



self-service business intelligence synergies
with microsoft powerpivot

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INTRODUCTION

In recent years Self-Service Business Intelligence (SSBI) has become an industry phenomenon due to a handful of key dynamics. Enterprise Data Warehousing & Business Intelligence (DW/BI) teams have not been able to keep pace with their analytical consumer's demands for ever-increasing volumes of reports & measurements. Ad-hoc sources of data and measurements float about the enterprise without any business prioritization. Additionally, mid-market & small businesses need the ability to harvest rich business insight without requiring steep investments in hardware, software, and people.

SSBI is the concept of having an analytical consumer additionally act as an analytical author. With SSBI in-place the people who know the business best author rapid, rich insights while corporate DW/BI teams continue to harvest standardized metrics & measurements. The best way to think about SSBI is: ***SSBI is for your organization's Unknown Questions and Corporate BI is for your Known Questions.***

Various analytical toolsets and technologies of the past had supported the notion of SSBI to varying degrees. However, only as of relatively late have toolsets & software been built specifically with SSBI as their core objective. Two of the best software products built for SSBI needs are Tableau Software's suite of analytical applications as well as Microsoft's PowerPivot.

Note: For the purposes of this whitepaper I am using sample data from the Adventure Works 2008 R2 sample databases. A screenshot of the sample PowerPivot workbook I am using for this whitepaper can be seen in Figure 1. For more information on Microsoft SQL Server Sample Databases please go to <http://msftdbprodsamples.codeplex.com>

TABLEAU SOFTWARE OVERVIEW

Tableau is the result of an internal R&D project at Stanford University in 1997. In 2003, the company was launched with Tableau Desktop, a tool that enables rapid-fire SSBI. Since 2003 the product has incurred 5 major versions including spawning its Server and Reader brethren. When the Tableau components are used together, they cover all major SSBI needs. All Tableau software ships in x-86 only builds although they run just well on x64 operating systems. Tableau Software is currently shipping version 5.2 of its analytical suite.

FIGURE I:
Adventure
Works Sample
PowerPivot
Workbook

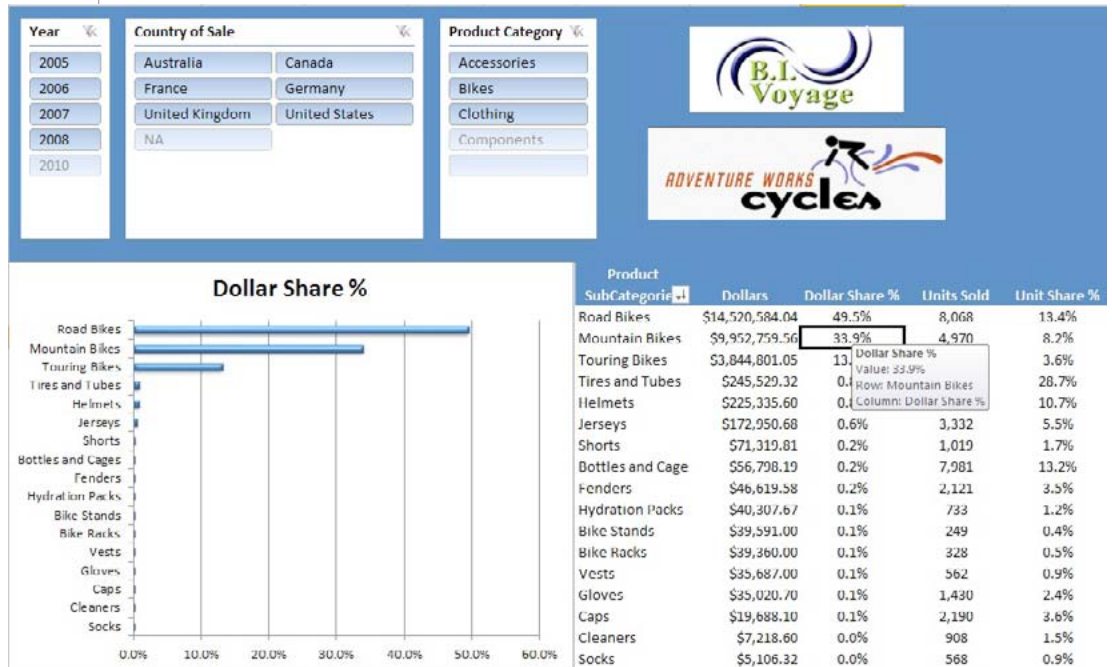
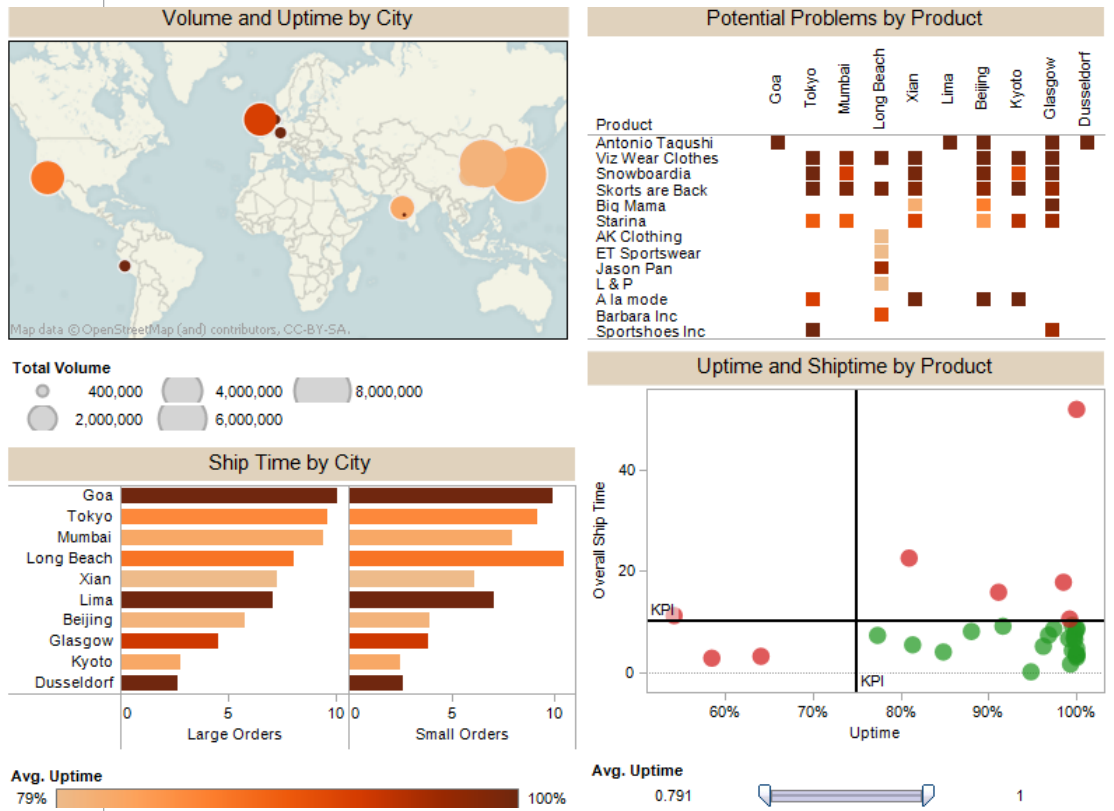


