

The Quant-Optimal Christmas Carol

Text Mining in R and its many (relevant) uses.

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Section 1

Sentiment Analysis

Sentiment Analysis

Sentiment analysis is a particular type of **Natural Language Processing** (NLP) which aims to systematically characterise the tonality of unstructured, textual data sets.

- Sentiment Analysis has been used for:
 - **Twitter** - determining an overall opinion on a specific topic.
 - **Brand Reputation** – assessing the general opinion on social media platforms associated with a brand name.
 - **Politics** - classifying the reaction to proposed policy changes and campaign announcements.
 - **New Product Releases** – tracking the sentiment about new products to gauge ongoing demand.
 - **Trading Decisions** – translating unstructured data into a trading signal.
 - **News Mining** – characterising the dominant sentiment associated with a particular subject of a news release.
- **Sentiment** analysis is carried out via one of three methods: knowledge-based, statistical (including Machine Learning) or a hybrid of the two.

Sentiment Analysis: How is it done?

Any form of **Sentiment analysis** requires transforming the raw textual data into a form which a computer can understand, digest and perform computations on.

- **Knowledge-based** approaches typically categorise text according to particular emotions using a pre-defined sentiment library.
- **Statistical** approaches harness machine-learning techniques; using a training set of pre-classified text to build a model which can then be used on new textual datasets.

In general, performing sentiment analysis on textual data requires carrying out the following steps:

- 1) Load the textual data;
- 2) Transform the raw text into a form in which R can read and manipulate;
- 3) Remove nonessential characters and words such as punctuation marks and connecting words.
- 4) Finally, perform the sentiment analysis.

Sentiment Analysis in R

Several packages exist for carrying out text analysis in R including:

- 1) tm
- 2) RTextTools
- 3) pdftools
- 4) tidytext

We use **pdftools** and **tidytext** and **sentimentr** in what follows:

- **pdftools** can be used for scraping research reports for the dominant tone;
- **tidytext** comes with four sentiment lexicons – afinn, nrc, Bing and Loughran;
- **sentimentr** assigns sentiment scores to words and can account for negative words such as "not" which are not included in other sentiment lexicons.

Section 2

Sentiment Analysis in Finance

News Articles

We can use the **"AFINN" sentiment lexicon** to analyse the overall sentiment of financial news articles.

- AFINN is a database of words which are assigned to integer scores in the range [-5,5].
- It currently contains 2477 words and phrases and has been used for sentiment analysis in financially-related texts including twitter and blogs.
- It is targeted, mainly, to shorter texts.

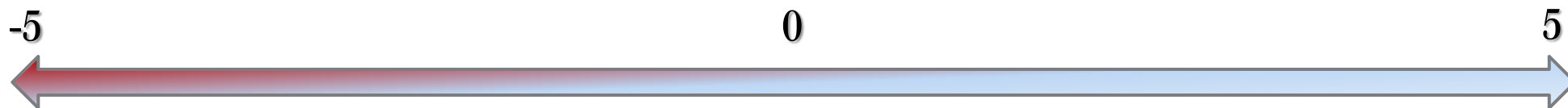
```
> get_sentiments("afinn")
# A tibble: 2,476 x 2
  word score
  <chr> <int>
1  abandon -2
2  abandoned -2
3  abandons -2
4  abducted -2
5  abduction -2
6  abductions -2
7  abhor -3
8  abhorred -3
9  abhorrent -3
10 abhors -3
# ... with 2,466 more rows
```

"UK retail sales jump unexpectedly in November, aided by Black Friday bargain shopping..."

"Christmas squeeze as food prices reach four-year high..."

"H&M to shut stores after 'unexpected' dip in sales..."

News Articles Continued...



Given a set of financial news articles which are either negative, neutral or positive in tone, can the "AFINN" sentiment lexicon correctly classify each article?

How do we analyse these?

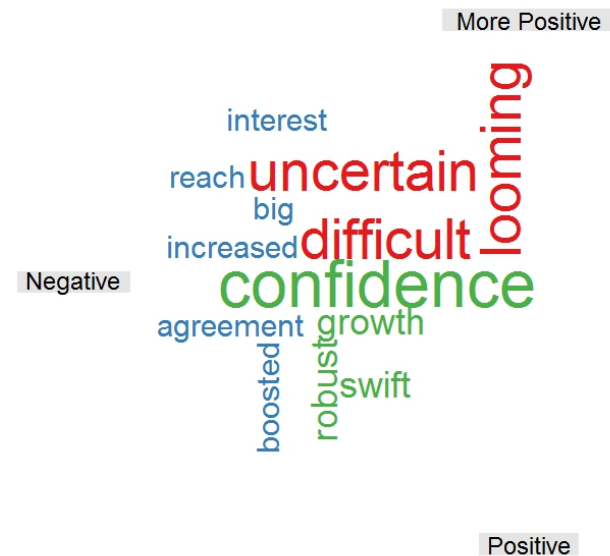
- 1) Load the articles in as **text files** (can also be loaded as rds or csv files)
- 2) **Remove punctuation** marks
- 3) Split the article into words using **unnest()** from *tidytext*.
- 4) **Map** the words to sentiment scores in the AFINN lexicon
- 5) **Summarise** the overall sentiment.

