(index.html)

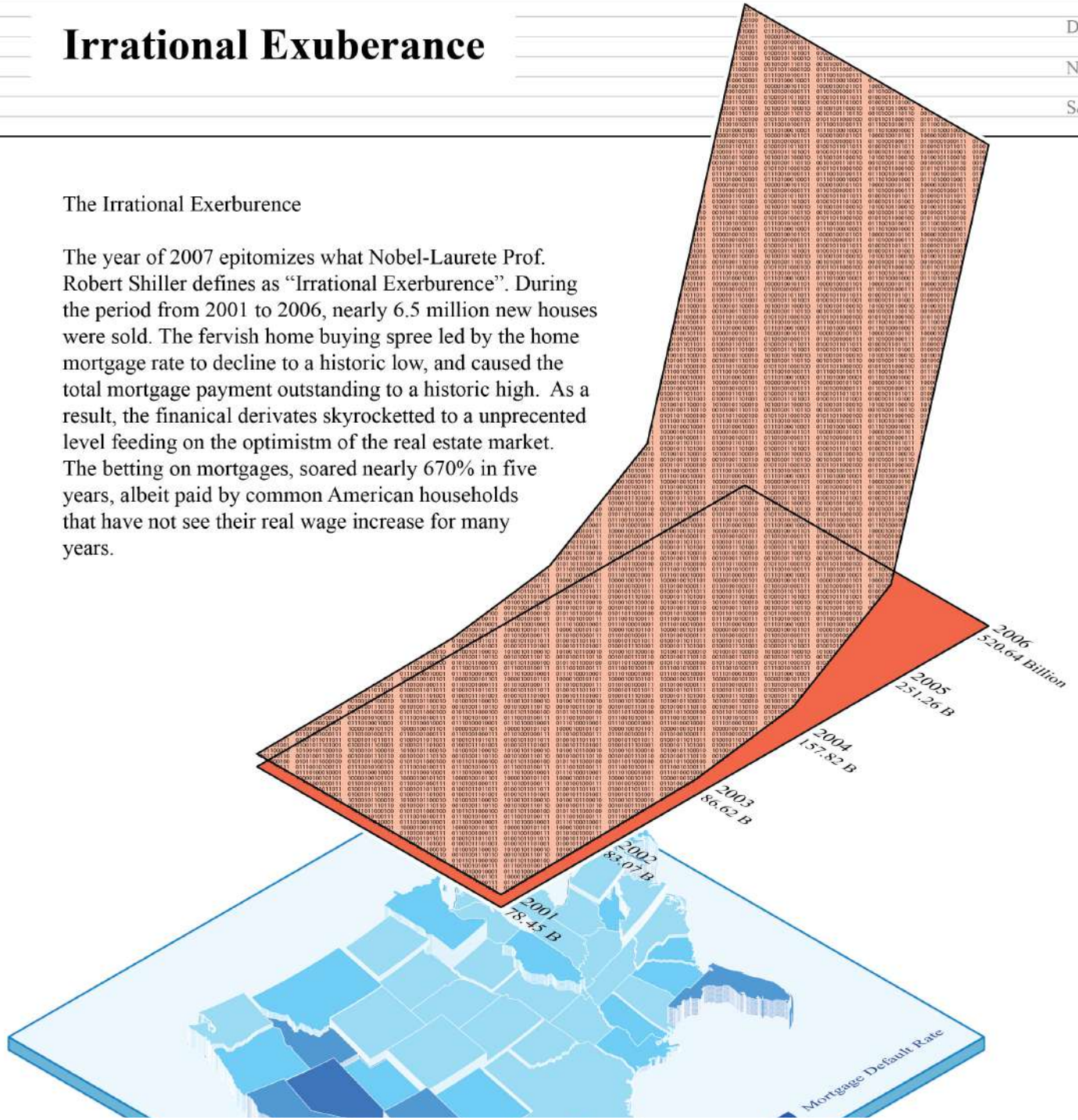
Intro Video (index.html) Literature Review (inside-page.html) Github (https://github.com/vincentjiang777/visualize_the_crisis)

