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Financial bubbles and the COVID-19 pandemic

Supervisor
Ch. Prof. Caterina Cruciani

Graduand
Giorgia Carraro
Matriculation Number 857171

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Introduction

The COVID-19 pandemic has been dominating the news for the past two years and a half, affecting not only people's health, but also many other aspects of their lives. From lockdowns, to online meetings, to stockpiling of food and toilet paper, to social distancing, everyday life underwent very significant changes. In the same way also the economic sphere suffered from the emergence of the pandemic: while the financial sector only recorded a very sharp contraction within the first month of the emergency but swiftly recovered, many non-financial sectors suffered heavy losses and setbacks.

Thus, the aim of this thesis is to provide an economic interpretation of the events that occurred since the outbreak of the coronavirus emergency and of the current happenings. Through a very wide approach the analysis is presented taking into consideration economic bubbles and their consequences, financial crises, state interventions in response to the emergencies and supply chains and the production sector. The analysis of financial markets is quite limited, however they are still taken into consideration since nowadays they are profoundly interlinked with the other parts of the economy.

It is true that the pandemic is still ongoing, mostly from a systemic perspective, however it is already possible to draw some of the lessons learnt from this crisis and advance some speculative inferences on what to expect from the future.

The thesis is divided in four chapters. Chapter I entails a theoretical introduction on stock valuation and the formation of bubbles. A comparison is provided between the traditional view on stock valuation, based on the Efficient Market Hypothesis vis-a-vis the behavioural theory supporting the lack of perfect rationality and thus the presence of overvalued stocks in the market which might lead to the formation of a bubble. Subsequently, a definition of the term "bubble" is given, together with a description of the main characteristics that it features: the classification, the stages of its evolution, and the consequences that a burst can provoke. An analysis of the main behavioural biases that lead to the formation of a bubble is presented, including overconfidence and representativeness, and finally a series of models for rational and irrational bubbles are introduced. Among these models it is possible to find the heterogeneous beliefs model, the feedback trading model, the biased-self attribution model and the representativeness-heuristics and conservatism bias model.

Chapter II presents a collection of the most important bubbles that emerged throughout history, including the Tulipmania, the Mississippi Bubble, the South Sea Bubble, the Great Bull Market of 1929, the Dot-com Bubble and finally the subprime-mortgage bubble, examining the main events that defined them and which led to the eventual burst. The description of each historical event is followed by an analysis on whether it could actually be classified as a bubble and the causes of the rise in stock prices and their subsequent crash. Scholars have diverging opinions on whether all of these events, except from the Dot-com bubble, were actually bubbles since they tend to assign different definitions to the term. Finally, a comparison between the impact of the Great Depression of 1929 and the Great Recession of 2008, two of the largest and most recent crises that arose as a consequence of the burst of the bubble, will be presented.

Chapter III describes the institutional responses adopted in response to the crises that emerged after the burst of the bubble for three selected events: the stock market crash of 1929, the Global Financial Crisis of 2008-2009 and the COVID-19 recession. These events were specifically selected for the common features they share. Each description will focus on the main measures implemented by public authorities in the U.S. and the EU, comparing similarities and differences and analysing the eventual spill over effect that emerged. Subsequently, a comparison between the measures adopted across the different crises will be presented: as it will be argued more recent policies seem to be an evolution of the past ones with measures improved thanks to the lessons learnt from past experiences. In particular, policy responses in the past were slow and in some cases not large enough to support a prompt recovery and this often led to additional contractions and setbacks.

Chapter IV presents some examples of disruption in supply chains to show the impact it had on the economy and "second stage" responses to the COVID-19 emergency with a particular focus on the Italian National Recovery and Resilience Plan. As it will be discussed, one of the main themes of this recovery programme is the implementation of measures against the repetition of this disruption by acquiring more independence from importing technology and by strengthening R&D in innovative sectors.

Chapter I: The theory behind financial bubbles

In the present chapter a review of the theoretical principles behind the valuation of a stock will be provided, in particular comparing the traditional view promoting the Efficient Market Hypothesis with the behavioural argument supporting the lack of perfect rationality. While the traditional approach asserts that capital markets work in a perfectly rational way and thus stock prices always reflect their fundamental value, the behavioural reasoning states that overvaluation and undervaluation of stocks are present in the market and they often lead to the formation of bubbles. An analysis of the main factors contributing to the creation of bubbles will follow, focusing especially on overconfidence and representativeness. This section is followed by a presentation of the main characteristics of a bubble and the five stages we can identify in a bubble scenario. The final section analyses several rational and behavioural models that have been proposed to justify the existence of bubbles.

1.1. Classic theory of valuation versus overvaluation in bubbles

Capital markets are essential in order for an economy to develop and function properly and it is only when they work efficiently that resources are allocated in the best way possible. The classical financial theory rests on the assumption that all individuals are rational in order to obtain an efficient, well-functioning market.

We can identify three classes of efficiency that can be found in capital markets: informational efficiency which entails a close link between the information available in the market and the prices of securities, allocative efficiency which requires the optimal allocation of resources so that funds are distributed to the most productive activities, and finally operational efficiency which consists in providing services or goods in the most cost-effective way while simultaneously granting high-quality (Hamdi and Mousavi, 2014, p. 868).

The valuation of an asset represents the process by which the theoretical value of a stock or a firm is computed. The classical theory supports the Efficient Market Hypothesis to determine the stock valuation. According to the Efficient Market Hypothesis the price of an asset reflects all the information available on the stock such that the marginal benefit

of acting on that information does not exceed the marginal cost of acquiring it (Ackert and Deaves, 2009, p. 29).

Bodie, Kane and Wells (2014) describe the three different versions of the Efficient Market Hypothesis originally defined by Fama (1970): the weak form, the semi-strong form and the strong form. The weak form states that stock prices already reflect all information related to market trading data like past prices, trading volume and short interest. The semi-strong form asserts that all publicly available information, including balance sheet and other information related to the prospect of a firm, must be reflected in the stock price. The strong form states that all information, either publicly available or only available to insiders, are reflected in stock prices. This is clearly the most extreme version of the hypothesis.

This theory therefore implies that the price of an asset is determined by its fundamental value: if we consider the present value model of stock prices, the price of a security corresponds to the present value of its expected future dividends. Equation 1.1 shows the formula for the valuation of a stock with zero growth:

$$P_0 = \frac{Div_1}{R} \tag{1.1}$$

Where Div_1 is the expected dividend per share and R represents the firm's cost of equity capital.

Equation 1.2 on the other hand represents the stock valuation with constant growth:

$$P_0 = \frac{Div_1}{R - g} \tag{1.2}$$

Where g represents the constant growth rate in perpetuity that is expected for dividends. The Efficient Market Hypothesis only holds if one of three statements is true: either all individuals are rational, or if there are irrational agents their actions are not correlated and therefore when they trade their operations cancel each other out without having an impact on stock prices, or if their actions are correlated the intervention of arbitrageurs prevents them from affecting prices. As a consequence, in an efficient market there are no overvalued or undervalued assets, as investors react immediately to new information available on assets, thus adjusting their prices. Moreover, since the price of a security is

equal to its fundamental value, the price should move only in reaction to some news about the asset's value.

In reality, however, the empirical evidence suggests that individuals are not perfectly rational as the Efficient Market Hypothesis assumes and that consequently the valuation of securities may likewise be performed with some degree of irrationality.

Bubbles represent a deviation of the price of an asset from its fundamental value, usually caused by an exogenous shock that generates a favourable outlook for the future and the promise of positive earnings. Supporters of the efficient market hypothesis therefore believe that bubbles cannot exist and that individuals should simply invest in a low-cost passive portfolio.

1.2. Definition and characteristics of a bubble.

The term "bubble" is used to describe a situation in which there is a rapid surge of value of an asset which seems to be "generated more by traders' enthusiasm than by economic fundamentals". A bubble can only be defined ex post once it has burst and the prices have dropped (Ackert and Deaves, 2009, p. 244).

Hindsight bias usually arises after the crash, with investors and analysts looking back for signals that might have warned them about the existence of a bubble. This bias leads them to believe that they could have predicted the outcome beforehand and it generates a feeling of regret for not having recognized the signs and acted in time.

Bubbles therefore imply the presence of a mispriced asset which is usually overvalued and whose price keeps increasing. The asset price might suddenly drop quickly and cause a bubble burst or it might deflate gradually.

According to Jordà, Schularick, and Taylor (2015) bubbles can be classified in two ways: the first categorization concerns the type of asset and accordingly we can have either equity bubbles or housing bubbles. Secondly we can categorize bubbles depending on whether they are financed through debt or not. As a consequence, four types of bubbles can be distinguished: equity bubbles not financed through debt, equity bubbles supported by debt, housing bubbles with average credit growth and leveraged housing bubbles. Kindleberger and Aliber (2005) report the five stages of a bubble cycle identified by Minsky's credit cycle:

I. Displacement: this stage entails an exogenous shock at the macroeconomic level which generates positive expectations on at least one specific sector of the economy, thus encouraging individuals to increase their investments in assets related to that category. The surge of investments would accelerate economic growth creating even more enthusiasm about the economic situation.
II. Boom: following the first stage, prices start increasing and gain momentum by attracting more investors: the more investors enter the market the quicker the prices rise, detaching themselves from their fundamental values. Growth of credit and fear of missing out also play a role in attracting traders.
III. Euphoria develops at this point: a lot of traders buy assets expecting gains from future increases in prices. More and more individuals want to take part in the speculation after witnessing how easily investors are making profits.
IV. Profit-taking: at this stage more experienced investors recognize that the assets are overvalued and decide to sell them in order to make a profit. As a consequence the price rise starts slowing down.
V. Panic: once investors see other individuals selling and prices not rising as quick as before panic starts spreading. More and more investors start selling the overvalued assets and the prices decline, sometimes very quickly, leading to the burst of the bubble.

The consequences of a bubble burst can be quite significant as the crash usually leads to a critical loss of wealth due to a prolonged price deflation and more generally to a period of recession that can spread also outside the affected market's borders.

In a bubble scenario one would expect arbitrage to emerge and manage to remove the mispricing, but in reality there are some limitations. Firstly, short sale is not always achievable and this often constrains the possibility to make an arbitrage; secondly, making an arbitrage is always risky as you cannot predict with certainty how the market is going to behave and when exactly a bubble is going to burst. Finally, more than one arbitrageur might be needed in order to be able to implement a successful arbitrage, but agents might not be able to coordinate to seize the opportunity (Abreu and Brunnermeier, 2003).

1.2.1. The behavioural biases at the basis of the formation of a bubble

Bubbles are often associated with some form of irrationality and one of the main reasoning to justify their existence was given by Tversky and Kahneman (1974) who state that individuals often form subjective probabilities based on heuristics that lead them to cognitive biases. Overconfidence and representativeness stand out as the main factors playing a role in affecting people's actions and valuations and for their contribution to the formation of bubbles.

Overconfidence represents an overestimation of an individual's own abilities and judgement and it can manifest itself in several forms: either through miscalibration, illusion of control, excessive optimism or through the so-called "better-than-average effect". Miscalibration is defined by Ackert and Deaves (2009) as the propension for people to overestimate how precise their knowledge is. In particular, this type of bias is related to confidence intervals: if an individual is subject to a series of questions and they believe they were correct with a 70% confidence interval this means they should not have got more than 30% of the answers wrong, however in reality that percentage is higher. Miscalibration has been analysed and proved by several studies, specifically a study conducted by Adams and Adams (1960) shows how when individuals were absolutely certain about particular events being true they were actually correct only 80% of the time. Illusion of control represents a situation in which individuals believe they can control the outcome of events that are completely dependent on chance. Experiments have proved that individuals facing the same gamble, only dependent on chance, might behave differently and therefore gamble more or less depending on the person they are facing. Whenever an individual feels a sense of superiority they make higher bets thinking that the character of a person can affect the event.

Excessive optimism is closely connected to the illusion of control and it entails people assigning probabilities that are too high for positive events and probabilities that are too low for negative events with respect to the historical data. Some famous examples include assigning an excessively high probability to a lottery win or to a successful marriage, and a probability that is too low to be dying of cancer or to having a car accident. This kind of bias encourages individuals to undertake risky behaviour and it can lead to significant negative outcomes in the financial markets. As Sharot (2011) states, many economists believe that excessive optimism was one of the main factors that contributed to the global

financial crisis in 2008 as individuals and analysts had unrealistic expectations on the market growth. Because of these excessively optimistic expectations all agents kept engaging in highly risky practices which led to the formation of the bubble, and eventually to its enlargement and its burst.

Strictly related to excessive optimism is the valence effect which consists in the overestimation of the probability of positive events over negative ones. The term valence is used to rate feelings and emotions of happiness and unhappiness on a scale. This type of bias can induce to an overestimation of the future earnings of a firm and therefore lead to an overvaluation of the company.

The better-than-average effect is defined by Alicke and Govorun (2005) as a specific form of social comparison in which an individual is asked to compare their skills or behaviour against a relative average of their peers. In general, everyone has the tendency to evaluate themselves above the average but clearly only a bit less than 50% of individuals can actually be above it. The better-than-average effect can be explained mainly through two different mechanisms: from a motivational perspective an individual could compare himself against people that are doing quite poorly, on the other hand from a cognitive point of view individuals may have different ideas about what being competent or excelling means in any particular case. By assigning different definitions to the meaning of excellence every individual selects the criteria in which they think they fare best.

In general, in the event of a rise in the price of an asset investors affected by overconfidence believe the price will keep increasing even though they know from past experience that the trend will revert at some point. Individuals that have invested early in these types of assets start feeling overconfident in their abilities because of the decision they made and keep investing in the stock.

Representativeness is one of three heuristics identified by Kahneman and Tversky (1972) and it leads to errors in probability judgements and violations of the laws of probability. In particular, representativeness induces investors to overweight the importance of small samples by evaluating the probability of an event depending on the similarity. Investors affected by representativeness believe that the law of large numbers is also valid for small numbers and in general tend to neglect prior probabilities. The law of large numbers states that a sample that is large enough should be close to the characteristics of the true population and it will be closer the larger it gets. Therefore, individuals influenced by representativeness believe that even a small sample produces a good representation of

the characteristics of the population when in fact this cannot happen. On the other hand, the neglection of prior probabilities implies a failure in the application of Bayes' theorem, shown in Equation 1.3, which determines the optimal procedure to update probabilities once new information is available.

$$p(B|A) = p(A|B) * \frac{p(B)}{p(A)} \tag{1.3}$$

Where p(B|A) is a conditional probability which determines the probability of event B occurring given that A is true. Applying the same logic, p(A|B) represents the probability of event A happening given that B is true.

Bayes' rule essentially states that the probability of an event B, conditional on event A, is equal to the probability of A, conditional on event B, multiplied by the ratio of the simple probability of event B over the simple probability of event A (Ackert and Deaves, 2009, pp. 90-95).

Representativeness can manifest under different guises: the base-rate neglect which is the tendency to disregard prior probabilities in particular when additional, worthless evidence is provided (Tversky and Kahneman, 1974, pp. 1124-1125), the conjunction fallacy which consists in the belief that the probability of two joint events is higher than the probability of only one of those events. For example, individuals affected by this bias believe that the probability of winning the lottery and being happy is higher than the probability of just winning the lottery because they feel it is more representative. Furthermore, two other biases that arise as a consequence of representativeness are the gambler's fallacy and the hot-hand phenomenon. The gambler's fallacy entails the application of the law of large numbers to a small sample: because of this, individuals believe that for random events, like the toss of a coin, a series of a specific outcome (e.g. tails) will have to be balanced by a propensity for the opposite outcome (e.g. heads) (Ayton and Fischer, 2004, p. 1369). In particular, Kahneman and Tversky (1972) underline how individuals believe that even a small sample should be representative of the population and therefore they expect the population distribution to be reflected even locally.

The hot-hand phenomenon, on the other hand, consists in believing that a successful outcome is more likely to occur after a run of positive outcomes. As a consequence,

investors infer the price growth trend too quickly and on the basis of a sample that is too small, therefore leading to an overreaction in stock returns**.** The hot-hand fallacy is thus at the basis of the reason why investors usually purchase stocks that have been experiencing a positive trend. As a result, this behaviour could promote the formation and enlargement of a bubble.

Another important feature in the formation of bubbles is what Shiller (2000) defines as "feedback loop": past positive price increases for an asset leads to a feeling of excitement among investors which increases demand for the stock and, as a consequence, leads to a further rise in the price of the asset.

The circulation of positive news both from the media and among individuals attracts even more investors and strengthens the positive trend, thus continuing the feedback system.

Furthermore, the greater fool theory offers a different perspective on the reason why bubbles exist. Camerer (1997) asserts that the theory was firstly elaborated by Keynes in the 1930s when he introduced the concept of beauty contests for stocks. In this case investors are aware of the fact that the asset they bought is overvalued but they hold onto it in the belief that there is a "greater fool" who is willing to buy that asset for an even higher price.

1.3. Rational and irrational models for bubbles.

Two different perspectives have risen to justify the existence of bubbles: supporters of the Efficient Market Hypothesis have advanced models for the so-called "rational bubbles", while behavioural theories support the existence of "irrational bubbles".

1.3.1. Rational bubbles

The main rational argument justifying the presence of bubbles in the market is that extreme prices reflect extreme preferences, nevertheless Scherbina (2013) distinguishes between a classic and new models supporting the existence of rational bubbles.

The classic model states that when all individuals are perfectly rational and there is no asymmetric information bubbles can exist for infinitely lived assets when the growth rate of the bubble is equal to the discount rate.

If the asset was not infinitely lived the bubble would necessarily burst at the end of the

life of the asset at time T, but if all agents are aware of this no one would buy the asset at time T-1. Following this reasoning then no agent would buy the asset at time T-2, T-3 and so on, proving that bubbles cannot exist for finitely lived assets.

The only conditions under which bubbles can exist for finitely lived assets is when there is asymmetric information and a short sale constraint. In this case investors know the asset is overvalued but hold onto it in the hope of selling it to an individual that values it more. (Allen, Morris, and Postlewaite 1993)

The new models explaining rational bubbles explore how bubbles are related to perverse incentives, non-standard preferences and market frictions. Three main mechanisms support the existence and propagation of rational bubbles according to the new models: herding, limited liability and perverse incentives.

Firstly, in the case of herding, DeMarzo, Kaniel and Kremer (2008) assert that when non-standard preferences exist, individuals may give more weight to relative wealth and look at the situation of other agents who are investing in the bubble while it is still growing. Fear of missing out might emerge at this point and push individuals to invest in the same asset in order to be able to match the level of wealth of their peers. Herding behaviour can also be found among managers because of the incentive structure of their job which is solely aimed at having the best possible reputation. As Scharfstein and Stein (1990) state, unskilled managers may get a better return than "smart" managers just out of luck and because of the unpredictability of the market, despite receiving signals that are further from the truth. For this reason, managers' abilities are evaluated not only based on their performance but also by checking whether their investment decisions are in line with the ones of other managers. Another reason leading managers to herd is the presence of limited time and resources and the fact that betting against the herd is very costly, especially when the bubble is still on the rise. Shiller (2002) underlines how managers do not have enough time to evaluate complex situations and often rely on analyses and decisions made by other professionals to decide their investment strategy. He also cites the prudent person standard as an important factor encouraging managers to follow "conventional wisdom", and thus not distancing their actions too much from what other professionals are doing. The author also affirms that the media plays an important role in focusing the attention on specific assets whose prices are increasing, thus directing non-professional investors towards them. As a consequence, the prices of those assets rise even more and grab even more attention. Moreover, the dumb money

phenomenon is another important feature that leads to herding by pushing fund managers to invest in high-sentiment stocks, as per their clients' requests, resulting in the preservation of the bubble. (Lamont and Frazzini, 2008).

Secondly, the presence of limited liability for the majority of agents in the market pushes them to invest in bubbles because of the great advantages they can derive and, on the other hand, the little consequences they face when the bubble bursts.

Allen and Gorton (1993) assert that this system favours even unskilled managers by limiting the drawbacks of a possible crash of a fund by pooling together skilled and unskilled managers. Moreover, Allen and Gale (2000) state that the very structure of the investment payoff is at the heart of the generation of the bubble: by having a very limited downside risk and, on the other hand, a much bigger chance of positive returns managers are encouraged to borrow money and invest in risky assets. As a consequence, a bubble is generated and its magnitude is directly related to the riskiness of the asset.

Finally, the presence of a bubble creates different and sometimes contrasting incentives among market players: analysts and auditors do not have any incentive to publish negative reviews on assets or firms to avoid creating panic among investors. In particular, it has been shown that equity analysts have misaligned incentives with respect to investors which induces them to issue "buy" recommendations for assets even when they hold negative beliefs about the business. The perverse incentives arise for several reasons: firstly, analysts receive a percentage of the trading commissions for the firms they work for and it is more difficult to generate trade with "sell" rather than with "buy" recommendations; another source of profit comes from the investments they help generate by publishing positive reviews. Furthermore, analysts are worried that issuing a negative review about a firm will ruin their relationship with the management, thus endangering possible future opportunities.

Auditors and rating agencies are often short-sighted and value the opportunity to make profits in the short run much more than their reputation in the long run. For this reason they prefer to issue optimistic outlooks for the firms to keep doing business with them even though they do not truthfully reflect the information they have.

The creation of a bubble actually favours several agents in the market because of the increase in trading volume, in IPOs and SEOs (Scherbina, 2013). Moreover, as previously mentioned, the existence of limited liability for managers and stockholders, together with the knowledge that the government will intervene to bail out companies in the financial

sector in the event of a major crash encourage managers to ride the bubble and take more risks.

1.3.2. Irrational bubbles

Scherbina (2013) also analyses a series of behavioural theories for bubbles in which there is at least one agent that is assumed to be irrational. She classifies them into four different categories: models in which there are differences of opinions and short sale constraints, models with feedback trading, models with biased self-attribution and finally models characterised by representativeness heuristic.

In the first type of model that was originally developed by Miller (1977) it is assumed that investors have different beliefs about assets and that there are short sale constraints. In this scenario optimistic investors might disregard the fact that there might be other market players who hold pessimistic views on the same asset but are not allowed to sell it because of short sale constraints. This condition leads to a market price for the asset that is too high as it does not take into account the more pessimistic opinions. The price eventually adjusts once the short sale constraint is eased or when investors manage to get a common view on the fair value of the asset.

The feedback trading model instead is based on the belief that there is a group of investors that trade following past price movements. When the price of an asset increases because of some positive news related to it feedback traders are attracted to it because they believe the price will keep rising and they can get positive returns. The new investments increase the asset price above its fundamental value and attracts additional feedback traders; as a consequence the price rises even more, thus generating a bubble. The bubble keeps on growing as long as new capital is invested in the asset with the rate of bubble growth following the rate of capital inflow. Once agents start selling the stocks the bubble deflates. As mentioned in Section 1.1 the media also contributes to expanding the feedback system: once the price of an asset starts increasing the media develops an interest for it and includes it in their news coverage. This in turn attracts new investors and pushes the price up, which in turn leads to even more attention from the media (Shiller, 2002).

The third model entails investors that are affected by biased self-attribution which induces them to only look for signals validating their opinions, disregarding completely

any signal that might point to a different theory. This model was presented by Daniel, Hirshleifer and Subrahmanyam (1998) who assert that investors feel overconfident and only react to positive signals thus leading to increases in the price of the asset. The system also applies in the case investors developed private negative signals: in this instance they only consider negative public signals which then lead to a decrease in the price of the security. Nevertheless, the price movement does not reflect the fundamentals anymore and thus a bubble is created. The bubble usually deflates when investors realise the extent of public information that contradict their beliefs and start losing confidence in their initial opinion.

The fourth and final model encompasses two important behavioural features: representativeness heuristics, which leads individuals to put too much weight on sample data over population parameters and especially focusing on salient events, and the conservatism bias which, on the other hand, gives too little importance to sample data and leads individuals to stick to a certain reference point. While representativeness causes overreaction by overweighting sample data and salient events, conservatism leads to an underreaction due to the slowness in updating the reference point. Despite the two elements being contrasting they can still coexist because individuals are "coarsely calibrated" and thus can switch from paying too much attention to not paying enough attention depending on the context in which they find themselves.

In this system, elaborated by Barberis, Shleifer and Vishny (1998), individuals believe that stocks follow either a mean-reverting model or a trending model, when in reality they actually follow a random walk. As a consequence investors look at past stock returns as a salient signal to determine the kind of model the asset is following: if past stock returns have been of the same sign for a significant period then investors will apply the trending model and expect future returns to keep having the same sign. In reality the presence of several consecutive returns of the same sign is merely due to chance but because of investors' beliefs they will overreact, drawing the stock price away from its fundamentals and thus forming a bubble. Eventually investors will gather a significant amount of signals leading them to switch from the trending to the mean-reverting model and thus ending the overvaluation and therefore the bubble.

The model with short sale constraints and divergence of opinions is the only one that considers solely positive bubbles, while the others can develop both positive and negative bubbles.

To conclude, an analysis of the classical theory of capital markets has been presented, particularly focusing on how this view supported the idea that individuals are perfectly rational. In fact, according to the efficient market hypothesis stock prices reflect all the available information and they adjust as soon as some new information on the security is available. Since the price of an asset expresses its fundamental value there cannot be overvalued or undervalued assets.

It has then been asserted how these conditions cannot actually be found in real markets as agents often show at least some degree of irrationality: this is due to behavioural biases and heuristics and in particular to overconfidence and representativeness.

As it will be shown in the following chapter, bubbles have become quite a frequent occurrence in the last centuries, and by representing a deviation of the stock price from its fundamental value they serve as one of the main examples of market irrationality.

Several models have been elaborated by both the supporters of the efficient market hypothesis and the proponents of behavioural theories to justify the existence of bubbles, hence why a review of classical and newer models for rational and irrational bubbles has been provided. Despite the lack of perfect rationality behavioural models are still supported by empirical observations and principles of psychology and furthermore, in an effort to be exhaustive, they attempt to include several anomalies that stock returns actually experience in the market.

Nevertheless, since a number of models have only been introduced in the last decades, the debate is still open between supporters of the different systems and no consensus has been reached among scholars yet.

The following chapter will instead focus on an analysis of the most important and well-known bubbles that occurred throughout history.

Chapter II: Famous bubbles throughout history

In this chapter a series of famous bubbles will be explored, namely the Tulipmania, the Mississippi Bubble, the South Sea Bubble, the Great Bull Market of 1929, the Dot-com Bubble and finally the subprime-mortgage bubble, reviewing in particular the main events that characterised them and led to the eventual bursts of the bubbles. This historical analysis will be followed by an examination of whether these events can actually be classified as bubbles and the reasons behind the rise in stock prices and the subsequent bursts. As it will be shown, scholars tend to have diverging opinions on whether to recognise any of these events as bubbles, and part of the reason is due to the fact that they assign different definitions to what a bubble is and compute the fundamental value of the stocks in different ways.

2.1. The Tulipmania

The first evidence of a bubble dates back to 1634 with the so called "Tulipmania". Tulips were exported to Europe during the XVI century and their cultivation spread particularly in the Netherlands towards the end of the century. In this period the country had just entered its Golden Age with the Dutch economy flourishing especially thanks to the trade with the East Indies and the operations of the Dutch East India Company, and the Dutch West India Company which created a new class of wealthy individuals.

As the latest addition to the flower market tulips quickly became the highest-priced flowers and wealthy people were willing to pay extremely large amounts of money to obtain the most particular and rarest varieties. Because of their slow reproductive cycle the demand for tulips rapidly exceeded the supply, turning them into luxury goods.

As Van der Veen (2012) explains, the most expensive types of tulips were actually created by a virus which generated multicoloured petals. However, at the time the cause was unknown and this hindered the systematic production of new varieties. As a consequence, investing in the so-called "flaming" tulips was always risky since the final design was unpredictable and individuals were not sure whether they would end up owning valuable assets. To avoid part of the uncertainty tulip traders mostly made arrangements to purchase and sell bulbs when they were in bloom with the payment and actual exchange happening only when the bulbs were dug up months later. Because of the high uncertainty

and the presence of mostly informal arrangements some exchanges failed, and complaints were filed to notaries.

Van Der Veen (2012) asserts that during the 1620s and 1630s lots of varieties of tulips were already available, but the supply was still very limited as was the number of growers. Up until the early 1630s trades only happened between tulip collectors, mainly wealthy merchants who could face an eventual loss in the event of a bad purchase. By 1634 sales started to take place throughout the year and a formal futures market was created in 1636 where individuals could negotiate the price of a purchase or sale of bulbs that would be delivered at a specified future date.

Thanks to the creation of a futures market, individuals could now sell bulbs that were not in their possession but for which they had only signed a contract. This new type of market attracted a number of speculators who started entering the market. Five factors that might have promoted the speculation were identified by Van Der Veen (2012): the thrive of the Dutch commerce, the profits created by the trade in the East Indies, the presence of low barriers to trade, the introduction of the free coinage policy and the Bubonic Plague.

Dutch commerce was flourishing mainly thanks to the achievements of the Dutch East India Company and the Dutch West India Company. The former, also known as VOC, was a precursor of modern conglomerates that is believed to be "the most successful trading company of the seventeenth and eighteenth centuries" (Unoki, 2013, p. 39). Before the birth of the Dutch East India Company the life of a sailing enterprise was restricted to a single travel to the East Indies: once the ships had come back, all the goods had been sold and the profits distributed, company dissolution would follow. The VOC traded mostly with India and the South-East Asian countries and was granted by the Dutch government the monopoly on spice trade for more than twenty years. Moreover, at the beginning of the XVII century the VOC also became the world's first publicly listed company (Petram, 2020) granting large profits and thus helping make Amsterdam one of the major markets of the period.

The Dutch West India Company, also known as GWC, was initially founded in an attempt to financially support the war against Spain in the Atlantic, but at the end of the Dutch War of Independence in 1648 the economic interest became the leading one (Den Heijer, 2014). The GWC operated mainly in West Africa, Brazil and North America and in 1621 they were granted trade monopoly with the Dutch West Indies by the government. Although not as profitable as the VOC, the Dutch West India Company still represented an

important asset to the Dutch Republic as it provided supplies of raw materials from the Atlantic and by contributing to the slave trade. The prosperous commerce favoured not only the elite, but it also created a wealthy middle class who had the resources to afford luxury good and could then engage in the tulip trade. Moreover, the important gains produced by trade with the East Indies together with speculation in the shares of the VOC led to a rise in incomes and encouraged more risk taking with future contracts because investors found themselves in a more comfortable situation.

Another significant factor that favoured speculation was the presence of fairly low barriers to trade in tulips, mainly because of the lack of a supervisory authority (Schama 1988). Furthermore, the introduction of the free coinage policy with the foundation of the revolutionary government of the Dutch Republic might have attracted additional capital (French, 2006). Helfferich (1969, p. 370) provides a description of the aforementioned policy: private citizens delivered different types of metals to the State that would mint coins and return the same quantity back, either making a small charge to cover the cost of minting or with no charge at all. This policy was very successful as a considerable number of individuals had retrieved precious metals in the Americas and were trying to find a way to avoid the fees imposed in Europe (Del Mar, 1895).

Lastly, the Bubonic Plague of 1635-1637 might have contributed to the diffusion of the speculation. As Garber (2000) asserts, the Plague killed more than fourteen thousands people in Leiden in 1635 and caused the death of one seventh of the Amsterdam population and Haarlem population in 1636. Initially, scholars believed there was a causal relationship between the tulip mania and the plague but more recently this link was reversed. The author in fact underlines how the rising death threat between 1635 and 1637 coincided with the increase in the tulip craze: it seems that the increase in risk-taking was actually linked to a drinking game that emerged as a response to the increase in the probability of an imminent death. Moreover De Vries (1976) affirms that the plague might have evoked a sense of fatalism that led to the peak in speculation in tulips.

As new individuals entered the market a system of “colleges” was set up in the bigger towns in the Netherlands where traders would meet at a particular inn to negotiate deals. The contracts were usually mediated by one or two “neutral” individuals and they all included a small fee that was immediately spent on food, wine, tobacco, tips to the inn or alms (Van der Veen, 2012). Colleges did not verify whether traders had the money to fulfil contracts or were actually in possession of the bulbs they were selling. Speculators were

not planning on having an actual exchange happening at the settlement date but only on having a payment of the difference between the contract and the predetermined settlement price (Garber, 2000).

Because of the increase in the prices new, mostly uninformed, individuals entered the market. This event caused the introduction of several changes in the contracts: in particular, deals now explicitly mentioned the weight of the bulbs, new types of contracts were made on offsets of bulbs, but most importantly bulbs started being sold in bulk. This latter novelty might have been the cause of the end of the speculative bubble and the trigger of the real bubble as trade was not focused on a specific bulb anymore but just on the general variety and sellers could decide which type of bulbs to give. Moreover, as new agents in the market were less knowledgeable, only a general understanding of the rate of a particular variety was required. Although prices had been steadily increasing in the previous years, a drastic rise was recorded after the introduction of the bulk contracts (Van der Veen, 2012).

As Dash (1999) reports, the price of the Semper Augustus, "the most celebrated, the scarcest, and by common consent the most wonderful tulip", rose from 5,500 guilders in 1633 to 10,000 guilders in 1637. To put that into perspective, a carpenter in the 1630s earned around 250 guilders per year, while an average merchant made around 1,500 guilders. As the author mentions, 10,000 guilders was a big enough sum to provide an entire family with food, clothes and housing for half a lifetime or, as an alternative, it allowed to buy one of the biggest and most fashionable houses in Amsterdam. As a matter of fact, this sum could only be afforded by a few dozens of individuals in the Republic. The prices of tulips were so high that some individuals decided to sell some of their properties to be able to purchase the rarest varieties.

The price rise suddenly stopped on February 3rd 1637 when traders showed up at one of the usual auctions in Haarlem but refused to make any bid (Dash, 1999). The college therefore suspended trading and a sense of worry immediately flowed among traders throughout the country, pushing them to panic sell.

In the following days the prices of bulbs started dropping quickly and, as can be seen in the tulip price index depicted in Figure 2.1, the market for tulips crashed.

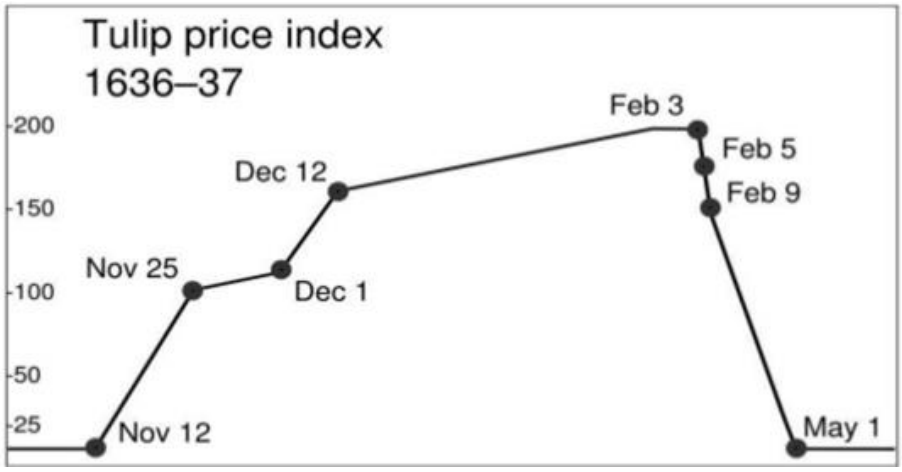

Figure 2.1: Tulip price index between November 1636 and May 1637
Source: Consob, "La bolla dei tulipani", viewed 9 September 2021.

