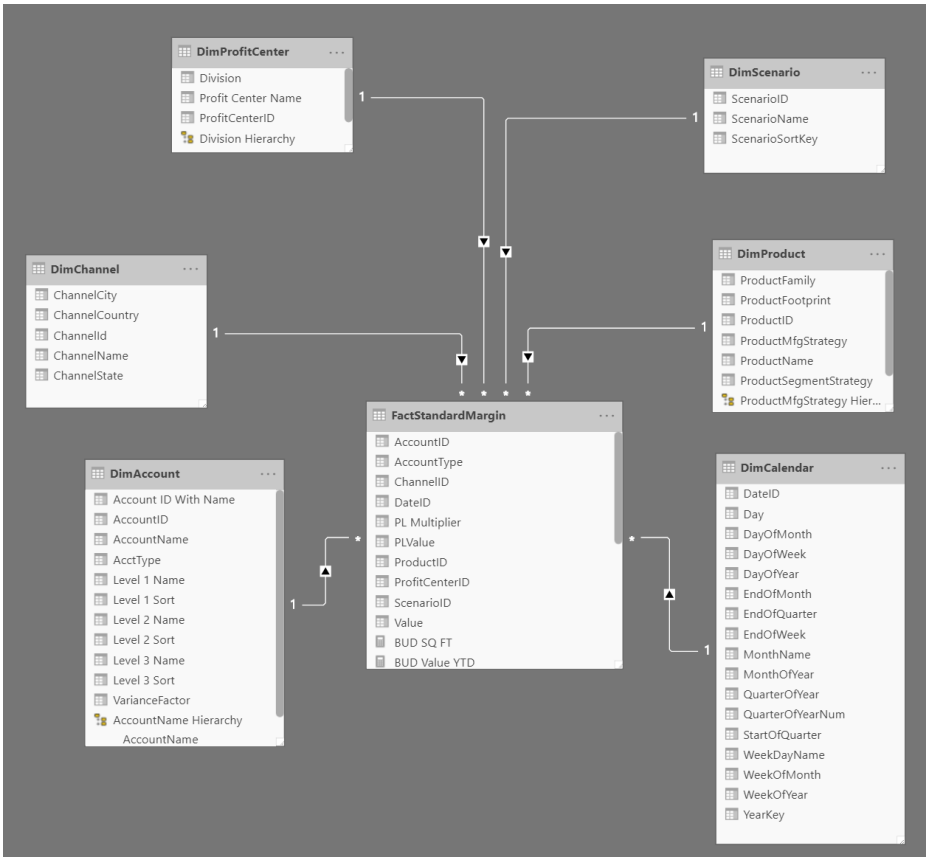
You have been able to extract a set of files including a data dump of the budget and forecast by GL Account from the General Ledger system. You would like to try to create a more interactive users experience for sharing and analysing data and have heard that Power BI and Power Query might be able to help with this task.

It is also widely acknowledged that the budgeting process is too time consuming. Senior Management would also like to hear some thought and recommendations on how to improve the budgeting and forecasting process to bring the organization in line with best practices.

11.2 Exercise 2.1: Begin Data Exploration (Matrix Visualization)

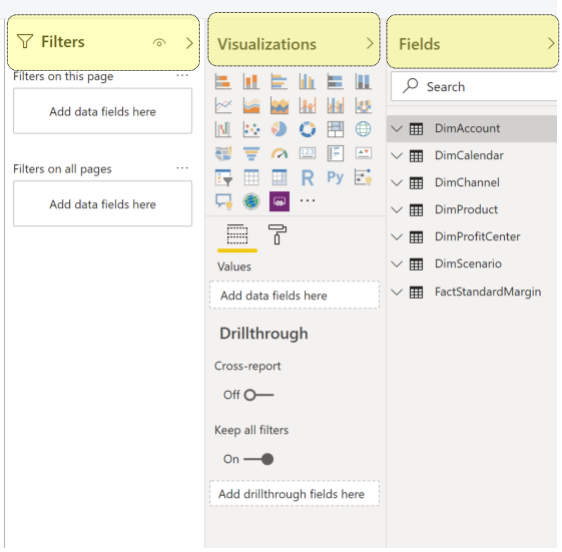
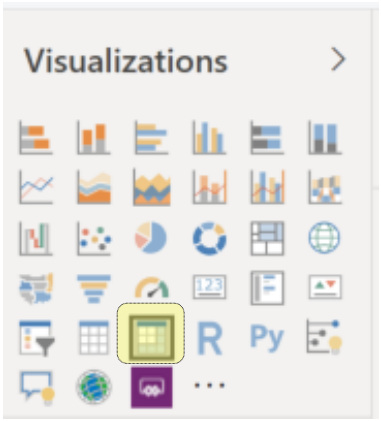
In this workshop, we will take it as a given that the data has already been loaded into our Power BI report.

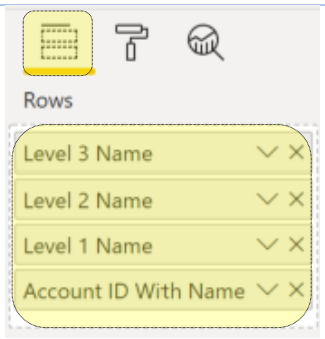
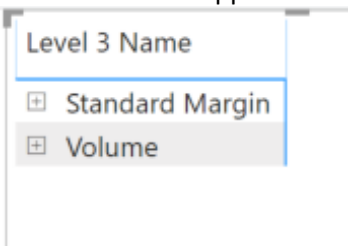
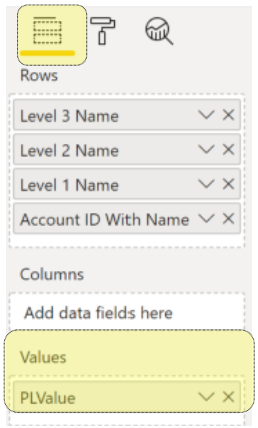
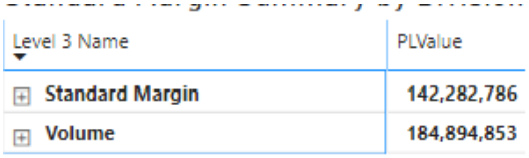
The data model will appear as follows:

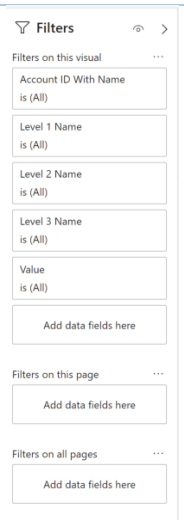
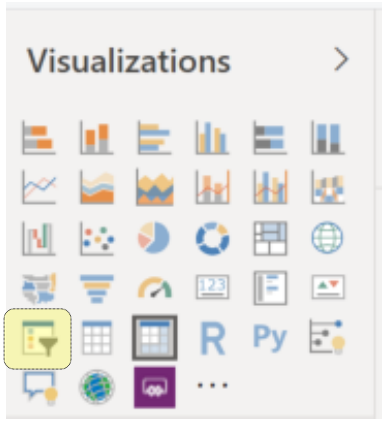
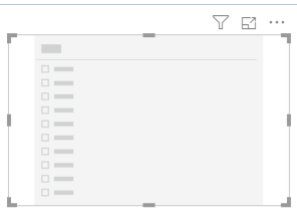


DimAccount	List of GL Accounts organized by PL Line
DimCalendar	Calendar table. Allows us to define custom time calculations / settings
DimChannel	List of Sales Channels / Distribution Methods / Locations
DimProduct	List of Products
DimProfitCenter	List of company profit centers organized by Division
DimScenario	List of Scenarios loaded into the model (Actual, Forecast, Budget)
FactStandardMargin	Fact Table containing data summarized by: • Scenario • Account • Channel • Product • Profit Center • Period

Let’s start with a simple matrix (crosstab) report to validate that our results appear as we would expect.

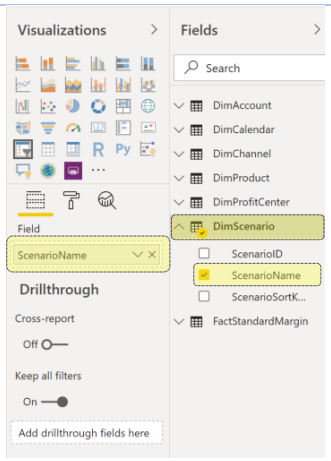
First, let’s explore the list of available Fields and Visualizations. In the same part of the window we can also quickly see any and all filters that are being used on any of our reports or visualizations	
Add a Matrix Visualization onto the report by	1. Click on the Matrix Visual. The new visualization will be added to the top left corner of the page.  
Now we can start to define the data in the report. We are going to start by adding some rows to the report.	2. Click on the Matrix Visualization in the report canvas 3. In the Visualizations Pane, we can define the data to be found in this Matrix by clicking the “Fields” icon 4. Click on the Chevron beside the DimAccount table to show all the available field. Drag and drop the following columsn into the “Rows” section of the Matrix

The rows of this report are going to be based on the Account Dimension.	 5. The crosstab will appear as follows:  6. We will look at drilling and expanding details in a moment
We will now add measure to this Matrix so we can begin to see some numbers. We will add the [Value] field to be able to see numbers in our Matrix.	7. Add the PL Value Field from “FactStandardMargin” to the “Values” area of the CrossTab as follows: 
The number, however, is not very meaningful because it there is no context and a lot of duplication is happening. For example, Actuals Data, Forecast Data, and Budget Data is all being	8. The Matrix will now appear as follows  To confirm this, the Filters pane will display the following:

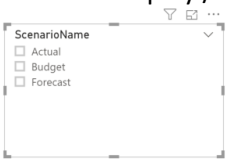
aggregated together, which is not meaningful.	
We now need to add filters to the report to have a meaningful data. The simplest way to add filters is with the "Slicer" visual to take advantage of the default behavior. A slicer is a way of filtering that narrows the portion of the dataset shown in the other visualizations in a report.	9. Click on the Slicer Visual 
A new Slicer Visual will appear on the report canvas	

Add the Scenario Name from the Scenarios table to this filter

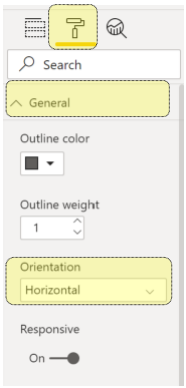
Select the “Forecast” Scenario when finished.



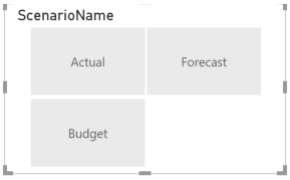
By default, the slicer will appear as a checkbox. There are many different ways to have the slicer display / behave. Here are a couple of the more popular options



To make it be a list of cards that can be toggled on/off:



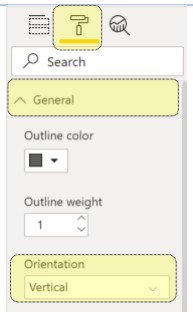
The slicer will now appear as follows:



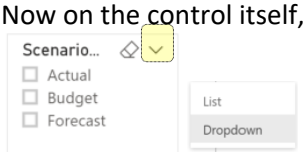
Based on resizing the filter box size, the orientation will automatically adjust:

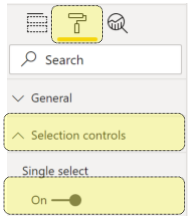


We wish to have this be a drop down item to minimize space. We also only want one single item to be available at a time



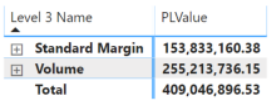
Now on the control itself, select drop down from the menu





We can now shrink the size of the filter and move it to the top of the report. Arrange the items on your page as follows:



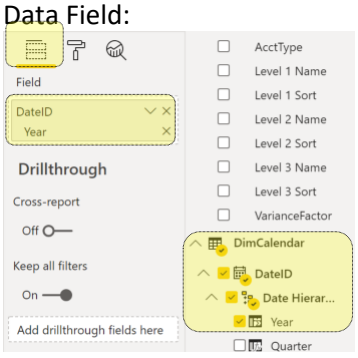


Level 3 Name	PLValue
Standard Margin	153,833,160.38
Volume	255,213,736.15
Total	409,046,896.53

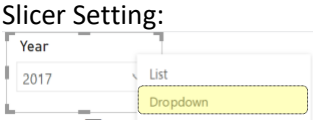
Add a filter to show a single Year as follows:

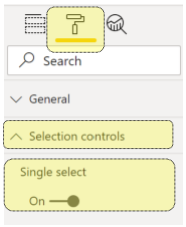
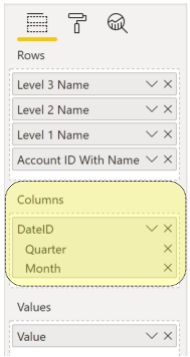
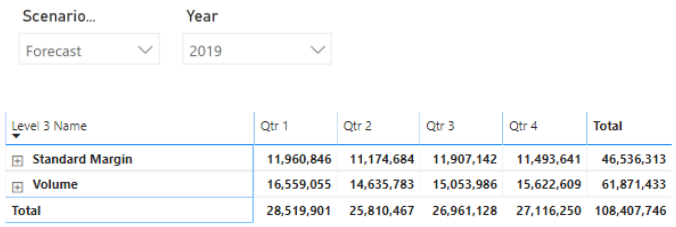
When finished, select 2019 as the Year Filter Value

Data Field:



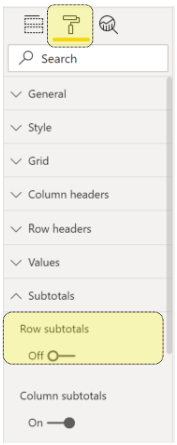
Slicer Setting:



	Format:  The values on the Matrix visual will change
Make columns of the report be the Months of the year	Click on the Matrix Visual Drag the Quarter field from the DateHierarchy found in the DimCalendar table to the "Columns" area of the visual. Drag the Month field from the DateHierarchy found in the DimCalendar table to the "Columns" area of the visual. 
Review progress so far	Your screen should now appear as follows:  Level 3 Name | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Total Standard Margin | 11,960,846 | 11,174,684 | 11,907,142 | 11,493,641 | 46,536,313 Volume | 16,559,055 | 14,635,783 | 15,053,986 | 15,622,609 | 61,871,433 Total | 28,519,901 | 25,810,467 | 26,961,128 | 27,116,250 | 108,407,746
The Matrix visual is now showing a grand total at the bottom which is the sum of all our Standard Margin Accounts plus volume.	The "Total" shown at the bottom of this report has no meaning. It is summing our Standard Margin + Volume, which doesn't make any sense in a business context Level 3 Name | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Total Standard Margin | 11,960,846 | 11,174,684 | 11,907,142 | 11,493,641 | 46,536,313 Volume | 16,559,055 | 14,635,783 | 15,053,986 | 15,622,609 | 61,871,433 Total | 28,519,901 | 25,810,467 | 26,961,128 | 27,116,250 | 108,407,746 To remove this we can remove the "Subtotals" from the visualization and that will make the undesired row at the bottom.