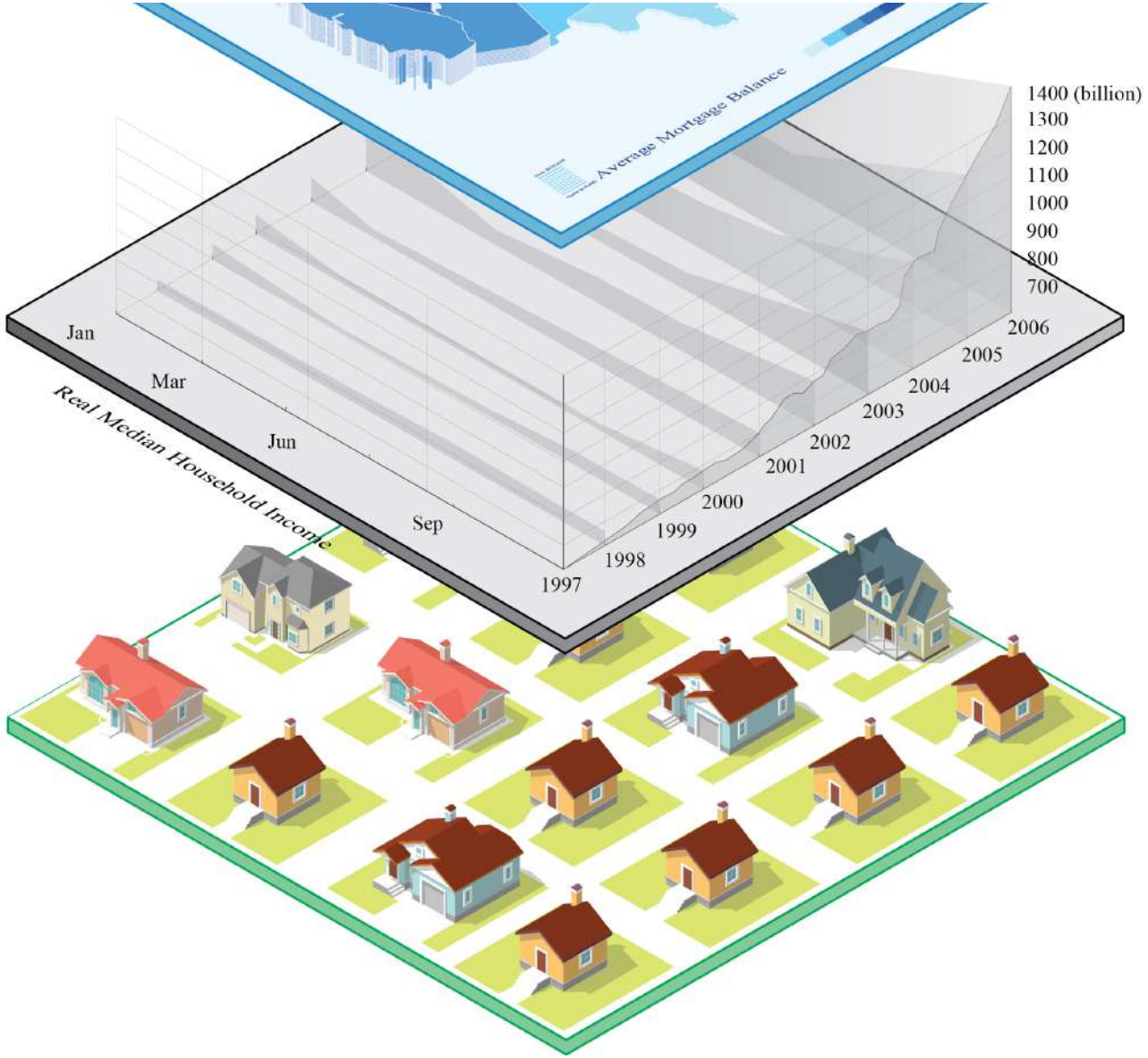
Irrational Exuberance

DJIA	12156.81	+416.66	+3.55%
NASDAQ	1,330.74	+54.14	+4.24%
S&P 500	2,212.49	+89.12	+4.11%

The Irrational Exerburence

The year of 2007 epitomizes what Nobel-Laurete Prof. Robert Shiller defines as "Irrational Exerburence". During the period from 2001 to 2006, nearly 6.5 million new houses were sold. The fervish home buying spree led by the home mortgage rate to decline to a historic low, and caused the total mortgage payment outstanding to a historic high. As a result, the finanical derivates skyrocketted to a unprecented level feeding on the optimistm of the real estate market. The betting on mortgages, soared nearly 670% in five years, albeit paid by common American households that have not see their real wage increase for many years.





(img/rmbs_visualized.jpg)

What is the greatest invention mankind has ever created? A common answer would be electricity and internet. Few times people would suggest an invention that is just as significant: the financial market. To the dislikes of many, the financial market has been blamed and flawed as the system that empowers the rich and disenfranchise the poor. Throughout the 7000 year of human civilization, it has however played an indispensable role as the one invention that brings the most goods to our society. Once in while however, it cripples our society. The latest crisis started in 2007 was caused by subprime mortgages. Billions of financial products derived from home mortgages, which are paid by common household evaporated as the home loans went insolvent. This devastating catastrophe was often blamed on the reckless betting of financial institutions, and imprudence of government regulators. Though we must recognize that, despite complex human emotions the market system is a simple mechanism, with comprehensive set of rules and common sense. It is often the players who can be irrational, sentimental, and even delusional. The excitement and fright, induced by arbitrary gains and losses make a volatile market ever so intriguing to the speculators, but on the contrary, disheartening to the common masses.

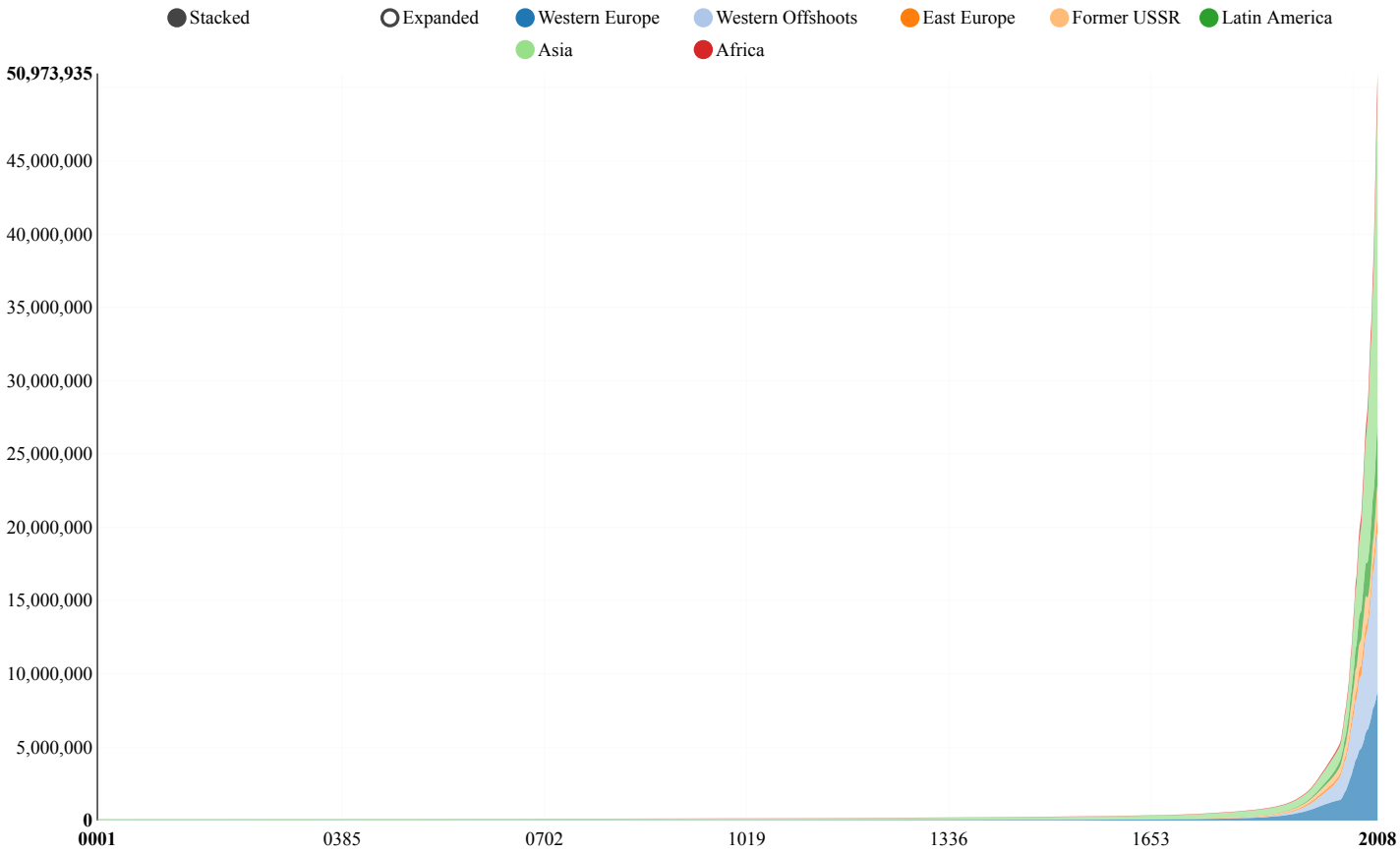
According to the *Economists,* the market system embodies essentially two things; first it works as an economic time capsule, help savings from today's surplus transport into future income, or give borrowers access to future earnings now. Second, it can work as a safeguard, insuring against natural disasters and personal illness.

