

HEXANET BI WEB APPLICATION

Product Manual

An interactive company network visualization tool,
providing insights on potential business customers and trade war effect.

<http://hexanet.live>



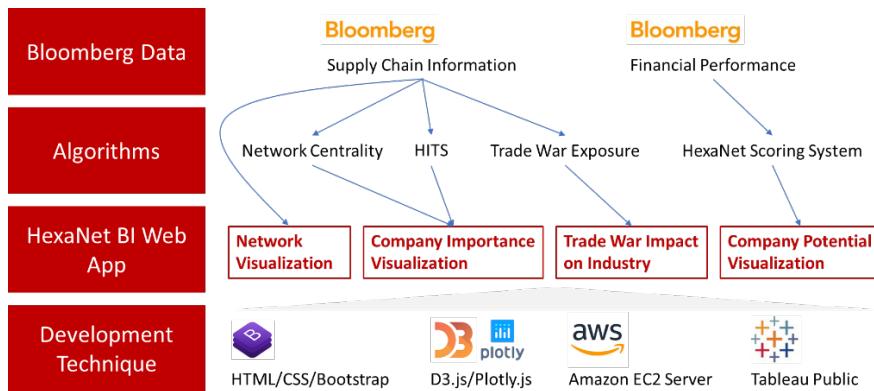
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Introduction

HexaNet BI Web App is an interactive company network visualization tool, providing insights on potential business customers and trade war effect. Visit <http://hexanet.live> to access the BI Web App.

Architecture



Main Features

The main features of HexaNet BI Web App are:

- interactive network visualization based on supply chain relationship
- visibility of different importance of the companies in the network
- visualization of network evolution and company financial performance with timeline
- incorporation of HexaNet Scoring System to measure a company's potential to become a new customer
- discovery of overall trade war effect on different company financial performance

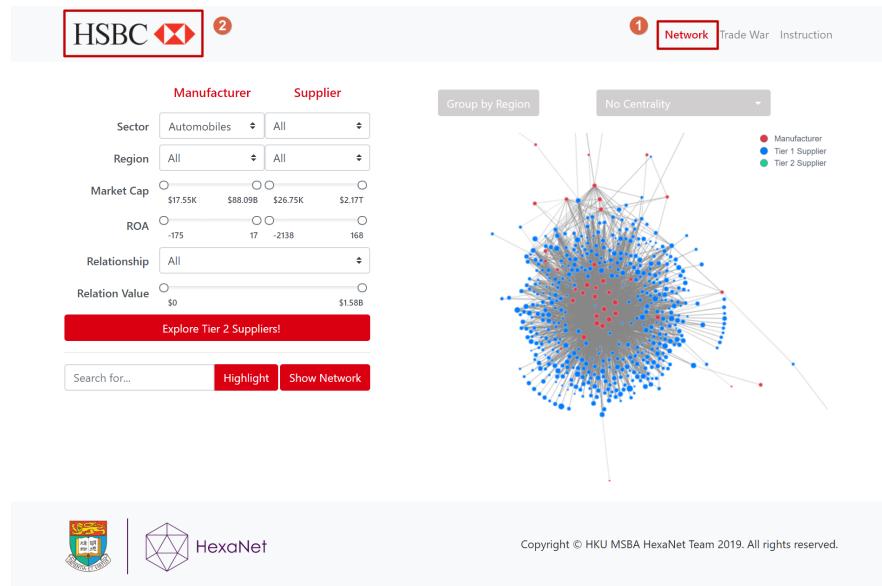
Data Source

HexaNet BI Web App uses supply chain data and financial data from Bloomberg Terminal.

Bloomberg Terminal allows subscribers to access the Bloomberg Professional service to monitor and analyze real-time supply chain data and financial data. Bloomberg Terminal covers information of both public and private markets globally, while the data of public companies is complete and more accurate.

Network Visualization

Choose **Network Tab**, or click **HSBC Logo** to view the whole supply chain network.