This total does not make sense as the Account Hierarchy is already set up to organize our data in a manner that creates our desired totals.

The Matrix visual has a lot of possible settings that will make this a very flexible presentation mechanism. We will discuss a few of these settings here, but everyone is encouraged to explore this independently.



Level 3 Name	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Total
Standard Margin	11,960,846	11,174,684	11,907,142	11,493,641	46,536,313
Volume	16,559,055	14,635,783	15,053,986	15,622,609	61,871,433

Let's now look at the sorting and Drill behavior in the Matrix.

Let's start by drilling down into the details of the Account Dimension.

We notice 2 things that are slightly troubling:

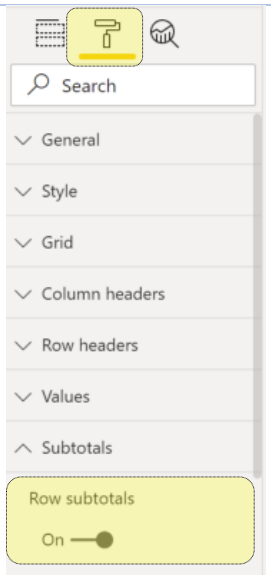
- "Cost of Sales" shows before "Net Sales". We don't like this order

Click on the [+] icon beside Standard Margin

Level 3 Name	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Total
Standard Margin					
Cost of Sales at Standard	-18,454,215	-16,912,776	-17,692,113	-17,787,508	-70,846,612
Net Sales	30,415,060	28,087,460	29,599,255	29,281,150	117,382,925
Volume	16,559,055	14,635,783	15,053,986	15,622,609	61,871,433

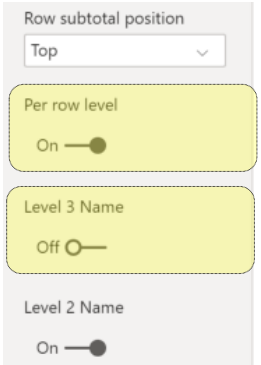
To fix the Subtotals, turn subtotals back on for the Matrix Visual:

- The "Standard Margin" total has disappeared. This was caused by our "Fix" done in the above step to turn off row subtotals. We need to find a more intelligent solution than simply turning off all Row Subtotals.



This will recreate the unwanted "Total" at the bottom of the report. We wish to turn this off without affecting every other item on the row set. Fortunately, this is something we can do by scrolling further down the pane to see "Per Row Level" under "Subtotals"

The default will be set to "On", but by turning off the "Level 3 Name" , we have removed the unwanted tow at the bottom of the report, while still keeping the "Standard Margin" subtotal that is



Level 3 Name	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Total
Standard Margin	11,960,846	11,174,684	11,907,142	11,493,641	46,536,313
Cost of Sales at Standard	-18,454,215	-16,912,776	-17,692,113	-17,787,508	-70,846,612
Net Sales	30,415,060	28,087,460	29,599,255	29,281,150	117,382,925
Volume	16,559,055	14,635,783	15,053,986	15,622,609	61,871,433

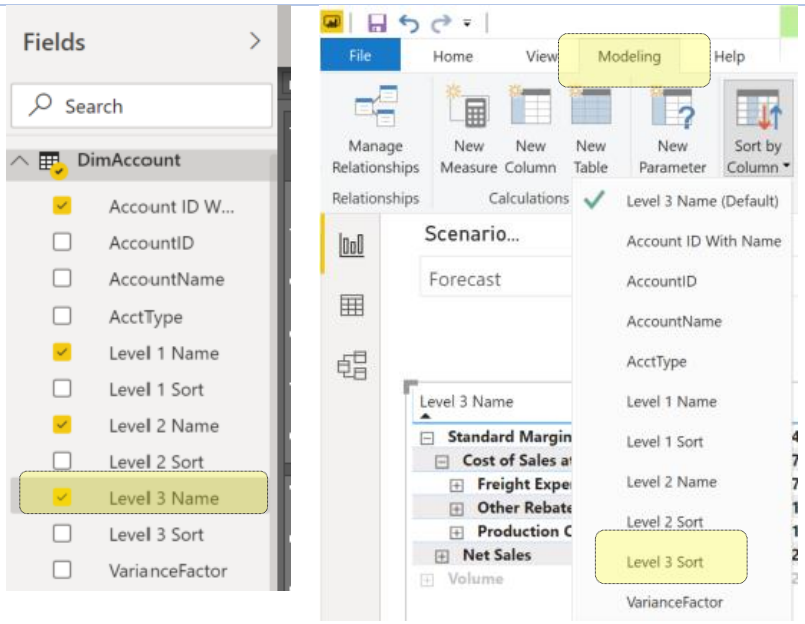
Update the Sort Key for each of the levels on the report

Each Level of the Account Dimension has a corresponding

For each Level Defined as the rows of the report:

1. Click on the Name in the "Fields" pane
2. Click on the Modelling Ribbon > Sort by Column > Choose the appropriate Sort Key

Sort Key Defined.



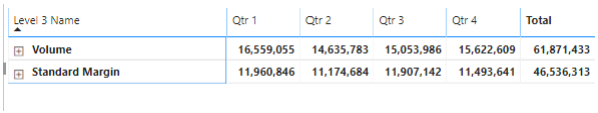
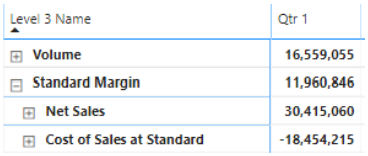
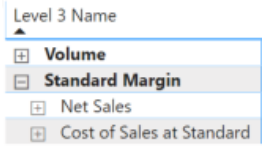
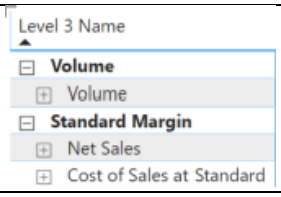
Repeat the above Steps for each level of the crosstabl.

This setting will be global and will be applied to all your visuals using these fields, so they won't need to be repeated over again.

Let's examine the Drill Behavior now.

There are a couple of ways of drilling on the matrix visual:

- You can click on the [+] icon on any of the row headers (note that these icons may be turned off in the "Row Headers" Section of the matrix visual format if desired

Click Here:	Results In:
	
Right Click > Expand > Selection	
Right Click > Expand > Entire Level	

- You can right-click on any of the elements in the Matrix

- You may use the drill down buttons on the visual

Right Click > Expand > All



Using the Drill Buttons on the Visual



Define whether the controls work on Rows or Columns



Toggle Drilling Down on or off



Go One level down in the hierarchy



Item being drilled on will no longer be visible
Expand All One Level
The same as clicking the [+] sign beside each visible item on the visual.

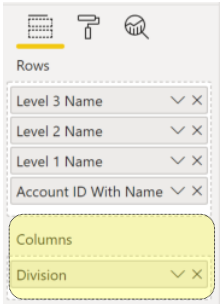


With Power BI you may easily swap out rows or columns to slice and dice your visuals along different dimension

We will now look at the data to be able to see aa P&L by Division instead of by Period

We also wish to stop displaying pennies on the

Remove the columns from the visual
Drag the Division field from the "DimProfitCenter" table to the Columns



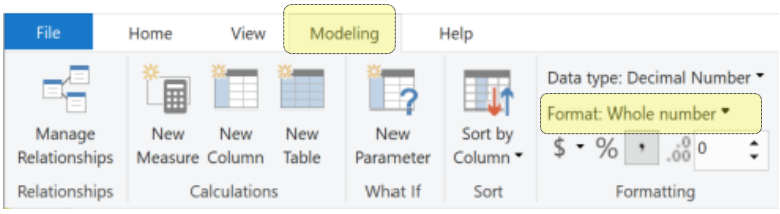
The report canvas will now show the following:

report as they are distracting to the overall effect

Level 3 Name	Commercial	Industrial	Residential	Total
Volume	**23,203,872.03**	**1,840,644.05**	**36,826,916.99**	**61,871,433.07**
Standard Margin	**17,289,617.78**	**2,568,709.57**	**26,677,985.69**	**46,536,313.04**
Net Sales	**50,883,778.73**	**4,235,685.67**	**62,263,460.81**	**117,382,925.21**
Gross Sales	**65,305,870.17**	**4,680,979.98**	**71,030,748.89**	**141,017,599.04**
30000: Sales	65,095,291.75	4,571,525.90	70,664,015.06	**140,330,832.71**
30005: Restocking Charges	29,269.82	1,528.73	34,369.70	**65,168.25**
30007: Cut Fees	169,970.91	106,410.44	326,667.50	**603,048.85**
30008: Sales - Other	0.00	0.00	-6,296.29	**-6,296.29**
30009: Other Revenue	993.19	0.54	10,853.30	**11,847.03**
30023: Sales - Intercompany	10,344.50	1,514.37	1,139.62	**12,998.49**
Sales Discounts	**-11,332,331.10**	**-262,033.57**	**-6,029,391.69**	**-17,623,756.36**
30100: Program Rebates	-8,158,458.05	-261,645.73	-4,054,267.68	**-12,474,371.46**
30120: Selling Discounts	-54,670.06		-79,894.32	**-134,564.38**
30200: Promo Rebates	-3,119,202.99	-387.84	-1,895,229.69	**-5,014,820.52**
All Volume Rebates	**-2,002,508.57**	**-116,167.70**	**-1,616,313.67**	**-3,734,989.94**
30220: Volume Rebates - Special Agreements	-68,152.48		-53,192.15	**-121,344.63**
30300: Volume Rebates	-1,857,488.42	-116,167.70	-1,191,013.47	**-3,164,669.59**
30301: Volume Rebates - Other	-49,261.25		-156,465.09	**-205,726.34**
30310: Builder Rebates	-27,606.42		-215,642.96	**-243,249.38**
Other Rebates and Discounts	**-1,087,251.77**	**-67,093.04**	**-1,121,582.72**	**-2,275,927.53**
30400: Claims & Allowances	-959,517.11	-54,776.81	-1,057,954.46	**-2,072,248.38**
30500: Cash Discounts	-127,734.66	-12,316.23	-63,628.26	**-203,679.15**
Cost of Sales at Standard	**-33,594,160.95**	**-1,666,976.10**	**-35,585,475.12**	**-70,846,612.17**
Other Rebates and Discounts	**-32,660.31**		**-40,499.55**	**-73,159.86**
30210: Spiff Rebates	-32,660.31		-40,499.55	**-73,159.86**
Freight Expense	**-1,243,606.69**	**-101,770.10**	**-1,172,911.43**	**-2,518,288.22**
30610: Freight	-300,246.90	-3,843.08	-630,531.52	**-934,621.50**
30611: Freight - West	-650,389.91	-78,756.53	-373,515.29	**-1,102,661.73**
30612: Freight - Mid-West	-292,969.88	-19,170.49	-168,864.62	**-481,004.99**
Production Cost	**-32,317,893.95**	**-1,565,206.00**	**-34,372,064.14**	**-68,255,164.09**
40000: Cost of Goods Sold	-32,312,440.89	-1,564,014.10	-34,371,250.92	**-68,247,705.91**
40008: Cost of Goods Sold - Other	-104.41			**-104.41**
40023: COGS - Intercompany	-5,348.65	-1,191.90	-813.22	**-7,353.77**

To remove the decimals in the chart to remove the pennies which are causing clutter, simply format the measure being displayed on the matrix.

- Click on the PL Value field in the [Fields] Pan
- Click the “Modelling Ribon”
- In the “Format” button, select “Whole Number”



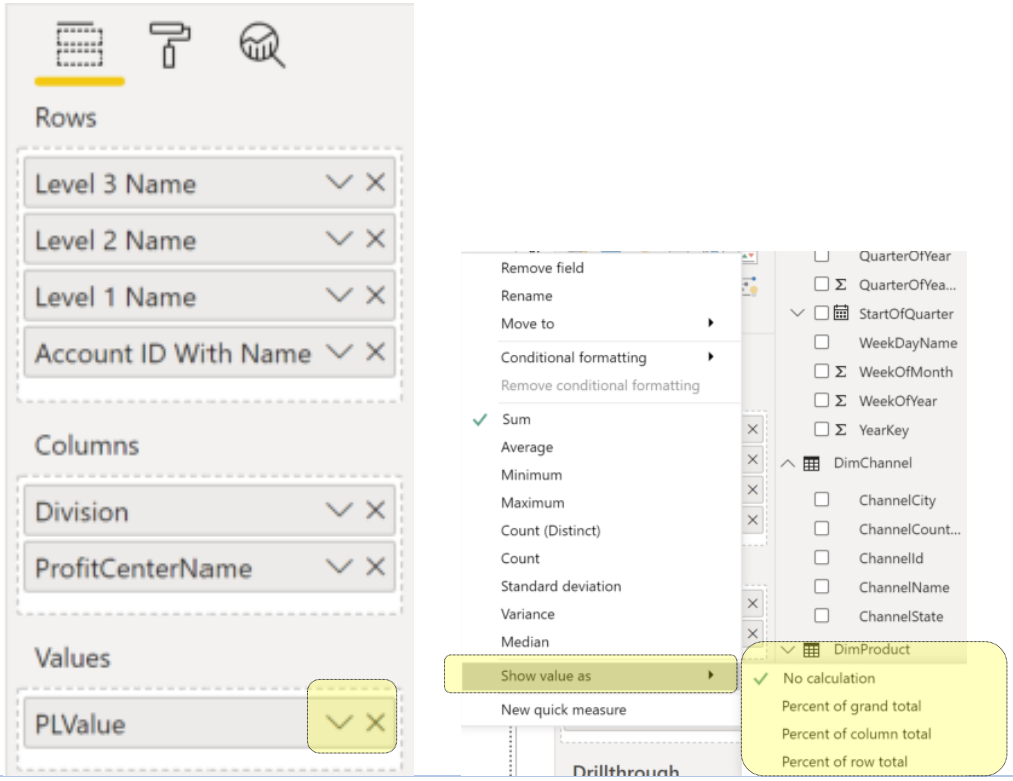
Caution!!