Data could not be collected between February 9th and May 1st so the exact movements in the price changes are unknown, however Dash (1999) affirms that it is quite likely that the collapse of trade was more or less instantaneous; even if that was not the case it could not have taken more than three or four months. This means that, with respect to more recent crashes like the Wall Street crash in 1929, the tulip market crash was much quicker and complete. As a matter of fact, during the Great Depression the prices reached their minimum after two years and even at that point they still preserved a fifth of their old value. The author affirms that the reason for the crash was linked to the fact that the demand for bulbs had increased much more than the supply. Because of the mania that spread even the less valuable varieties started selling for quite remarkable prices, however there were no new cheap bulbs entering the market. As a consequence, no new florists could enter the market as they could not afford to buy even the more common varieties and, as some traders were already selling to make some profits, bulbs were concentrated in the hands of very few individuals. This meant that, as the prices kept rising, a point would be reached when not even the most committed tulip traders would be able to afford or take the risk to purchase the very expensive bulbs. By February 1637 both money and bulbs were lacking and this ultimately led to the burst of the bubble. What actually caused the sudden drop in prices according to Dash was the lack of bears in the market waiting for the prices to fall in order to buy valuable assets at favourable prices.

The absence of these kinds of traders was mainly due to the fact that the tulips traded in bulk in the months just before the crash were not very valuable and consequently there was no demand for them.
In April 1637 the government decided to suspend all contracts, only allowing the sellers to sell the existing bulbs for the current market price and leaving to the buyers the responsibility for the difference between the market price and the price determined for the contract settlement. From 1638 in many cities the councils determined that contracts could be extinguished through the payment of 3.5% of the settlement price by buyers (Garber, 2000).

2.1.1. Was the tulipmania actually a bubble?

Scholars have taken different positions on whether the tulip craze was indeed a bubble: Garber (1989) asserts that the rarest bulbs' prices were always reflective of market fundamentals as can be proven by looking at price movements for tulip and hyacinth bulbs in the XVIII century. The hyacinth would in fact become the most fashionable and requested flower, replacing tulips at the beginning of the XVIII century. The author states that the price patterns for rare varieties of bulbs were very similar between the XVII and the XVIII century as even in the latter case valuable bulbs were worth around 1,000 guilders, moreover there was no economic depression following the sudden decrease in prices. The only event not justifiable by market fundamentals is the rapid rise in prices of common bulbs that happened in January 1637 and the sudden drop they experienced shortly after. According to Garber this is mainly attributable to the behaviour of traders in colleges where "million-dollar bets" would be made with the belief that the government would not enforce the contracts.
Kindleberger and Aliber (2005), on the other hand, assert that the tulipmania was indeed a bubble because it was strictly connected to the nation's economy: the Dutch economy had in fact experienced a period of depression in the 1620s as a consequence of the resuming of the war with Spain but the situation quickly improved in the 1630s. As a matter of fact, in this period the shares of the Dutch East India Company doubled in price, mainly after 1636, and real estate prices rose up sharply in the middle of the decade. The authors cite De Vries (1978) who states that this period of recovery prompted new investments in infrastructures and canals that lasted up until the 1660s. According to De

Vries this period of exceptional growth and investments was strictly related to the tulipmania. Moreover, Kindleberger and Aliber (2005) also highlight how the sharp decrease in the prices of tulip bulbs caused a general decline in the Dutch economy as households were less inclined to spend due to the reduction of their wealth.
Mackay (1841) as well mentions the fact that the Dutch economy suffered a collapse that lasted several years.

2.2. The Mississippi Bubble

Towards the end of the reign of Louis XIV, France had accumulated a big debt because of the many wars in which the king had engaged and had troubles in finding the money to pay the interests on his bonds (Sandrock, 2013). John Law exploited this occasion to advance his financial theories to the Regent by proposing to found a National Bank that would issue paper currency. According to Law, in specie transactions were the major cause of the hindrance of trade, of the rise in interest rates and of unemployment and underemployment (Knight, 2002). Once the National Bank was found a private company would have to manage the national debt by purchasing bonds from the public using the money gained by selling the company's stocks. Subsequently, the Bank and the private company should be allowed to work in synergy, possibly even by merging, in order to coordinate the monetary policy with the policies aimed at managing the public debt. Finally, the domestic exchange rates should be adjusted to incentivise individuals to convert their coins into banknotes (Knight, 2002).
The Banque Générale was therefore created in 1716 with the purpose of issuing paper money to replace coins and thus improve the economic situation. In 1717 John Law purchased the Mississippi Company, whose main aim was to expand the French territories along the Mississippi River and later obtain complete monopoly of France's foreign trade with the colonies and refinanced it by acquiring the French public debt in exchange for shares of the company. In 1718 the Banque Générale and the Mississippi Company were merged under the name of Banque Royale (Bammer, 2002).

Interest in the Mississippi Company sparked among investors because of the supposed presence of numerous resources in the American territories controlled by the French, in particular precious metals, furs and land that could be easily cultivated and thanks to the favourable terms offered for the share subscription (Sandrock, 2013). Moreover, as Sandrock underlines, the speculation in the shares of the Mississippi company begun in 1719 because of a successful marketing strategy that convinced the French population of the abundant presence of sources of wealth in the Louisiana region. Initially the company shares were sold for 150 livres (Sandrock, 2013), the French monetary unit used in accounting at the time, but quickly increased to 10,000 livres within a couple of months as it can be seen from Figure 2.2.

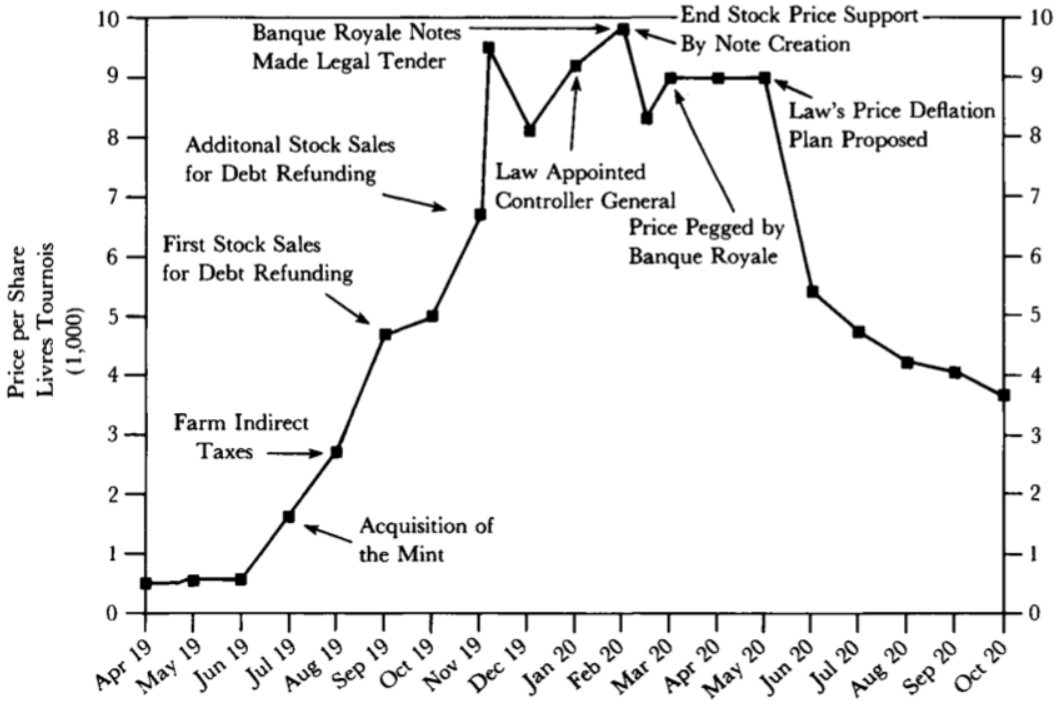

Figure 2.2: Value of one share of the Mississippi Company stock in Livres Tournois
Source: Garber, 1990.

The share price initially reached 1,800 livres after the Company acquired the rights to mint new coinage at the end of July 1719, subsequently it rose to 3,000 livres in October when the Company took over the collection of direct taxes. The price finally reached 10,000 livres after Law decided to acquire most of the national debt through three new rounds of share offering (Garber, 2000).

Lower social classes also took part in the speculation facilitated by the fact that money was easy to borrow and only a 10% down payment was needed to enter the market (Sandrock, 2013) as is also testified by Davis (1887) who asserts that the Banque Royale gave generous credit lines to attract even "people of small means into the vortex of speculation", moreover the Company also promised a 12% dividend on its share (Knight, 2002). When the share price began to rise drastically during the summer of 1719 some investors understood that the prospects for profits had been exaggerated and decided to cash in on their shares to convert them in gold (Sandrock, 2013).

In January 1720 Law was appointed France's Controller General and Superintendant General of Finance which meant he was responsible for all government finances, expenditures and the money creation of the Banque Royale. As a consequence, Law was able to promote the use of bank notes by prohibiting in specie payments over 100 livres and by making the bank notes the legal tender for this type of payments (Garber, 2000). As the author points out, in March 1720 the share price fell to 9,000 livres after the Regent sold all his stocks and, as a consequence, more investors decided to cash out sensing that the system was not working. The Banque Royale thus decided to encourage individuals to convert their Company shares in bank notes to increase their circulation while drastically lowering the value of metal coins. As Velde (2009b) asserts, these actions caused a spike in the inflation rate and forced Law to either decrease the number of outstanding bank notes or to reduce their value. He initially decided to opt for the latter option which resulted in the investors' loss of confidence, while he switched to the first option in the summer or 1720 trying to buy the bank notes through any kind of in specie payment but with no success. In the following months metal coins started circulating more and naturally regained value while the share price of the Mississippi Company kept declining, reaching 2,000 livres in September 1720 and 1,000 livres in December 1720. By September 1721 the share price fell to 500 livres which was around the value it had before the speculation had started (Moen, 2001).

2.2.1. Was this event actually a bubble?

Garber (2000) asserts that the Mississippi Bubble was not, in fact, a bubble and as a consequence should not be referred to as such. He argues that the event is "easily explainable on the basis of market fundamentals" as investors need to have some confidence in the operation in order for it to be successful. If they lose confidence a system that could have been profitable in the medium-long term will suddenly crash and lead to bankruptcy.

Velde (2009b) affirms that the bubble did not originate spontaneously as Law had created a system that allowed him to influence, if not manipulate, the share price of the Mississippi Company. The author's analysis concludes that Law's calculations were far too optimistic, in particular because of the discount rate he applied: a 2% discount rate did not, in fact, reflect the economic and financial situation in France in that period. According to Velde, a more realistic calculation determines that the company was overvalued by a factor of 5.8, and even assuming the lower interest rates of the Netherlands the overvaluation factor would only decrease to 2. He therefore asserts that this event does not represent what is considered a bubble in the modern sense since the overvaluation was not due to the irrationality of the market but simply to Law's actions.

Knight (2002), on the other hand, states that this episode was indeed a bubble. He argues that every economist has a different definition of bubble but he agrees with Kindleberger (2000) that they are quite easily "recognizable when encountered". He then asserts that for the previous statement to be true bubbles must have a specific pattern that can be detected. By combining the Kindleberger's interpretation of Minsky and the speculative bubbles model elaborated by Spotton (1997), Knight (2002) describes the stages of the bubble development. Initially an exogenous shock will cause a review of the forecasts, generating positive expectations that will attract more investments in the market until even the general public is included. When the bubble reaches the peak, insiders sell and doubt starts spreading among investors who end up panic selling. This situation can either exhaust itself or be stopped by an external authority.

Every stage of the model can be found in the Mississippi Bubble: Law by creating the Banque Générale and purchasing the Mississippi Company generated a new system for the French economy. Speculation started to rise and led the share price to reach excessive high levels that could only result in a crash. The collapse caused a wave of panic selling

among investors which led to a deep recession in the country, with French citizens being the main party suffering the consequences of the burst of the bubble rather than the French economy. According to Knight (2002) the Mississippi Bubble is therefore the perfect representation of a speculative bubble and Law's scheme can be used as a model to consider in the history of speculative bubbles.

2.3. The South Sea Bubble

Another well-known event that eventually led to one of the first financial crises in modern history was the South Sea Bubble of 1720. The South Sea Company was a British joint-stock company founded in 1711 officially with the aim of trading with the Spanish colonies in South America; in reality though, the main purpose of the company was to restructure the national debt.

As a matter of fact, at the time of the Company's foundation the English government had reached an outstanding floating debt of £ 9,000,000 (Sperling, 1962) and, inspired by what John Law did a few years earlier with the Mississippi Company, in 1719 the South Sea Company proposed a similar scheme to purchase the national debt from public creditors in exchange for its shares. The Bank of England advanced a counter-proposal which caused a bidding war between the two entities that ended in favour of the South Sea Company, mostly thanks to bribery and corruption (Hoppit, 2002). The South Sea Company was granted monopoly of all types of trades in South America in exchange for taking the national debt upon itself. Investors were attracted by the future prospects and the profit opportunities that could be made through trade with South America particularly after the end of the Anglo-Spanish War and, as a consequence, purchased a big number of South Sea Company stocks, thus driving its price up (Malkiel, 2010)

Dale et al. (2005) state that during the debt conversion process the Company devised a series of operations to issue more shares while maximizing its price. Four consecutive rounds of share subscriptions were issued with very favourable terms which included a modest down payment and extended call options, moreover the share was easily transferable to favour speculators. Furthermore, the South Sea Company encouraged investors to borrow from the company itself using its shares or subscription receipts as collateral in order to increase its clients' liquidity and the demand for the Company's stock; this operation produced more than £ 11,000,000 of loans. The stock price was also

sustained by the Company buying its own shares, by providing positive news about the firm on the days preceding a new subscription issue and by hampering the sale of the shares for the investors, although the latter action had no success.

Thanks to this strategy the share price of the Company rose from £ 130 in February 1720 to £ 300 at the beginning of April, then quickly reaching £ 400 on May 20th, £ 500 on May 28th and £ 600 on May 31st. This rapid increase protracted in the following month with the price rising to £ 700 on June 1st and reaching £ 800 only three days later. During the period in which the Company closed its books to calculate and review the midsummer dividend only forward prices were quoted and the highest price recorded was £ 1,050 on June 25th. Despite this, when the books reopened the share price had dropped to £ 820, dividend included. This event led to a loss of confidence in the Company and to a downward spiral: the price fell to £ 520 in mid-September, dropping to £ 290 in early October and finally reaching a low of £ 170 on October 14th, thus signalling the burst of the bubble.

The evolution of the share price of the South Sea Company is reported in Figure 2.3 together with the values of the Bank of England and the East India Company stocks.

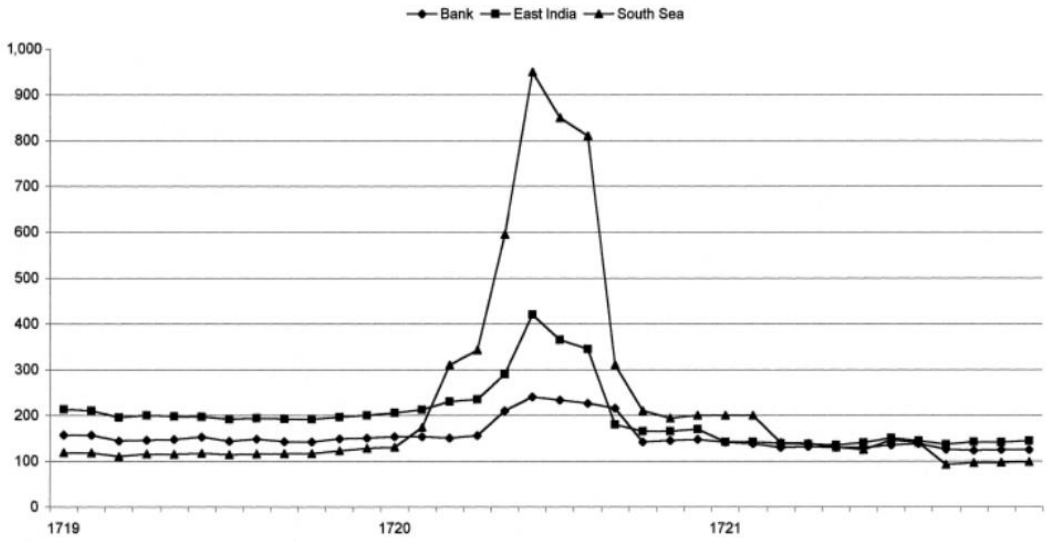

Figure 2.3: Share price of Bank of England, East India Company and South Sea Company
Source: Hoppit, 2002.

2.3.1. Can this event be considered a bubble?

Temin and Voth (2004) assert that, unlike other bubbles that had happened earlier, the South Sea Bubble was mostly a result of pure speculation as investors mostly relied on the greater fool theory. As Anderson (1801) underlines individuals were aware of the fact that the South Sea Company share price was too high but decided to invest in any case expecting that there would be a foolish individual willing to buy the share for a higher price allowing them to make a profit. Temin and Voth (2004) also report that despite the massive presence of inexperienced investors, institutional investors decided to ride the bubble because it was profitable. The example of Hoare's Bank is a good representation of how a bank was able to make a profit by trying to predict investors' sentiment during the bubble. The Bank traded mostly South Sea stock and had been buying shares in the months of February and March 1720 and sold some of them at the end of March and in April. After the transfer books closure the Bank decided to sell 3,000 shares on September 1st to reduce its risk after the stock had reached its peak, making a 67% gain from the average share price of the May subscription. As the share price kept dropping dramatically the Bank decided to sell 1,000 shares on September 12th for £630. According to the authors between February and this date the Bank had made a £19,355 profit. Moreover, they provide an analysis on the correlation between the stock returns on the day the Bank had purchased or sold the Company's shares and the returns on the following days. The analysis found that the share price increased highly when the Bank purchased a large number of shares and that this positive relation becomes even stronger with the length of the return period. On the other hand, no significant result was found for share sales. Temin and Voth (2004) assert that, unlike what the theory often advances, short-sale constraints were not an important factor contributing to the bubble. Hoare's Bank was still extensively invested when the bubble reached its peak. The Bank, despite following trading operations of their clients, was not exploiting insider knowledge to make its trading decisions as the clients had no connection to the South Sea Company. Moreover, the authors state that it was clear to the majority of investors that the share price was overvalued, mainly thanks to the ability to predict investor sentiment. The dramatic fall of the share price in September was due to a coordinated action of investors once they realised that the share price had reached an upper limit and there was no more steady presence of "foolish" investors driving the price up.

2.4. The Great Bull Market of 1929

The Great Bull Market of 1929 is listed among the most important bubbles of the modern era. During the 1920s the American economy was recovering from the post-war recession thanks to newly discovered technologies and the birth of a number of large-scale enterprises (White, 1990). These newly established firms were much more efficient and had different needs with respect to the old, smaller enterprises and thus the structure of capital markets altered as well to meet their needs. In particular, XIX century regulations forbade commercial banks to make large, long-term loans which pushed companies to use retained earnings and issue stocks and bonds to finance their investments (Rappoport and White, 1993). Moreover, on top of purchasing bonds, since banks were also prohibited from purchasing or trading equities, they set up a system to avoid this restraint by creating wholly-owned securities affiliates (White, 1990). Rappoport and White (1993) state that, as this new practice started to spread, banks assumed more the role of brokers that simply issued securities for companies and abandoned their function of lending directly to firms. Commercial banks, as opposed to brokerage houses, had a much larger customer base which meant that they sold securities even to individuals that had no past experience with investment in stocks and bonds. In order to allow also small investors to purchase a diversified a portfolio of stocks despite the lack of funds, investments funds were created (White, 1990). These kinds of institutions offered the same services of nowadays' mutual funds. Carosso, Sears and Katz (1970) assert that there were only 40 institutions of this kind in 1921 but that number grew to 770 by the end of 1929. The presence of such a great number of inexperienced investors generated favourable conditions for a bubble to form (White, 1990).

According to Rappoport and White (1993), the most traded stocks in the 1920s were the General Motors and Radio Corporation of America, also known as RCA. General Motors had replaced Ford as the leading car manufacturer thanks to the new management and organisation system they introduced, while RCA emerged in the market by developing products that utilised the new technologies. The authors underline that a surprising and unusual aspect was that, apart from General Motors, almost none of the most heavily traded stocks actually paid dividends. Besides the formerly mentioned firms, other heavily traded stocks included utility companies, and other firms that employed new technologies like the Aluminum Company of America and the United Aircraft and

Transport Corporation. Considering that most of these companies did not distribute dividends yet, this trend indicates that the majority of investors had to had expectations of future dividends.

Allen (1997) identifies the beginning of the bubble in March 1928: as it can be seen from Figure 2.4, the positive trend had already started back in 1926 but in March 1928 a sudden increase in prices was registered. Allen reports that the General Motors stock had gained 5% between Friday 3rd March closing price and the price it reached on Monday 5th March after two hours, moreover General Motors' volume of trade represented one third of the entire trading of that day, signalling that the market speculation had begun. White (1990) reports that in that same week the RCA stock price had increased by 14% and furthermore the common stock index had increased by 15% between the months of April and May. While Allen believes that this sharp rise was due to speculators being bullish, White argues that this initial increase might actually be simply a result of the innovations introduced and the developments the economy had experienced since it had exited a recession at the end of 1927. As Figure 2.4 shows, the utilities sector was the main focus of the bull market, followed by the industrials. On the other hand the already established railroads sector trailed behind.

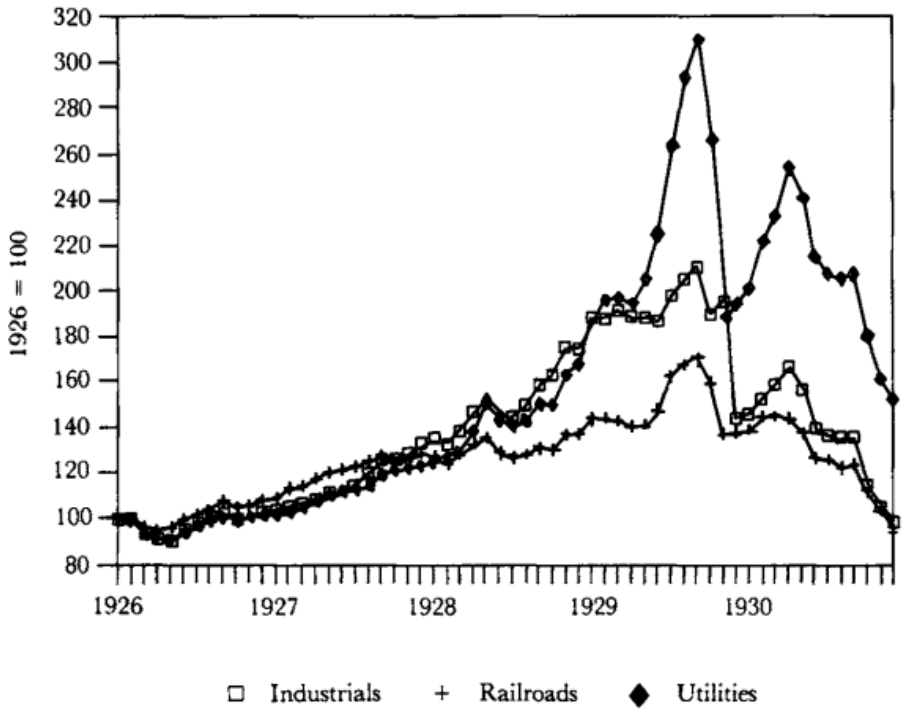

Figure 2.4: Monthly common stock indices from 1926 to 1930.
Source: Board of Governors of the Federal Reserve System, 1943 as cited in White, 1990.

A new quarterly index of dividends for companies in the Dow Jones Index from 1920 to 1934 was introduced to examine the market. This new index is shown in Figure 2.5 and supports Allen's theory that the bubble firstly originated in March 1928. As it can be seen, at the beginning of the 1920s the share price of the Dow Jones stocks moved closely together with the dividends until the stock price experienced a big surge in 1928.

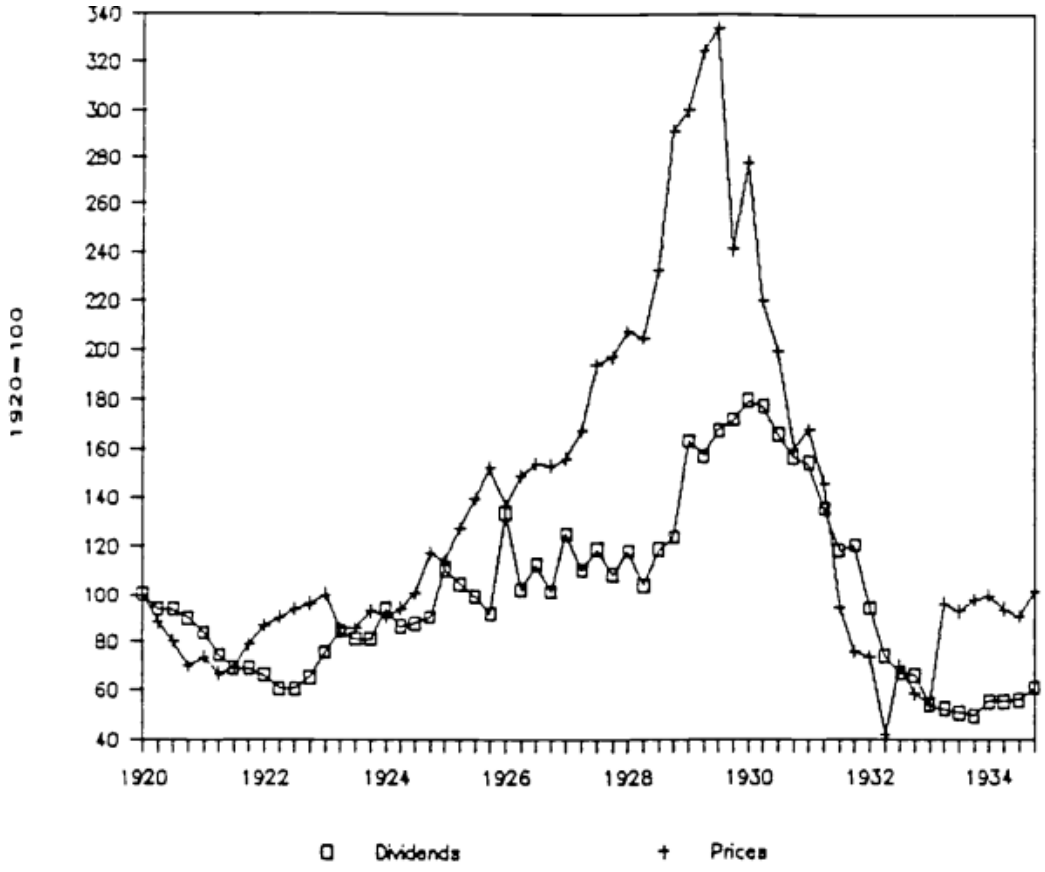

Figure 2.5: Dividend and price indices of Dow Jones Stocks
Source: Rappoport and White, 1993.

The presence of a bull market encouraged firms to issue new stock: $1474 million of stocks were issued in 1927, reaching $5924 by 1929. In the single month of September 1929 over $1 billion of shares were issued (White, 1990). As Richardson et al. (2013) affirm, the Dow Jones Industrial Average experienced a 500% rise from sixty-three in August 1921 to 381 in September 1929. After the Index reached its peak on the 3rd of September Irving Fisher asserted that stock prices had reached "what looks like a permanently high plateau" ("Fisher Sees Stocks Permanently High", 1929). The positive trend suddenly stopped on Black Thursday, October 24th 1929 when 13 million shares were sold (Consob, viewed 1 October 2021), making the Dow Jones Index fall by 11%,

with some stocks decreasing by as much as 25% (Malkiel, 2010). This event was quickly followed by a subsequent 13% loss recorded on Black Monday, October 28th and finally a 12% drop on Black Tuesday, October 29th.

Ultimately, the Dow Jones Index lost 25% during the last week of October and 34% during the last three months of the year. (Kyle and Obizhaeva, 2019).

A great number of Americans decided to get involved in the market during the boom and heavily invested mostly through leveraged margin accounts. Fisher (1930) believes that the possibility to borrow money and buy the stock on margin had "encouraged unwise speculation". This assumption is further supported by the fact that brokers loans moved closely together with the stock prices index during the second half of the 1920s as can be seen in Figure 2.6.

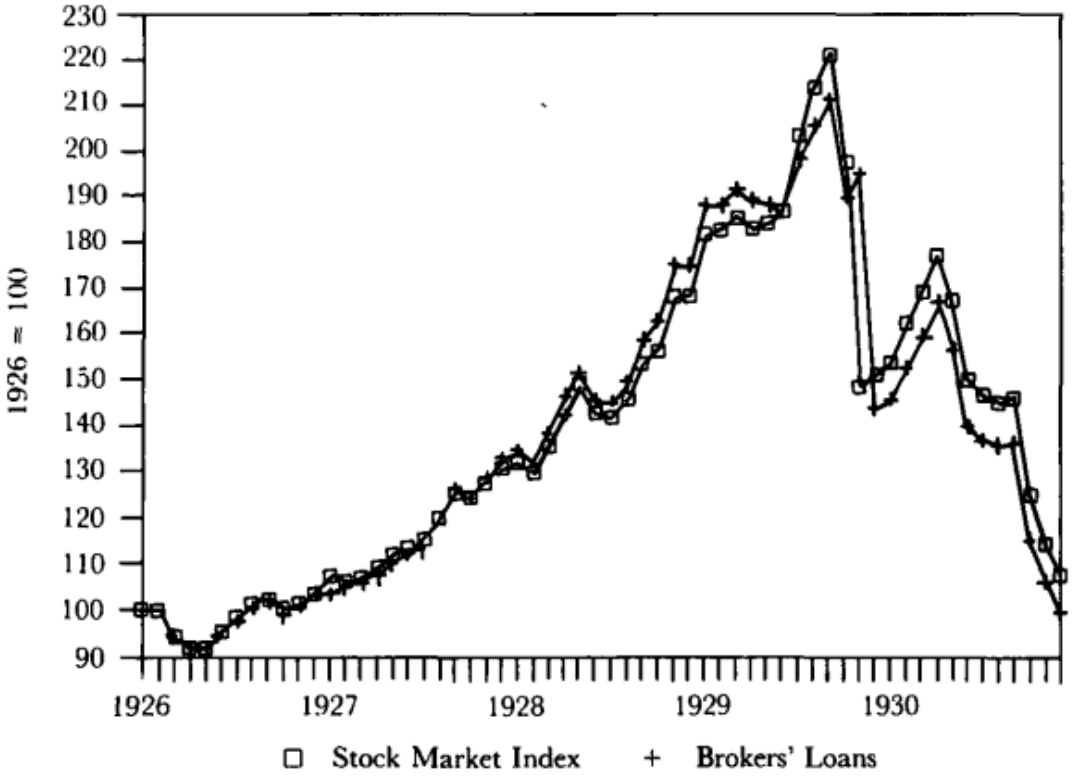

Figure 2.6: Stock Market Index and Brokers' Loans between 1926 and 1930
Source: Board of Governors of the Federal Reserve System, 1943 and the New York Stock Exchange (1930) as cited in White, 1990.

As White (1990) states, these data seem to contrast with the tight money policy implemented by the Federal Reserve to avoid providing excessive credit for speculation. While domestic banks complied with the regulations, brokers' loans increased thanks to

a rise in loans from private investors, firms and European and Japanese banks that substituted them. However, White asserts that the increase in brokers' loans was not a contributing factor to the stock market bubble since the increasing demand for credit to purchase shares actually attracted more funds into the market.

2.4.1. Causes of the crash

White (1990) asserts that despite the rise in stock issues that the Director of the Bankers' Trust Company of New York believed to have overwhelmed the market, these actions could only have been marginal to the crash of the market as the total supply of securities was much larger.

Wanniski (1983) believes that the introduction of the Smoot-Hawley tariff, which increased the level of protectionist trade policies in the United States, was the exclusive cause of the market crash. White (1990) disputes this theory by arguing that if the tariff was central to the collapse of the market it would have impacted export companies in particular, however when the tariff was implemented all the stocks declined by the same amount. As a consequence, the author concludes that the tariff introduction could not have played a critical role in the market crash. Another factor that was believed to have contributed to the crash was the disruption of Clarence Hatry's companies in the UK on September 20th 1929. As Galbraith (2009) reports, Hatry had created a financial empire which had rapidly expanded in the 1920s mainly through issuing unauthorized securities, forging stock certificates to increase assets and other forms of informal financing. The sudden collapse of his enterprises after the uncovering of the illegal activities might have negatively affected markets in New York by causing a loss in confidence. Fisher (1930) argues that as a consequence of the collapse of Hatry's companies there was a sharp drop of the stock prices in the UK before the Wall Street crash that might have contributed to it. However, White (1990) firstly finds that the price decrease in the UK was not as sharp as Fisher asserted, and secondly, he points out that in the 1920s the New York stock market moved quite independently from the foreign markets and thus could not be influenced particularly by them. On the contrary, he argues that the foreign stock markets were mostly reacting to the American markets and the Federal Reserve policies. White finally affirms that there is no evidence pointing to the fact that a change in dividends or earnings might have led to the crash, but that there were at least the signs that a recession

was imminent: some of the Federal Reserve indices started dropping in August and September and moreover rising real interest rates both in the U.S. and abroad were recorded. These conditions were sufficient to prompt shareholders to revise their expectations. The stock market crash caused the bankruptcy of several companies and banks, including the Bank of the United States, a sharp rise in unemployment of around 25% of the working population and a dramatic fall of income.

2.4.2. Can this event be considered a bubble?

The 1929 stock market boom has divided experts' opinion in two fronts: the speculative madness school of thought, and the ones believing that the rise in the stock prices was mostly due to changing fundamentals.

Galbraith (2009) asserts that the crash was simply a result of the "speculative orgy" that had arisen in 1928 and 1929 and that it was only a matter of time before investors would lose confidence, start selling stocks and the market would crash. Moreover, he asserts that speculation only emerges in periods of economic expansion because the preconditions needed are an optimistic outlook and a good amount of savings.

Malkiel (2010) believes that closed-end investment company shares had an unusual behaviour that testifies the presence of market irrationality in the 1920s. He asserts that the fundamental value of these funds is usually equal to the market value of the assets they hold. However, while since 1930 the funds have sold at around 20% discount of their security values, during the period from January to August 1929 they usually sold at a premium over net asset value of 50% or over. In particular, the most renowned funds like the Goldman Sachs Trading Corporation and Tri-Continental Corporation sold at as much as 2 and a half times the value of the securities they held which Malkiel believes to be a clear demonstration of the irrational speculation that existed at the time.

On the other hand, many scholars do not believe that the sudden rise in prices was actually a bubble, and instead have argued that the bull market was a result of changing fundamentals in the economy. Bierman (1991) argues that the surge in stock prices is justifiable considering the "extraordinary performance" of the economy and of the firms affected by the stock price rise. The same view is shared by Irving Fisher (1930) who believes that at least two-thirds of the stock price rise between 1926 and September 1929

was justified. Sirkin (1975) asserts that Fisher's view was dismissed mainly because it was not supported by an accurate analysis of the stock values.

