Covid-19 Risk and business sustainability: A view from economies of contagion

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Abstract
The Covid-19 outbreak is believed to cause a severe 2020 global market crash. This study uses economic contagion from financial theory to identify the systematic process on how the pandemic has impacted the global stock exchange and slowly degrade the economic performance. The study argues that economic contagion theory has failed to explain the current phenomena. One plausible reason is due to the characteristic of the observed phenomena. Most market crash event happened because of the problem within intra-financial system. But the Covid-19 crises happened due to a global pandemic. For this reason, the study uses complexity theory to accommodate a complex adaptive system for each agent in the analysis. The study found that Covid-19 is not the only factor that hit the global market. Massive panics due to insecurity over the health problem caused by the pandemic has enrage the tension which later leads to a massive equity sell-off, thus creating a global market crash. This is the point where pandemic has become major global economic risk with directly affected business sustainability. The study enclosed with discussing the proposed way in details and portraying directions for future agenda.

Keywords: Risk; Covid-19; Sustainability; Contagion; Adaptive system; Market crash

Introduction

In 2013, Robert Peckham publishes a seminal paper on economies of contagion theory. By focusing on how epidemiological models has fundamentally shaped economic and financial thinking, the paper addresses three important issues. First, the importance of analogies and metaphors to develop knowledge of poorly understood phenomena to be logically understood. This is mostly used by news maker, government agencies or even expert in disseminating the phenomena to the society. Unwittingly the previous path might cause a collective panic to the market.

Second, the financial shock which precedes the crises could be seen as virus which can be easily transmitted from one agent to another agent. According to Roubini and Mihm (2010), the transmission process occurs because of risk trade-off among economic agent, and hence developing global pandemic, leaving the helpless agent in the form of emerging economies. Therefore, as the third issues, the paper suppresses on risk as the mutated virus which later may develop a new kind of pandemic.

The previous analyses show that the biological and financial analogies may provide better explanations on how global crises are fully created. The methodology supports Allen and Babus (2009), Bell and Kristol (1981) and Besomi (2011).

However, new question has arose: what if the pandemic and crises happen at almost the same time, is the theory still useful? Can we still analyze the market crash with the same model? The answer is somewhat important to both the policy maker and business owner in order to initiate the crucial steps for economic-recovery reasons.

Our reflection derives from Covid-19 pandemic. The virus that originated from the city of Wuhan, China has now become a global pandemic. The death toll rate is higher among non-China region such as Italy, Iran and The United States. At the end of March 2020, Italy has widely defined as an epicentre of the new outbreak. With the death rate almost 11%, Italy is ten times higher that Germany which is only 1%, or even China[1] leaving Israel as the lowest rate worldwide, at 0.35%.

Southeast Asia has just experiencing the outbreak. Starting from early of February, it takes only two months for the virus to create 10% death rate in Indonesia. This proves that the power of Covid-19 pandemic has caused government to prioritizing health matters, leaving economic matters at the second row. The social distancing policy or even regional lockdown must be pursued to enervate the dispersion of the pandemic.

As it happens in several countries, the policy indirectly forces business sector to shut-down their facilities while concentrate more on the health aspect. However, at almost the same time, the global stock market had crash and a great depression on currencies occur. Some experts as well as news media claims the pandemic as vital triggers but others mention that financial crises happened earlier than the pandemic. The trade war between US and China can be potentially alleged as the original pandemic. Afterwards, Covid-19 has deteriorate the crises.

Former studies highlight the importance of decomposition among the two factors to formulate the most appropriate policy (Kostylenko et al. 2017, Toivanen, 2013, Allen et al. 2009). This is importance to identify which factors effects other in order to select which policy should be firstly implemented.

Generally speaking, financial theory has seen crises as contagion. Most analysis uses contagion to analogizing the systematic impact of crises. Former research performed by Peckham (2013), Besomi (2011), Caballero and Simsek (2009) found that through inter connected financial system. Crises in one country may easily spread out to their networks. Strong trade connection among nation has leads crises to give a negative impact to another nation. However, research on what if financial crisis followed by global pandemic has not been widely explored.