Network Elements

Node – a company

Node color – whether a company is a manufacturer, tier 1 supplier or tier 2 supplier

Node size – the market capital of a company

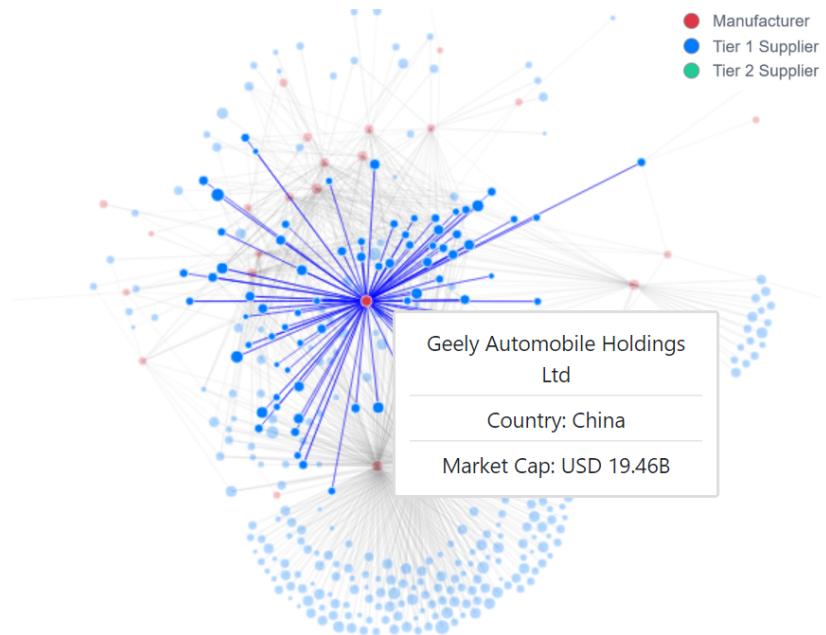
Link – a supply relationship

Link width – the relationship value between two companies, provided by Bloomberg. The calculation is based on Bloomberg internal algorithm by estimating maximum revenue get from central companies and maximum COGS contributed to suppliers

* If there is no data about a company's market capital or relationship value, the node size and link width will be set as the smallest value.

Network Interaction

Basic Operation



On the network,

Scroll up – zoom-in and have a deeper look

Scroll down – zoom-out

Mouse over – show basic information of a company

Click – highlight a company' s supply chain network. The information of the company will show up on the left area. The top 10 supplier list ranked by relationship value will show up below

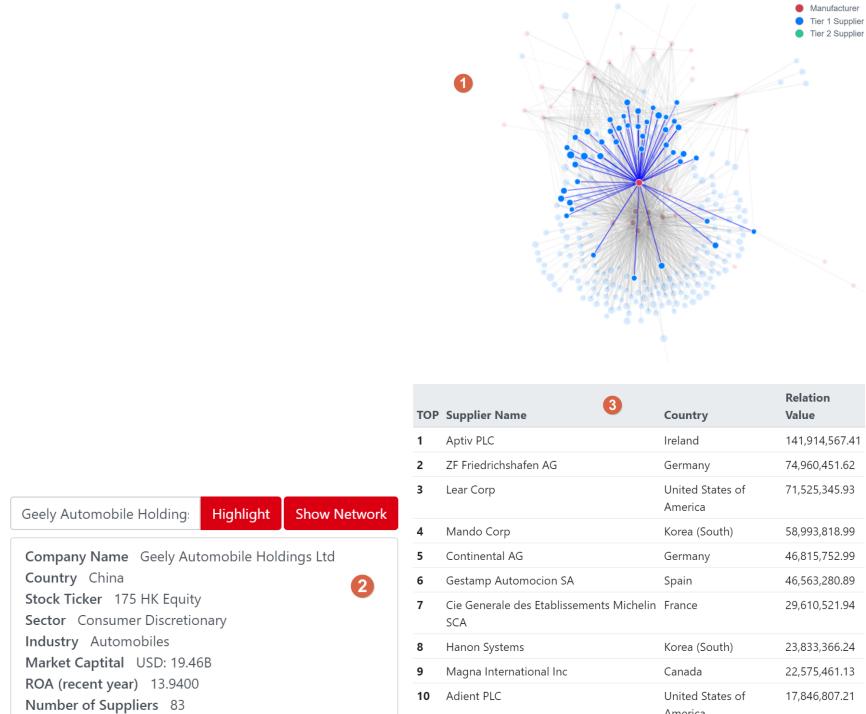
Double click – move a company to the center of the canvas