Subject	General Story	Tone
Food Prices	Reach 4-year high this Christmas	Negative
H&M	Stores will be closed due to a dip in Sales	Negative
Ocado	Revenue rise but driver shortage hits sales	Neutral
UK Retail	Sales jump following Black Friday	Positive

News Sentiment using AFINN

"UK retail sales jump unexpectedly in November, aided by Black Friday bargain shopping..."

Article	Mean Score	% Positive Words	% Negative Words
Food Prices	0.93	78.57	21.43
H&M	0.43	64.29	35.71
Ocado	0.06	51.52	48.48
UK Retail	0.74	69.57	30.43

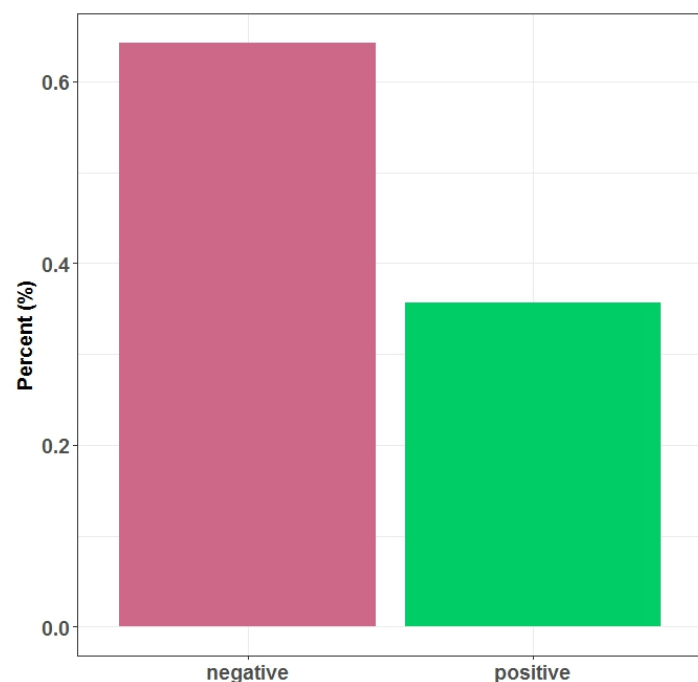


Be careful of your source though...


Article	Mean Score	% Positive Words	% Negative Words
Sports Direct article (Guardian)	-0.18	36.36	63.64
Sports Direct article (The Independent)	0.86	75	25

Research Reports: pdf reader

In R, **pdftools** and **tidytext** functions can be used to read the textual content of pdfs, process the text and transform it into a form in which we can perform sentiment analysis on it using one or more of the available sentiment lexicons.



Source: UBS Quantitative Research



Global Research17 November 2017

Fresenius SE & Co KGaA

Generics pricing pressure coming to Kabi. Sell.

We expect pricing pressure to spread to injectables. Downgrade to Sell.

In the past two years the rate of injectable generic drug approvals in the US has increased ~40% and those to compete against Kabi more than tripled. Whilst pricing is currently stable, parallels with the oral drug space suggest pressures could increase as soon as H1 18, and so we conservatively expect price falls of 10% by 2019; resulting in no organic profit growth until 2021. Our SOTP model suggests consensus values the division, which accounts for 40% of Fresenius equity value, at 19x 2018 PE. Whilst this is a discount to the 25x that we believe the division has traded on in June, we believe 10x is more appropriate. Sell.

Barriers to entry are easing, approvals increasingly from minor competitors

We had [previously agreed](#) with consensus and management that the barriers to entry in injectable drugs were materially higher than in oral drugs, so pricing would remain sanguine. However our analysis suggests only 25% of injectable drugs approved today are filed by incumbent manufacturers, suggesting barriers to entry are eroding. Whilst bulls may point out that most approvals are into small and already competitive categories, IMS data suggests that 2/3rds of Kabi drug sales come from such drugs.

