Sri Lanka Institute of Information Technology

Assignment 02

Data Warehousing & Business Intelligence

2021

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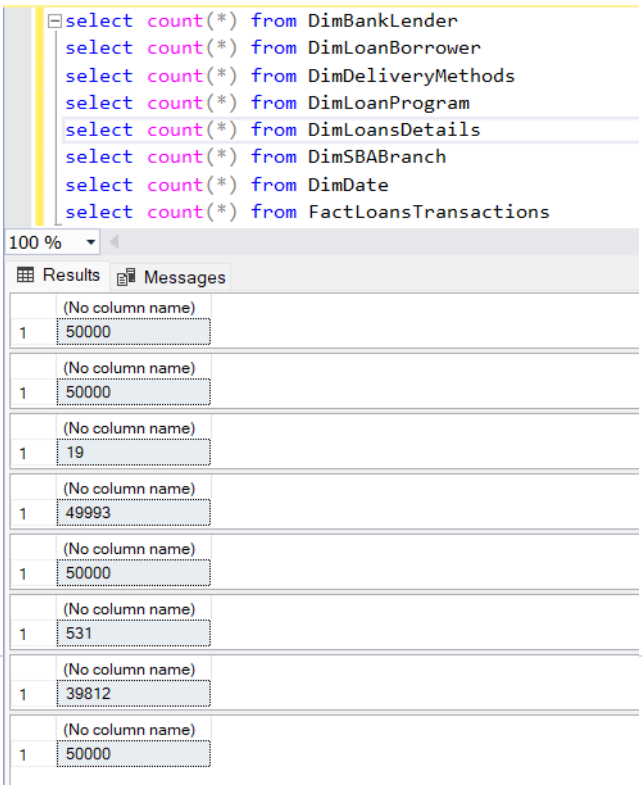
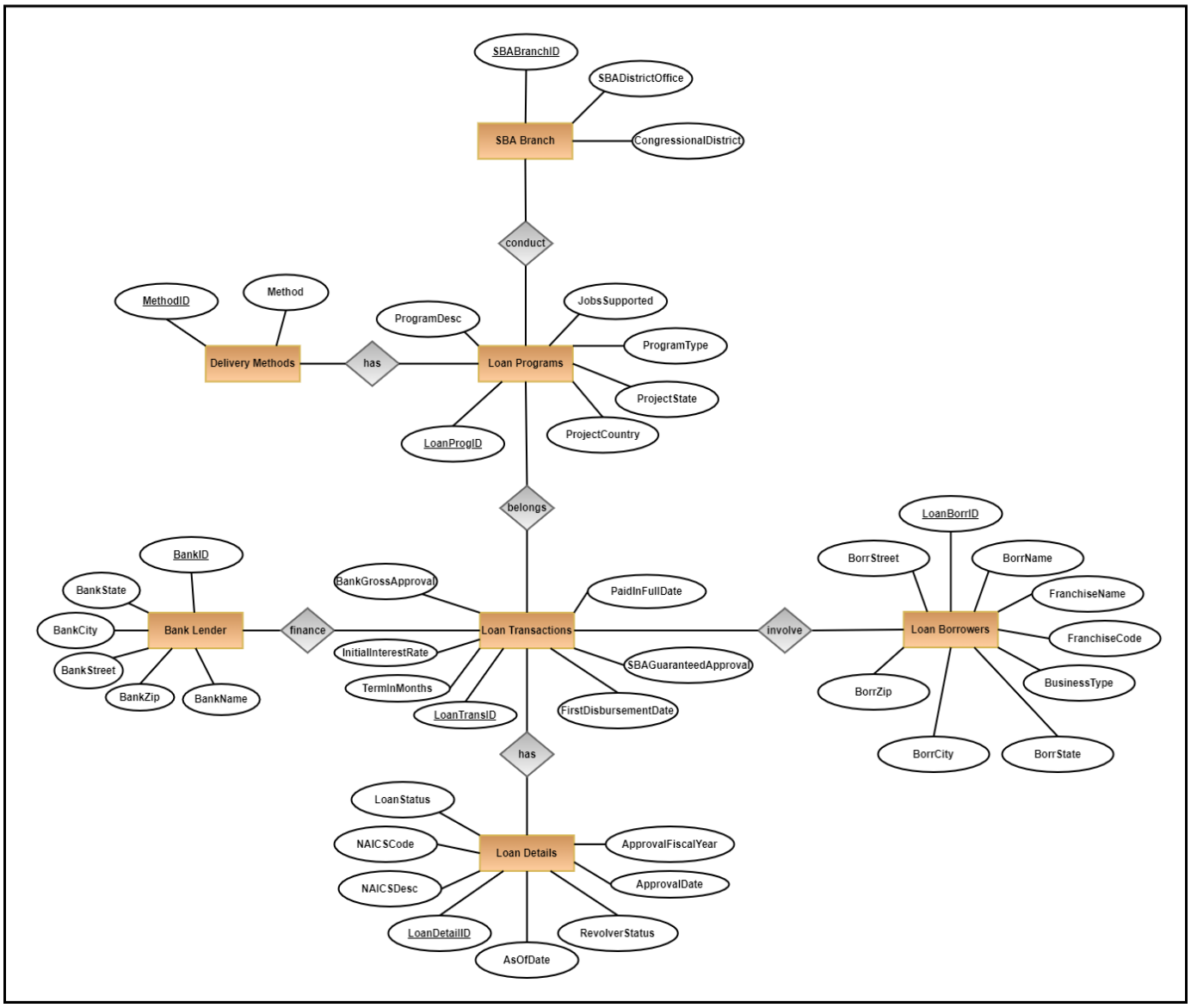
IT20202736

Data source for the Assignment 2

- DataWarehouse: SBA_7a_LoanProgram_DW
- There are 7-dimension tables. They are,
  - DimLoanBorrower
  - DimBankLender
  - DimLoanProgram
  - DimDeliveryMethods
  - DimLoansDetails
  - DimSBABranch
  - DimDate
- There is a Fact table called FactLoansTransactions.
- The data in each dimension in the data warehouse are as follows.



ER Diagram


SBABranchID
SBADistrictOffice
SBA Branch
CongressionalDistrict
conduct
MethodID
Method
ProgramDesc
JobsSupported
Delivery Methods
has
Loan Programs
ProgramType
ProjectState
LoanProgID
ProjectCountry
belongs
LoanBorrID
BorrStreet
BorrName
BankID
BankState
BankGrossApproval
PaidInFullDate
FranchiseName
BankCity
Bank Lender
finance
Loan Transactions
involve
Loan Borrowers
FranchiseCode
InitialInterestRate
BankStreet
SBAGuaranteedApproval
BusinessType
BorrZip
TermInMonths
BankZip
BankName
LoanTransID
FirstDisbursementDate
has
BorrCity
BorrState
LoanStatus
NAICSCode
Loan Details
ApprovalFiscalYear
NAICSDesc
ApprovalDate
LoanDetailID
RevolverStatus
AsOfDate

SSAS Cube Implementation

First, Open the SQL Server Data Tools.

Create Analysis Services Multidimensional and Data Mining Project named 'SBA_7a_LoanProgram_SSAS'.

