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Covid-19, Chaos theory and the "drop of honey effect". Viruses and human behavior

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Abstract:

The paper applies the "drop of honey effect" to the Covid-19 disease's spread and to the timing for acting. The timing and level of the adopted measures are considered crucial in terms of the virus spread and of the health consequences for populations. The study allows to conclude that a small difference in the adoption of the most proper measures in the initial moment, as much as the measures' level, may make all the difference in the consequences of the disease and in its pandemic effects, what is valid not only for the first moment after the disease appearance in China but also after its arrival to each country. The "drop of honey effect" is perfect to explain the way how this coronavirus spread all over the world after its detection in humans and to explain its effects. The consequences on the public health were devastating, with thousands of deaths. Also the social, economic and financial implications around the world were enormous, particularly with many stock exchanges declining severely as coronavirus spread.

Keywords: Covid-19, Drop of Honey Effect, Chaos Theory, Human Behavior.

JEL Classification: I10, C00

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1. Introduction

Infections and epidemics destabilized Humanity along the course of human existence. The diseases associated to them often changed the course of History. Nowadays science allows to understand the evolution of the viruses spread, to identify the origin place and the causes or probable focuses of dissemination. In the past, it was not always possible, in rigor, to do that, by identifying the very particular point of origin. Anyway, viruses have an initial point/place from which they spread. It is crucial first to identify epidemics' causes and then try to get the ways for their control.

A new coronavirus (that would be later named *Severe Acute Respiratory Syndrome Coronavirus 2* - SARS-CoV-2) and its much infectious sickness (later called Covid-19) appeared in Wuhan (the capital city of the Chinese Hubei province) by the end of 2019 and spread all over the world.

The Covid-19 was declared by the World Health Organization as a global pandemic (WHO Director-General's opening remarks at the media briefing on Covid-19 - 11 March 2020), having consequently a huge global impact. This novel coronavirus has been causing a severe crisis for the world's societies, economies and markets.

Travels and trade accelerated very significantly in the past two decades, having for example the airline passenger traffic more than doubled, what has been contributing enormously for the fast dissemination of the disease all over the world.

The history of Covid-19, although very short, allows to understand the way how the virus SARS-CoV-2 spread from Wuhan, China to the rest of the world. Initially the virus was circulating in Wuhan, the capital of the Hubei Chinese province. Then, it spread to the rest of China and then to the rest of the world. Over 300,000 infected people were already confirmed all over the world by March 23, 2020 (around 100,000 cases in 4 days), according to the WHO. "It took 67 days from the first reported of Covid-19 to reach 100,000 cases, 11 days for the second 100,000, and just four days for the third 100,000" as reported by BBC (BBC News March 23, 2020).

The "drop of honey effect" represents very well the way the virus spread around the world, being now present in the generality of the world's countries. The consequences on the public health were devastating. Also, there were enormous economic and financial implications around the world, with some important world's stock exchanges declining around 30% in approximately one month, particularly as soon as markets realized about the evolution of the disease and its strong economic impact. Covid-19 abruptly interrupted a more than a decade of bull market and shot the markets for the muddle.

First, countries considered that alarmism could be a problem. After the disease largely installed, the panic generalized and hard measures were taken.

The paper, that is intended to fit more like a note, is developed as follows: first the "drop of honey effect" tale is summarized, showing the importance of controlling the situation and of well managing causes and effects. Follows the "drop of honey effect" metaphor and then the Covid-19 disease spread, including its modelling. In the fifth section a brief note on governments' policies and the social, economic and financial impacts of the disease in the short term are presented. Some considerations on central banks' intervention follow. Finally, a discussion and some final considerations end the present paper.

2. The Tale

The tale was presented in previous works (see for example Ferreira et al, 2014). The way events spread is interesting and the effects are obvious. The tale shows clearly the phenomenon and that's why we present and summarize it in the present paper. The similarities to the present situation of Covid-19 are evident.

The tale is summarized as follows:

In a splendid palace that overlooked the market place of the city, the king and his minister were enjoying their situation, looking over their prosperous city. While the king was eating some puffed rice on honey, a little drop of honey dripped from his puffed rice onto the window ledge. The minister was about to call a servant to wipe up the honey, when the king waved a hand to stop him. “Don’t bother, it’s only a little drop of honey, it’s not our problem”.