Detailed analysis prompted by changing industry commentary

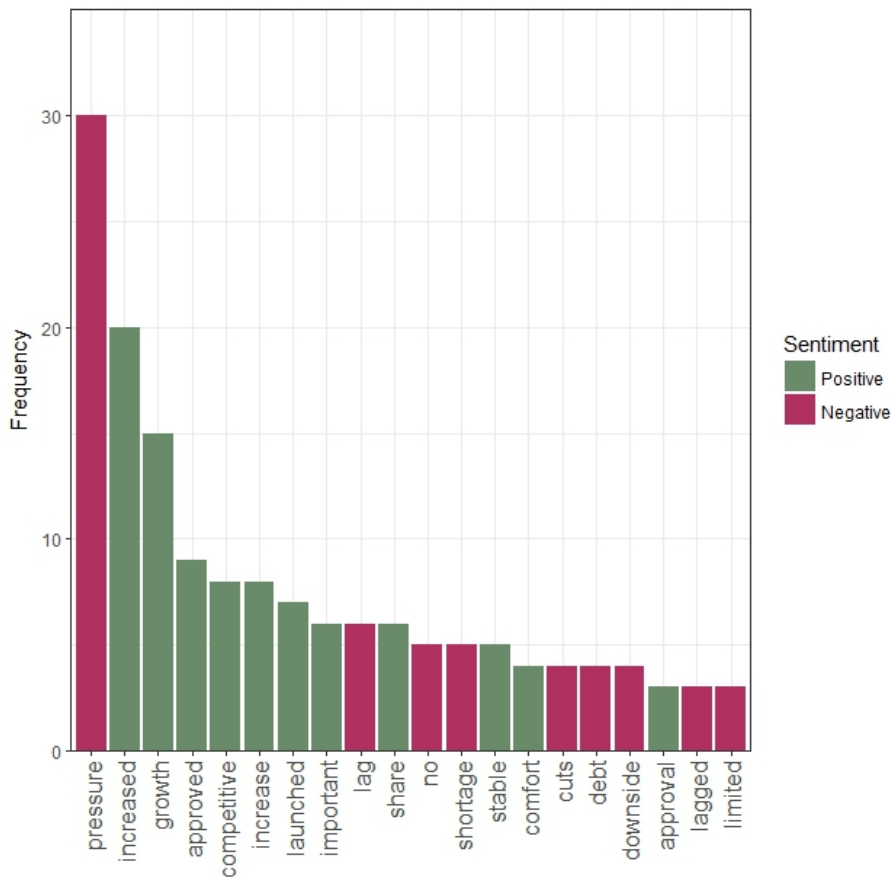
Group Purchasing Organisations, Kabi's main customers, have consolidated significantly in recent years. We estimate 80% of volumes are now negotiated by three players, suggesting buyer purchasing power may be increasing. We believe our detailed analysis of 34k new drug approvals provides a lead indicator and suggests that competitive pressures facing Kabi may also be increasing.

Equities	
Germany	
Healthcare Providers	
12-month rating	Sell
	Prior: Neutral
12m price target	€57.00
	Prior: €74.00
Price	€67.01
RIC: FREG.DE BBG: FRE GR	
Trading data and key metrics	
52-wk range	€79.65-65.60
Market cap.	€36.2bn/US\$42.6bn
Shares o/s	540m (ORD)
Free float	71%
Avg. daily volume ('000)	1,150
Avg. daily value (m)	€80.2
Common s/h equity (12/17E)	€14.5bn
P/BV (12/17E)	2.5x
Net debt / EBITDA (12/17E)	3.3x
EPS (UBS, diluted) (€)	
	From To % ch Cons.
12/17E	3.31 3.19 -4 3.35
12/18E	3.54 3.26 -8 3.63
12/19E	4.00 3.47 -13 4.09

Ian Douglas-Pennant, CFA
Analyst

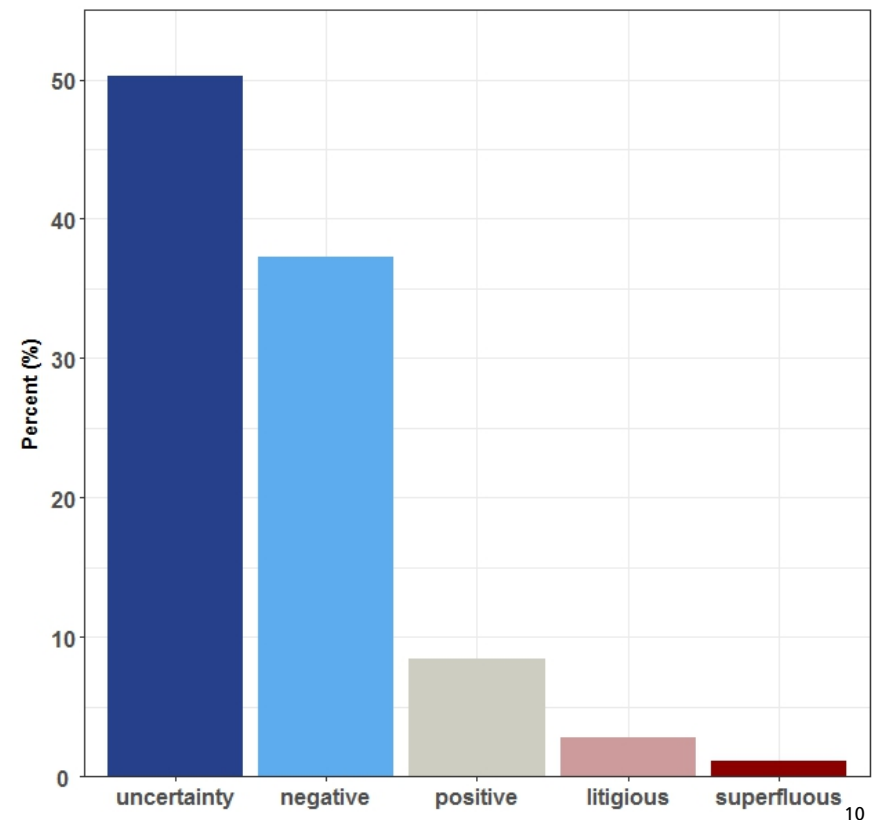
Analyst Research Report Sentiment Analysis