Filter

	Manufacturer	Supplier
Sector	Automobiles	All
Region	All	All
Market Cap	<input checked="" type="checkbox"/> [Select all] <input checked="" type="checkbox"/> APAC <input checked="" type="checkbox"/> China <input checked="" type="checkbox"/> Europe <input checked="" type="checkbox"/> Hong Kong <input checked="" type="checkbox"/> USA	
ROA	<input max="2.17T" min="2.17B" type="range" value="2.17B"/> \$2.17B \$2.17T	
Relationship	<input max="168" min="-1622" type="range" value="-1622"/> -1622 168	
Relation Value	\$1.54K	\$184.16M

On the filter area, choose multiple options to display interested companies only, according to their **Sector** and **Region**. Or change the range of **Market Capital** and **ROA** to filter out unconcerned companies. Similarly, it is available to filter out unconcerned relationships.

Search

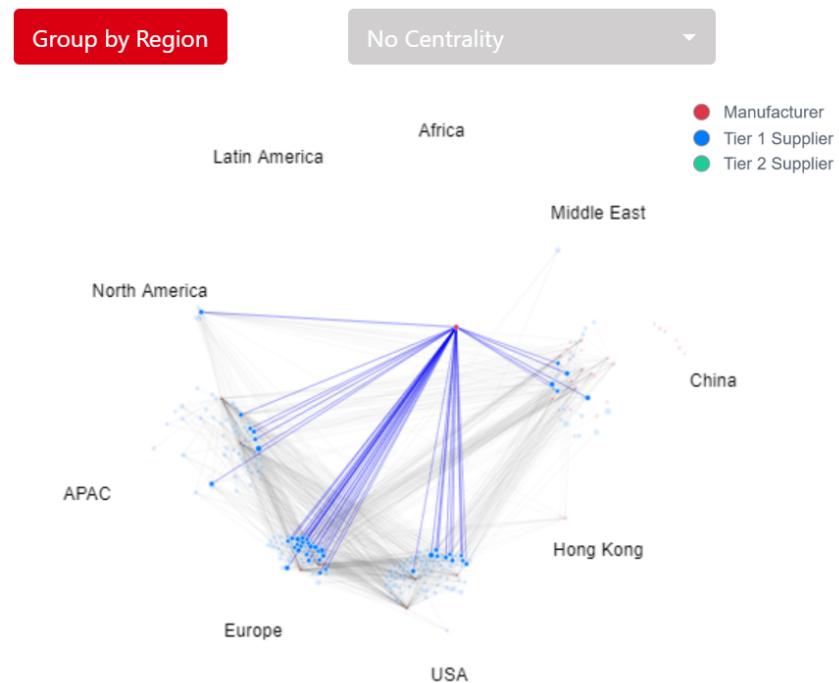


Type in a company's name in the search box, hit **Enter** or click **Highlight** to

- 1) highlight the network of one company on the whole network

- 2) view more information about the company
- 3) view the top 10 supplier list ranked by relationship value