FIGURE II:
Tableau
Dashboard Sample



MICROSOFT POWERPIVOT OVERVIEW

PowerPivot is Microsoft's recent SSBI suite. PowerPivot is like-wise composed of Desktop and Server components. In PowerPivot, the client experience is embedded into Excel 2010 via a free add-in known as PowerPivot for Excel. The Server component of PowerPivot is a combination of SQL Server Analysis Services 2008R2 (SSAS) and SharePoint 2010, known as PowerPivot for SharePoint. When the PowerPivot components are used together, they cover all major SSBI needs. Microsoft PowerPivot for Excel ships in both x86 and x64 builds, while PowerPivot for SharePoint ships only in an x64 build.

Note: The x64 build of PowerPivot for Excel is recommend for SSBI authors wishing to work with datasets greater than or equal to one million records of data.

FIGURE III:
Microsoft
PowerPivot
Dashboard Sample



TABLEAU & POWERPIVOT: BETTER TOGETHER

While both Tableau and PowerPivot are industry leading SSBI toolsets each has its unique strengths that can benefit one another. Tableau Desktop enables SSBI users to create stunning analytical visualizations with one click in an extremely user-friendly environment. Tableau Server provides an easy-to-manage server product that is built solely for sharing and empowering users of Tableau visualizations. Tableau Server also provides easy integration of its published views with any web application using simple URLs.

PowerPivot's data infrastructure is extremely scalable and empowering for SSBI users. 'Vertipaq', the in-memory version of SQL Server Analysis Services (SSAS), powers all PowerPivot applications and provides the ability to process vast quantities of data. Data Analysis eXpressions (DAX) is PowerPivot's formula language. DAX provides SSBI users with a rich and vast expression language that includes capabilities such as time intelligence, statistical analysis, filtering, and logical functions. Because DAX is built into 'Vertipaq' it obtains superior data processing performance as well.

In the remainder of this whitepaper I will take you on a tour of the unique synergies SSBI users have available to them when they combine both Tableau and PowerPivot software.

TABLEAU DESKTOP & POWERPIVOT DATA MODELS

As mentioned earlier, Tableau Desktop provides the ability to create insightful visualizations of your data with ease of use. With Tableau Desktop 5.2 the tool now provides full support for published PowerPivot workbooks. In addition, we gain the unique capability to consume and extend DAX expressions in Tableau Desktop. There is also the ability to drill into PowerPivot data models directly from Tableau Desktop when further business insight is needed.

Tableau Desktop PowerPivot Connections

To begin exploring Tableau Desktop with PowerPivot data models you need to establish a successful data connection to a previously published PowerPivot workbook. Tableau Desktop provides native support for PowerPivot workbook connections using either a UNC or URL address. With Tableau Desktop open, select Data | Connect to Data... from the main menu. You will now see the Tableau Connect to Data dialog as shown Figure 4.

Note: Installing Tableau Desktop is beyond the scope of this whitepaper, for more information on installing Tableau Desktop please see Tableau's help documentation at <http://www.tableausoftware.com/community/support/documentation>