Using the **AFINN** sentiment lexicon, the 20 most frequent words with an assigned sentiment are plotted below:



Source: UBS Quantitative Research

The **Loughran** sentiment lexicon is the most common one to use for financial texts.



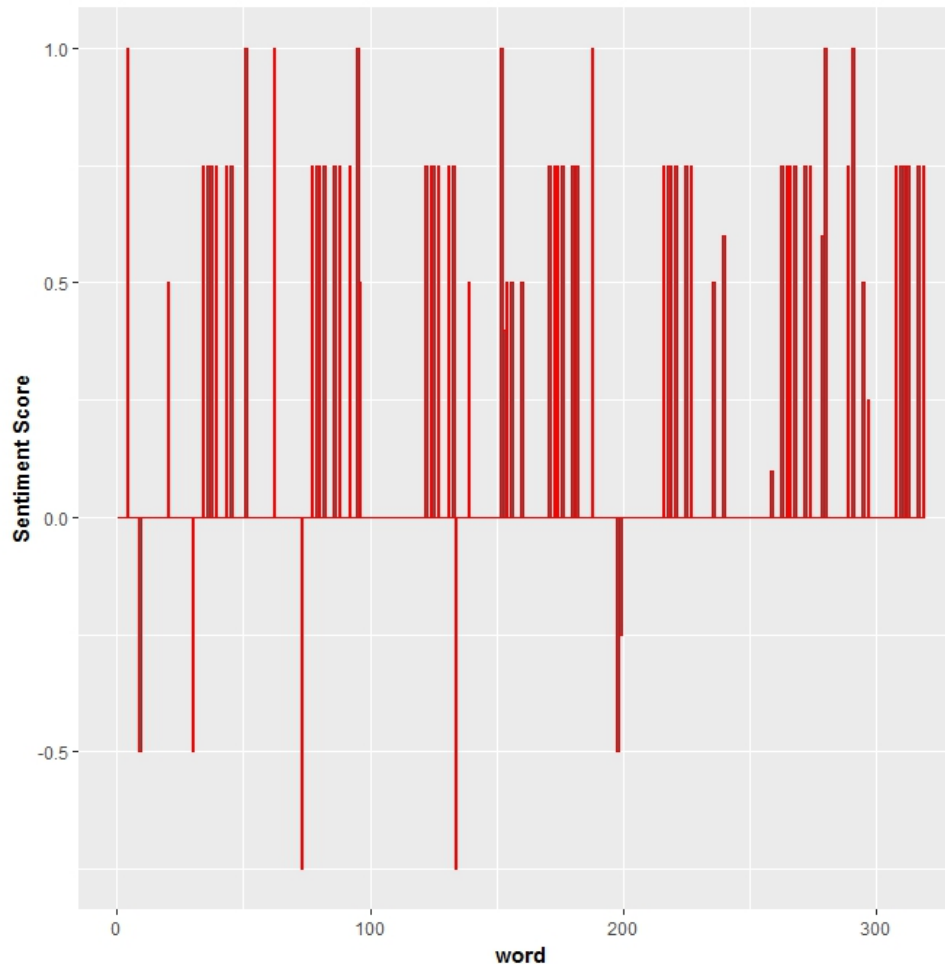
Section 3

The Quant Optimal Christmas Carol

Carol Sentiment Analysis

Let's focus on one Carol: "God Rest Ye Merry Gentlemen"

We can plot the sentiment evolution using the **sentimentr** package.