Create Data Source

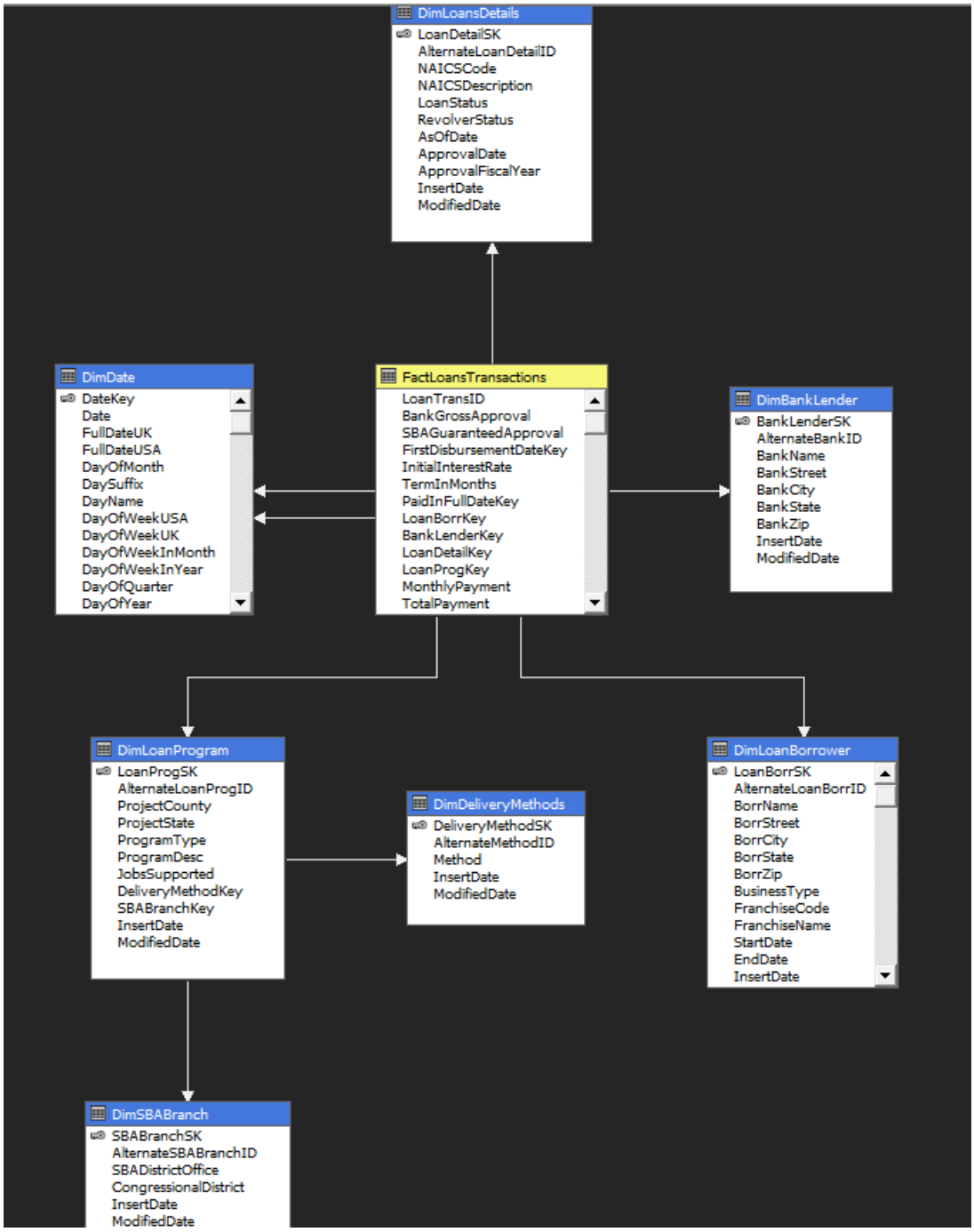
- Right Click on the Data Sources and select Add New Data Source. Then it will prompt a Data Source Wizard and click on next to continue.
- Select the previously created Data warehouse to create a cube in SSAS.
- Then Provide the correct Windows Username and Password.
- Give the data source name; 'DS_SBA_7a_LoanProgram_DW' and finish the process.

Create Data Source View

- Right click on Data Source Views and select New Data Source View.
- In the Select a Data Source page, select the data source that created under the Data source.
- Select the Same key as primary key option and click on Next.
- In the Select Tables and Views page, first click on 'FactLoansTransactions(dbo)'and click on "<" button to move it to the Included objects window. Then click on "Add Related Tables" button.
- Provide a data source view name; 'DSV_SBA_7a_LoanProgram_DW' and click Finish.
- Tables were automatically connected due to foreign key relationships I have given when creating the data warehouse tables.

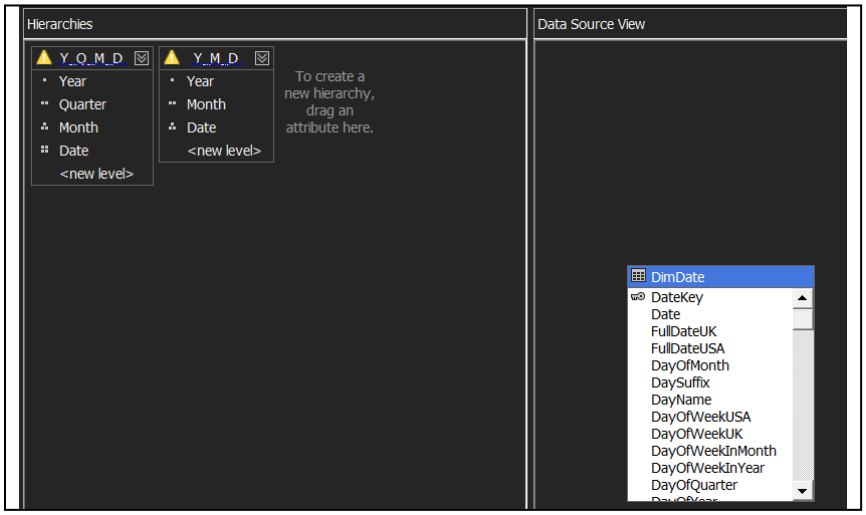
Create Cube

- Right click on Cubes and select New Cube.
- In the Cube Wizard, click on the Next.
- In the Select Creation Method page, select Use existing tables option and click Next.
- In the Select Measure Group Tables page, select the data source view called 'DSV_SBA_7a_LoanProgram_DW' from the dropdown list.
- Select 'FactLoansTransactions' and click Next.
- In the Select Measures page, select all the Measure fields and click Next.
- In the Select New Dimensions page, select all the dimension tables and click Next.
- Provide a cube name; 'DSV_SBA_7a_LoanProgram_DW' and click Finish.
- It displays the same snowflake schema is built as a cube.
- In the Dimensions section, expand 'Dim Loan Borrower' and then 'Attributes'. only the 'Loan Borr SK' is listed as an attribute.
- To add rest of the attributes, click on the 'Edit Dim Loan Borrower' link.
- Select all the fields except for 'Loan Borr SK' in 'DimLoanBorrower' tables visible in Data Source View pane on right.
- Drag and drop them on the Attribute pane on the left side.
- Go back to 'DSV_SBA_7a_LoanProgram_DW' design view expand 'Paid In Full Date' in the Dimensions section and click on 'Edit Dim Date' and add all the attributes except for 'DateKey' by following the same steps you follow to add attributes to 'Dim Loan Borrower'.
- Follow same steps to add all the attributes of 'Dim Bank Lender', 'Dim Loans Details' and 'Dim Loan Program'.

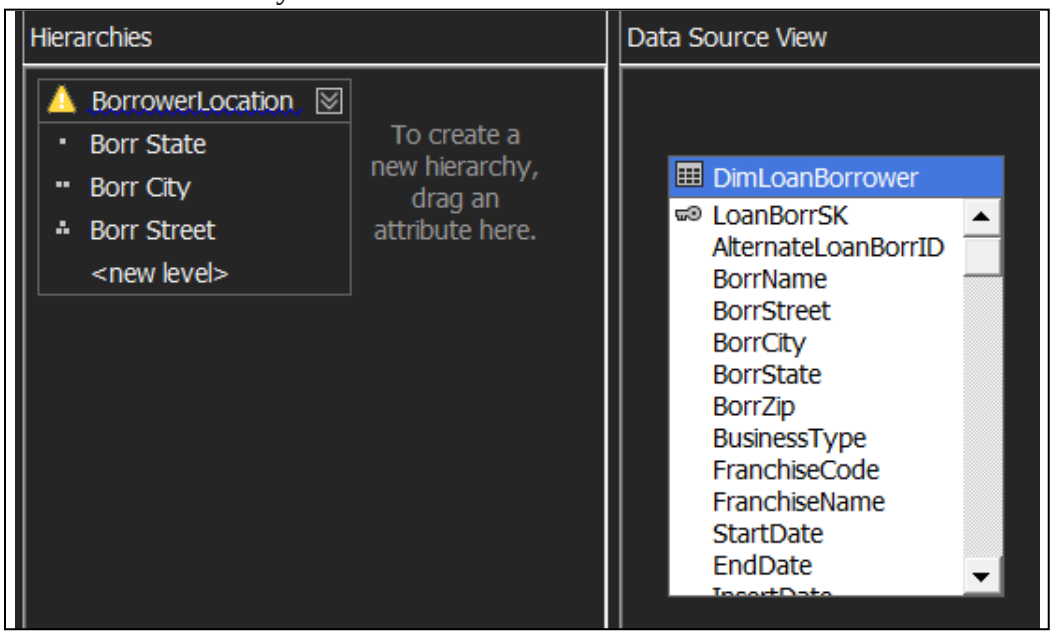

DimLoansDetails
LoanDetailSK
AlternateLoanDetailID
NAICSCode
NAICSDescription
LoanStatus
RevolverStatus
AsOfDate
ApprovalDate
ApprovalFiscalYear
InsertDate
ModifiedDate
DimDate
DateKey
Date
FullDateUK
FullDateUSA
DayOfMonth
DaySuffix
DayName
DayOfWeekUSA
DayOfWeekUK
DayOfWeekInMonth
DayOfWeekInYear
DayOfQuarter
DayOfYear
FactLoansTransactions
LoanTransID
BankGrossApproval
SBAGuaranteedApproval
FirstDisbursementDateKey
InitialInterestRate
TermInMonths
PaidInFullDateKey
LoanBorrKey
BankLenderKey
LoanDetailKey
LoanProgKey
MonthlyPayment
TotalPayment
DimBankLender
BankLenderSK
AlternateBankID
BankName
BankStreet
BankCity
BankState
BankZip
InsertDate
ModifiedDate
DimLoanProgram
LoanProgSK
AlternateLoanProgID
ProjectCounty
ProjectState
ProgramType
ProgramDesc
JobsSupported
DeliveryMethodKey
SBABranchKey
InsertDate
ModifiedDate
DimDeliveryMethods
DeliveryMethodSK
AlternateMethodID
Method
InsertDate
ModifiedDate
DimLoanBorrower
LoanBorrSK
AlternateLoanBorrID
BorrName
BorrStreet
BorrCity
BorrState
BorrZip
BusinessType
FranchiseCode
FranchiseName
StartDate
EndDate
InsertDate
DimSBABranch
SBABranchSK
AlternateSBABranchID
SBADistrictOffice
CongressionalDistrict
InsertDate
ModifiedDate