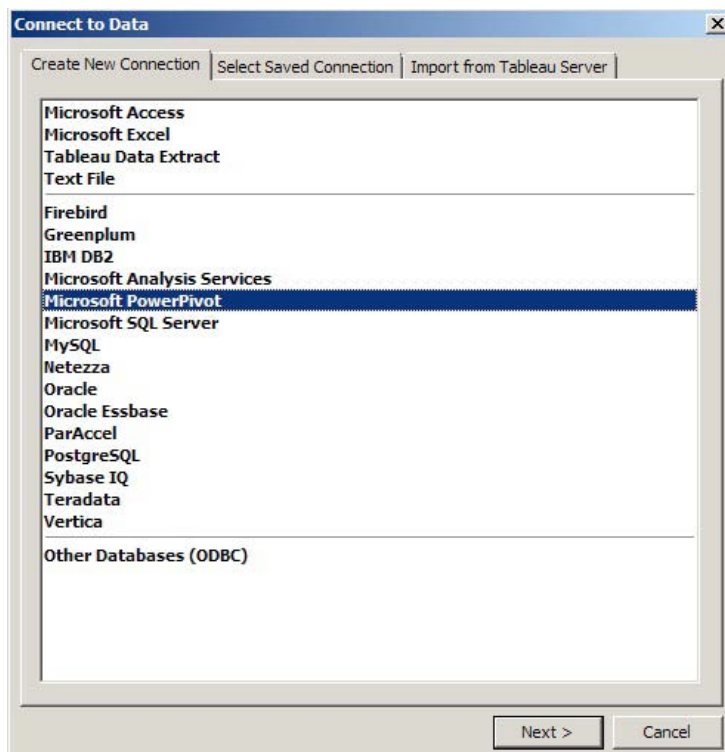


FIGURE IV: Tableau Desktop's Connect to Data dialog

With the Connect to Data dialog open click the Microsoft PowerPivot connection option and select the Next button. Choose the type of PowerPivot address you wish to use and type in the PowerPivot workbook's location. You can optionally select the Test Connection button to ensure you have entered a valid PowerPivot workbook address. With a correct PowerPivot workbook address entered you will see the dialogs shown in Figure 5. Upon clicking the OK button you will see Tableau Desktop shown with a pre-populated list of Dimensions, their individual attributes, and associated measures.

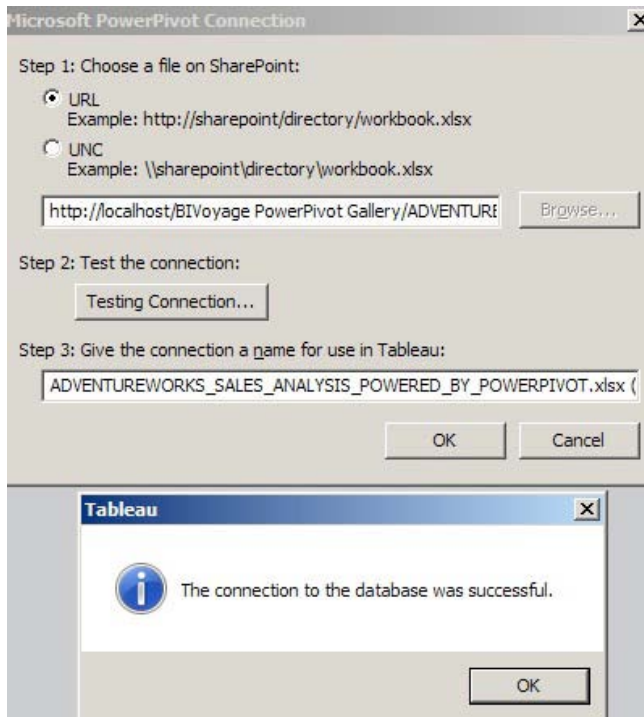


FIGURE V: Successful PowerPivot Workbook Connection

Finally, to review the details of your PowerPivot workbook's data connection you can select Data | Data Connection... Properties. The resulting dialog is shown in Figure 6. This dialog is useful when you need to confirm the PowerPivot workbook you are currently connected to in Tableau Desktop.

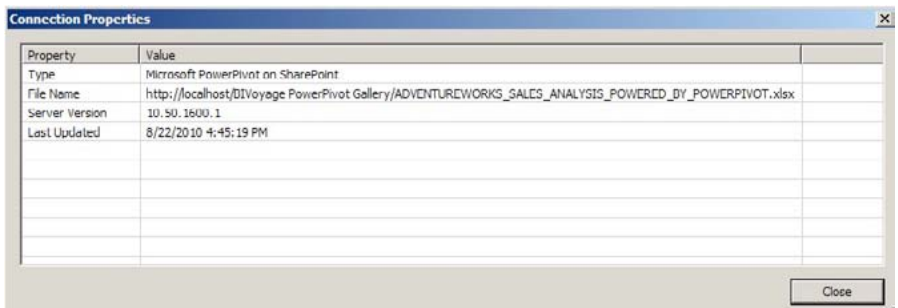


FIGURE VI: Existing PowerPivot Workbook Connection Properties

Tableau Desktop Rapid Visualizations

Tableau makes creating stunning analytic visualizations easy with one and two click visualization processes. With an existing PowerPivot workbook connection in place simply drag the dimension attributes and measures you wish to be displayed in the pivot table on Rows, Columns, or Color areas among others. Tableau Desktop (by default) selects the right data visualization for you based upon the nature of the data you have selected. In Figure 7, I have placed the EnglishProductName attribute from the DimProduct dimension onto Rows and I have thrown Sum of SalesAmount onto Columns. As you can see we get back a nice Bar chart reflecting the sum of sales amounts by product names.

Note: To disable Automatic Marks, the Tableau Desktop feature that automatically selects the right data visualization for your selected data change the Mark Type to one of the available options other than Automatic.