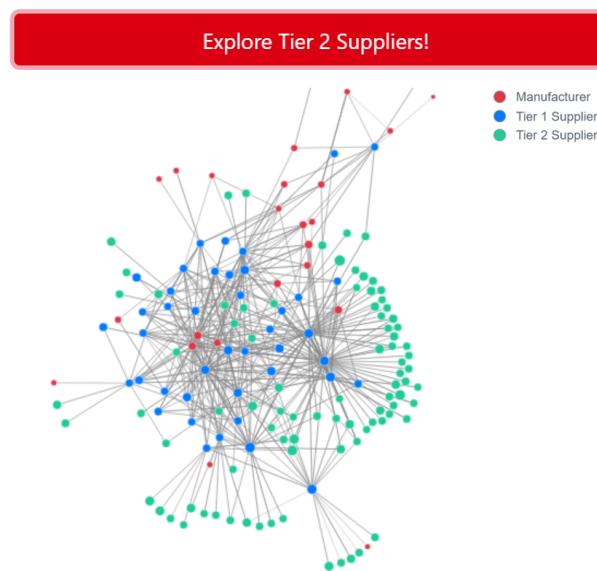
Group by Region



Click **Group by Region** button on the top to display the distribution of suppliers. Especially, China, Hong Kong and USA are excluded from APAC and North America.

Click **Group by Region** button again to restore the network.

Show Tier 2 Suppliers



Click **Explore Tier 2 Suppliers!** button on the left to show tier 2 suppliers. The suppliers and relations added are also under the control of the filters and sliders.

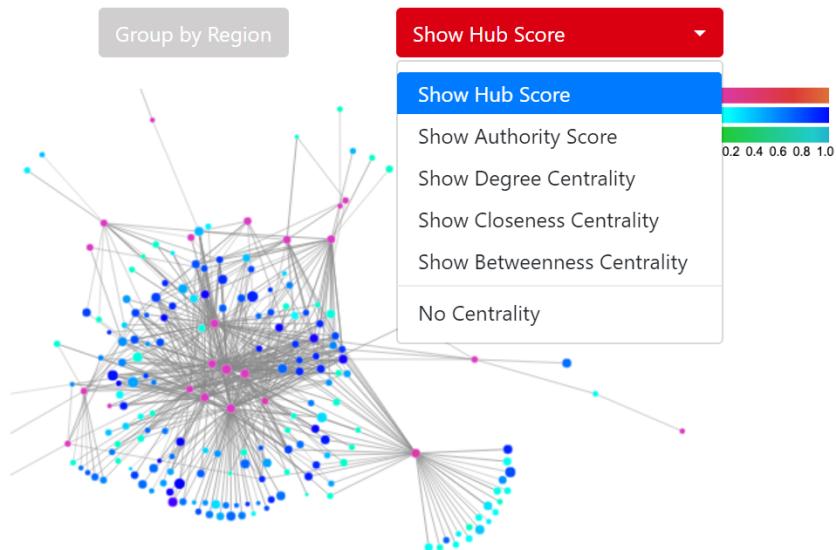
Click **Explore Tier 2 Suppliers!** button again to hide tier 2 suppliers.

Show Centralities

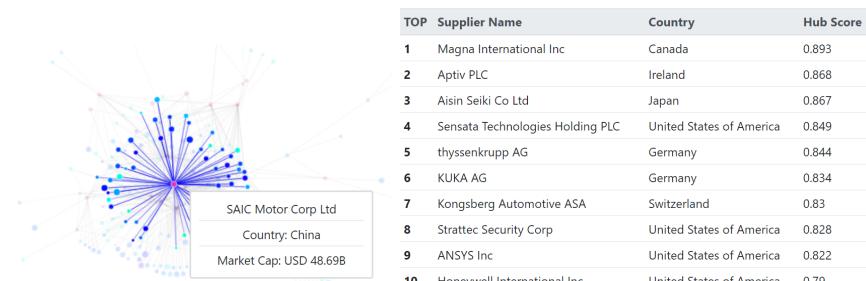
Hub Score, Authority Score, Degree Centrality, Closeness

Centrality and **Betweenness Centrality** measure the importance of each company in the network.

For example, **Degree Centrality** of Company A counts the number of companies which have connection with Company A. If Company A has high degree centrality, then we can presume Company A can bring us more potential customers. Companies which have higher centrality scores are more likely to be new customers.