Create Hierarchy

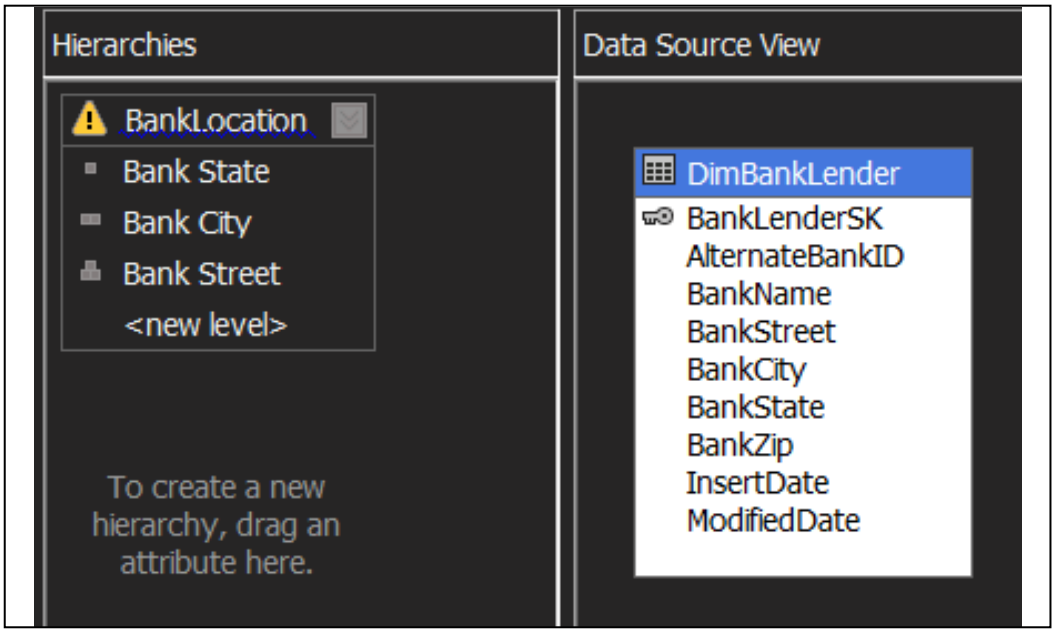
- In Dimension editor window for ‘DimDate’, drag and drop the attributes to Hierarchy window to create hierarchies.
- In ‘DimDate’ Created Two hierarchies,
  - Year => Quarter => Month => Date
  - Year => Month => Date
- Rename that hierarchies as ‘YQMD’ and ‘YMD’.



- In Dimension editor window for ‘Dim Loan Borrower’, drag and drop the attributes to Hierarchy window to create hierarchies.
- In ‘Dim Loan Borrower’ Created a hierarchy,
  - State => City => Street
- Rename that hierarchy as ‘BorrowerLocation’.



- In Dimension editor window for ‘Dim Bank Lender’, drag and drop the attributes to Hierarchy window to create hierarchies.
- In ‘Dim Bank Lender Created a hierarchy,
  - State => City => Street
- Rename that hierarchy as ‘BankLocation’.



Deploy The Cube

- The Cube must be deployed to be used for analysis.
- Right click on the project name, 'SBA_7a_LoanProgram_SSAS' in solution explorer and click on Deploy.
- It will generate a pop-up window displaying the progress of the deployment.
- To check the deployment in SSMS, open SQL Server Management Studio, select Analysis Service and click on Connect.

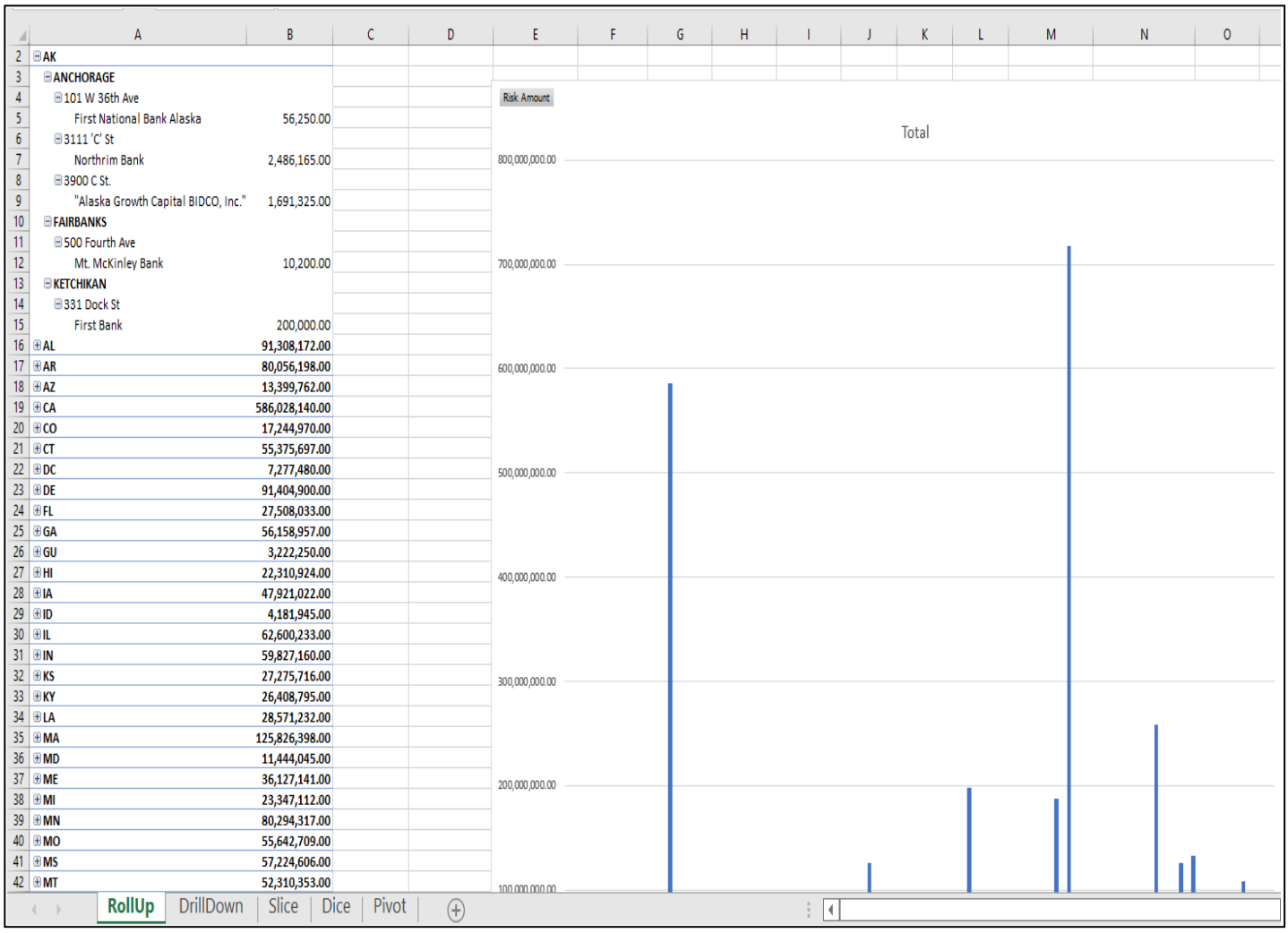
Connecting Excel to SSAS Cube using a MDX Query

- Download the Silverlight and install it.
- To enable Power Pivot add-in for Excel, click File a Options.
- Go to Add-Ins tab and select COM Add-ins under Manage and click GO.
- In the COM Add-Ins window, select both Microsoft Office PowerPivot for Excel and Microsoft Office Power View for Excel options and click OK.
- A new tab named 'POWERPIVOT' is available in the Excel workbook now. Go to new tab 'POWERPIVOT' and click on Manage.
- Power Pivot for Excel <Excel Workbook Name> will open.
- In the Home tab of this new window, click on From Database -> From Analysis Services or Power Pivot.
- In the Table Import Wizard window, provide connection details to connect to SSAS Server.
- Provide the database name 'SBA_7a_LoanProgram_SSAS', test the connection, and click Next.
- In the next window, paste the MDX query copied, and click on Validate button to ensure there are no errors and click Finish.