The drop of honey slowly trickled down the window ledge and landed on the street below. After a fly landed on the honey, a nearby lizard caught the fly, that was taken by surprise when a cat leapt on it. The cat was pounced by a dog.

The minister was about to call a servant to go and deal with the brawling cat and dog when the king said, “Relax, the cat and dog belong to the market people. We shouldn’t interfere. It’s not our problem”.

After seeing the cat being attacked by the dog, the cat’s owner started whacking the dog. The dog’s owner attacked then the cat. Friends were involved in the fight.

The worried minister turned to the King but his only comment was, “Not our problem. Here, have some more puffed rice and honey”. The king and his minister ate as they watched the fray below.

Police came, but people were so angry, each side convinced that they were right (right about what, they couldn’t remember) that started attacking the policemen. The fight rapidly broke out into a full-scale riot.

The king eyed the minister and said, “I know what you are thinking, but the army will handle it. Besides, this is not our problem”.

The riot swiftly escalated into a civil war with looting and destruction all over the city. Buildings were set alight and by nightfall, the magnificent city was reduced to a pile of smoking ashes. The king and his minister stood spellbound rooted to the spot where they had been watching all day. Their mouths were hanging open in horror.

“Oh…” said the king quietly, “maybe the little drop of honey WAS our problem.”

(freely adapted from the tale of Hovhannes Tumanyan).

3. The “drop of honey effect” metaphor

The “drop of honey effect” metaphor is recent as approach in the chaos theory field. After its introduction, the concept was applied to represent social and humanities phenomena - see for example, Ferreira and Filipe (2012), Filipe and Ferreira (2013, 2014), Ferreira, Filipe, Coelho and Pedro (2014), Ferreira and Filipe (2017), Filipe (2020).

For instance, in Filipe and Ferreira (2013), several situations in the political and war area are explained through the “drop of honey effect”. In this work, some examples are presented for illustrating this effect, like the Iranian revolution, the predictions made on the post-Castro environment in Cuba, Adolf Hitler in Germany, September 2001 in USA, Alexander in the Persian Empire, the arrival of Attila to Europe, the arrival of gunpowder in Europe.

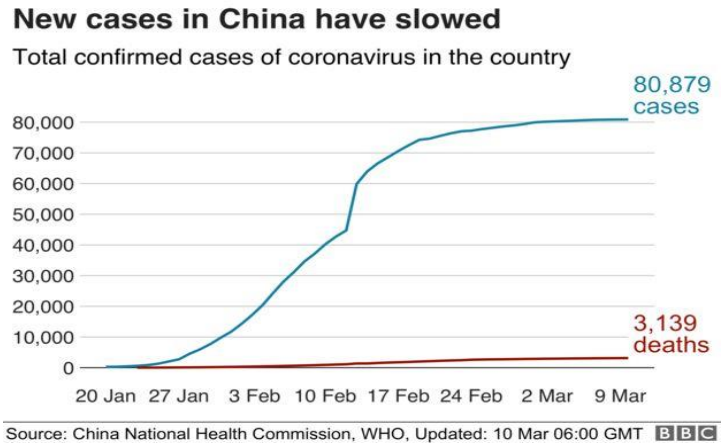
The introduction of the notion of chaos - derived from the chaos theory and developed in mathematical and physics sciences - into the socio-political phenomena study brought a new capacity for understanding the dynamic evolution of the non-linear systems in this area (Plaza I Font and Régis, 2006). The “butterfly effect” has been the preferred and elected metaphor in this field for academic, and also for a much wider public (Plaza i Font, 2014). This “butterfly wing effect is due to the mathematically well-known effect of chaos” (Grabinski, 2008). However, for approaching the political science in the chaos theory context, the “drop of honey effect” applications work as an interesting metaphor proposal for the explanation of these phenomena (Plaza i Font, 2014). Other studies (see, for example, the recent paper by Grabinski and Klinkova, 2020, in which the Covid-19 spread is studied) recognized that such chaos effects may work more like “the ‘drop of honey effect’ as defined in Filipe & Ferreira, 2013 […] in contrast to chaos effects like in the weather forecast” (Grabinski and Klinkova, 2020).

4. The Covid-19 Disease Spread

In this section, we intend to show the development and diffusion of the Covid-19 disease, since the moment the coronavirus appeared, in a way that allows to understand how the "drop of honey effect" suits well for the explanation of the virus dissemination. Our objective in the present section is basically to make a bit of history, fit it in the Tumanyan's tale and frame it within the chaos theory.

