Project: Analyzing a Market Test

Step 1: Plan Your Analysis

1.1. What is the performance metric you'll use to evaluate the results of your test?

I use Gross Margin as the performance metric to evaluate the results of the test. The business decision that needs to be made here is whether to apply the menu changes to all stores. The threshold is when there is at least 18% increase in profit growth compared to the comparative period while compared to the control stores.

1.2. What is the test period?

The test period spans over 12 weeks from April 29, 2016 to July 21, 2016.

1.3. At what level (day, week, month, etc.) should the data be aggregated?

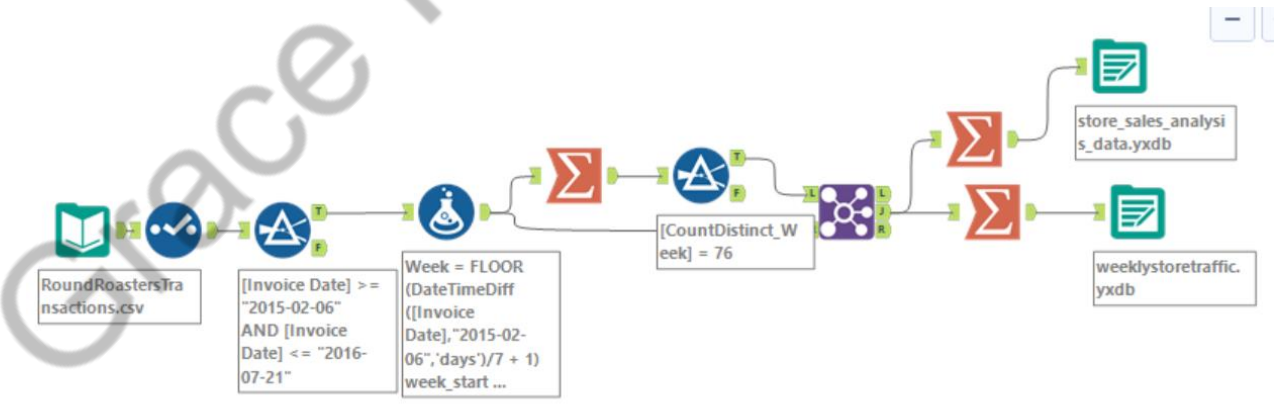
Since the test runs for 12 weeks, it makes more sense to aggregate the data at the week level.

Step 2: Clean Up Your Data

2.1. Preparing Weekly store traffic data and Store Sales Analysis Data

I used the following workflow:

Workflow 1 Preparing Weekly store traffic data and Store Sales Data



We need to create the weekly store traffic data to calculate trend and seasonality as variables to match treatment stores with control stores; and create store sales analysis data to feed the AB analysis tool later. To do that, I take the following steps:

- Use the Input tool to load the *RoundRoastersTracactions.csv* file
- Use the Select tool to deselect unimportant variables such as **SKU**, **Category**, **Product**, **QTY**, **Size**; and to change the data type of the **Invoice Date** field into Date and those of **Gross Margin** and **Sales** into Double.
- Use the Filer tool to only keep date from 2015-02-06 to 2016-07-21 (76 weeks of data), using the expression "[Invoice Date] >= "2015-02-06" AND [Invoice Date] <= "2016-07-21". This is because to leverage the AB analysis tool in Alteryx, we need one full year of historical data, plus another 12 weeks to calculate trend and seasonality, and finally 12 weeks to run the experiment. Therefore, we need 76 weeks of data in total.
- To aggregate data at the week level, I used the Formula tool to create 3 additional fields: **Week**, **Week_Start**, and **Week_End** with the following formulas:

Week	Floor(DateTimeDiff([InvoiceDate], "2015-02-06", 'days')/7 + 1)
Week_Start	DateTimeAdd('2015-02-06', 7*([Week]-1), 'days')
Week_End	DateTimeAdd([Week_Start]), 6, 'days')

- Since we only need stores that have 76 weeks of data, we will use the Summarize tool to group by Store then count week; then we will filter to keep only stores that have 76 weeks.
- Use Join to bring back other fields, such as **Gross Margin** and **Sales** into the data stream.
- Use the Summarize tool to calculate the total gross margin and sales amount per invoice. Save the data as '*store_sales_analysis_data.yxdb*' by using the Output tool.