Demonstration of OLAP operations

Roll-up:

- Climbing up a hierarchy of a dimension to aggregate data.
- First, I select the Bank Name of the BankLender dimension.
- It then moves to Bank Street.
- It then moves to the Bank City.
- It then moves to the Bank State.
  State ← City ← Street ← Bank Name

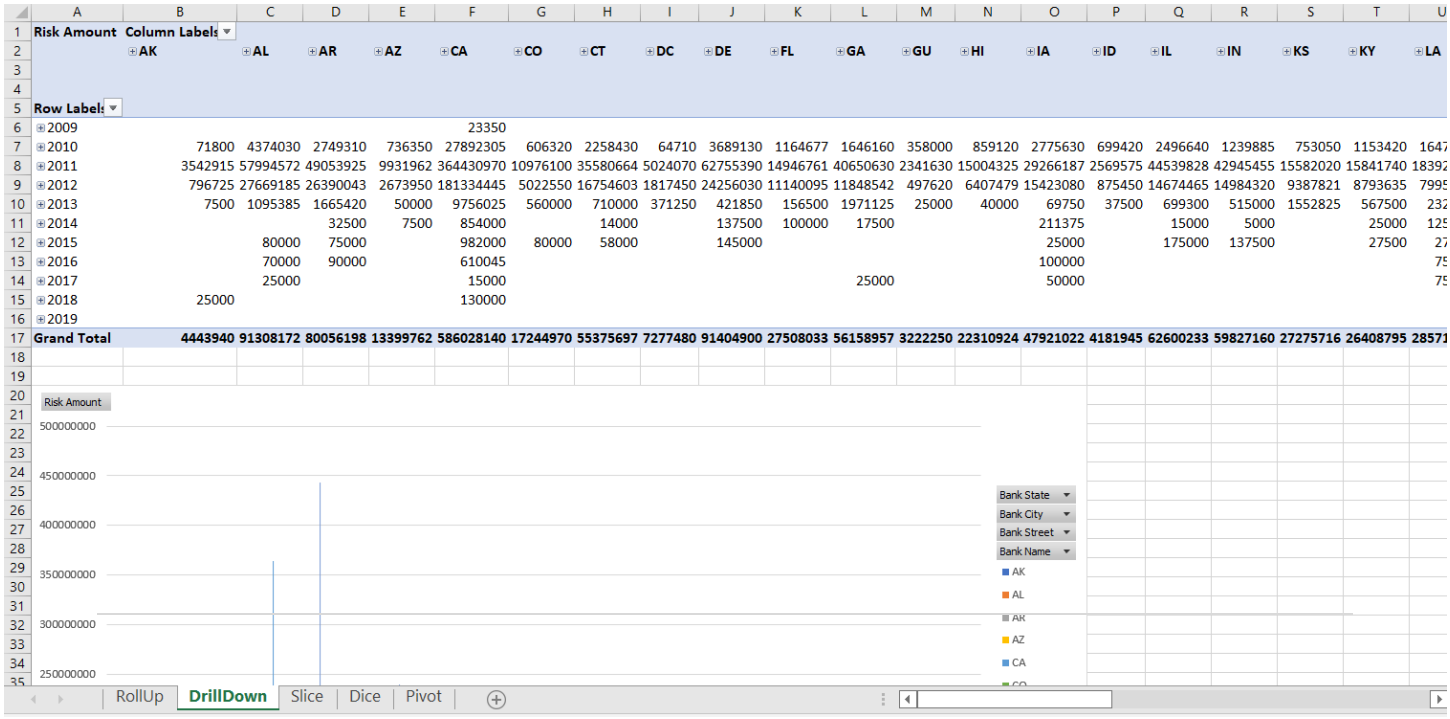


	A	B
2	AK	
3	ANCHORAGE	
4	101 W 36th Ave	
5	First National Bank Alaska	56,250.00
6	3111 'C' St	
7	Northrim Bank	2,486,165.00
8	3900 C St.	
9	"Alaska Growth Capital BIDCO, Inc."	1,691,325.00
10	FAIRBANKS	
11	500 Fourth Ave	
12	Mt. McKinley Bank	10,200.00
13	KETCHIKAN	
14	331 Dock St	
15	First Bank	200,000.00
16	AL	91,308,172.00
17	AR	80,056,198.00
18	AZ	13,399,762.00
19	CA	586,028,140.00
20	CO	17,244,970.00
21	CT	55,375,697.00
22	DC	7,277,480.00
23	DE	91,404,900.00
24	FL	27,508,033.00
25	GA	56,158,957.00
26	GU	3,222,250.00
27	HI	22,310,924.00
28	IA	47,921,022.00
29	ID	4,181,945.00
30	IL	62,600,233.00
31	IN	59,827,160.00
32	KS	27,275,716.00
33	KY	26,408,795.00
34	LA	28,571,232.00
35	MA	125,826,398.00
36	MD	11,444,045.00
37	ME	36,127,141.00
38	MI	23,347,112.00
39	MN	80,294,317.00
40	MO	55,642,709.00
41	MS	57,224,606.00
42	MT	52,310,353.00

Drill-down:

- Stepping down a hierarchy of a dimension to allowing navigation through details.
- First, we select the state of the bank lender dimension.
- It then moves to the bank lender city by state.
- Then to street by city.
- It then displays the years of the transactions according to the bank location.
- It then shows the total amount of loan amounts approved by a relevant bank.