Make sure to select “Format” and not “Data Type”.

“Format” controls how the number is displayed in the visuals.

“Data Type” will change the way that the numbers are physically stored in the model. Changing the data type may cause data loss

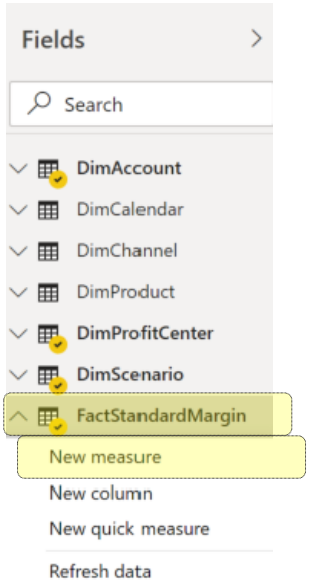
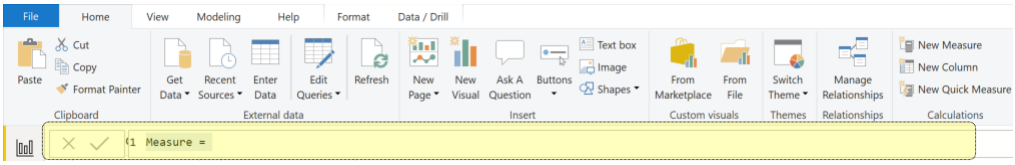
---

Explore other Matrix Formatting Options at your leisure and convenience	Consider investigating the following settings to get the look that is most appealing to you: Style Choose from one of the predefined styles as a starting point Grid Row Padding, colors, font sizes Column Headers / Row Headers Formatting of the column headers and row headers Consider showing Values as a % of total to see how performance and profitability breaks down by division 
Save your Power BI file.	

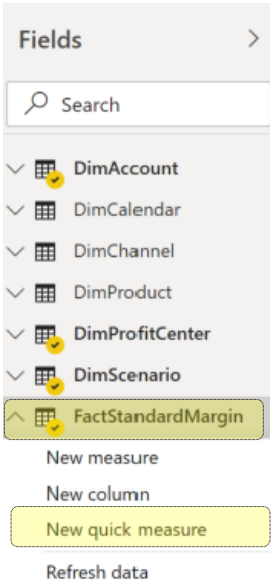
11.3 Exercise 2.2: Creating Basic Financial Measures

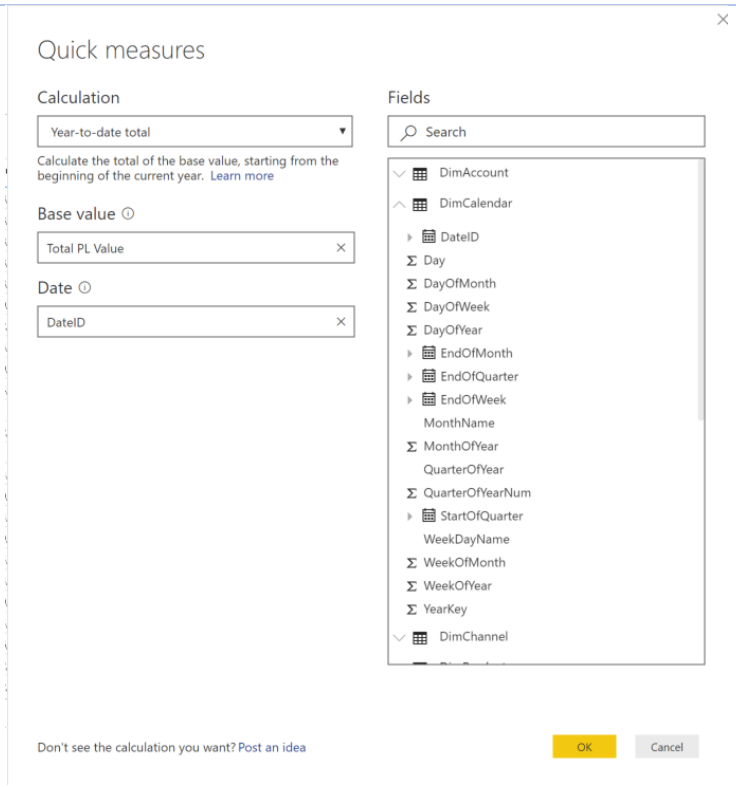
What we have done so far has been useful for being able to explore our data in its raw form. However, we need to be able to create additional metric in order to perform meaningful analysis.

Specifically, we will create some measures for simple aggregations, calculating filtered totals, as well as some basic variance analysis.

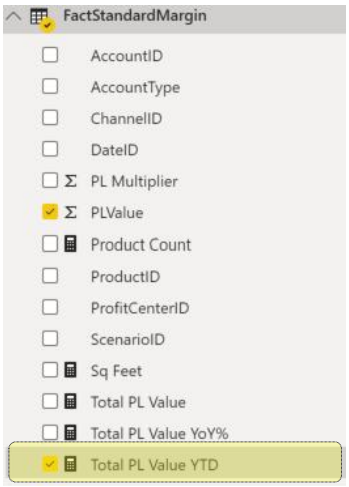
We will want to be able do some analysis to see how our forecast data compares to prior year information	Start by Creating a Measure based on our [PL Value] field that will be a summary of this field. By default, Power BI has been summarizing our values, but it is best practice to be explicit about how our number should behave when showing above the base level on all our dimensions. We can also use this measure for an argument in the calculation of other measures. Right Click on the [FactStandardMargin] table and select "New Measure"  In the formula bar at the top, enter a DAX expression to define the calculation  DAX could be a lesson as its own course, for today we will stick with very basic formulae. Enter the following: `Total PL Value = Sum(FactStandardMargin[PLValue])`

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	A new measure will now be created called [Total PL Value] which can be used for our other calculations. This measure is the one that SHOULD be placed in all visuals instead of the [PL Value] column.
Calculate YTD Values: While we can already see full year values for our forecast or our budget data, it is also very nice to be able to see the Year To Date value for any given period. This is especially useful when we wish to compare our Actual Data compare to Budget. Since at any given point during the year, it is not meaningful to compare the Budget for the year vs the Actual Values we have only accumulated for a portion of the year.	Right Click on the [FactStandardMargin] table and select "New Quick Measure" You can use Quick measures to quickly and easily perform common calculations. A Quick measure creates a set of DAX commands behind the scenes (you don't have to write the DAX – it's done for you) based on input you provide in a dialog box. Best of all, you can see the DAX that's executed by the Quick measure and jump-start or expand your own DAX knowledge.  Take a moment to peruse the various calculation types to see which ones look promising for using in your organization. More information is available on quick measures here: https://docs.microsoft.com/en-us/power-bi/desktop-quick-measures Populate the Quick Measures dialog as follows:



A new measure called “Total PL Value YTD” will be created

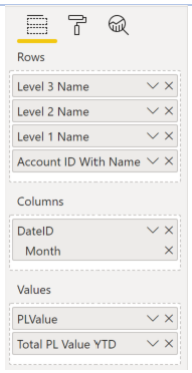


As an added bonus, we can also see the DAX expression that was created by clicking on the measure. This will help us learn more DAX to use in the future.



We can test this new measure calculates correctly by making the crosstab of our

report show months across the columns and display both the [Total PL Value] and [Total PL Value YTD] measures



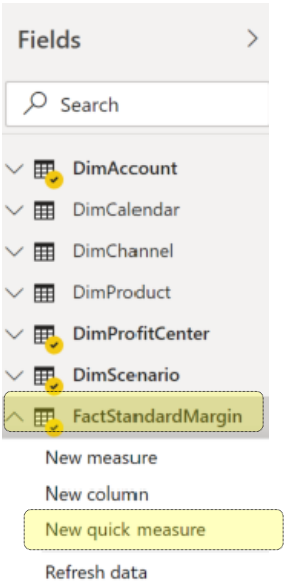
We can see that the [Total PL Value YTD] measure is calculated by summing all periods up to that point in time together.

Standard Margin Summary by Division

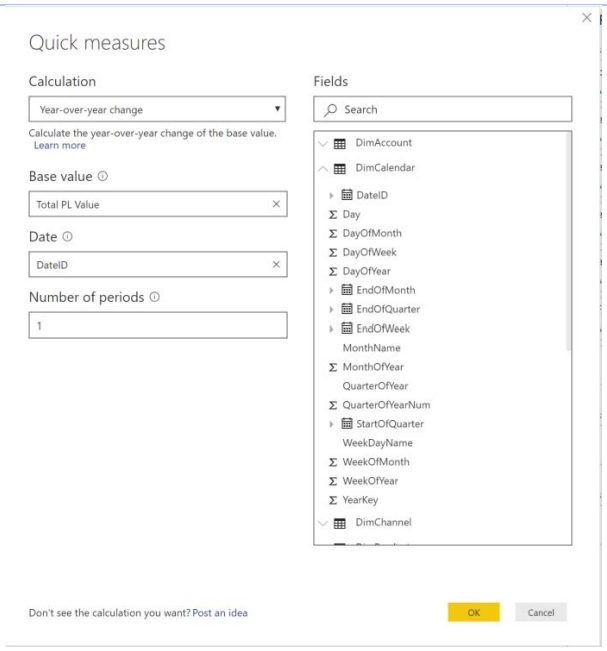
Month	January		February		March		April	
Level 3 Name	PLValue	Total PL Value YTD	PLValue	Total PL Value YTD	PLValue	Total PL Value YTD	PLValue	Total PL Value YTI
⊞ Volume	31,768,192	31,768,192.37	10,140,062	41,908,254.62	25,666,658	67,574,912.87	19,482,354	87,057,267.0
⊟ Standard Margin	19,575,182	19,575,182.44	5,093,371	24,668,553.09	14,954,872	39,623,424.64	11,149,064	50,772,488.1
⊟ Net Sales	55,322,116	55,322,116.19	16,008,175	71,330,291.67	43,098,021	114,428,312.49	33,174,781	147,603,093.1
⊟ Gross Sales	67,497,894	67,497,894.11	20,624,810	88,122,704.35	53,537,769	141,660,473.22	41,104,710	182,765,183.5

It is also necessary to calculate the prior year value so that we will be able to compare vs last year.

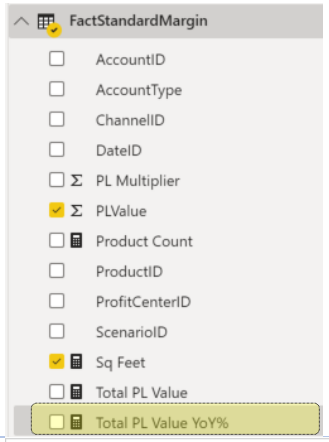
Ther is a quick measure that will claculate a Year Over Year % variance. We can use the DAX from this measure to create the Prior Year Amount. This will be useful



Fill out the Quick Measures Dialog box as follows:



The newly created measure is created as follows:



Examine the generated MDX.

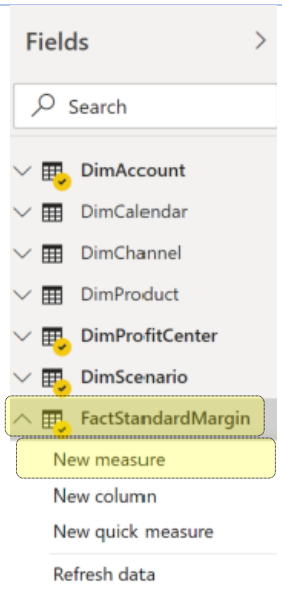
With a little bit of analysis, we can see how the DAX is generated to calculate the Prior Year value

```
Total PL Value YoY% =
IF(
    ISFILTERED('DimCalendar'[DateID]),
    ERROR("Time intelligence quick measures can only be grouped or filtered by the Power BI-provided date hierarchy or primary date co
    VAR __PREV_YEAR =
        CALCULATE(
            [Total PL Value],
            DATEADD('DimCalendar'[DateID].[Date], -1, YEAR)
        )
    RETURN
        DIVIDE([Total PL Value] - __PREV_YEAR, __PREV_YEAR)
)
```


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Create a New Measure that is the Prior Year Value.

This will be useful to us if we need to create reports that show current year and prior year side by side.

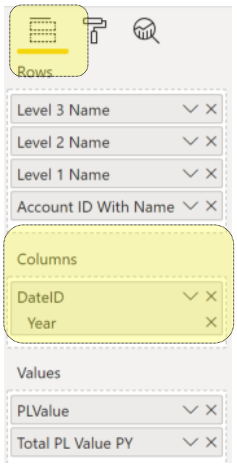


Type the following MDX (Copy / Past from highlighted section above):

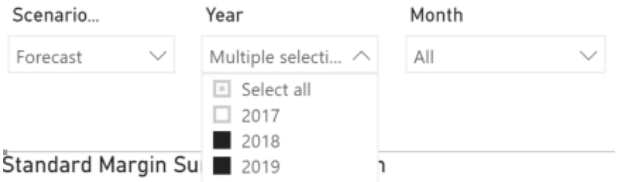
```
Total PL Value PY = CALCULATE(
      [Total PL Value],
      DATEADD('DimCalendar'[DateID].[Date], -1, YEAR))
```

Test the new measure by updating our matrix visual to show 2 years side by side. The [Total PL Value PY] column should be identical to the [PL Value] column from the year before.