This virus, a new coronavirus, appeared in China by the end of 2019. By March 10, 2020, China had more than 80,000 confirmed cases and more than 3,000 deaths (see figure 1).

Figure 1 In BBC News March 10, 2020.



After the identification of the virus in China, authorities admonished and reprimanded officially Dr. Li Wenliang for warning about the coronavirus outbreak who would die from the disease, although the later recognition of the error by the ruling Communist Party, that generally prefigures no challenges to its authority.

Chinese authorities tried to control the spread of the virus but due to its virulence features, it was then necessary to recognize the importance of the disease in terms of the enlargement of the territory affected and its spread to other regions.

Epidemiologists say that China's massive late response was an evident error. In the very first weeks of the outburst in December, 2019 and January, 2020, Wuhan authorities reported in a very slowly way these mysterious infection's cases, delaying the main actions and procedures to contain the virus spread. One of the many voices heard, was the one of Howard Markel (a public health researcher at the University of Michigan), who reported the delay of China to act as having been probably the responsible factor for this world event (see the Dawson, March 17, 2020 press article). In fact, only in the mid-January the first visible actions were taken.

The referred press article reports that "models from other researchers show [that] if the country had taken steps to contain the virus one week earlier, it could've prevented 67% of all cases, according to Nature. If the Chinese government had acted three weeks prior, at the beginning of January, they found it would've slashed the number of cases to 5% of the total".

The disease spread to other countries. By March 20, 2020 some European countries (Italy, Germany and Spain) were the ones with more reported confirmed infections' cases (BBC News (The Visual and Data Journalism Team) March 23, 2020).

In the following weeks after the first reported cases in Europe, health authorities in general took minimalist measures for controlling the virus spread. As people in general did not assume also the severity of the disease, it spread to more and more places. It was time for no alarmism – governments were assuming.

As the spread of the virus began to reach many countries and the number of infected people and deaths began to increase significantly, hard measures began to be taken in numerous countries and

the problem began then to be assumed very seriously, first as epidemic and then as pandemic considered (Filipe, 2020).

The exponential curves showed the need for significant measures to be adopted; and an enormous control for the disease dissemination was also needed.

It is crucial to note that the time for taking hard measures is key for the disease control and for the growth rate of the disease spread. This means that a simple fact caused a disrupted growth of the disease. The opportune recognition of the disease and the necessary number and level of measures undertaken timely in the very beginning would have made a huge difference. About the exact alternative´s developments we don´t know. But we know that there would have been a big difference if the warning of Dr. Li had been heard and the first significant measures would have been adopted previously to the mid-January. A small difference in the initial conditions would have had a very huge different effect in the final results. It is the “drop of honey effect” working. It is the chaos theory showing the importance of acting timely in this kind of situations.

Human behavior is essential for controlling the virus’ speed of dissemination.

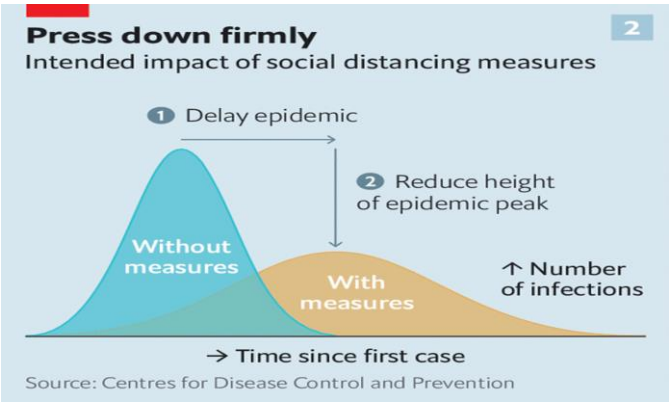
As measures such as household lockdown are seen as critical in order to lower the infection rate, in many countries authorities have been appealing for people staying home. It is also assumed that the capacity of hospitals is limited and a responsible individual behavior (and consequently the one of the population as a whole) retards the peak of the disease and makes the representative curve much less narrow and high (the situation for which all cases happen in a short period of time), to become represented by a wider and lower curve (where cases happen within a larger period of time) – see Grabinski and Klinkova (2020). This allows to avoid peaks in hospitals and help hospitals to respond more suitably, once health resources are limited.