Table 1 Store Sales Data

Record	StoreID	Week	week_start	week_end	Sum_Sales_store_week	Sum_Gross Margin_store_week
1	10018	1	2015-02-06	2015-02-12	4741.48	2212.7105
2	10018	2	2015-02-13	2015-02-19	4571.25	2164.007
3	10018	3	2015-02-20	2015-02-26	3348.25	1560.929
4	10018	4	2015-02-27	2015-03-05	5114.96	2342.984
5	10018	5	2015-03-06	2015-03-12	4799.48	2199.4065
6	10018	6	2015-03-13	2015-03-19	4554.97	2103.143
7	10018	7	2015-03-20	2015-03-26	2999.55	1412.927
8	10018	8	2015-03-27	2015-04-02	4519.61	2124.3715
9	10018	9	2015-04-03	2015-04-09	4727.05	2216.152
10	10018	10	2015-04-10	2015-04-16	3689.33	1686.246
11	10018	11	2015-04-17	2015-04-23	4168.13	1938.1365
12	10018	12	2015-04-24	2015-04-30	4002.32	1874.485
13	10018	13	2015-05-01	2015-05-07	3334.79	1571.1225
14	10018	14	2015-05-08	2015-05-14	3417.03	1586.3945

- Add another Summarize tool and connect to the J output of the Join tool to calculate the number of invoices per store per week. Save the data as '*weeklystoretraffic.yxdb*'

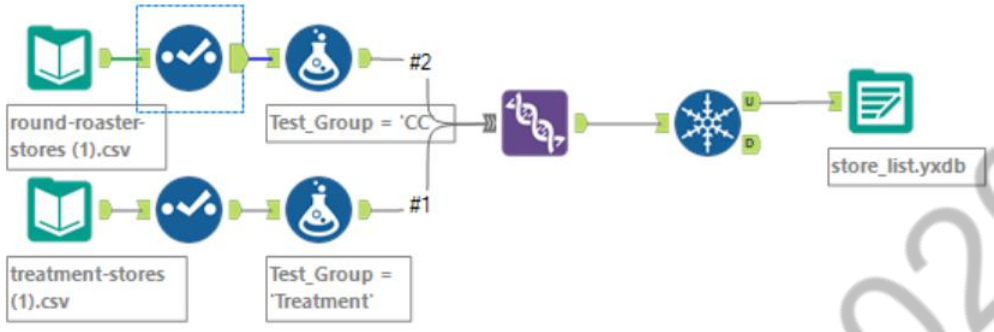
Table 2 Weekly Store Traffic

Record	StoreID	Week	week_start	week_end	CountDistinct_Invoice Number
1	10018	1	2015-02-06	2015-02-12	308
2	10018	2	2015-02-13	2015-02-19	288
3	10018	3	2015-02-20	2015-02-26	204
4	10018	4	2015-02-27	2015-03-05	320
5	10018	5	2015-03-06	2015-03-12	284
6	10018	6	2015-03-13	2015-03-19	288
7	10018	7	2015-03-20	2015-03-26	194
8	10018	8	2015-03-27	2015-04-02	286
9	10018	9	2015-04-03	2015-04-09	274
10	10018	10	2015-04-10	2015-04-16	215
11	10018	11	2015-04-17	2015-04-23	277
12	10018	12	2015-04-24	2015-04-30	251
13	10018	13	2015-05-01	2015-05-07	201
14	10018	14	2015-05-08	2015-05-14	207

2.2. Create a store list data set that includes both control stores and treatment stores for the matching in step 3

I use the following workflow:

Workflow 2 Create Store List of Control Stores and Treatment Stores



- Use the Input data tool to load the *round-roaster-stores(1).csv* file. This data file contains all control stores and their information.
- Use the Select Tool to only select **StoreID**, **AvgMonthSales**, **Region**. Those are important fields. **StoreID** acts as the identifiers of unique stores. **Region** helps us create and view the reports for each region. **AvgMonthSales** is a variable that is highly correlated with Gross Margin so I will keep this field to match treatment stores and control stores later.
- Use the Formula tool to create a new field called **Test_Group** that give each store a 'CC' value, which indicates Control stores.
- Likewise, iterate these above steps with the *treatment-stores(1).csv* file. Afterwards, use the Formula to give each store a 'Treatment value' contained in a field called **Test_Group**.
- Use the Union tool to unite the two data streams together. And then use the Unique tool to filter out all duplicate records.
- The resulting data has 4 fields and 133 records as followed:

Table 3 Store list

Record	StoreID	AvgMonthSales	Region	Test_Group
1	10018	18000	West	CC
2	10068	16000	West	CC
3	10118	13000	West	CC
4	10168	19000	West	CC
5	10218	15000	West	CC
6	10268	25000	West	CC
7	10318	16000	West	CC
8	10368	19000	West	CC
9	10418	19000	West	CC
10	10468	21000	West	CC
11	10518	11000	West	CC
12	10568	21000	West	CC
13	10618	15000	West	CC
14	11268	12000	West	CC

- Export the result in a new file named '*store_list.yxdb*' using the Output tool.

Step 3: Match Treatment and Control Units

3.1. What control variables should be considered?

AvgMonthSales and **Sq_Ft** should be considered as potential control variables because they may correlate with our target variable- Gross Margin. They all are numeric variables, whose correlation with Gross Margin can be validated by a Pearson Correlation Analysis. It is also probable that a larger store (Sq ft) is likely to gain a larger Gross Margin. Likewise, a higher average monthly sales amount can link to a higher gross margin per store per week.

3.2. What is the correlation between each potential control variable and your performance metric?

Plugging these two potential variables and the performance metric, we have:

Pearson Correlation Analysis

Full Correlation Matrix

	Sq_Ft	AvgMonthSales	Sum_Gross.Margin_store_week
Sq_Ft	1.000000	-0.046967	-0.019345
AvgMonthSales	-0.046967	1.000000	0.790358
Sum_Gross.Margin_store_week	-0.019345	0.790358	1.000000

Matrix of Corresponding p-values

	Sq_Ft	AvgMonthSales	Sum_Gross.Margin_store_week
Sq_Ft		2.3119e-06	5.1796e-02
AvgMonthSales	2.3119e-06		0.0000e+00
Sum_Gross.Margin_store_week	5.1796e-02	0.0000e+00	

It is clear that **AvgMonthSales** is highly correlated with **Sum_Gross.Margin_store_week** with a coefficient of 0.79. The p-value for this coefficient is extremely small (0.0000e+00), which means this observation is statistically significant. In contrast, **Sq_Ft** is poorly correlated with **Sum_Gross.Margin_store_week** with its coefficient and p-value being -0.019345 and 0.05, respectively.

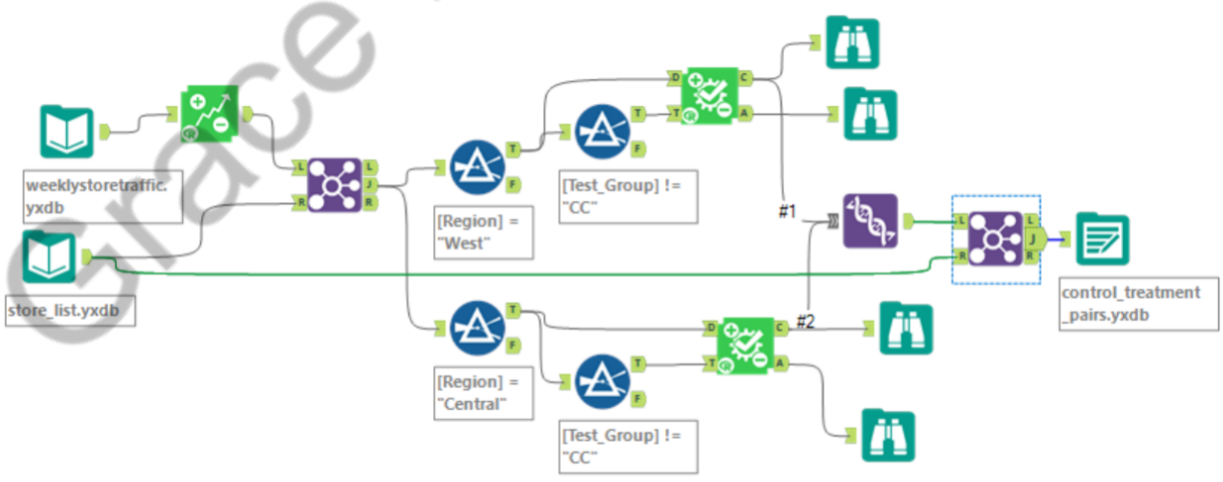
3.3. What control variables will you use to match treatment and control stores?