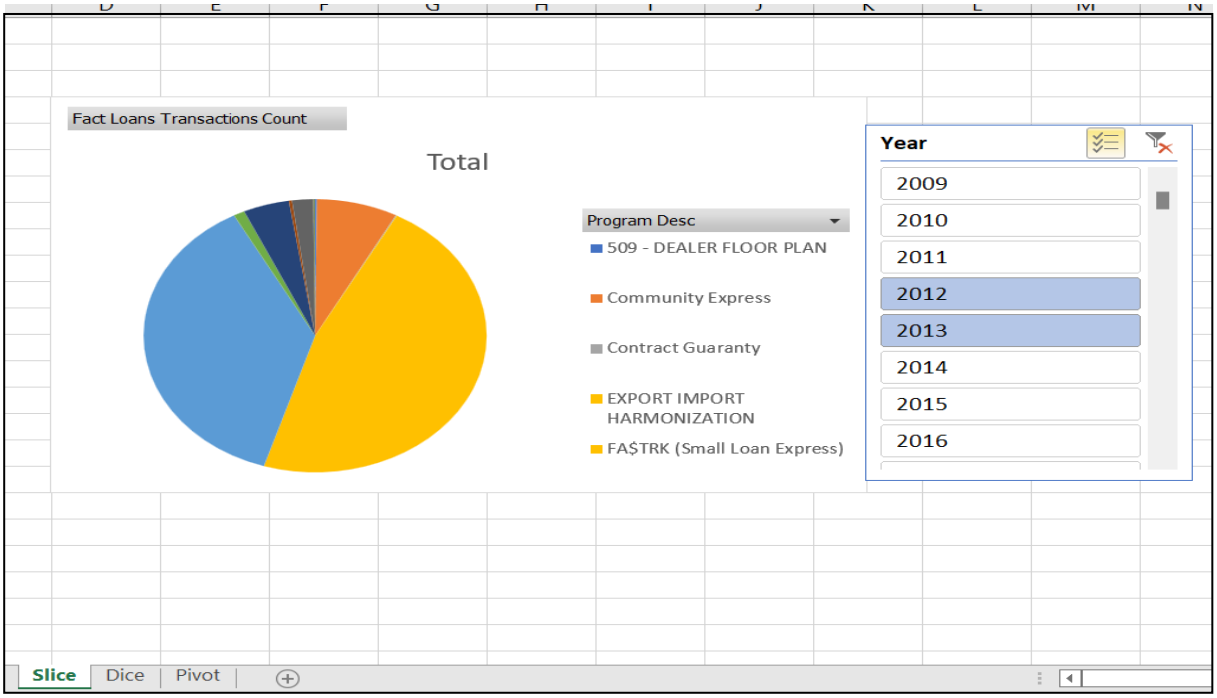
State → City → Street → Bank Name



Risk Amount	Column Labels																			
	AK	AL	AR	AZ	CA	CO	CT	DC	DE	FL	GA	GU	HI	IA	ID	IL	IN	KS	KY	LA
Row Labels																				
2009					23350															
2010	71800	4374030	2749310	736350	27892305	606320	2258430	64710	3689130	1164677	1646160	358000	859120	2775630	699420	2496640	1239885	753050	1153420	1647
2011	3542915	57994572	49053925	9931962	364430970	10976100	35580664	5024070	62755390	14946761	40650630	2341630	15004325	29266187	2569575	44539828	42945455	15582020	15841740	18392
2012	796725	27669185	26390043	2673950	181334445	5022550	16754603	1817450	24256030	11140095	11848542	497620	6407479	15423080	875450	14674465	14984320	9387821	8793635	7995
2013	7500	1095385	1665420	50000	9756025	560000	710000	371250	421850	156500	1971125	25000	40000	69750	37500	699300	515000	1552825	567500	232
2014			32500	7500	854000		14000		137500	100000	17500			211375		15000	5000		25000	125
2015		80000	75000		982000	80000	58000		145000					25000		175000	137500		27500	27
2016		70000	90000		610045									100000						75
2017		25000			15000						25000			50000						75
2018	25000				130000															
2019																				
Grand Total	4443940	91308172	80056198	13399762	586028140	17244970	55375697	7277480	91404900	27508033	56158957	3222250	22310924	47921022	4181945	62600233	59827160	27275716	26408795	28571

Slice:

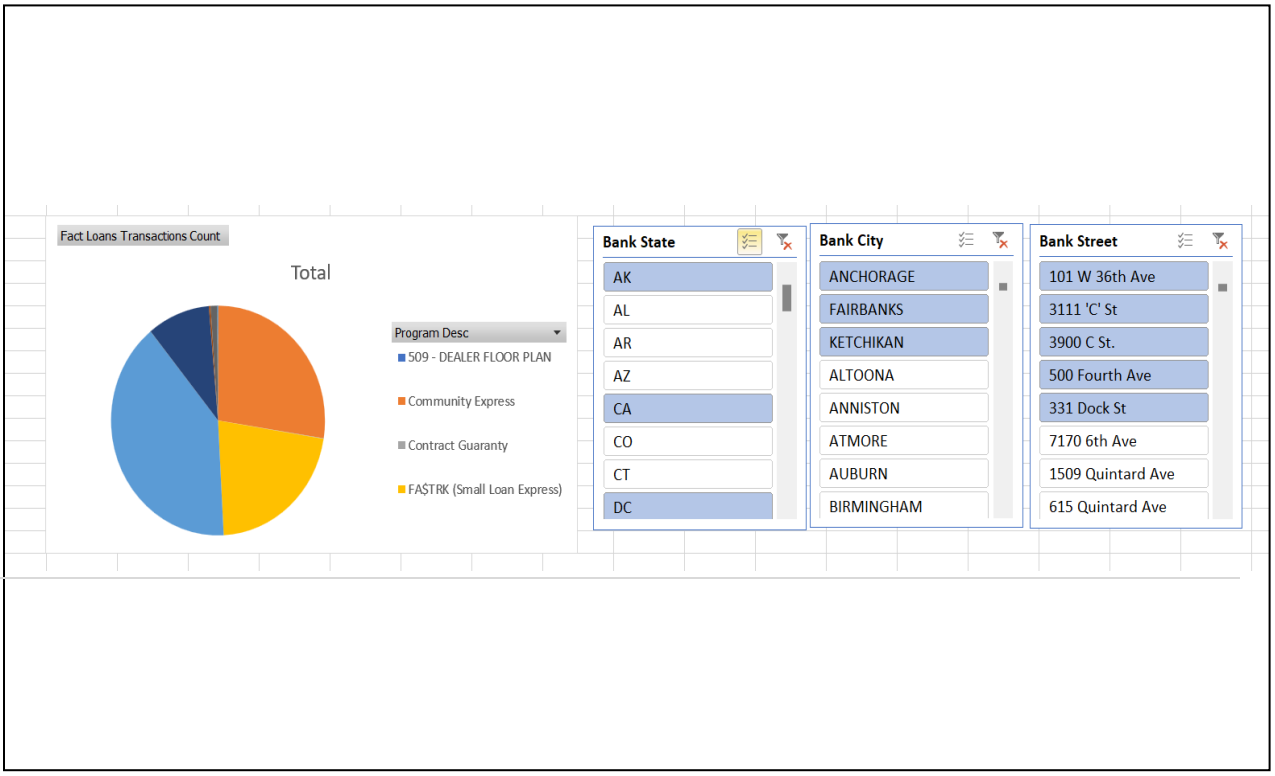
- ❖ All the transactions for a particular loan program are designed as a pivot chart.
- ❖ Then the pivot chart is sliced by Year of the transaction that happened.



Dice:

- The dice operation defines a sub cube by performing a selection on two or more dimensions.

- Count of transactions for a loan program is filtered by the location hieracy.

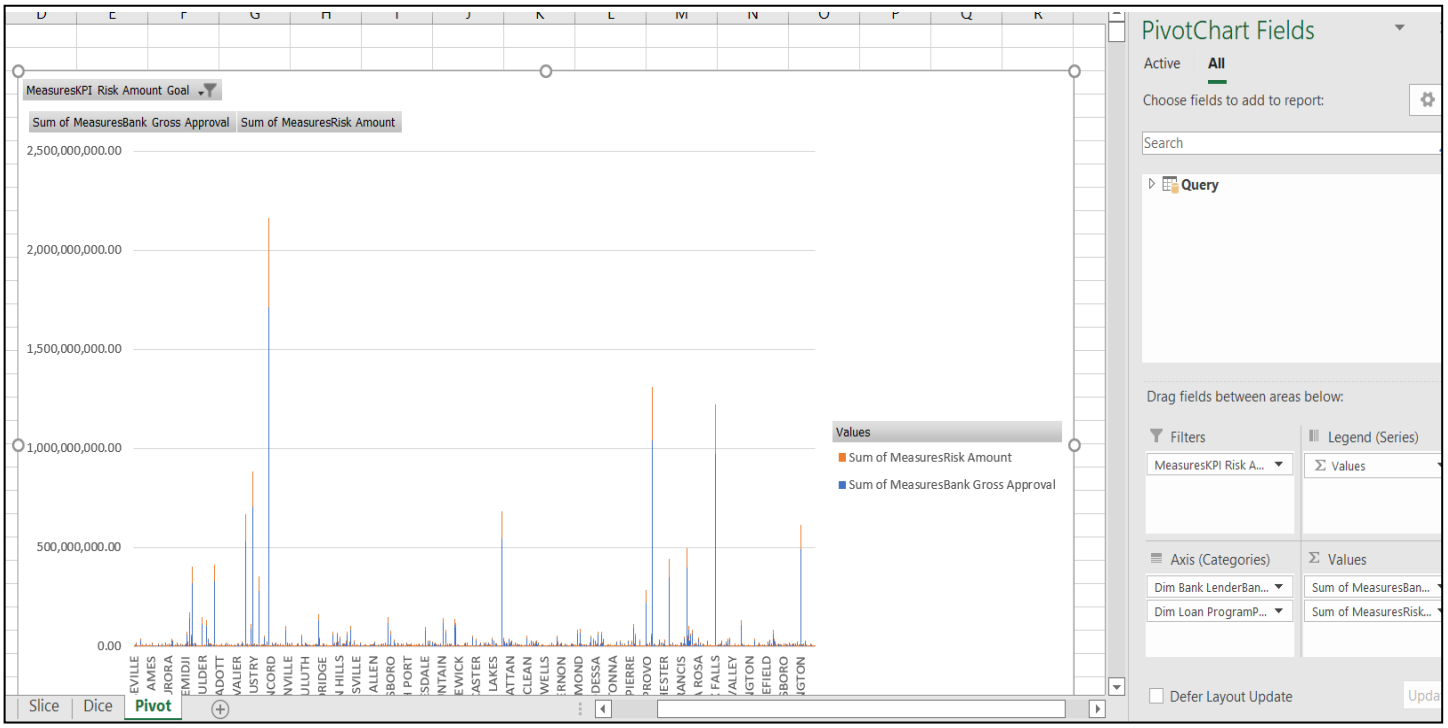


Pivot:

- ❖ Pivot is a visualization operation which rotates the data axes to provide an alternative presentation of the data.
- ❖ The Bank Lender dimension selects the Loan Risk Amount KPI as rows.
- ❖ The location is selected as a column in the Bank Lender dimension.
- ❖ In FactLoanTransaction, select Bank Gross Approval and the kpi values as values.