In today's financial market however, many lose faith to the market, and eventually miss out on a strong recovery. Consequently, lack of market participation is now leaving millions behind, creating a widening economic gap that separates the rich and poor, and the have and have-nots. While people demand for more participation and better distribution, often they are dismissed due to information asymmetry and lack of financial literacy. This project sees to the needs of helping people understand complex information and democratize financial concepts, is a visual essay that describe a story of financial crisis, the causes, effects and lessons that come with it. Through the visualization of data, we may gain a better understanding of the trend, and scale for our sophisticated market system.

Chapter 1 The World Economy

Our world economy as a whole has grown exponentially since the beginning of Gregorian calendar. Though it is not until recent two centuries that the gross production increases drastically. Largely due to the industrial revolution led by Western Europe, our once-agrarian society was then transformed to a more efficient and productive industrial society with more specialty in labor, and progress in technology.

Click here for full screen (streamgraph/streamgraph.html)



In recent years however, the distribution of growth has shifted from favoring Western Europe to more on Asia. Largely due to a stabilizing socio-political climate in respective Asian country after World War II, countries such as China, Japan South Korea have now established themselves as important economic power globally. However, the economic growth distributes unevenly across the globe despite there have been more trade agreements, contracts and organizations being formed. This makes us wonder what really widens the economic gap between the rich and poor, and why our market system is consistently impairing the poor.

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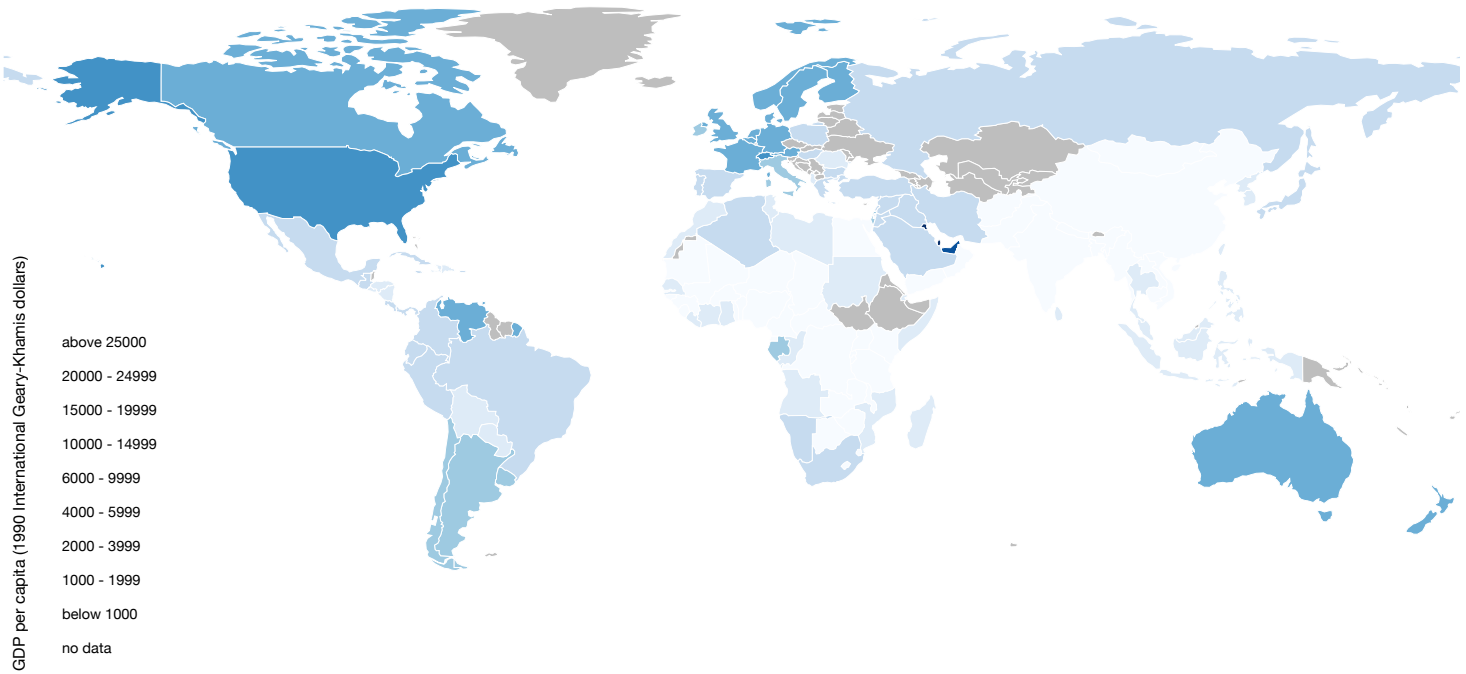
AD 1 1000 1500 1700 1820 1870 1913 1950 1960 1970 1980 1990 2000 2008

GDP per Capita in the year 1960



Chapter 2 The Financial Crises

“Freedom isn’t free”. The same applies to the market, where great changes and chaos have taken place. In the modern history of the financial market dated back to the 1700s, there have been quiet a few crises, and each of them can teach us important lesson.