Due to the reasoning above, I use **AvgMonthSales** as the control variable.

3.4. Please fill out the table below with your treatment and control stores pairs:

I use the following workflow to match store pairs. The basis for matching are **trend**, **seasonality** (obtained by analysis the weekly store traffic data) and the control variable **AvgMonthSales**:

Workflow 3 Matching treatment stores and control stores



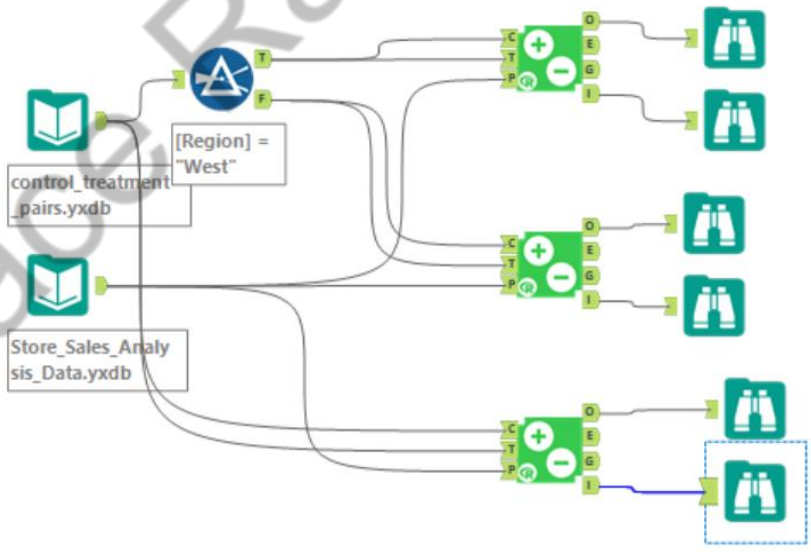
The resulting matchings are:

Treatment Store	Control Store 1	Control Store 2
1664	7162	8112
1675	1580	1807
1696	1964	1863
1700	2014	1630
1712	8162	7434
2288	9081	2568
2293	12219	9524
2301	3102	9238
2322	2409	3235
2341	12536	2383

Step 4: Analysis and Writeup

Using the following workflow, I generated three reports: Profit growth for stores in West region, Central region, and overall of all regions:

Workflow 4 Analyzing AB Testing results

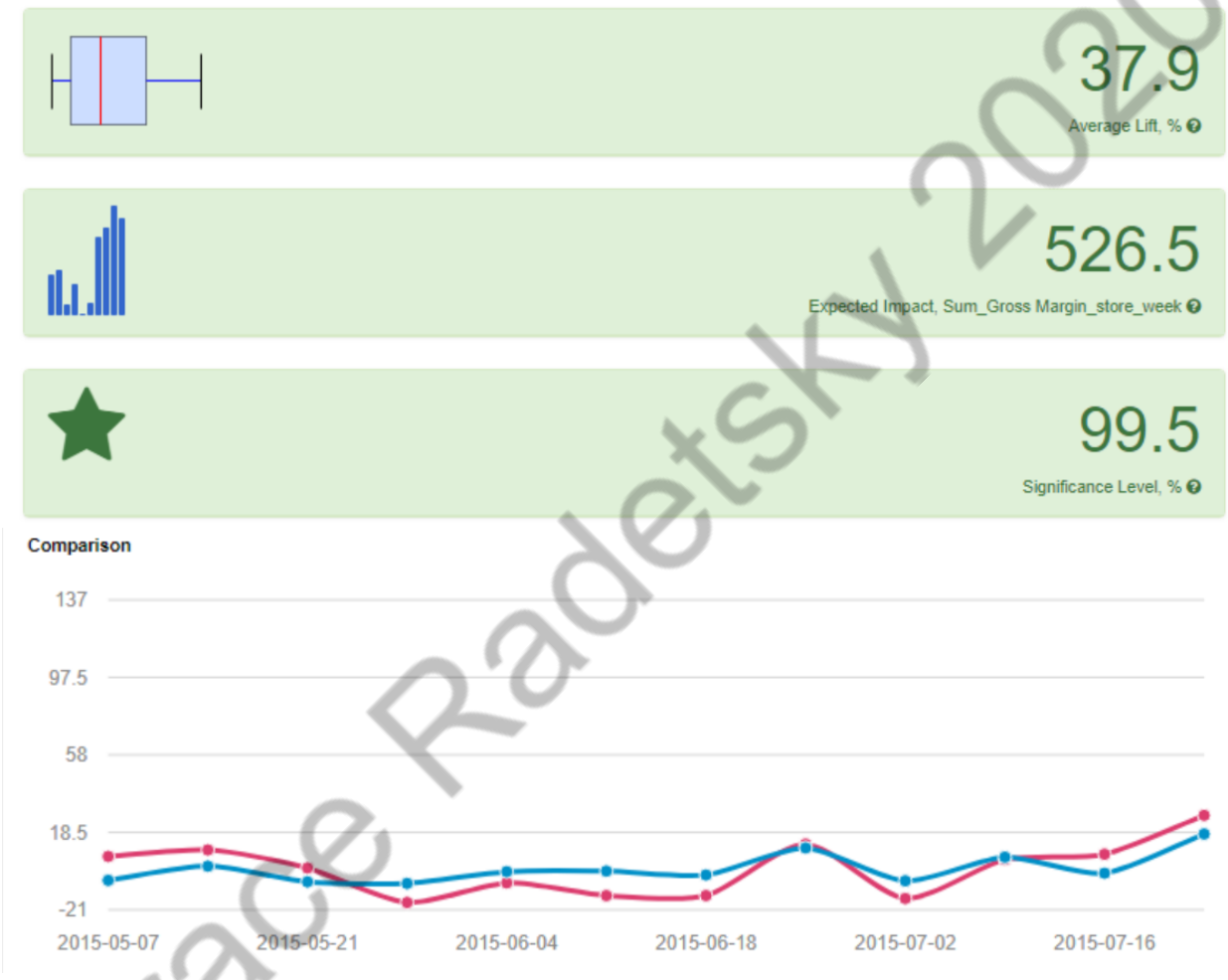


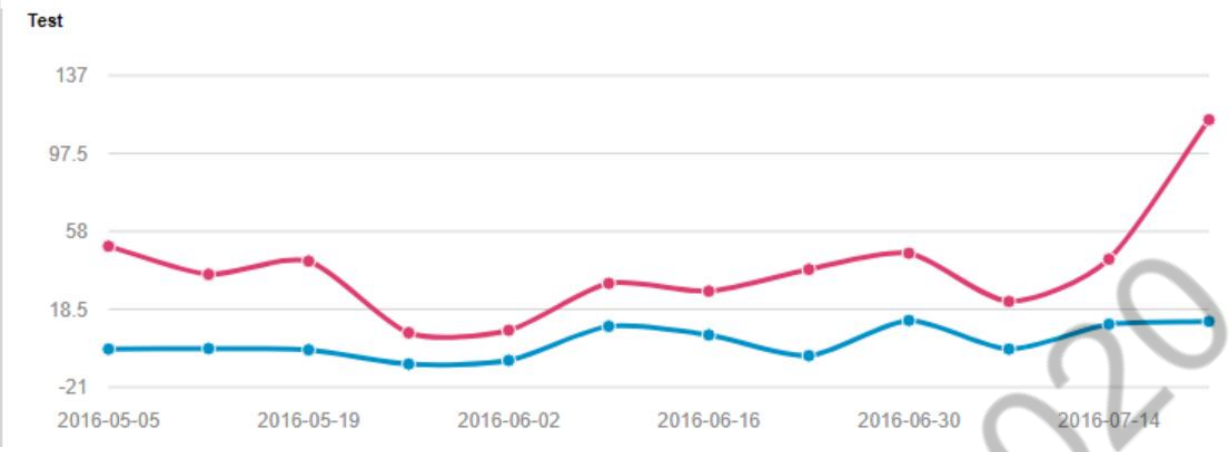
4.1. What is your recommendation - Should the company roll out the updated menu to all stores?