A study by Clara-Rahola (2020) modelled the virus spread dynamics in China, South Korea and the early stages in Italy and Spain (the paper was published at April 1, 2020), showing that the spread of Covid-19 displays the characteristic virus diffusion contagion dynamics for the different countries. This spread is marked by exponential infection rates in free spread. The characteristic exponential growth rate slows down when confinement and necessary healthcare measures are implemented. The author proposes a curve (the author labels it as Wuhan Quality Curve, or Wuhan Q-Curve) for displaying a Covid-19 daily infection curve and for representing a mastercurve in all Covid-19 outbreaks. It is also assumed that the incubation period for Covid-19 is of 2-14 days.

By considering the studied cases, the author refers that, although the particular case of South Korea where proper protocols were implemented at early Covid-19’s outbreak, in those countries a crossover point between fast and slow daily growth infection rates was found one week after the lockdown, which in turn, is considered the average Covid-19’s incubation period (“the lockdown crossover”). Here, new infections are reduced due to the confinement, but latent infections develop as well in this period until, due to the confinement, a lockdown critical point of infections be reached. This means that after that crossover point (i.e. “the lockdown crossover”), and following the slow growth rate, infections reach a maximum after which the infection rate starts to decrease. Such point takes place about 15 days after lockdown, the upper limit of Covid-19’s incubation period. It is here that daily diagnosed Covid-19 cases start to reduce, with a possible peak point due to infections in locked households. The author states that, although such peak is a singularity due to the lockdown, the diagnosed infections keep decreasing exponentially.

Grabinski and Klinkova (2020) show the importance of not representing certain situations by averages, because that often creates simplifications. These simplifications may induce errors in the analyses and in the resulting measures taken by authorities. As stated by these authors, they can lead to results extremely different from the exact solution in at least some applications when non-linear differential equations are used.

Figure 2 Development of desease (The Economist, 2020)



Source: Grabinski and Klinkova (2020)

For epidemic situations, considering the speed of the virus spread, several types of equations can be used (see for example Keeling and Rohani, 2008).

In the context of the Covid-19 disease spread, Grabinski and Klinkova (2020) use a model for this spread. In the model, a population $n(t)$ will grow proportionally to n:

$$\dot{n}(t) = \frac{1}{\tau} \cdot n(t) \tag{1}$$

As Equation (1) will lead to unlimited growth, the constant τ is the speed. A small τ will lead to rapid growth, a big one to slow growth. In the case of the spread of diseases, τ can be estimated by a reproduction number. And different values for τ for different parts of the population can be assumed. For the case of Covid-19, experts estimate that about two thirds of the population will get infected eventually without vaccination. In this context, these authors assume a limit for Equation (1) considering the logistic equation:

$$\dot{n}(t) = \frac{1}{\tau} \cdot n(t) \cdot \big(1 - n(t)\big) \tag{2}$$

which is not untypical for growth limitations. When $n(t)$ approaches its maximum 1, growth becomes slower and slower. The solution of Equation (2) can be given in a closed form:

$$n(t) = \frac{n_0 \cdot \mathrm{e}^{t/\tau}}{1 - (1 - n_0) \cdot \mathrm{e}^{t/\tau}} \tag{3}$$

By calculating the derivative with respect to time of Equation (3), the authors study the specific curves for the way the infection spread in the societies according to their populations' particular behaviors. They note that the bad behavior of one half cannot be compensated by the very good behavior of the other half of a society's population, in order to reach the goal of spreading cases of a disease over a long period. The authors also register that the very broad majority of people must take the appropriate measures for becoming effective measures.

It is also worth mentioning that the τ in Equation (2) can be a function of time which, of course, modifies the solution in Equation (3). τ can also change discontinuously when, e.g. a curfew has been introduced. Because of the exponential behavior, introducing a chance in τ slightly earlier or later may also lead to a very big change. And the change in τ is identical to the above discussed "drop of honey effect". Simulations and quantification of the effects and outbreak growth rates can be observed in Grabinski and Klinkova (2020).

The free spread period prior to measures being implemented, and the characteristics of the lockdown and measures undertaken are primary parameters that establish the overall infection dynamics as is the population behavior in the outbreak process.