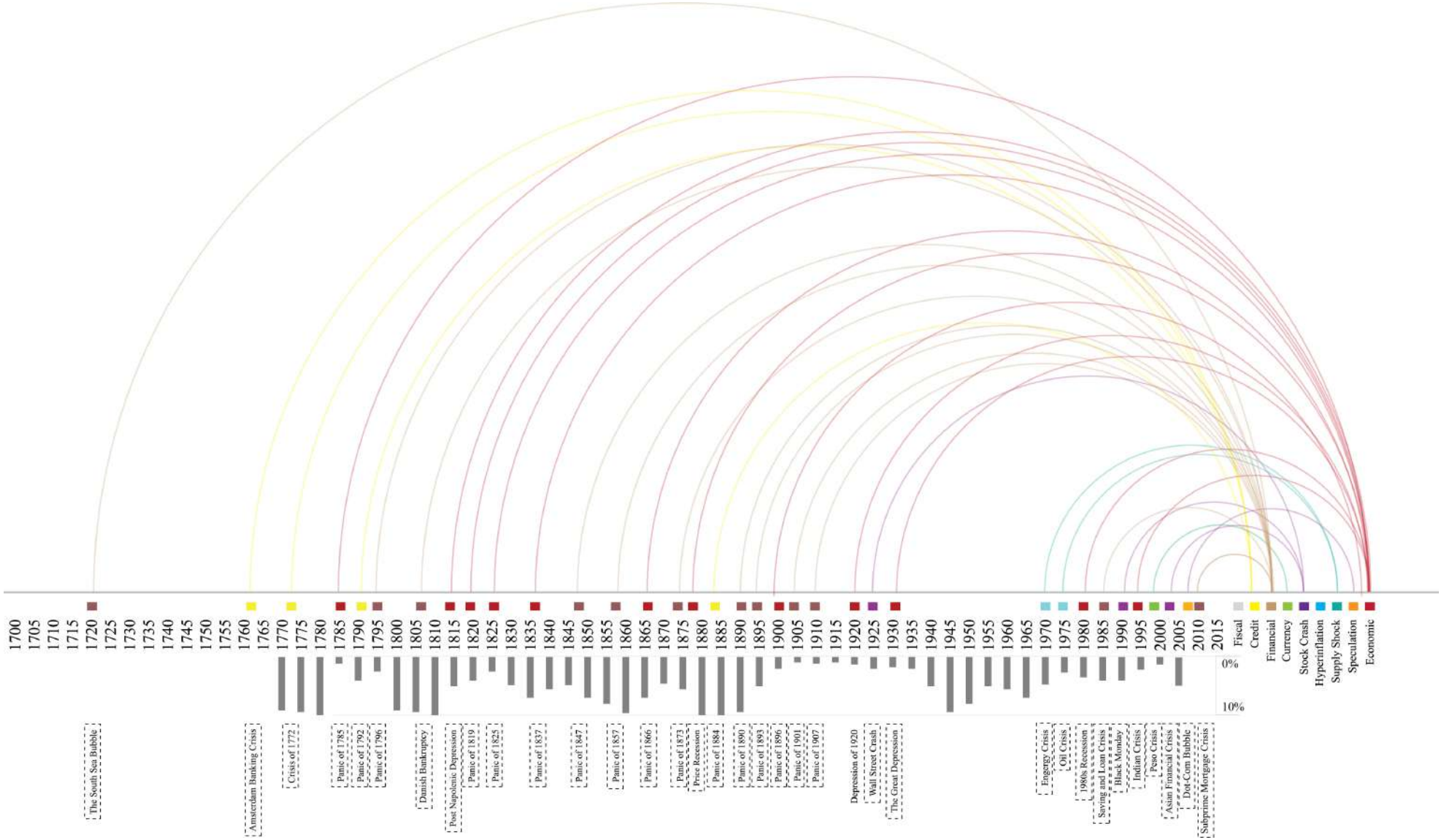
1720

South Sea Bubble

The South Sea Company granted a monoply to trade with South America, took a huge loan from the British Empire. Investors went on a frenzy. Its shareprice skyrocketted despite dismal earning and poor management. The company subsequently collapsed as the bad news leaked out, and badly hurt the British economy.

Panic of 1792

Based on what happened in the past, the financial crises can generally be classified as 9 types: Fiscal | Credit Financial | Currency | Economic | Hyperinflation | Supply Shock | Speculative Bubble | Stock Market Crash



(img/financial_history.jpg)

- **Fiscal:** inability of the government to finance its regular activities
- **Credit:** reduction in the general availability and accessibility of loans
- **Financial:** value of financial institutions or assets suddenly drop
- **Currency:** whether a country's central bank has enough reserves to maintain the country's fixed exchange rate
- **Economic:** country experiences sudden downturn brought on by a financial crisis

◦ **Hyperinflation:** extremely rapid period of inflation, usually caused by fast priThenting of money
◦ **Supply Side Shock:** unexpected event that changes supply of product, resulting in a sudden change in price
◦ **Speculative Bubble:** spike in asset value with a particular industry caused by exaggerated expectations of future growth
◦ **Stock Market Crash:** sudden decline of stock prices across different asset classes in market

It's a human instinct to recognize pattern and detect trend. Throughout the history of modern financial market dated back 17th century, there have been numerous crisis taking place one following another. This diagram maps out the relationship between crisis frequency, type of cause, and change in gross world production. Based on the diagram, we can deduce a few notable trends.

◦ Regional financial crisis caused by sovereign debts, speculative investment, and regulatory loopholes can often be followed by large-scale economic recession that has global effect. Especially during the early stage of modern financial market.
◦ Credit crisis can dramatically increase one nation's gross product
◦ Recent financial have more diverse causes compared to the earlier ones, and are occurring in a more frequent basis.

"What goes up must come down". Despite the fact that our economy has been growing continuously from a broader perspective, there can be hiccups along the way. One main cause is the creation of credit, an integral part of our market and catalyst of economic growth. Therefore, understanding what happened during the credit crisis is the focal point of deciphering all financial crises.

Chapter 3 The Economic Machine

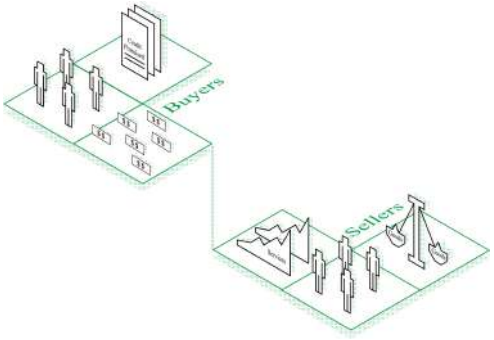
In traditional school of economics, the market is interpreted from two sides; supply and demand. Though it often over-complicates the relation between buyer and seller, and overlooks the market in total quantity of goods being exchanged. Standing in contrast to conventional belief, Ray Dalio, a legendary hedge fund manager explained in his info-video " How the Economy Works" , that the economy is actually a very simple machine that operates logically and predictably. What he promotes in economic theory is more of a "transaction-based" structure rather than supply and demand. He elegantly summarizes his theory in two equation,

$$P = T/Q$$

$$T = M+C$$

(P: Price of any goods, services or financial asset. T: Total amount spent by buyer. Q: Total quantity sold by seller. M: Money in cash. C: Money in Credit)

(img/transactions.jpg)

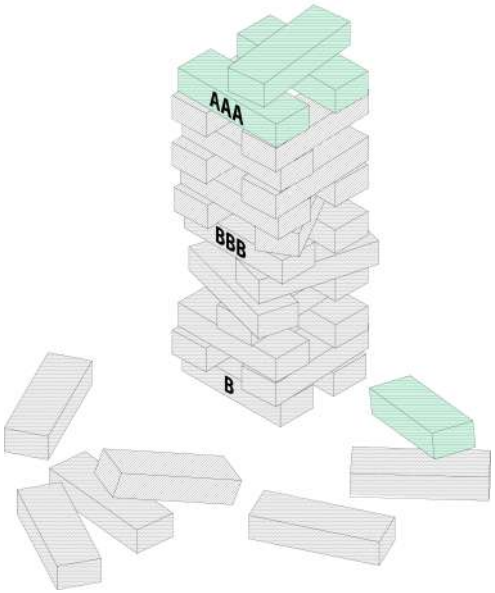


The equation describes a relationship between seller and buyer in terms of money, credit and goods exchanged, is a more practical interpretation of supply and demand side of economics.

