

DATA VISUALISATION

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Abstract –

This study on data visualisation of balance sheet(or financial statement) mainly depicts the extent to which the terms in the balance sheet are able to capture the needed information visually, that a person is in search of.Generally people who look for investing in the shares of a company or the lawyers who are legal advisors of any company who are about to merge with another company, examines the balance sheet to get an overview about the financial condition of the company and find out if it is in possibly good condition to invest or not.Mostly they rely on few ratios that should be derived from the balance sheet and then decide but with visualisation without the need of ratios and with all the very well known terms of balance sheet,observe the graphs and take decisions faster and with ease.For this I have made visualisations in javascript and HTML5 and using few libraries like D3.js we can make visualisations that fit our needs.We can also find if there are any frauds involved by looking at them.

Keywords – Visualisation,Financial statements,plotting,Business reports,Decision making,Fraud.

1.INTRODUCTION

Data visualisation is an emerging area of analytics.With the increase in the computational power of modern computers, the representation of data through graphs, charts or pictures, is made easier and faster.It helps in finding relationship or structures that are hidden in the data.This also helps in easily communicating the information with others. There is always a continuous need to analyse and take decisions in business sector or for that matter in any sector. Thus,visualization of business reports or financial statements has received greater attention in recent years.Rather than reading the reports of bundles of pages it is easier and faster to visualise and

understand the information which can be easily remembered and retrieved with in a short time.Financial statements include Balance sheet,Profit and loss and Cash flow statements.

My work started with reading the research papers on the topic like “Learning From Balance Sheet Visualization” by Uthai Tanlamai, Oranuj Soongswang ,Thailand. and “Analyzing Financial Data through Interactive Visualization” Fizi Yadav, Prudue University and many articles in the web. These papers are quite high in level of topic but the insights helped me in knowing why visualisation is helpful for financial statements and the methods to follow to make them.

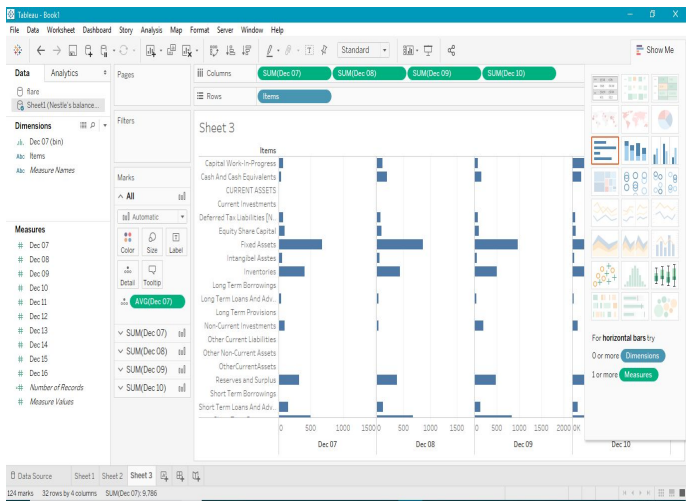
To visualise a balance sheet or a Profit and loss statement knowing the terms in it is important(e.g. tangible and intangible Assets,shareholders funds,current and non current liabilities and many more).I started knowing about them and which terms lead to profit or loss or fraud.There are many ratios that tells about the company’s situation in that year.Analysing these terms every year or quarter or month(as per company’s wish) gives an idea how well or bad the company is doing and helps in taking necessary decisions.

II. METHODOLOGY AND APPROACH

I started analysing what are the methods that are used presently to visualise the financial statements and the problems involved in them.Most of the companies showed the results by plotting the ratios in bar and line charts.

There are few online tools that helps us in plotting the data and visualising graphs.Some of them are Tableau,Plotly,R,Power BI etc., which gives the basic bar,pie,line charts etc.,. I have taken Nestle India’s Financial data and started to plot on these tools to know which has a good interface and easy to use.As the data is present from 2007 to 2016 first I naively plotted the whole data with time and the terms(categories) in balance sheet on the X-axis and Money on Y-axis and found few insights

about the profit, assets, liabilities etc., Of all those tools,Tableau seems easier with drag and drop options and having wide range of graphs.



This figure shows how graphs are made in Tableau we can see on the top right corner there are few visualisations which we can choose and on top we can drag the values of the columns and rows that are needed from left side and click on the graph desired then tableau shows up these graphs with the given inputs.

But to make new visualisations these tools are do not fit the need.Using D3.js which has many templates of visualisations that are coded in D3.js(which is a library of javascript that enables visualisations more interactive and dynamic), JavaScript, HTML5, CSS. We can make new visualisations in an Open-source text and code editor called ‘ATOM’.With the help of these tools we can make required plots based on the requirements.