Drag the Years as columns of the report

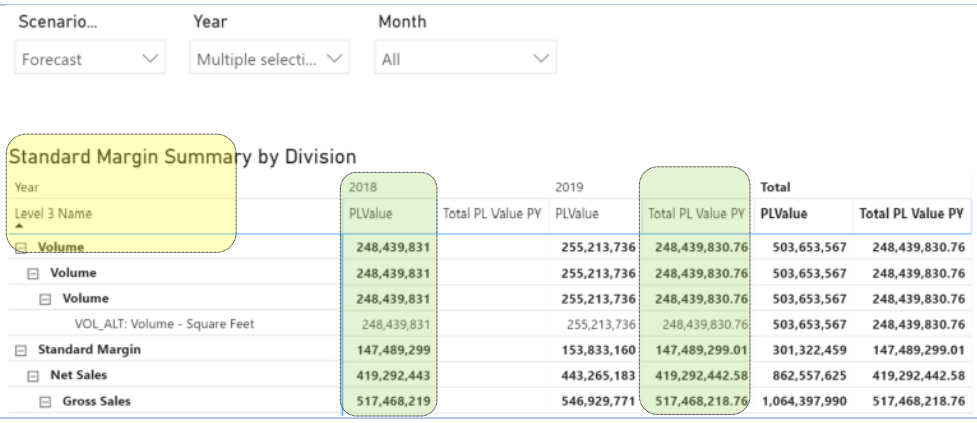


Make sure the years have 2019 and 2018 selected. And the scenario is set to "Forecast"



The Matrix visual should appear as follows:

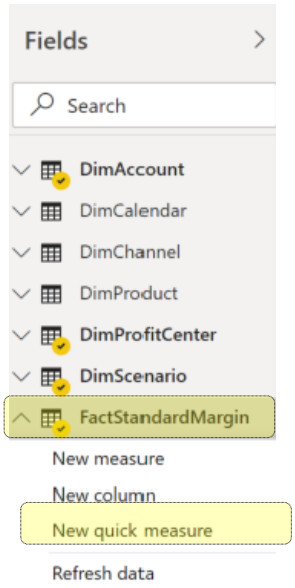
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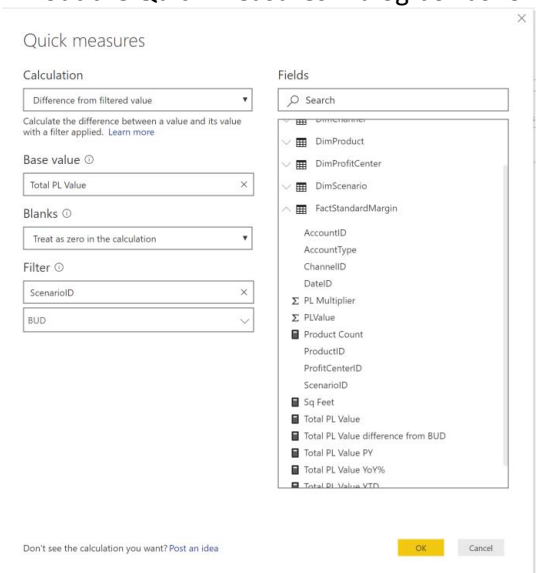
Now we want to be able to create a variance to our Budget Value.

Budget Values will always be stored in a version that is identified as "BUD"

Let's begin with the same approach as before, by creating a new Quick Measure



Fill out the Quick Measures Dialog box as follows:



A new measure will be created as follows:

```
Total PL Value difference from BUD =
VAR __BASELINE_VALUE = CALCULATE([Total PL Value], 'FactStandardMargin'[ScenarioID] IN { "BUD" })
VAR __MEASURE_VALUE = [Total PL Value]
RETURN
    IF(NOT ISBLANK(__MEASURE_VALUE), __MEASURE_VALUE - __BASELINE_VALUE)
```

Let's test the new measure by stacking [PLValue] and [Total PL Value difference from BUD] side by side in our matrix for 2019.

We can create a simple visual:

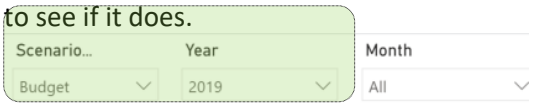


Standard Margin Summary by Division

Year	2019	
Level 3 Name	PLValue	Total PL Value difference from BUD
⊞ **Volume**	**255,213,736**	**255,213,736.15**
⊟ **Standard Margin**	**153,833,160**	**153,833,160.38**
⊟ **Net Sales**	**443,265,183**	**443,265,182.89**
⊞ Gross Sales	546,929,771	546,929,771.49
⊞ Sales Discounts	-79,201,232	-79,201,232.40
⊞ All Volume Rebates	-14,899,002	-14,899,001.93
⊞ Other Rebates and Discounts	-9,564,354	-9,564,354.27
⊞ **Cost of Sales at Standard**	**-289,432,023**	**-289,432,022.51**

It looks like our variance is the same as our [PL Value] for every row. But….why?!?!?

First, let's go check our budget data. Does it exist? Let's change our Scenario Filter to see if it does.



Standard Margin Summary by Division

Year	2019	
Level 3 Name	PLValue	Total PL Value difference from BUD
⊞ **Volume**	**273,002,196**	**0.00**
⊟ **Standard Margin**	**165,642,926**	**0.00**
⊟ **Net Sales**	**477,448,391**	**0.00**
⊞ Gross Sales	593,068,163	0.00
⊞ Sales Discounts	-89,570,506	0.00
⊞ All Volume Rebates	-15,338,900	0.00
⊞ Other Rebates and Discounts	-10,710,365	0.00
⊞ **Cost of Sales at Standard**	**-311,805,465**	**0.00**

We can see that this data exists. And our variance = 0, which is completely expected.

Let's look at the Dax Expression we used to calculate our variance.

```
Total PL Value difference from BUD =
VAR __BASELINE_VALUE = CALCULATE([Total PL Value], 'FactStandardMargin'[ScenarioID] IN { "BUD" })
VAR __MEASURE_VALUE = [Total PL Value]
RETURN
    IF(NOT ISBLANK(__MEASURE_VALUE), __MEASURE_VALUE - __BASELINE_VALUE)
```

The reason we are having a problem is because the "CALCULATE" DAX function applies a filter to the data in the extract (ScenarioID = "BUD"). Our slicer at the top of the report is also applying a filter to our data (Scenario = "Forecast"). So, in our formula above:

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- VAR__BASELINEVALUE is pulling everything where the Scenario is both Budget and Scenario at the same time. Since no records will every satisfy both criteria simultaneously, this will always be 0

So what can we do about this?

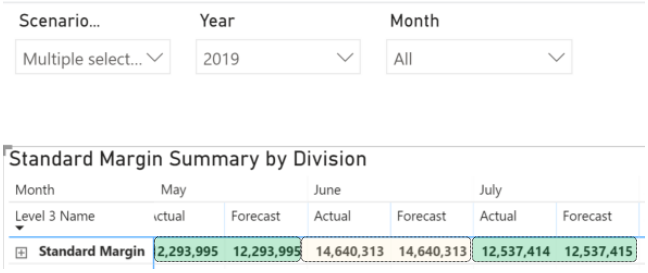
Our data is structured as follows:

- The [Forecast] version is made up of Actual Data all the way up to July 2019
- Periods AFTER July 2019 have forecast data but no actual data.

We will address this by removing the Scenario slicer from the report. But as we discussed earlier, without this slicer, [Total PL Value] will sum values from All Scenarios. The solution we will undertake is to create a new Measures to us in the place of [Total PL Value] to always be filtered on the "FCST" version

This will work if the "Forecast" version continues to be updated with Actual values as new actual data becomes available. If the Forecast is

Comparing the Actual and Forecast Version up until July shows the following:



Create a **New** Measure: FCST Total PL Value as follows:

```
FCST Value = CALCULATE([Total PL Value], 'FactStandardMargin'[ScenarioID] IN { "FCST" })
```

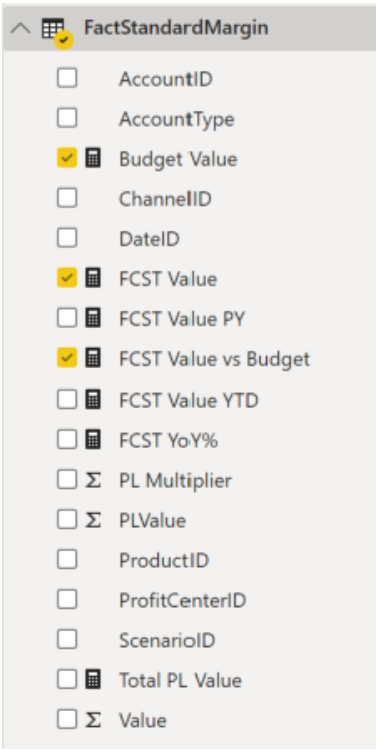
Update the following measures to replace [Total PL Value] in the DAX expression with [FCST Total PL Value]

Total PL Value difference from BUD Rename measure	FCST Value vs BUD = VAR __BASELINE_VALUE = CALCULATE([Total PL Value], 'FactStandardMargin'[ScenarioID] IN { "BUD" }) VAR __MEASURE_VALUE = [FCST Value] RETURN IF(NOT ISBLANK(__MEASURE_VALUE), __MEASURE_VALUE - __BASELINE_VALUE)
Total PL Value PY Rename measure	FCST Value PY = CALCULATE([FCST Value], DATEADD('DimCalendar'[DateID].[Date], -1, YEAR))
Total PL Value YoY% Rename measure	FCST YoY% = IF(ISFILTERED('DimCalendar'[DateID]), ERROR("Time intelligence quick measures can only be grouped or filtered by the Power BI-provided date hierarchy or primary date column."), VAR __PREV_YEAR = CALCULATE([FCST Value], DATEADD('DimCalendar'[DateID].[Date], -1, YEAR)) RETURN DIVIDE([FCST Value] - __PREV_YEAR, __PREV_YEAR))
Total PL Value YTD Rename measure	FCST Value YTD = IF(ISFILTERED('DimCalendar'[DateID]), ERROR("Time intelligence quick measures can only be grouped or filtered by the Power BI-provided date hierarchy or primary date column."), TOTALYTD([FCST Value], 'DimCalendar'[DateID].[Date]))
Total PL Value YoY%	FCST YoY% = IF(ISFILTERED('DimCalendar'[DateID]),

updated less frequently (e.g. Forecast is only revisited on a quarterly basis), then extra measures may be required for this analysis to be able to compare ACTUAL data to prior year and Budget where it is not the same data as found in the Forecast.

Rename measure	ERROR("Time intelligence quick measures can only be grouped or filtered by the Power BI-provided date hierarchy or primary date column."), VAR __PREV_YEAR = CALCULATE([FCST Value], DATEADD('DimCalendar'[DateID].[Date], -1, YEAR)) RETURN DIVIDE([FCST Value] - __PREV_YEAR, __PREV_YEAR))

This list of measures should now appear as follows:



Test the newly created measures by adding them to the Matrix

To see the newly created measures on the visual, simply add them to the Values area of the Control.

For example, if you define the values as follows:



The Matrix will now display as follows:

Level 3 Name	FCST Value	Budget Value	FCST Value vs Budget
Volume	**61,871,433**	**67,699,724**	**-5,828,290.89**
Standard Margin	**46,536,313**	**54,242,070**	**-7,705,757.45**
Net Sales	**117,382,925**	**132,274,289**	**-14,891,363.35**
Gross Sales	**141,017,599**	**156,654,145**	**-15,636,545.55**
30000: Sales	140,330,833	155,956,600	-15,625,767.68
30005: Restocking Charges	65,168	14,755	50,412.85
30007: Cut Fees	603,049	686,488	-83,439.31
30008: Sales - Other	-6,296	-5,144	-1,152.76
30009: Other Revenue	11,847	1,444	10,402.86
30023: Sales - Intercompany	12,998		12,998.49
Sales Discounts	**-17,623,756**	**-17,871,273**	**247,516.57**
30100: Program Rebates	-12,474,371	-4,604,989	-7,869,382.57
30120: Selling Discounts	-134,564	-260,002	125,437.96
30200: Promo Rebates	-5,014,821	-13,006,282	7,991,461.18
All Volume Rebates	**-3,734,990**	**-3,971,053**	**236,063.22**
30220: Volume Rebates - Special Agreements	-121,345	-147,830	26,485.73
30300: Volume Rebates	-3,164,670	-3,349,121	184,451.76
30301: Volume Rebates - Other	-205,726	-223,402	17,675.85
30310: Builder Rebates	-243,249	-250,699	7,449.88

11.4 Exercise 2.3: Rate / Volume Variance Calculations

This exercise will cover how we can do the following based on the structure of our sample data:

- Calculate Rate / Unit for our different PL Lines
- Calculate a simple Rate / Volume Variance to get better understanding of our variances

It is a common requirement to be able to view a unit rate for the various lines on our P&L report.

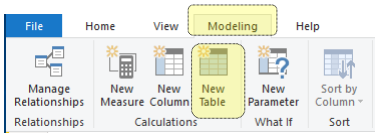
In our example, we wish to see a [Rate per Square foot] on every line of the report. To do this, we need to find a way to repeat the VOL_ALT value for every line so we can create a formula that will replicate for every item in DimAccount.

Start by creating a new fact table that will ONLY contain volume data.

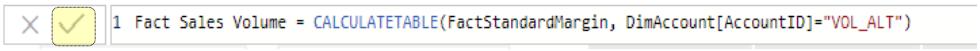
This table can then be joined to the other tables in the model to be used in our calculations.

Note that this is just one possible way of solving this issue. Different solutions may be modelled depending on the layout of source data.