As previously seen, the Clara-Rahola (2020) model is also used for the Covid-19 disease's spread. In this study, there are two scenarios (below, for illustration, we will adopt the China's case): in this model, there is an "early infection regime" (where τ_1 is used - fast exponential growth) and a "late infection regime", post lockdown (where τ_2 is used – slower growth), as will be seen. The evolution of the infection in time is considered first without measures and later with measures, as the lockdown. The proposed approach by Clara-Rahola (2020) resolves quantitatively the outbreak in different key periods and in terms of the expected number of diagnosed individuals in each period.

Without the lockdown, the increasing rate of infected individuals is expected to be significantly larger than the one with the lockdown.

There is a set of factors that can influence τ_1, such as climate, lifestyle, culture, alimentation or being in large or small cities or towns, which slightly vary the magnitude of the fast spread rate, and thus the characteristic growth rate τ_1. The slower growth rate, τ_2, is strikingly similar in cases in which measures have been adopted, being confinement a paramount parameter (Clara-Rahola, 2020).

Clara-Rahola (2020) uses data that displays the typical spread exponential trend, found in uncontrolled infection scenarios. It is given by the following functional form:

$$M(t) = M_0 \exp[(t - t_0) \,/\, \tau] \tag{4}$$

M(t) is the number of infected individuals at time t, being M_0 the initial number of infected individuals, t_0 the initial infection time, and τ the infection growth time rate. In order to properly perform the analysis, the logarithm transformation of equation (4) is considered, which yields:

$$\ln[M(t)] = \ln[M_0] + (t - t_0) \,/\, \tau \tag{5}$$

The initial number of infected individuals is considered to be 1. Thus:

$$\ln[M(t)] = (t - t_0) \,/\, \tau \tag{6}$$

According to Clara-Rahola (2020), in China for the initial regime there was an infection rate time of τ_1=2.2 days, while for the one belonging to large times τ_2 = 6.4 days. Also, at the early infection regime, t_{01} = 11.7 days, while for the late one, t_{02} = 17.1 days. The subindexes 1 and 2 respectively correspond to the early and late regimes. The aim is clear: to distance Covid-19 transmitters from the healthy population, and thus there will be a gradual decrease in the number of infected individuals.

Also in the Clara-Rahola (2020) model, we can use τ to represent the "drop of honey effect". The exponential effect is much different from τ_1 to τ_2 and the difference in the effects in the disease spread is highly significant, what represents a huge difference between the situations of non-implemented measures and implemented measures and the importance of the moment they are adopted.

5. A Note on Governments' Policies and on the Social, Economic and Financial Impacts of the Disease in the Short Term

After the Chinese authorities made the virus known to the world, they implemented an aggressive policy to control the virus epidemic, particularly a very effective lockdown in an operative tentative of controlling the Covid-19 disease spread.

In mid-January, Chinese authorities announced unparalleled procedures to contain the disease, stopping movement in and out of Wuhan, the focus of the epidemic, and then on 15 other cities in the Hubei province. Under a strong and effective process of controlling behaviors, Chinese authorities made that more than 60 million people stayed at home in an extreme lockdown public health policy's measure. Given the Chinese regime, this routine was very effective. It told people for staying confined to their homes in many Chinese cities, in certain circumstances, going out only for getting food or medical help. Subsequently, more than 760 million people, approximately half the country's population, were made to stay at home (Zhong and Mozur, February 20, 2020). Flights and trains were

suspended; roads were blocked. They reported that "China has flooded cities and villages with battalions of neighborhood busybodies, uniformed volunteers and Communist Party representatives to carry out one of the biggest social control campaigns in history" and still that "despite China's arsenal of high-tech surveillance tools, the controls are mainly enforced by hundreds of thousands of workers and volunteers, who check residents' temperature, log their movements, oversee quarantines and - most important - keep away outsiders who might carry the virus". This way the epidemic was controlled in China. But the dissemination continued around the world, in a sequence of effects that made the most recent generations in the modern developed world to live an unprecedented crisis with social, economic and financial tremendous costs. In fact, the social, economic and financial impact was an obvious consequence as the economy stood "paralyzed".

As Covid-19 spread around the world, many countries with accelerating occurrences followed this kind of measures and began to adopt them for bringing the health crisis under control, announcing lockdowns, limiting movements within their borders, restricting strongly international visitors. However, in some countries and in some situations sometimes people don't comply with certain recommendations or rules, like "staying at home" for example, although they know the risks for them and for others, often devaluating these risks. For Krstić (2015) there is no reason a priori to believe that all social phenomena can ultimately be explained as the product of deliberative or intentional efforts of individuals to maximize their utility.