This paper is amongst to use the term contagion for both biological and financial theory. By treating the theory individually and then linked together, the study aims for a short review of the systematic impact between the two. The focus of this paper is to analyze the systematic approach to which Covid-19 has played a vital role in creating turbulence on the financial system by leveraging risk spontaneously. Specifically, it addresses the questions: how, why and when the global financial system had struck by the pandemic? What are the consequences for how risk must be understood, evaluated and communicated?

The study engages with these issues by stressing on twofold areas: the development of financial theory of contagion especially for emerging market and the evolution of theories of 'emerging-diseases'. The paper is designed as follows: section two provides argument on the theory of contagion using two financial theories. Section three provides the argument on the relations between biological and financial contagion. This is the foundation to address the importance of risk consideration - which is created by Covid-19, on post pandemic event to enhance global sustainability.

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[1] Henriques, M. (2020). Coronaviruses: Why death and mortality rates differ. BBC. Downloaded from https://www.bbc.com/future/article/20200401-coronavirus-why-death-and-mortality-rates-differ, on April 16th

Models of contagion

The words of contagion in financial theory is actually taken from epidemiology. It is used to explain the spillover of volatility and the diffusion of distress through an intra-financial system which is depend on its complexity (Caballero and Simsek, 2009). And the complexity itself is depending on the interconnectedness between one agent and other agent in the industry. The higher the levels of dependency between two companies, the higher the level of complexity of the relationships.

Referring to figure 1, consider in one contextual economy there are two significant players namely A and B. Player A has three important resources, labeled with A1, A2 and A3. Resource A3 is actually fully financed by contribution margin from A2. In other hand, A1 is a self-finance product.

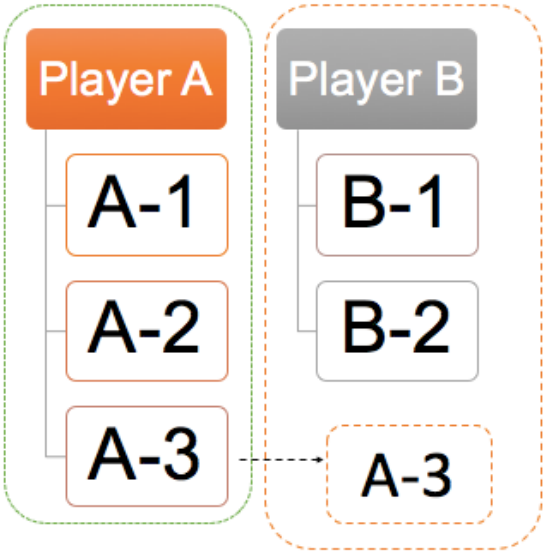

Figure 1. Basic illustration of contagion model

Meanwhile player B has only two important resources namely B1 and B2. In order to perform at the normal level, B needs 70% from A3. To player A, this context is benefited to them since they already have a regular customer. In terms of account receivable, player A will be able to minimize the probability of uncertainty using the current contract with B. They only have to sell the rest 30% to other players.

Up to that point, unconsciously player A has created a higher level of dependency to player B for both terms: targeted income and risk. In moderate scenario when B is fully able to create sales and therefore has the ability to pay to A, then both parties may experience a win-win solution.

Now imagine the worst scenario in which B is no longer able to create sales. They will loosen the ability to fill their financial obligation to A for the product of A3. As the A3 is fully financed by A2, then it would be difficult for player A even to maintain the operational of A2.

The lack of cash inflow has made A to create a short-term financing from Bank Y. This is done to retain the daily operation of A2 and A3, thus player A still can support B. Now as the economic reality is worst, player B has to shot down their factory facilities for couple of months and asked for rescheduling to player A. At this point of view, A is totally messing up with internal working capital. In one side of the coin, they lose some targeted income from B.

Notwithstanding, player A will be found it difficult to pay their short-term loan to the Bank, asking for similar permission to reschedule their debt payment.

The contagious virus from B (as refers to figure 2) has now spread out not only to player A, but also to the Bank. Considering that player B is also dependable to another player which become the customer of the same Bank, then the pandemic took place. Contagion from player B has successfully leads the overall economy to crises. Now as the Bank also a member of closed global circuit financial system, therefore the pandemic will create an outbreak to another financial system. This is because one closed circuit in global financial system is actually a member of global network. They work closely through intra-financial system to maintain the global stability.