	A	B	C
1	MeasuresKPI Risk Amount Goal	True	
2			
3	Row Labels	Sum of MeasuresBank Gross Approval	Sum of MeasuresRisk Amount
4	ABBEVILLE	1,755,000.00	626,500.00
5	ABBOTSFORD	1,177,500.00	357,500.00
6	ABERDEEN	6,416,400.00	1,789,610.00
7	ABILENE	17,820,200.00	4,615,025.00
8	ABINGTON	7,238,000.00	1,894,550.00
9	ADA	285,000.00	66,250.00
10	ADAIR	400,000.00	100,000.00
11	AFTON	654,600.00	72,960.00
12	AIKEN	250,000.00	125,000.00
13	ALAMOSA	550,000.00	275,000.00
14	Albany	31,188,665.00	8,246,532.00
15	ALBEMARLE	2,635,000.00	942,500.00
16	ALBIA	990,000.00	247,500.00
17	ALBUQUERQUE	1,671,000.00	548,500.00
18	ALDEN	5,000,000.00	1,250,000.00
19	ALEXANDRIA	2,220,800.00	508,570.00
20	ALGONA	271,900.00	58,175.00
21	ALHAMBRA	1,000,000.00	500,000.00
22	ALLENTOWN	160,000.00	56,000.00
23	ALLISON PARK	12,739,000.00	3,071,240.00
24	ALMA	3,669,200.00	1,057,925.00
25	ALMENA	599,700.00	161,100.00
26	ALPHARETTA	2,801,400.00	1,023,850.00
27	ALTAMONT	1,172,500.00	333,425.00
28	ALTO PASS	2,928,800.00	697,370.00
29	ALTOONA	1,664,500.00	511,300.00

RollUp | DrillDown | Slice | Dice | Pivot



SSRS Reports

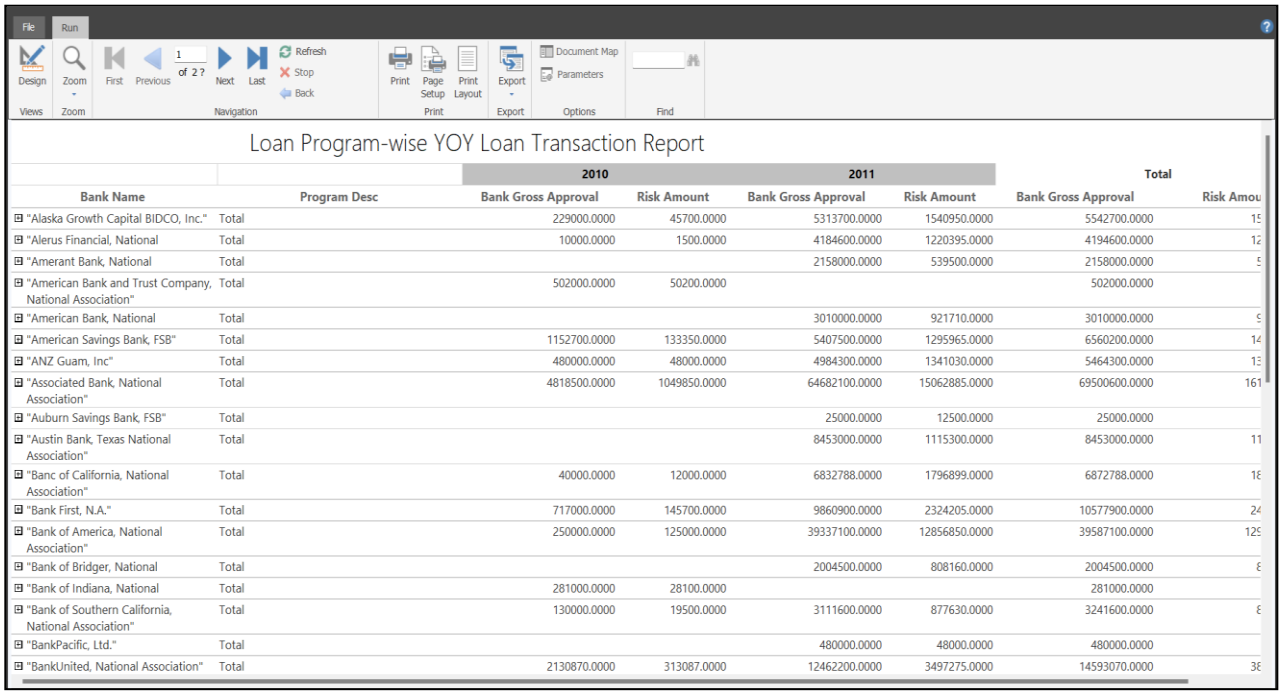
MDX query used for creating Reports,

```
select dlp.ProgramDesc, dsb.SBADistrictOffice, ddm.Method, dld.ApprovalDate,
dbl.BankName, dbl.BankStreet, dbl.BankCity, dbl.BankState, dlb.BorrName, dlb.BorrStreet,
dlb.BorrCity, dlb.BorrState, dlb.BusinessType, dd.Month, dd.MonthName, dd.Year,
flt.BankGrossApproval,
flt.SBAGuaranteedApproval, flt.RiskAmount, flt.InitialInterestRate, flt.MonthlyPayment,
flt.TotalPayment,
flt.TermInMonths, flt.TotalInterest
from FactLoansTransactions flt
inner join DimLoanProgram dlp on flt.LoanProgKey = dlp.LoanProgSK
inner join DimDeliveryMethods ddm on dlp.DeliveryMethodKey = ddm.DeliveryMethodSK
inner join DimSBABranch dsb on dlp.SBABranchKey = dsb.SBABranchSK
inner join DimLoansDetails dld on flt.LoanDetailKey = dld.LoanDetailSK
inner join DimBankLender dbl on flt.BankLenderKey = dbl.BankLenderSK
inner join DimLoanBorrower dlb on flt.LoanBorrKey = dlb.LoanBorrSK

        inner join DimDate dd on flt.FirstDisbursementDateKey = dd.DateKey
```

Creating a Matrix Report

- First, we need to select fields for Row groups and Column groups.
- drag and drop ‘Bank Name’, ‘Program Desc’ to Row groups section and ‘Year’ to Column groups section and ‘Bank Gross Approval’ and ‘Risk Amount’ to Values section and click Next.