In essence, Dalio believes that we should not look at market as one entity but rather a platform for many different buyer sand sellers. There could be many transaction taking place for one product or service. Therefore, credit can be produced out of thin air, such as one buyer is promised credit by one seller for a payment later on. As a result, credit can be incremented to a high level where individual risk of failing to pay can accumulate and agglomerate to a dangerous magnitude.

Chapter 4 The Mortgage Crisis

(img/jenga.jpg)



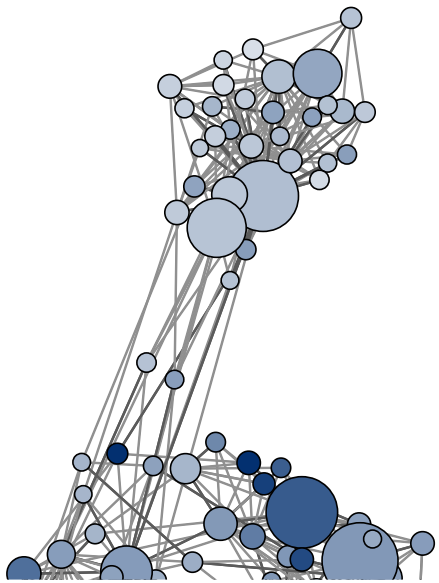
The year of 2000s is an era when investing ideas can spread like epidemics. Fallacy in news and media channel can create hope that transcends the truth. “Housing market will never crash”, “Real Estate is the safest investment”, “ Housing price will always rise”, we may hear these many times in news and media. Though it does not change the fact that these are baseless claims that paint an unrealistic picture of the market. *“The outright ownership of real estate has long been considered as a sound long-term investment, carrying with it a goodly amount of protection against inflation. Unfortunately, real estate values are also subject to wide fluctuations; serious errors can be made in location, price paid, etc;”* Benjamin Graham explained in his all-time classic Intelligent Investor, that even if being a tangible, hard asset as “safe” as a pieces of real estate, it is not risk free.

However, the general public of investors, financial institutions and government regulators have all underestimated the risk of real estate and poured billions into this single class of asset. To accelerate growth and profit, they created products based on real estate for trading. Known as “derivatives”, these are financial products that are backed by the money pooled from real estate. Initially, it was an invention to democratize the real estate market and share profits with the public. Over time however, speculation occurred. What happened after is something similar to this jenga building. Each building block that represents American home mortgages was each graded by the rating agency. So you have the Tripple As and lower Bs. So once the game came down to the players taking out the Bs in the foundation, the entire structure started collapsing.

During the bubble era in early 2000s, more and more financial intermediaries become optimistic about the market and start borrowing and lending more, therefore formed a more interconnected pattern. This co-dependency jeopardized even the largest bank with highest-rated loans. Delinquency spreads epidemically in the next few years. Consequently, the subprime mortgage as we know it caused 2.25 million home foreclosures, 15.2 million loss of jobs, and 1.5 million bankruptcies in just year 2010.
Had there been a more developed and sophisticated real estate market before the crisis, it would plausibly have reduced the severity of the crisis. Because it would've allowed people to mitigate their risk in real estate, which was a highly leverage undiversified asset. However, the system would still collapse if some other type of asset went bad. Therefore, it is crucial to monitor the system with close attention in how the pattern developed and transformed.

click here for full screen (http://localhost:3000/)

Year: 2007 Quarter: Q1



Tranche Details

Lender: Bank of America

Channel: CORRESPONDENT

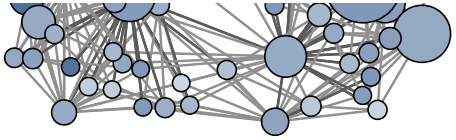
Purpose: OTHER REFINANCE

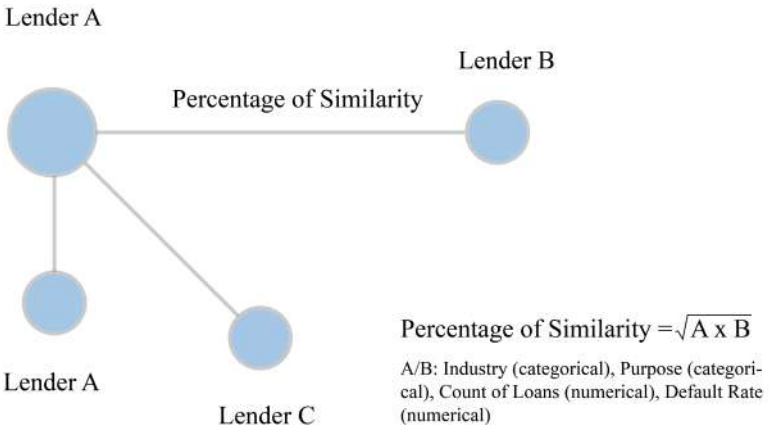
10,897 Loans

14.4% Delinquent

Similar Tranches

Similarity Rate	Critical Path?	Lender	Channel	Purpose	Count of Loans





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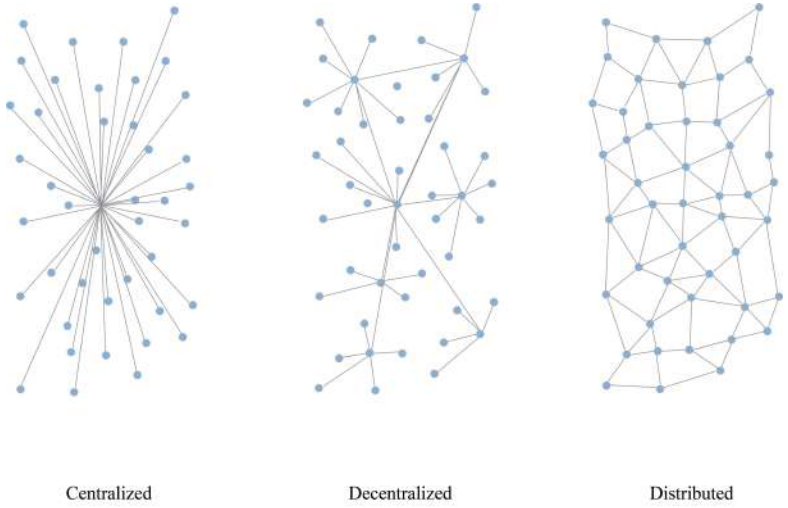
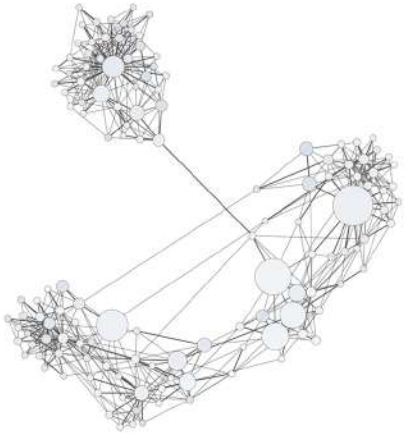