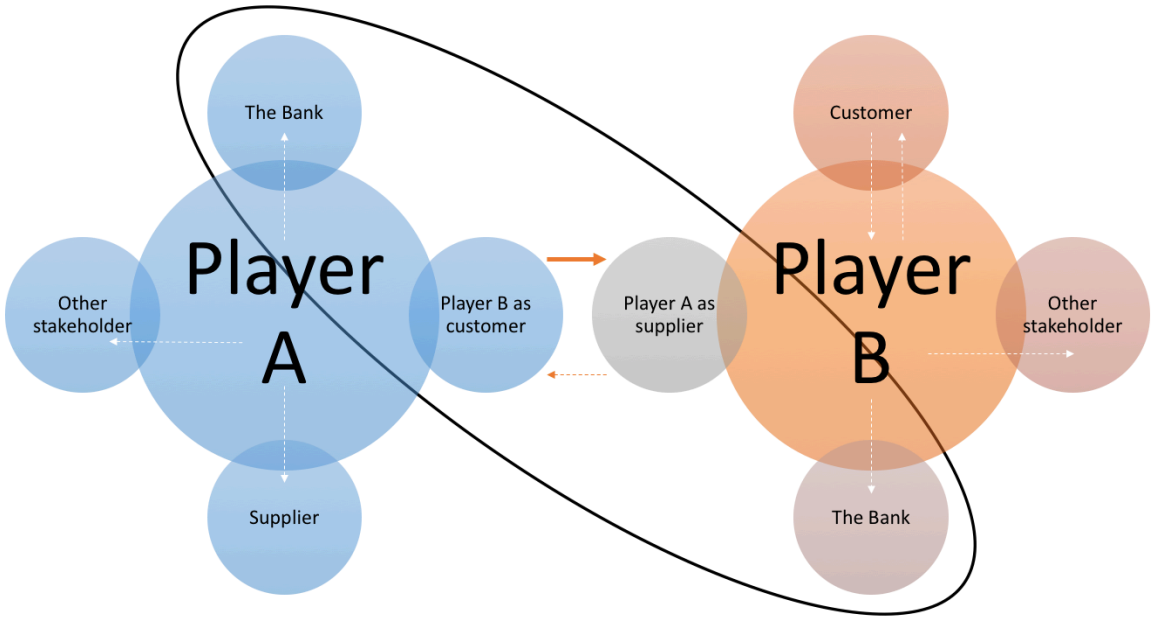

Figure 2. The complexities of contagion model

In financial theory, the virus usually denotes to a financial distress in one company which mostly act as intermediaries. Taken in the example is the case of Enron in 2001 which is happen in the United States and it takes at least 7 years to affect US market stock (2008) and another 4 years to hit China's financial system (2011) (Arbogast, 2013). But now, what if the virus is actually originated from its nature of epidemiology, say Covid-19? Would the model remain the same?

Method

The study uses exploratory research method. Conceptually exploratory research is defined as a method used to investigate a problem which is not clearly defined. The method is conducted to have better understanding of the existing problem. The study began with a general idea, followed by problem identification. We study series of secondary data such as newspaper, economic magazines, research, books, regulation from the government which related to Covid-19 and market crash.

We carefully analyze 9 research report related to Covid-19 especially from epidemiological and economic perspective. Furthermore 13 crises-related research reports are analyzed to identify the chance in implementing the economic contagion theory. In addition, 9 articles from the newspaper are also used to provide some data to this study. After all data has been

analyzed, the next step is to compile each fact in order to support the argument in the paper as well as proposing the two propositions for future studies.

Revisiting theory of financial contagion

The inability from theory of financial contagion to explain the case of real biological pandemic is because of its lenses of analysis. The theory only focuses on using the epidemiological terms to dismantle the cause of the crisis without trying to put the real pandemic into considerations. According to Summer (2013), addressing financial contagion theory in analyzing the real crises phenomena cannot be done solely. One analysis tool needs to be inserted, namely complexity analysis.