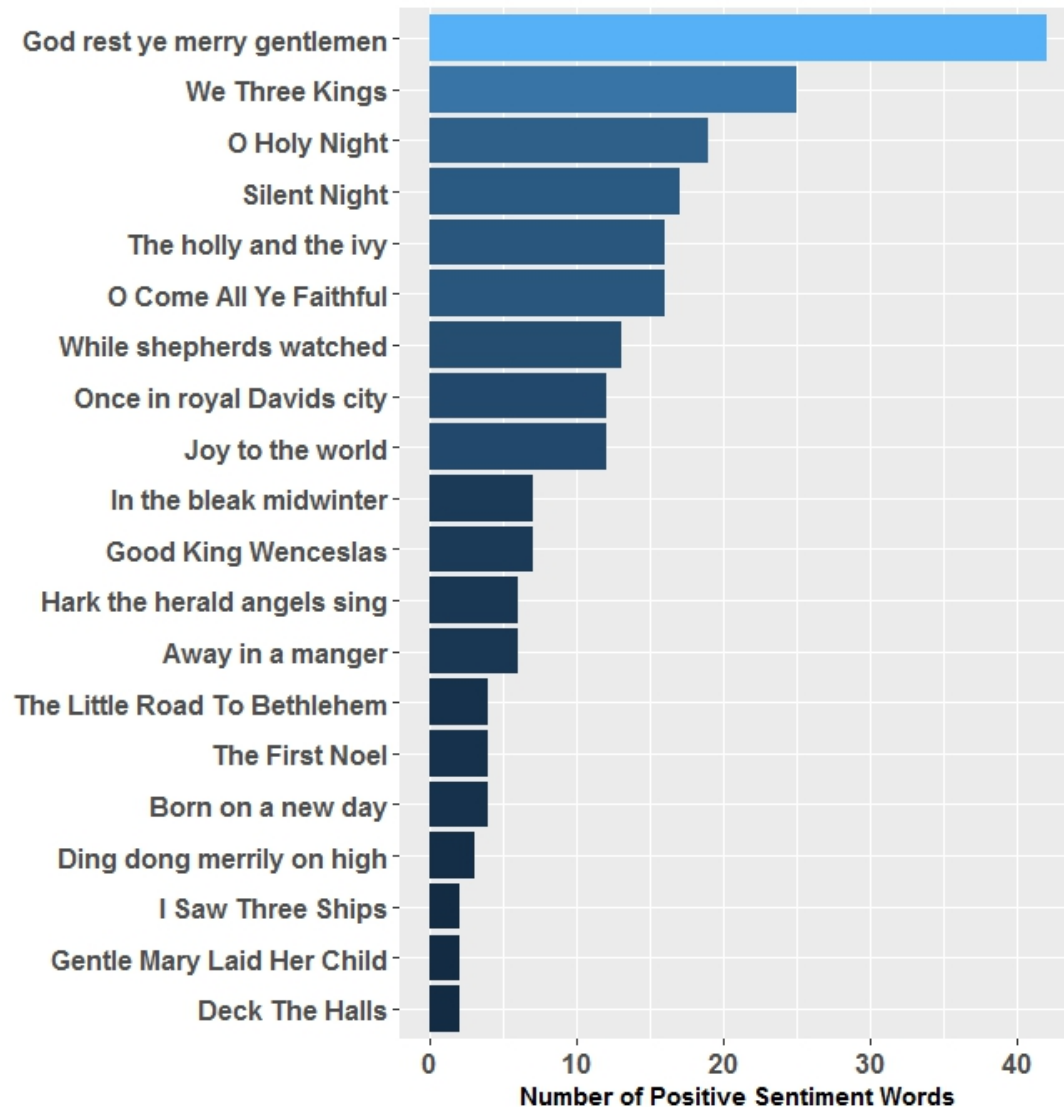


Source: UBS Quantitative Research

God rest ye merry, gentlemen
Let nothing you dismay
Remember, Christ, our Saviour
Was born on Christmas day
To save us all from Satan's power
When we were gone astray
O tidings of comfort and joy,
Comfort and joy
O tidings of comfort and joy

In Bethlehem, in Israel,
This blessed Babe was born
And laid within a manger
Upon this blessed morn
The which His Mother Mary
Did nothing take in scorn
O tidings of comfort and joy,
Comfort and joy
O tidings of comfort and joy
From God our Heavenly Father
A blessed Angel came;
And unto certain Shepherds
Brought tidings of the same:

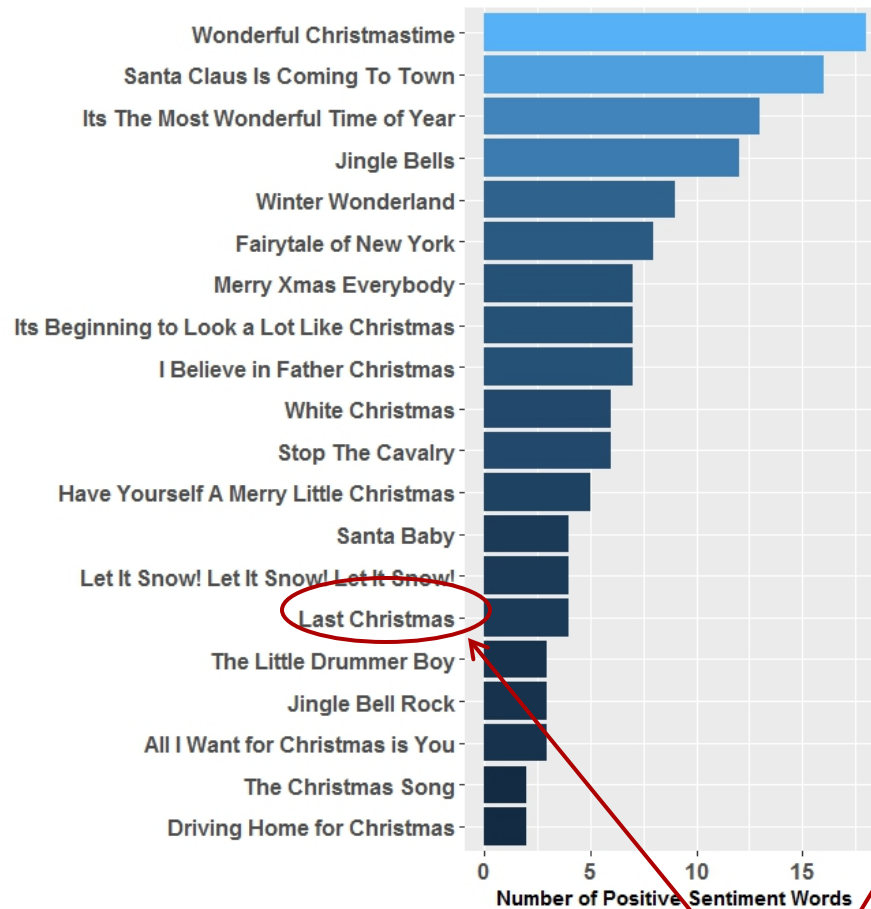
Which Carol is the most positive?



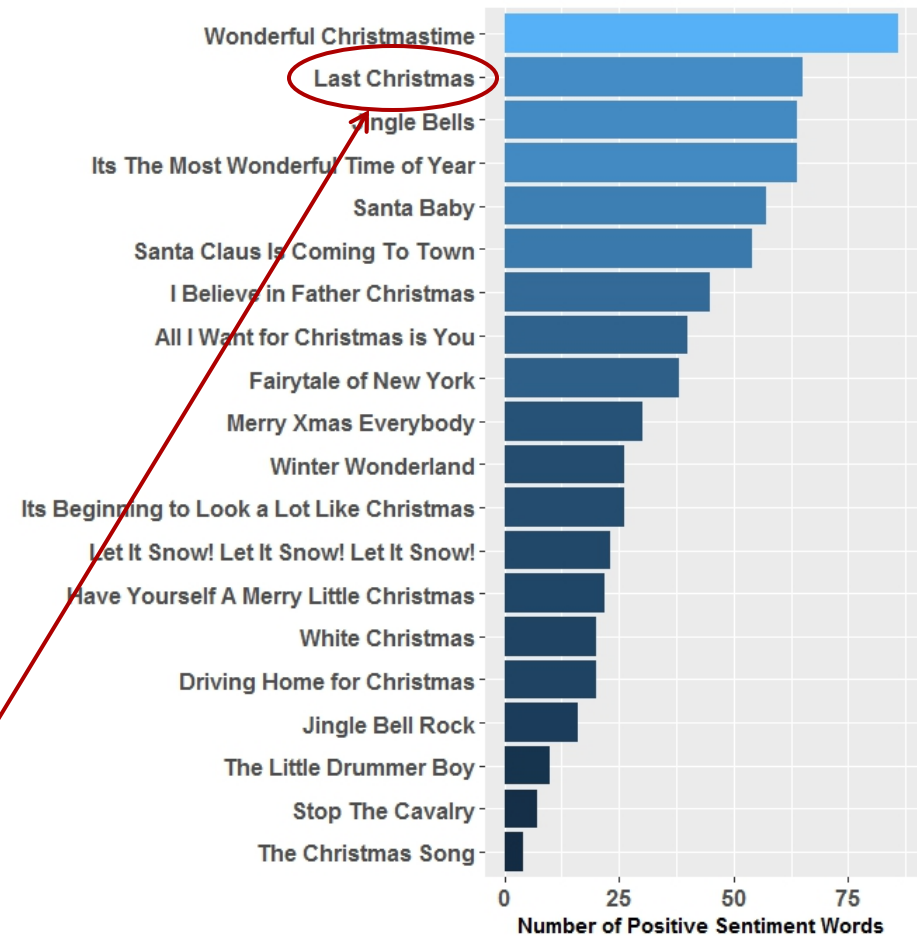
- Based on the "Bing" sentiment lexicon, if we sort the Carols in order of the number of positive sentiment words in the text, which Carol comes out top?
- "God Rest ye Merry Gentlemen" also ranks the highest with the "nrc" sentiment lexicon.