He therefore advances his analysis of the stock market which entails the calculation of the price-earnings ratio applying the formula proposed by Malkiel (1963) that is shown in Equation 2.1:

$$\frac{P}{E} = \bar{p}\,\frac{(1+g)^n}{(1+r)^n} + d\left[\frac{1+g}{r-g} - \frac{(1+g)^{n-1}}{(r-g)(1+r)^n}\right] \tag{2.1}$$

This scenario entails the assumptions that the earnings per share of a stock are expected to grow at a rate *g*, that is higher than the standard rate, for *n* years; after that the growth rate is expected to go back to normal. Moreover, it is also assumed a given dividends-earnings ratio, *d*, and a rate of return, *r*, required to convince investors to hold the stock. With this data available it is then possible to compute the share price *P* at which it can be purchased to obtain the required rate of return *r*. The share price is then divided by the earnings per share, *E*, to obtain the price-earnings ratio. $\bar{p}$ represents the price-earnings ratio when the growth rate is normal. As we can see from the equation, the price-earnings ratio therefore depends on five factors: the expected higher growth rate, the expected length of the rapid-growth phase, the required rate of return, the dividend-earnings ratio and the normal price-earnings ratio.

Sirkin does not have knowledge of all the specific variables but analyses the price-earnings ratio in 1929 to examine whether the implied expectations are close to a reasonable value. He considers the price-earnings of the Dow Jones Industrials stocks in 1929 and confronts them with a random sample of thirty stocks of the New York Stock Exchange in 1929. The findings point to the fact that the price-earnings of the New York Stock Exchange shares are lower than the ones of the Dow Jones Industrials but the quality of the stocks of the former is also lower. According to Sirkin's calculations the median growth rate of the previous four years could not justify the actual median recorded at the peak of price-earnings ratio, however the sharp difference only entailed around one fifth of the stocks in the sample and, moreover, calculations were made following a conservative formula. As a matter of fact, the formula used in the model assumes that the rapid-growth period will be immediately followed by a drastic decline

that will lead back to a normal growth rate. On the other hand, evidence has shown that it is probable that the growth rate will decrease gradually; in this case then the price-earnings projections would be much closer to the ones previously computed. Sirkin in particular rejects the claim that the stock market boom was the result of a general speculative madness by arguing that only a small number of stocks had actually behaved slightly irrationally.

2.5. The Dot-com Bubble

The Dot-com bubble is one of the most recent bubbles as it occurred between 1995 and 2002. During the 1990s computer ownership increased sharply from 15% in 1990 to 35% in 1997 (U.S. Department of Labor, 1999) which favoured the diffusion of the use of the Internet. This phenomenon was mainly due to the evolution in information technology and the creation of the first browsers which allowed computers to enter the World Wide Web. In particular, the Netscape IPO in 1995 is considered as the event that kickstarted the so-called "New Economy" which shifted the focus mainly on the technology sector, thus relegating the manufacturing sector to a secondary role. Netscape was one of the first companies providing a web browser that facilitated the way to navigate the web and on the day it went public its share price rapidly surged from $28 to $75 after a few hours to then close at $58.25 (Frontline, 2002). During this period a considerable number of dot-com companies emerged, particularly thanks to the reduction of the interest rates from 6% to 4.5% (Consob, viewed 8 October 2021). Moreover, the introduction of the Taxpayer Relief Act of 1997 reduced considerably capital gains tax rates, in particular the top tax rate, which encouraged individuals to be more inclined to speculation (Shan, 2011).
All these factors attracted investors' interest in any internet-related stock regardless of whether their fundamentals were good or not. As a matter of fact, investors tended to disregard looking at the companies' important metrics like revenues, business plans, industry analysis and market trend analysis to mostly focus on insignificant values like the traffic growth of their websites (Corporate Finance Institute, viewed 8 October 2021).

As a consequence, the number of Initial Public Offerings surged in the 1990s and culminated in 1996 with almost 700 IPOs as can be seen in Figure 2.7.

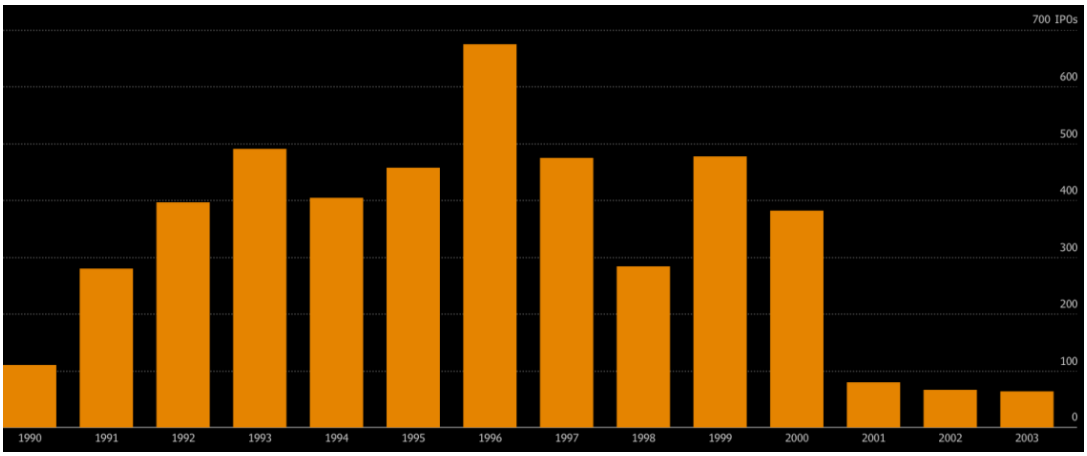

Figure 2.7: Number of IPOs during the Dot-Com Era
Source: Bloomberg.
https://www.bloomberg.com/toaster/v2/charts/4a186ad7d48045ba8f839d99ffe167a7

In 1996, first-day returns on IPOs had an average of about 17%, while in 1999 the average reached 69% to then decrease to 56% in 2000. In particular, IPOs of dot-com companies recorded an average first-day return of 88% in 1999 and 2000 (Ljungqvist and Wilhelm Jr, 2003).

Before this wave of internet IPOs, companies usually waited to be profitable before going public and the process usually took years. As Jay Hoag, the founder of a venture capital firm in the Silicon Valley, explains, the Netscape IPO instilled the belief that firms could go public even if they were not profitable yet because if they were growing fast enough they would eventually reach profitability (Frontline, 2002).

A lot of dot-com companies followed what has become known as the "Get Big Fast" business model which is described by Reid (1997) as a model in which a firm must grow as rapidly as possible, even without generating revenue, and occupy as much space in the market as possible to beat the competition. As Kirsch and Goldfarb (2006) explain, this would enable the companies to have a strategic position to shut down later entrants and thus obtaining long-term returns above the average. The model therefore urged companies to invest a lot in advertising to build brand awareness and try to dominate the e-commerce market.

With the majority of dot-com companies having received funding from venture capitalists without presenting a business plan but mostly by personally knowing them or being introduced to them it was clear that most of the companies did not necessarily have good prospects and might not end up being profitable (Berlin, 2008).

In 1996 Alan Greenspan, the Federal Reserve Chair, gave a speech at The American Enterprise Institute for Public Policy Research warning against a possible "irrational exuberance" that could affect asset value (Greenspan, 1996).

The dotcom fever had however started and any stock containing the ".com" suffix saw his share price increase remarkably. In particular, the NASDAQ index, which was mainly composed of technology stocks, rose from just below 1,000 points in 1995 to more than 5,000 points in 2000, an increase of over 400%, as can be seen in Figure 2.8.

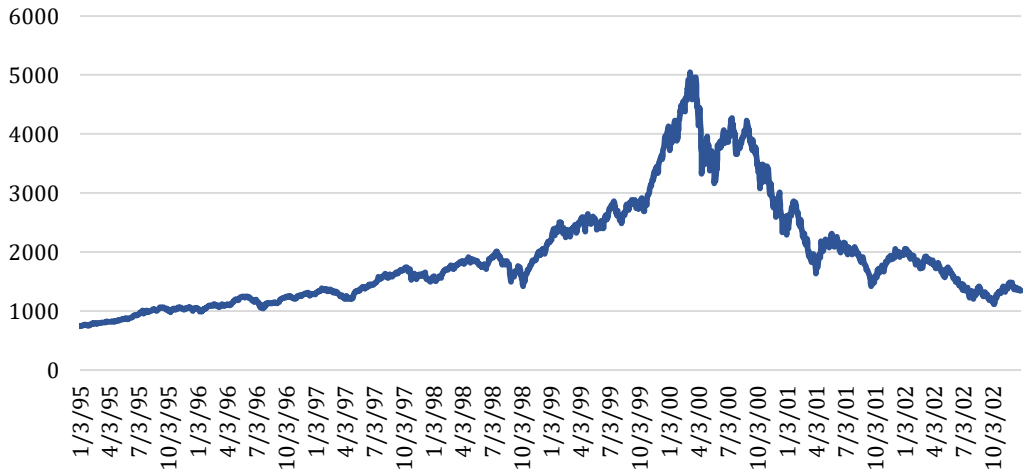

Figure 2.8: Adjusted Close Values NASDAQ Index, January 1995 - December 2002
Source: Yahoo Finance

By March 1st 2000, dot-com companies had reached a combined market value of $1.7 trillion, however their valuations started to drop drastically right after (Lewellen, 2003). By this time companies had published their balance sheets which showed quite some disappointing results, thus alerting investors that the chances to make profits were quite low. As a consequence, a lot of investors, realising that their stocks were highly overvalued, decided to sell them before the share price would decrease even more (Consob, viewed 8 October 2021). The NASDAQ index after reaching its peak of 5048.62 points on March 10th, dropped by 2.8% on the following day and recorded a 9% loss in the first three days. This event marked the start of its long decline that would eventually

lead the index to lose three quarters of its value from February 2000 to September 2002 (DeLong and Magin, 2006). The bubble had burst and a lot of internet companies were forced to either declare bankruptcy, merge or be acquired by competitors in the following months. As Ofek and Richardson (2001) assert, dot-com companies earned over 1000% returns on their stocks between the beginning of 1998 and February 2000, but these gains had entirely vanished by the end of the year.

A number of companies that had become famous, also thanks to the many advertisements they ran, fell victims of the market crash. Among the most famous names it is worth mentioning Pets.com, eToys and Webvan. All these companies had been very successful in the early stages of their lives but soon crashed because their business models were not sustainable.

Pets.com, a firm that produced pet food and supplies, became the symbol of the Dot-com bubble: the company ran a vast marketing campaign, even featuring in a Super Bowl advertisement and at the Macy's Thanksgiving Day Parade in 1999. The company went public in February 2000 with an initial price of $11 which kept decreasing as the days passed, reaching values below $1 from August 2000, until the firm decided to shut down in November. eToys suffered a similar fate by spending tens of millions of dollars in advertisement but after suffering a $74.5 million loss it was forced to file for bankruptcy in February 2001. Webvan became known as the biggest dot-com failure, reaching a valuation of $1.2 billion at its peak in November 1999. The company planned to invest $1 billion much in expansions but investors realised the margins were not large enough and started selling their stocks. Webvan shut off in July 2001 having reached a share price of only 6 cents (Goldman, 2010).

Nonetheless, as Kirsch and Goldfarb (2006) report, not all the dot-com companies that emerged suffered the same fate: during this period, in fact, other companies like Amazon, Yahoo and eBay were created. Despite following the "Get Big Fast" model they managed to produce a profitable business and survive the burst of the bubble. The authors also assert that out of the about 50,000 dot-com companies that were founded in the U.S. between 1998 and 2002 only 48% survived through 2004. This does not indicate that all of them became successful and reached the objectives they had fixed in their business plan but simply that they did not declare bankruptcy. Many small technology companies were able to survive by growing slowly and providing useful and valuable services.

2.5.1. The reasons behind the inflated stock prices and their sudden drop

There are several reasons for the inflated stock prices of internet companies which can be categorised under two categories: the structural features of the market and the behavioural factors.

The arguments relating to the former category assert that the tech companies stock boom was due to some intrinsic characteristics of the market, in particular a lack of short selling due to constraints. Ofek and Richardson (2001) state that during the dot-com bubble there were some pessimistic investors willing to short the internet stocks, however they were overwhelmed by the optimistic investors. This situation could be attributed to two different factors: either investors could not short the stock or they were reluctant to do so. As Chen, Hong (2002) underline, a lot of mutual funds were not allowed to take short positions or were very reluctant to do so. Furthermore, Shleifer and Vishny (1997) assert that specialised arbitrageurs that are risk averse might avoid getting involved in extremely volatile markets. As Ofek and Richardson (2001) show, the dot-com stocks during this period were much more volatile than other stocks, recording a standard deviation of over 60 for any internet stock price while other stocks only reached a standard deviation of 39.61. The authors also show that in February 2000 short interest, which is defined as the ratio of total amount of shares that have been sold short over the total amount of shares outstanding, was substantially higher for dot-com stocks with respect to other stocks. Indeed, the short interest recorded a 2.8% mean for internet stocks with a 1.6% median, while other stocks had a 1.8% mean and a 0.7% median. Moreover, also the 90th and 95th percentiles recorded considerably larger measures for internet stocks, 6.9% and 10.6%, with respect to the others which reached only 4.7% and 7.8%, respectively. However, these data are not sufficient to determine whether the amount of shorted internet stocks had reached their limit. For this reason, the authors analysed the rebate rate as well, as it serves as a good indicator of the difficulty in shorting. The results show that the mean rebate rate for the internet stocks corresponds to the eight percentile of the other stocks distribution, thus supporting the argument that the shorting of internet stocks had reached a saturation point. The authors also advance a second method to analyse whether the shorting positions had reached their limit by looking at the options market. By analysing the data on calls and puts with the same strike price, Ofek and Richardson applied the put-call parity to compute the implied stock price.

Equation 2.2 reports the put-call parity formula used in the case of a non-dividend paying stock with European options.

$$c + Xe^{-rT} = p + S_0 \tag{2.2}$$

In this equation c represents the price of a European call option, X is the strike price of an option, r represents the continuously compounded risk-free interest rate, T the time to expiration of option, p represents the price of a European put option and S_0 the current stock price.

Whenever the put-call parity is not respected, then either there is no possibility to short sell securities or the options and stock markets are segmented in a way that causes investors to hold onto the stock despite the presence of a portfolio of a bond, a call on the stock and a short put on the stock yielding a higher return in any circumstance (Ofek and Richardson, 2001). The analysis results show that the arbitrage violations are much higher for dot-com companies, which recorded a 36% of violations, with respect to non-Internet firms which stopped at 23.8%. The results are significant at the one percent level, thus indicating that the presence of short sale constraints was higher for Internet stocks. A final analysis was elaborated on the relation between the different measures of short sale constraints and on the relation between these measures and the implied P/E ratios of each stock. The results show the presence of a negative, significant correlation between short interest, the rebate rate and put-call parity violation. This means that a higher short interest implies a lower rebate rate and therefore theoretically a higher short sale constraint. Moreover, the data confirm the presence of a negative correlation significant at the 1% level between the implied P/E ratio of Internet stocks and the previously mentioned measures. This final result confirms that a higher implied P/E indicates a more overvalued stock which implies a lower rebate rate since the short selling would be at its limit.

Further evidence supporting the argument that the presence of short sale constraints were part of the reason for inflated prices of Internet stocks is provided by the negative long-run excess returns recorded after the lockup period expiration, which coincides with the termination of the constraints (Ofek and Richardson, 2001).

On the other hand there are a series of factors that have contributed to the inflated stock prices that refer to the behavioural side, because of the presence of an "irrational exuberance" of investors in the market, as described by Alan Greenspan on December 5, 1996.

As Shiller (2002) underlines, individual investors tend to purchase stocks that have attracted their attention because of an important price rise. Scherbina (2013) defines this as the "dumb money" phenomenon and asserts that it was a very common practice during the dot-com bubble. A lot of investors are prone to purchase high-sentiment stocks whose prices are on the rise and sell them as soon as the price starts to decrease. As a consequence, they end up earning below-average returns over the following years.

According to Ofek and Richardson (2001), a factor that played an important role in the stock price boom was the presence of heterogeneous investors in the market. The authors collected data that show that markets related to Internet stocks had a much higher volume than markets dealing with non-Internet securities and moreover there were more retail investors in Internet-markets with respect to other markets. The evidence shows significant results for both the median percentage of holding by institutional investors in the entire market as well as restricted only to IPOs that confirm a lower percentage for Internet stocks than non-Internet equity. However, these numbers may actually be overestimated as recently formed Internet-based mutual funds, namely funds that were created in 1999 and early 2000, were categorised as institutional investors despite clearly being driven by retail investors' demands. The presence of a high number of retail investors relative to a normal market situation can be interpreted as a tendency to more frequent behavioural biases that can lead to overoptimistic views. Ofek and Richardson also report that Internet stocks represented 4.38% of total market capital but only 2.32% of the pension funds holdings, thus supporting the argument advanced by Chen, Hong and Stein (2002) that mutual funds tend to choose stocks that perform better and that when ownership breadth is lower for institutional investors there usually is negative information not reflected in the stock's price.

Furthermore, Shiller (2000) lists a series of "structural factors" that might have contributed to increase the internet stocks demand and thus their price. Among these he mentions a rise in materialistic values which could have translated in practices that offered the possibility to get rich quickly. Moreover, the diffusion of gambling facilities and the increase in the actual act of gambling might have changed individuals' attitude

towards risk taking, thus increasing the involvement in the stock market. The downsizing of the 1980s and 1990s which led to a great number of layoffs might have pushed towards more speculative investments as an alternative source of income. Moreover, the change in management compensation packages from fixed salary towards participation in the company as investors might have played a role since in this way managers had an incentive in increasing the share price as much as they could. Shiller also mentions the fact that managers holding incentive options were prone to substitute their share repurchases for a portion of the dividend pay-out as this would increase the value of their options. The evidence actually shows that between 1994 and 1998 a sample of 144 of the largest S&P500 companies earlier repurchased 1.9% of their outstanding shares each year, while only issuing 0.9% per year, mostly to meet the exercise of their employees' options. It is estimated that this practice alone should have increased the stock prices by a couple of percentage points. Another important contributor to the increasing the demand for stocks was the expansion of media outlets reporting business news also trying to use a language that could be understandable for the entire population and not only for the experts. Finally, increasingly optimistic forecasts by analysts mostly made to maintain a good relation with the companies might have led to an increase in stock demand. The evidence collected by Zacks Investment Research on around 6,000 companies show that analysts only issued "sell" recommendations for 1% of the stocks in late 1999, with 69.5% of the recommendations being "buys" and 29.9% "holds". On the other hand, in 1989 the "sell" recommendations amounted to 9.1% of the total, nine times more.

2.6. The Housing Bubble and the Global Financial Crisis

The housing bubble is finally the latest bubble that arose between 1998 and 2006. The boom in house prices in the U.S. occurred during the Great Moderation, a period that began in the mid-1980s which was characterised by the presence of low volatility and relatively low inflation (Hakkio, 2013). These conditions, together with a better monetary policy favoured economic activity and led to the longest period of economic expansion since World War II (Hakkio, 2013).

As Weinberg (2013b) explains and as Figure 2.9 portrays, between 1998 and 2006 the real estate sector experienced a remarkable growth during which nominal home prices increased by more than 100%, the largest increase recorded in such a short period of time in U.S. history.

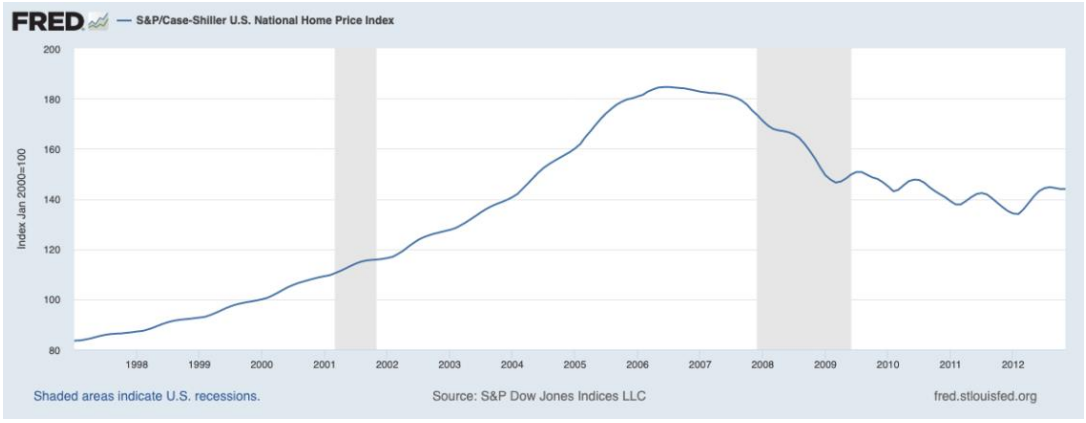

Figure 2.9: S&P/Case-Shiller U.S. National Home Price Index, January 1996 - January 2007
Source: S&P Dow Jones Indices LLC as reported by the Federal Reserve Economic Data

The property boom saw home ownership increase by about 5% and the residential investment's share of U.S. GDP rise by about 2% between 1994 and 2005, moreover between 2001 and 2005 the real estate sector contributed to the creation of around 40% of net private sector jobs (Weinberg, 2013b).

The home price index started falling in the summer of 2006, recording a 27.4% drop between July 2006 and February 2012.

Shiller (2008) underlines that while similar booms for real estate prices could be found also in the past they only occurred in singular cities. On the other hand, in this occasion the phenomenon involved most of the country. Moreover, despite the presence of slight differences in price movements across cities, the decline occurred at the same time for all of them as can be seen from Figure 2.10.

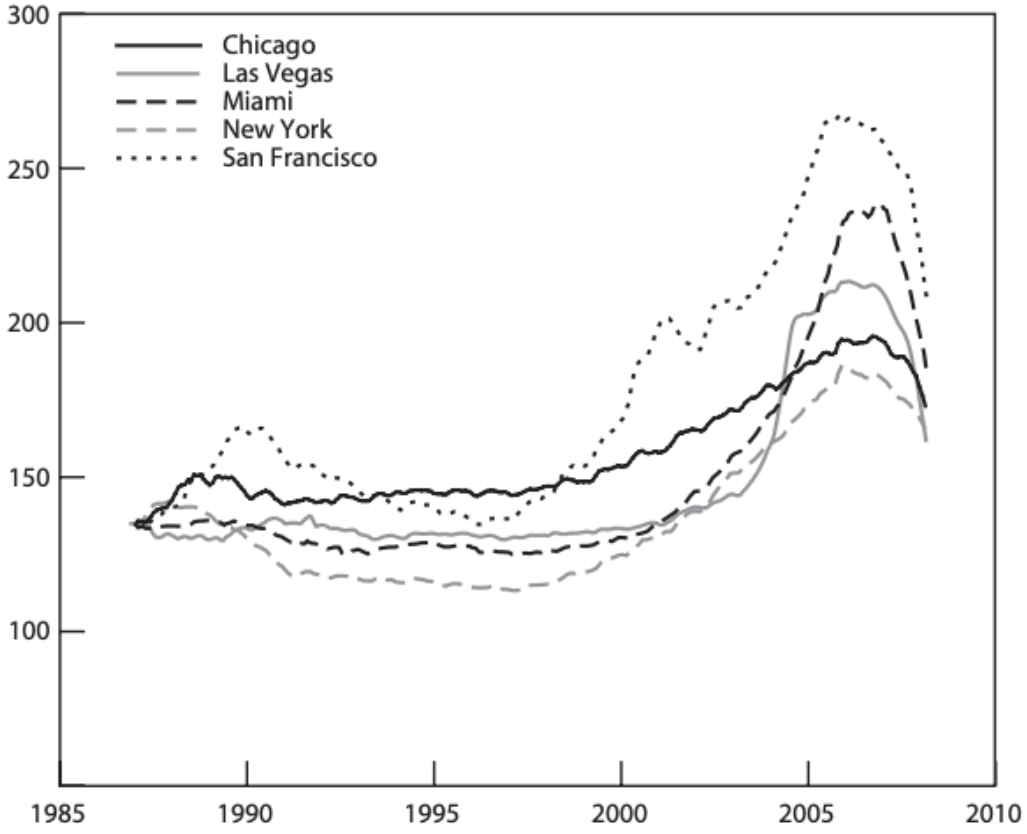

Figure 2.10: Monthly real home prices in selected U.S. cities, January 1987 - March 2008
Source: Shiller (2008)

As Quinn and Turner (2020) assert, the housing boom that occurred in the U.S. was not an isolated case, but it was actually a global phenomenon that emerged in several countries including Ireland, the U.K. and Spain. The aforementioned countries experienced similar trends in house prices between 1998 and 2007, as can be seen in Figure 2.11, recording increases of 133% for Ireland, 134% for the U.K. and 103% for Spain. Moreover, numerous other countries contributed to the promotion of the housing boom due to the interconnectedness of the markets and were therefore linked to the evolution of the house prices.

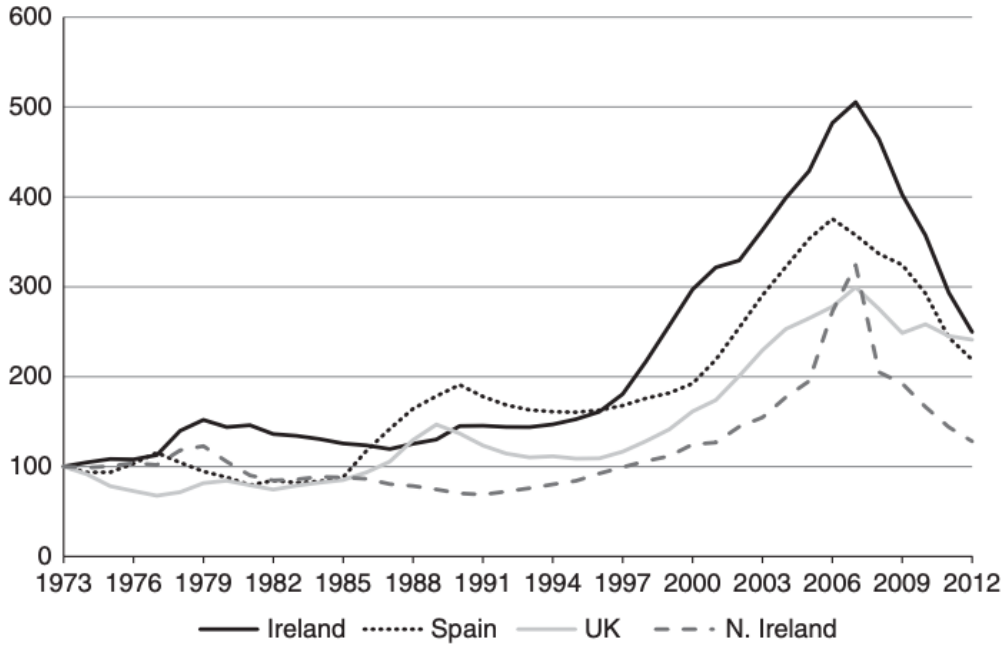

Figure 2.11: Indexes of real house prices for Ireland, Spain, UK and Northern Ireland, 1973-2012
Source: Quinn and Turner (2020)

2.6.1. Was this event a bubble?

In 2005 Shiller declared that "the market is in the throes of a bubble of unprecedented proportions that probably will end ugly" (Laing, 2005). He asserts that the bubble was the result of the "social contagion of boom thinking" (Shiller, 2008, p. 41) which pushes individuals to believe that the prices will keep increasing and that the boom would not stop.

Shiller (2006) also compares the housing rent-to-price (R/P) ratio, which had been gradually decreasing since 1913 but started recording an abrupt fall from 1995, with the real interest rates and determines that because the real interest rate did not follow the R/P ratio movements, then there probably was irrational overpricing. The evolution of these two indicators is shown in Figure 2.12.

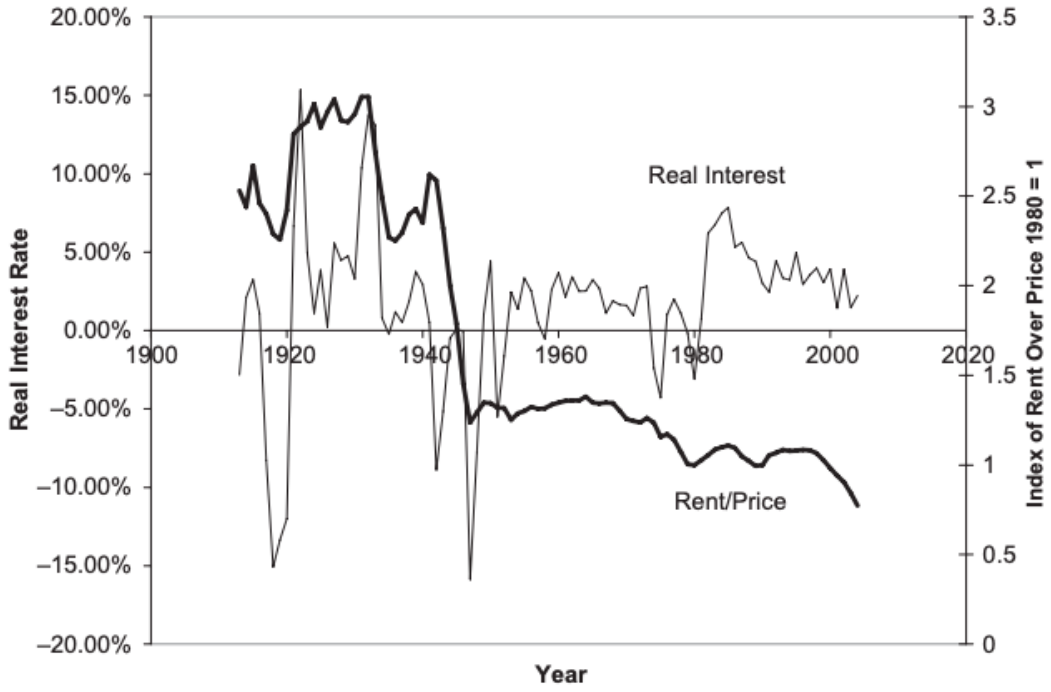

Figure 2.12: Real interest rate and rent-to-price ratio in the U.S., 1913-2005
Sources: Shiller (2006).

On the other hand, Himmelberg, Mayer, and Sinai (2005) assert that, as of 2004, there is no evidence of any housing bubble since the price increases still reflect the fundamentals. In fact, the rise in prices is consistent with the low real long-term interest rates, large increase in income and the exceptionally low house prices in the mid-1990s. They also justify the rise in the price-to-rent ratio by asserting that it is more sensitive to low long-term interest rates. Moreover, they find that in 2004 only a couple of cities might have had overvaluations in their housing prices at best, however in the majority of cases prices were “reasonable”.

2.6.2. Factors that contributed to the formation and development of the bubble

Several theories have been advanced on the potential causes of the housing bubble which are based on different perspectives.

Taylor (2009) argues that the easy monetary policy implemented by the Federal Reserve was the main source of the swift rise in real estate prices and what ultimately led to the burst of the bubble. Because of the presence of low interest rates, risk taking increased and mortgages started being extended to more individuals than before as the mortgage underwriting procedures saw delinquency rates being particularly low.

On the other hand, Shiller (2006) asserts that the bubble was the result of "irrational exuberance" and of the belief of many individuals that real estate prices would keep increasing. This thought was strengthened by the behaviour of the media who published several articles revolving around the price increase, thus creating a feedback loop. Investors reading the articles expected prices to continue their upward trajectory and therefore purchased more stocks which in turn led to a further increase in prices.

Levitin and Wachter (2012) believe that the causes of the bubble are multiple, however they assert that the predominant element that determined its emergence was the excessive supply of housing finance which arose as a consequence of the transformation of the structure of the mortgage-finance market.

As Quinn and Turner (2020) state that one of the main factors that contributed to the development of the bubble was the extension of credit, in particular related to mortgages, thanks to the loosening of lending standards. As a consequence of this, several new financial instruments emerged, including the subprime mortgage which is type of loan that is extended to individuals who do not completely fulfil the prerequisites necessary to apply for a mortgage. This product therefore entails a higher interest rate than standard mortgages as the borrowers have a higher default risk (Bondarenko, 2019b). Thanks to the introduction of these financial instruments, loan-to-value ratios started reaching levels close to 100% to extend access to housing credit to many more individuals coming in particular from poorer backgrounds (Quinn and Turner, 2020) and subprime mortgages increased sharply from 8% in 2003 to 20% in 2005 and 2006 (Joint Center for Housing Studies of Harvard University, 2008).

The subprime mortgages were funded by repackaging them in pools with other types of mortgages to create mortgage-backed securities which would then be purchased by

investors who receive a percentage of the underlying payment in exchange (DiMartino and Duca, 2007). However, these practices often hid several risks since many contracts offered discounted rates only for the first years and then reset terms, thus leaving borrowers exposed to sudden increases in their obligations which were not as manageable as before (Joint Center for Housing Studies of Harvard University, 2008). Moreover, as Quinn and Turner (2020) state, mortgage-backed securities were often assigned an AAA rating from rating agencies during the bubble period, making them attractive to investors since they basically signalled the absence of risks from the security. Riskier mortgages that could not be included in mortgage-backed securities were instead incorporated in Collateralised Debt Obligations (CDOs) which nevertheless received AAA ratings, despite the high risk they entailed, because of perverse incentives.

This repackaging process, also known as securitisation, produced a series of consequences including the almost total elimination of due diligence and audit by lenders on borrowers since they did not bear any risk but the losses would be suffered only by the owners of mortgage-backed securities and CDOs. Secondly, the extension of lending standards allowed borrowers to have a bigger leverage, moreover many CDOs and mortgage-backed securities were financed through debt or were used as collateral to create additional CDOs funded by loans. Finally, thanks to these new financial instruments investors had the possibility to exploit the housing boom without having to buy or sell an actual property and without making loans to homeowners (Quinn and Turner, 2020).

2.6.3. The burst of the bubble and the financial markets contagion

As Duca (2013) asserts, the increase in subprime mortgages, and therefore in home purchases, drove up the house prices especially in the areas where there were shortages and generated expectations for even higher returns in the future. At the beginning investors holding mortgage-backed securities gained large profits and were protected from risks by the constant rise in home prices: in fact, if the borrowers were not able to meet their payment obligations they could either settle the mortgage by selling their house or borrow more, exploiting the higher market prices for houses as collateral. However, due to the novelty of the situation there was uncertainty about the sustainability of the new financial instruments in the long-run. In fact, despite the increase in the interest rate implemented by the Federal Reserve in 2004, house prices kept rising

rapidly and by the end of 2005 the levels reached were too high and not sustainable anymore (Joint Center for Housing Studies of Harvard University, 2008). As a consequence, refinancing the mortgage or selling the house did not constitute feasible options anymore and mortgage loss rates increased for both lenders and borrowers, thus pushing demand for housing and house prices down (Duca, 2013).

By 2007 home sales had dramatically declined as did home equity, moreover many homeowners were not able to comply with the payments deadlines but were not able to sell their houses to fully repay their mortgage (Joint Center for Housing Studies of Harvard University, 2008 and Duca, 2013). Between February and March 2007 more than 25 subprime lending companies declared bankruptcy and, as a result of this crash, the Dow Jones Industrial Average recorded the biggest one-day point loss since 9/11 on February 27th (Council on Foreign Relations, viewed 19 January 2022). Because of the dramatic, sharp decline in demand for mortgage-backed securities investors were forced to sell them at a loss and in some cases they even had to default since they could not pay back the funds they had borrowed to purchase the securities (Joint Center for Housing Studies of Harvard University, 2008).