FIGURE VII:
Tableau Desktop
Bar Chart
Visualization with
PowerPivot
Connection

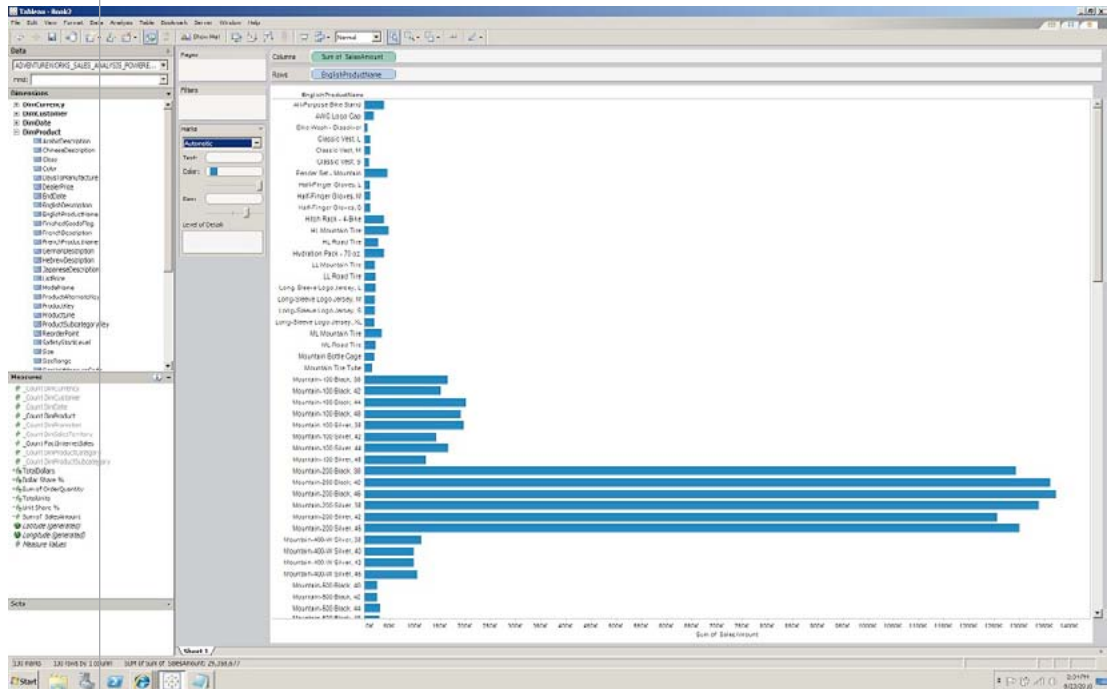
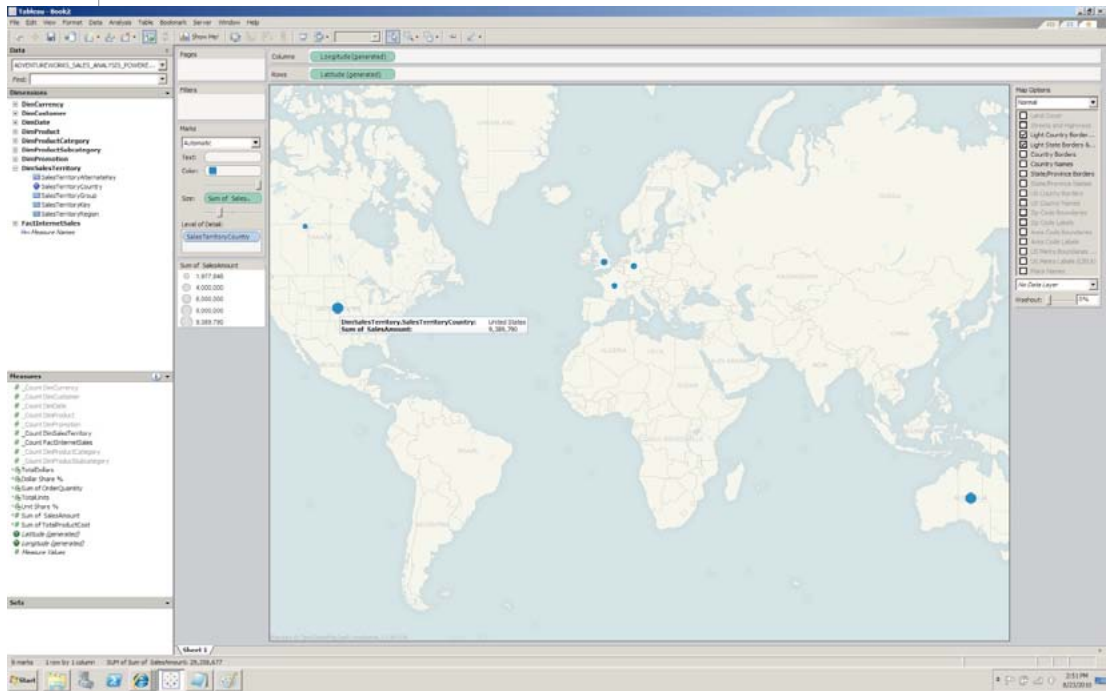