... and Christmas Songs?

"nrc" sentiment lexicon



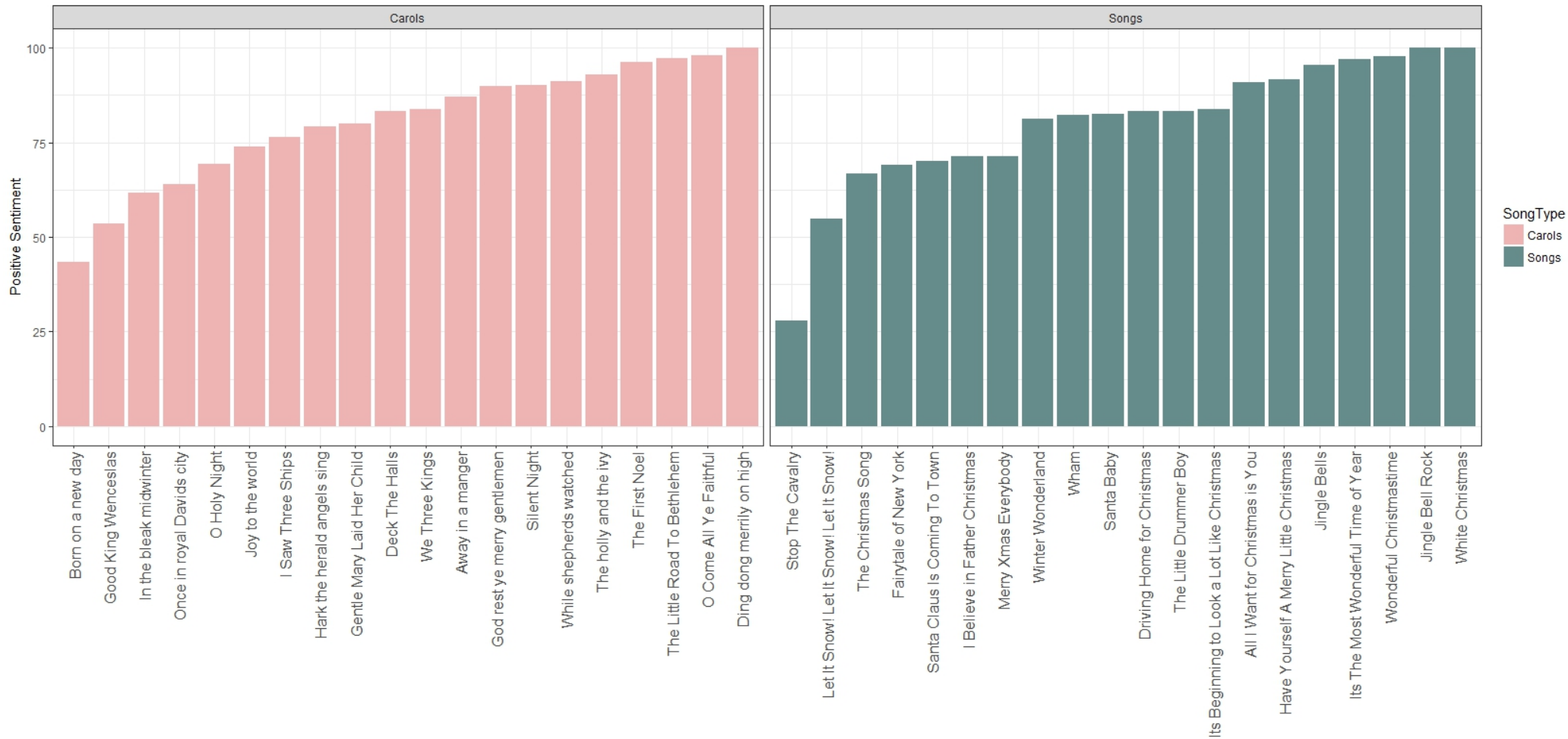
"bing" sentiment lexicon



➤ Using different lexicons can give different results!

Carol Sentiment Analysis

Are Secular Christmas songs generally more positive?



How do we choose the optimal Carol?