The company should roll out the updated menu to all stores because the profit growth for both test regions are higher than 18% (West region has a 37.9% average lift and Central region has 43.5% average lift)

4.2. What is the lift from the new menu for West and Central regions (include statistical significance)?

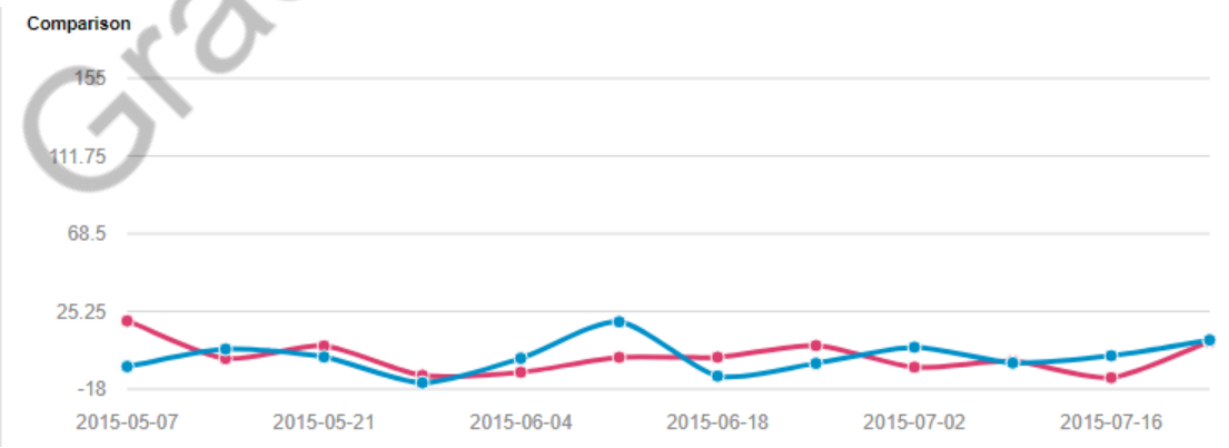
West Region

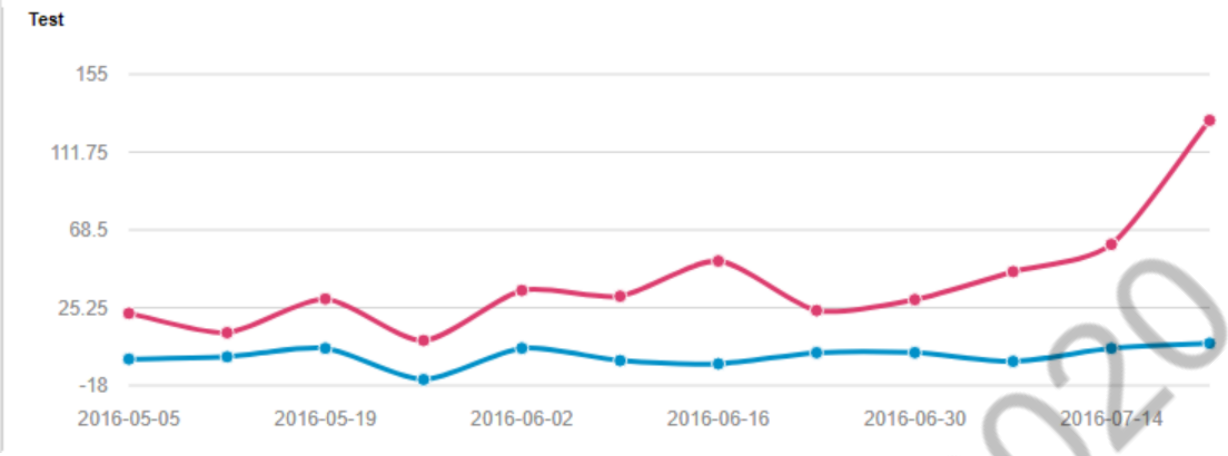




The lift from the new menu launch for the West region is 37.9%, at a significance level of 99.5%. This means that after the change, an average store in the West expected a 37.9% increase in gross margin, which equates $526.5 gain.