(img/systems.jpg)

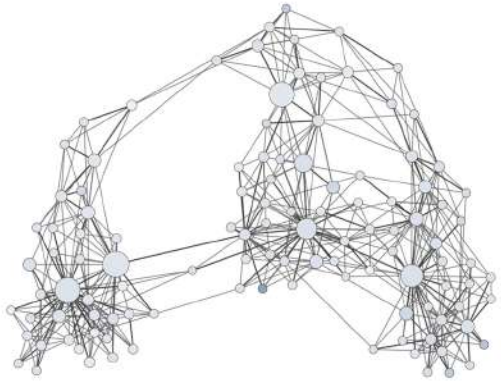
Global financial market today is a dynamic, complex, scale-free system that has unprecedented level of depth, speed of transmission and scale of loss. Therefore, we may use vertices to bind relevant data and represent the system in a more comprehensive way.

Based on the borrowing and lending pattern, we understand that the subprime crisis is essentially a network crisis. Network architecture is a tradeoff between efficiency and robustness or stability. There are three basic network topologies: the centralized network, the decentralized network, and the distributed network, with the centralized system being the most efficient, as there is only one hub, but the most vulnerable in the event that the central hub fails. The widely distributed network, such as the Internet, is much more resilient to viruses and hacker attacks because

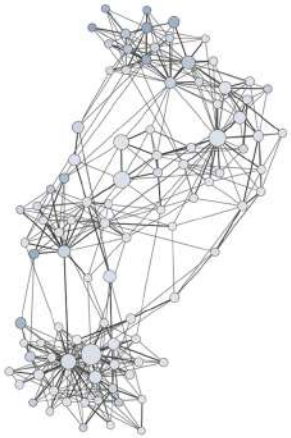
of multiple hubs, where links can be shut down, bypassed, and repaired without damaging the whole system. In the case of lending pattern during the years before and after the crisis, Individual node acts as financial institution that borrows and lends money to each other, owns debt issued from one to another. Each has a delinquent rate based on quality of their debt. In an event of delinquency of a larger financial institution, a distributed network bears the highest risk of contagion, because there are more paths for each node to get to another. Whereas a decentralized system can contain risk within separate cluster, therefore is more risk adverse.