This situation induced financial institutions to apply more strict credit standards, particularly for high-risk mortgages, ensuing a disruption in the housing market for an extended period of time (Di Martino and Duca, 2007 and Joint Center for Housing Studies of Harvard University, 2008). The collapse of subprime mortgages only exacerbated the decline in housing prices and the recession in the economy since investors started asking for higher returns to bear the higher risk (Joint Center for Housing Studies of Harvard University, 2008). As the Council on Foreign Relations (Viewed 19 January 2022) states, in April 2007 the financial distress spread forcing more and more subprime lending institutions, including the largest one, New Century Financial Corporation, to declare bankruptcy. In the following months the pressure started affecting also other sectors in the financial market; indeed Bear Stearns, one of the most important investment banks in the U.S., announced in July 2007 that two of its hedge funds would file for bankruptcy after losing almost all of their investor capital. The subprime crisis subsequently expanded worldwide once it became known that many foreign financial institutions held significant stocks of mortgage-backed securities and lending markets all around the world drained. In particular, the first evidence appeared on August 7th when the French BNP Paribas announced that it had suspended the redemption of shares of some of its money market

funds (Mishkin, 2011) and subsequently declared that there was no liquidity in the market for these assets (Council on Foreign Relations, viewed 19 January 2022). As Quinn and Turner (2020) assert, because of the cessation of interbank lending due to the surge of LIBOR, the interbank market interest rate, some financial institutions found themselves in challenging situations as they lacked liquidity. In particular, the largest mortgage bank in Britain, Northern Rock, heavily suffered from this situation as it was not able to raise funds and had to be supported by the Bank of England. When depositors discovered this operation they began a run to withdraw their money which only came to a halt after the Chancellor ensured that their deposits were guaranteed and the bank ended up being nationalised on February 17th, 2008.

As Mishkin (2011) states, in the U.S. throughout the following months a run on shadow financing system emerged which culminated with the disruption of Bear Stearns in March 2008. The institution had encountered financial troubles since January 2008 and by March it was not able to raise enough funds to meet its obligations anymore and was thus forced to accept a merger with JPMorgan Chase, assisted by the Federal Reserve (Weinberg, 2013c). This event raised uncertainty over the stability in the financial markets and spread panic over a possible crash of the financial sector (Council on Foreign Relations, viewed 19 January 2022) which led to an increase in credit risk (Mishkin, 2011).

In the summer of 2008 the federal government announced it would seize Freddie Mac and Fannie Mae, the two federally backed private corporations that support the mortgage market by supplying constant and affordable home financing (Nolen, 2020a and 2020b) after they recorded significant losses. In fact, the two institutions were affected by the decline in value of subprime mortgage-backed securities they had purchased through borrowed funds and by the default on prime mortgages they had bought and then repackaged in mortgage-backed securities to sell to investors (Duca, 2013).

2.6.4. The Global Financial Crisis

The transformation of the subprime crisis into a global financial crisis occurred on September 15th with the collapse of Lehman Brothers, one of the largest investment banks in the U.S. (Mishkin, 2011). When the institution filed for bankruptcy the government refused to bail it out since it was deemed not to constitute a systemic threat and also in order to avoid the expansion of moral hazard among financial institutions (Quinn and Turner, 2020 and Council on Foreign Relations, viewed 19 January 2022). As a consequence of the disruption of Lehman Brothers, on the following day AIG, which had entered $400 billion of credit default swaps, found itself under pressure to provide payments for these insurance contracts and saw its short-term funding dissolve (Mishkin, 2011). The Federal Reserve therefore intervened by providing liquidity to bail out AIG in order to avoid a collapse of the entire system considering that many financial institutions had purchased credit default swaps from it (Quinn and Turner, 2020). Nevertheless the financial system still threatened to explode and even the loans that were once considered totally safe like money market mutual funds suffered from the financial turmoil that arose (Romer, 2009). In fact, the Reserve Primary Fund, a very important money market fund that had purchased $785 million of Lehman's commercial paper, announced it was not able to redeem its shares at the usual value of $1 thus generating a run among investors who rushed to withdraw their money (Mishkin, 2011). This announcement generated a general run on money market funds that did not exclusively hold U.S. Treasuries and other federal bonds, with investors either exiting completely these funds or moving their money on government-only funds (Weinberg, 2013c). Mishkin (2011) reports that between September and October 2008 the assets in institutional money market funds declined from $1.36 trillion to $0.97 trillion, almost a 30% loss. This decrease generated distress in the banks as a large contribution to their funding was provided by money market funds through commercial paper and certificates of deposits. As de la Merced, Bajaj and Sorkin (2008) describe, on September 21st Morgan Stanley and Goldman Sachs applied to become bank holding companies, thus ending the era of independent investment banks in favour of gaining more stability. This process in fact granted both institutions more access to funding, in particular from the Federal Reserve, by accepting more regulations and prudential supervision while proving to investors that the banks were stable and safe.

On September 25th the largest bank failure in U.S. history occurred with the bankruptcy of Washington Mutual, a $307 billion institution which was seized by the Federal Deposit Insurance Corporation (FDIC) and subsequently auctioned off to JPMorgan Chase (Office of Thrift Supervision, 2008). As the Office of Thrift Supervision (2008) reports, within the previous 10 days Washington Mutual had suffered a $16.7 million withdrawal which left the institution with insufficient liquidity to fulfil its obligations and therefore making it not financially sound.

Panic kept spreading as credit spreads expanded, in particular, as Romer (2009) reports, the TED spread, which calculates the difference between the three-month LIBOR and the interest rate on the three-month Treasury bill (Federal Reserve Bank of St. Louis, viewed 31 January 2022), increased by more than 400 basis point between September and October 2008 as Figure 2.13 depicts.

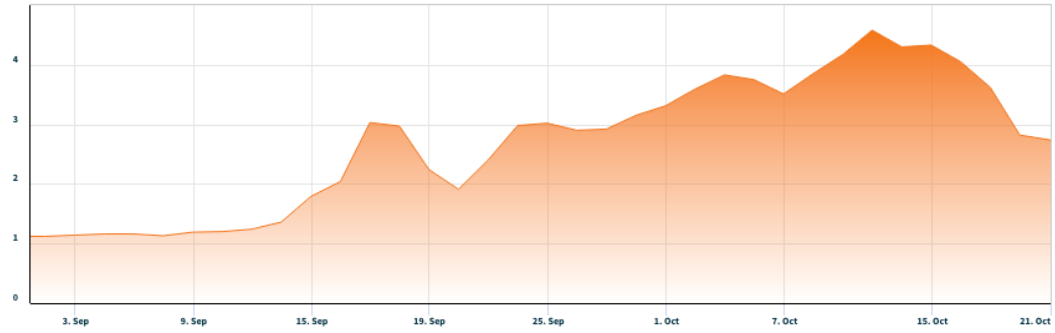

Figure 2.13: TED spread September-October 2008
Source: Nasdaq Data Link

This spread is particularly important as it is considered as a measure of credit risk since Treasury bills are considered to be risk free. In fact, this hike in the TED spread induced investors to move to safer assets and thus caused a significant reduction of the interest rates of government bonds.

The impact on financial markets was extensive as well, with stock prices that declined by 24% between September and October and recording very high levels of volatility especially in the last four months of 2008 where the variance of the S&P 500 stationed at 16.3 (Romer, 2009). Romer (2009) also states that during 2008 house prices decreased by 9% and household wealth declined by 17%.

Finally, the subprime crisis also heavily affected unemployment which sharply increased by around 400000 between August and November 2008 (U.S. Bureau of Labor Statistics, 2008a and 2008b). Nevertheless, the peak in the unemployment rate was reached only in October 2009 when it hit 10% (U.S. Bureau of Labor Statistics, 2022). Moreover, also the real GDP started declining from the third quarter of 2008 at an increasing rate, progressing from 2.7 to reach 6.4 in the first quarter of 2009 (Romer, 2009). The evolution of both the unemployment rate and the real GDP are shown in Figure 2.14.

Figure 2.14: Real GDP and unemployment rate, January 2007 - January 2016
Source: Federal Reserve Economic Data

Between the end of 2008 and the beginning of 2009 two other important financial institutions like Citigroup and Bank of America found themselves under pressure and had to rely on the Federal Reserve, the Treasury and the FDIC assistance to protect them against possible bankruptcies (Weinberg, 2013b).

The economy started recovering in the summer of 2009 with different paces depending on the sector. Real GDP managed to go back to its pre-crisis level already in the third quarter of 2010, on the other hand unemployment had a much slower recovery and only reached 5%, its pre-crisis level, in December 2015. Financial markets recovered fully only towards the end of 2012 as can be seen from Figure 2.15.

Figure 2.15: Percentage change of S&P500 Index and Dow Jones Industrial Average Index, 2007-2013.
Source: Yahoo Finance

2.6.5. The Sovereign Debt Crisis

The situation in Europe was even more drastic as the burst of the housing bubble led to a sovereign debt crisis. As Baldwin and Giavazzi (2015) assert, several Eurozone countries' governments and banks were in fact relying on loans coming from investors from other member states and were left in a very precarious situation when the lending markets dried up. The lack of liquidity consequently led to a decline in growth which caused an extension of deficits and rising public debt ratios as governments were forced to provide assistance to their banks. The crisis was exacerbated by the very nature of the Eurozone and the incompleteness of its system, in fact the countries that came under pressure did not have a lender of last resort since national central banks cannot produce more money to provide it to governments and the ECB is specifically prohibited from performing this function. Furthermore, one of the most common responses to the crisis, devaluation, was not a viable option in the Euro area. Many financial institutions in the Eurozone were highly leveraged and thus had a much larger percentage of debt with respect to equity, in particular the debt they held was often larger than their country's GDP. This condition

made the banks systemically important and thus forced governments to intervene to bail them out despite running the risk of defaulting themselves in doing so. Because of the close connection between banks and their governments, the lack of liquidity of banks caused apprehension over the possible lack of solvency of governments and vice versa. Between September and October 2008 many institutions in the euro area had to receive financial assistance from their governments, however the situation in some countries was more worrying than in others (Quinn and Turner, 2020). In particular, Copelovitch, Frieden and Walter (2016) provide a short summary of the main events that characterised the sovereign debt crisis. The emergency was originated by the announcement of the newly elected Greek government that the country's budget deficit was much larger than the previous computations had estimated and that the level actually exceeded the rules established by the EU. As a consequence, credit rating agencies began downgrading Greek bonds until they reached the junk grade and their spreads climbed, depressing stock markets and the euro currency. In particular, Sibert (2010) reports that the spread on the 10-year government bond with Germany, which is considered a risk-free country, amounted to around 225 basis points in January 2010 and increased to more than 1000 basis points in May, as can be seen in Figure 2.16.

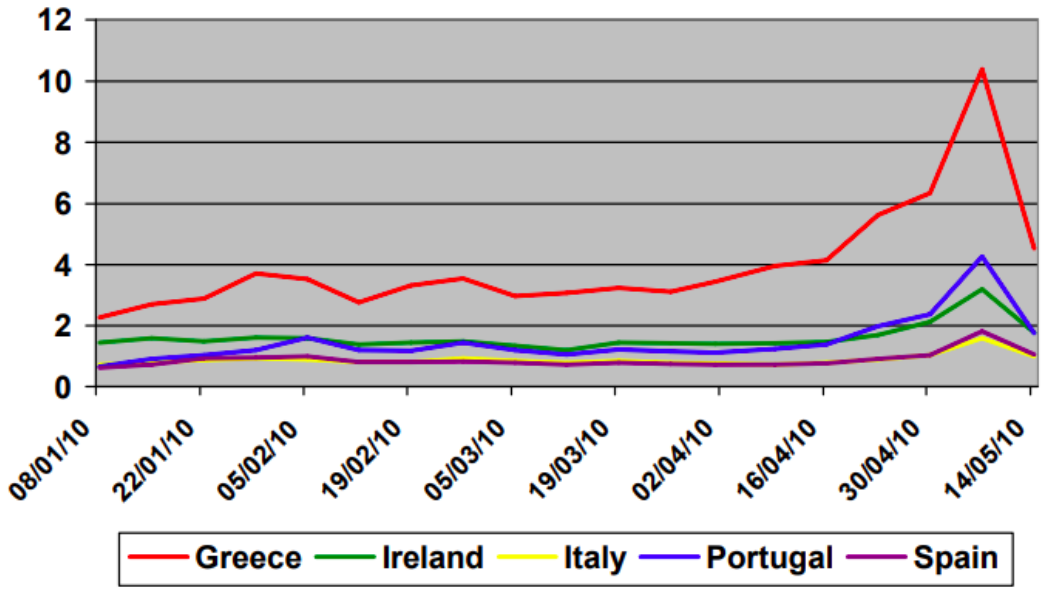

Figure 2.16: 10-year government bond spreads (%) over German benchmark
Source: Financial Times as cited in Sibert (2010)

Moreover, a similar evolution could be documented for the spread on the 5-year credit default swap for Greek government debt.

At the beginning of 2010 Greece had introduced austerity measures which did not succeed in improving the situation, forcing the government to ask to the EU for assistance. However, the EU did not react promptly to the request as debate arose on whether to intervene and to which extent and, in the end, together with the International Monetary Fund, it provided a €110 billion support package only in May, conditional on the implementation of fiscal reforms and austerity measures (Gibson, Hall and Tavlas, 2012). Nevertheless, these policies encountered the opposition of the general public who protested against their implementation (Copelovitch, Frieden and Walter, 2016).

Despite the implementation of several measures to provide liquidity to member states in distress and to introduce stricter surveillance of macroeconomic measures, the sovereign crisis in the EU only worsened throughout 2010, affecting especially Ireland and Portugal (Copelovitch, Frieden and Walter, 2016).

In particular, Quinn and Turner (2020) report that at the beginning of 2009 Ireland had nationalised the Anglo Irish Bank which had been one of the major institutions to finance the housing bubble, and it had created the National Asset Management Agency to acquire part of bad property loans from banks. In spite of this, the financial institutions were suffering much larger losses which would require a very significant contribution from the government, thus international markets began fearing that the Irish government would not be able to bear all these costs. As a consequence, many foreign investors started withdrawing their money from Irish banks, while the Irish sovereign debt yield increased considerably. The EU had to intervene in November 2010 by bailing out Ireland with a €85 billion package to provide assistance to the disrupted banking system. Portugal suffered a similar fate and received a €78 billion rescue package in May 2011.

As the pressure kept rising in Greece because of additional implementation of austerity policies and considerations were made about the possibility of an exit from the EU, Greece obtained a second support package of €130 billion in March 2012.

In June 2012 Spain experienced a similar situation to what Ireland suffered 18 months earlier; as Quinn and Turner (2020) report, the government was in fact trying to provide liquidity to troubled financial institutions through a restructuring plan by promoting mergers among banks and granting debt guarantees to institutions that purchased the insolvent ones. However, in doing so it created systemic institutions where they did not

exist before and the government's debt guarantees strictly tied the state creditworthiness to the one of the banks. International markets were worried about the resilience of the banking system which in turn pushed the EU to provide a €100 billion of assistance to recapitalise the sector.

Finally, also Cyprus had to request the EU assistance which was provided in March 2013 after lengthy consultations. The terms of the package also included high fees on deposits that exceeded €100000 and the closure of the troubled Laiki Bank (Copelovitch, Frieden and Walter, 2016).

Because of the slow response of the European institutions the recession kept worsening as credit agencies downgraded government bonds of several member states while the public protested against the austerity policies. (Copelovitch, Frieden and Walter, 2016).

The first country to exit the EU support packages was Ireland in December 2013, subsequently followed by Spain in January 2014 and Portugal in May 2014. (Copelovitch, Frieden and Walter, 2016).

2.6.6. Comparison on the impact on markets during the Great Depression and the Great Recession

Romer (2009) proposes a comparison between the impacts of the Great Depression of 1929 and of the Great Recession of 2008. While in both cases one of the main factors contributing to the emergence of the crisis was the decline in household wealth, the severity of the shock was much larger in 2008. In fact, it is true that between September and December 1929 stock prices declined by 33%, however between June and August 1930 they experienced a 27% growth, hence recording only a 14% drop over the year. The evolution of the S&P90 index during the Great Depression is depicted in Figure 2.17.

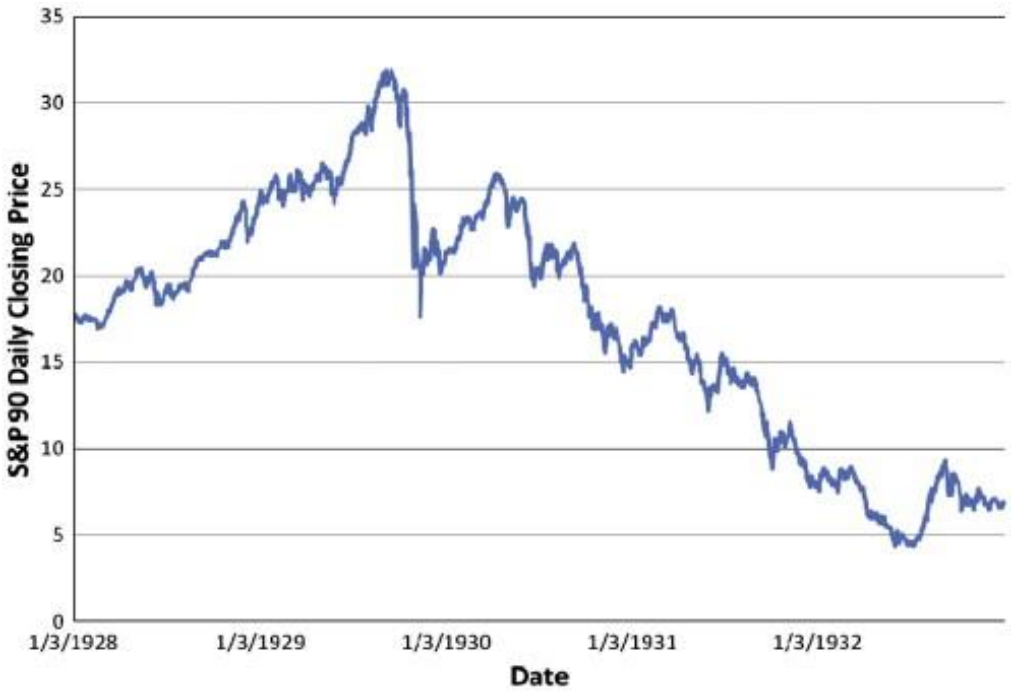

Figure 2.17: S&P90 Daily Closing Price
Source: Global Financial Data as cited in Shachmurove (2011)

On the other hand, during the Great Recession the S&P500 recorded a 24% drop only between September and October 2008, and almost a 40% decline over the year as is shown in Figure 2.18.

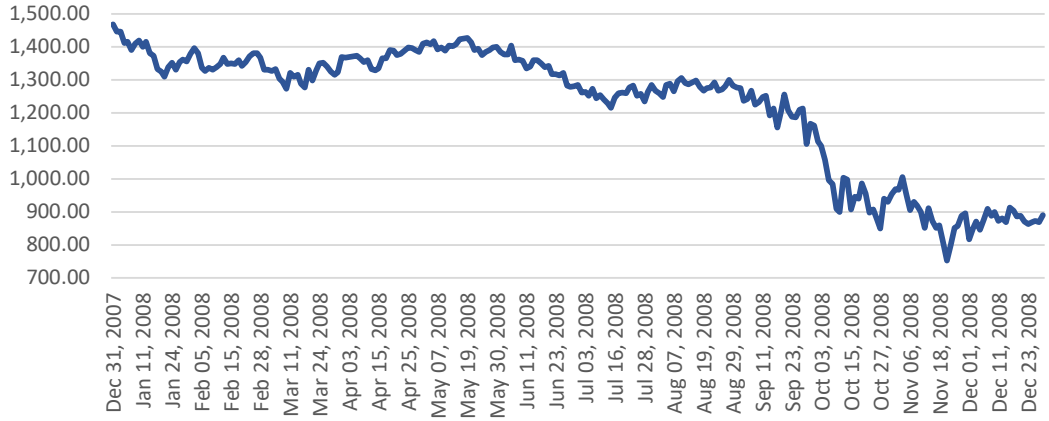

Figure 2.18: Adjusted Close Prices of S&P500, December 31st 2007 - December 31st 2008
Source: Yahoo Finance

As Romer (2009) reports, the S&P500 volatility throughout the last four months of 2008 which amounted to 16.3 was more than a third larger than the volatility recorded in the same period of 1929 for the S&P90 which only reached 12. Moreover, between December 1928 and December 1929 house prices only decreased marginally, thus entailing a 3% drop in household wealth, which corresponded to about one fifth of the decline in household wealth experienced in 2008.

Another factor which has highlighted the difference in the perception of risk between the two crises is the credit spread. There is no available data for the TED spread before 1986, however it is possible to compare the spread between Moody's BAA and AAA bonds.

As it can be seen in Table 2.1 and in Figures 2.19 and 2.20 the spread only rose by less than 10 basis points between August and October 1929, on the other hand in the same period in 2008 it increased by 109 basis points, later peaking at 338 basis points in December

Date	BAA-AAA spread (%)	Date	BAA-AAA spread (%)
1929-08-01	1.25000	2008-08-01	1.51000
1929-09-01	1.32000	2008-09-01	1.66000
1929-10-01	1.34000	2008-10-01	2.60000
1929-11-01	1.27000	2008-11-01	3.09000
1929-12-01	1.28000	2008-12-01	3.38000

Table 2.1: Spread between Moody's BAA and AAA bonds, July 1929-January 1931 and July 2007-January 2009
Source: Federal Reserve Economic Data

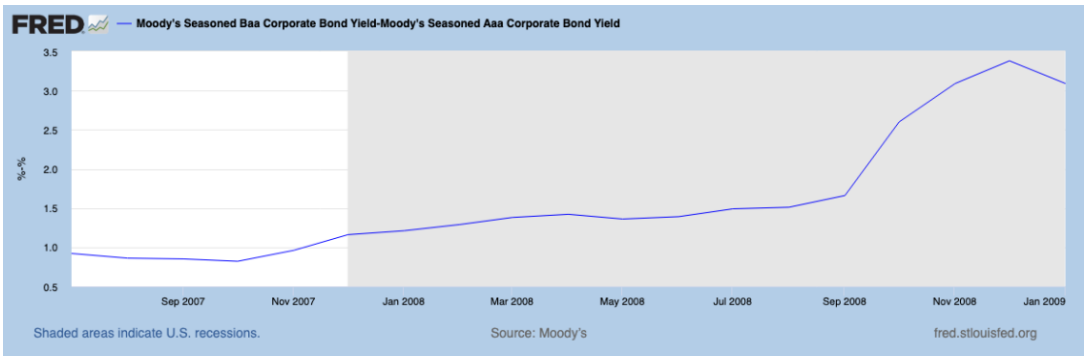

Figure 2.19: Spread between Moody's BAA and AAA bonds, July 2007-January 2009
Source: Moody's as cited by the Federal Reserve Economic Data

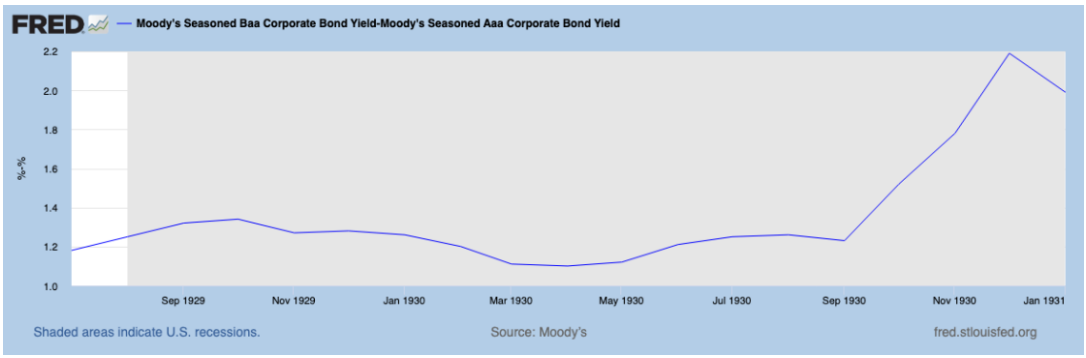

Figure 2.20: Spread between Moody's BAA and AAA bonds, July 1929-January 1931
Source: Moody's as cited by the Federal Reserve Economic Data

The peak in the spread during the Great Depression only occurred after the banking panic of September 1930, nevertheless the increment was lower than during 2008 since the spread only reached 219 basis points, recording a 96 basis points increase (Romer, 2009).
To conclude, an overview of the most important bubbles that have occurred throughout the course of history has been presented, firstly by introducing a brief historical summary of the event, followed by an analysis of the possible reasons that might have led to the burst of the bubble and the crash of the market in every single case. Subsequently, the opinions of several scholars on whether any of these occurrences could actually be defined as a bubble have been collected. Aside from the Dot-com bubble, on which no evidence of scholars disputing the presence of a bubble has been found, in all the other cases opinions are divergent. Many scholars have in fact assigned different definitions to what a bubble is or have used different methods, data and calculations to compute the fundamentals of the companies.
In the following chapter an overview of the main institutional responses to the most recent crises is presented, with a focus on the principal differences between them and on how the previous experiences served as a lesson for governments and central banks to operate more efficiently in order to promote the economic recovery.

Chapter III: Institutional responses to the burst of the bubble

The current chapter will present an analysis of the main monetary policies that were implemented as a consequence of the burst of a bubble. In particular, the focus will be on the institutional responses to the stock market crash of 1929, the Global Financial Crisis of 2007-2008 and the COVID-19 recession. The first two historical events were specifically selected since they share commonalities with the current crisis that will be highlighted in this chapter. After an initial assessment of the main measures that were introduced during these crises and of the eventual spill over effect, several comparisons will be carried out. Firstly, there will be a comparison between the policies implemented by the U.S. and the EU during the same financial crisis and subsequently an analysis of the similarities and differences in the measures implemented during the Global Financial Crisis and the COVID-19 crisis will be executed. As it will be argued, the more recent policies are an evolution of the ones applied in the previous experiences as governments and central banks learned from past mistakes to be more proactive and efficient in order to promote a faster recovery of the system.

3.1. The institutional response to the stock market crash of 1929 in the U.S.

The 1929 stock market crash was followed by the period commonly known as the Great Depression. As Crafts and Fearon (2010) report, during this period unemployment reached record levels, increasing from 2.9% in 1929 to 22.9% in 1932. Moreover, industrial production collapsed, and a lot of families were left with no source of income and, as a consequence, also the level of consumer spending drastically decreased.

Despite the critical situation the Federal Reserve did not act promptly to try and recover from the crisis and instead decided to preserve its strict monetary policy as it believed that implementing an expansionary policy would be inappropriate (Crafts and Fearon, 2010), however this decision only worsened the recession (Mishkin and White, 2002). In fact, Fishback (2010) asserts that the contractionary policies implemented between 1929 and the beginning of 1933 contributed to 50-70% of the real GNP decrease.

As Figure 3.1 depicts, the economy seemed to be on its road to recovery at the beginning of 1930, however there was a significant drop in April 1930 which led to a decreasing trend with a series of fluctuations that only started improving in mid-1932.

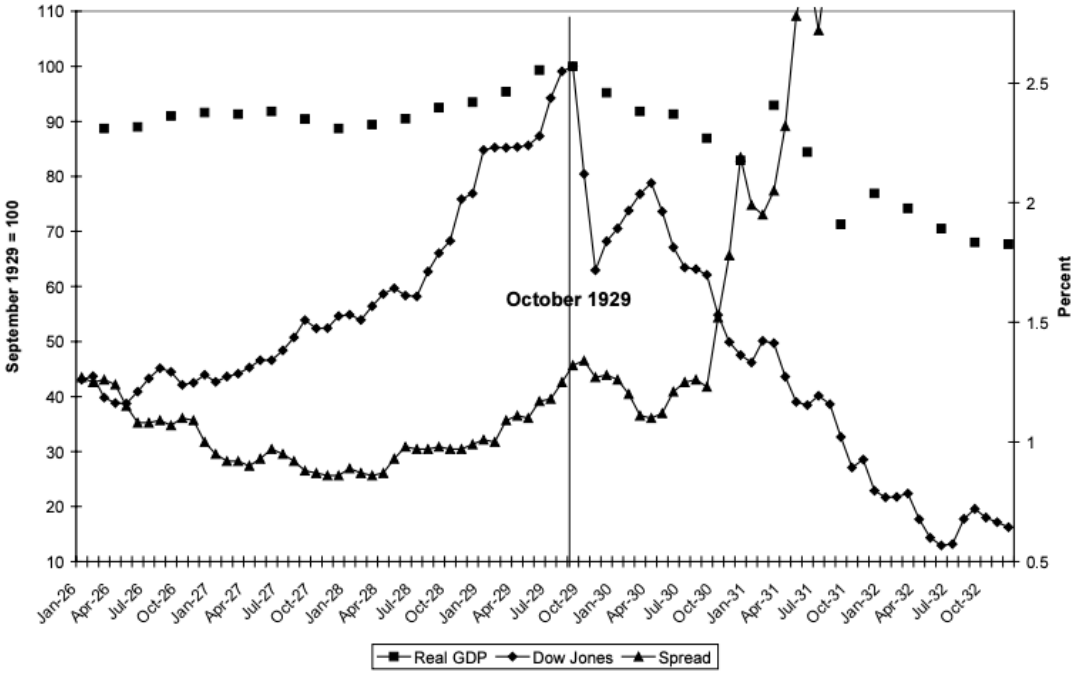

Figure 3.1: Real GDP, Dow Jones Index and Spread between Moody's AAA corporate bond rates and BBA corporate bond rate.
Source: Mishkin and White (2002)

The reason why the Federal Reserve originally failed to initiate the economic recovery is because at the time its structure was not particularly efficient and it thus prevented some governors to take effective actions (Richardson, 2013). Most importantly, a number of the Federal Reserve's Board members, including President Hoover's secretary of treasury, were supporters of the "real bills doctrine". As Richardson (2013) explains, this doctrine recommended Central Banks to provide less funds to commercial banks during contractions, including banking panics. A more extreme version even suggested not to

intervene at all in order to let weak institutions fail. The Federal Reserve therefore did not manage to halt the fall in money supply which recorded a 30% decrease between the autumn of 1930 and the winter of 1933. Friedman and Schwartz (1963b) strongly criticise its decision, asserting that it could have easily prevented the events that unfolded and raised the money stock, supplying enough liquidity to meet the financial institutions' needs without jeopardizing the gold standard.

As Fishback (2010) reports, the Federal Reserve started cutting the nominal interest rates in October 1929; following 11 steps the nominal rate was lowered from 6% to 1.5% in 1931. The members of the Board actually believed that these actions represented an implementation of easy money policy, however Fishback states that the assumption was based on the fact that they did not adjust the nominal interest rate for deflation. In fact, the real ex post discount rate, which is given by the nominal discount rate minus the inflation rate, was actually higher than the nominal interest rate since the inflation rate was dramatically dropping and entering negative territory. The data reported by Fishback (2010) which can be seen in Figure 3.2 show that in late 1929 the inflation rate was around 0% and then decreased to -2.4% at the beginning of 1930; this slightly increased the ex post real interest rate from 4.5% to 4.77%. Nevertheless, in 1931 the inflation rate reached -9% and this pushed the ex post real discount rate to 10.5%.

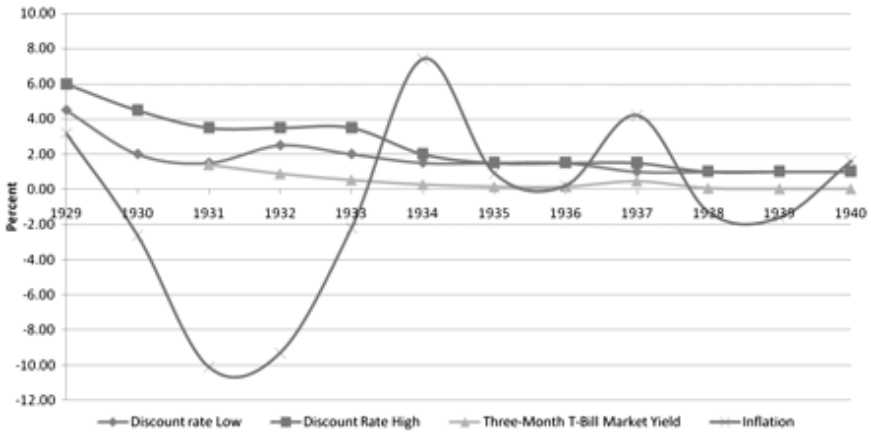

Figure 3.2: Annual high and low Federal Reserve discount rates, 3-month Treasury bond market yield, and rate of inflation, 1929–1940
Sources: Wheelock (2006), James and Sylla (2006), US Bureau of the Census (1975) as reported by Fishback (2010).

In 1930 the introduction of the Smoot–Hawley tariff which increased import duties caused a serious decrease of U.S. foreign trade as several countries responded in retaliation (Crafts and Fearon, 2010).

Towards the end of the year a wave of bank failures hit the U.S. and, although the banks involved were mostly small institutions in the south-east, a sense of panic spread among depositors. As a consequence of these events, financial institutions resolved to acquire liquidity back by calling in loans, dramatically decreasing lending even for deserving cases and by bankrupting their clients (Crafts and Fearon, 2010).

In the spring of 1931, the Federal Reserve started increasing its monetary base but the operation was not big enough to actually outweigh the effects of the recession (Richardson, 2013). Moreover, in September 1931 the UK decided to leave the gold standard[1]: this resolution prompted a second wave of bank failures in the U.S. that ultimately shattered the depositors' confidence in financial institutions and caused several bank runs. The majority of individuals did not want to deposit their funds in other banks but rather preferred to keep them idle. During the second half of 1931 a lot of employers also started cutting wages and laying off workers as they could not withstand the losses they were experiencing anymore (Crafts and Fearon, 2010). Up until then firms had complied with President Hoover's request of increasing, or at least preserving, nominal wages and to share work among the personnel (Ohanian, 2009). According to Hoover (1952), these measures would preserve "social order and industrial peace", however, Ohanian (2009) believes that these actions actually heavily worsened the Depression since, because of the deflation, wages were increased above their competitive level.

As Bowsher (1965) asserts, towards the end of 1931 the Federal Reserve also decided to increase considerably the interest rate as the several bank failures, the foreign crises, deflation and distrust of the dollar had caused important gold outflows. While long-term interest rates rose by around 1%, short-term rates actually doubled from 2% to 4%. Still, the effect of the deflation was quite severe as the real interest rate rose to 10.5% in 1931 and peaked at 12.5% in 1932 despite the decrease in the nominal interest rate operated by the Federal Reserve (Fishback, 2010). Crafts and Fearon (2010) state that the persistence of deflation led to a loss of confidence among individuals which translated into a substantial drop in investments and consumption since they would rather wait for the deflation to reach its bottom before considering important expenditures.

[1] The gold standard is a monetary system in which the unit of currency corresponds to a fixed quantity of gold in a "large international market which is substantially free" (Kemmerer, 2009). As a consequence, at any moment any country adopting this system is ready to convert currency into gold at the predetermined parity, hence the exchange rates between countries are fixed (Blanchard, Amighini and Giavazzi, 2010).

