Relating Graduate Employment Survey with Labour Market

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Abstract — In todays information rich age, more and more public data such as housing prices, car prices, taxes and salary are publicly available and published on the internet. Usually, these are published in tabular form with limited or no analytical function available to transform these data into useful insights. The foucs of this paper would be on Singapore, a small but rich country in South Easy Asia. It will focus on fresh graduates salary and the changes in the labour market over the years.

Index Terms — Singapore, Graduates, Labour, Vacancy, Resignation, Recruitment, Visualisations

1 Introduction

Singapore has developed rapidly over the past few decades and part of this development is attributed to the Education System. Singapore Education System is known to be stressful and concerns have been raised about the need to change. Is the goal at the end of this rat race worth the stress?

The Graduate Employment Survey (GES) is conducted on a yearly basis to provide insights on the salary prospects of a course. The Ministry of Education (MoE) conduct these surveys yearly for Local Universities in Singapore [1]. However, the results of these surveys are not interactive and do not provide any trends and insights with respect to the Labour Market demands.

Labour Market data such as Job Vacancy are collect by Ministry of Manpower (MoM) to provide insight and information of the labour market to the public. Data for Job Vacancy are pertaining to private sector establishment each with at least 25 employees and the public sector. However, those data are usually in tabular form and provide minimum insight to the public for analysis of the labour market.

This project aims to offer insights about the fresh graduate salary with respect to the Labour Market in Singapore and its changes over the years. We will be focusing on the vacancy rate of the labour market and the reason contribute to the vacancy, as it affects the fresh graduate employment indirectly.

2 Motivation & Objectives

This section will contain our motivation and objectives of these research.

2.1 Motivation

Our research and development efforts were motivated by the lack of easy to use web-based visualizations about the fresh graduate salary and labour market as these data are mainly published in table form which are hard to illustrate trends moreover gain insights.
In addition, as graduates who will be entering the job market soon, we want to better understand the industry outlook in the labour market. Ultimately, we hope that these visualizations would help other students from Junior Colleges and Polytechnics decide their career paths.

2.2 Objectives

In this research, we aim to accomplish the following objectives:

1) Visualise the fresh graduate salary with against employment rate overtime with respect to each course.
2) Visualise the ranking of each specific course throughout the years.
3) Visualise the changes in salary with respect to the labour market by industry over the years
4) Visualise the overall Recruitment, Resignation and Vacancy Rate by Occupation Group
5) Visualise the possible reasons for Vacancy by Sector and Education

3 Related Works

This section will contain our research about some of the related works we have found.

3.1 Georgetown University

Georgetown University Centre on Education and the Workforce has published a report about the value of college major in the United States of America (USA) based on its National data for all majors [2].

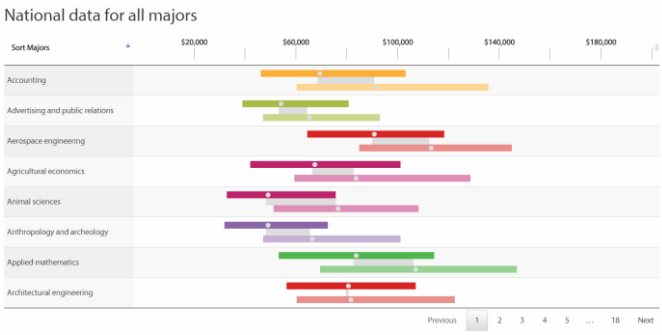

Fig. 3.1 Divergent Bar Graph for each major in USA

The visualisation above does provide useful insights with regards to a specific major by telling us the distribution of annual salary and its relation to other majors. However, this does not offer a clear comparison of majors over time about a specific course itself. Even though there is an option to search, there is no tooltip available to tell use the exact

median, upper 25 and 75 percentiles. Colour coding allows a reader to see the difference clearly which is good.