III. NASCENT THEOREMS

Looking into balance sheet gives few insights.It contains Assets,Liabilities,Equity in Block letters. They are further divided into many sub-categories We can observe that the value of the categories, **Assets=Equity+Liabilities**.This is the basic equation on which the whole balance sheet works. Profit And Loss statements also have similar type of equations.So with this basic ideas and understanding the terms in these statements we can start visualising them in the tools discussed above.

IV. LIMITATIONS

There are certain limitations in using these tools for example:

- In ‘ASSETS’ there are many sub-categories likecurrent,non-current,tangible,intangible,cash etc., which are plotted showing the money they posses over

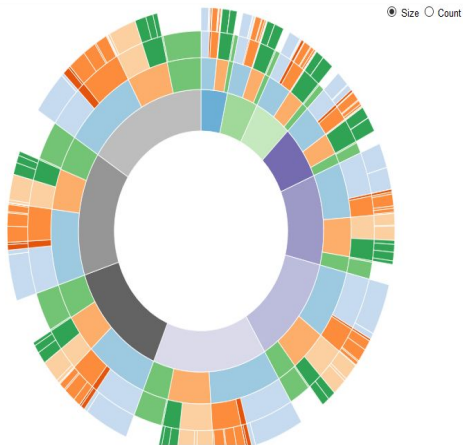
the period of time.Similarly,with liabilities and Equity,while plotting these, if there are any outliers the other sub-categories look either too small or huge in the bar chart and are not visible to analyse.To overcome this problem normalisation is done but that did not represent the money these sub-categories show as it represents only the percentage increase compared to the previous years.

- Plotting different ratios like quick,current debt ratios etc., which can be easily represented in bar or line charts over the years(most of the companies use line charts).Though these ratios give maximum information about the company but to a person who does not know these ratios they will see them as just lines and bars.
- Another limitation is for a balance sheet to visualise we can use Bar,Line,Stacked Bar,Bubble,Pie charts or Tree map.The problem with the mentioned charts is that as there are more terms in Balance sheet, representation of bar,line charts with years and terms of balance sheet on X-axis and money on Y-axis gives us a horizontally long chart so I used Bubble,pie charts and Tree-Map,one advantage is that all the categories and sub-categories are well shown but the problem is that they were only of one particular year.

So,I started to analyse different visualisations to know the situation of a company using the terms that are in financial statements only.

V.OBSERVATIONS

1.As discussed in the limitations with the conventional bar and other kind of graphs it is difficult to represent the whole balance sheet.So the following graph called sun-burst visualisation gives



the whole information. The inner circle represents the years upon each year sector there are the categories like assets liabilities and equity upon each category arc, sub-categories are represented with

their values. In Nestle's we can see the inner arcs are gradually increasing in size which means over the period of time the company's value is increasing.

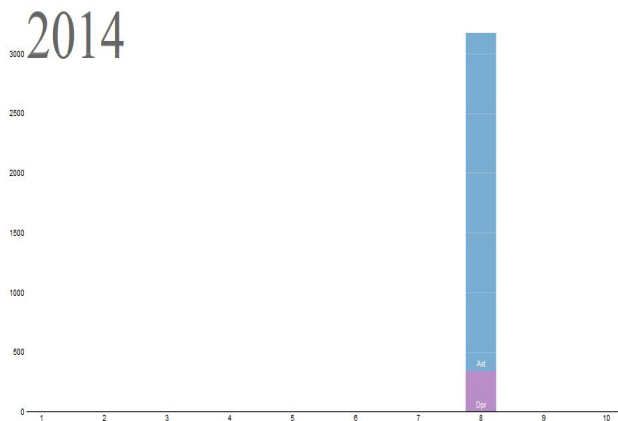
Above the inner arcs the categories are represented with respect to their value so small valued items are small in size and bigger ones are large in size. Another advantage of this is that we can also see the visualisation according to the count of the items. In the above figure I preferred size of the item.

2. From the Profit & Loss statements we can know the how the depreciation of assets (only tangible assets) is varying. Some companies show the depreciation less even if assets are increasing to show more profits this type of fraud can be found out by looking at it.

I have made an animated visualisation that has a bar representing the share of Assets and Depreciation (represented in dark Blue) with money on Y-axis and years on X-axis by clicking left and right arrows we can see the years changing and the visualisation also shows the data with respect to the year shown on the screen.

In the data that I have taken of Nestle's, the depreciation is varying in proportion to Assets. So the chances of fraud are less.

In case if the size of purple color is always the same irrespective of the value of Blue colored bar then there are high chances that there is some kind of fraud showing in the balance sheets.