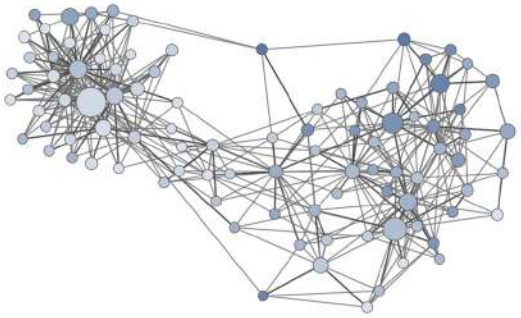
2003



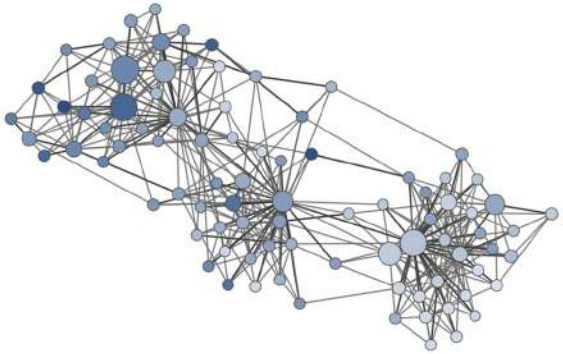
2004



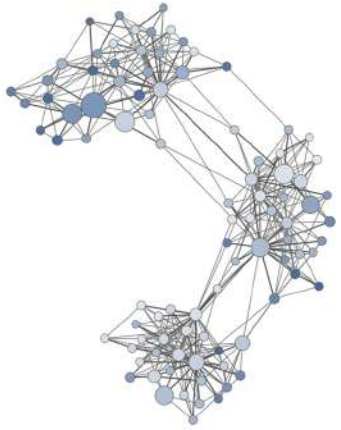
2005



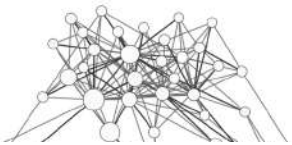
2006

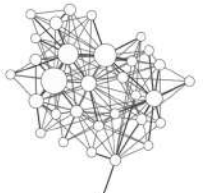


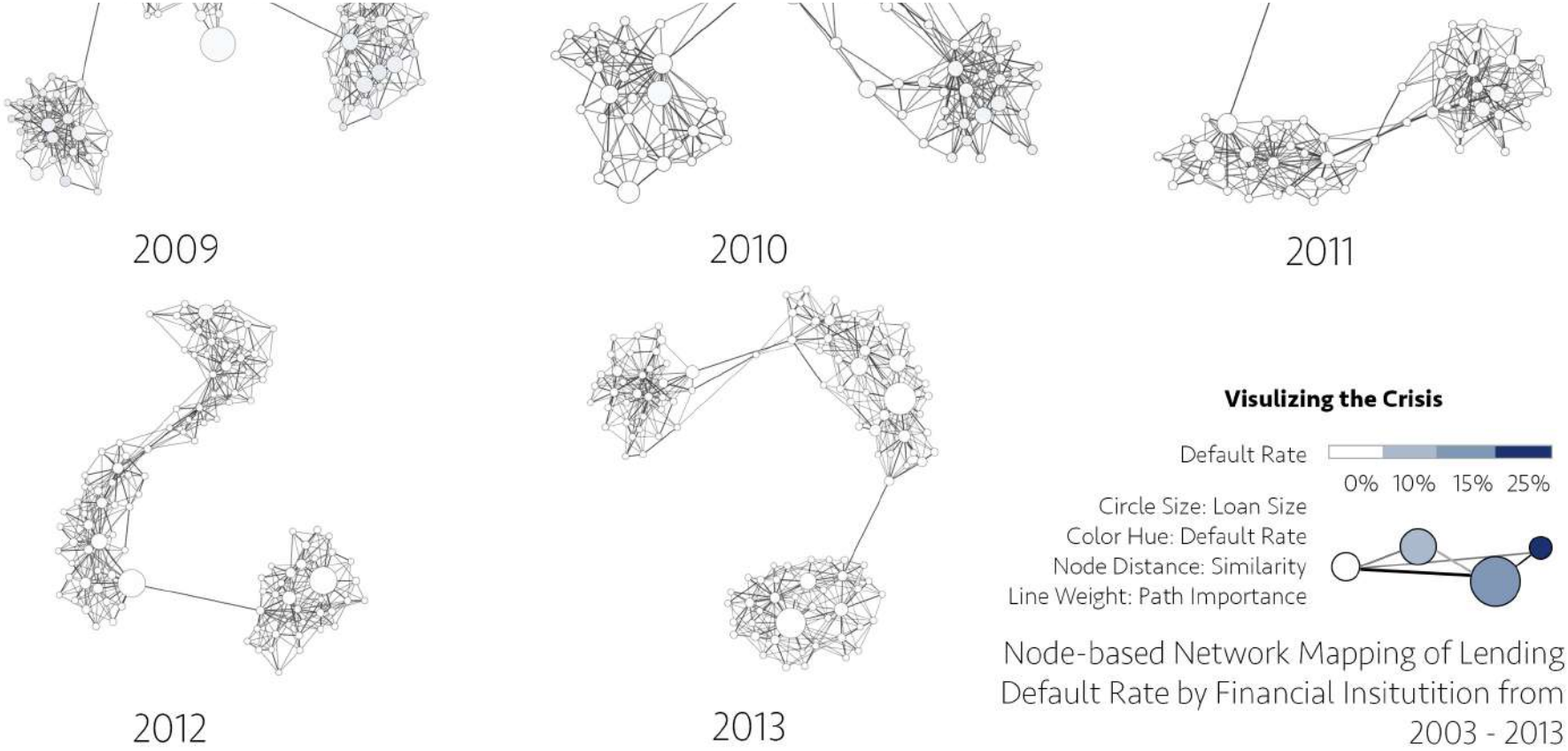
2007



2008







(img/risks_network.jpg)

As a result, the subprime mortgage (bad loans) set off a wave of panic selling of financial assets. The U.S government had to bail out caused 2.25 million home foreclosures, 15.2 million loss of jobs, and 1.5 million bankruptcies in just year 2010. Had there been a more developed and sophisticated real estate market before the crisis, it would plausibly have reduced the severity of the crisis. Because it would've allowed people to mitigate their risk in real estate, which was a highly leverage undiversified asset. However, the system would still collapse if some other type of asset went bad. Therefore, it is crucial to monitor the system with close attention in how the pattern developed and transformed.

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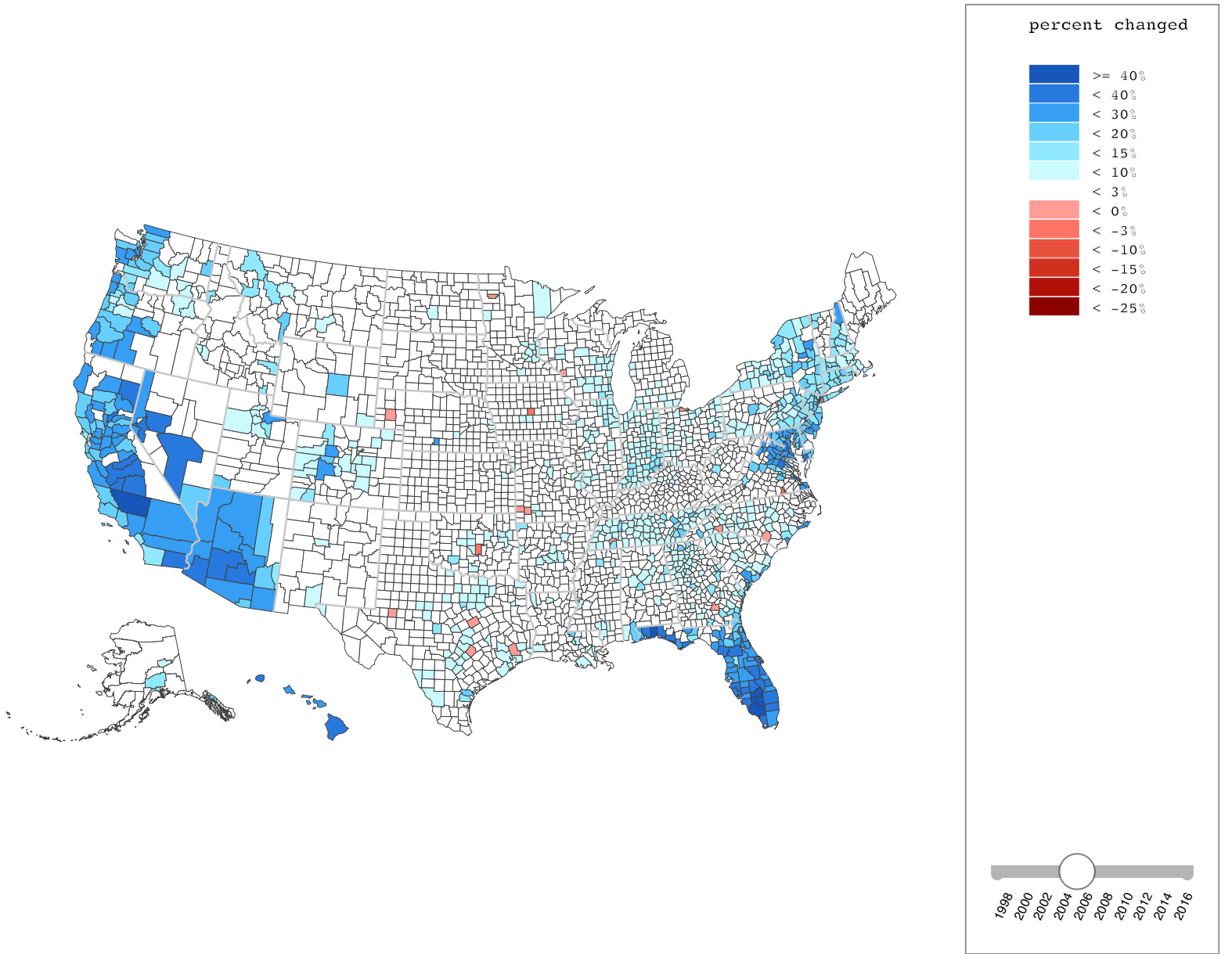
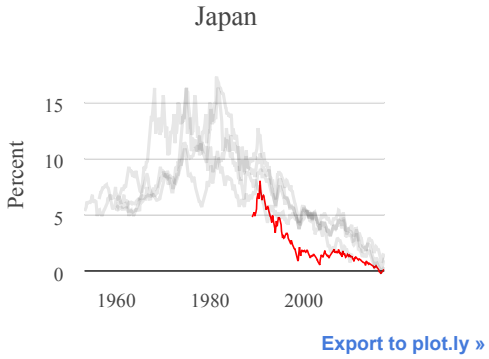
Median Home Price Change in Percentage