3.2 Ideas Illustrated

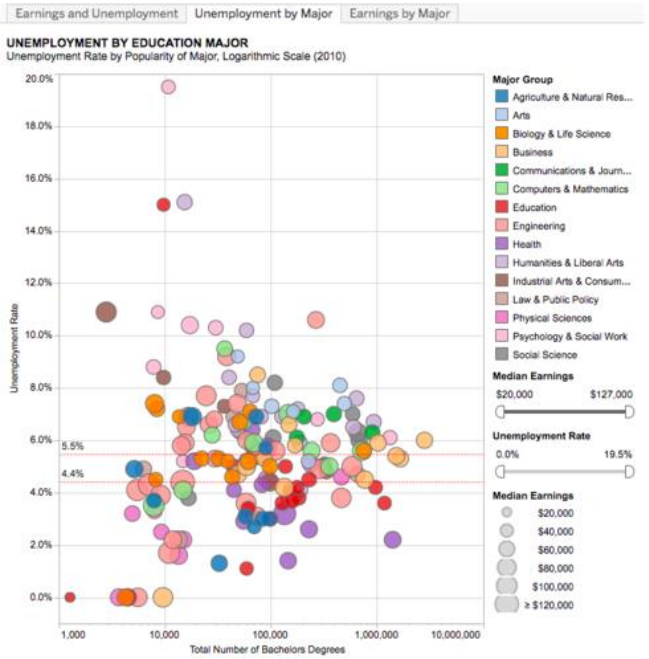

Fig. 3.2 Scatter Plot illustrating Unemployment

This was taken from a blog post which attempts to visualise the unemployment rate by majors against the total number of degree [3].

The Scatter plot above provides an extremely clear overview of how Unemployment rate is related to the number of degrees. It has made good use of the size of the circle to illustrate the median annual earnings. However, it does not provide the trend over the years how each major has progress over the years. This could be due to the lack of data.

3.3 SgPayCharts

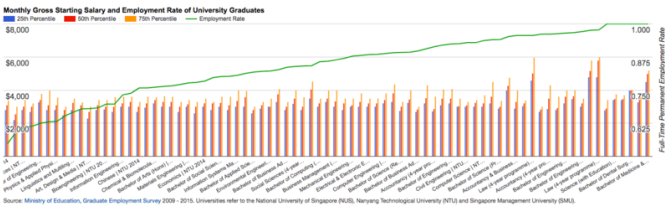

Fig. 3.3 Bar and line graph

Taken from another independent publisher of visualisations, we felt that the above bar and line graph is provides a good comparison of the 25th, 50th and 75th percentile of each course with its employment rate. However, it does not provide a comparison across the years [4].

3.4 Ministry of Manpower

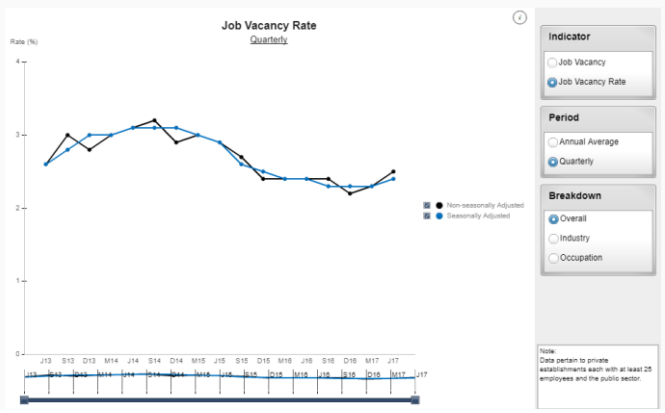

Fig. 3.4 Line graph Visualization by MoM

Taken from MoM chart visualisation of the Job Vacancy Rate [5]. We felt the data could incorporate with Job Recruitment & Resignation Rate to provide better insight of the vacancy rate. This will allow us to better understand, whether does the value implies a health rate.

4 Data Preparation

For this project, we have obtained our data sources from Ministry of Education [6], Ministry of Manpower [7] and Data.gov [8]. As those data are from government and easily available to the public, minimal cleaning is required.

4.1 Data Cleaning

As university courses in Singapore tend to change every other year, we had to standardize the naming for such courses as well as cater to the addition of new courses and Universities over the years.

Similarly, for the labour market data, we will follow how MoM has categorize the labour industry into the main sectors followed by the breakdown of each sectors. Most of the data are in tabular format, the approach the data are displayed are difference. In order to use the data for analysis, we need to reformat the structure of the data as well and the order of it. Hence, we have used excel for the sole purpose of transforming these data and formatting them such that we are able to use them in our application.