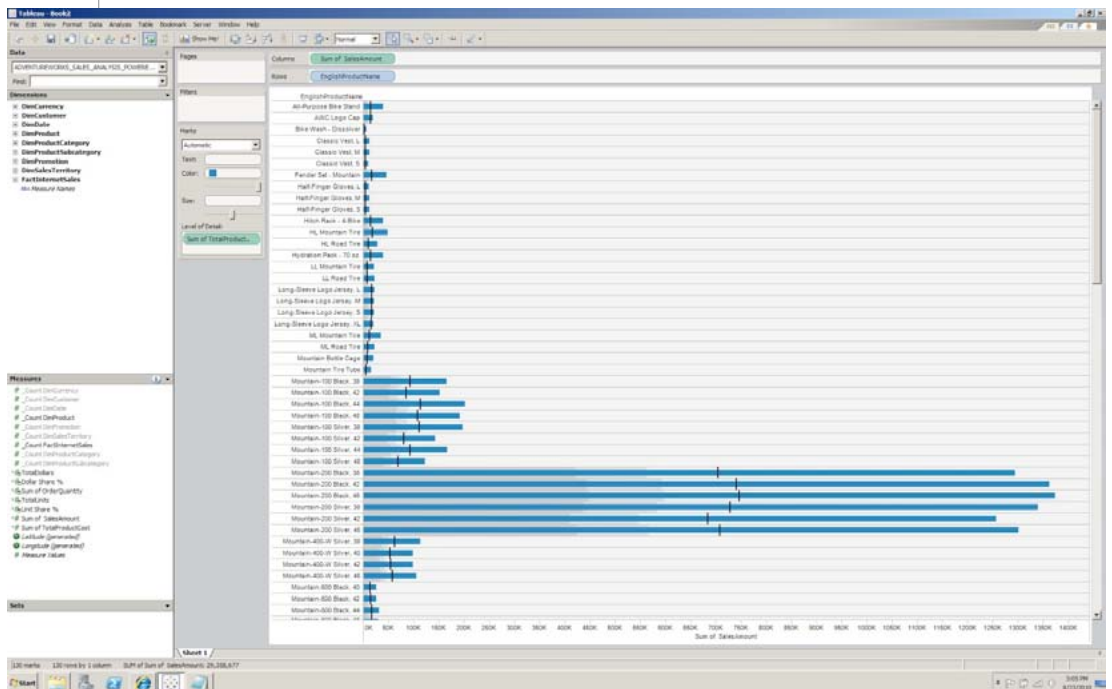
Tableau Desktop not only provides bar, line and other standard visualizations the product also supports advanced visualizations such as maps. In this scenario I have SalesTerritoryGroup on Rows with Sum of SalesAmount on Columns and by default we receive a nice bar chart. However, if I then click the Show Me! button and select the map option we now receive a nice world map visualization reflecting each country that has contributed sales as shown in Figure 8.

FIGURE VIII:
Tableau Desktop
Map Visualization
with PowerPivot
Connection



Consider a third scenario in which I want to measure total sales amounts against total product costs. A bullet graph provides a nice visualization for comparing two measures against one another across various dimensional attributes. By placing EnglishProductName back onto Rows, Sum of SalesAmount and Sum of TotalProductCost onto columns, and selecting the Bullet Graph option I now receive a nice bullet graph visualization as shown in Figure 9.

FIGURE IX:
Tableau Desktop
Bullet Graph
Visualization with
PowerPivot
Connection



Leveraging DAX with Tableau Desktop

As mentioned prior, with PowerPivot we gain access to DAX, an extension to the Excel formula language designed to work exclusively with Analysis Services (the analytical engine that powers PowerPivot workbooks). DAX is not only an extensive formula language but also simplifies MDX for business users using syntax more comfortable to them. DAX can be used for building calculated columns & measures in PowerPivot for Excel. A few examples of DAX measures can be found below:

```
Unit Share % = If(IsBlank(EXPORT_POWERPIVOT[Dollars]), BLANK(),  
((EXPORT_POWERPIVOT[Dollars] - [LY Dollars])/[LY Dollars]))
```

```
Store Selling % =EXPORT_POWERPIVOT[Stores Selling] / EXPORT_  
POWERPIVOT[Total Stores]
```

Note: DAX is an extensive and powerful language, for a detailed listing of the PowerPivot DAX language please see <http://technet.microsoft.com/en-us/library/ee835533.aspx>

Consuming DAX Expressions with Tableau Desktop

Simply by creating a valid PowerPivot workbook connection in Tableau Desktop we gain the ability to reuse previously defined DAX measures. DAX measures are listed under the measures pane in Tableau Desktop as shown in figure 10.



FIGURE VI: Tableau Desktop Reflecting PowerPivot Workbook DAX Measures

Like any other measure in Tableau Desktop, I can now drag-and-drop our DAX measures onto the canvas, slicing them by any number of dimensional attributes I see fit. This capability is important because it empowers PowerPivot authors to leverage DAX calculations for performing advanced calculation including concepts such as context while affording Tableau Desktop authors the ability to reuse the DAX investments made.

Extending DAX Expressions with Tableau Desktop

I not only gain the ability to use existing PowerPivot DAX measures but I can extend them with Tableau’s formula language. This is another key ability of Tableau 5.2 to extend PowerPivot’s value as it empowers SSBI users who are familiar with Tableau’s formula language and syntax to extend existing DAX investments. For example, consider the scenario in which I already have a DAX measure defined in our PowerPivot workbook for Dollar Share %. This measure is useful in assessing how each product’s sales performance compares to the organization’s total sales. While powerful, the Dollar Share % measure does not reflect the Dollar Share % per unit sold for the product in question. To remedy this business question I simply create a new Tableau Calculated Field with the expression shown below:

$$\text{AVG Dollar Share \% Per Unit Sold} = [\text{Dollar Share \%}] / [\text{Sum of OrderQuantity}]$$

By creating the AVG Dollar Share % Per Unit Sold metric and adding it to the Columns area I get back the answer to our business question as shown in Figure 11.