In 1932 President Hoover proposed the creation of the Reconstruction Finance Corporation with the aim of providing aid to smaller banks that could not be helped directly by the Federal Reserve. The Congress subsequently approved the Reconstruction Finance Corporation Act establishing the agency which was owned by the federal government with the mandate to make loans to "solvent but illiquid institutions" whose assets the agency deemed to be valuable enough in the long term (Gou et al., 2013). In fact, the Reconstruction Finance Corporation acted as a lender of last resort to save disrupted banks from imminent failures in an effort to provide stability to the economy. Nevertheless, the effect was hindered by the fact that the agency was forced by the Congress to make every request of help from any financial institution public. Moreover, President Hoover decided to invest in more work relief projects by extending the amount of federal spending dedicated to it to 4% of GNP. This sum was not large enough to actually have an effect on the sense of discontent of society, however it was considerable enough to result in a budget deficit for the fiscal year 1931 (Crafts and Fearon, 2010).

Between April and August 1932 the Federal Reserve also acquired $1 billion in government securities as part of a large-scale open market purchases programme (Engemann, 2013). During the summer and autumn of 1932 the American economy experienced an expansionary period which was brought to a quick end by the uncertainty over the economic policies of newly elected President Roosevelt who would only take office in March 1933 (Crafts and Fearon, 2010 and Engemann, 2013). As a consequence, a further wave of bank failures hit the country, generating panic among depositors who once again rushed to the banks to retrieve their money. The emergence of bank runs forced some states to declare state banking holidays in order to postpone the fulfilment of the banks' debt obligations (Engemann, 2013). However, these operations caused a surge in demand for currency in the other states, in particular in New York City institutions which saw their stock of government securities decline by $260 million during the month of February 1933 (Friedman and Schwartz, 1963a). Friedman and Schwartz (1963a) provide an accurate description of the events that followed: the circumstances, in fact, forced the New York City banks to ask for borrowed funds to the Federal Reserve despite their reluctance to borrowing and the panic rose even more when savings and interior banks asked for a large withdrawal of money. The Federal Reserve, however, responded to the crisis in the same way it had dealt with the previous wave of bank failures of September 1931: it increased discount rates in February 1933 to stop the

outflow but did not proceed to extend its open market purchases. Moreover, rumours about President Roosevelt implementing a currency devaluation led financial institutions to increase their foreign currency stock.

In order to stop the crisis President Roosevelt had to intervene in first person by declaring a nationwide bank holiday from March 6th to March 9th and by withholding gold shipments (Wheelock, 1992). In his Inaugural Address President Roosevelt (1933b) tried to instil a sense of hope and security among the American citizens by stating that "the only thing we have to fear is fear itself". In the following days the Congress passed a legislation that allowed Roosevelt to gradually reopen only sound financial institutions and to create a rehabilitation program for banks in distress. Under the new program the Government could in fact offer direct help to the institutions in need of a reorganisation also by providing part of the new capital required (Roosevelt, 1933a).

As Greene (2013) reports, the Emergency Banking Act had an overall positive impact as clients went back to deposit the withdrawn money once the banks had reopened. Customers had in fact redeposited about two thirds of the $1.78 billion withdrawn between February 8th and March 8th.

The new legislation also granted the President more independence from the Federal Reserve System on monetary policy choices and therefore allowed him to leave the gold standard within the first two months of his presidency (Fishback, 2010). Crafts and Fearon (2010) report that the devaluation transformed the country into a safe haven for gold and the new inflows, mostly from distressed European countries, promoted the recovery by increasing the money supply.

In April 1933 the discount rate was reduced by the Federal Reserve from 3.5 to 3% and after the election of the new Chair of the Board in May it was further lowered to 2.5%. The new Chair of the Federal Reserve Board was in fact the former Governor of the Atlanta Federal Reserve Bank which was notoriously recognised to be one of the most accommodating in supplying liquidity in the events of bank runs. Under the new direction the nominal interest rate eventually reached 2% at the end of the year; in addition to that the ex post real interest rate stayed low as well (Fishback, 2010).

Box 3.1 | The principal tasks of the Federal Reserve

The Federal Reserve has the mandate to conduct monetary policy "so as to promote effectively the goals of maximum employment, stable prices, and moderate long-term interest rates" (Art. 2A Federal Reserve Act, 1977). These objectives are often defined as the "dual mandate" of the Federal Reserve since it pursues both price stability and maximum employment with the same priority. The moderate long-term interest rates goal is achieved as a consequence of the realisation of the first two objectives. In fact, an environment where individuals that want to work either have a job or are likely to find one quite rapidly and where the price level is stable promotes the establishment of the interest rates at moderate levels (Federal Reserve, 2021b).

There is no fixed target set in order to achieve the maximum level employment as this goal is not directly measurable and varies over time, thus the Federal Open Market Committee (FOMC) bases its monetary policy decisions on estimates of the deficits from the maximum level of employment. On the other hand for what concerns inflation, the FOMC has established that the 2% rate of inflation is the most appropriate rate over the long run to achieve the Federal Reserve's mission to promote maximum employment and achieve price stability (Federal Reserve, 2021a).

Every year the FOMC issues a public statement in which it explains the interpretation of their monetary policy objectives and the foundations on which the strategy to achieve them is based. The main actions that the Federal Reserve can implement to conduct monetary policy are changes to the federal funds rate target which affect the cost of short-term interbank credit and market interest rates. Moreover, since the Global Financial Crisis the Federal Reserve has also introduced forward guidance to provide clear communications on the future monetary policy and large-scale asset purchases to increase the demand for securities and thus reduce long-term interest rates (Federal Reserve, 2021b).

In addition to this in 1933 President Roosevelt initiated a series of measures and regulations known as the "New Deal" in an attempt to recover from the effects of the Depression. A series of agencies were created in order to build new infrastructures that could improve the living situation of the population in need and provide jobs to the unemployed. Among these the Tennessee Valley Authority (TVA) was founded in 1933 with the aim to protect the region from floods by building dams and launching other

hydroelectric projects, to improve navigation and produce cheap electricity for the population (History.com editors, 2021a). Moreover, in May 1933, the Congress approved the Agricultural Adjustment Administration, a legislation that would pay farmers to control their production in order to eliminate surpluses and raise the commodities prices (History.com editors, 2021b).

In the following years two important agencies were created: the Civilian Conservation Corps (CCC) in 1933 and the Works Progress Administration (WPA) in 1935. Both institutions were designed to provide work for the unemployed, in particular the CCC entailed programs mainly directed at young unmarried men which comprised the conservation of forests, parks and farm lands (Paige, 2002). On the other hand the WPA mainly focused on building infrastructure like schools, hospitals, bridges, roads and the like and entailed a multitude of cultural programs that employed writers, actors and artists (Britannica, 2020). History.com (2021a) reports that from 1935 to 1943 the WPA provided jobs to 8.5 million people.

In 1935 the Congress ratified the Social Security Act which determined five programs: an unemployment insurance relief program, three "categorical" relief programs that provided grants to the elderly, widows with children and blind people. The final program was the Old Age and Survivors Insurance which provided pensions for old age and benefits for veterans. This project, unlike the ones previously mentioned, was solely funded and administered by the national government (Fishback and Wallis 2012).

Moreover, the government established the Securities and Exchange Commission (SEC) and the Federal Deposit Insurance Corporation (FDIC) in an effort to regulate more strictly financial institutions, protect depositors and avoid encountering again the conditions that led to the stock market crash in 1929 (History.com, 2021a).

In 1934 the discount rate reached 1.5% and, with the inflation rate boosted to 7%, this meant that the real interest rate was around -5.5% (Fishback, 2010).

Despite still involving 15% of the workforce, the unemployment rate had considerably decreased in the past years (Fishback, 2010) and real GDP was rapidly recovering, recording a 9% average growth rate between 1933 and 1936 (History.com, 2021a).

In 1935, after the implementation of the Banking Act, the Federal Reserve was granted administrative control over the reserve requirements of member institutions. After the huge loss recorded in 1929 real GDP was growing quickly but unemployment was still at 15% in 1935. The Federal Reserve was particularly afraid that financial institutions were

keeping more reserves than necessary as this would allow them to loan the excess and, as a consequence, cause a rise in inflation and hamper the recovery (Fishback, 2010).

Between 1937 and 1938 the country was hit by a contraction during which the real GDP dropped by 11% in less than a year and industrial production decreased by 32% (Park and Van Horn, 2013). Friedman and Schwartz (1963a) assert that the cause of the recession was most likely the increase in reserve requirements that were implemented by the Federal Reserve. As Fishback (2010) reports, the long-standing reserve requirements were doubled through a process that encompassed three stages: August 16th, 1936, March 1st, 1937 and May 1st, 1937. Fishback also underlines how the Federal Reserve did not understand that the reason why financial institutions increased their reserves was because they were protecting themselves from possible bank runs that may arise in the future since they did not rely on the Federal Reserve intervention as lender of last resort in the event of banking panics.

As White (1990) states, during the 1920s stock markets abroad were usually independent from the American market and thus were not influenced by the Great Depression. As a consequence there were no real spillovers of the recession on foreign economies.

Nevertheless, the impact of the Great Depression on the American economy was particularly severe: as Figure 3.3 depicts, the unemployment rate experienced a swift increase between 1929 and 1933, it peaked at 25.59% in May 1933 and subsequently encountered some swings in the following years, however it only reached levels below 5% by July 1941. The real GDP growth rate was negative between 1929 and 1933 and it reached its lowest point in 1932 when it recorded a -12.9% change, nevertheless after a first attempt at a recovery it experienced a sudden drop in 1937 and 1938 when it entered negative territory again, and then it gradually recovered in the following years.

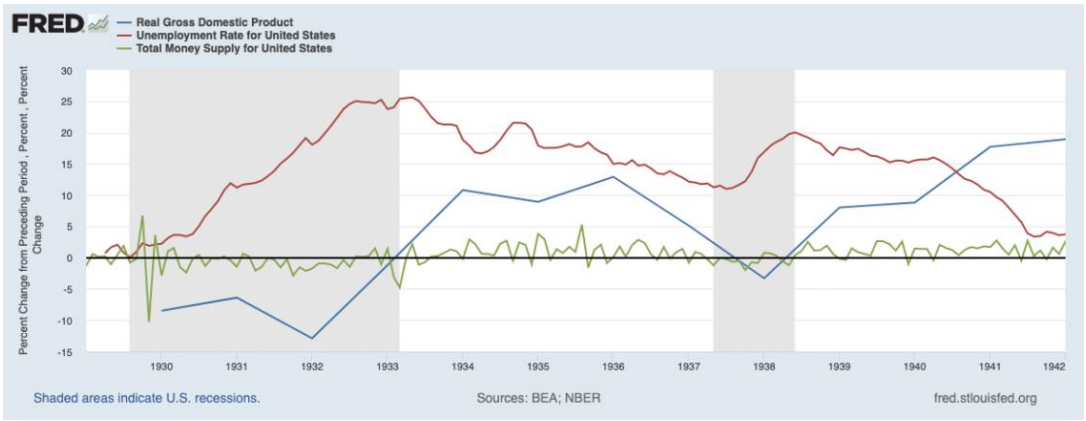

Figure 3.3: Percentage change of real GDP, unemployment rate and total money supply for the U.S. *Source:* U.S. Bureau of Economic Analysis and National Bureau of Economic Research as cited by the Federal Reserve Economic Data.

The change in the money supply suffered a significant fall towards the end of 1929 and did not really enter positive territory until the end of 1932, suggesting that there were no big liquidity injections until that period. Between July and November 1932 there was a first positive trend which approximately coincides with the Federal Reserve open market purchase programme. The increase in money supply however started in mid-1933 which coincides with the time in which President Roosevelt exited from the gold standard.

As the data show the U.S. entered a severe recession between 1937 and 1938 during which GNP decreased by 9% and deflation was at 11% (Fishback, 2010). As Velde (2009a) states, one theory advances that this contraction was the result of "premature tightening of policies and inflation concerns". In fact, there had been increasing concerns over the size of the public debt which had moved from 16% of GDP in 1929 to 40% of GDP in 1936 due to the financing of the New Deal. As a consequence, the government tried to go back to a balanced budget in 1936 by increasing taxes, nevertheless the taxes were repealed shortly after in 1938 as they were not successful. Moreover Friedman and Schwartz (1963a) assert that the rise in reserve requirements operated by the Federal Reserve and the sterilisation of gold inflows[2] by the Treasury "significantly intensified the severity of the decline" by initially sharply declining the money stock and subsequently turning it into a decline.

As Eggertsson and Pugsley (1997) state, the main mistake made by the government was the lack of a clear and efficient communication policy: in fact, as the government was concerned over the possibility of an excessive inflation, it started producing ambiguous and confusing signals about future policies. As a consequence, negative expectations over the future growth and inflation started arising which led individuals to believe that the government would adopt deflationary policies and those very expectations contributed to the actual contraction. In particular, the authors find that the effect of communication policy is important especially when the short-term interest rate is zero since the economy is more sensitive to contractionary spirals.

The institutional response to the crisis was not particularly varied since the Federal Reserve mostly operated by altering the interest rate, however the government response brought a radical change. The decision of President Roosevelt to exit the gold standard

[2] Gold sterilization is an operation made by the central bank to protect the domestic monetary base from fluctuations due to gold inflows and thus avoid appreciation and/or inflation. In order to do so, the Treasury started paying for the gold that was brought at the price of $35 per ounce using proceeds from the sales of bonds. In this way despite the increase in the gold stock, the monetary base stayed more or less the same.

meant the change of monetary system and allowed him to increase the money supply and implement a large relief programme, that lasted from 1933 to 1939, to promote the economic recovery and provide support to the unemployed and the most disadvantaged individuals. The New Deal total spending amounted to $41.7 billion in then-current dollars, however Fishback and Kachanovskaya (2015) report that the sum corresponds to around $793 billion of 2021 dollars. Nevertheless, the stimulus package implemented at the time corresponded to about 40% of the 1929 GDP (Dupor, 2021). Moreover, as Velde (2009a) when the recession hit in 1937-1938 President Roosevelt decided to implement an additional fiscal support programme by increasing spending by $2 billion and monetary policy was turned around as well to promote a quick recovery. Gold sterilisation was therefore halted and reserve requirements were reduced (Waiwood, 2013).

3.2. The institutional response to the Global Financial Crisis of 2007-2008

3.2.1. The Federal Reserve response

The fall in residential construction activity and the consequent subprime mortgage crisis that occurred in 2007 had serious repercussions in the financial markets all over the world, in particular leading the U.S. to enter a recession in December 2007 (Weinberg, 2013b). As Figure 3.4 shows, real GDP growth started declining, reaching -2.6% in 2009, while the unemployment rate suffered a steep increase, peaking at 10% in October 2010.

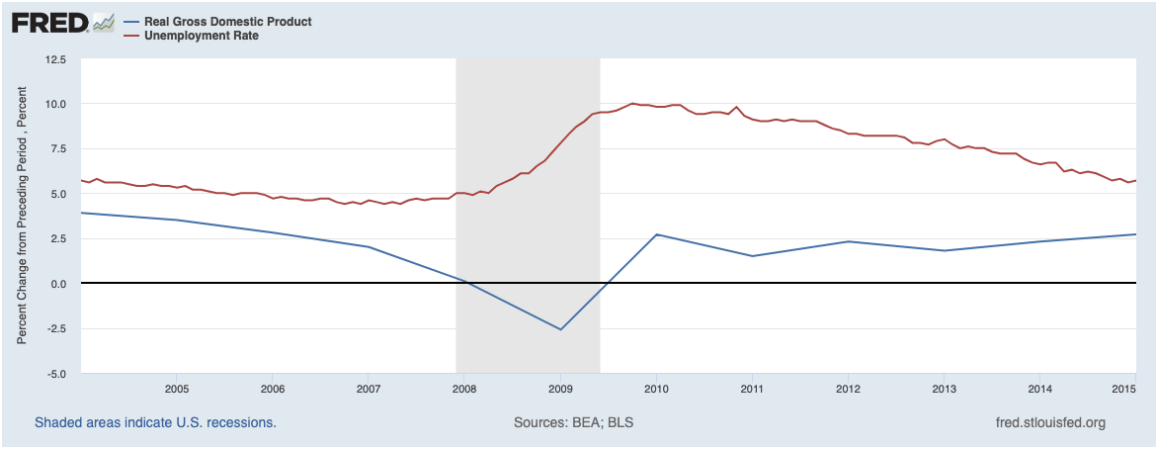

Figure 3.4: Percentage change in real GDP and percentage of unemployment rate
Source: Bureau of Economic Analysis and National Bureau of Economic Research as cited by the Federal Reserve Economic Data.

During this period a series of large financial institutions, including Bear Stearns and AIG, found themselves in situations of hardship because of the huge losses they had suffered. Weinberg (2013a) states that unlike after the stock market crash of 1929, this time the Federal Reserve responded promptly to the needs of the financial institutions for liquidity by applying Section 13(3) of the Federal Reserve Act that allowed it to extend lending also to corporations, partnerships or individuals in "unusual and exigent circumstances" (Federal Reserve Act, 1913).

The Federal Reserve lowered the discount rate from 6.25 to 5.75 in August 2007, reducing it to only 0.5 more than the federal funds rate, the rate at which interbank loans are granted (Weinberg, 2013a). Moreover, despite the fact that the Federal Reserve had extended the access to discount windows, its standard lending facility, many financial institutions were not willing to borrow through it as they were worried it would be interpreted as a sign of financial distress. Consequently, the Term Auction Facility (TAF) was formed in December 2007 with the aim of providing a more direct connection to request term funding (Federal Reserve, 2016). The TAF was only available for financially sound institutions, moreover the funds were provided through auctions and all loans were fully collateralised (Weinberg, 2013a).

Furthermore, in December 2007 the Federal Reserve also joined central bank liquidity swap lines [3]to increase the interconnection and coordination between the most important central banks in the world and provide liquidity in U.S. dollars to foreign markets (Truman, 2009). In March 2008 the Federal Reserve also created the Term Securities Lending Facility (TSLF), the TSLF Options Program (TOP) and the Primary Dealer Credit Facility (PDCF). Weinberg (2013a) presents a description of each project: the first measure provided the possibility for primary dealers, which are financial institutions that can trade securities with a national government, to borrow relatively liquid Treasury securities in exchange for less liquid assets as collateral. On the other hand, the TOP entailed the possibility to buy options to access a TSLF loan in exchange for an appropriate collateral. Finally, the PDCF provided overnight loans for primary dealers with fully collateralised credit.

[3] Central bank liquidity swap lines are arrangements made between the central banks of different countries allowing them to borrow currency issued by the other country in exchange for its own currency. The borrowed sum will have to be paid back with an agreed interest at a specified date in the future. The aim of this instrument is to relieve some of the pressure from international funding markets (European Central Bank, viewed 11 February 2022).

As Weinberg (2013c) asserts, some of the beneficiaries of these measures were large financial service institutions like Bear Stearns and AIG. The former encountered liquidity problems in March 2008 and could not find enough funding to meet its obligations. In this case the Federal Reserve Bank of New York was allowed by the Board of the Federal Reserve to grant a loan through JP Morgan Chase (JPMC), however the financial distress increased throughout the following days and Bear Stearns was forced to accept a merger with JPMC. On the other hand, AIG had found itself in serious distress after investing the cash collateral of their securities lending in risky assets backed by subprime residential mortgage loans and having written credit default swaps, most of them related to mortgage, with a notional value of $527 billion (Mcdonald and Paulson, 2015). Because of the market situation in September 2008 many counterparties made collaterals calls that AIG was not able to meet on its own and, as a consequence, the Federal Reserve Bank of New York had to intervene to provide credit to the institution (Weinberg, 2013c).

Nonetheless, the real catalyst of the Great Recession was the bankruptcy of Lehman Brothers on September 15th despite its primary dealer accessing the special credit facilities and the Federal Reserve, the Treasury and the SEC trying to help it secure funding. The largest bankruptcy in the U.S. history (Wiggins, Piontek and Metrick, 2019) provoked an economic turmoil since a money market mutual fund that incurred huge losses prompted many investors to withdraw money from money market funds that did not deal exclusively with Treasury and federal agency bonds (Weinberg, 2013c). In order to help the mutual funds selling commercial papers the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF) was established. This measure provided nonrecourse loans to several institutions that could be used as funding to purchase asset-backed commercial papers from the money market mutual funds (Weinberg, 2013a). The Federal Reserve also implemented a program to help limited liability companies by granting them three-months loans through the Commercial Paper Funding Facility (CPFF) (Weinberg, 2013a).

Between September 2007 and December 2008 the federal funds rate was reduced from 5.25% to a range of 0/0.25% (Kang, Ligthart and Mody, 2016) and towards the end of 2008 the Federal Reserve also began unconventional monetary policies. These measures included Quantitative Easing and “forward guidance” through which the Federal Reserve let the public know about its intentions to maintain the interest rates low “for some time” (Federal Reserve, 2008).

Quantitative Easing is a set of unconventional, expansionary monetary policies enacted by central banks to increase the supply of money and promote economy activity. These policies usually include asset purchase programmes, direct lending programmes and programmes that ease credit conditions (Bondarenko, 2019a). Quantitative Easing is adopted whenever central banks cannot intervene on short term interest rates, which is the standard monetary policy, because they are already close to zero. Through large-scale asset purchases, central banks are able to decrease the interest rate of long-term bonds which in turn leads to a decline in interest rates on loans for individuals and firms and thus promotes spending. New investments made by businesses increase the economic activity and might also lead to the creation of new jobs, hence reducing the unemployment rate (Ricketts, 2011). Moreover, through the economic growth, countries are able to reach their inflation target over the medium term and therefore achieve price stability (European Central Bank, 2021b).

On the other hand, forward guidance consists in the provision of information about future monetary policies that the central bank intends to adopt based on its most recent analysis of the outlook for price stability (European Central Bank, 2021c). Businesses and individuals will base their investments and spending decisions on the information provided, therefore forward guidance, despite informing on future policies, can influence the present financial and economic conditions (Federal Reserve, 2015).

Overall the Federal Reserve implemented three rounds of Quantitative Easing: QE1 was implemented in December 2008 and included a series of large-scale asset purchases (LSAPs) through which the Federal Reserve purchased $600 billion of agency mortgage-backed securities and debt in order to push real long-term interest rates down, improve the financial markets performance and thus secure less strict credit conditions (Bernanke, 2012). The program was expanded in March 2009 when the Federal Reserve additionally bought $750 billion of mortgage-backed securities and $300 billion of Treasury bonds (Bhar and Malliaris, 2021). The second round of Quantitative Easing began in November 2010 when the Federal Reserve purchased $600 billion of Treasury bonds (Bernanke, 2012) and was later followed by Operation Twist which entailed the sale of shorter-term Treasury bonds in order to acquire $400 billion of longer-term ones; in June 2012 an additional $267 billion were purchased with the same system (Bhar and Malliaris, 2021). The FOMC issued a statement on the final round of Quantitative Easing in September 2012 asserting that the Federal Reserve would buy an additional $40 billion of mortgage-

backed securities every month (Federal Reserve, 2012b). Furthermore in December 2012 an additional monthly purchase of $45 billion of longer-term Treasury bonds was announced (Federal Reserve, 2012a).

Sahay et al. (2014) assert that between May and June 2013 the Federal Reserve started advancing the possibility of a tapering off of its unconventional monetary policy measures since there were better and stronger prospects for recovery. However, there was shock and confusion over the real intentions of the Federal Reserve and on the possibility of an earlier-than-expected tightening of interest rates which led markets to adjust their expectations. As Davis (2021) asserts, the shock expanded also to foreign, emerging countries which held mostly dollar-denominated debt as they feared increasing obstacles to their debt financing: as a consequence equity prices dropped, external financing premia rose, capital flows slowed and the debtor countries' currencies depreciated quickly (Sahay et al., 2014). The Federal Reserve only began the tapering off of the LSAPs of both mortgage-backed securities and bonds in 2014 as Chairman Bernanke had announced in May 2014 (The Economic Outlook, 2013) and the process ended on October 29th, 2014. (Bhar and Malliaris, 2021).

Unlike during the Great Depression, the constantly rising level of globalisation caused the financial crisis to have international spillovers, affecting many countries outside the U.S.. The spillover effects involved mainly systemically important financial institutions (later defined G-SIB, Global Systemic Important Banks) across the world that suffered the contagion (Strauss-Kahn, 2020). Fischer (2021) states that in particular, the effects of the crisis in the U.S. spread to Europe a few months later, at the beginning of 2009, causing a recession in the EU which recorded a 4.4% reduction of GDP in 2009 and a 12.1% unemployment rate in 2013.

3.2.2. The European Central Bank reaction

The European Central Bank's first response to the financial crisis occurred when the interbank markets crisis arose on August 9th, 2007; under these circumstances the European Central Bank (ECB) decided to grant to all banks in the euro area the possibility to borrow overnight the total value of liquidity they needed against collateral at the main refinancing rate (European Central Bank, 2010a). As the monthly bulletin of the European Central Bank (2010a) reports, the situation in the euro money market was quite serious

as the central bank lent €95 billion in total, adding a series of refinancing rounds with three- and six-month maturities in the following months. Moreover, following the creation of central banks swap lines with the Federal Reserve, the ECB also started supplying liquidity in US dollar against collateral denominated in euro.

Nevertheless, in July 2008 the ECB, unlike the Federal Reserve, resolved to increase the main refinancing rate from 4% to 4.25% (Kang, Ligthart and Mody, 2016). This action was undertaken in order to "prevent broadly based second-round effects from materialising at that time and to counteract the increase in upside risks to price stability in the medium term as a result of these shocks" and to highlight that the ECB was focused on preserving price stability, its main mission (European Central Bank, 2010a, p. 65).

Box 3.2 | The main roles of the ECB

The ECB is a specialised independent organisation which is in charge of determining and implementing the monetary policy of the EU. The principal tasks it performs in addition to this are the conduct of foreign exchange operations, the management of the official foreign reserves of member states and the support of the smooth functioning of payment systems (Art.105(2) EC Treaty). The ECB is also the only institution that can issue legal tender banknotes within the euro area (Art.106 (ex Art. 105a) EC Treaty).

Furthermore, the ECB promotes the stability of the financial system and the safety and soundness of the banking system since it is responsible for the prudential supervision of credit institutions in the euro area and in participating non-euro area Member States (European Central Bank, viewed 12 February 2022).

As Scheller (2006) asserts, the control over the monetary policy is granted by the total control that the ECB exercises over base money, moreover since foreign exchange operations affect exchange rates and the level of domestic liquidity, the assignment of these operations to the ECB guarantees that the action will reflect the general direction of the monetary policy.

The main mission of the ECB together with the National Central Banks of the Eurosystem is the preservation of price stability, however they also promote the "general economic policies in the Community" which entail "high level of employment and sustainable and non-inflationary growth" without compromising the primary objective (Scheller, 2006). Moreover, the ECB must operate in conformity to the

principle of "an open market economy with free competition, favouring an efficient allocation of resources" (Art.105(2) EC Treaty). The decision to adopt price stability as the ECB main mission is based on the fact that price stability improves the recognition of changes in relative prices, reduces the inflation risk premia in the real interest rates, prevents stockpiling of goods as a hedging practice against inflation, prevents distortions in the tax and welfare system, raises the benefits of holding cash and protects against arbitrary redistribution of wealth and income (European Central Bank, 2004).

After the Lehman Brothers bankruptcy and the worsening of the conditions in most financial markets the ECB implemented new non-standard measures that were denominated "enhanced credit support" to provide liquidity and revitalise the markets (Trichet, 2009). As Tumpel-Gugerell (2009) states, these measures are mainly concentrated on commercial banks, as they represent the principal source of funding for both households and firms in the euro area, and are based on five building blocks: the provision of unlimited liquidity to banks at fixed interest rates, also known as fixed-rate full allotment, the expansion of the categories of assets that are eligible to be used as collateral, the extension up to 1 year of the maturities of the refinancing operations, the possibility of receiving liquidity also in foreign currency, mainly in US dollar as mentioned previously, and finally the purchase of €60 billion of euro-denominated covered bonds issued in the euro area.

Moreover, the ECB also decided to markedly cut the main refinancing rate by 325 basis points between October 2008 and May 2009 thus reaching a 1.00% rate (European Central Bank, 2010a). In particular, the first step was undertaken on October 8th, 2008 when there was an internationally coordinated 0.5% decrease of the policy rate (Kang, Ligthart and Mody, 2016). However, the slow pace at which the ECB was lowering the main refinancing rate was interrupted twice in April and July 2011 when the rate was raised by 25 basis points on each event in order to control inflation. The policy rate was in fact reduced to zero only in November 2013 (Kang, Ligthart and Mody, 2015).

With the emergence of the sovereign debt crisis in 2010, the ECB introduced the Securities Market Programme (SMP), a measure whose main aim was to restore financial market liquidity while not affecting the money supply (European Central Bank, 2010b). The Programme consisted in the purchase of government bonds from the secondary markets

of mainly Southern European countries and Ireland to improve the functioning of their securities markets and restore a well-working monetary policy transmission mechanism to realise price stability in the medium term (Smith, 2020). In order to improve the situation in the markets and mitigate the rising fear of an imminent dissolution of the euro Mario Draghi, then President of the ECB, delivered his renowned "whatever it takes" speech (Whelan, 2019). The SMP was concluded on September 6th, 2012 when it was substituted by the Outright Monetary Transactions (OMT) programme which had a similar purpose, but managed to erase one of the main causes of macroeconomic uncertainty, the redenomination risk (Constâncio, 2018). The redenomination risk is defined as the risk that a euro-denominated security will be "redenominated into a devalued legacy currency after a partial or total euro breakup" (Bleaney and Veleanu, 2021, p. 1304).

Furthermore, on December 8th, 2011 the ECB announced the implementation of two three-year longer-term refinancing operations (LTROs) amounting to €1 trillion that would be executed in December 2011 and February 2012 (Constâncio, 2018). Constâncio (2018) also underlines that the combination of all these measures managed to mitigate the severe crisis that was affecting the euro area.

Despite all the actions undertaken, the EU economy was still not fully recovering and was mostly threatened by the risk of deflation as the inflation rate was remarkedly decreasing below the 2% target. As a consequence, from June 2014 a series of expansionary measures were initiated which comprised of a reduction of policy rates and negative deposit facility rate, two asset purchase programmes for covered bonds (CBPP) and asset-backed securities (ABS) and targeted longer-term refinancing operations (TLTROs) (Constâncio, 2018). This final measure entailed the provision of long-term loans to credit institutions at favourable conditions to promote the financing of the real economy from banks.

To avoid the prospect of deflation, and since it could not reduce the policy rate anymore as it was already cut to zero, at the end of 2014 the ECB announced it would launch a Quantitative Easing programme (Van den End, de Haan and Kearney, 2015). The new Public Sector Purchase Programme (PSPP) involved the possibility to purchase euro-area sovereign bonds and assets from European institutions and national agencies (Claeys, Leandro and Mandra 2015). As Van den End, de Haan and Kearney (2015) state, the PSPP began in March 2015 and included a purchase of private and public assets with maturities between 2 and 30 years up to €60 billion until the end of September 2016 and, in any

case, until the inflation trend would have improved enough to be close to the 2% target in the medium term (European Central Bank, 2015). In particular, the Eurosystem National Central Banks' shares in the ECB's capital key would determine the quantity of sovereign bonds to be purchased, moreover a series of restrictions also prohibited the ECB from buying more than 33% of any issuer's debt and from purchasing more than 25% of each issue of a specific asset (Van den End, de Haan and Kearney, 2015).

In March 2016 the ECB declared that Quantitative Easing would be extended to at least March 2017, however subsequently the ECB President asserted that the measures would be maintained until inflation was on a consistent track to the 2% inflation rate target (Draghi and Constâncio, 2016). On June 14, 2018 the European Central Bank (2018) announced it would begin phasing out the Quantitative Easing programme starting with a first reduction of net purchases in September to finally end it in December 2018. The ECB also added that despite the end of Quantitative Easing it was planning on maintaining the key interest rates unchanged "at least through the summer of 2019 and in any case for as long as necessary to ensure that the evolution of inflation remains aligned with the current expectations of a sustained adjustment path" (European Central Bank, 2018). As Rostagno et al. (2021) state, the presence of clear indications of the dates in which the phasing out would start and be completed, and the announcement of the protraction of monetary policy helped the public adjust their expectations gradually. The "dovish" revision of the expectations also helped the ECB in having a smooth transition to the phasing out stage without experiencing important shocks in the market.

Furthermore, during the sovereign debt crisis a new loan mechanism was created in the temporary form of the European Financial Stability Facility (EFSF), an intergovernmental special purpose vehicle, essentially a bail-out institution for euro zone countries, which was later replaced by the permanent European Stability Mechanism (ESM) (Gocaj and Meunier, 2013). The EFSF was established in May 2010 with the aim of preserving financial stability by lending funds to countries in the euro zone which had difficulties in obtaining refinancing. In particular, the EFSF had €440 billion to manage with its debt guaranteed by the countries in the euro area (Horvath and Huizinga, 2011). The EFSF provided funds to Ireland, Portugal and Greece between 2010 and 2012, however, as the sovereign debt crisis persisted and the threat of a Greek default increased in the autumn of 2010, the EFSF was converted into the permanent ESM which was established in 2011. The ESM grants loans conditional on the implementation of a series of policies intended

to restore financial stability which are specified in a Memorandum of Understanding (MoU) which is signed by the member state in need of assistance (Zoppè and Dias, 2019). The financial crisis in the EU and the resulting sovereign debt crisis are the consequences of the lack of regulation in the international financial system and, they have shown the weaknesses in the architecture of the Union which only contributed to the increase in systemic risk (Akhtar, 2013). Because of the incompleteness of the banking union, the current authorities are not able to manage a sovereign debt crisis on their own as they lack resources and have limited room for decision-making. As a consequence, some reforms should be implemented in the Euro area to develop a centralised supervisory system, a system of common deposit insurance and common resources for bank resolution and capitalisation. Once these measures are realised and the banking union is complete, common fiscal resources will be available to counteract systemic banking crisis and sovereign debt runs (Tabellini, 2015).

Another issue that arose was the lack of coordinated monetary and fiscal policies across the EU due to the limits in the ECB mandate. As a consequence, during the sovereign debt crisis debate arose on the possibility of allowing the Eurozone to issue its own bonds, however the option did not seem to be particularly appreciated by the ECB leadership (Tabellini, 2015).

3.2.3. A comparison between the two responses to the Global Financial Crisis

Fischer (2021) compares the reactions to the Global Financial Crisis of the U.S. and EU: the response of the ECB in decreasing and maintaining the interest rates low was slower and more tentative than the Federal Reserve and, as a consequence, it led the ECB to adopt negative rates to face the most troublesome times while the American economy was already recovering and interest rates were being lifted again. From the perspective of the provision of liquidity, both the Federal Reserve and the ECB reacted promptly to the emergence of the crisis in order to preserve the smooth functioning of the financial markets and avoid additional bankruptcies that might cause a collapse of the system (Fischer, 2021). Both central banks adopted Quantitative Easing, however while the U.S. implemented several rounds starting at the end of 2008, the ECB response came much later since the programme was adopted only in 2015. The positive impact of Quantitative Easing can be seen by comparing the balance sheets of the Federal Reserve and the ECB

between 2007 and 2014 when the programme was ongoing only in the U.S.: while the Federal Reserve's balance sheet increased by 381%, the ECB's balance sheet only rose by 103% (Blackstone, 2014).

Overall, the Federal Reserve had a more proactive approach and reacted fast and aggressively to the Global Financial Crisis, thus managing the recovery earlier than the EU which always lagged behind and therefore suffered a prolonged period of economic distress (Fischer, 2021).