5 Methods & Tools

In this section, we will discuss our main tools that we have used in the development of our application.

5.1 Tools and Library

As our application would be hosted online, we have used Data-Driven Documents library (D3.js), a JavaScript library written by Micheal Bostock [9] in developing some of these visualizations. In addition to D3, other external libraries that are built upon it such as Highcharts [10], amCharts [11] and Plotly [12] are also implemented in our application. Beside customizing the chart using D3 related libraries, we use tableau for one of or visualization. These libraries and tools have greatly helped us achieve the visualizations we wanted. With the combination of HTML5 and JavaScript libraries, provides an interactive and dynamic user interface.

5.2 User-Interface

Fig. 5.2 User Interface of application

The user-interface was designed with bootstrap, css framework, to provide ease of use and interactivity. It was a template created by isna nur azis, which contain clean and user-friendly design. By integrating with the template, we derived with a clean and easy to use web application to illustrate our charts and provide meaningful insights.

6 Visualizations & Analysis

This section will illustrate our visualizations as well as our insights from each visualization.

6.1 Graduate Employment Survey

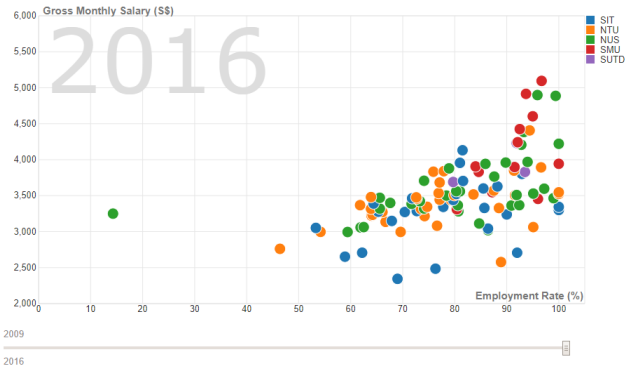

Fig. 6.1 Scatter Plot (Monthly Salary against Employment Rate)

6.1.1 Insights and Findings

We have decided to use a scatter plot to visualize the Gross Monthly Salary against the Employment Rate for all the courses offered by the local Universities in Singapore. This firstly provides a clear overview and comparison of the various courses.

The top income earners with the highest employment rate are those in SMU Law, NUS Medicine, SMU Information Systems and NTU Business which are consistent over the years. The lowest income earners and the least employment rate NUS Bachelor of Music and Psychology which are also consistent throughout the years.

It is interesting to note that from 2013 onwards, the employment rate of some degrees has fallen below 60% and has become more widespread over the years. Those courses mostly belong to the Arts and Humanities category. This could evident in saying that such skill set from the degree are declining in the labour market. The direction of the labour market are moving towards professional area such as management, finance, law and Information Technology.

6.2 Graduate Employment Survey Ranking

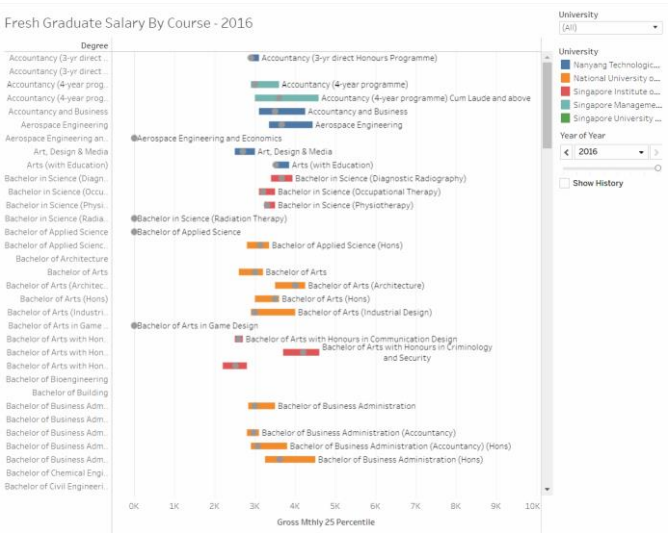

Fig. 6.2 Divergent Bar graph

6.2.1 Insights and Findings

The use of divergent bar graphs provides a good overview of the ranking of course across Singapore as well as within individual Universities. From this we can observed that graduates from the Accounting and Law degrees has the highest interquartile range. This suggest that some graduates are either being paid too high or too little relative to their peers.