FIGURE IV:
Tableau Desktop
with Calculated
Field Extending
Base DAX Measure

EnglishProductSubc..	Sum of SalesAmount	Sum of OrderQuantity	Dollar Share %	AVG Dollar Share % Per Unit Sold
Bike Racks	39,360	328	0.1%	0.000409%
Bike Stands	39,591	249	0.1%	0.000542%
Bottles and Cages	56,798.19	7,981	0.2%	0.000024%
Caps	19,688.1	2,190	0.1%	0.000031%
Cleaners	7,218.6	908	0.0%	0.000027%
Fenders	46,619.58	2,121	0.2%	0.000075%
Gloves	35,020.7	1,430	0.1%	0.000083%
Helmets	225,335.6	6,440	0.8%	0.000119%
Hydration Packs	40,307.67	733	0.1%	0.000187%
Jerseys	172,950.68	3,332	0.6%	0.000177%
Mountain Bikes	9,952,759.5644	4,970	33.9%	0.006821%
Road Bikes	14,520,584.0363	8,068	49.5%	0.006130%
Shorts	71,319.81	1,019	0.2%	0.000238%
Socks	5,106.32	568	0.0%	0.000031%
Tires and Tubes	245,529.32	17,332	0.8%	0.000048%
Touring Bikes	3,844,801.05	2,167	13.1%	0.006043%
Vests	35,687	562	0.1%	0.000216%

Tableau Desktop Quick Filters

Tableau Quick Filters provides a similar experience to PowerPivot's Slicers. With Tableau Quick Filters the user gains the ability to visually filter as opposed to traditional expression filtering. Because Tableau Desktop 5.2 treats PowerPivot data sources like any other data source you gain the ability to use any existing dimensional attribute or measure as a Quick Filter. For example, if I wish to visually filter the sum of sales amounts per product sold by CalendarYear and TaxAmt I can easily do so as shown in Figure 12. To create a Quick Filter in Tableau Desktop simply right-click on a given attribute or measure and select the Quick Filter context menu option.

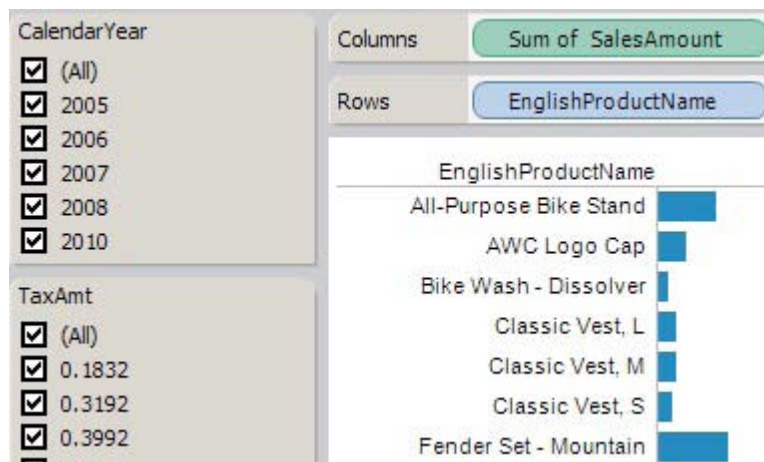


FIGURE XII: Tableau Desktop Quick Filters Using PowerPivot Fields

ANALYTICAL COLLABORATION WITH TABLEAU SERVER & MICROSOFT SHAREPOINT 2010

Tableau and Microsoft PowerPivot both ship with corresponding server components. The server components (PowerPivot for SharePoint and Tableau Server) are used for collaboration and sharing of SSBI generated insights. While each toolset's server component provides the features needed there are some unique synergies you gain when having access to both.

Configuring Tableau Server's Security Context

If you install Tableau Server using its default configuration the server's windows service (tabsvc.exe) runs under the windows local Network Service account. This configuration can cause problems when you publish Tableau Desktop visualizations that are built using window security for data connections. For example, when I build a Tableau workbook that contains a data connection to a pre-published PowerPivot workbook I have to use windows security for my connection's security context. To remedy this problem you simply need to reconfigure Tableau Server using a windows account that contains the needed credentials. In Figure 13 you see the Tableau Server Configuration utility being configured using an administrator account.

Note: Using administrator accounts is not a recommend practice for production deployments of Tableau Server

Note: Installing & Configuring Tableau Server is out of scope for this whitepaper please see Tableau's help documentation at <http://www.tableausoftware.com/community/support/documentation>