Click **No Centrality** button on the top. Choose a type of centrality score to visualize the importance of companies. The depth of color represents the score number.



Click a company, in the supplier list below, the company's suppliers will be ranked by the chosen score accordingly.

Click **Show ... Score/Centrality** button and choose **No Centrality** to restore the network.

Meaning of different measurements:

Hub Score – The company connected with how many companies outward (supply from).

Authority Score – The company being connected with how many companies towards them (supply to).

Degree Centrality – It measures how many neighbors a company has, which implies how many companies are directly dealing business with them.

Closeness Centrality – It measures its average distance to all other nodes.

Betweenness Centrality – It measures the amount of influence a node has over the flow of information in a graph.

Check [Appendix A](#) for the details of centrality calculation.

Trade War Study

Choose **Trade War Tab** to discover trade war effect.



HexaNet Scoring System

Concepts

Borrow Need Score

Abnormal Change of Inventories – Abnormal Change of Cash*

When a company's inventory increases and cash decreases, the company's operation may be inefficient, thus needs borrow more money.

Risk Score

Abnormal Change of D/E Ratio

When debt-to-equity ratio increases, a company's financial flexibility may decrease. In this situation, the company may have higher risk that it cannot repay its debt.

FX Score

Number of Foreign Suppliers

If a company has more suppliers from other countries, meaning that it has higher foreign exchange opportunities.

All of the above three scores have been standardized to the range of 0 to 1.

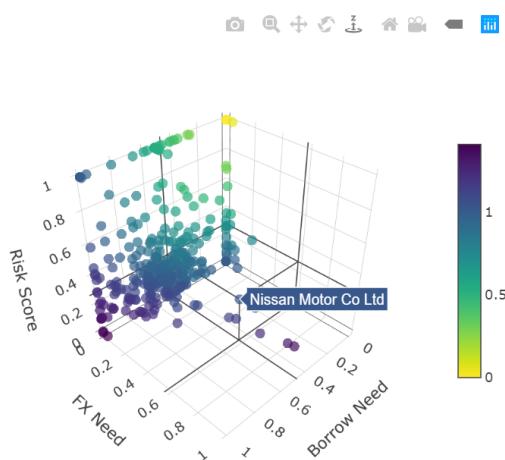
HexaNet Score

$$\sqrt{\text{Borrow Need}^2 + \text{FX Need}^2 + (1 - \text{Risk})^2}$$

An aggregated score to measure a company's overall potential to be a new customer. Higher HexaNet Score means that a company may have higher borrow need, higher FX Need and lower risk.

* Abnormal Change of Financial Metrics is the difference of actual value and expected value as if there is no trade war. Expected performance is calculated by a three-factor regression model. More details of Abnormal Change calculation can be found in [Appendix B](#).

Visualization – 3D Scatter Plot



The scatter plot takes **Risk Score**, **FX Need Score** and **Borrow Need Score** as three axes. Each company takes its position in the three-dimensional space.

The color of a company represents the aggregate **HexaNet Score**. The darker the color, the higher potential a company to be a new customer.

Download Plot, **Rotate**, **Zoom** or **Reset** using the buttons on the top right corner.