The basic premise of complexity theory that is plausibly complement financial contagion theory is by justifying each agent and phenomena as a complex adaptive system. One might say that intra-financial system is not the only complex adaptive system which cause crises, but also the pandemic itself. Covid-19 must be seen as complex adaptive system for both the way the virus created the outbreak and how it is also supported by the complexity behavior of human.

As we put the concepts from Pearce and Merletti (2006), the pandemic itself is a complex self-organizing system that has the ability to perform an evolutionary mechanism. The unique thing about the current Covid-19 pandemic is that the virus cannot solely create the outbreak. It takes the role of human adaptive behavior to transfer the virus from one community to another social system (Gralinski and Menachery, 2020).

Referring to Choe (2001), citizen mobilisation from one region to another is not happen digitally, but also physically. This is the origin from complex adaptive system. During the first global pandemic around 1920, known as the Spanish flu, the pandemic is spread out through physical contact. This is the reason why the pandemic only happens in several regions (i.e. European countries and some part of US). This is different from SARS (severe acute respiratory syndrome) and MERS (middle-east respiratory syndrome) which is signal for a new form of pandemic.

The mobilization of human is unstoppable through trading and travelling. As we take a closer look to the pandemic, the Wuhan municipal health commission reported the first case on 31st December 2019[2]. Therefore, the local government decided to lock the entire region begin with Wuhan and followed by several cities in Hubei's province. Due to the rapid outbreak, the policy is then being implemented to another province and soon to another country.

At almost the same time, the phenomena of US and China trade war has not come to an end. The war has escalated since July 2018. This is where the US government put almost 34 billion USD to China's product which is in return, China also use the same tariffs for US product. Within only two months later, the tariffs climbed heavily to 200 billion USD followed by 120 billion USD from China in two rounds of response (September 2018 and June 2019)[3]. To some scholar, this is the external factors that leads to a market crash (Gong, et al. 2020, Huynh et al. 2019, Yao et al. 2019, Zhang et al. 2019).

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[2] Wuhan municipal health and health commission's briefing on the current pneumonia epidemic situation in our city. Available online: http://wjw.wuhan.gov.cn/front/web/showDetail/2019123108989 (accesses on 16 April 2020)

[3] BBC News. A quick guide to the US-China trade war. Available online: https://www.bbc.com/news/business-45899310 (accesses on 16 April 2020)

The significant fluctuation along the periods of 2018 to 2019 has dominated the global stock market, including in the United States. In 2018, the US market lowered 20% due to the trade war[4]. However, approaching the end of 2019, the US stock market shows an optimistic bull-trend. Sectors related to high-tech giant such as Apple and Google, as well as communications and financial sectors has succeeded in creating at least 29.2% increase in return (NASDAQ, 2020). From this point we can see that the market response focuses on the local economy (specifically the US).

Entering the year of 2020, right after the decision to lockdown the city of Wuhan. All market lenses are focusing on the outbreak of coronaviruses. Starting from the second week of January 2020, the market shock had just started. Almost all indexes are red, signaling the greatest downturn since the financial crisis on 2008 (see table 1).

Table 1. The US market indices

US indices	**YTD (As of 2-29)**	**February**	**January**	**2019**
Dow Jones	-11.0%	-10.1%	-1.0%	22.3%
S&P 400	-12.1%	-9.6%	-2.7%	24.1%
Russell 2000	-11.5%	-8.5%	-3.3%	23.7%
S&P 500	-8.6%	-8.4%	-0.2%	28.9%
Russell 3000	-8.6%	-8.4%	-0.2%	28.5%
Russell Microcap	-11.3%	-6.9%	-4.7%	21.0%
Nasdaq 100	-3.1%	-5.9%	3.0%	38.0%

Source: Author's compilation

Using the terminology from economic of contagion, it can be seen clearly that the shock began on January 2020. The series of shock is worst on January 27th when one of the local TV channels investigate the first person-to-person spread of virus in the United States[5]. Soon after the issuance of travel warning, the 2020 stock market crash began on March 9. The Dow Jones fell 7.79% on one day, following on another fell down on March 12 to 9.99%, and March 16 at 12.93%, bringing the greatest crash since the October 1929 black Monday[6].