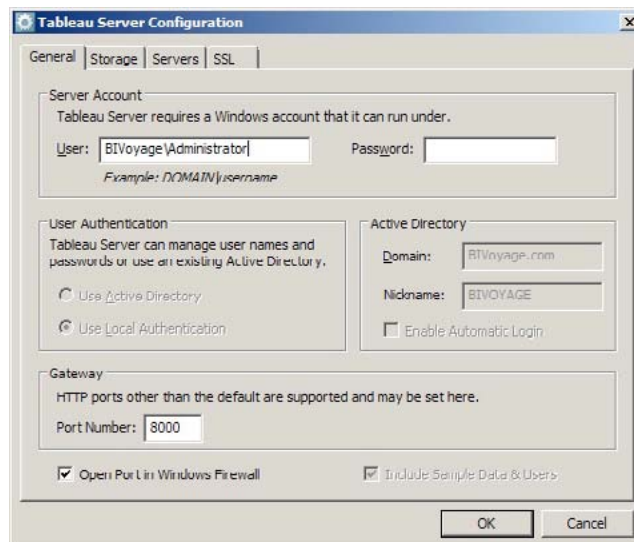


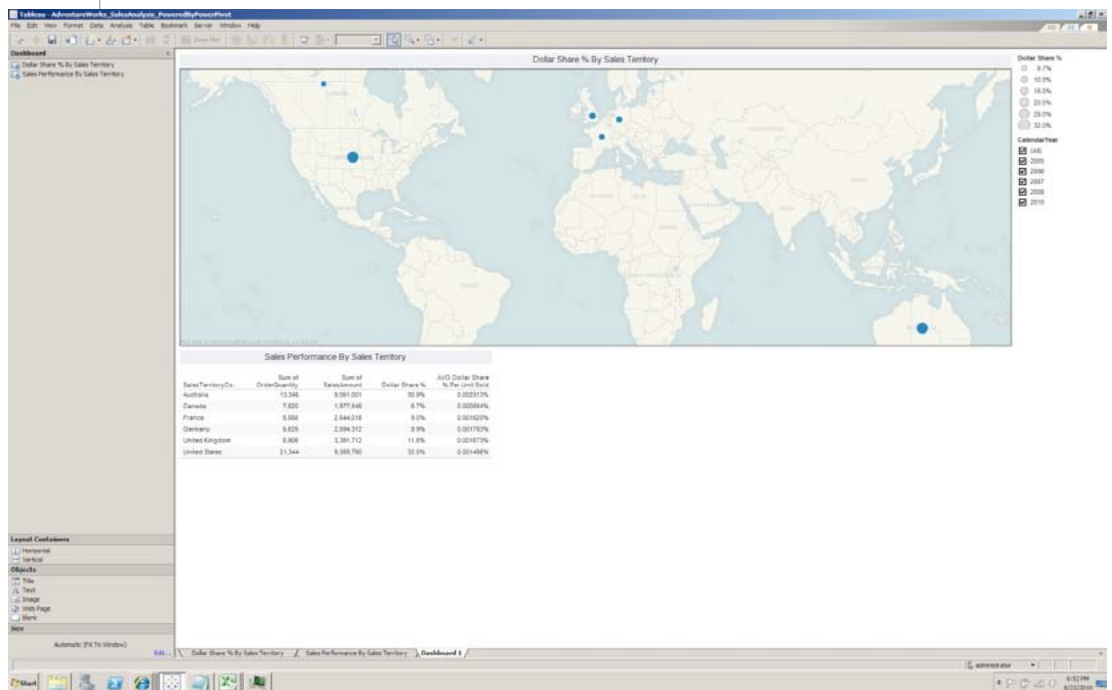
FIGURE XIII: Tableau Server Configuration Utility

Sharing Tableau Visualizations with Tableau Server

Publishing and sharing Tableau workbooks built using PowerPivot data models as a data source is no different than publishing any other Tableau authored workbook. This capability ensures Tableau users can expect the same sharing and collaboration features with PowerPivot driven workbooks. For the purposes of this whitepaper, I have constructed a sample Tableau Desktop Dashboard as shown in Figure 14. This dashboard provides consumers with viewing sales performance across sales territories using both a map with added measurements in a table. Additionally, I have created a Global Quick Filter in the dashboard to provide users with the ability to filter both visualizations by calendar year.

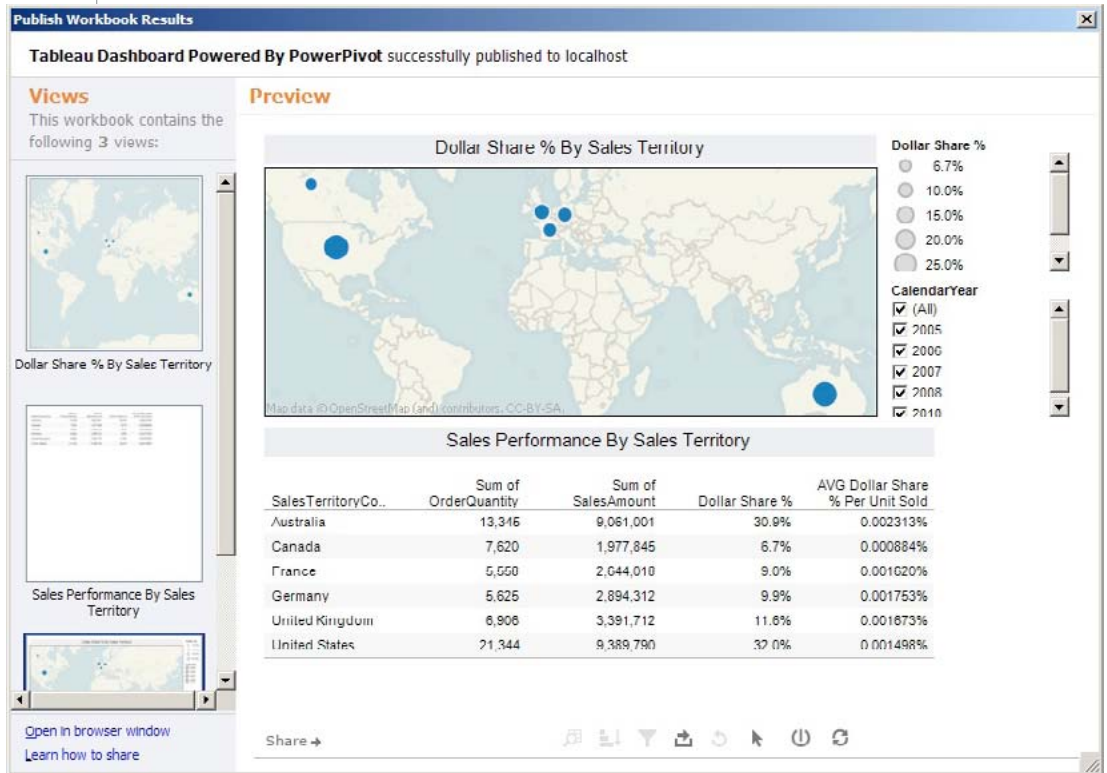
Note: Tableau Desktop provides the ability to construct dashboards by combining multiple worksheets and their corresponding visualizations into a consolidate analysis.

FIGURE XIV:
Tableau Desktop
Dashboard Powered
by PowerPivot



To publish the Tableau dashboard I simply select Server > Publish Workbook... from Tableau Desktop's main menu. This action invokes the Tableau Server publishing dialog box. I provide some basic properties such as project, name, and select which visualizations I wish to share via Tableau Server. Upon entering the publishing parameters and clicking the Publish button I receive a nice publish preview dialog as shown in Figure 15.