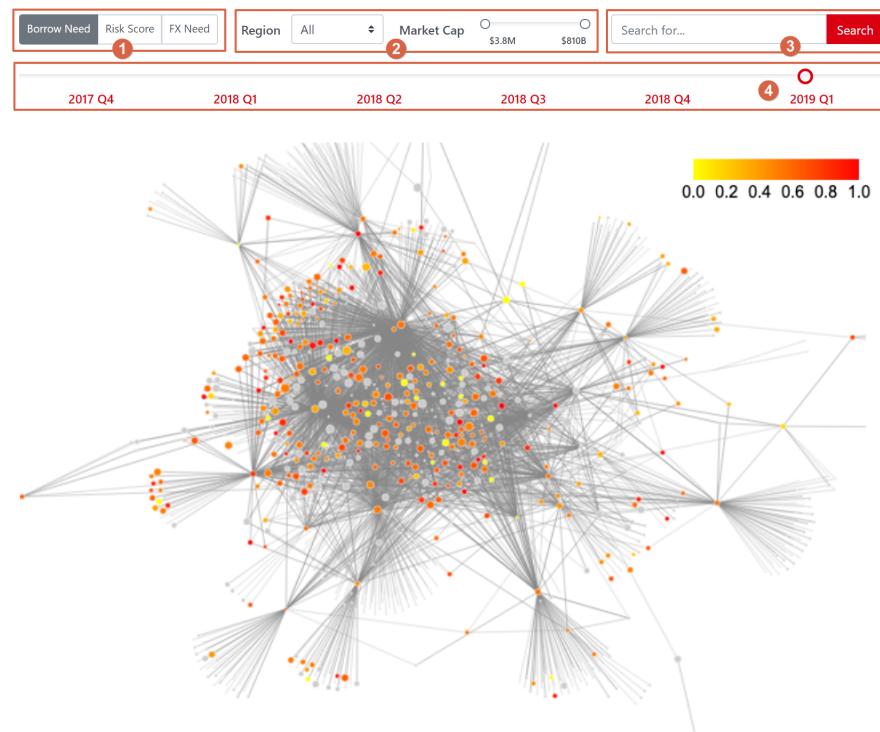
Company Ranking

Company Name	Borrow Need	Company Name	Risk Score	Company Name	FX Need
Hyundai Rotem Co Ltd	1.000	NN Inc	1.000	Samsung Electronics Co Ltd	0.974
NN Inc	1.000	Core Molding Technologies Inc	1.000	Fiat Chrysler Automobiles NV	0.832
Core Molding Technologies Inc	1.000	AMAG Austria Metall AG	1.000	Bayerische Motoren Werke AG	0.776
Lydall Inc	1.000	Kawasaki Kisen Kaisha Ltd	1.000	General Motor	0.728
Meritor Inc	1.000	Noblelift Intelligent Equipment Co Ltd	1.000	Ford Motor Co	0.625
Korea Autoglass Corp	1.000	Cheng Uei Precision Industry Co Ltd	1.000	Nissan Motor Co Ltd	0.573
China Yuchai International Ltd	1.000	Ferrari Nv	1.000	Honda Motor Co Ltd	0.560

The table lists top 100 companies ranked by **Risk Score**, **FX Need Score** and **Borrow Need Score**. Scroll down to view more companies.

Network Interaction

Basic Operation



- 1) Choose one score to decide the color of the companies. Grey means no data for this company, or the company is not appearing in this quarter's network.

- 2) Set filters on the companies. See [Filter](#) for reference.
- 3) Search for a specific company. See [Search](#) for reference.
- 4) Change the quarter to view the evolution of network. Notice that, in 2017 Q4 and 2018 Q1, there is no data for Borrow Need, Risk Score or FX Need. The color will be set to represent the role of a company plays in the network.

The [Filters](#) and [Timeline](#) are also applicable for the 3D Scatter Plot.

