Empirical Network Analysis of Hong Kong Stocks Market

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Introduction

This analysis aims to reveal the influence of enterprises in the Hong Kong economy. Hong Kong is one of the remarkable financial centers in the world. Hong Kong economy is highly coherent to the stocks market, in which the Hang Seng Index (HSI) is the most representative because the 50 constituent companies account for about 60% of capitalization of the Hong Kong Stock Exchange. This study refers to the 50 constituent companies as of 29th November, 2013 published by the Hang Seng Indexes website (http://www.hsi.com.hk/HSI-Net/HSI-Net). Each public listed company typically constitutes a several major shareholders who own a significant portion of shares. These major shareholders influence the strategies of the public listed company. If an organization plays as a major shareholder in several public listed companies simultaneously, it creates a sufficient condition to exert her influence in the stocks market and even the economy. This study will find out are there any super power to influence the Hong Kong stocks market, and in which degree they exert the influence.

Dataset

All the raw data used in the study is available for free in the HKExnews website (http://www.hkexnews.hk/sdw/search/search_sdw.asp). The raw data is queried on company base. After merging and cleaning, the data will looks alike in figure 1. The tabular dataset shows the constituent companies and the associated shareholders who own a significant portion of share (>=1%). The pid (shareholder id) is designated as node. Any two organizations play as the shareholders of a public listed company will be represented by an undirected edge. ("sid" refers to stock id, pid refers to shareholder id, and pname refers to the name of the shareholder.)

sid	pid	pname
00005	C00019	THE HONGKONG AND SHANGHAI BANKING
00005	C00039	STANDARD CHARTERED BANK (HONG KONG) LTD
00005	C00100	JPMORGAN CHASE BANK, NATIONAL
00005	C00010	CITIBANK N.A.
00011	C00019	THE HONGKONG AND SHANGHAI BANKING
00011	C00039	STANDARD CHARTERED BANK (HONG KONG) LTD
00011	C00100	JPMORGAN CHASE BANK, NATIONAL
00011	C00010	CITIBANK N.A.
00011	C00018	HANG SENG BANK LTD
00011	C00033	BANK OF CHINA (HONG KONG) LTD
00011	B01284	HANG SENG SECURITIES LTD
00023	C00003	THE BANK OF EAST ASIA LTD
00023	B01451	GOLDMAN SACHS (ASIA) SECURITIES LTD
00023	C00019	THE HONGKONG AND SHANGHAI BANKING
00023	C00039	STANDARD CHARTERED BANK (HONG KONG) LTD
00023	C00100	JPMORGAN CHASE BANK, NATIONAL
00023	C00033	BANK OF CHINA (HONG KONG) LTD
00023	B01209	GUOCOCAPITAL LTD
00023	C00010	CITIBANK N.A.
00023	B01118	EAST ASIA SECURITIES CO LTD
00388	C00019	THE HONGKONG AND SHANGHAI

Figure 1

Evaluation

In figure 2, there are 40 organizations (nodes) plays as the major shareholder in 50 HSI constituent companies. The number of edges is 225 and resulted in a high average degree of 11.25. It indicates that the organizations tend to maximize their participation in the constituent companies. There are three uneven sized clusters in the network. The largest cluster (yellow nodes) is formed by HSBC, JP Morgan, Citibank, and Standard Chartered Bank and other organizations. These four organizations form a strong bonding among each other (indicated the thick edges) and participate in large extend (node degree >= 32) as shareholders in the constituent companies, resulted in >60% participation among the 50 companies. In addition, they play as the hub in the network as they have a betweenness > 60. It can be interpreted that these four big powers can collaborate among clusters to exert the influence in the stocks market and economy. The second large cluster is lead by Goldman Sachs, Credit Suisse Securities, and Hang Seng Bank (blue nodes). However they have not formed a strong bonding as compared to the four big powers (degree >=15). It indicates that they are even difficult to collaborate within their own cluster, and thus difficult to exert a influence in the economy. It is interesting to find out that all organization having Chinese Government background tends to attach to the largest cluster, for example, China International Capital, China Merchants Securities, ICBC, CSC, Bank of Communications. It can be explained that the Chinese Government try to exert their influence in the Hong Kong economy by attaching to the hub, to ease the collaboration among the whole network. The network is complex and highly concentrated to the four powers. They can influent the economy effectively; in contrast, if the four powers decrease the investment in Hong Kong, it will reduce the importance of the hub and average betweenness of the network.

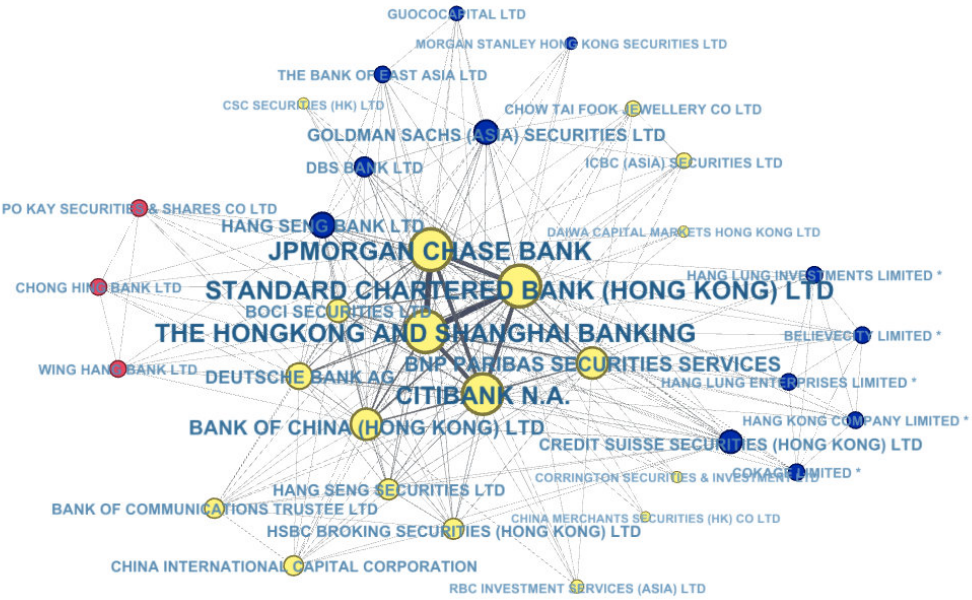

Figure 2

Conclusion

The network gives strong evidence that foreign based organizations (U.S. and U.K.) dominate the influence in the Hong Kong economy. While there is a growing number of Chinese based organizations participate and actively attach to the four big powers. It can be expected that the domination will diminish gradually when the Chinese based organizations exert their influence in the clusters. The high centrality network cause effective diffusion of influence, in contrast, if any of the four big power diminish their role in Hong Kong, it damage the hub and the influence will be less effective to diffuse through the network.

Source code

All the source code for the analysis is available in my github respository (https://github.com/m41highway/sna) . The dataset is merged and cleaned with a piece of Python script using Numpy and Pandas. It will generate a GML format file. The GML format file will then be analyzed using Gephi.

File	Purpose
https://github.com/m41highway/sna/blob/master/hsindex.csv	Dataset
https://github.com/m41highway/sna/blob/master/create_network.py	Data merge, clean, generate GML
https://github.com/m41highway/sna/blob/master/hsi.gml	Network file in GML format
https://github.com/m41highway/sna/blob/master/EmpiricalNetworkAnalysis.pdf	Analysis results