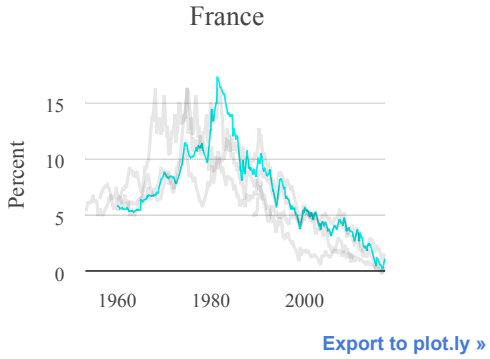
Current years: 2004 to 2005

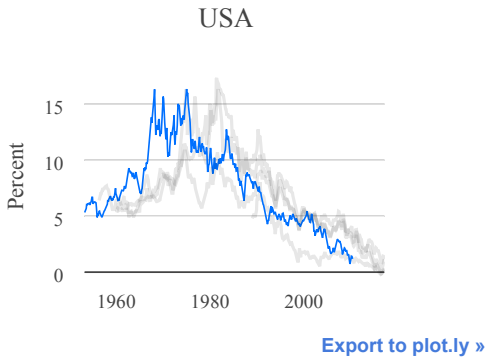


Chapter 5 Future Crisis

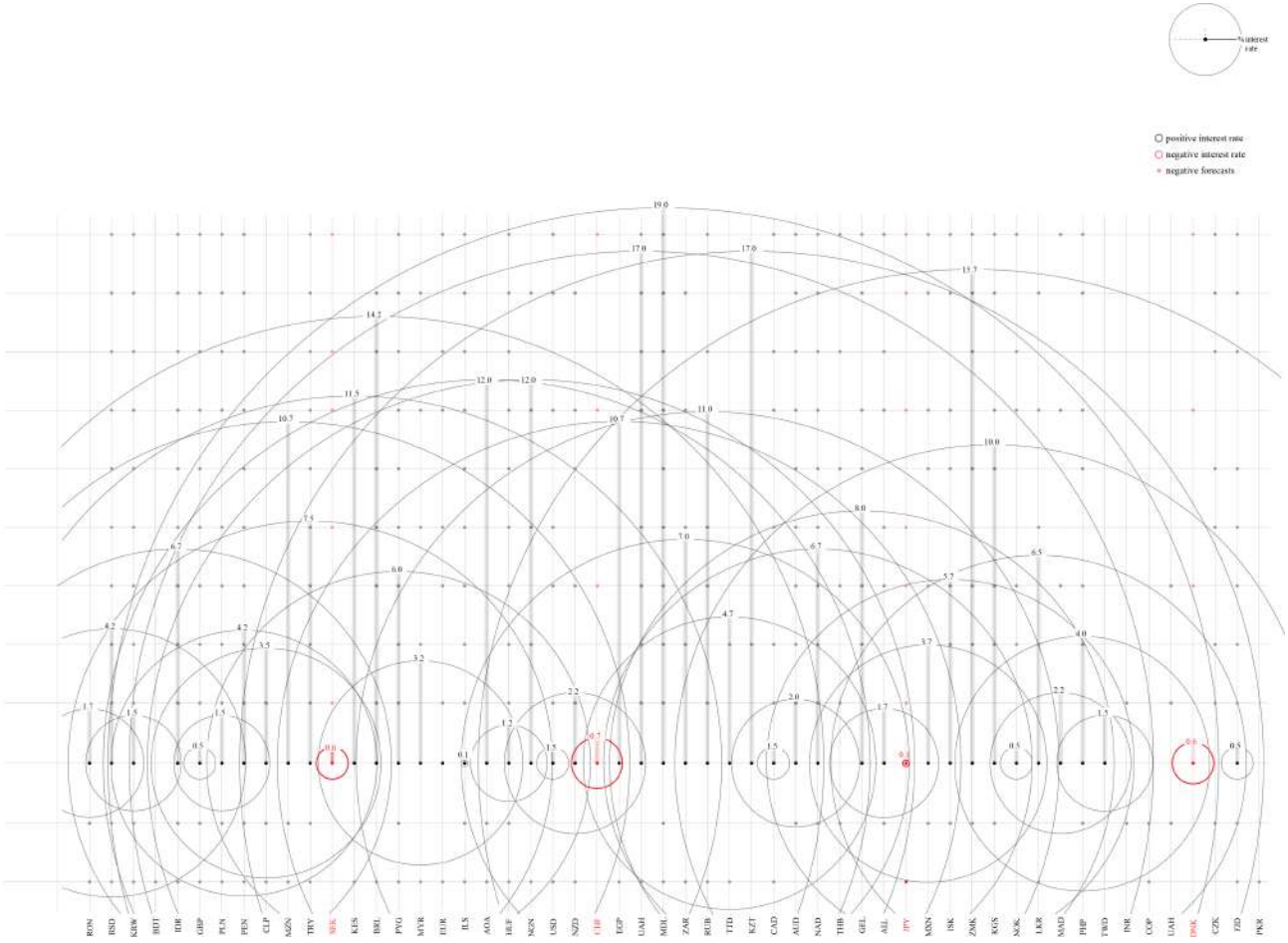
Interest rate has been continuing to decline since the crisis-ridden1980s. In particular, the western economic hemisphere has now seen a historic low interest. Struggling to stimulate demand for goods and services, developed countries such as Japan, France and the US are now playing out of their last hands of monetary policies and macro-economic measures. In response to the 2007 global recession, Sweden pioneered in turning its interest rate to negative to counter the “zero lower bound” problem. Though it is an experimentation that our world has little or no prior knowledge of, many countries have echoed and followed suit.







Low interest rates encouraged growth of the leveraged carry trade and, given disparities in national interest rates and exchange rates, gave rise to large capital flows. Excessive leverage, large capital flows, loose monetary policy, and lax financial regulation is a perfect recipe for a financial crisis. Therefore, it is crucial to monitor the system with close attention in how the lending and borrowing pattern developed and transformed in our global economy so the next crisis will not hit us as hard as the previous one. And through the power of designing a good network system, we can manage risks and reduce the impact of a crisis.



(img/negative_interest_rate.jpg)

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