Reacting to the strong economic and financial crisis installed around the globe, governments and central banks took unprecedented measures for supporting their economies. Governments showed very particularly concerned about the companies' maintenance and the jobs' safeguarding. Fiscal tools and financial support/monetary stimulus may mitigate the drastic reduction of the economic activity in the short term, counteracting the disruption caused by the coronavirus spread.

Alpert (March 24, 2020) presents an exhaustive list of some countries or regions measures to stimulate their economies (United States, Australia, China (Hong Kong), China (Mainland), South Korea, United Kingdom, European Central Bank, Germany, France, Italy, Japan, Canada, Multi-country or International).

6. Central Banks' Intervention

From the learnings of the past financial crisis, the banking system worked in the last decade for becoming much more strengthened. The Basel III standards made the resilience of the banking system much stronger. The global banking system increased significantly the levels of capital and liquidity, being now much more prepared to absorb shocks and to soften interruptions on banking services. Anyway, the monetary policy may not be powerful enough once the existing tools, when deployed, may have their impact capacity limited.

The Basel Committee on Banking Supervision held a conference call on March 20, 2020 to discuss the impact of the rapid worldwide spread of the new Covid-19 coronavirus disease on the global banking system (Basel Committee on Banking Supervision Press Release, March 20, 2020). This Committee reports to the Group of Central Bank Governors and Heads of Supervision. Although it is the primary global standard setter for the prudential regulation of banks and provides a forum for cooperation on banking supervisory matters, its deliberations do not have legal force. The Committee reported that the spread of Covid-19 reached a critical stage with an increasingly significant impact on the economic activity. It recommended that banks and supervisors have to remain vigilant in light of the evolving nature of Covid-19 to ensure that the global banking system remains financially and operationally resilient. The Committee is actively coordinating with the Financial Stability Board and other standard setting bodies on cross-cutting financial system issues and considers to propose additional measures to support the financial resilience of banks.

As the Covid-19 crisis is disrupting the world economy, central banks have been announcing massive measures to support the economy. According to this Committee's Press Release, "member jurisdictions are pursuing a range of regulatory and supervisory measures to alleviate the financial

stability impact of Covid-19. These measures target the provision of lending by banks to the real economy and facilitate banks' ability to absorb losses in an orderly manner”. The Committee reports that it supports the objectives of these measures and notes that members have flexibility to undertake further measures if needed (Basel Committee on Banking Supervision Press Release, March 20, 2020).

The capital and liquidity buffers included in the Basel III framework are designed to be used in periods of stress. Countercyclical capital buffer and supportive injection of capital to support the real economy and to meet liquidity demands are considered crucial in these moments of crisis.

For reference, central banks cut rates to face the severe crisis for supporting companies and populations (see Figure 3). In USA, “the US Federal Reserve virtually erased what was left of its benchmark interest rate in a desperate bid to spare the world’s biggest economy from a deep, coronavirus-induced recession” (Letzing, March 19, 2020). It is interesting to refer the cases of the European Central Bank and the Bank of Japan, which had already cut rates into negative territory before the pandemic, what represents an “extreme measure” that can (at least theoretically) lead to paying a bank to hold the money. This shows that there is a set of tools with no much room to be operated. This is the case of some central banks that have no more some of their operative tools available.