6.3 Labour Market Monthly Income Salary by Sector

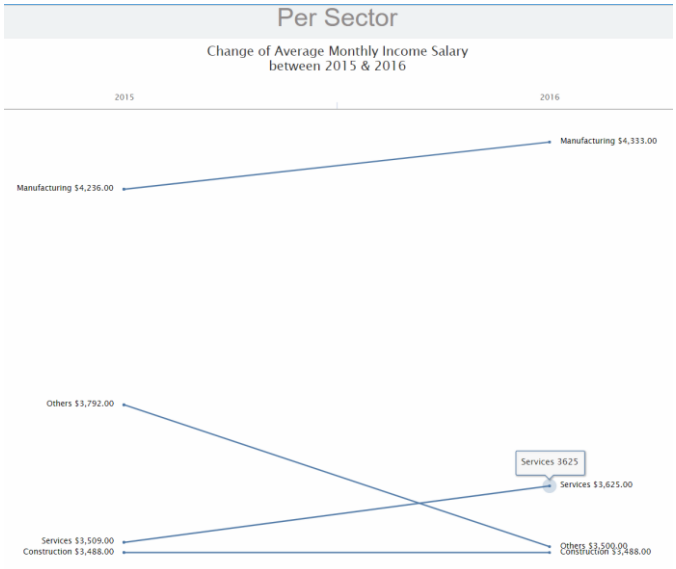

Fig. 6.3 Slope Graph by Sector

6.3.1 Insights and Findings

Using a slope graph to shows the changes in the monthly income salary, aid the illustration of the changes and provide ranking with respect to the difference sectors.

As seen from above, it shows the changes between 2015 & 2016. Among the changes, only the “Others” sector have a negative change which the rest either increase or remain constant. With slope graph, it shows both Manufacturing and

Services sector are growing at almost identical rate whereas the Construction Sector remains relatively constant.

6.4 Labour Market Monthly Income Salary by Services

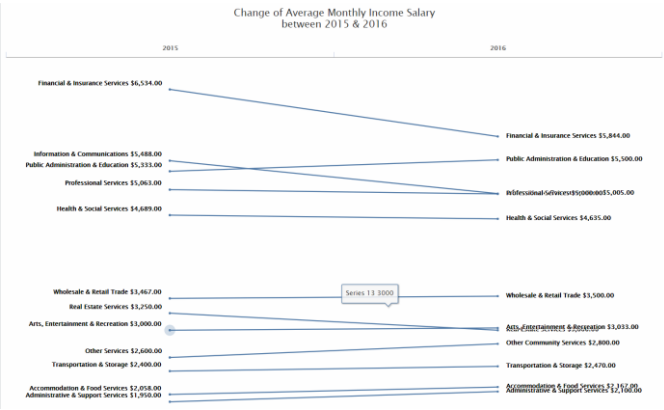

Fig. 6.4 Slope Graph by Services Industry

6.4.1 Insights and Findings

As Services sector are made up of many different industry, we drill down further into the different industry. As observe on the graph above, three of the industry among the rest have a decline changes over the year. Financial & Insurance Services and Information & Communications have almost identical rate of decline and have higher decline rate compared to Real Estates Services. This could indicate a high supply of employees for those industry, which result in the decline over the year, as those are the popular industry choices among the rest.

6.5 Overall Recruitment, Resignation & Vacancy Rate

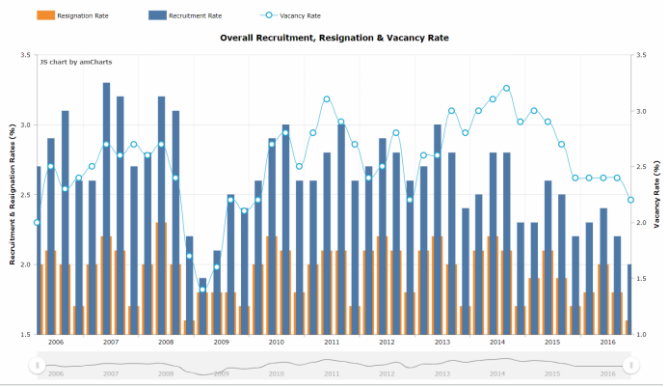

Fig. 6.5 Bullet Chart with line graph

6.5.1 Insights and Findings

Bullet chart is used to illustrate the relationship between Recruitment, Resignation and Vacancy Rate. With Vacancy as the target, Recruitment as the actual amount and Resignation being the contribution factor. We have decided to plot a line graph of the Vacancy Rate to show the trend over the duration period.