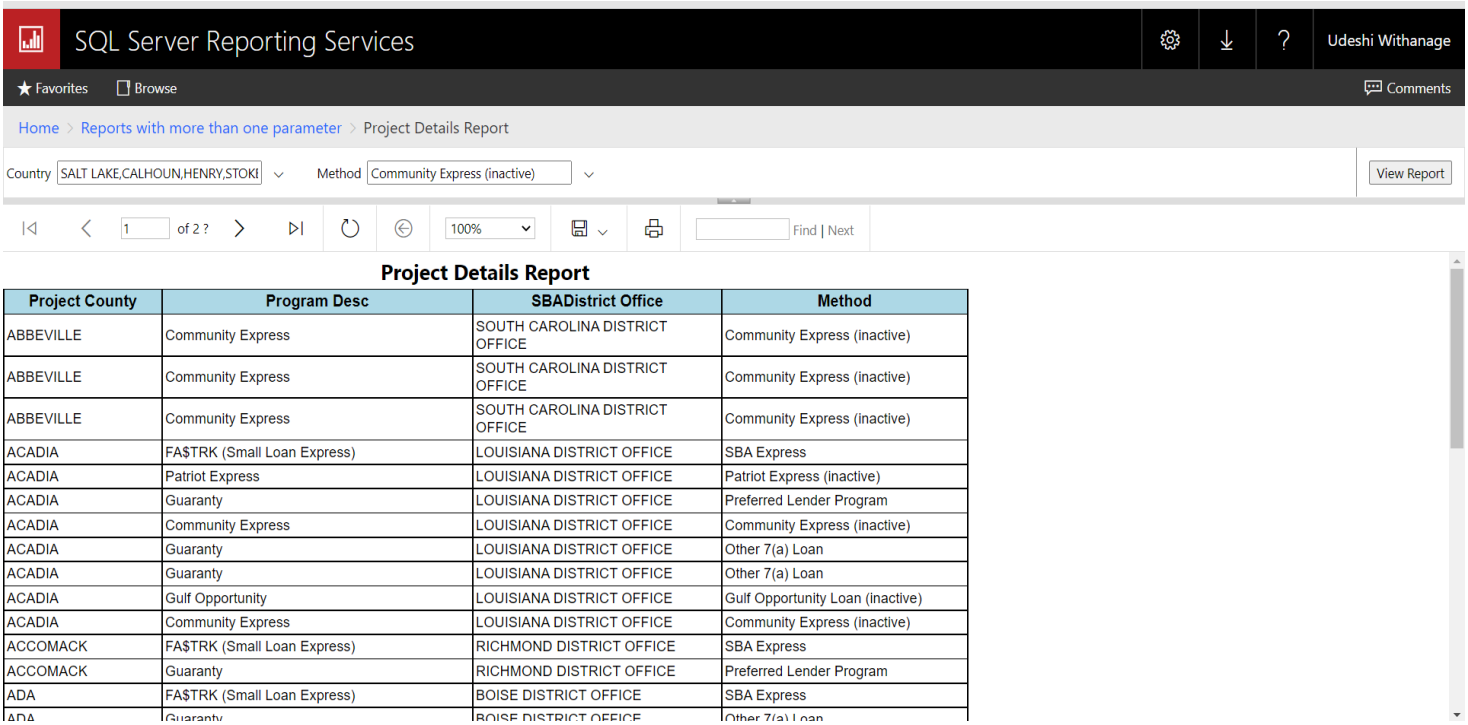


Loan Program-wise YOY Loan Transaction Report

		2010		2011		Total	
Bank Name	Program Desc	Bank Gross Approval	Risk Amount	Bank Gross Approval	Risk Amount	Bank Gross Approval	Risk Amou
"Alaska Growth Capital BIDCO, Inc."	Total	229000.0000	45700.0000	5313700.0000	1540950.0000	5542700.0000	15
"Alerus Financial, National	Total	10000.0000	1500.0000	4184600.0000	1220395.0000	4194600.0000	12
"Amerant Bank, National	Total			2158000.0000	539500.0000	2158000.0000	5
"American Bank and Trust Company, National Association"	Total	502000.0000	50200.0000			502000.0000	
"American Bank, National	Total			3010000.0000	921710.0000	3010000.0000	9
"American Savings Bank, FSB"	Total	1152700.0000	133350.0000	5407500.0000	1295965.0000	6560200.0000	14
"ANZ Guam, Inc"	Total	480000.0000	48000.0000	4984300.0000	1341030.0000	5464300.0000	13
"Associated Bank, National Association"	Total	4818500.0000	1049850.0000	64682100.0000	15062885.0000	69500600.0000	161
"Auburn Savings Bank, FSB"	Total			25000.0000	12500.0000	25000.0000	
"Austin Bank, Texas National Association"	Total			8453000.0000	1115300.0000	8453000.0000	11
"Banc of California, National Association"	Total	40000.0000	12000.0000	6832788.0000	1796899.0000	6872788.0000	18
"Bank First, N.A."	Total	717000.0000	145700.0000	9860900.0000	2324205.0000	10577900.0000	24
"Bank of America, National Association"	Total	250000.0000	125000.0000	39337100.0000	12856850.0000	39587100.0000	129
"Bank of Bridger, National	Total			2004500.0000	808160.0000	2004500.0000	8
"Bank of Indiana, National	Total	281000.0000	28100.0000			281000.0000	
"Bank of Southern California, National Association"	Total	130000.0000	19500.0000	3111600.0000	877630.0000	3241600.0000	8
"BankPacific, Ltd."	Total			480000.0000	48000.0000	480000.0000	
"BankUnited, National Association"	Total	2130870.0000	313087.0000	12462200.0000	3497275.0000	14593070.0000	38

Creating a Multi-Parameter Report

- Create a report with 2 parameters.
- First parameter is the loan project country with a list of values for the user to select.
- Second parameter is the loan disbursement method, where the values for project country should be populated based on the selected value for disbursement method.
- First, we need to select fields for Row groups and Column groups.
- Then create 2 separate datasets for all available countries and all available disbursement methods.

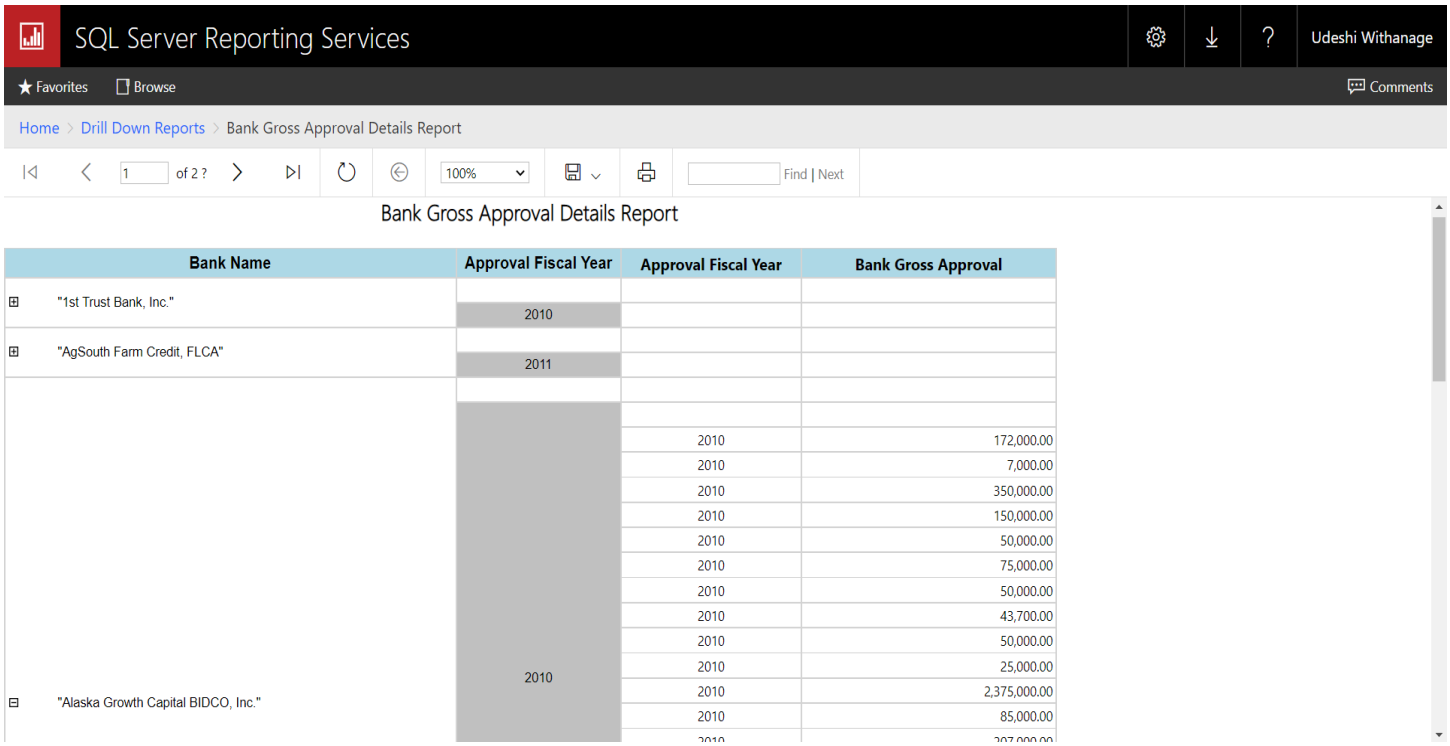


Project Details Report

Project County	Program Desc	SBADistrict Office	Method
ABBEVILLE	Community Express	SOUTH CAROLINA DISTRICT OFFICE	Community Express (inactive)
ABBEVILLE	Community Express	SOUTH CAROLINA DISTRICT OFFICE	Community Express (inactive)
ABBEVILLE	Community Express	SOUTH CAROLINA DISTRICT OFFICE	Community Express (inactive)
ACADIA	FA$TRK (Small Loan Express)	LOUISIANA DISTRICT OFFICE	SBA Express
ACADIA	Patriot Express	LOUISIANA DISTRICT OFFICE	Patriot Express (inactive)
ACADIA	Guaranty	LOUISIANA DISTRICT OFFICE	Preferred Lender Program
ACADIA	Community Express	LOUISIANA DISTRICT OFFICE	Community Express (inactive)
ACADIA	Guaranty	LOUISIANA DISTRICT OFFICE	Other 7(a) Loan
ACADIA	Guaranty	LOUISIANA DISTRICT OFFICE	Other 7(a) Loan
ACADIA	Gulf Opportunity	LOUISIANA DISTRICT OFFICE	Gulf Opportunity Loan (inactive)
ACADIA	Community Express	LOUISIANA DISTRICT OFFICE	Community Express (inactive)
ACCOMACK	FA$TRK (Small Loan Express)	RICHMOND DISTRICT OFFICE	SBA Express
ACCOMACK	Guaranty	RICHMOND DISTRICT OFFICE	Preferred Lender Program
ADA	FA$TRK (Small Loan Express)	BOISE DISTRICT OFFICE	SBA Express
ADA	Guaranty	BOISE DISTRICT OFFICE	Other 7(a) Loan