Click on the Modeling Tab, and select "New Table"

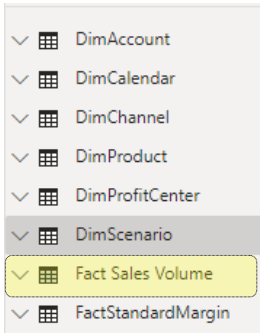


In the Formula Bar, type the following:

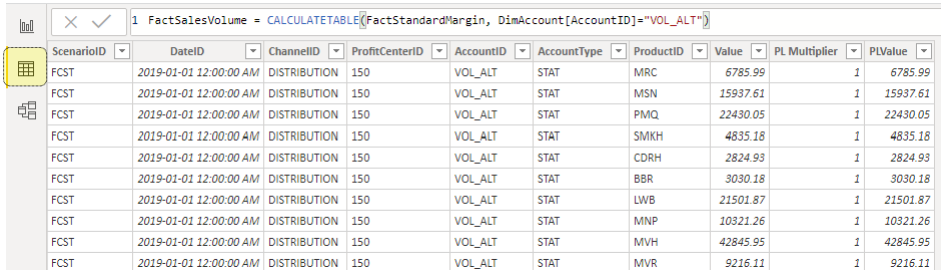


Click the check mark to commit the change

A new table will be created to reflect this new change



To see exactly what is in this table, click the "Data" Section in the canvas and click on the "FactSalesVolume" table in the "Fields" pane. The table appears as follows:



ScenarioID	DateID	ChannelID	ProfitCenterID	AccountID	AccountType	ProductID	Value	PL Multiplier	PLValue
FCST	2019-01-01 12:00:00 AM	DISTRIBUTION	150	VOL_ALT	STAT	MRC	6785.99	1	6785.99
FCST	2019-01-01 12:00:00 AM	DISTRIBUTION	150	VOL_ALT	STAT	MSN	15937.61	1	15937.61
FCST	2019-01-01 12:00:00 AM	DISTRIBUTION	150	VOL_ALT	STAT	PMQ	22430.05	1	22430.05
FCST	2019-01-01 12:00:00 AM	DISTRIBUTION	150	VOL_ALT	STAT	SMKH	4835.18	1	4835.18
FCST	2019-01-01 12:00:00 AM	DISTRIBUTION	150	VOL_ALT	STAT	CDRH	2824.93	1	2824.93
FCST	2019-01-01 12:00:00 AM	DISTRIBUTION	150	VOL_ALT	STAT	BBR	3030.18	1	3030.18
FCST	2019-01-01 12:00:00 AM	DISTRIBUTION	150	VOL_ALT	STAT	LWB	21501.87	1	21501.87
FCST	2019-01-01 12:00:00 AM	DISTRIBUTION	150	VOL_ALT	STAT	MNP	10321.26	1	10321.26
FCST	2019-01-01 12:00:00 AM	DISTRIBUTION	150	VOL_ALT	STAT	MVH	42845.95	1	42845.95
FCST	2019-01-01 12:00:00 AM	DISTRIBUTION	150	VOL_ALT	STAT	MVR	9216.11	1	9216.11

Notice that our new table only contains records where the AccountId = VOL_ALT

Similar to our earlier fact table, we will create measures as follows:

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```
Total SQ Feet  sum('FactSalesVolume'[Value])

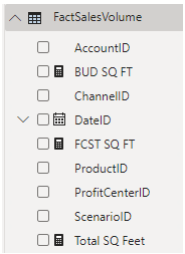
FCST SQ FT  CALCULATE([Total SQ Feet],
            'FactSalesVolume'[ScenarioID] = "FCST")

BUD SQ FT  CALCULATE([Total SQ Feet],
           ‘FactSalesVolume’[ScenarioID] = “BUD”)
```

Hide the following columns by Right clicking on them and selecting “Hide in Report View”. This will help to avoid clutter for report authors when navigating the data

- Account Type
- Account ID
- PL Multiplier
- PL Value
- Value

When you go back to the “Report View”, the new table should appear as follows:



After creating our new fact table, we need to examine the relationships that it has to the other tables in our model to make sure everything is going to render as expected.

Click on the “Model” icon to view the table relationships:



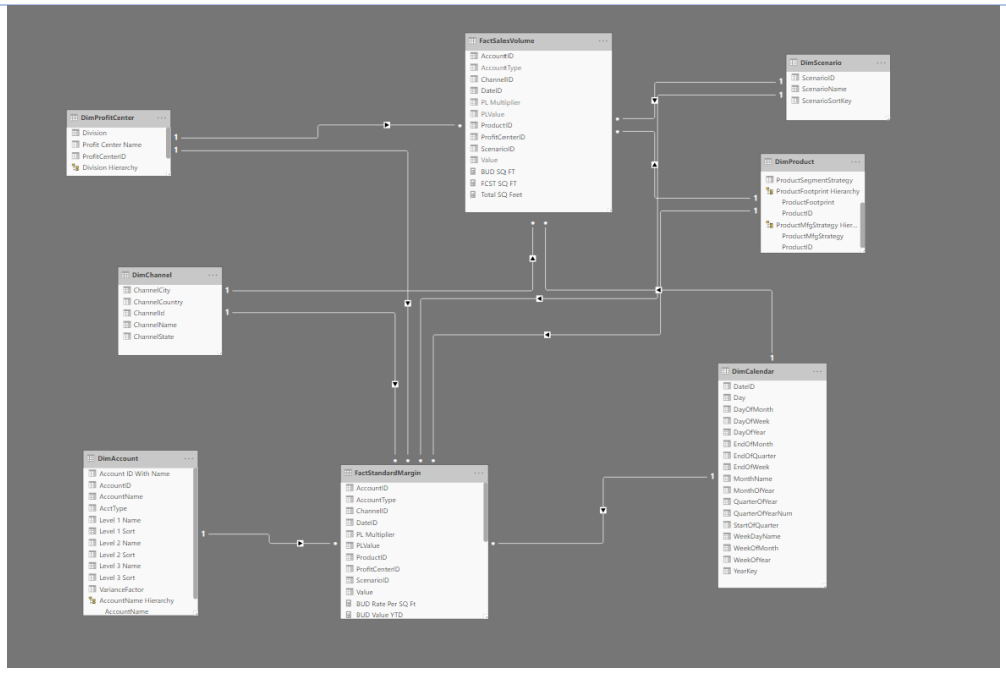
The [Fact Sales Volume] table needs to join to the following tables:

- DimChannel
- DimProduct
- DimProfitCenter
- DimScenario
- DimCalendar

Notice that we are **not** joining this table to DimAccount. That is because we want to see records repeat from this table for Every account (so we can calculate a Rate / SQ Foot for every account)

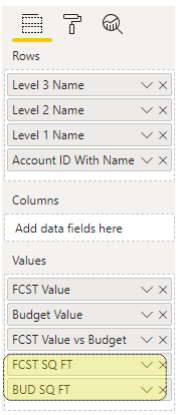
Drag and drop the respective ID fields from the Dim table to “Fact Sales Volume”

When you are finished, the Relationship diagram should look like this:



Now let's see what happens when we try to add our new measures to the report.

Go back to the Report canvas and look at the Crosstab created earlier. Add the new measures we just created from the [Fact Sales Volume] table as follows:



Level 3 Name	FCST Value	Budget Value	FCST Value vs Budget	FCST SQ FT	BUD SQ FT
Volume	**61,871,433**	**67,699,724**	**-5,828,290.89**	**61,871,433.07**	**67,699,723.96**
Volume	**61,871,433**	**67,699,724**	**-5,828,290.89**	**61,871,433.07**	**67,699,723.96**
Volume	**61,871,433**	**67,699,724**	**-5,828,290.89**	**61,871,433.07**	**67,699,723.96**
VOL_ALT: Volume - Square Feet	61,871,433	67,699,724	-5,828,290.89	61,871,433.07	67,699,723.96
Standard Margin	**46,536,313**	**54,242,070**	**-7,705,757.45**	**61,871,433.07**	**67,699,723.96**
Net Sales	**117,382,925**	**132,274,289**	**-14,891,363.35**	**61,871,433.07**	**67,699,723.96**
Gross Sales	**141,017,599**	**156,654,145**	**-15,636,545.55**	**61,871,433.07**	**67,699,723.96**
30000: Sales	140,330,833	155,956,600	-15,625,767.68	61,871,433.07	67,699,723.96
30005: Restocking Charges	65,168	14,755	50,412.85	61,871,433.07	67,699,723.96
30007: Cut Fees	603,049	686,488	-83,439.31	61,871,433.07	67,699,723.96
30008: Sales - Other	-6,296	-5,144	-1,152.76	61,871,433.07	67,699,723.96
30009: Other Revenue	11,847	1,444	10,402.86	61,871,433.07	67,699,723.96

We see that the same volume amouns shows on every line, which will help us with the next step, which is to calculate a rate / sq foot.

This Rate / SQ Foot measures will be calculated in the "FactStandardMargin" table because it needs to calculate for every account.

Create 2 new measures in the [FactStandardMargin] table as follows:

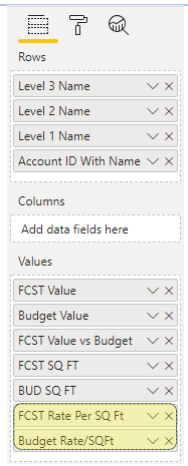
```
BUD Rate Per SQ Ft    DIVIDE([Budget Value], [BUD SQ FT])

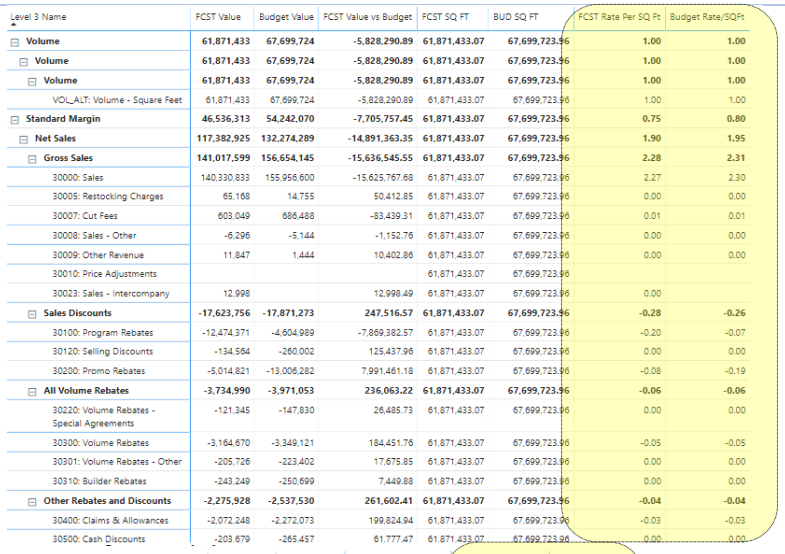
BUD Rate Per SQ Ft    DIVIDE([Budget Value], [FCST SQ FT])
```

Now let's add the new Rate / SQ Foot

Adding these 2 new measures will show us how our data is doing on a unit basis.

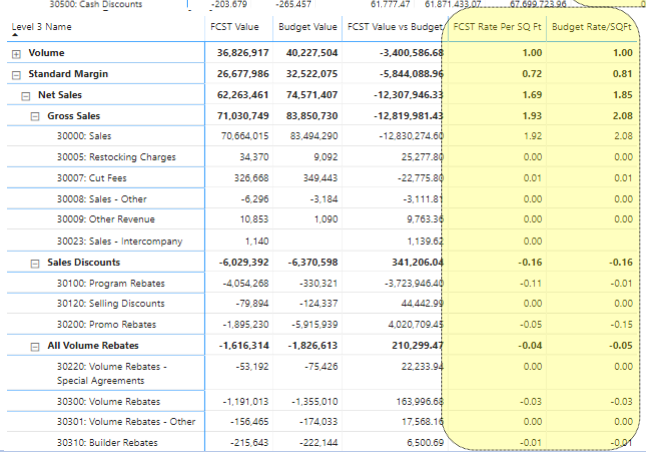
measures to the Matrix controls we were examining earlier so we can verify the calcutions.





Level 3 Name	FCST Value	Budget Value	FCST Value vs Budget	FCST SQ FT	BUD SQ FT	FCST Rate Per SQ Ft	Budget Rate/SQFt
Volume	61,871,433	67,699,724	-5,828,290.89	61,871,433.07	67,699,723.96	1.00	1.00
Volume	61,871,433	67,699,724	-5,828,290.89	61,871,433.07	67,699,723.96	1.00	1.00
Volume	61,871,433	67,699,724	-5,828,290.89	61,871,433.07	67,699,723.96	1.00	1.00
VOL_ALT: Volume - Square Feet	61,871,433	67,699,724	-5,828,290.89	61,871,433.07	67,699,723.96	1.00	1.00
Standard Margin	46,536,313	54,242,070	-7,705,757.45	61,871,433.07	67,699,723.96	0.75	0.80
Net Sales	117,382,925	132,274,289	-14,891,363.35	61,871,433.07	67,699,723.96	1.90	1.95
Gross Sales	141,017,599	156,654,145	-15,636,545.55	61,871,433.07	67,699,723.96	2.28	2.31
30000: Sales	140,330,833	155,956,600	-15,625,767.68	61,871,433.07	67,699,723.96	2.27	2.30
30005: Restocking Charges	65,168	14,755	50,412.85	61,871,433.07	67,699,723.96	0.00	0.00
30007: Cut Fees	603,049	686,488	-83,439.31	61,871,433.07	67,699,723.96	0.01	0.01
30008: Sales - Other	-6,296	-5,144	-1,152.76	61,871,433.07	67,699,723.96	0.00	0.00
30009: Other Revenue	11,847	1,444	10,402.86	61,871,433.07	67,699,723.96	0.00	0.00
30010: Price Adjustments				61,871,433.07	67,699,723.96		
30023: Sales - Intercompany	12,998		12,998.49	61,871,433.07	67,699,723.96	0.00	
Sales Discounts	-17,623,756	-17,871,273	247,516.57	61,871,433.07	67,699,723.96	-0.28	-0.26
30100: Program Rebates	-12,474,371	-4,604,989	-7,869,382.57	61,871,433.07	67,699,723.96	-0.20	-0.07
30120: Selling Discounts	-134,564	-260,002	125,437.96	61,871,433.07	67,699,723.96	0.00	0.00
30200: Promo Rebates	-5,014,821	-13,006,282	7,991,461.18	61,871,433.07	67,699,723.96	-0.08	-0.19
All Volume Rebates	-3,734,990	-3,971,053	236,063.22	61,871,433.07	67,699,723.96	-0.06	-0.06
30220: Volume Rebates - Special Agreements	-121,345	-147,830	26,485.73	61,871,433.07	67,699,723.96	0.00	0.00
30300: Volume Rebates	-3,164,670	-3,349,121	184,451.76	61,871,433.07	67,699,723.96	-0.05	-0.05
30301: Volume Rebates - Other	-205,726	-223,402	17,675.85	61,871,433.07	67,699,723.96	0.00	0.00
30310: Builder Rebates	-243,249	-250,699	7,449.88	61,871,433.07	67,699,723.96	0.00	0.00
Other Rebates and Discounts	-2,275,928	-2,537,530	261,602.41	61,871,433.07	67,699,723.96	-0.04	-0.04
30400: Claims & Allowances	-2,072,248	-2,272,073	199,824.94	61,871,433.07	67,699,723.96	-0.03	-0.03
30500: Cash Discounts	-203,679	-265,457	61,777.47	61,871,433.07	67,699,723.96	0.00	0.00

Since we no longer need the [FCST SQ FT] and [BUD SQ FT] columns, remove them from the matrix.



Level 3 Name	FCST Value	Budget Value	FCST Value vs Budget	FCST Rate Per SQ Ft	Budget Rate/SQFt
Volume	36,826,917	40,227,504	-3,400,586.68	1.00	1.00
Standard Margin	26,677,986	32,522,075	-5,844,088.96	0.72	0.81
Net Sales	62,263,461	74,571,407	-12,307,946.33	1.69	1.85
Gross Sales	71,030,749	83,850,730	-12,819,981.43	1.93	2.08
30000: Sales	70,664,015	83,494,290	-12,830,274.60	1.92	2.08
30005: Restocking Charges	34,370	9,092	25,277.80	0.00	0.00
30007: Cut Fees	326,668	349,443	-22,775.80	0.01	0.01
30008: Sales - Other	-6,296	-3,184	-3,111.81	0.00	0.00
30009: Other Revenue	10,853	1,090	9,763.36	0.00	0.00
30023: Sales - Intercompany	1,140		1,139.62	0.00	
Sales Discounts	-6,029,392	-6,370,598	341,206.04	-0.16	-0.16
30100: Program Rebates	-4,054,268	-330,321	-3,723,946.40	-0.11	-0.01
30120: Selling Discounts	-79,894	-124,337	44,442.99	0.00	0.00
30200: Promo Rebates	-1,895,230	-5,915,939	4,020,709.45	-0.05	-0.15
All Volume Rebates	-1,616,314	-1,826,613	210,299.47	-0.04	-0.05
30220: Volume Rebates - Special Agreements	-53,192	-75,426	22,233.94	0.00	0.00
30300: Volume Rebates	-1,191,013	-1,355,010	163,996.68	-0.03	-0.03
30301: Volume Rebates - Other	-156,465	-174,033	17,568.16	0.00	0.00
30310: Builder Rebates	-215,643	-222,144	6,500.69	-0.01	-0.01

Another common requirement when doing analysis of our data is to calcute a Rate and Volume breakout of the variance.

Now that we have the Rate / SQ Foot, we can do some more involved rate / volume variance analysis.

This will help us answer questions like:

- How much of our surplus / (shortfall) is caused by selling more (or fewer) units than planned?

First, let's begin with a simple example looking at a single products volume and total sales

	FCST	BUD	Variance
Volume (loaded from GL)	110	150	- 40
Revenue (Loaded from GL)	$ 260.00	$ 340.00	-$ 80.00
Rate: Revenue / Volume	$ 2.364	$ 2.267	$ 0.097

The volume variance explains how much of our total variance (-$80) is caused by the fact that we sold less than we expected, and is calculated as follows:

Volume Variance
([FCST Volume] - [Bud Volume]) / [BUD Rate]
(100 - 150) x $0.97
-$ 90.67

Rate Variance
([FCST Rate] - [BUD Rate]) x [FCST Volume]
([$2.364] - [2.267]) x 110
10.666667

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- How much of our surplus (shortfall) / surpluse is caused by our price or cost per unit not being what was planned?

Total Variance Volume Variance + Rate Variance
-90.67 +10.67
-$ 80.00

We can easily create 2 new measures as follows:

```
FCST v BUD VOL Var   ([FCST SQ FT] - [BUD SQ FT]) * [FCST Rate Per SQ Ft]

FCST v BUD RATE Var  ([FCST Rate Per SQ Ft] - [BUD Rate Per SQ Ft])*[BUD SQ FT]
```

Now we can drag these measures into the matrix to see the impact of our Volum and Rate Variance.

Level 3 Name	FCST Value	Budget Value	FCST Value vs Budget	FCST Rate Per SQ Ft	Budget Rate/SQFt	FCST v BUD RATE VAR	FCST v BUD VOL VAR
Volume	**61,871,433**	**67,699,724**	**-5,828,290.89**	**1.00**	**1.00**	**0**	**-5,828,291**
Volume	**61,871,433**	**67,699,724**	**-5,828,290.89**	**1.00**	**1.00**	**0**	**-5,828,291**
Volume	**61,871,433**	**67,699,724**	**-5,828,290.89**	**1.00**	**1.00**	**0**	**-5,828,291**
VOL_ALT: Volume - Square Feet	61,871,433	67,699,724	-5,828,290.89	1.00	1.00	0	-5,828,291
Standard Margin	**46,536,313**	**54,242,070**	**-7,705,757.45**	**0.75**	**0.80**	**-3,322,035**	**-4,383,722**
Net Sales	**117,382,925**	**132,274,289**	**-14,891,363.35**	**1.90**	**1.95**	**-3,833,888**	**-11,057,475**
Gross Sales	**141,017,599**	**156,654,145**	**-15,636,545.55**	**2.28**	**2.31**	**-2,352,683**	**-13,283,862**
30000: Sales	140,330,833	155,956,600	-15,625,767.68	2.27	2.30	-2,406,599	-13,219,169
30005: Restocking Charges	65,168	14,755	50,412.85	0.00	0.00	56,552	-6,139
30007: Cut Fees	603,049	686,488	-83,439.31	0.01	0.01	-26,632	-56,807
30008: Sales - Other	-6,296	-5,144	-1,152.76	0.00	0.00	-1,746	593
30009: Other Revenue	11,847	1,444	10,402.86	0.00	0.00	11,519	-1,116
30023: Sales - Intercompany	12,998		12,998.49	0.00		14,223	-1,224
Sales Discounts	**-17,623,756**	**-17,871,273**	**247,516.57**	**-0.28**	**-0.26**	**-1,412,642**	**1,660,158**

Verify that the [FCST vs BUD RATE VAR + FCST v BUD VOL VAR] is equal to [FCST Value vs Budget]

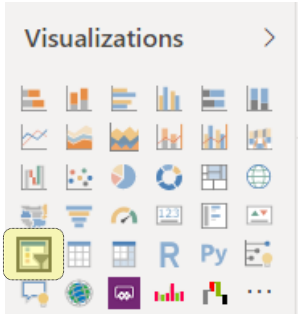
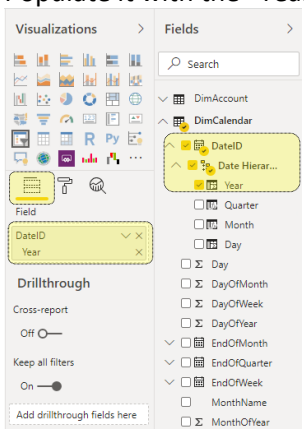
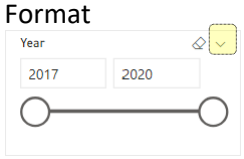
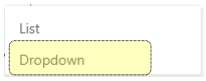
Save your Power BI file

11.5 Exercise 2.4: Create a Dashboard Using Power BI Visuals

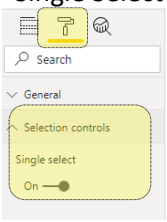
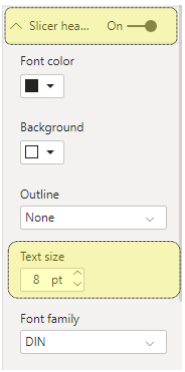
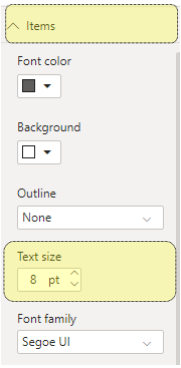
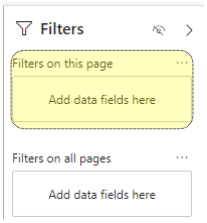
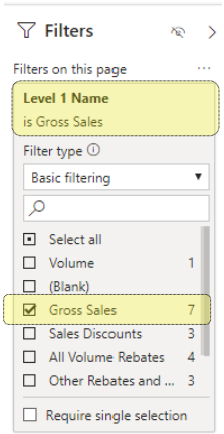
Now that we have loaded our data and created some measures, let's begin the process of doing some analysis to see what we can discover about the data so we can focus our business resources on items that need the most attention.

We are going to begin by trying to find some insights on Gross Sales to see if we can learn about the overall health of our market. We will want to be able build an interactive dashboard that will let us see relationships between our products, channels, and time simultaneously.

For now, we will want to perform comparisons for our most recent forecast vs. the budget that was created at the beginning of the year.

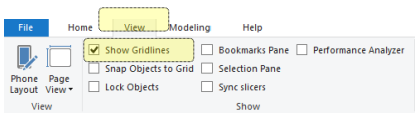
We know that for now we are going to be looking at 2019 data, but we also anticipate that this dashboard will be used well into the future, so we are going to begin by adding a time prompt to let us choose a year for our analysis.	1. Create a new page by clicking the new page icon at the bottom of the screen  2. Add a new Date Slicer.  3. Populate it with the "Year" from the Date Hierarchy in the DimCalendar table. 
Format the Slicer as follows: Slicer should be a dropdown Only a single year to be selected	Format   Select 2019 from the filter 

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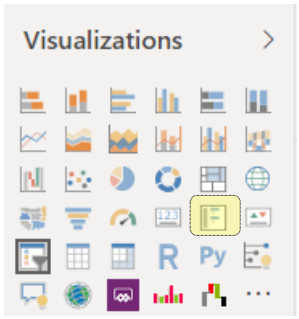
Make the size and font small enough that this slicer doesn't occupy very much real estate	To prevent users from combining multiple years together on the dashboard, set "Single Select" to "On"  To make the slicer take up less space, set the Slicer Header to 8-point font, Text Size to 8 point, and shrink the Slicer size on the screen  
Add a Page Level Filter Since this page is always going to be focused on Gross Sales, we will add a page level filter that will apply to all visuals on the page.	Open up the Filter Pane, if it is not already opened. You will see the following:  Expand the DimAccount table, and bring in the Level 1 Name field to the "Filters on this Page" section. Apply a Basic Filter by Checking the "Gross Sales" Option 

Now we are going to add a couple of card visuals to show a total based on all the filters being applied on the screen (either through the Page Filter, or by interacting with the visuals we will add later).

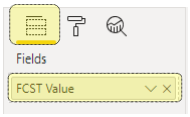
Turn on the gridlines to help you keep everything organized and neatly aligned.



Insert a new Card Visual

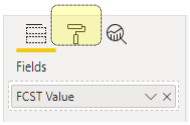


On the Card Visual, drag and drop the measure [FCST Value] to the "Fields"





Set the Category and Data Label Text Size to be 10. Set the Decimal places to 1. Drag and Drop the Card to the top left corner of the dashboard



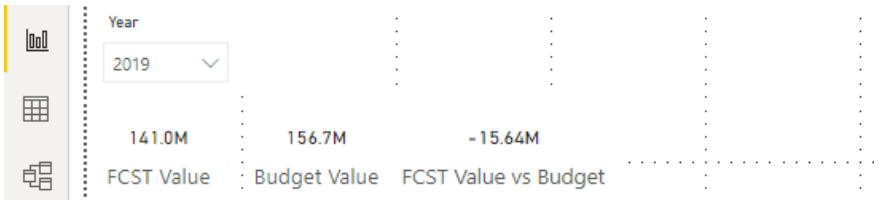




Add 2 more visuals for [Budget Value] and [FCST Value vs Budget]. The easiest way to proceed is:

- copy the card that was just created
- Past two copies
- Change the data field setting.

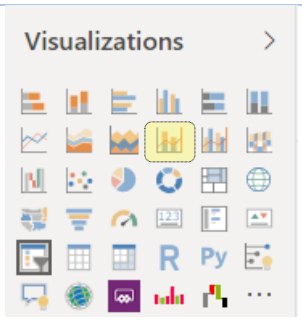
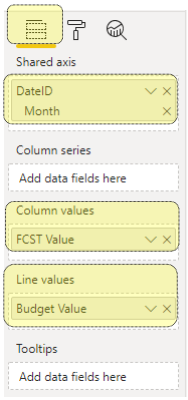
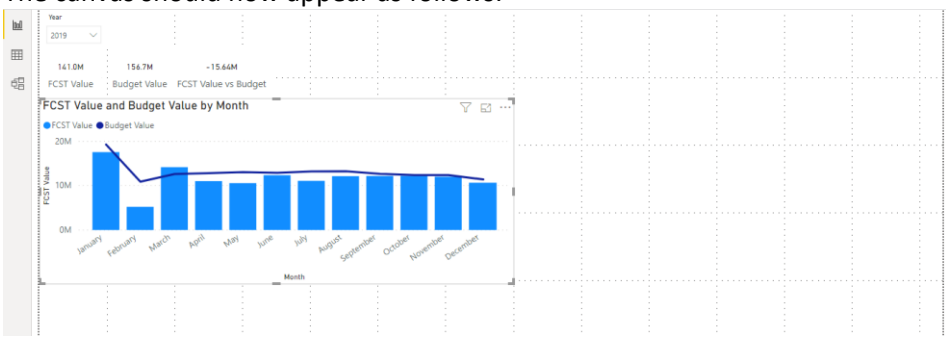
Your screen should now appear as follows:



We can see that our FCST value

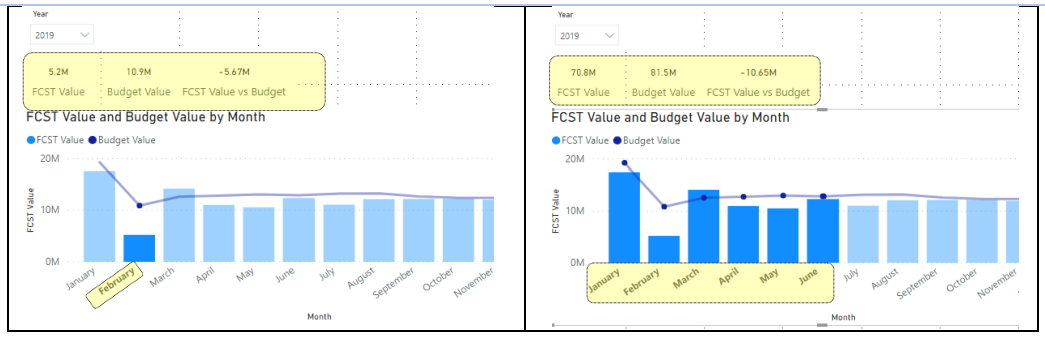
Insert a new [Line and Stacked Column Chart] visual

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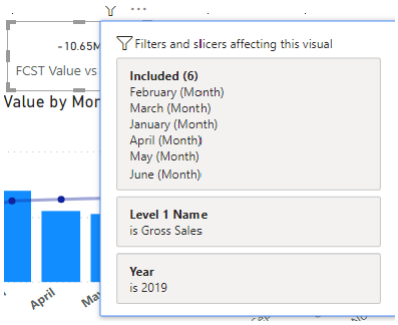
for Gross Sales is well below the Budget Value. Let's create some more visuals to see if we can find out exactly what is going on. The first thing we will do is create a Line and Column Chart to show our Budget Value and Forecast Value by Period to see if there is anything stands out with our seasonality	 Drag the following: **Shared Axis:** Month Column from the Date Hierarchy **Column Series:** FCST Value **Line Series:** Budget Value  Align the chart along the left of the canvas and take roughly half the remaining height of the blank canvas The canvas should now appear as follows:  Immediately we can see that there is a significant downturn in February vs. both budget and the other months of the year. This is definitely something we will want to look into.