Figure 3

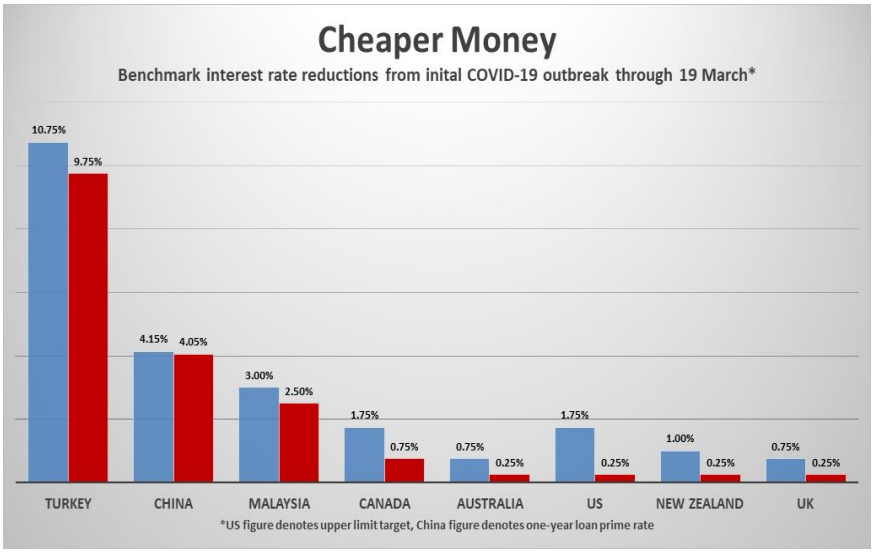


Image: World Economic Forum
Source: Letzing (March 19, 2020).

A set of tools are being used by central banks. Several of them used their emergency quantitative easing debt-buying programs, strengthening bond prices and containing interest rates. Only as examples, the European Central Bank, with no much room to use interest rates’ tool, revealed a new package of €750 billion bond-buying program in response to COVID-19 on 18 March; and US announced a $700 billion program on a day when the number of confirmed cases reached 3,000 (Letzing, March 19, 2020).

The strong impacts on national and on the global GDPs are an evident consequence of the lockdown in the world’s economy. Unemployment rates have been abruptly increasing worldwide in many economies, as many sectors business levels and the inherent production reduced significantly (some of the most affected sectors are the tourism sector - catering, hospitality; aviation; fuel companies, for example). Due to the Covid-19 outbreak, the economy as a whole has been strongly impacted in general, which effects are observed in the short term, many resting for the medium term and even many companies will suffer a strong impact in the long term and other go to the bankruptcy.

7. Discussion and Final Considerations

The paper presents an overview of the origin and the evolution of the ongoing spread of the virus SARS-CoV-2 and its sickness Covid-19. This situation is related with the concept "drop of honey effect", as an illustrative metaphor for explaining the diffusion and the chain reaction of events, eventually leading to a disastrous scenario.

This document reports the importance of taking well-timed measures. As referred, the very initial moment when the disease could be controlled was crucial for the spreading of the Covid-19 disease. As the due measures where not taken or were taken lately, the infection spread and became first epidemic and then pandemic, reaching all the world in several weeks with hundreds of thousands of infected people and thousands of deaths. Only after the pandemic, will be possible to have a very complete study. The recent approaches to Covid-19 by Grabinski and Klinkova (2020) and Clara-Rahola (2020) are examples of the Covid-19 spread modelling and give room to show how this pandemic disease can be illustrated by the "drop of honey effect".

As there is not yet a Covid-19 effective treatment nor a vaccine at the moment, the confinement/household lockdown, a great care and health measures are the only practices shown effective to stop the spread of Covid-19.

The Dawson (March 17, 2020) press article, cited above, shows the importance of acting timely: "models […] show [that] if the country [China] had taken steps to contain the virus one week earlier, it could've prevented 67% of all cases […]. If the Chinese government had acted three weeks prior, at the beginning of January, […] it would've slashed the number of cases to 5% of the total".

It was "our" problem, should have realized the Chinese authorities in due time. The "honey dropped" and the "war" happened, this time against this invisible enemy.

There is neither possibility nor capacity of knowing each place where the coronavirus is "hidden". There is yet no way to detect it and it is not possible to know if anyone is infected until the symptoms get visible and tests are made. There is also no capacity of foreseen the possible replicas and new possible rounds, and there is no possibility of knowing the possible modifications of the virus meanwhile.

A macroeconomics context is also given and shows that the outcome of 2008's Great Recession made the financial system get more strengthened and resilient to deal with the current crisis and the impact of Covid-19 in finance and economy.

This may be a long war but a small difference in the initial decision makers' actions/behaviors on the virus possible control in the very first moment could have made all the difference in the public health, in the economies and in the world finance.

The "drop of honey effect" represents suitably the way this phenomenon developed.

It would be interesting to analyze the factors that influence the people's behavior, individually or in group, along the process of the virus spread as much as the way the markets work based on expectations some weeks after the disease appearance and as soon as they include this situation in the models, often by incorporating the lower prices and by anticipating new stages for the economic and financial developments. This is left for posterior works.

Acknowledgement

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