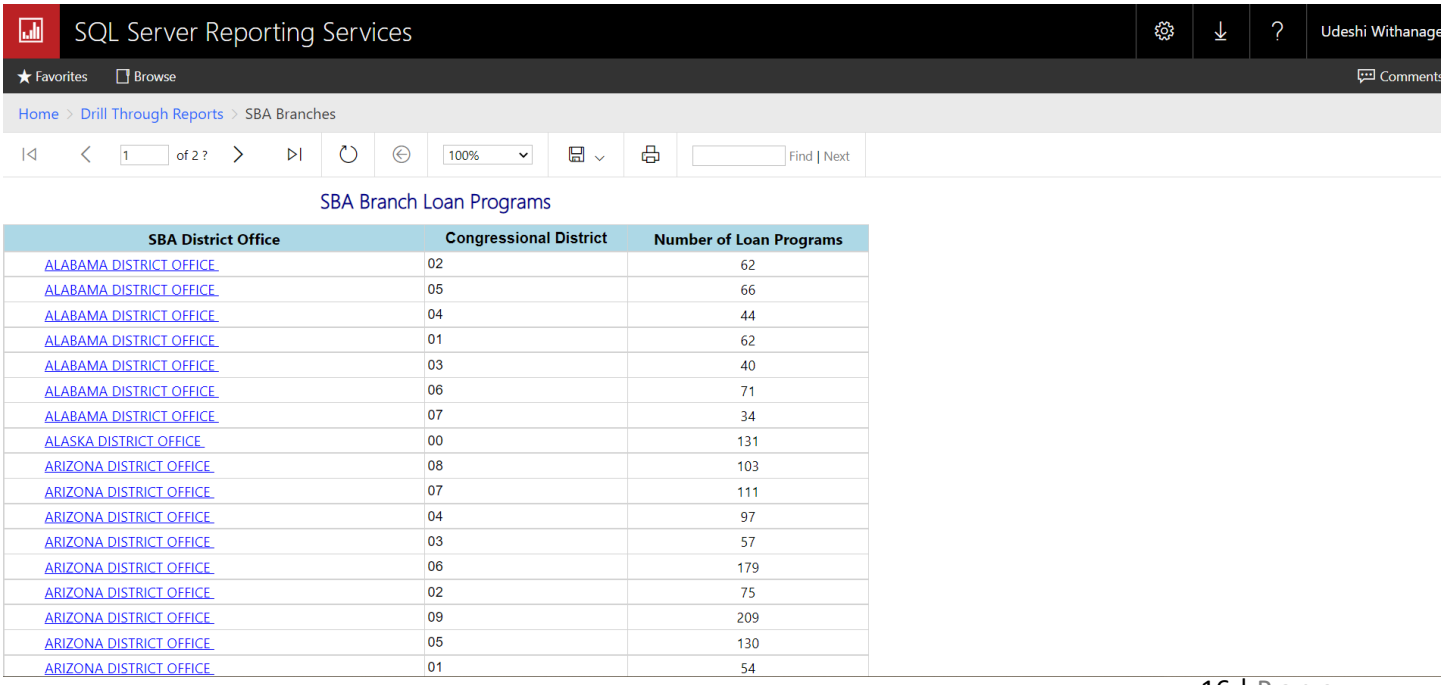
Creating a Drill Down Report

- First chose the data set which I want to make a report.
- Grouping the data by bank name wise and approval year wise to allow users to show or hide data with a plus or minus symbol.

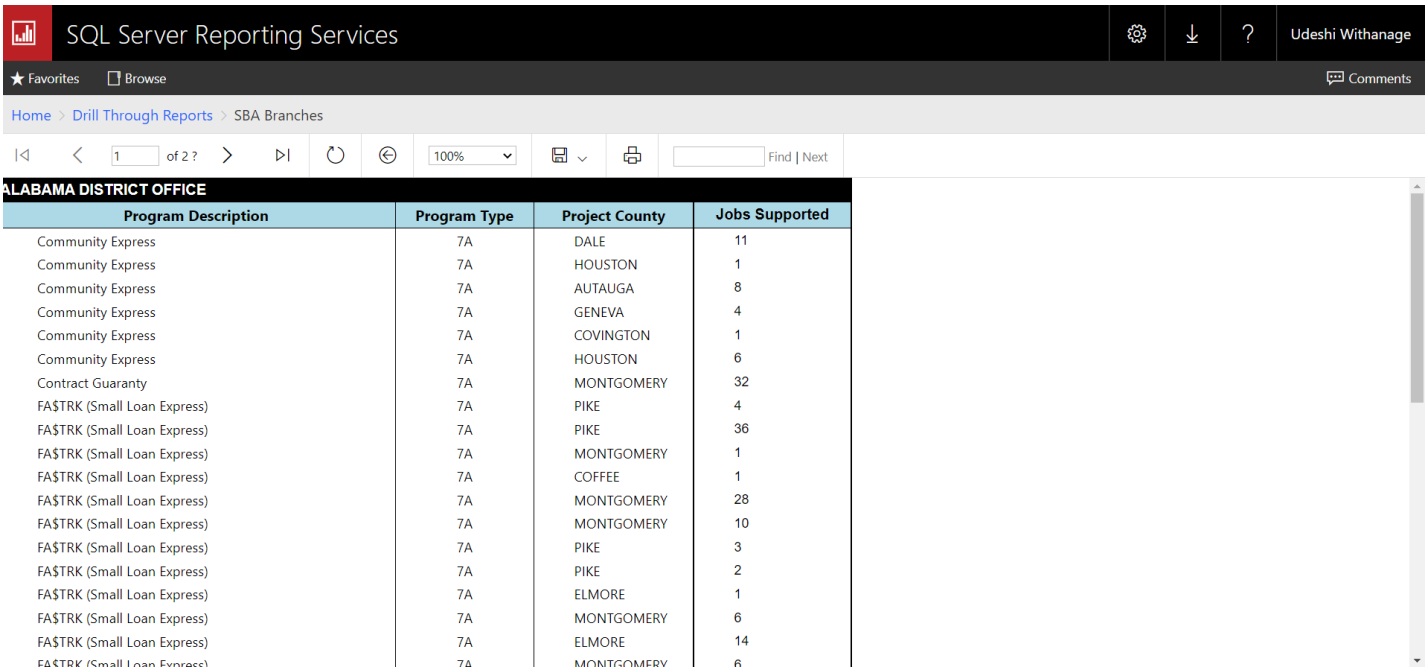


Creating a Drill Through Report

- Chose the data set which I want to make in the child report.
- Creating the child report with 2 parameters which expecting values from parent reports.
- Chose a dataset for the parent report.
- Pass values to the child report parameters to view the child report.



SBA District Office	Congressional District	Number of Loan Programs
ALABAMA DISTRICT OFFICE	02	62
ALABAMA DISTRICT OFFICE	05	66
ALABAMA DISTRICT OFFICE	04	44
ALABAMA DISTRICT OFFICE	01	62
ALABAMA DISTRICT OFFICE	03	40
ALABAMA DISTRICT OFFICE	06	71
ALABAMA DISTRICT OFFICE	07	34
ALASKA DISTRICT OFFICE	00	131
ARIZONA DISTRICT OFFICE	08	103
ARIZONA DISTRICT OFFICE	07	111
ARIZONA DISTRICT OFFICE	04	97
ARIZONA DISTRICT OFFICE	03	57
ARIZONA DISTRICT OFFICE	06	179
ARIZONA DISTRICT OFFICE	02	75
ARIZONA DISTRICT OFFICE	09	209
ARIZONA DISTRICT OFFICE	05	130
ARIZONA DISTRICT OFFICE	01	54



ALABAMA DISTRICT OFFICE

Program Description	Program Type	Project County	Jobs Supported
Community Express	7A	DALE	11
Community Express	7A	HOUSTON	1
Community Express	7A	AUTAUGA	8
Community Express	7A	GENEVA	4
Community Express	7A	COVINGTON	1
Community Express	7A	HOUSTON	6
Contract Guaranty	7A	MONTGOMERY	32
FA$TRK (Small Loan Express)	7A	PIKE	4
FA$TRK (Small Loan Express)	7A	PIKE	36
FA$TRK (Small Loan Express)	7A	MONTGOMERY	1
FA$TRK (Small Loan Express)	7A	COFFEE	1
FA$TRK (Small Loan Express)	7A	MONTGOMERY	28
FA$TRK (Small Loan Express)	7A	MONTGOMERY	10
FA$TRK (Small Loan Express)	7A	PIKE	3
FA$TRK (Small Loan Express)	7A	PIKE	2
FA$TRK (Small Loan Express)	7A	ELMORE	1
FA$TRK (Small Loan Express)	7A	MONTGOMERY	6
FA$TRK (Small Loan Express)	7A	ELMORE	14
FA$TRK (Small Loan Express)	7A	MONTGOMERY	6