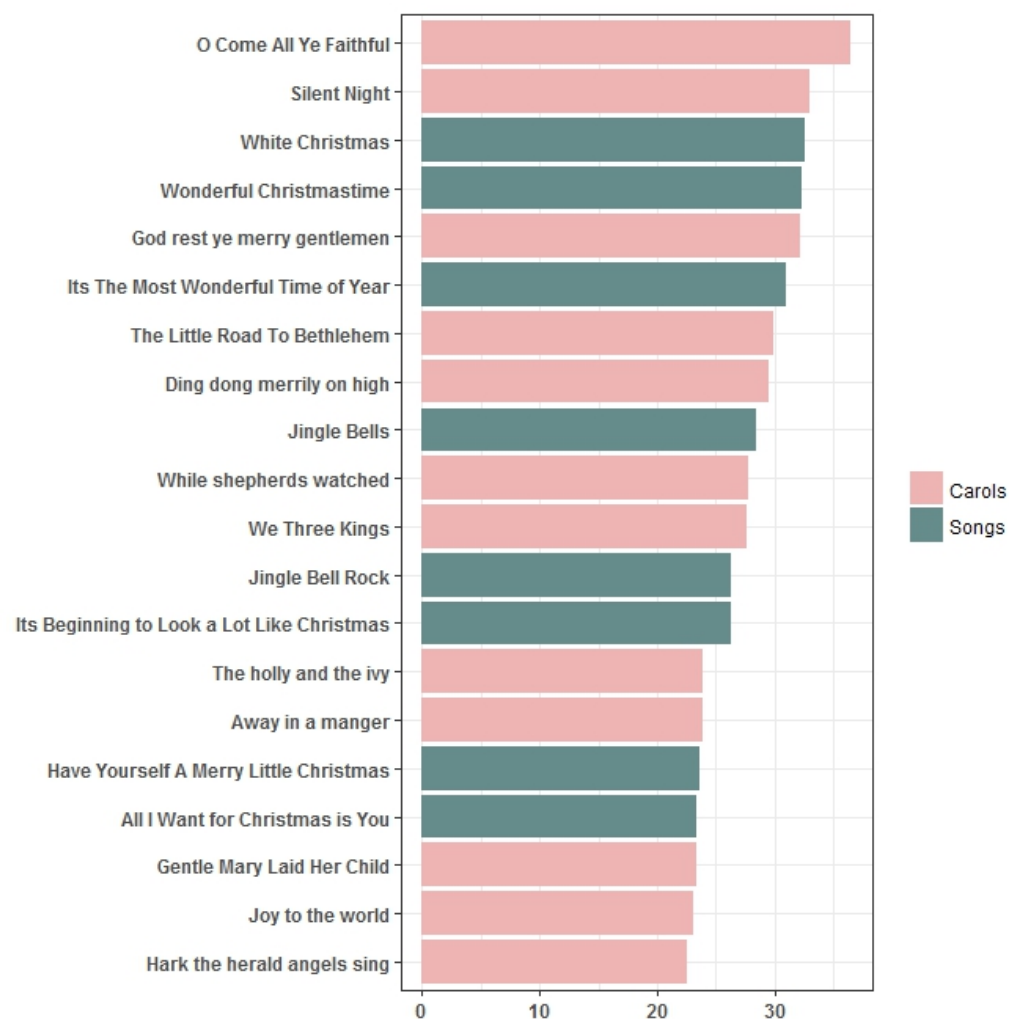
We rank Christmas songs according to five measures:

- 1) The percentage of positive words according to the **bing** lexicon
- 2) The percentage of positive sentiment words based on the **nrc** lexicon;
- 3) The total sentiment score according to the **afinn** sentiment lexicon.
- 4) The average sentiment score according to the **afinn** sentiment lexicon.
- 5) The mean sentiment based on the sentiment scores from **sentimentr** package.



Songs are then sorted according to their **average rank**.

The Quant-Optimal Christmas Song!



Top 5 Christmas Songs	Rank
O Come All Ye Faithful	36.5
Silent Night	33
White Christmas	32.56
Wonderful Christmastime	32.31
God rest ye merry gentlemen	32.12

Bottom 5 Christmas Songs	Rank
Wham	6.38
Fairytale of New York	5.75
Let It Snow! Let It Snow! Let It Snow!	4.44
Good King Wenceslas	3.62
Stop The Cavalry	1.75

To conclude, O Come All ye Faithful and ...

**Happy Holidays from
the Quant Team at UBS**

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Neutral	FSR is between -6% and 6% of the MRA.	39%	23%
Sell	FSR is > 6% below the MRA.	16%	11%
Short-Term Rating	Definition	Coverage ³	IB Services ⁴
Buy	Stock price expected to rise within three months from the time the rating was assigned because of a specific catalyst or event.	<1%	<1%
Sell	Stock price expected to fall within three months from the time the rating was assigned because of a specific catalyst or event.	<1%	<1%

Source: UBS. Rating allocations are as of 30 September 2017.

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