As Figure 3.5 shows, despite a quicker economic recovery, the majority of U.S. workers saw a decline in their real wages between 2007 and 2014, while only the highest income percentiles saw their wages increase.

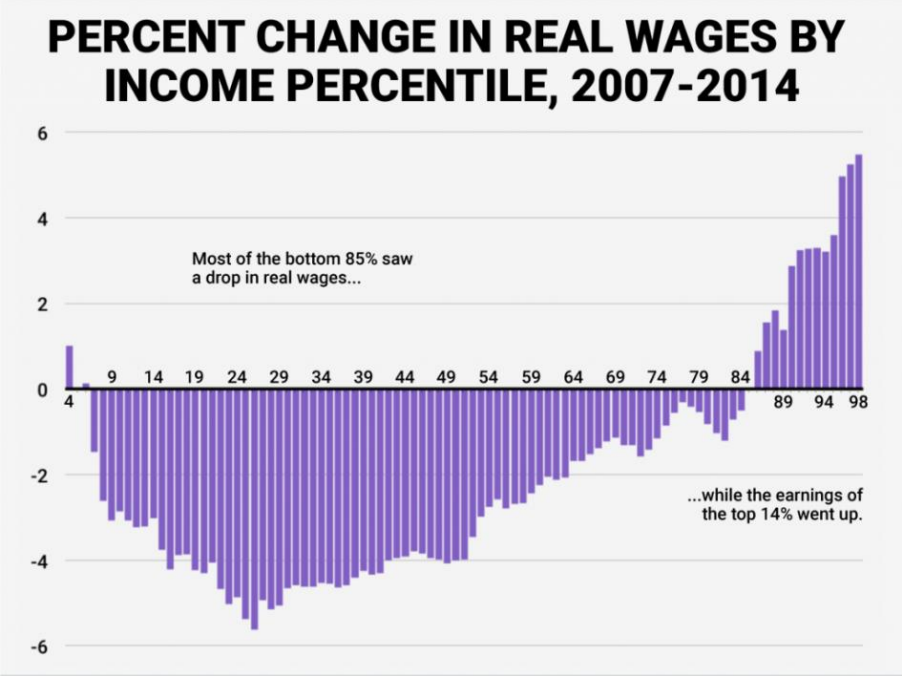

Figure 3.5 : Percentage change in real wages by income percentile, 2007-2014. *Source*: Bureau of Labor Statistics and Business Insider as reported by the World Economic Forum

The Global Financial Crisis also highlighted how underregulated the banking sector was and therefore how exposed it was to sudden crashes.

Once financial stability was restored and the economy was on its road to recovery, public authorities decided to intervene on the supervision and regulation of the financial sector to prevent future failures of financial institutions, in particular of systemically important ones (Weinberg, 2013b). The Basel Committee on Banking Supervision therefore

announced a series of measures to enact in order to "improve the resilience of banks and banking system" which is also known as "Basel III" framework. The key features of the new system comprise an increase in the required quantity and quality of capital in banks, the improvement of risk coverage, the introduction of a leverage ratio, of capital conservation and countercyclical buffers together with a global standard for liquidity risk (Basel Committee on Banking Supervision, 2018, p. 2).

The measures related to capital are enforced on all internationally active banks to make sure they all keep an appropriate amount of capital relative to each bank's exposure. The Liquidity Coverage Ratio was introduced to improve the short-term resilience of the banking sector and it requires banks to maintain an "adequate stock of unencumbered high-quality liquid assets (HQLA) that can be converted easily and immediately in private markets into cash to meet their liquidity needs for a 30 calendar day liquidity stress scenario". The HQLA stock that the bank must hold in the absence of a situation of financial stress need to be at least equal to the total net cash outflows. This requirement was introduced to ensure that the financial institution can survive on its own for 30 days after the emergence of a crisis, by which time supervisors and competent authorities should be able to intervene to take appropriate measures (Basel Committee on Banking Supervision, 2013, p. 1-4). To promote longer-term resilience the Basel Committee on Banking Supervision (2011) introduced the Net Stable Funding Ratio (NSFR) which aims at discouraging banks from relying too heavily on short-term funding from the wholesale market as they are believed to be more volatile than other sources of funding. The NSFR therefore requires a minimum quantity of stable funding based on the liquidity characteristics and residual maturities of the bank's assets and the contingent liquidity risk arising from its off-balance sheet exposures over a one-year horizon. Finally, two types of buffers were introduced, the capital conservation buffer which requires banks to build up capital buffers outside distressful periods so that they can be drawn when banks incur in losses, and the counter-cyclical capital buffer which protects against possible large losses that may arise after a period of excessive credit growth. As the Global Financial Crisis showed, significant losses in the banking sector can create a vicious cycle as contractions in the financial sector start affecting the real economy which will then turn to the banking sector for assistance.

In particular, in order to avoid the crash of the entire financial sector due to the interconnectedness of large financial institutions, global systemically important banks (G-

SIBs) were required to hold an additional buffer at all times. The amount of the buffer varies based on the bank's scores of systemic importance (Basel Committee on Banking Supervision, 2019).

Moreover, to reduce the level of interconnectedness, global cross-border capital flows have significantly declined from 11.3% of the global GDP between 2000 and 2010 to 7.1% of global GDP between 2010 and 2017. The most important contribution in this decline came from Eurozone banks which decreased their total foreign loans and other claims by 38% between 2007 and 2017 (Lund et al., 2018).

In the years following the crisis global debt has kept growing fueled by the increase in advanced economies' public debt, and at the same time thanks to the persistence of low interest rates, corporate debt more than doubled between 2007 and 2017 as is displayed in Figure 3.6 (Lund et al., 2018).

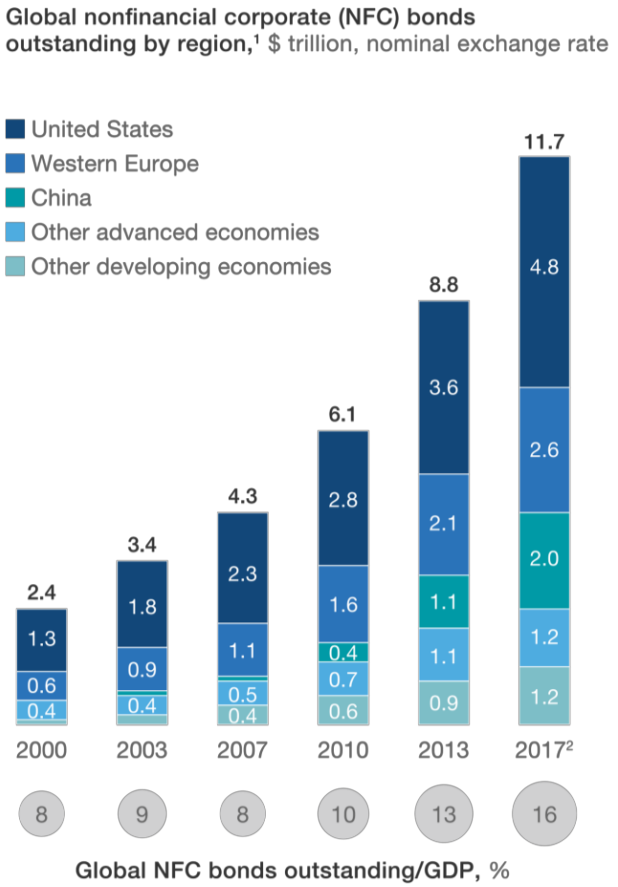

Figure 3.6: Global nonfinancial corporate debt
Source: Dealogic, McKinsey Global Institute Analysis

3.3. The institutional response to the COVID-19 recession

3.3.1. The reasons to compare the COVID-19 recession with the Great Depression and the Global Financial Crisis

The decision to compare the Great Depression and the Great Recession with the COVID-19 emergency is based on the fact that each of the past crises shares some common factors with the current one.

During all three crises, in fact, world industrial production suffered a significant contraction which is depicted in Figure 3.7.

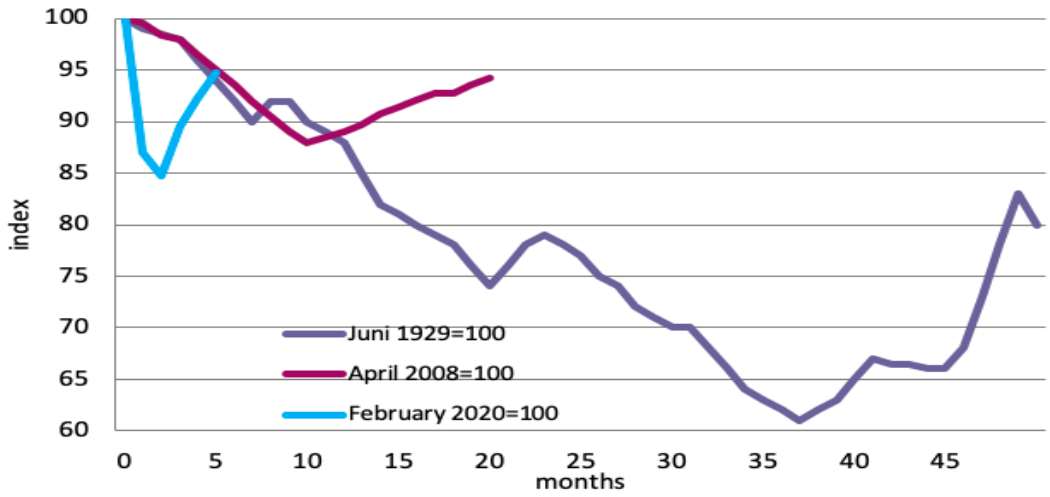

Figure 3.7: World industrial production during the three most recent crises
Source: Eichengreen and O'Rourke (2010); Eurostat for EU 2020, Federal Reserve for US 2020, and OECD for China 2020 as cited by De Grauwe and Ji (2020). The February 2020 line relates to the aggregate industrial production of China, the US, and EU

The decline was larger and faster during the COVID crisis because of the presence of shocks in both the supply and demand side which ultimately amplified each other (De Grauwe and Ji, 2020), while the hardest and longest decrease was the one recorded during the Great Depression. These differences, as explained in the chapter, are the result of different monetary and fiscal responses implemented by the public authorities and the timing of these measures.

As Strauss-Kahn (2020) asserts, the 2008 and the COVID-19 crises share some major economic similarities. In particular, uncertainty arose as one of the main factors that

characterised both crises as they spread globally after emerging in one of the leading economies of the world (the U.S. in 2008, China in late 2019).

In the Global Financial Crisis case, the situation arose as a consequence of the lack of knowledge on the risk of subprime loans which was concealed through the securitisation process. As international financial relationships were halted, uncertainty increased sharply, involving also the economic policies to implement as a response to the crisis.

On the other hand, uncertainty in the COVID-19 pandemic arose, especially in the first months, as a consequence of the lack of knowledge on the evolution of the virus and because of the freezing of many economic and trading activities around the world (Strauss-Kahn, 2020). The Index of Economic Policy Uncertainty comprising the period in which the two crises emerged is displayed in Figure 3.8.

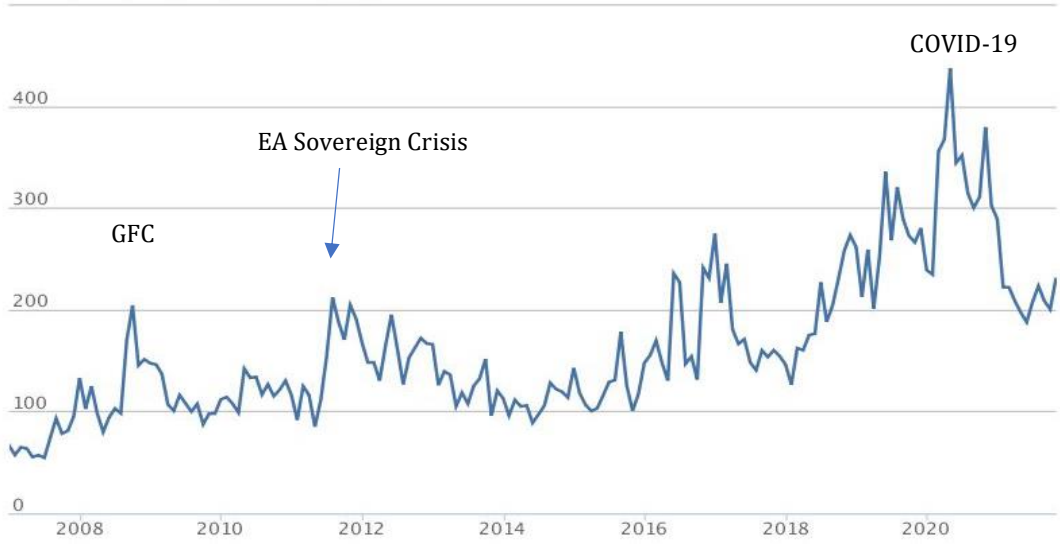

Figure 3.8 : Monthly Global Economic Policy Uncertainty Index January 2007 - October 2021
Source: policyuncertainty.com

Furthermore, during both crises stock prices suffered a significant decline in the first monhts as is shown by the Dow Jones Industrial Average historical data in Figure 3.9.

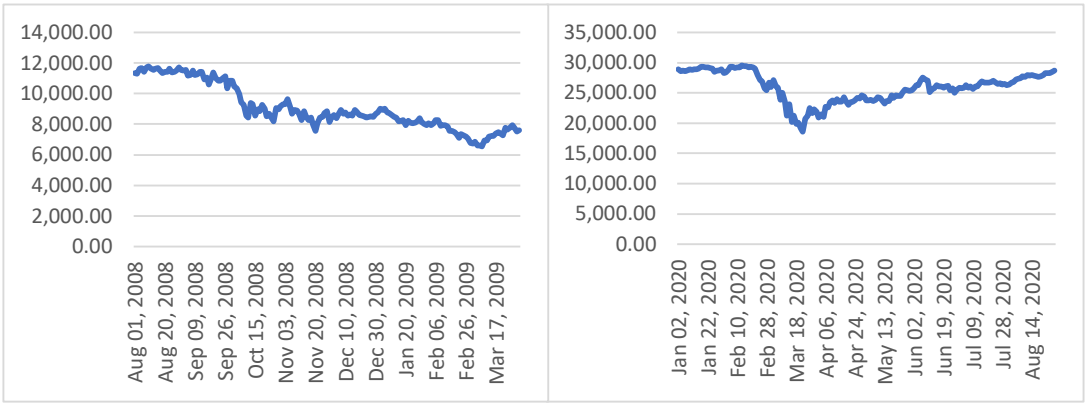

Figure 3.9: Dow Jones Industrial Average, August 2008-March 2009 vs. January 2020-August 2020
Source: Yahoo Finance

As it was already highlighted in the industrial production evolution, the stock price decline during the COVID-19 emergency was sharper than during the Global Financial Crisis, however prices started recovering earlier.

Nevertheless, both emergencies were classified as the largest crises since the Great Depression and in all three occasions the GDP growth rate recorded negative values as shown in Figure 3.10.[4]

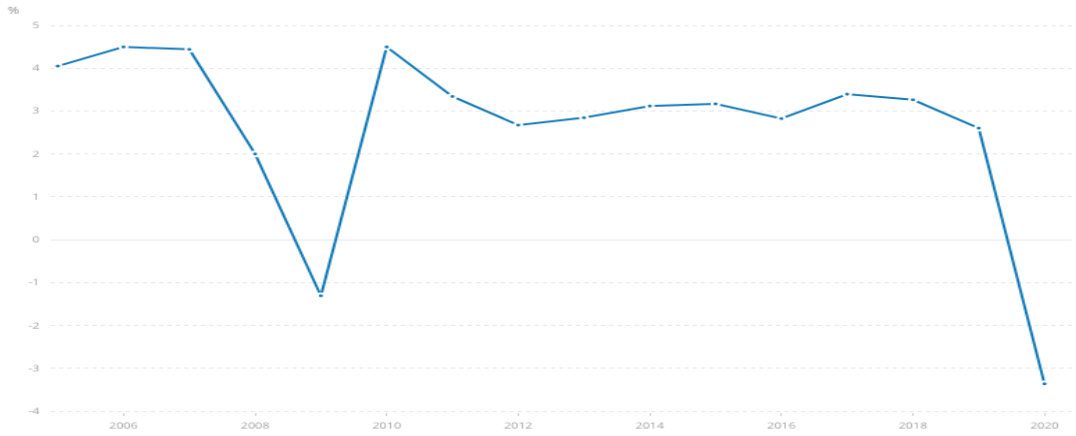

Figure 3.10: World real GDP growth rate 2005-2020
Source: World Bank

[4] World real GDP growth rate is not available before 1961, however real GDP growth in the United States amounted to -8.5% in 1930, -6.4% in 1931 and -12.9% in 1932 (Statista, 2022).

Because of these commonalities, institutions both in the U.S. and in Europe have adopted similar actions to those implemented in the past crises to counteract the recession and promote recovery. Naturally, learning from past experiences, the policy responses were adapted and improved to avoid the mistakes made in the previous recessions.

3.3.2. The U.S. reaction

The COVID-19 outbreak was declared a pandemic on March 11th, 2020 by the World Health Organization (2020) and on the following days the FOMC reacted rapidly to the crisis by reducing the federal funds rate by 1.5% to reach the target of the 0-0.25% range (International Monetary Fund, 2021a). Moreover, the Committee also implemented forward guidance to publicly assert that it would maintain the target rate until the economy would recover from the critical situation and be moving in the right direction to reach price stability and maximum employment (Federal Reserve, 2020).

The Federal Reserve also supported the increase in purchases of Treasury securities and agency mortgage-backed securities by lending more funds to primary dealers in order to preserve a proper functioning market and a good amount of reserves. Initially the Federal Reserve Bank of New York's Open Market Desk increased the number and size of overnight and term repurchase agreements, on March 15th it was required to increase its stock of Treasury securities by at least $500 billion and its agency mortgage-backed securities by at least $200 billion, however in the following week the FOMC allowed the purchase of those types of assets and agency commercial mortgage-backed securities in the amounts needed (Clarida, Duygan-Bump and Scotti, 2021). As the conditions of the market improved over the months the Open Market Desk decided to reintroduce a limit on the minimum amount of assets to purchase monthly, fixing it at $80 billion for Treasuries securities and $40 billion for agency mortgage-backed securities (Federal Reserve Bank of New York, 2020).

Furthermore, the demand for liquidity that emerged in mid-March prompted the Federal Reserve to decrease the primary credit rate to 0.25%, a 1.50% reduction, to promote the use of the discount window lending by banks, in addition to the extension of the loan terms to up to 90 days. In line with this objective, the reserve requirement ratios were cut to 0% and banks were asked to use intraday credit granted by the Reserve Banks with or without collateral (Clarida, Duygan-Bump and Scotti, 2021).

As investors started exiting money market mutual funds since uncertainty over the Commercial Paper market rose (Clarida, Duygan-Bump and Scotti, 2021), the Federal Reserve introduced a series of emergency lending facilities to support the provision of liquidity and credit to households and businesses. The International Monetary Fund (2021a) advances a list of the aforementioned facilities: the CPFF, the Money Market Mutual Fund Liquidity Facility (MMLF), the PDCF, Primary Market Corporate Credit Facility, Secondary Market Corporate Credit Facility, Term Asset-Backed Securities Loan, Paycheck Protection Program Liquidity Facility (PPPLF), Main Street Lending Program *and the* Municipal Liquidity Facility. In particular the CPFF, the MMLF and the PDCF were established on the basis of the measures implemented during the Global Financial Crisis, while the last six facilities received $200 billion of funds distributed by the Congress through the CARES Act. The facilities were able to reduce the pressure in the market, improve its functioning and provide liquidity throughout the pandemic (Clarida, Duygan-Bump and Scotti, 2021).

Foreign markets were suffering as well from the lack of dollar liquidity, therefore the Federal Reserve extended the dollar swap lines to more central banks, reduced the costs of the existing swap lines and increased the maturity of foreign exchange operations (International Monetary Fund, 2021a). Moreover, it created a new temporary facility, the Foreign and International Monetary Authorities (FIMA) Repo Facility to grant the provision of dollar liquidity also to states that did not have a swap line agreement with the Federal Reserve. The facility allows central banks to make overnight repos by exchanging U.S. Treasury securities for U.S. dollars (Clarida, Duygan-Bump and Scotti, 2021).

From the supervisory and regulatory perspectives, supervisors instructed banks to cooperate with borrowers affected by the pandemic by using their capital and liquidity buffers to help them and not to record as troubled debt restructuring any modification to loans due to the Covid-19 crisis (International Monetary Fund, 2021a). Moreover, the Federal Reserve Board temporarily removed deposits and holdings of U.S. Treasury securities at the Federal Reserve Banks from the computation of supplementary leverage ratios for holding companies and it provided temporary regulatory relief by decreasing the extension and frequency of checks and by granting more time to fix non-critical issues (Clarida, Duygan-Bump and Scotti, 2021). To help smaller depository institutions the Federal Reserve reduced the community bank leverage ratio to 8%, assigned a 0% risk

weight to Paycheck Protection Program covered loans and removed additional capital requirements for purchased assets that were subsequently added as collateral (International Monetary Fund, 2021a).

For what concerns mortgages, Freddie Mac and Fannie Mae granted forbearance for 12 months eliminating the attached fees, withheld delinquency reports related to forbearance, foreclosure sales and evictions for 60 days, granting instead the possibility to modify the loan (International Monetary Fund, 2021a).

The U.S. also implemented a series of stimulus packages including the Coronavirus Preparedness and Response Supplemental Appropriations Act which provided $8.3 billion to fund the development of COVID-19 vaccines, virus testing and to reinforce the the Centers for Disease Control and Prevention responses (International Monetary Fund, 2021a). The second fiscal stimulus came from the Families First Coronavirus Response Act (2020) which entailed a $192 billion funding for Medicaid and to provide paid sick or emergency leaves, food assistance, unemployment benefits, tax credits and free COVID-19 testing. Subsequently, $2.3 trillion, about 11% of the GDP, were allocated to the Coronavirus Aid, Relief and Economic Security Act (CARES Act) for several purposes: to distribute a one-time tax rebate to individuals, to extend unemployment benefits, to provide food assistance, to grant loans and guarantees to avoid corporate bankruptcies, to provide forgivable loans to small firms that did not fire their employees, to support hospitals, state and local governments and to provide international aid (International Monetary Fund, 2021a). Finally on March 2021 President Biden introduced the American Rescue Plan, providing $1884 billion, almost 9% of the 2020 GDP, to invest in public health, and to support families and firms. In particular the programme entailed an additional extension of unemployment benefits, a direct payment of $1400 to the more vulnerable individuals, more funding to the vaccination campaign, to schools to help in their reopening and to states and local governments (International Monetary Fund, 2021a).

3.3.3. The EU response

When the COVID-19 crisis started affecting the EU in March 2020, some non-standard measures of expansionary policy were still in place. In particular, the ECB had already reinstated TLTROs in September 2019 and asset purchases of €20 billion per month in November 2019 (Rakic, 2021). On March 12th the ECB announced a series of monetary policy measures in response to the pandemic which entailed an extension of the existing asset purchase program (APP) of additional €120 billion until the end of 2020, additional LTROs at favourable conditions to supply liquidity in the event of shortages until June 2020, and the preservation of the current key interest rates (European Central Bank, 2020d). As a consequence, the main refinancing operations rate still stands at 0%, while the interest rates of the marginal lending facility and the deposit facility remain respectively at 0.25% and -0.5% (Rakic, 2021). Furthermore, an improvement of the conditions of the existing TLTROs (TLTRO III) was also announced to be effective from June 2020 to June 2022. Notably, the interest rate on the operations could be reduced by as much as 50 basis points below the average deposit facility rate (International Monetary Fund, 2021a).

In the following week the ECB established the Pandemic Emergency Purchase Programme (PEPP), an additional €750 billion asset purchase program of both public and private sector securities (European Central Bank, 2020b). The PEPP was subsequently expanded twice: firstly on June 4th when €600 billion were added to reach €1.35 trillion of net purchases with a term extension of the program until at least the end of June 2021 and the continuation of reinvestment of principal payments of maturing securities under the programme to at least the end of 2022 (European Central Bank, 2020e). Finally, on December 10th an additional €500 billion were included, thus increasing the total asset purchase to €1.85 trillion. A further extension of the duration of the PEPP was granted to at least the end of March 2022, together with the expansion of the period of reinvestment of principal payments to at least the end of 2023 (European Central Bank, 2020c). As Rakic (2021) asserts, the PEPP benefits from the presence of less restrictions and more flexibility with respect to the standard APP, in particular there is no fixed level of purchases to make in a month and no strict indication on the classes of assets to buy monthly. Moreover, under the programme the requirements needed to buy assets issued

by the Greek government are suspended and all commercial papers of sufficient credit are eligible for purchase.

On April 30th the ECB initiated a new set of measures, the Pandemic Emergency Longer-Term Refinancing Operations (PELTROs) which consists of seven additional operations, starting in May 2020 and ending with the expiry of the last maturities in September 2021, to provide liquidity to the financial system. The funds will be lent at a favourable rate 25 basis points below the average rate of the main refinancing operations (European Central Bank, 2020a). Four supplementary PELTROs were added by the ECB in December 2020 each expiring in a year (European Central Bank, 2020c).

The central bank also operated on the collateral framework by easing the eligibility requirements: initially the collateral haircuts on non-marketable assets were permanently reduced by 20%, while collateral valuation haircuts of 20% across the board were granted for the duration of the PEPP, all Greek government bonds were allowed to be used as collateral, moreover the additional credit claims framework was expanded to also include public sector guaranteed loans to SMEs, households and self-employed individuals (Rakic, 2021). Furthermore, to reduce the possible negative effects of rating downgrades the ECB granted the exemption from eligibility requirements of marketable assets in the event of a downgrade as long as their rating is equal to or above BB (BB+ for asset-backed securities) (Rakic, 2021).

The provision of US dollar liquidity was increased at the beginning of the COVID-19 pandemic in March 2020 using the pre-existing swap lines: the costs of the operations were reduced and weekly operations with 84-days maturity were added. The frequency was later increased to daily operations until the end of June 2020 and then it was gradually reduced until it reached a weekly frequency once again (Rakic, 2021). Euro repo lines were also established by the Eurosystem repo facility for central banks (EUREP) to provide euro liquidity to countries outside the euro area and preserve the smooth implementation of the ECB monetary policy (International Monetary Fund, 2021a).

The EU also established the largest stimulus package ever financed in Europe, amounting to over €1.8 trillion (in 2018 prices), by approving the EU long-term budget and the Next Generation EU (NGEU) to finance additional spending in order to help the recovery of the Union (European Commission, 2020). As the International Monetary Fund (2021a) underlines, €750 billion, collected by borrowing at the EU level, have been allocated to the NGEU programme and the Recovery and Resilience Facility has been created to

provide grants (€390 billion) and loans (€360 billion) to EU countries. The objective of the programme is to relieve the member states from the impact of the pandemic on both society and the economy and to support their reforms and investments to move towards a more sustainable, digital and resilient system, to promote gender equality and support modernisation (European Commission, 2020). The majority of the funds will be used in the first two years of the recovery package and will be provided to the high-debt countries that suffered the biggest impact from the COVID-19 crisis (International Monetary Fund, 2021a).

Furthermore, the European organisations also implemented other important measures to mitigate the effects of the pandemic which are listed by the International Monetary Fund (2021a): a safety net was created through the Pandemic Crisis Support to support health-related investments up to 2% of the 2019 GDP of each country in the Eurozone provided by the European Stability Mechanism (ESM). The SURE programme was developed to protect workers and jobs by issuing up to €100 billion of social bonds to both EU and non-EU countries, €25 billion in government guarantees were provided to the European Investment Bank to preserve the possibility for SMEs in particular to access loans, and finally the European Commission removed the fiscal adjustment requirements for member states that are not in line with their medium-term target.

3.3.4. A comparison between the policy responses to the Great Depression, the Global Financial Crisis and the COVID-19 pandemic

The response to the Great Depression was quite slow since the Federal Reserve did not react immediately to the financial shock: this passive approach caused the recovery to be very long and characterised by several halts as the economy experienced new recessions, while international trade suffered a critical decline (Crafts and Fearon, 2010). Having learned from the past experience, the Federal Reserve reacted promptly to the Global Financial Crisis using a more proactive approach. The impact of the Global Financial Crisis was much larger than the Great Depression, however the response to the crisis was more appropriate thank to the large extent of funds allocated to the fiscal and monetary policies (Crafts and Fearon, 2010).

The constant increase of globalisation and of the level on interconnectedness of markets led the COVID-19 crisis to have a much more severe impact on global economy than the

Global Financial Crisis. As the International Monetary Fund (2021b) reports, the global GDP only declined by 0.1% in 2009 as a consequence of the Global Financial Crisis, on the other hand the impact of COVID-19 in 2020 was much higher as the global GDP suffered a 3.1% contraction. The data are reported in Table 3.1 below.

Real GDP growth (Annual percent change)	**2008**	**2009**	**2010**	**2019**	**2020**	**2021**
Advanced economies	0.3	-3.3	3.2	1.7	-4.5	5.2
Emerging market and developing economies	5.7	2.8	7.4	3.7	-2.1	6.4
World	3.1	-0.1	5.4	2.8	-3.1	5.9

Table 3.1: Real GDP growth rate for advanced and emerging economies in selected years
Source: Amended from International Monetary Fund, 2021b.

As it can be seen, the impact of the COVID-19 crisis was stronger in both advanced and emerging economies, moreover there is a discrepancy due to the difference in GDP growth in developing economies. In fact, right before the Global Financial Crisis developing economies were still experiencing a very high GDP growth which meant that when the crisis occurred the growth rate only slowed down but did not enter negative territory. On the other hand, in 2019 the GDP growth rate for developing countries had already reached a lower, albeit still positive, level than during the pre-Global Financial Crisis period and thus, when the pandemic struck, it reached negative rates. The presence of such a high level of spillovers was mostly due to the disruption of international supply chains and to the obstructions to trade that arose (Mou, 2020). In fact, businesses that are part of global value chains have been particularly affected by the supply chain disruptions that arose during the pandemic due to shortages of inputs coming from other firms. Initially, because of the lockdown in China, many companies that relied on Chinese firms to provide them with intermediary inputs faced an input disruption since factories had to reduce their production (Lafrogne-Joussier, Martin and Mejean, 2022). The presence of inventories significantly reduced the negative impact of the shock, however as Helper and Soltas (2021) underline, inventories still have not completely recovered as they are not back to the pre-pandemic level yet. Moreover, as the virus spread, several lockdown measures were implemented around the world causing global demand to decline, while at the same

time retail activity became very limited. Siripurapu (2021) however asserts that after the initial drop in demand in March and April 2020, consumers started increasing their demand again but shifting it to goods that could be used at home, in particular electronics and home workout gear. This rise in demand however emerged when many workers were still forced to stay at home, therefore the production in many manufacturing sites was still limited and only a restricted number of the staff was working at the ports. The decreasing availability of workers impacted especially the logistics sector where also lorry driver absenteeism was particularly high (Notteboom, Pallis and Rodrigue, 2021). The combination of high demand and dampened supply strongly affected shipping costs which have sharply risen, with the routes from Asia and China to Europe and the Mediterranean as well as the United States experiencing the most severe rises (Attinasi, Bobasu and Gerinovics, 2021).

One of the most requested goods that experienced significant shortages were the semiconductors: increased demand for electronics and cars required an increase in the production of chips and led companies to stockpile supplies, however this action only worsened the crisis (Siripurapu, 2021).

Figure 3.11 displays the evolution of global container freight shipping costs.

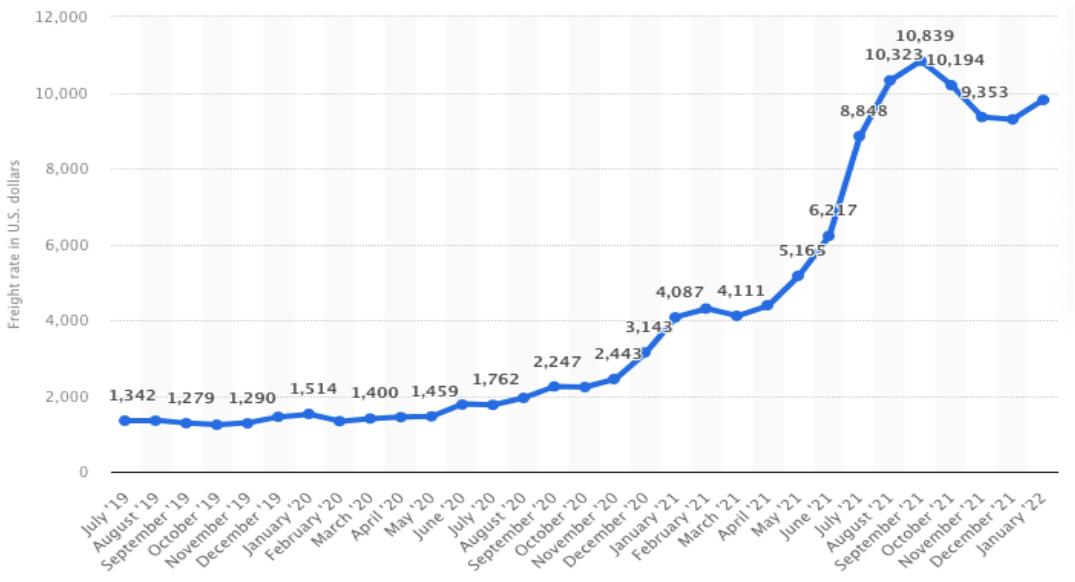

Figure 3.11 : Global container freight rate index from July 2019 to January 2022 in U.S. dollars
Source: Statista

As it can be seen, since the onset of the pandemic in March 2020 shipping costs have risen by more than 650%.

The combination of these factors contributed to a contraction in world trade which is highlighted in Figure 3.12 As it can be seen, the decline in world trade was particularly sharp in the first months of the COVID-19 pandemic and went back to positive growth rates from the third quarter of 2020.

Figure 3.12 : Quarterly and annual growth rate of world trade 2016-2021
Source: UNCTAD

Finally, Figure 3.13 shows the U.S. national average responses to the Small Business Pulse Survey related to the hardships they encountered due to supply chain disruption.