A few interesting patterns can be observed here. Firstly, the patterns are largely cyclical. With Resignation Rates being the lowest in the fourth quarter of each year which is around December period, and highest around the second quarter which is the month of June. This could be due to the fact that most bonuses are given out at the end of the year hence resignation rates are low during that period, and most employee do not wish to miss out on the bonus. Therefore, most of the resignation are perform during the second quarter, after acquiring the bonus. In addition, recruitment rate tends to be the highest during the third quarters. This could suggest that most people tend to change their job during this period, as they might resign from their job in second sector and join another companies on the third quarter. Alternatively, it might imply that most companies start their hiring cycle on the third cycle as that the period which most fresh graduate embark on their working journey, as most universities end the academic year on second quarter. This pattern is consistent as it is largely cyclical across the years.

Over the years, the recruitment rate is on a declining trend. This could imply the recruitment rate is dropping for median and large size company. This could probably due to the rising trend of entrepreneurship over the years. This might be due to the improvement of technology and a lower entry cost for new start-ups. With the many attractive success story of start-ups, this might result in more people moving away from large corporate and towards start-ups.

Lastly, another interesting finding we had was that from 2013 onwards, the gaps between Vacancy Rate and Recruitment Rate was large compare to the previous year and is always above both the Recruitment Rates. This lead us to the next point, in which we will look into the Vacancy Reasons in the labour market to have a better understanding as to why these companies have such high vacancy rates.

6.6 Vacancy Reasons by Sector

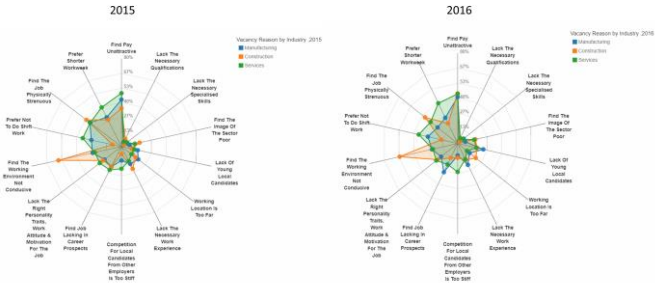

Fig. 6.6 Rader Chart by Sector

6.6.1 Insights and Findings

We decide that a radar (spider) chart would be the most appropriate form of Visualization to illustrate the Vacancy Reasons in the Labour Market. As Ministry of Manpower broadly categorizes the labour market into three distinct sectors, namely, Manufacturing, Construction and Services. From the chart above, we can tell that the top reason as to why there are vacancy would that people find the pay unattractive. This can be observed across all three sectors. In addition, certain distinct characteristics in each of the three industries when visualized in this way.

For example, in each construction industry, most of the people felt that the working environment in the construction industry is not conducive, job is physically strenuous and working location is too far. These description fits the jobs in the construction industry as it often requires hard labour at remote places. It is interesting to note that the construction

industry ranks the lowest in term of shift work. This could be due to that fact that it is as expected when working in the construction industry.

Next, in the services industry, most people would prefer shorter workweek, not to do shift work, and often hard to find local candidates for the job. This suggest that the services industry is highly competitive, and many employers would prefer to hire locals over foreigners.

Lastly, in the manufacturing industry, it can be observed that many young local candidates prefer not to head into the manufacturing industry as shift work would be required and they feel that it lacks career prospects.

It is interesting to note that not many people felt that they lack the necessary specialized skills across all three industries. This suggest that other reasons are more prominent when seeking for a job. A spider chart is perfect for showing the characteristics of the different industry in Singapore labour market.