Most of the analyst believes that the market crash is due to Covid-19 global pandemic (Baldwin and Mauro, 2020; Jones, 2020, McKibbin and Fernando, 2020, Nuno, 2020, Ramelli and Wagner, 2020). The reason is because China which is the epicentre of the pandemic has played an important role in terms of global supply chain. Furthermore, the G-7 economies (US, China, Japan, Germany, Britain, France and Italy) account for 60% of the world supply and demand, 65% of world manufacturing and 41% of world manufacturing exports. As China itself accounts for 17% of global supply and demand, 11% of world trade, 9% of global tourism and over 40% of global demand for some basic commodities (Boone, 2020).

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[4] The NASDAQ market intelligent desk team. Available online: https://www.nasdaq.com/articles/2019-review-and-outlook-2020-01-07 (accessess on 17 April 2020)

[5] Elwood, P., & Crews, J. (2020). Chicago women infects husband with coronavirus, US issues travel warning. Available online: https://wgntv.com/news/chicago-woman-infects-husband-with-coronavirus-first-human-to-human-spread-in-us/ (Access on 17 April 2020)

[6] The Balance. (2020). How does the 2020 stock market crash compare with others? Available online: https://www.thebalance.com/fundamentals-of-the-2020-market-crash-4799950 (Access online on 17 April 2020)

At that point, the shock has turn into contagious viruses. On March 13, the Singapore stock market experiencing a drop as much as 6.3%, the lowest since 2009 financial crises[7]. It takes another 2 weeks for the virus to hit Indonesia stock market. On March 27, the trading hours must be shortened due to series of downfall to more than 10%, leaving the market indices down to 3,989. At the same time, The Philippines dropped 30.9%, Japan market tumbled 21% and Australia declined 24.5%[8]. This how the contagion has created the global outbreak.

If we compare the 2020 market crash with the rest of contagion which happened around 1990 to early 2008, there is a significant different. During the Asian financial crises in 1997, the contagion happened because of the closed circuit of intra-financial system. And it has nothing to do with global health-pandemic. The rise of credit default risk among several big financial institution has led the contagion to spread to another system which later create global economic crises. For 2020 cases, the financial pandemic is triggered by market panic as the Covid-19 death toll rate surpasses the expectation rate.

At this point we can see that there are two contagious factors. First is due to unfinished 2008 crises and 2018 trade war between US and China. Second is related to Covid-19 which create a global health issue and sustainability. This is the reason why stock market panic played important roles in Covid-19 pandemic which later cause significant decline in currency rate, and followed by potential default credit risk from banking sector.

Although the process happened in a short term – less than one month, but all response activities including massive stock-sell or US Dollar panic buying are the way in which every market is trying to be quickly-adaptive to the current economic turbulences, thus reflecting the existence of complexity theory. With this argument, the study proposed the first and second proposition as follows:

Proposition 1: Global health pandemic has the power to leads the market into massive panic sell-off which later leads to a financial crisis.

Proposition 2: The massive panic equity sell-off is actually representing a complex adaptive system from the market who is trying to maintain their wealth at their targeted level.

The pivotal roles of risk

Rethinking the economic contagion theory plausibly has two important reflections. First is due to investor responses to economic turbulences. For most cases, investors are trying to maintain their wealth in every scenario (Peckham, 2013) including when they are facing a global pandemic. It consists of both logical and non-logical decision. If we put SARS or MERS pandemic in this context, Seetoh et al. (2016) found that the stock market shows a slow response to the issue. During the pandemic, investor seems to perform reaction with logical decision which proofed the absent of market panic behavior. Moreover, Elbe (2011) explained that as long as the pandemic fail to show the biggest concern in global health system then there is no reason to put insecurity in the context of analysis.