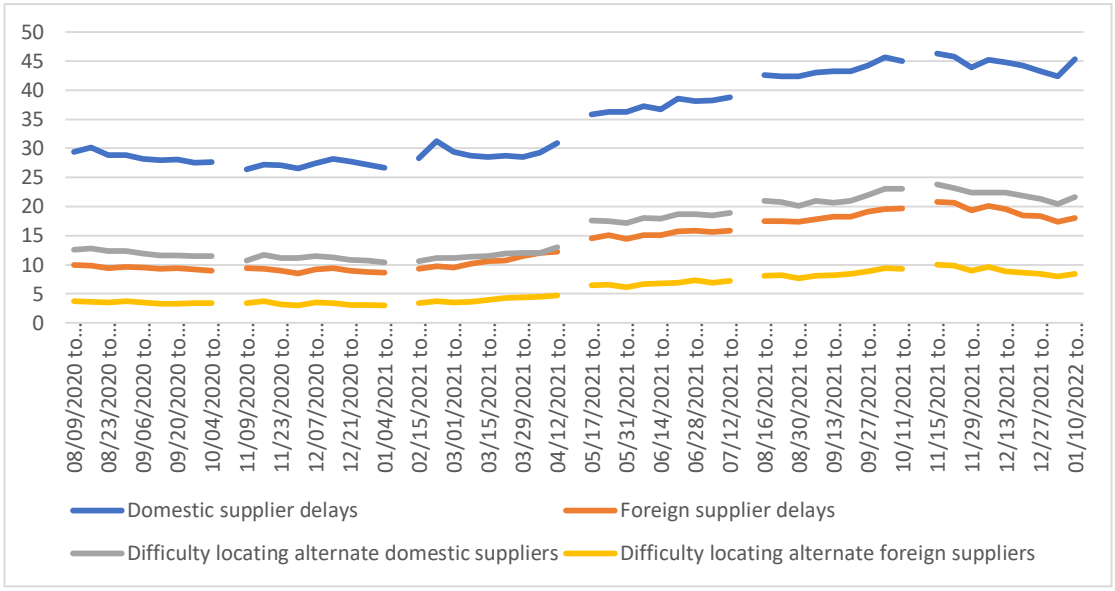

Figure 3.13: Responses to Small Business Pulse Survey's question "in the last week, did this business have any of the following?"
Source: United States Census Bureau

As the graph displays, the difficulties have been significantly increasing since mid-May 2021 and, after a slight decrease towards the end of the year they appear to be on the rise again.

As we can infer from the previous sections, the measures implemented during the COVID-19 crisis, although similar, were much larger and begun much earlier than the programmes adopted during the Global Financial Crisis. In particular, while the majority of actions to counteract the pandemic were initiated in a couple of weeks between March and April 2020, most measures implemented to react to the Global Financial Crisis happened between 2008 and 2009, moreover the programs were not usually effective instantly but required a certain time (Fischer, 2021).

As Fischer (2021) explains, these discrepancies are due to a series of elements: firstly, the different nature of the crises implied different speed of reactions; in particular, the quick diffusion of the COVID-19 virus which led to the sudden announcements of lockdowns required prompt reactions from central banks. Subsequently, the majority of programmes adopted during the pandemic had already been implemented during the Global Financial Crisis, thus allowing central banks to react immediately to the crisis. Finally, the previous experience of the Global Financial Crisis served as a lesson to devote the largest resources possible to the countries' monetary policies to recover from the crisis and to react as rapidly as possible to avoid a worsening of the economic conditions.

Moreover, considering the size of the policies, the amount of funds allocated to the U.S. economic stimulus package of 2020 was twice as much the 2009 package (Sahm, 2021). Additionally, Fischer (2021) asserts that just the U.S. initial response to the pandemic amounted to 12% of its annual GDP, while the total allocation, as of October 2021, reached about 27% of its annual GDP. This measure is about four times the size of the Global Financial Crisis fiscal stimulus. On the other hand, despite a lower percentage of its annual GDP allocated to the fiscal package with respect to the U.S., the EU still allocated a much larger sum than during the Global Financial Crisis. In fact, while the stimulus package adopted between 2009 and 2010 amounted to around 2% of its GDP (Afonso et al., 2010), the total amount of funds allocated for fiscal measures in 2020 corresponds to about 8% of the EU annual GDP (Fischer, 2021).

This comparison is highlighted in Table 3.2.

	Response to the Global Financial Crisis	**Response to the COVID-19 crisis**
U.S.	1% of GDP in 2008	12% of GDP in 2020
	4% of GDP in 2009, 5,6% between 2008 and 2010	27% of GDP between 2020 and 2021
	$1.8 trillion between 2008 and 2012	$4.7 trillion up until October 2021
EU	Around 2% of GDP between 2009 and 2010	8% of annual GDP in 2020

Table 3.2: Comparison between responses to Global Financial Crisis and COVID-19 Crisis in the U.S. and in the EU
Sources: Afonso et al. (2010), Fischer (2021) and OECD (2009).

Another important aspect that can be noted is that during the COVID-19 crisis the central banks provided a more direct support to SMEs and individuals through non-monetary measures like the PPPLF, the Municipal Liquidity Facility, the Main Street Lending Program in the U.S. and TLTROs in the EU. On the other hand, during the Global Financial Crisis the assistance was mostly directed to financial institutions and left many individual and businesses on their own to deal with the crisis (Fischer, 2021). Therefore, in this case, instead of being part of the problem, financial institutions became part of the solution thanks to a better regulated system (Strauss-Kahn, 2020). In fact, in 2008 many financial institutions were undercapitalized and thus represented a threat to the economic recovery when they started lending funds to unsounds firms as they could not manage the losses. As Blattner, Farinha and Rebelo (2019) state a weak banking sector was partially responsible for the sluggish recovery. On the other hand, thanks to the introduction of more demanding capital requirements by the European Banking Authority in 2011, banks have become more resilient and remained strong even during the COVID-19 crisis. The stricter regulation in fact led to the introduction of capital buffers which provide an additional level of capital that can absorb losses. As a consequence, during the COVID-19 recession financial institutions have kept providing loans to

households and firms, also supported by the large fiscal packages implemented by public authorities (Hernández de Cos, 2021).

For what concerns the phasing out stage of the policies there is still no data available for the COVID-19 crisis as the measures are still ongoing, however on its regional outlook for Europe the International Monetary Fund (2021c) has highlighted the importance of the timing and degree of tapering which need to be appropriate to each country's specific situation in order to avoid a premature halt to the recovery. In particular, the International Monetary Fund (2021c) advises against a too rapid withdrawal of the fiscal stimulus and suggests that during its phasing out the expansionary monetary policy should be preserved since a rise in inflation is not likely to cause wage pressures. However, it also recommends an initial and gradual tapering of accommodative monetary policy for some emerging European economies since the expected inflation rate is rising due to strong economic activity. Nevertheless, caution should be exercised in order to avoid any setbacks as mentioned in Section 3.1.: a premature tapering of monetary policy might in fact lead to an additional recession with significant declines as was the case in 1937 (Velde, 2009a).

An initial tapering of fiscal support has already been applied as can be seen by the reaction in corporate credit growth which started decreasing in 2021 for the majority of European countries and which is displayed in Figure 3.14.

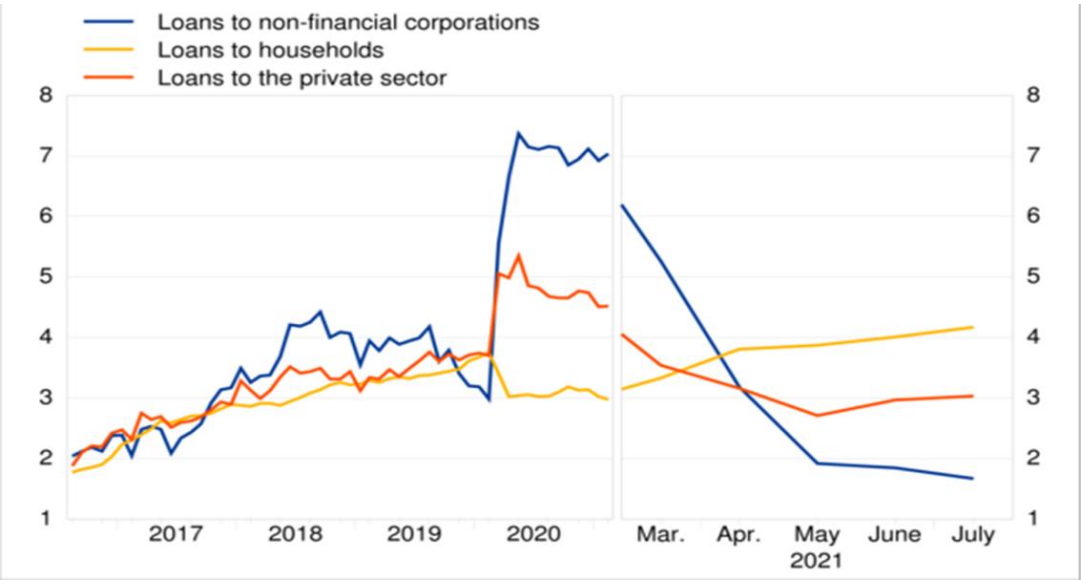

Figure 3.14 : Loans to non-financial corporations, households and private sector, 2017-July 2021 (discontinued).
Source: European Central Bank

Nevertheless, the International Monetary Fund (2021c) asserts that there needs to be a "gradual, careful and well-communicated withdrawal of policy support" while Europe recovers from the pandemic with a particular attention to more fragile countries where there is low underlying growth, a low percentage of vaccinated individuals and ageing population.
For what concerns the global outlook, the International Monetary Fund (2021d) has warned against a premature tapering of expansionary monetary policy arising as a consequence of an increase in inflation since it could create panic in the markets. Moreover, as mentioned at the end of Section 3.2.1., the spillover from the phasing out of policy measures might have an impact on developing economies as it happened in 2013 and cause currency depreciations and capital outflows.

To conclude, an analysis was provided of the main policy responses to the three largest financial crises that have occurred with the relative comparisons between them.
While during the Great Depression only the U.S. was affected by the crisis and had very little spillovers abroad, the Global Financial Crisis had a more severe impact on both the U.S. and Europe. The reaction to these critical situations was different both in speed and size: in the U.S. the response to the Global Financial Crisis was immediate and much more aggressive than during the Great Depression by adopting unconventional monetary policies and implementing large stimulus packages. On the other hand, the reaction to the Global Financial Crisis was slower and more hesitant in the EU, therefore leading to a protraction of the adverse situation. Nevertheless, the European Union eventually implemented Quantitative Easing as well, also allocating an important amount of money to the package. The phasing out of the Quantitative Easing in the U.S. provoked some negative reactions in the markets because of the ambiguity of the message delivered by the Federal Reserve, on the contrary the process was smoother in Europe thanks to the clear communications provided by the ECB.
The COVID-19 pandemic was the largest crisis to hit both in severity than in extension. In fact, the crisis not only affected the U.S. and Europe but expanded to essentially all of the world because of the high level of globalisation and the presence of international supply chains. However, the lessons provided by the past crises were useful to face the current situation: both the U.S. and the EU in fact reacted quickly to the emergency and immediately implemented unconventional monetary policies and introduced the largest

fiscal stimulus packages in U.S. and EU history, respectively, to prevent a further worsening of the situation. The world is on its way to recovery, however caution is of the utmost importance because a too early and too quick interruption of monetary and/or fiscal policies might hamper the process and lead to additional contractions. Therefore, in order to have a smooth and successful recovery there must be a gradual and well-communicated tapering process which needs to be adapted to every single country's specific situation.

Chapter IV: The way forward

In the current chapter an analysis of the future responses to COVID-19 will be carried out with a particular focus on the Next Generation EU programme and the Italian National Recovery and Resilience Plan (PNRR). The COVID-19 pandemic is still ongoing from a systemic perspective and it is difficult to make predictions with respect to what lies ahead, however some speculative reasoning will be presented.

The impact of the COVID-19 pandemic on the entire system was so strong and disruptive that it required diversified responses over multiple periods. In particular, many countries exploited the large amount of liquidity that was allocated for the stimulus packages not only to address short-term needs, but also in order to promote the technological and digital transition of the economy. National governments seem to have learnt from past experiences and have provided swift responses to the crisis to avoid a prolonged economic contraction; nevertheless, some issues still emerged, in particular related to the global supply chain. Thanks to the large recovery package introduced by the EU, the focus is now on long-term investments to promote the modernisation and digitalisation of the public administration and production systems in order to solve the structural problems that affected businesses during the crisis.

4.1. The impact of the pandemic on the economy

As it was discussed in the previous chapter, both the real economy and financial markets initially suffered from the pandemic outbreak. In particular, the productive and the manufacturing sectors were the ones affected the most by the enforcement of lockdowns and the subsequent shortages in inputs and decreases in international trade that occurred.

Just to prove how unsettling the disruption of the supply chains was, and its magnitude, a few examples are presented.

One of the main problems that arose in the supply chains was the stacking of containers in some strategic ports due to delayed operations and the lack of workers.

In May 2021 a COVID-19 outbreak hit the city of Shenzhen, China, where the world's fourth-largest container port is located and forced it to partially close from May 25th to May 27th after some positive cases were found among the crew of a container ship docked

at the port. As the cases spread also among port workers, operations were still delayed on June 8th (LaRocco, 2021).

In fact, satellite images in Figure 4.1 and 4.2 show the difference in port activity between May 6th, before the forced shut off, and June 8th, after the partial closure.

Figure 4.1: Satellite image of Yantian port, 7 May 2021. Yellow arrows indicate docked ships. *Source:* Pellegrino, A., Planet Labs

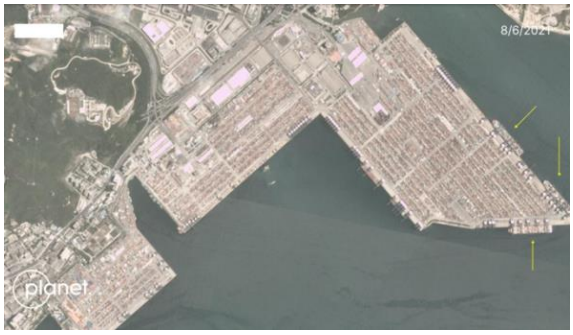

Figure 4.2: Satellite image of Yantian port, 8 June 2021. Yellow arrows indicate docked ships. *Source:* Pellegrino, A., Planet Labs

LaRocco (2021) reports that, as of June 17th, there were still approximately 160000 containers of about 12m waiting to be exported, and a long list of ships waiting to dock, however some of them might only unload imports without taking exports onboard. Furthermore, around 90% of the world's electronics are exported out of the Yantian terminal, which raised concerns over possible delays and shortages.

In October 2021 the combination of a boom in demand for consumer goods, labour shortages, bad weather and disruption in the supply chains caused by COVID-related issues caused congestions at the Los Angeles and Long Beach ports, the two busiest container ports in the U.S. (Voiland, 2021). Kay (2021b) asserts that on October 5th there were about half a million of 6m containers waiting in drift areas or at anchor to dock and unload, with 63 ships waiting off the shore, in some cases even more than 20 miles off. Some of these ships had to wait for more than a month to dock and unload their containers.

Figure 4.3 shows the comparison in ship congestion at the Los Angeles and Long Beach ports between the pre-pandemic period, on October 11th 2019, and the situation on October 10th 2021.

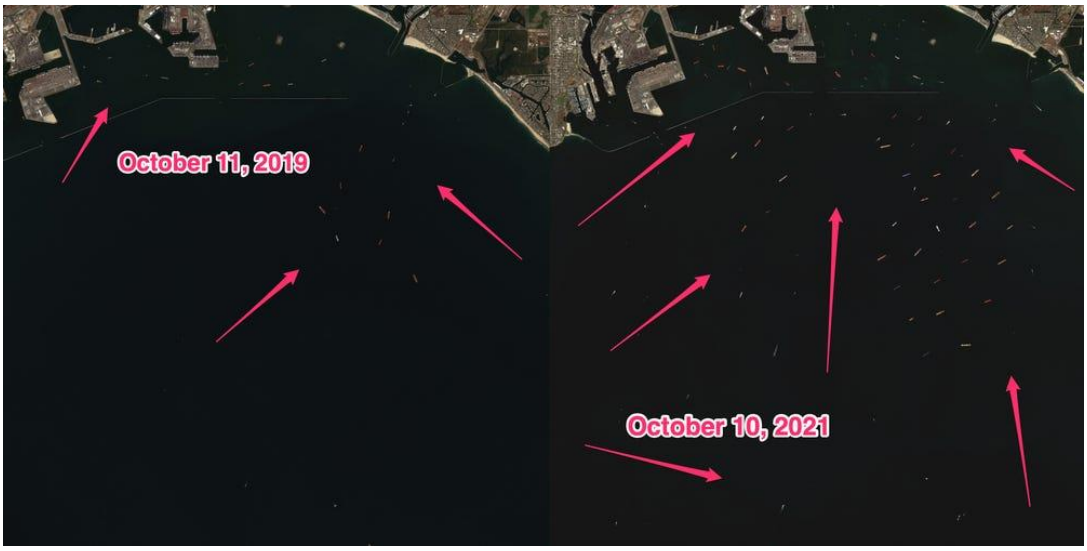

Figure 4.3: Comparison of ship congestion at Los Angeles and Long Beach Ports, 11 October 2019 vs. 10 October 2021.
Source: Copernicus Sentinel-2 satellite imagery as reported by Snodgrass (2021).

Los Angeles and Long Beach are not, however, the only ports that experienced this type of bottlenecks. As Kay (2021a) reports, the Port of Savannah, the fourth largest in the U.S., had 20 ships waiting to dock on October 2nd, and had just hit a record number of containers moved in a fiscal year. Port Houston established a new record of shipping containers that stopped by the port over the course of a month, while the Port of New Jersey and New York achieved a new record number of cargo for the 13th consecutive month.

The delays and congestions continued also in 2022: as Morris (2022) reports, on January 25th 82 container ships were waiting off the coast of Shanghai and Ningbo to load containers, while an additional 61 ships stationed off the ports of Yantian and Hong Kong. At the same time, 68 ships were waiting near the Los Angeles and Long Beach ports to unload, while 19 ships were stationed off the shores of Antwerp and Rotterdam.

Furthermore, since consumer demand is remaining strong and ports still have to reduce their backlogs, the so-called "blank sailings", i.e. the cancelling of routes or missing out of ports on container ships' normal schedule, are expected to continue well into 2022.

The impact of the delays and bottlenecks is reflected by the World Container Index displayed in Figure 4.4. As it can be seen, the Index increased significantly from May to September 2021, however after a slight decrease towards the end of the year, it started growing again from the second half of December.

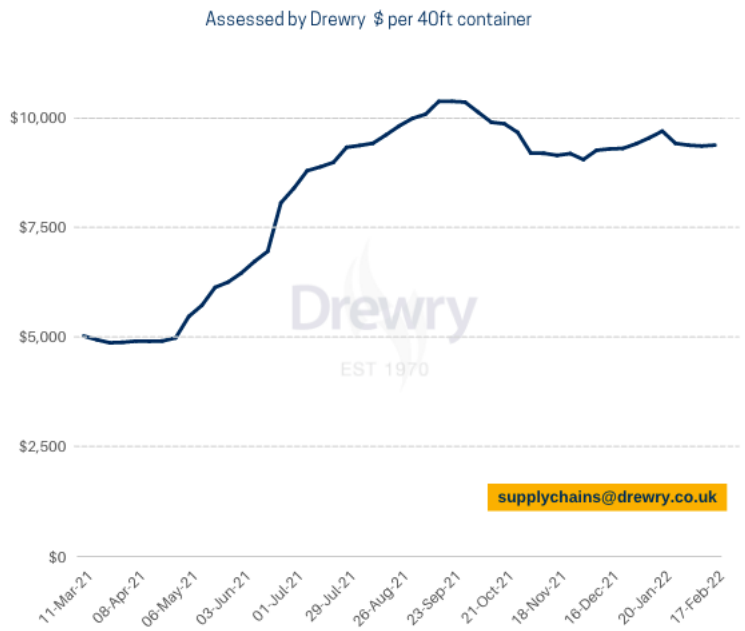

Figure 4.4: Drewry's composite World Container Index
Source: World Container Index and Drewry Supply Chain Advisors as reported by Drewry

Another factor that highlights the disruption in the supply chains is the increasing lead times in the automotive sector. As Guilloux-Nefussi and Rusticelli (2021) assert, because of the shortages in semiconductors and other inputs, delays in the transportation of goods, especially of electronics, and congestion of container ships off shore, car manufacturers were forced to reduce production despite the rising demand. Sadler (2021) reports the statement of Marcus Weller, a market expert at the Central Association of the German Motor Vehicle Industry, who states that the average delivery time for cars is between three to six months, however some premium models might take nine to twelve months to be delivered.

AlixPartners (2021) reports that shortages in semiconductor might cause a decline in the automotive production of around 7.7 million units and $210 billion in revenues in 2021.

The impact of shortages and bottlenecks are reflected in Figure 4.5.

Figure 4.5: The impact of bottlenecks and delays on volatility, prices, delivery times and inventories. Delivery times are displayed on an inverted scale.
Sources: Federal Reserve Bank of St. Louis, FRED; Bloomberg; Datastream; IHS Markit; BIS calculations as reported by Rees and Rungcharoenkitkul (2021).

As it can be seen, the lack of commodities and inputs caused a sharp rise in shipping costs in 2021, especially for transportation from China to North America, and a halt in production that led to backlogs of work and increases in delivery times. Furthermore, many companies, especially in the automotive sector, were forced to empty their inventories in order to sell their products.

The expectations for the future are mostly negative, as Intel CEO Pat Gelsinger is expecting the global chip shortage to last until 2023 thus leading the experts to fear that the delays could worsen (Prem Kumar, 2021).

While for some sectors the path to recovery has just started, the situation is quite different for other areas where national governments and the EU were quick to react, providing a powerful and univocal response by implementing a series of stimulus programmes and expansive monetary policy to promote a swift recovery.

4.2. The Italian response to promote the recovery

The Italian response to the COVID-19 crisis represents an interesting case to analyse not only because we lives there, but also because it was the first European country that was hit by the pandemic.

4.2.1. The first stage of the responses

The Italian government introduced swift and effective measures in response to the emergency to provide assistance in particular to the productive and manufacturing sectors which were the activities that suffered the most from the effect of the pandemic.
In fact, the first set of provisions, the "Cura Italia" Decree (D.L. n. 18/2020), was introduced on March 17th 2020, only 8 days after the government had declared the enforcement of the national lockdown, as an immediate response to the outbreak of COVID-19. As the Osservatorio CPI (2020) states, these measures were an appropriate response in order to mitigate the negative shocks of the pandemic on the healthcare system and the economy, however they did not provide measures that would promote the recovery and boost the economy.

Box 4.1 | The "Cura Italia" Decree (D.L. n. 18/2020)

The "Cura Italia" Decree (D.L. n. 18/2020) was the first set of measures implemented by the Italian government in response to the pandemic and it entered into force on March 17th, 2020.
€25 billion were allocated by the government to revitalize the economy and support workers, businesses, and all the productive sectors that were negatively affected by the coronavirus emergency. The main measures implemented with the Decree are:

- The provision of liquidity to businesses.
  In particular, SMEs were supported through a moratorium in relation to loans they were granted (mortgages, leasing agreements, overdraft facilities or short-term loans), moreover €1.5 billion were added to the SME Guarantee Fund to facilitate access to credit and a specific section was dedicated to subsidise the financial institutions affected by the moratorium. The guarantees (up to 80% of

the loan) were granted free of charge and the risk rating procedures had to exclude any assessment of the firm's performance from the previous six months. The maximum amount of the guarantees was also increased to €5 million for a single company, while the guarantee for loans suspended due to the COVID-19 emergency was automatically extended. Furthermore, the guarantee was also extended for micro loans granted to self-employed workers, professionals and individual entrepreneurs (Ministero Dello Sviluppo Economico, 2020).

The deadline for the completion of the investments by the beneficiaries of the "Nuova Sabatini" law, which entailed the facilitation of the purchase or lease agreement of new plants, equipment, hardware, software and digital technologies through low-interest loans, was extended for 6 months (Ministero dello Sviluppo Economico, 2022).

Furthermore, a nine-month extension was granted to the solidarity fund for first-home mortgages of self-employed and freelance workers who experienced a decrease in turnover of over 33% with respect to the last quarter of 2019 as a result of the measures adopted during the COVID-19 emergency (Ministero dell'Economia e delle Finanze, 2020c).

- Support to workers:

  €5 billion of social safety nets were allocated for workers on temporary layoff and €2.9 billion for one-off stimulus checks for professionals, seasonal workers in the tourism sector and workers in the agricultural sector, entertainment and spa industries (Ministero Dello Sviluppo Economico, 2020). A fund for an "income of last resort" of €300 million was created for all workers enrolled in mandatory private pension schemes who had to cease, reduce or suspend their employment or business as a consequence of the coronavirus emergency (Ministero dell'Economia e delle Finanze, 2020c). Furthermore parental leave was created for private-sector employees with children under the age of 12.

- Tax subsidies:

  Suspension of a wide range of withholding taxes and contributions, including social security contributions and compulsory insurance premia, by postponing deadlines and suspending tax and contribution payments (Ministero dell'Economia e delle Finanze, 2020c).

Additional measures included €400 million for strategic and innovative development programmes of significant dimensions and support to telecommunication companies to guarantee the proper functioning of their services (Ministero Dello Sviluppo Economico, 2020).

A second set of measures was introduced 3 weeks later with the "Liquidità" Decree (D.L. n. 23/2020) whose main focus was on the provision of liquidity to companies in order to support Italy's production system (Ministero dell'Economia e delle Finanze, 2020b).

Box 4.2| The "Liquidità" Decree (D.L. n. 23/2020)

The "Liquidità" Decree (D.L. n.23/2020) came into force on April 8th, 2020 with the aim of preserving the sustainability of businesses and, as Irrera and Fregonara (2020) assert, its measures consisted mostly of first responses to the emergency and would not be sufficient to provide an efficient reaction to the "second phase" of the crisis. Part of this Decree is an expansion of the provisions of the "Cura Italia" Decree (D.L. n. 18/2020), in fact the measures included encompass the promotion of lending to SMEs and firms with less than 500 employees by providing loan guarantees, with an increased coverage of 90%, up to €200 billion from SACE which is part of the Cassa Depositi e Prestiti group, the Italian development bank (Shehata et al., 2020). Coverages of 100% are granted to SMEs, self-employed and professionals who have been affected by the coronavirus crisis and request a new loan, conditional on a series of qualifications: the duration of the loan must not be larger than 6 years, and the maximum amount must be either less than double the beneficiary's annual salary expenditure for 2019, or less than 25% of 2019 turnover, or less than the necessary quantity to cover working capital costs and investment costs in the successive 18 months for SMEs, and 12 months for the other companies (PMI Tutoring, 2020) .

Other measures that were introduced were the postponement of the implementation of the new Code of business crisis and insolvency, the suspension and/or extension of the terms of minor ongoing insolvency proceedings and the halt to applications for bankruptcy until June 30th 2020 (Irrera and Fregonara, 2020). Furthermore, the new resolutions also entailed the temporary suspension of the applicability of some Civil

Code provisions concerning capital reduction and the repayment deferment of quotaholder/shareholder loans (Salvadè et al, 2020).
Further suspensions of tax and contribution payments until the end of June 2020 were implemented for businesses and professionals with either tax domicile, legal or operational headquarters in Italy, who had less than €50 million in income and remuneration and suffered a reduction in revenue of more than 33% or more than 50% in the case of firms with larger incomes (Barone and Tenuta, 2020).
The main objective of these provisions was to protect companies that used to be sound before the pandemic from the situation of illiquidity that emerged as a consequence of the COVID-19 crisis by lifting the strictest insolvency regulations, deferring some tax payments and promoting the funding of the firms (Irrera and Fregonara, 2020).

The implementation of these provisions within the first month from the shock caused by the COVID-19 pandemic was crucial in order to safeguard many economic activities from complete disruption. The quick recovery was the result of the easing of access to credit thanks to the massive amount of funds that were allocated by the Italian government.

As Figure 4.6 shows, credit standards in Italy experienced a significant easing in the second quarter of 2020, consistent with the implementation of the Decrees, moreover banks did not report changes in credit standards in the third and fourth quarter, thus confirming that access to credit was still wide.

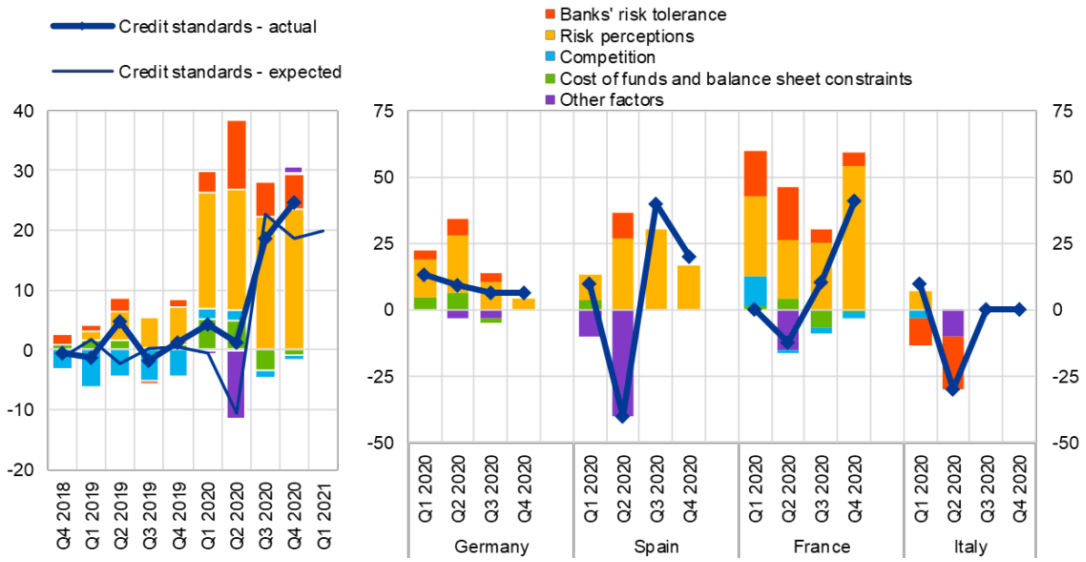

Figure 4.6: Quarterly changes in credit standards applied to the approval of loans or credit lines to enterprises, and contributing factors in the EU an selected countries.
Source: ECB

As reported by the European Central Bank (2021a) in its bank lending survey, the continued increase in realised loan flows to Italian companies in autumn was the responsible for the lack of tightening of credit standards in the last two quarters of 2020. The Italian government in fact introduced additional decrees, the "Rilancio" Decree (D.L. n. 34/2020) on May 19th 2020 and the "Agosto" Decree (D.L. n. 104/2020) on August 14th 2020, which consisted mostly of continuations and integrations of the measures implemented by the first two decrees to continue the support of the economic recovery with a particular focus on the most disadvantaged categories.

Box 4.3| The "Rilancio" Decree (D.L. n. 34/2020)

The third Decree, D.L. n. 34/2020, which came into force on May 19th, 2020 was the first set of measures implemented during the recovery phase and it aimed at reviving the economy by protecting and strengthening companies, promoting social cohesion and security with a €155 billion package.

To this end, the Italian government introduced non-repayable grant for firms not exceeding €5 million in revenues to assist in the payment of rent and utility bills, in the absorption of losses and to promote recapitalisation (Ministero dell'Economia e delle Finanze, 2020d). Furthermore, €4 billion were allocated for the elimination of the June IRAP tax, the regional tax on productive activities with up to €250 million turnover and additional relief measures were implemented based on the size of companies.

To further assist in the provision of liquidity to firms, €34 billion were introduced as SACE guarantees and to refinance the SME Fund, while €12 billion were granted to pay Public Administration debts to suppliers and service providers (Ministero dell'Economia e delle Finanze, 2020d).

€300 were allocated to the creation of a fund "to safeguard employment levels and the continuation of business activities" for distressed companies, historic firms or companies of "strategic importance" (Ministero dello Sviluppo Economico, viewed 18 February 2022).

The Decree prolonged the suspension of the payments due in March, April and May until September 2020 and included new provisions to support entrepreneurial activity and to reduce the costs of protective equipment and of the adaptation of workplaces to the new sanitary measures (Ministero dell'Economia e delle Finanze, 2020c). Moreover, the so-called "safeguard clauses" that would automatically increase VAT and excise duties on certain products at the beginning of 2021 were eliminated.

The safety net measures that were introduced with the "Cura Italia" Decree (D.L. n. 18/2020) were extended for further 9 weeks, while new wage subsidies were introduced in accordance with the new European Temporary Framework. Local authorities were granted the possibility to provide subsidies to firms' and self-employed workers' wage costs to prevent lay-offs. The contribution would not have to exceed 80% of the employee's gross salary, it had a 12 months duration and was

directed at workers whose contracts would have been terminated otherwise (Ministero dell'Economia e delle Finanze, 2020c).

Box 4.4| The "Agosto" Decree (D.L. n. 104/2020)

The fourth Decree, D.L. n. 104/2020, which came into force on August 14th, 2020 introduced an additional €25 billion stimulus programme to further extend the support to the recovery. The Ministero dell'Economia e delle Finanze (2020a) presents the main characteristics of the programme.

The new measures, introduced in order to promote growth and employment, featured specific assistance to firms in disadvantaged areas with a 30% reduction of pension contributions that employers must pay to their workers, a further extension of the safety net measures for 18 weeks and the exclusion from paying social security contributions, for a maximum of four months, for businesses that decided not to extend the safety net programmes. The exclusion is also applied for up to six months to firms hiring employees with permanent contracts.

Unless definitively ceasing to operate, companies are forbidden from implementing collective dismissal and, in the case of firms that did not fully exploit the safety net and exemptions, individual dismissal as well.

New indemnities were introduced for workers from sectors that were most affected by the crisis and an additional €400 of emergency income will be provided to those most in need. Furthermore, the "New Skills Fund" was created with the aim of redefining working times while keeping the working hours and salary fixed to promote training and the redistribution of workers.

Additional funds were also allocated to extend and reinforce the support to economic and productive activities already introduced by the previous decrees, with special attention dedicated to the catering and culture sectors and tourism, for which €500 million in non-refundable grants were reserved. The moratorium for SMEs loans and mortgages was extended until January 31st, 2021 and March 31st for firms operating in the tourism sector. Among the measures that were refinanced, the "Nuova Sabatini" received €64 million, development programmes were allocated €500 million and the

"Fund to safeguard employment levels and the continuation of business activities" received €200 million.
Finally, €1.5 billion were allocated to reinforce the capital of state-controlled companies and promote their recovery and further development.

After the second wave of COVID-19 emerged in October 2020 the Italian government implemented a series of decrees known as "Decreti Ristori" (D.L. n. 137/2020, D.L. n. 149/2020, D.L. n. 154/2020 and D.L. n. 157/2020) which largely reintroduced strengthened versions of measures that were implemented with the previous provisions: over €5.5 billion in grants were allocated to the self-employed, while businesses affected by the COVID-19 restrictions were initially provided with 100% to 400% of the grants they received with the "Relaunch" decree (D.L. n. 34/2020). Additional grants were later provided in the following rounds of the decrees.
As PMI.it (2021) reports, SMEs comprise 99.9% of the activities operating in Italy and thus represent the backbone of the Italian production system. By their very nature, SMEs have always faced bigger costs and had to rely on less time and resources to train, manage and develop the business, moreover they were the activities that suffered the heaviest impact from the COVID-19 emergency (European Commission, 2022). The annual Report on European SMEs of 2020/2021 highlighted a 7.6% decline in SMEs' value added with respect to 2019, a higher contraction than the one recorded for the entire economy which stopped at -5.9%.

On the other hand, in 2021 the change in value added was positive, as shown in Figure 4.7, however the European Commission (2022) asserts that the recovery looks uneven across states and sectors.