Explore Interaction between visuals by clicking on and a point in the line or on	When we click on the February bar, or axis label, or line, the visuals reflect the numbers for that period. You may also use the [ctrl] key to select multiple data points to show sums of the Forecast, Budget, and Variances:

one of the columns.

When we look at the February bar, we can see that the card visuals at the top of the screen change to reflect the values for the month you have selected.

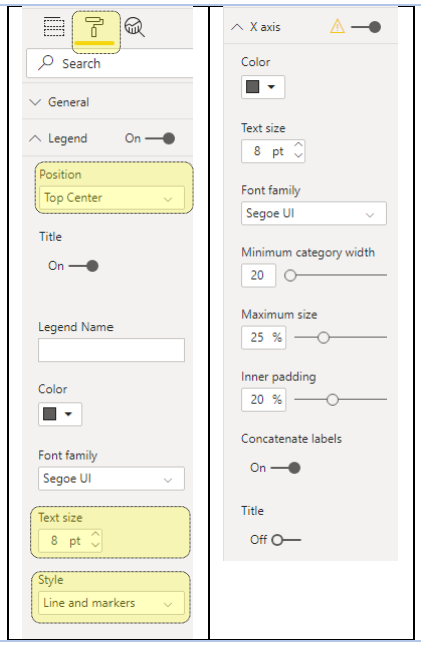


When you hover over the card visuals, you will see the filters that are being applied by the other visuals as follows:



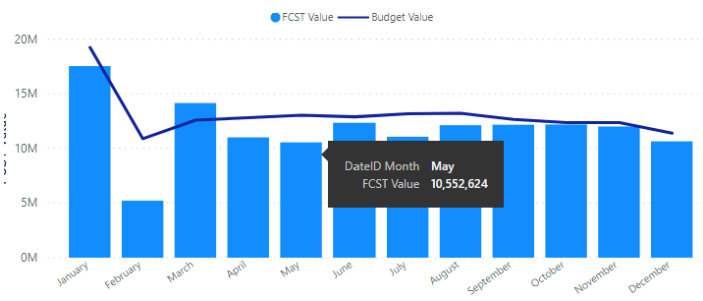
Let's explore some of the formatting options of the chart to optimize use of space.

There are many different options available here. Experiment with some of them to see what fits best



When we hover over a data point in the chart, a tool tip appears that allows us to see the data value. This is very useful, especially when we wish to

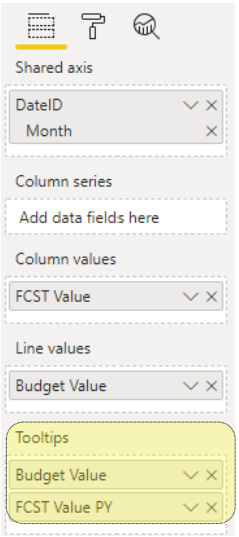
The default tooltip appears as follows:

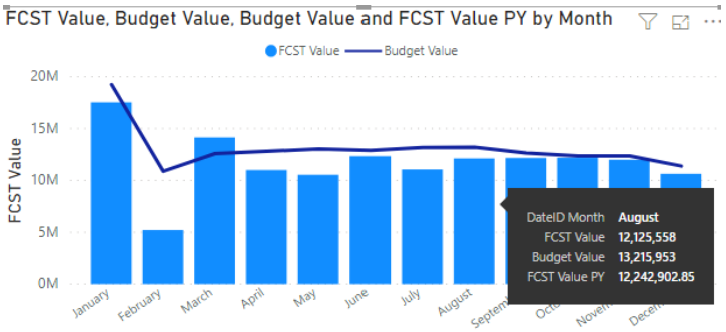


compare 2 numbers that are fairly close in value.

When looking at this chart, it might also be nice to be able to see some other values to have a little bit more context for the number we are currently examining.

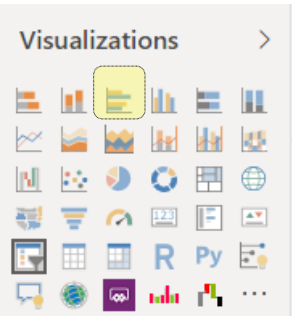
We can enhance the basic tool tip by dragging the desired columns into the “Tooltips” field so we can instandly have some additional context to our number. In this case, we will wanto to see prior year value as well as the budget value when we hover over a bar.

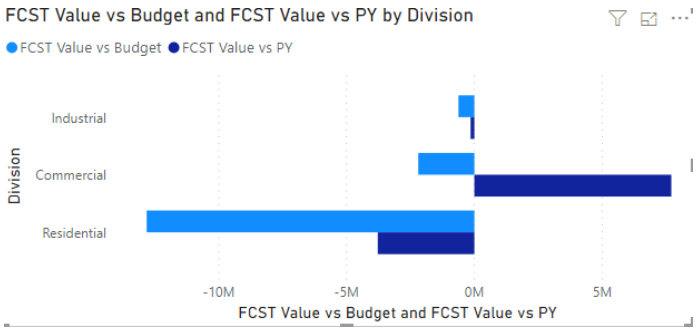
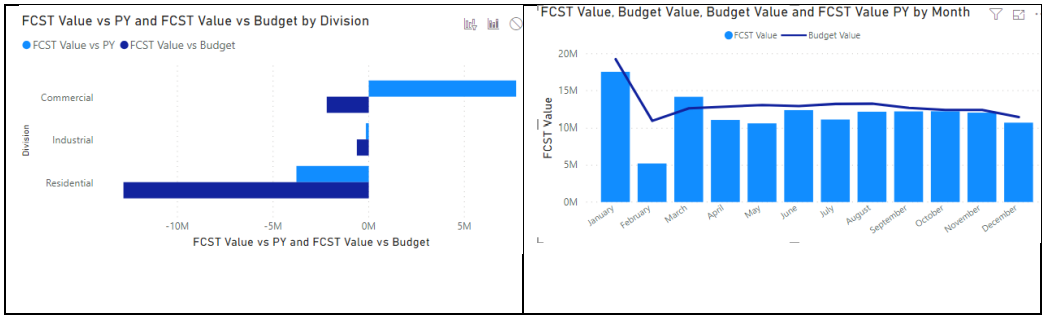




Next, we are going to create a visual that allows us to view data by our Profit Center dimension so we can see how our different lines of business.

Click on a blank area of the canvas and then click on the “Stacked Bar Chart” visualization

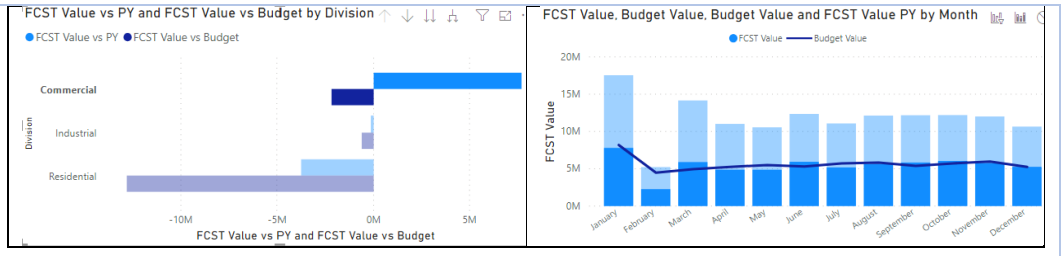


This chart is going to display the variance between the forecast and budget by division, but is going to allow us to drill down to explore more detail For this chart, we want to be able to drill down into more detail as we perform our analysis. When looking at a division, we will wish to see how the Profit Centers within that division are performing. Further to that, we will wish to be able to see data by Product Footprint, down to the Product Name.	Drag the "FCST Value vs Budget" into the "Value" field. Notice that Power BI builds a single bar on our chart reflecting the total value. Let's also look at how we are doing agains prior year to get a little better understanding of how performance is doing agains history by dragging in the measure "FCST Value vs PY" Since we want to start by seeing a different bar for each division, drag the Division field into the "Axis" placeholder. The chart should now look as follows:  To be able to drill down into further detail, add the following columns to the "Axis" placeholder. • Profit Center Name • Product Family • Product Name Notice that the Drill icons now appear in the top of the chart 
Power BI allows you to set up multiple drill levels across different dimension in the same object. It is also important to consider how drilling on one visualization will impact the other	Click on the either of the "Commercial" bars on the clustered bar chart you just created. Notice that as you do so the Line and column chart at the top of the page changes: 

visualizations in the model.

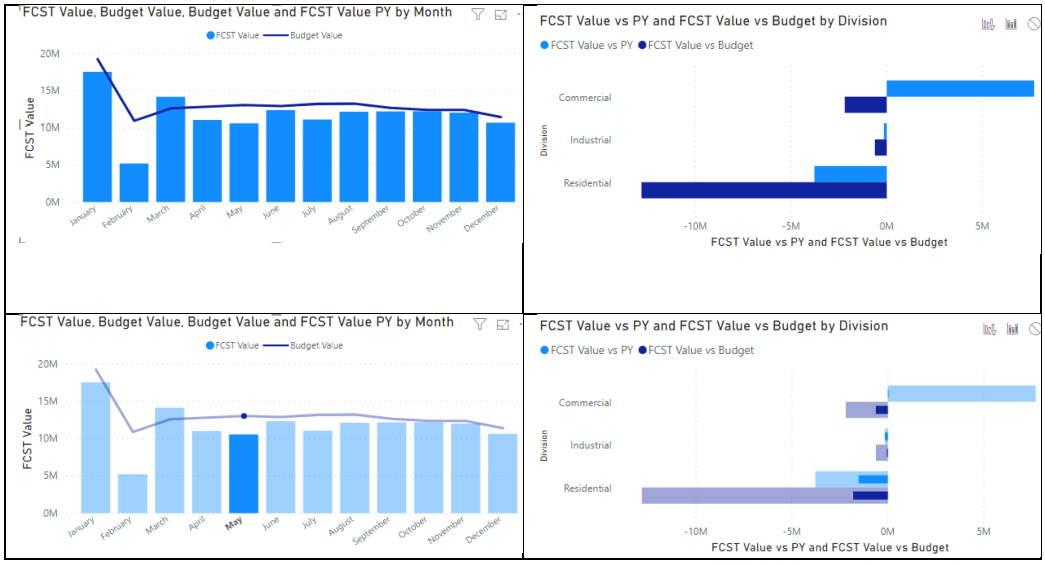
Depending on how you interact with a given visualization, you may affect the other visualizations on your page.

You can change these settings by clicking on the "**Format**" Ribbon and enabling the "**Edit Interactions**" button. From there, you click on a given visualization and then click the icon in the top right corner of the other visualizations depending on how you want them to behave.



Click on the Commercial bar again to reset the chart back to the default state.

Similiarly, if you click on a column chart, the clustered bar chart will also change.



This is because the default interaction between these 2 charts is a "Highlight" action".

There are 3 options for how a given visualization affects the others:



Filter: Target visualization will only include data that matches the selected category on the source visualization



Hightlight: Target visualization will highlight data that matches the selected category on the source visualization, but leave the total value also visible.



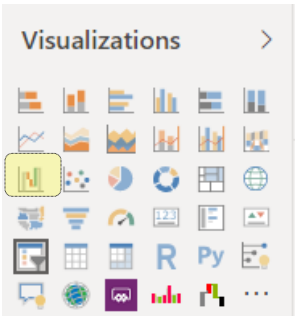
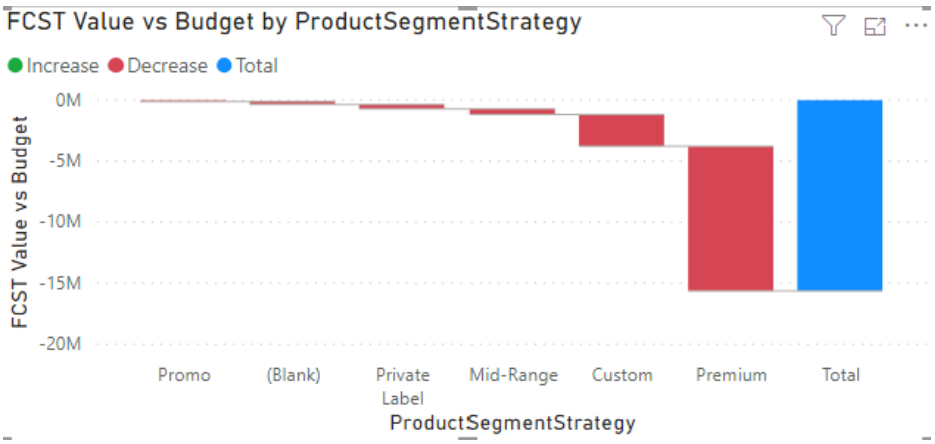
No Imact: Target visualization will not be affected by interacting with the source visulization.

By default, drilling on a visualization will filter all other visualizations. This can be turned on or off in the format ribbon.

To turn on drill mode, the functionality is the same as in the crosstab explored earlier.

Toggle Drilling Down on or off

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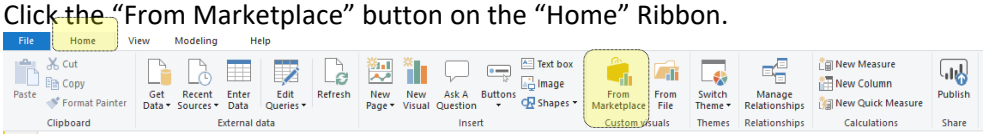
	Go One level down in the hierarchy Item being drilled on will no longer be visible Expand All One Level The same as clicking the [+] sign beside each visible item on the visual.
Answer the following questions to test your understanding of the data interactions:	1. Which residential Profit Center(s) have forecasted Gross Sales Better than Budget? 2. Which Profit Centers have forecasted Gross Sales better than budget for June?