Figure XV:
Tableau Desktop
Dashboard Powered
by PowerPivot
Publishing Preview
Dialog



Additionally, if I navigate to the Tableau Server using my web browser we see the dashboard in the browser without using any client toolset.

Integrating Tableau Visualizations into SharePoint 2010

Not only does Tableau Server support the thin-client viewing of workbooks authored with PowerPivot data models, you can also embed Tableau Server published views into consuming web applications and even emails. Integrating Tableau Server views into another web application is an important feature as it allows larger SharePoint business intelligence deployments to take full advantage of Tableau Server's capabilities while not forcing consumers of Tableau to a separate URL.

To embed a Tableau Server view into another web application or email simply click on the Share hyperlink and a new dialog is displayed with code you can copy and paste as shown in Figure 16. Notice that the HTML code generated in the Embed textbox contains <object> tags, thus you will need to ensure any consuming web application you use allows you to enter these tags. In my case I will copy the email code as I intend to use a simple URL for embedding my published Tableau dashboard into a larger SharePoint deployment.

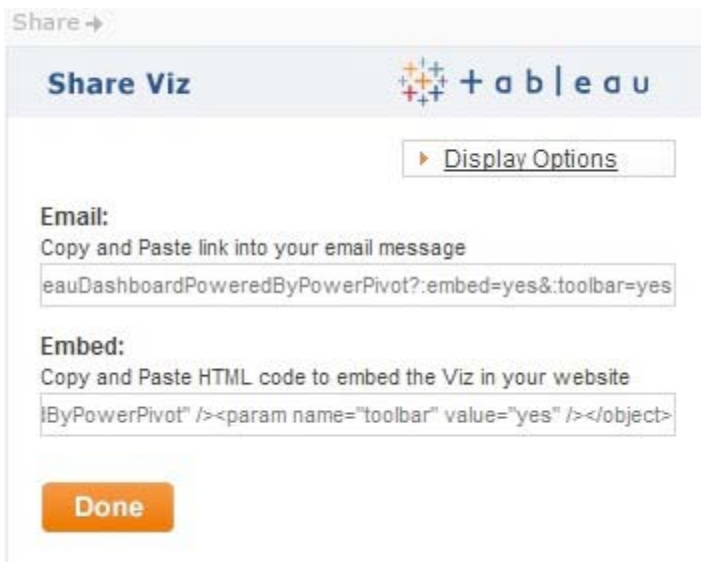


FIGURE XVI: Tableau Server’s Share Functionality

I can then navigate to a SharePoint 2010 web part page and add a Page Viewer web part. In the Page Viewer’s web part I simply paste the copied URL into the Link textbox within the web part configuration pane. I can optionally test the link and the test works just fine via a new web browser window opening up. I then set my web part’s width and height to fixed pixel settings to expand the web part’s view space and I save the web part page. I can now view my Tableau Server published dashboard inside of SharePoint 2010 as shown in Figure 17.

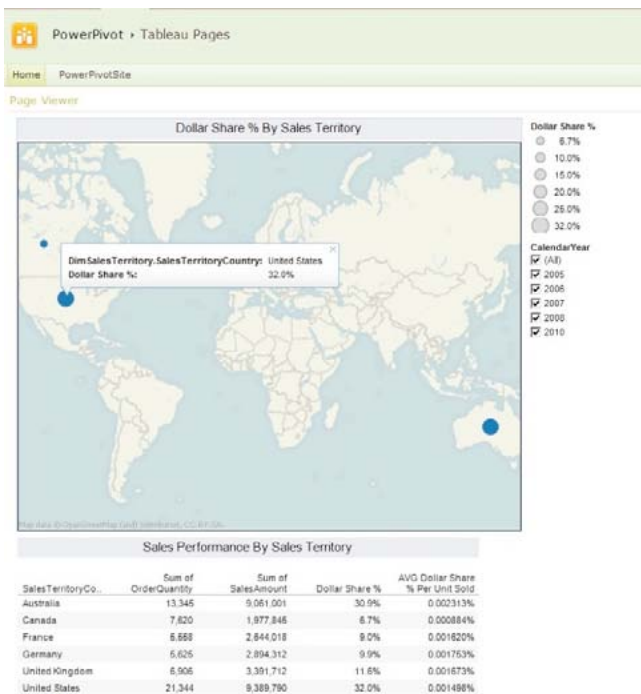


FIGURE XVI: Tableau Server Dashboard Viewed In SharePoint 2010 Portal

CONCLUSION

SSBI customers should strongly consider leveraging both the Tableau suite and Microsoft PowerPivot together in hybrid deployments. Each toolset has its strengths and those strengths can be leveraged to empower the other toolset as demonstrated in this whitepaper. PowerPivot gets you excellent performance and a central repository (SharePoint) for business users' data and Tableau offers a stunningly intuitive interface to create interactive application dashboards and reports that can be embedded back into that same central repository to share with others. While both Tableau and PowerPivot each have solid customer bases, this whitepaper has shown that each toolset has unique extensions to offer for existing customers of both SSBI toolsets.

RELATED LINKS

While this paper explored the unique synergies of using Tableau & PowerPivot together you may find it valuable to continue learning about each product independently as well.

Tableau Software Resources

Tableau Software's Website

<http://www.tableausoftware.com>

Tableau Software's Press Release Announcing PowerPivot Support

http://www.tableausoftware.com/press_release/connectivity-powerpivot-sharepoint-2010

Microsoft PowerPivot Resources

Microsoft's PowerPivot Website

<http://www.powerpivot.com>

Microsoft's PowerPivot TechNet Website

<http://technet.microsoft.com/en-us/library/ee210692.aspx>