Central region

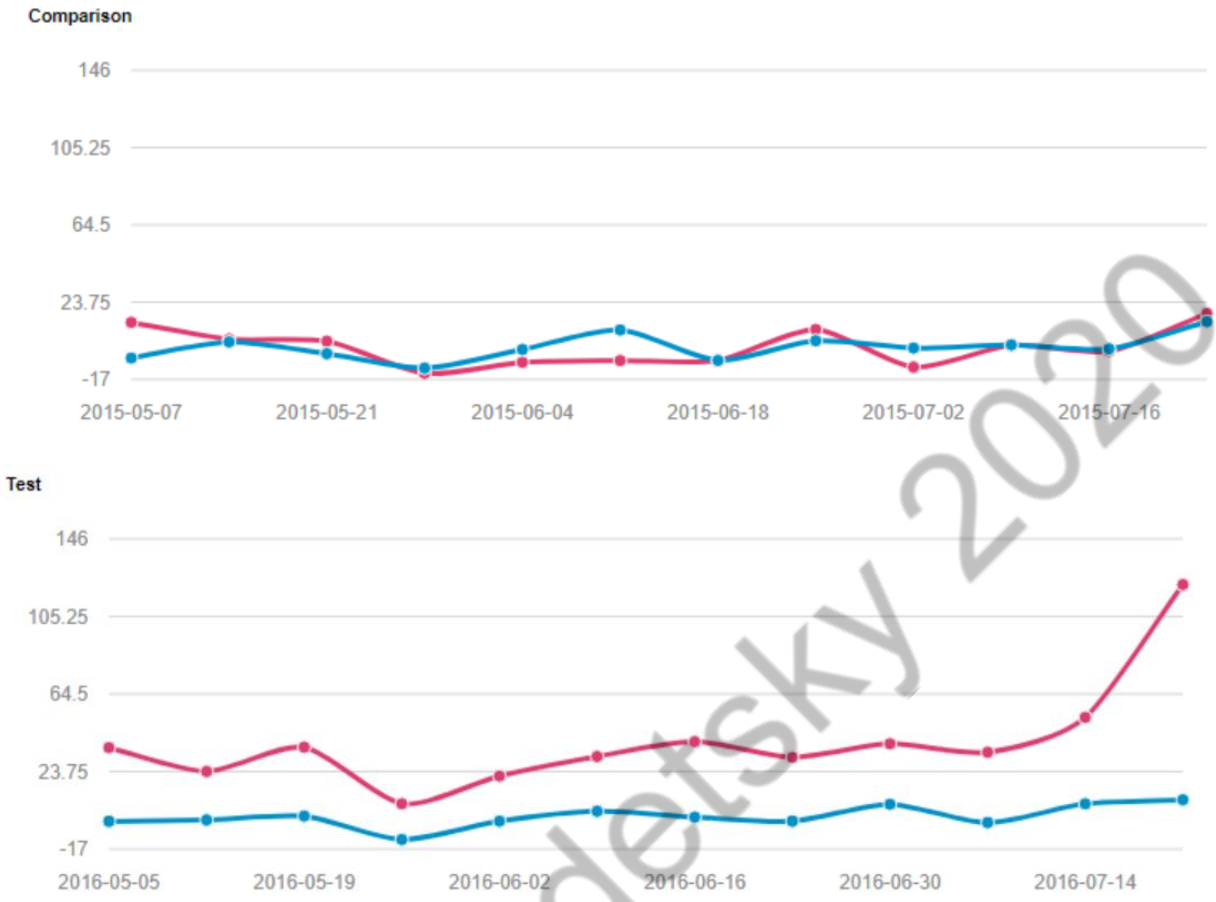




The lift from the new menu launch for the central region is 43.5%, at a significance level of 99.6%. This means that after the change, an average store in the central region saw a 43.5% increase in gross margin, which equates $835.9 gain.

It can also clear that the central region improves much more from the change than the west region. This prediction is also made at a higher level of confidence.

4.3. What is the lift from the new menu overall?



The overall lift from the menu launch for both regions is 40.7%, which is significant than management requirement of 18% profit growth. There is 100% confidence that the lift is statistically significant. This lift also means a store observed an average of $681.2 increase in gross margin per week.