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[7] Jenner, A. (2020). Singapore shares hit 10-year low over Covid-19 fears. CAN Business. Available online at: https://www.channelnewsasia.com/news/business/singapore-shares-sgx-stocks-10-year-low-covid-19-coronavirus-12534932

[8] Rahman, R. (2020). First time in history: shorter trading hours for Indonesian stock amid Covid-19. The Jakarta post. Available online at: https://www.thejakartapost.com/news/2020/03/27/first-time-in-history-shorter-trading-hours-for-indonesian-stocks-amid-covid-19.html (Access on 17 April 2020)

The previous explanation reminds us to the pivotal roles of risk. Using Elbe's term of insecurity, although SARS and MERS are having higher death rate but Covid-19 is more powerful in terms of creating outbreaks. Only less than two weeks, the virus has developed massively outside China, including in Iran, Unites States and Italy. Investors are worrying about the safety of the society. This is reflected in ways the panic stock-sale happen throughout the worlds. Although the event happened in seconds but we can see that the triggers is coming from the investor individually which later institute a short-term market panic. By the time the market indices fell off then the government took action to protect the market from badly injured.

The response to the current risk done by the government has a huge impact to intra-financial system which played mostly by the banking sector. The Fed has cut its target for the federal funds rate to near 0 (0.25%)[9] aiming at lowering the cost of borrowing on mortgages, auto loans, home equity loans and other loans. But indirectly, it will also reduce the interest income that savers may get. That is why some believes that Covid-19 has the possibility to create not only market crash but also economic crises within months (Becker et al. 2020, Sharif et al. 2020).

Reshaping business sustainability: post pandemic

Dealing with the two-giant risk – Covid-19 pandemic and potentials of economic crises are very complex. Relating to McKibbin and Fernando (2020) and McKibbin and Wilcoxen (2013), although the economic recovery must be done parallel with dealing with pandemic, but solving Covid-19 must still become the first priority.

Using the aggregate equity market and dividend futures to quantify investor's expectation, Gormsen and Koijen (2020) found that for April-June 2020, the expected growth rate will plausibly decline as much as 2.5% in the US and 3.5% in Europe. Meanwhile there are signs of catching up growth from year 4 to year 10. This is shows that the probability of economic crises during post Covid-19 pandemic might exists.

Using the case of avian flu pandemic on early 2000, the key to rebuild global economy is by strengthening market perception in order to develop a strong optimism about the future economy (Bloom et al. 2005). The government must able to lift-up the insecurity of the society relating to the current pandemic. Transformation in a health care system and health insurance mechanism as well as the acceleration in research and development policy which related to immune body system are amongst the top priority to increase public trust, thus minimizing massive panic.

Considering that the 2020 will ended up with recession, therefore over the short run, debt rescheduling must be done effectively. Through a proper schedule, economic player may have enough time to deal with internal restructuring which resulting on the faster cash inflow. This mechanism will lead to a better liquidity, the fundamental aspect of better solvency and profitability power.

On the macro level, the policy to deal with pandemic needs a good collaboration in terms of prevention strategy, medical science, medical tools, pandemic data, surveillance program, supply chain, and pharmaceutical network. Regional cooperation agency such as European Union or Association of Southeast Asian Nation might become a good initiator for this policy. With this initiative, pandemic will be seen as global agenda in which contribution of each

[9] Meraw, S. (2020). What's the Fed doing in response to the Covid-19 crisis? What more could it do? Available online at: https://www.brookings.edu/research/fed-response-to-covid19/ (Access on 17 April 2020)

country could minimize the overall risk (i.e. the economic crises), thus prolonging business sustainability. This argument leads us to the third proposition.

Proposition 3: The key to rebuild the global economies after pandemic, the government needs to strengthening market perception in order to develop a strong optimism about the future economy.

Conclusion

This paper succeeds in using the theory of economic contagion to describe details on how Covid-19 is related to the development of 2020 market crash. Using complexity theory as supporting concept to economic contagion, it is clearly seen that complex adaptive system among society (i.e. economic player) had triggers high risk in the system. Furthermore, the raise of insecure among investor has led the market into panic-sell in which most investor choose to convert their financial asset into cash. This is signaling the existence of logical and irrational decision among market players. In fact, this is the mechanism which later develop a contagion from one circuit to another financial system.

The paper argues that Covid-19 is not solely affect the market. Our analysis posits that before the pandemic, the current market has not fully recovered from 2008 financial crises and 2018 US-China trade war. Therefore, when the pandemic hits the market, it plays as complementary power to demolish the market.

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