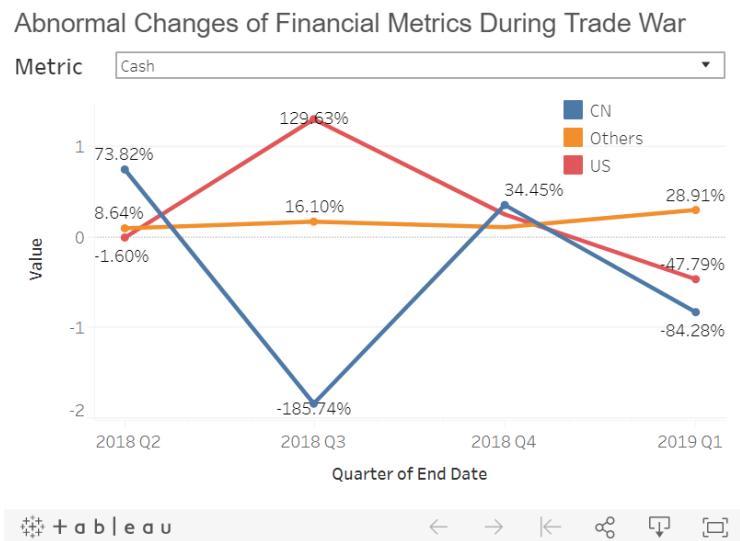
Individual Company Performance



Click a company on the network or **Search** it, more information about the company will show up below. The line charts show the change of Borrow Need, Risk Score, FX Need and financial performance of the chosen company over time.

Industry Landscape

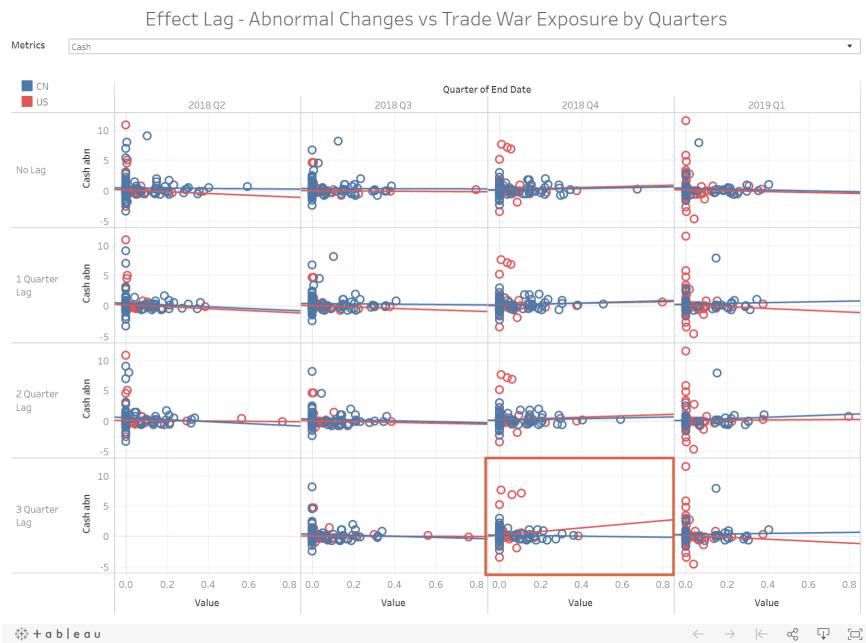
Abnormal Change of Financial Metrics During Trade War



The two graphs are the same. Multiple choices of financial performance are provided. The calculation of Abnormal Change can be found in [Appendix B](#). Here, the abnormal change is aggregated, grouping by the country of companies.

For example, the graph above shows the abnormal change of cash for companies from different country. It can be found that, during trade war, China's companies and US' companies are experiencing cash fluctuation more intensely than others.

Abnormal Change vs Trade War Exposure



X axis – trade war exposure. For China's companies, it's the portion of US' suppliers among all suppliers. For US' suppliers, it's the portion of China's suppliers among all suppliers

Y axis – abnormal change of financial metrics

Point – a China's or US' manufacturer

Lag – the effect of trade war may emerge after one or more quarters lag. For example, the subplot within the red rectangle shows the relationship between **Trade War Exposure** in 2018 Q1 (3 Quarter Lag) and **Abnormal Change of Cash** in 2018 Q4.

Line – the regression trend line of the relationship between trade war exposure and financial performance change.

Troubleshooting

Choose **Instruction Tab** to find the answers for your questions.