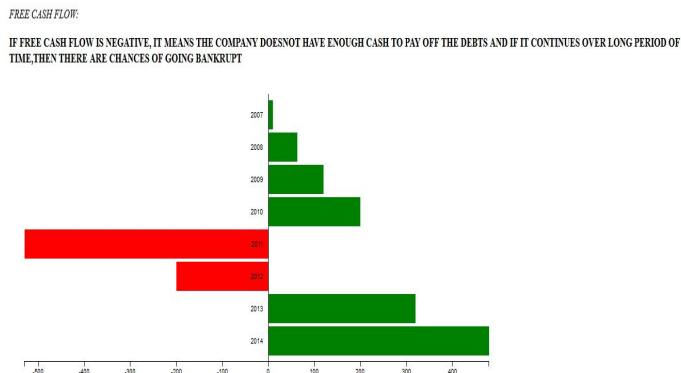


Here we can see the graph for 2014 purple colour indicates Depreciation and blue color indicates Assets. By clicking left and right arrows the bar moves along the axes. If the purple color increases/decreases in proportion to the blue color then it is safe.

The X-axis has numbers listed which represents the year from 2007-2016 (as the data is present during this period) starting with 1 as 2007 which will be shown on the screen above. In the

figure its 2014 and 8 on X-axis.

3. Another important Aspect to see in Financial statements is Free Cash Flow. It is the amount in which liquid cash is present in a company. It is the difference of net cash flow of operations present in Cash Flow statements and capital expenditures in balance sheet. A healthy company maintains a positive value of FCF. If it is negative over few years then there are chances that the company may go bankrupt and are unable to pay their ground level employees.



In this figure of Nestle company during 2011 and 2012 there is negative FCS but later they managed well. FCS is a kind of ratio that is very useful in these. So without a prior knowledge on these ratios also by looking at it we can get the required information.

4. To find out exactly how Assets and Liabilities are changing with respect to reserves and surplus this visualisation is very useful as it shows year wise distribution in different colours per year and by hovering the cursor to the needed block we can see the value of money that block holds. In Nestle's data we see that in all years Assets are in major proportion that has been increasing over the years which is also same with liabilities and reserves



In this visualisation instead of assets and liabilities if we give the data of current assets and current liabilities then it shows how they are varying across the years if liabilities is in a block of more size than assets then the situation of company is not good as it has more debts than money it has to pay them off. In general this is given as current ratio which is $(\text{current assets} / \text{current liabilities})$. So without calculating the ratio and just by looking at it we can know the condition in the company

VI.FUTURE WORK

There are few other observations other than ratios that also provide good information. For example, As discussed, Assets have 'cash' as their sub category which is used to pay the accounts('accounts payable') which is in Liabilities category. Generally the tangible assets are used in paying the long term loans and debts that are huge.

For accounts payable they generally use cash to pay. So venn diagram by which the overlapping part shows the money that has been spent on clearing loans and debts and for each year if the size of that overlapping part is decreasing it means the company is not able to pay them, the circles in venn diagram have sectors in proportion with the sub-categories in Assets and Liabilities. This can show if the company is maintaining the required balance or is it in a position to bankrupt.

There are still many ratios which can be visualised. Like sales to inventories ratio, Debt to equity ratio etc., that can be clearly visualised without those calculations. Those will be shown on a circular histogram and all of the ratios in a single page to avoid confusion. There is some part of the coding left as of today but the prototype will look like this with the program that have coded till now.

Each inner arc represents year and the violet and purple colors are Inventories and sales of that year. If inventories are higher than sales then the situation of that company is not so good. There are some Aesthetics to be added to this. Circular histogram can be used for most of the ratios. So after this I will compile all of those and represent them in a single page so that not much strain is taken in finding out each and every ratio separately.

For now I have been using Nestle company's data but all these visualisations should be working for any company's data to analyse and give required results.

All the results will be shown like a story telling starting from the basic plots to the important ones which gives a full over view of the financial statements i.e., the economic health of a company. Based on this information the person who might be having different needs(a lawyer may be interested in finding frauds a common person may be interested in the profits and losses) can actually look into these visualisations to save their time and most importantly decision making improves.

VII. CONCLUSION

In this project of visualising financial statements the main idea behind this was in this period of fast decision making and simple summaries of a problem, there is a need to update the available methods of analysing financial statements. If shown aesthetically, clearly and broadly, the user will know what he/she wants and what he/she should extract to meet their needs from the available information. With the available open source tools and technologies we can achieve this goal. JavaScript and HTML5 and D3.js are widely used in making such kind of visualisations. A better knowledge on financial statements and these tools and technologies there can come many more visualisations that help the users meet their needs.

VIII.ACKNOWLEDGEMENT

This project would not have been effectively done without the help of my On-Site mentor Prof.Dr.Kamalakar Karlapalem.His valuable suggestions and comments on my work over these weeks had made me intuitively curious of knowing more about this topic to deliver my best performance and my TA,Ayushi Guptha also helped me a lot .I would also thank Dr.Arnab Kumar sir,for his support by being my on-campus mentor.

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