Now we wish to add a waterfall visual to our metric to see which Product Segments are contributing to our overall increase or decrease in gross sales. Waterfall charts are very useful for showing how different segments of your data contribute to the overall increase or decrease in your total value	Click on a blank space in the canvas and click on “Waterfall “Chart” visualization  Add the ProductSegmentStrategy as the categories Add the FCST Value vs. Budget as the Y Axix. The chart should appear as follows: 
Answer the following questions to test your understanding	1. Describe what you see when you click on the “Mid-Range” waterfall category and look at data by Division? 2. The director of the “Vinyl” profit center (Residential) wants to know if their new Private Label Products are tracking. What would you tell that person?

The last of the major dimensions in our model that we have not yet touched is the Channel dimension.

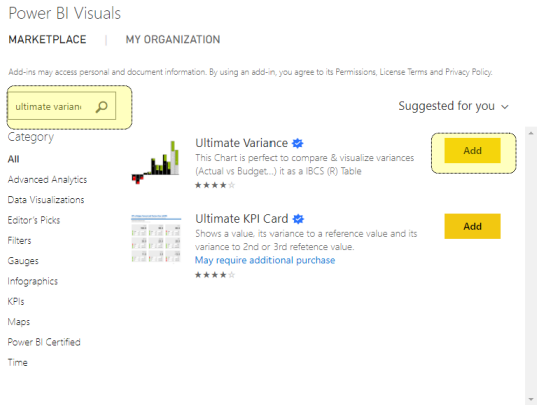
We would like to add a char that will show variance as a dollar amount as well as a % change vs. Budget.

We can scan the BI MarketPlace to see if we can find any pre-built visualizations that will help us with this.

1. Click the "From Marketplace" button on the "Home" Ribbon.

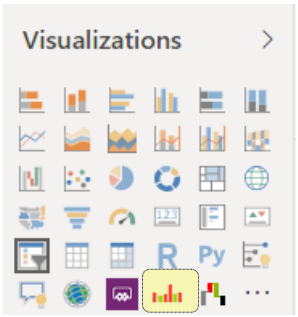


In the search window, type "Ultimate Variance". The first result should be the Visualization we are looking for. Click Add

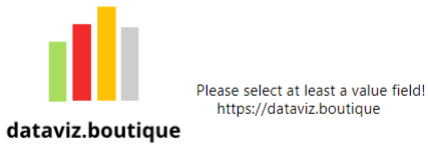


,

The new visualization should now appear in the pane on the right

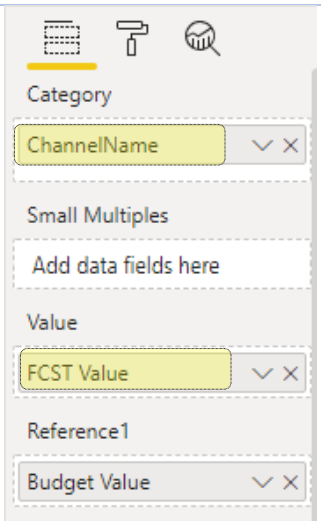


Click on an empty space in your canvas, and click the new Visualization

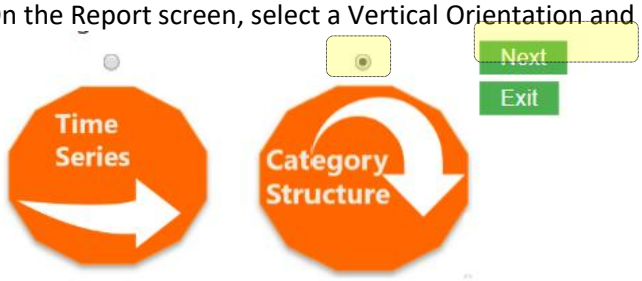


Add the following fields:

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On the Report screen, select a Vertical Orientation and click Next



In the next step of the wizard, we can select how many different charts will show in our visualization. We want to see variances as both a dollar amount and as a % of budget, so we will select option # 3

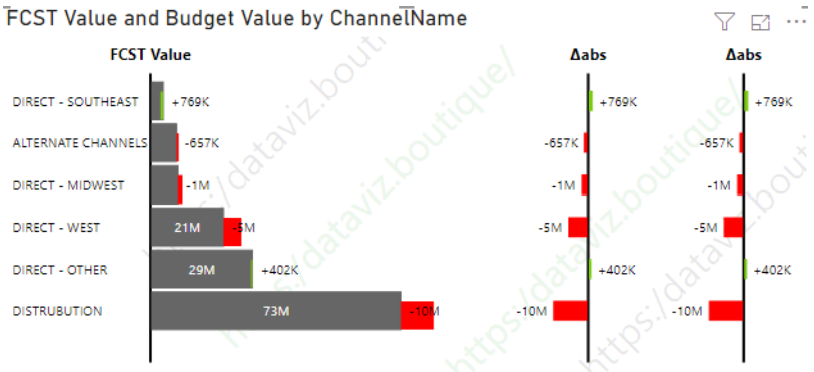
Click Next

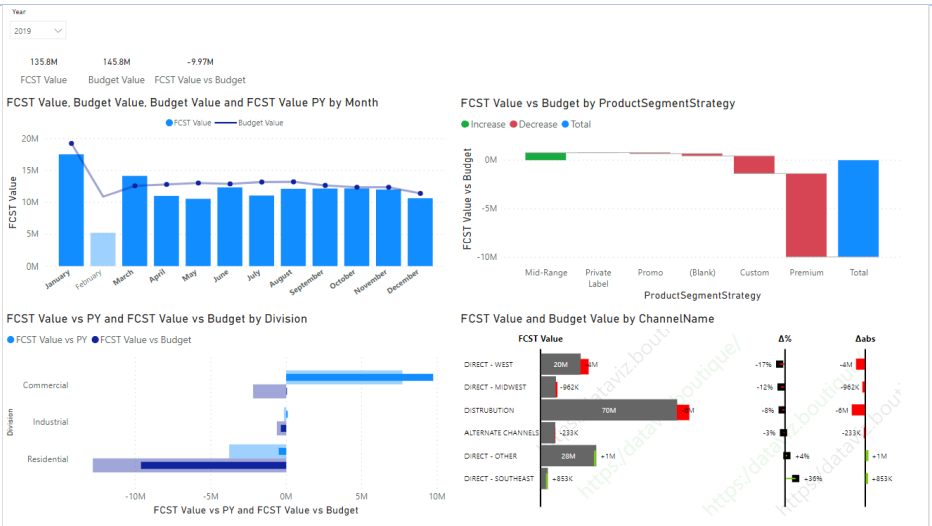
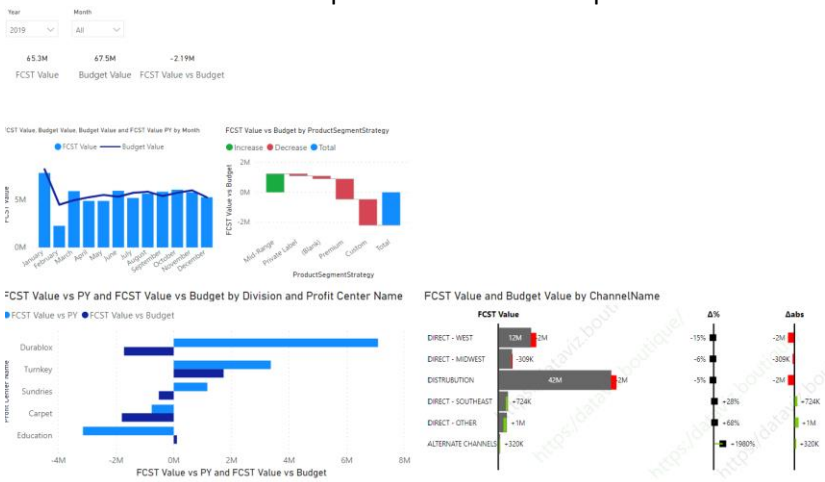
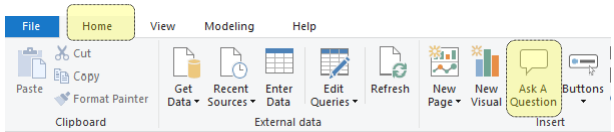
We have the option to show a table of values as well as the chart. Since we are a bit tight for space, we will Hide the table.

We will show the Axis Title and Sort By Options

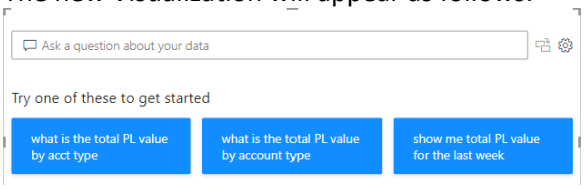
Click “Hide” on the option to show multiples

You should now be presented with a Visualization like this:



	This Visualization has a few controls to change the sequence of the charts, sorting, and formatting. Click on the report to see the options available.
Your canvas should now resemble the following:	
Answer the following questions to test your understanding	1. Which channel is performing the best? Which is the worst? 2. Do you see any interesting relationships that would let us hone in on where we need to go to get everything back on track?
Add a Natural Query Visual	Use Q&A to explore your data using intuitive, natural language capabilities and receive answers in the form of charts and graphs. Q&A is different from a search engine -- Q&A only provides results about the data in Power BI. • Shrink the viauals on the top row to make some space for a new visual  • From the Home Ribbon, click “Ask a Question” 

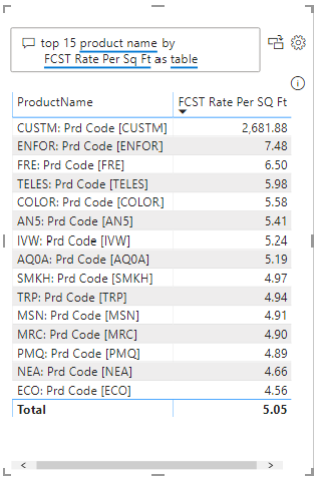
- The new Visualization will appear as follows:



- Type the following into the dialog:

top 15 product name by FCST value as table

The following will appear



ProductName	FCST Rate Per SQ Ft
CUSTM: Prd Code [CUSTM]	2,681.88
ENFOR: Prd Code [ENFOR]	7.48
FRE: Prd Code [FRE]	6.50
TELES: Prd Code [TELES]	5.98
COLOR: Prd Code [COLOR]	5.58
AN5: Prd Code [AN5]	5.41
IVW: Prd Code [IVW]	5.24
AQ0A: Prd Code [AQ0A]	5.19
SMKH: Prd Code [SMKH]	4.97
TRP: Prd Code [TRP]	4.94
MSN: Prd Code [MSN]	4.91
MRC: Prd Code [MRC]	4.90
PMQ: Prd Code [PMQ]	4.89
NEA: Prd Code [NEA]	4.66
ECO: Prd Code [ECO]	4.56
Total	**5.05**

To optimize your succes for natural language queries:

- Remember that this visual is subject to the same filter rules as other visuals. E.g. the results will be filtered based on other visual selections (unless this has been changed via the “Edit Intereactions” menu.

- Provide “natural” names for your measures and fields

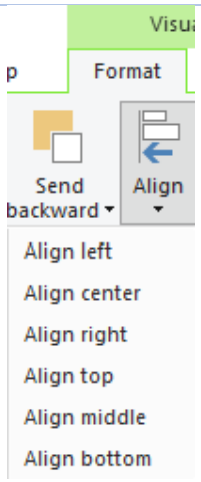
Use the following link for more information on tho

https://docs.microsoft.com/en-us/power-bi/consumer/end-user-q-and-a-tips

Cleanup Appearance of Visual Consider the following when finalizing the look and feel	The Align button can be found in the “Format” ribbon and appears as follows:

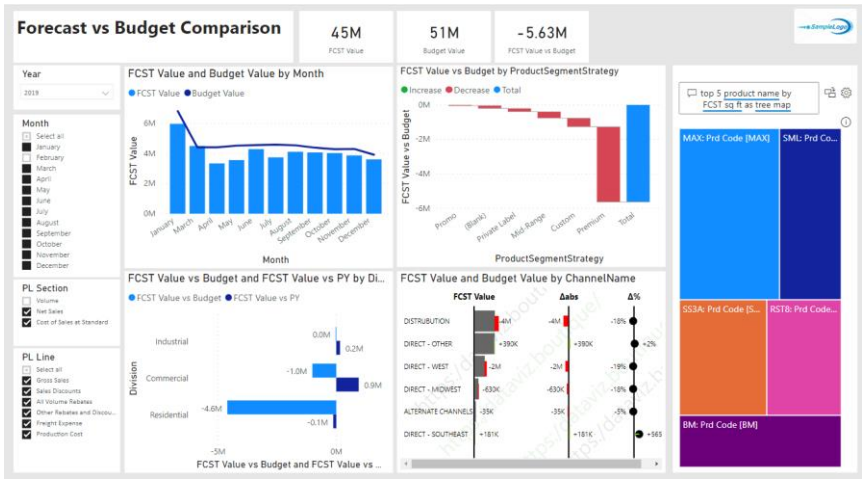
and layout of the dashboard:

- Avoid having too many visuals on the same page. Too much information shown at the same time can create confusion
- Try to make sure your visuals combine to tell a story to help your audience explore their data
- Make sure items that are meant to align are at the same place. Use the "Align" button in the Format Ribbon to make sure things look neat and organized.
- Make sure each visual has a clearly defined space. Consider using a different page



- Most objects have information about size and position in the "General" section. Use these to make sure objects line up perfectly

When you are finished, your dashboard may look something like this:



background color from the color of your visuals and using negative space as your borders • Most objects have information about size and position in the "General" section. Use these to make sure objects line up perfectly	
Save your Power BI file	

**** You have successfully completed the AFP Power BI Course for Financial Professionals! You now have the skills to emPOWER your company via the utilization of Power BI ****

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