HSBC 

Network Trade War **Instruction**

Supply Chain Network

Q1.1 What are the basic operations of the network?
Q1.2 Where does the data come from?
Q1.3 What do *Market Cap, ROA, Relation, Relation Value* mean?
Market Cap: Market capitalization is the market value of a publicly traded company's outstanding shares. Market capitalization is equal to the share price multiplied by the number of shares outstanding.
Return on Assets (ROA): A profitability ratio that provides how much profit a company is able to generate from its assets.
Relation: Relation shows the cost type of two companies. There are 3 types of relations: COGS, SG&A and CAPEX. **COGS:** Cost of goods sold is the expense most directly involved in creating revenue. It represents the costs of producing or purchasing the goods or services sold by the company. **SG&A:** Selling, general & administrative expense. This category includes marketing, salaries, utility bills, technology expenses and other general costs associated with running a business. **CAPEX:** Capital expenditures are funds used by a company to acquire, upgrade, and maintain physical assets such as property, buildings, an industrial plant, technology, or equipment.
Relationship Value: Amount involved in the relationship adjusted to quarterly-equivalent value.
Q1.4 How do you divide the countries to different regions? Why do I see APAC and China at the same time?
Q1.5 What do the color and size of a node mean? What does the thickness of a link mean?
Q1.6 What is the difference between function *Search* and *Show Network*?
Q1.7 What is the difference between *Hub Score, Authority Score, Degree Centrality, Closeness Centrality and Betweenness Centrality*?

Trade War Effect Analysis

Q2.1 What are *Borrow Need, Risk Score and FX Need*?
Q2.2 What does *Abnormal Change* mean?
Q2.3 How to use the timeline and what are the differences?
Q2.4 What do the colors of the nodes mean on network and scatter plot?
Q2.5 What is *Industry Landscape*?



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Appendix A: Centrality Score Calculation

Hub Score and Authority Score

1. Assign each company having an authority score and hub score of 1.
2. Updating the company's authority score by using the sum of the hub scores that other companies point to it.
3. Hub score is also updated by using the sum of the authority scores that the company point to.
4. Normalize the score by dividing each score by the square root of the sum of all the score.
5. Repeating the steps many times until the score reach a stable state.

Degree Centrality

Degree Centrality represents the number of links incident upon a node. The degree can be interpreted in terms of the immediate risk of a node for catching whatever is flowing through the network, such as corporate banking information.

The degree centrality of a node v is

$$C_D(v) = d(v)$$

Where

$$d(v) = \text{the number of links incident upon node } v$$

The normalized degree centrality of a node v is

$$\text{normal}(C_D(v)) = \frac{d(v)}{n - 1}$$

Where

$$n = \text{the total number of nodes}$$

Closeness Centrality

Closeness centrality looks for the node that is closest to all other nodes.

The closeness centrality of a node v is

$$C(v) = \frac{1}{\sum_y d(y, v)}$$

Where

$$d(y, v) = \text{the distance between node } y \text{ and node } v$$

The normalized closeness centrality of a node v is

$$normal(C(v)) = \frac{n}{\sum_y d(y, v)}$$

Where

$n = \text{the total number of nodes}$

Betweenness Centrality

Betweenness Centrality represents the degree of which nodes stand between each other.

The betweenness centrality of a node v is

$$g(v) = \sum_{s \neq v \neq t} \frac{\sigma_{st}(v)}{\sigma_{st}}$$

Where

$\sigma_{st} = \text{the total number of shortest paths from node } s \text{ to node } t$

$\sigma_{st}(v) = \text{the number of those paths that pass through } v$

The normalized betweenness centrality of a node v is

$$normal(g(v)) = \frac{g(v) - \min(g)}{\max(g) - \min(g)}$$

Appendix B: Abnormal Change of Financial Metrics

To get the expected performances, we used three-factor model on all financial metrics of all companies.

$$\begin{aligned} \text{Expected Performance} \\ = \beta_0 + \beta_1 * \text{industry average} + \beta_2 * \text{company size} + \beta_3 \\ * I(\text{quarter}) \end{aligned}$$

We get the abnormal changes by below equation.

$$\text{Abnormal Changes} = \frac{\text{Actual Performance}}{\text{Expected Performance}} - 1$$