6.7 Vacancy Reasons by Services Industry

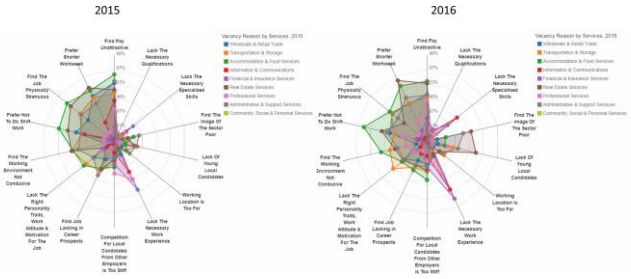

Fig. 6.7 Rader Chart by Services Industry

6.7.1 Insights and Findings

Similarly, when drilling down into the services industry, we found out that the main reason for the Vacancy across all the industry was that the pay was unattractive. In addition, there are a few interesting insights when comparing between 2015 and 2016.

Focusing on the Information & Communications Industry, we saw a great shift in preference preferring not to do shift work to lacking the necessary specialized skills for the job with the common peaks at lacking the necessary work experience and finding pay unattractive across both years. This suggest that many people feel that the ICT industry has potential as their next career options but feel that they lack the necessary skills to do so.

In Real Estate Services, we saw great shift in reasons from finding the job physically strenuous to finding the image of the sector poor and lack young local candidates. This suggest that many young people felt that the career outlook in real estate is bleak.

6.8 Vacancy Reasons by Education

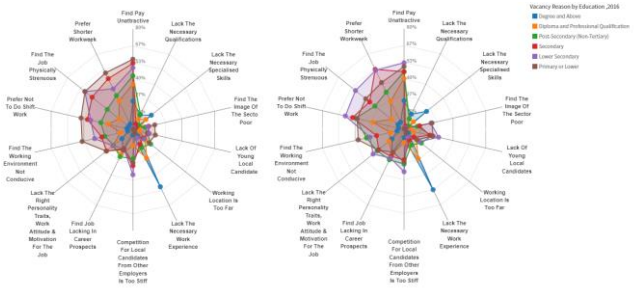

Fig. 6.6 Rader Chart by Education

6.8.1 Insights and Findings

Lastly, we consider the Education requirement of the Job which breakdown the category into different educational level, from primary or lower to degree and higher. Few insights could be derived from such level.

Firstly, with regards to jobs with the highest level of educational requirement, Degree and Above, the highest reason contribute to the Vacancy is due to lack necessary work experience. This could be due to the fact that many students focus on pursuing academic results and moving up to a higher education level, causing them to neglect acquiring sufficient working experience on the industry. As a fresh graduate, such information is important to us. To place our self in a more advantageous position, beside pursing academic goal, we could spend more time working on internship to gain more necessary working experience of the related industry.

Job with lower educational level, tend to be more labour intensive job. From the varies reasons, they fall towards characterize of high intense labour job such as “Find The Job Physically Strenuous”, “Prefer Shorter Work Week” and “Prefer Not To Do Shift Work”. These jobs does not require much specialize skillset, or rather, those skillsets could be acquired during work. Therefore, they do not fall significantly under the reason “Lack The Necessary Specialised Skills” and do not overlay with Degree and Above category.

7 Future Works

As the data used in some of our analysis are rather limited, as time proceeds, more of these data could be included in our analysis as well. In addition, inflation could also be taken into consideration with respect to the labour market and graduate salary such that more insights can be gained. Moving forward, with the intention of providing a clearer outlook of the labour market in Singapore, this project can include a comparison between graduates with other countries with respect to their labour market and economy as well. This could then provide a clearer picture of the labour market around the world. Currently, all the charts are independent of each other. It will be good to integrate the charts to provide the linkage and better highlight the relationship between fresh graduate and the labour market.

8 Conclusion

The use of our web application demonstrates how data obtain from government sources can be used and visually illustrated to the public such that valuable trends and insights can be easily understood. We hope that our research has helped the public, especially students in deciding their career path and better understand the changes in the labour market.

After having a better insight into the labour market and fresh graduate employment salary, this project can be easily extended to incorporate other countries and states such that more comparisons can be drawn across borders. Working across borders have been increasing over the year. By including more data, such analysis will be make possible. In addition, foreign talents, another common topic within Singapore's labour market, could be considered as well.

Acknowledgments

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