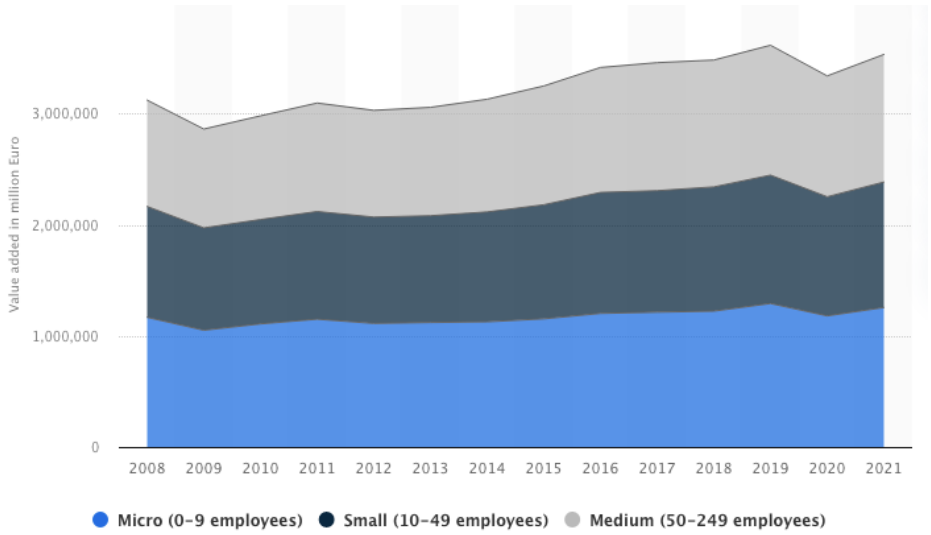

Figure 4.7: Value added by SMEs in the European Union (EU27) from 2008 to 2021, by enterprise size
Source: Statista

Access to credit is one of the main issues that has often hindered the recovery and development of SMEs, and as a consequence, it has always been one of the principal targets of the recovery policies of governments.

As Figures 4.8 and 4.9 depict, during the COVID-19 emergency demand for bank loans by SMEs has risen in response to a credit expansion that was the result of government interventions aimed at providing liquidity and at avoiding a credit crunch.

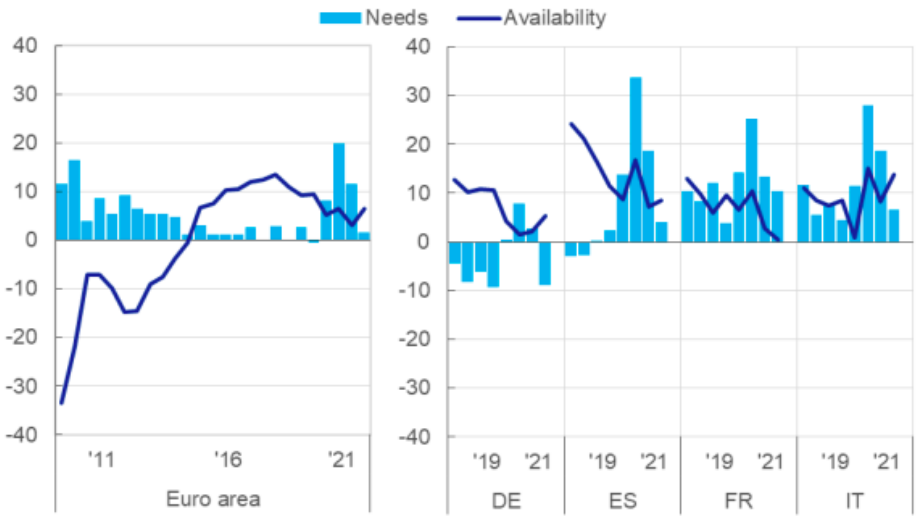

Figure 4.8: Changes in needs and availability of bank loans of SMEs (past six-month period, net % of respondents)
Source: Source: ECB and European Commission survey on the access to finance of enterprises (SAFE).

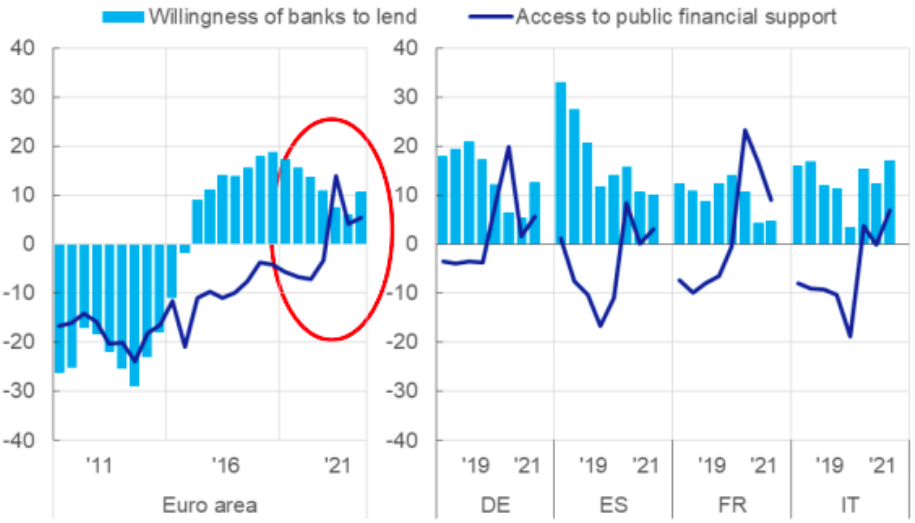

Figure 4.9: Changes in factors having an impact on the availability of external financing
Source: ECB and European Commission survey on the access to finance of enterprises (SAFE).

SMEs also seem to be unaware of the actual availability of financing for bank loans, trade credit, credit lines, leasing, and equity investments, as shown in Figure 4.10.

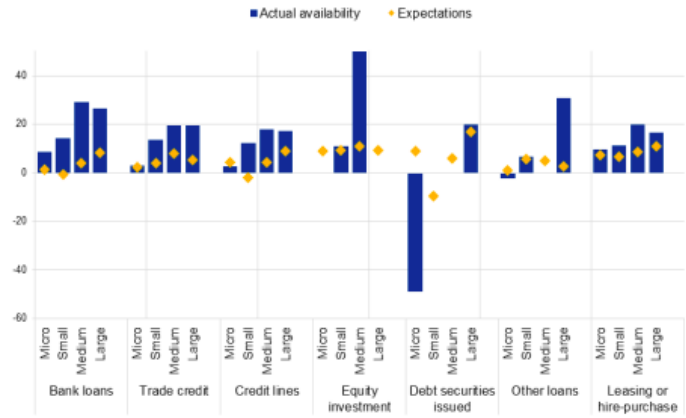

Figure 4.10: Changes in firms' expectations regarding the availability of financing in Italy, April-September 2021.
Source: ECB and European Commission survey on the access to finance of enterprises (SAFE)

Nevertheless, thanks to the implementation of significant measures aimed at the provision of liquidity, access to credit for SMEs does not seem to be a problem for them anymore. On the other hand, lack of skilled labour seems to be the issue on the rise as shown in Figure 4.11.

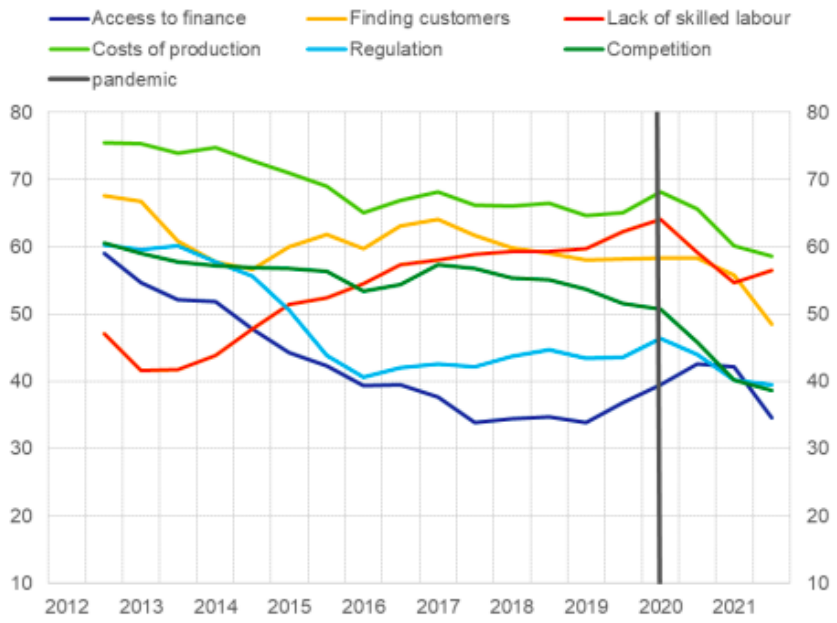

Figure 4.11: The most important problems faced by SMEs in Italy
Source: ECB and European Commission survey on the access to finance of enterprises (SAFE)

4.2.2. The PNRR and the second stage of responses, what can we expect from the future?

As the first group of interventions began its phasing out stage, the EU introduced a second package of measures, the Next Generation EU (NGEU). [5]While the first series of measures entailed predominantly short-term provisions, with the aim of supporting distressed companies and individuals and to promote a fast recovery, this second package adopts a longer-term approach. As mentioned in Chapter III, €750 billion were allocated to the NGEU to fund, through the Recovery and Resilience Facility, projects that aim at promoting digitalisation, modernisation, equality and inclusiveness, research and innovation in the health sector and at creating a more sustainable and resilient Union (European Commission, 2020).

€191.5 billion have been allocated to Italy for the Italian National Recovery and Resilience Plan (PNRR) as part of the NGEU programme, the largest amount destined to a single Member State. The programme comprises of six main missions: digitalisation, innovation, competitiveness, culture and tourism; green revolution and transition; infrastructure for sustainable mobility; education and research; inclusion and cohesion and healthcare. The government decided to invest 25% of the funds in the digital innovation and transition, both in the public administration and in the production system, 37% in the green transition, and 40% to the development of the Southern regions (PNRR, viewed 18 February 2022).

[5] https://europa.eu/next-generation-eu/index_en

The complete distribution of funds among the different missions is shown in Figure 4.12

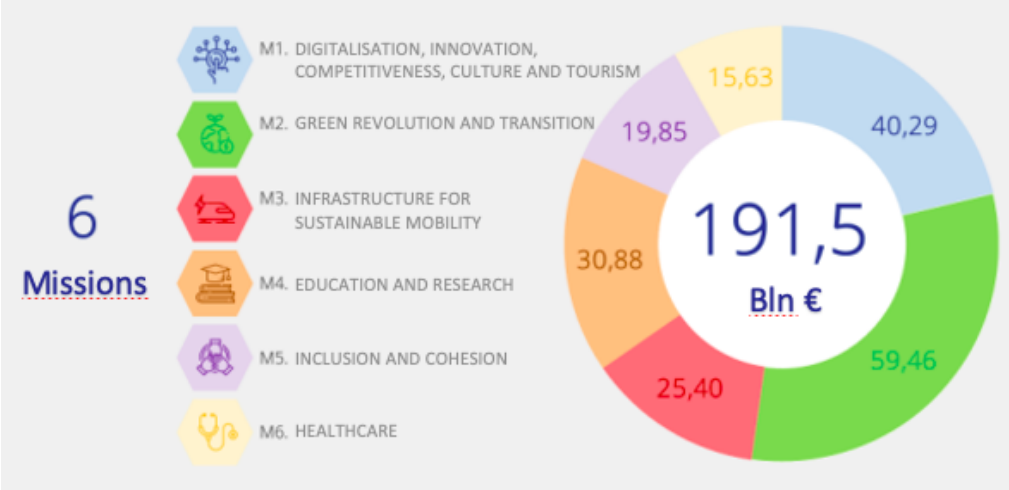

Figure 4.12: Distribution of the PNRR funds in billions of Euro, translated from Italian
Source: PNRR

Preliminary evaluations reported on the PNRR text on the effect of the programme on the potential growth reveal that it could increase potential growth by 0.5% through higher expenditure, and by 0.3% thanks to the implementation of all the scheduled reforms. A prudential approach estimates that potential growth might reach 1.4% by 2026, the final year of the programme, while before the pandemic it was equal to 9%.
Elaborations made on the impact of the PNRR on the Italian GDP based on three different scenarios, depending on the efficiency of public investments, are shown in Table 4.1.

	2021	2022	2023	2024	2025	2026
GDP – best case scenario	0.5	1.2	1.9	2.4	3.1	3.6
GDP – normal scenario	0.5	1.1	1.6	2.0	2.4	2.7
GDP – worst case scenario	0.5	0.9	1.4	1.5	1.7	1.8

Table 4.1: PNRR impact on GDP – three different scenarios, translated from Italian
Source: Ministero dell'Economia e delle Finanze elaboration as reported by the PNRR

The estimations point to a quite uniform growth for the best and medium scenarios, while in the case of the worst scenario the GDP is expected to grow at a faster rate in the first two years.

Investments directed at SMEs are one of the focal points of the NGEU and, more specifically, of the PNRR. Italy has in fact allocated €16359 million to the support of SMEs, about 8.5% of the entire package budget (European Commission, 2022). Some of the projects include support to the internationalisation, digital and ecological transition of SMEs through a fund that provides contributions and favourable loans to businesses operating in foreign markets. Up to 25% (40% for SMEs located in Southern Italy) of the funding to companies will be provided in grants and no guarantees are needed. A specific focus is placed on supporting companies in recovering from the production chains disruptions that affected them throughout the pandemic. In particular, the programme supports the development of competitive supply chains in the highest growth sectors in order to reduce the dependency on technology imports and to strengthen R&D in the most innovative areas (PNRR).

To conclude, thanks to the massive amount of liquidity that it provides, the PNRR offers the opportunity to the Italian government to invest in the modernisation and digital transition in order to strengthen its production system and to build towards a more resilient and sustainable economic growth by eliminating some of the structural flaws that have hindered the growth in the past years.

As it was illustrated in the chapter, the major issues that emerged during the COVID-19 crisis were initially the access to credit for companies, and subsequently the disruption of the supply chains. Policy responses therefore focused significantly on providing solutions to these areas as it can be clearly deduced by looking at the main themes included in the recovery programmes.

The main feature of the Global Financial Crisis was the disruption of the financial sector, and policy responses were thus centred on the resolution of its structural problems. The financial system learned its lesson and, in fact, did not suffer the same fate when the pandemic struck. In the same way, the implementation of the NGEU and the PNRR indicates that the production sector might be on its way to fix its shortcomings in order to avoid the repetition of a similar disruption in the future.

Conclusion

This thesis has presented a series of approaches to interpret the events that occurred during the current COVID-19 crisis.

In the first chapter the traditional theory of stock valuation was confronted against the theory of bubbles. While the Efficient Market Hypothesis entails that the asset price changes only when reacting to news about the asset's value, behavioural theories support the lack of perfect rationality and thus believe that bubbles arise when there is a mispriced asset. Bubble theory was then analysed presenting the most important literature on rational and behavioural models in order to identify the conditions that can lead to the creation of bubbles. Among these feature: short sale constraint, asymmetric information, herding by investors and/or managers, limited liability, perverse incentives and feedback loops for rational models. Moreover, four behavioural models were identified: one based on the presence of heterogeneous beliefs and short sale constraints, a feedback trading model in which investors trade following past price movements, a model based on biased self-attribution in which investors only react to positive signals, and finally a model based on representativeness and the conservative bias in which individuals believe that stock prices can only follow either a trending model or a mean-reverting model.

This chapter therefore provides a theoretical framework which can help in identifying typical features that characterise bubbles and overvalued assets in the current crisis.

Subsequently, an overview of historical bubbles was presented where causes and consequences of the events were analysed. Some common characteristics are found in all the events: every bubble is the result of the introduction of some object or instrument that is considered innovative and possibly life-changing, the share price increases for a while before recording a sharp rise in the final 12 months before the peak, there is a high presence of inexperienced investors and a high level of speculation, most bubbles emerge during periods of economic recovery characterised by easy credit and low interest rates, there is an increase in risk taking and, for more recent bubbles, there is a significant increase in corporate activities, IPOs and M&As in particular.

The literature has diverging opinions on whether to classify each of these events as bubbles, depending on the definition they assign to the term and the formulas they use to compute the fundamental value.

Many of these features emerged also during the COVID-19 crisis since the big injections of liquidity favoured a positive trend in stock prices which seems to be persistent and to continue in the future. Therefore, by analysing the causes of the rise in prices and the consequent crashes in historical bubbles public authorities can learn from the past dynamics in order to react in a different and more effective way to try and limit the negative impact of the crashes.

Significant similarities are found between the stock market boom of 1929 and the subprime-mortgage bubble of 2007, both during the evolution of the bubble and also in the aftermath of the burst. For this reason, the institutional response to the two financial crises that emerged after the burst of these bubbles are analysed and compared between each other and with the current emergency in Chapter III. The findings show that for the most recent events the policies implemented are simply an evolution of the measures applied in the past crisis. In fact, public authorities, having learned from past experience, adapt the measures implemented in previous emergencies to improve them and make them more effective.

The institutions that managed the policy responses during the Global Financial Crisis had learnt from the Great Depression that a quick expansionary response was crucial to avoid a further extension of the recession. Furthermore, as conventional measures were not enough to support the recovery, new measures were introduced like forward guidance and Quantitative Easing to lower long-term interest rates through large-scale asset purchases and provide clear messages to the public on the future direction of monetary policy. It should be also emphasised that the financial sector learned its lesson from the Global Financial Crisis and underwent important modifications to become more resilient and to improve risk coverage by implementing the Basel III framework.

These findings are useful to understand why the reaction to the COVID-19 emergency was so quick and powerful and why financial markets were almost left unscathed in this occasion.

The response, in fact, was the immediate implementation of Quantitative Easing in even larger scale than during the Global Financial Crisis to support a swift recovery and provide liquidity to distressed businesses, and the implementation of the largest stimulus packages in history to promote longer-term objective like the digital transition of businesses and public administration, modernisation, and green transition.

The introduction of the Basel III framework allowed the financial sector to suffer only from a fast contraction when the pandemic hit, recovering fairly quickly. This condition allowed banks to be in the opposite position with respect to 2008: while in the past they were the ones in need of funds to avoid bankruptcy, in this occasion they are the ones providing assistance to promote the recovery (Strauss-Kahn, 2020).

One of the predominant economic issues in the current emergency is the disruption of supply chains, whose effect reverberated through several economic sectors, ultimately causing shortages and rises in prices. However, much like during the previous crises, individuals seem to have learnt from the events that occurred, which explains why governments are allocating large parts of the recovery funds to promote the implementation of measures to counteract the supply disruption.

The limitation of this research is that the coronavirus crisis is still ongoing, therefore the literature is very limited and only speculative hypotheses can be elaborated on the evolution of the situation.

The next step in future research should be focusing on resilience: the current crisis has shown that nowadays the economies are sufficiently solid and can deal with the pressure of an emergency, however real markets still trail behind. More interventions are still required to strengthen these markets and improve their readiness to react to inevitable future disruptions and eventual crises.

Glossary

ABS, Asset-Backed Securities

AMLF, Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility

CBPP, Covered Bonds Purchase Programme

CCC, Civilian Conservation Corps

CDO, Collateralised Debt Obligation

CPFF, Commercial Paper Funding Facility

EFSF, European Financial Stability Facility

EMH, Efficient Market Hypothesis

ESM, European Stability Mechanism

EUREP, Eurosystem Repo Facility For Central Banks

FDIC, Federal Deposit Insurance Corporation

FIMA, Foreign and International Monetary Authorities

FOMC, Federal Open Market Committee

G-SIB, Global Systemic Important Banks

GDP, Gross Domestic Product

GFC, Global Financial Crisis

GNP, Gross National Product

GWC, Dutch West India Company

HQLA, High-Quality Liquid Asset

IPO, Initial Public Offering

LSAP, Large-Scale Asset Purchase

M&A, Merger and Acquisition

MMLF, Money Market Mutual Fund Liquidity Facility

NGEU, Next Generation EU

NSFR, Net Stable Funding Ratio

OMT, Outright Monetary Transactions

PDCF, Primary Dealer Credit Facility

PELTRO, Pandemic Emergency Longer-Term Refinancing Operation

PEPP, Pandemic Emergency Purchase Programme

PNRR, Piano Nazionale di Ripresa e Resilienza

PPPLF, Paycheck Protection Program Liquidity Facility

PSPP, Public Sector Purchase Programme

RCA, Radio Corporation of America

SEC, Securities and Exchange Commission

SMP, Securities Market Programme

TAF, Term Auction Facility

TLTRO, Targeted Longer-Term Refinancing Operation

TOP, the TSLF Options Program

TSLF, Term Securities Lending Facility

VOC, Dutch East India Company

WPA, Works Progress Administration

Bibliography

Abreu, D. and Brunnermeier, M. K. (2003). *Bubbles and Crashes*, Econometrica, Vol. 71, pp. 173–204.

Ackert, L. and Deaves, R. (2009). *Behavioral Finance: Psychology, Decision-Making, and Markets.* Mason, South-Western Cengage Learning.

Adams, P. A. and Adams, J. K. (1960). "Confidence in the recognition and reproduction of words difficult to spell", *The American Journal of Psychology, Vol. 73, No. 4,* pp. 544–552. Available at: https://doi.org/10.2307/1419942

Afonso, A., Checherita, C., Trabandt, M. and Warmedinger, T. (2010). "Euro area fiscal policies: Response to the economic crisis". *Occasional Paper Series*, No 109, ECB, Frankfurt am Main, April.

Akhtar, S. (2013). Lessons learned from debt crises and ongoing work on sovereign debt, United Nations Tuesday, April 23, 2013

Alicke, M. D. and Govorun, O. (2005). "The Better-Than-Average Effect". In Alicke, M. D., Dunning, D. A. and Krueger, J. I. (Eds.), *The Self in Social Judgment*. Psychology Press, pp. 85–106.

AlixPartners (2021). "Semiconductor shortages to cost the auto industry billions", press release, AlixPartners, 23 September. Viewed 18 February 2022. Available at: https://www.alixpartners.com/media-center/press-releases/press-release-shortages-related-to-semiconductors-to-cost-the-auto-industry-210-billion-in-revenues-this-year-says-new-alixpartners-forecast/

Allen, F. and Gale, D. (2000). "Bubbles and Crises", *Economic Journal*, Vol. 110, No. 460, pp. 236–255.

Allen, F. and Gorton, G. (1993). "Churning Bubbles", *Review of Economic Studies*, Vol. 60, No. 4, pp. 813–836.

Allen, F. L. (1997). *Only yesterday: An informal history of the 1920's* (Vol. 12). John Wiley & Sons.

Allen, F., Morris, S. and Postlewaite, A. (1993). "Finite Bubbles with Short Sale Constraints and Asymmetric Information", *Journal of Economic Theory*, Vol. 61, No. 2, pp. 206–229.

Anderson, A. (1801). *An Historical and Chronological Deduction of the Origin of Commerce*. London, J. Walter.

Atack, J. and Neal, L. (Eds.). (2009). *The origins and development of financial markets and institutions: From the seventeenth century to the present*. Cambridge University Press.

Attinasi, M. G., Bobasu, A. and Gerinovics, R. (2021)**.** What is driving the recent surge in shipping costs?, *European Central Bank Economic Bulletin***,** Issue 3.

Aveline-Dubach, N. (2020). "China's Housing Booms: A Challenge to Bubble Theory" In: Pumain D. (eds) *Theories and Models of Urbanization. Lecture Notes in Morphogenesis*. Springer international, pp.183-208. Available at: DOI: 10.1007/978-3-030-36656-8_11

Aveline-Dubach, N. (2020). *Covid-19 in China: the pandemic exacerbates the speculative mechanism in residential real estate*, Cybergeo Conversation, 2020. Available at: https://cybergeo.hypotheses.org/category/english-conversations

Ayton, P. and Fischer, I. (2004). "The hot hand fallacy and the gambler's fallacy: Two faces of subjective randomness?", *Memory & Cognition*, Vol. 32, No. 8, pp. 1369-1378. Available at: https://doi.org/10.3758/bf03206327

Baldwin, R. and Giavazzi, F. (2015). The Eurozone crisis: a consensus view of the causes and a few possible solutions, CEPR, chap. *The Eurozone Crisis: A Consensus View of the Causes*, pp. 18-63.

Bammer, S. (2002). *Anglo-American Securities Regulation: Cultural and Political Roots, 1690–1860*, Cambridge University Press, p. 42

Barberis, N., Shleifer, A. and Vishny, R. (1998). "A Model of Investor Sentiment", *Journal of Financial Economics*, Vol. 94, pp. 307–343.

Barone, F. and Tenuta, F. (2020). Decreto Liquidità – Misure fiscali e contabili, *PwC TLS*, 9 April. Viewed 18 February 2022. Available at: https://blog.pwc-tls.it/it/2020/04/09/decreto-liquidita-misure-fiscali-e-contabili/

Basel Committee on Banking Supervision (2011). Basel III: A global regulatory framework for more resilient banks and banking systems, *Bank for International Settlements*, 1 June. Viewed 12 February 2022. Available at: https://www.bis.org/publ/bcbs189.pdf

Basel Committee on Banking Supervision (2013) Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools, *Bank for International Settlements*, 7 January. Viewed 12 February 2022. Available at: https://www.bis.org/publ/bcbs238.pdf

Basel Committee on Banking Supervision (2018). Global systemically important banks: revised assessment methodology and the higher loss absorbency requirement, *Bank for International Settlements*, 5 July. Viewed 12 February 2022. Available at: https://www.bis.org/bcbs/publ/d445.pdf

Basel Committee on Banking Supervision (2019). Risk-based capital requirements RBC40 Systemically important bank buffers, *Bank for International Settlements*, 15 December. Viewed 12 February 2022. Available at: file:///Users/giorgiacarraro/Downloads/RBC40.pdf

Berlin, L. (2008). Lessons of Survival, From the Dot-Com Attic. *The New York Times*, 21 November. Viewed 11 October 2021. Available at: https://www.nytimes.com/2008/11/23/business/23proto.html

Bernanke, B. (2012). "Monetary Policy Since the Onset of the Crisis," Speech given at the Federal Reserve Bank of Kansas City Economic Symposium, Jackson Hole, Wyoming, August 31, 2012. Viewed 4 January 2022. Available at: https://www.federalreserve.gov/newsevents/speech/bernanke20120831a.htm

Bhar, R. and Malliaris, A. G. (2021). "Modeling U.S. monetary policy during the global financial crisis and lessons for Covid-19", *Journal of policy modeling*, Vol. 43, No. 1, pp. 15–33. Available at: https://doi.org/10.1016/j.jpolmod.2020.07.001

Bierman, H. (1991). *The Great Myths of 1929 and the Lessons to be Learned* (Vol. 118). Praeger.

Blackstone, B. (2014). European Central Bank Picked Tough Time to Diet. *The Wall Street Journal*, 3 August. Viewed 13 January. Available at: https://www.wsj.com/articles/european-central-bank-picked-tough-time-to-diet-1407098213

Blanchard, O., Amighini, A., and Giavazzi, F. (2010). *Macroeconomics: a European perspective*, Harlow, Pearson.

Blattner, L., Farinha, L., and Rebelo, F. (2019). *When losses turn into loans: The cost of undercapitalized banks*, European Central Bank Working Paper Series No. 2228, January 2019. Available at: https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2228~6fb5146f92.en.pdf

Bleaney, M. and Veleanu, V. (2021). "Redenomination risk in eurozone corporate bond spreads", *The European Journal of Finance*, Vol. 27, No. 13, pp. 1303-1325. Available at: https://doi.org/10.1080/1351847X.2021.1882524

Bodie, Z., Kane, A., and Marcus, A. J. (2014). *Investments*. New York, McGraw-Hill/Irwin.

Bondarenko, P. (2019a). Quantitative Easing. *Encyclopedia Britannica*, 22 January. Viewed 11 February 2022. Available at: https://www.britannica.com/topic/quantitative-easing

Bondarenko, P. (2019b). Subprime Mortgage. *Encyclopedia Britannica*, 23 September. Viewed 18 January 2022. Available at: https://www.britannica.com/topic/subprime-mortgage

Bowsher, N. N. (1965). Interest Rates, 1914-1965. FRASER Federal Bank of St. Louis. Viewed 16 December 2021. Available at: https://fraser.stlouisfed.org/files/docs/publications/frbslreview/pages/1965-1969/62472_1965-1969.pdf

Britannica, T. Editors of Encyclopaedia (2020). Works Progress Administration. *Encyclopedia Britannica*, 7 July. Viewed 21 December 2021. Available at: https://www.britannica.com/topic/Works-Progress-Administration

Camerer, C. F. (1997). "Taxi Drivers and Beauty Contests", *Engineering and Science*, Vol. 60, No. 1, pp. 10-19. Available at: https://resolver.caltech.edu/CaltechAUTHORS:20110209-085551417

Carosso, V. P., Sears, M. V. and Katz, I. (1970). *Investment banking in America: A history*. Cambridge, Harvard University Press.

Chen, J., Hong, H., and Stein, J. C. (2002). "Breadth of ownership and stock returns", *Journal of financial Economics*, Vol. 66, No.2-3, pp. 171-205.

Claeys, G., Leandro, Á. and Mandra, A. (2015). "European Central Bank quantitative easing: The detailed manual", *Bruegel Policy Contribution*, No. 2015/02, Bruegel, Brussels. Available at: http://hdl.handle.net/10419/126687

Clarida, R. H., Duygan-Bump, B. and Scotti, C. (2021). "The COVID-19 Crisis and the Federal Reserve's Policy Response", *Finance and Economics Discussion Series 2021-035*. Washington: Board of Governors of the Federal Reserve System. Available at: https://doi.org/10.17016/FEDS.2021.035.

Consob. (n.d.). La Crisi Del '29. Viewed 1 October 2021. Available at: https://www.consob.it/web/investor-education/la-crisi-del-29

Consob. (n.d.). Lo Scoppio Della Bolla Delle C.D. Dotcom. Viewed 8 October 2021. Available at: https://www.consob.it/web/investor-education/la-bolla-delle-c.d.-dotcom

Constâncio, V. (2018). "Past and Future of the ECB monetary policy". Transcript of speech delivered at the Central Bank of Malta, Valletta, May 4, 2018. Viewed 5 January 2022. Available at: https://www.ecb.europa.eu/press/key/date/2018/html/ecb.sp180504.en.html

Copelovitch, M., Frieden, J. and Walter, S. (2016). “The Political Economy of the Euro Crisis”, *Comparative Political Studies*, Vol. 49, No. 7, pp. 811–840. Available at doi:10.1177/0010414016633227

Coronavirus Aid, Relief, and Economic Security Act (CARES Act), Pub. L. No. 116-136, 134 Stat.

Corporate Finance Institute. (n.d.). Dotcom Bubble. Viewed 8 October 2021. Available at: https://corporatefinanceinstitute.com/resources/knowledge/trading-investing/dotcom-bubble/

Council on Foreign Relations (n.d.). The U.S. Financial Crisis, Council on Foreign Relations. Viewed 19 January 2022. Available at: https://www.cfr.org/timeline/us-financial-crisis

Crafts, N. and Fearon, P. (2010). “Lessons from the 1930s Great Depression”, *Oxford Review of Economic Policy*, Vol. 26, No. 3, pp. 285–317. Available at: https://doi.org/10.1093/oxrep/grq030

Dale, R. S., Johnson J. E. V. and Tang, L. (2005). “Financial Markets Can Go Mad: Evidence of Irrational Behaviour during the South Sea Bubble”, *The Economic History Review*, Vol. 58, No. 2, pp. 233–271. Available at: http://www.jstor.org/stable/3698692

Daniel, K., Hirshleifer, D. and Subrahmanyam, A. (1998). “Investor Psychology and Security Market Under- and Overreactions”, *Journal of Finance*, Vol. 53, No. 6, pp. 1839–1885.

Dash, M. (1999). *Tulipomania: The Story of the World's Most Coveted Flower and the Extraordinary Passions It Aroused*. New York, Crown Publishers.

Davis, A. M. (1887). *An historical study of Law's system*. Press of Geo. H. Ellis.

Davis, J. S. (2021). Don’t Look to the 2013 Tantrum for the Effect of Tapering on Emerging Markets, Federal Reserve Bank of Dallas, 10 August. Viewed 14 January 2022. Available at: https://www.dallasfed.org/research/economics/2021/0810#:~:text=That%20set%20off%20a%20market,world%2C%20particularly%20in%20emerging%20markets

De Grauwe , P. and Ji, Y. (2020). A tale of three depressions, *VoxEU*, 24 September. Viewed 12 February 2022. Available at: https://voxeu.org/article/tale-three-depressions

de la Merced, M. J., Bajaj, V. and Sorkin, A. R. (2008) . As Goldman and Morgan Shift, a Wall St. Era Ends, Dealbook, The New York Times, 21 September. Viewed 20 January 2022. Available at: https://dealbook.nytimes.com/2008/09/21/goldman-morgan-to-become-bank-holding-companies/

De Long, J. B. and Shleifer, A. (1991). "The stock market bubble of 1929: evidence from closed-end mutual funds", *The Journal of Economic History*, Vol. 51 No. 3, pp. 675-700.

De Vries, J. (1976). *The Economy of Europe in an Age of Crisis, 1600–1750*. Cambridge, Cambridge University Press, p.226.

De Vries, J. (1978). "Barges and Capitalism: Passenger Transportation in the Dutch Economy: 1632–1839", *A. A. G. Bijdragen,* Vol. 21, Wageningen, The Netherlands.

Del Mar, A. (1895). *History of Monetary Systems: A Record of Actual Experiments in Money Made By Various States of the Ancient and Modern World, as Drawn From Their Statutes, Customs, Treaties, Mining Regulations, Jurisprudence, History, Archeology, Coins Nummulary Systems, and Other Sources of Information*. Chicago, C. H. Kerr, p. 324.

DeLong, J. B. and Magin, K. (2006). A short note on the size of the dot-com bubble, NBER Working Paper No. 12011. Available at: http://www.nber.org/papers/w12011

DeMarzo, P. M., Kaniel R. and Kremer I. (2008). "Relative Wealth Concerns and Financial Bubbles", *Review of Financial Studies*, Vol. 21, No. 1, pp. 19–50.

Den Heijer, H. (2014). "A Public and Private Dutch West India Interest", in: Oostindie G. and Roitman J. (eds), *Dutch Atlantic Connections, 1680-1800: Linking Empires, Bridging Borders* (pp. 159-182). Brill, Leiden; Boston. Available at: http://www.jstor.org/stable/10.1163/j.ctt1w8h3c9.13

Díaz, A. and Puch, L. A. (2021). "EU After COVID-19: An Opportunity for Policy Coordination", *Intereconomics*, Vol. 56, No. 4, pp. 197-200.

DiMartino, D. and Duca, J. V. (2007). "The Rise and Fall of Subprime Mortgages", *Federal Reserve Bank of Dallas Economic Letter,* Vol. 2, No. 11, pp. 1-8.

Draghi, M. and Constâncio, V. (2016). "Introductory statement to the press conference (with Q&A) ". Transcript of statement delivered in Frankfurt am Main, September 8, 2016. Viewed 5 January 2022. Available at: https://www.ecb.europa.eu/press/pressconf/2016/html/is160908.en.html

Duca, J. V. (2013). Subprime mortgage crisis. *Federal Reserve History*, 22 November. Viewed 18 January 2022. Available at: https://www.federalreservehistory.org/essays/subprime-mortgage-crisis

Dupor, B. (2021). How Recent Fiscal Interventions Compare with the New Deal, *Federal Reserve Bank of St. Louis*, 9 February. Viewed 11 February 2022. Available at: https://www.stlouisfed.org/publications/regional-economist/third-quarter-2021/how-recent-fiscal-interventions-compare-new-deal

Eggertsson, G. B. and Pugsley, B. (2006). *The Mistake of 1937: A General Equilibrium Analysis*, Discussion Paper No. 2006-E-19, Institute For Monetary And Economic Studies, Bank Of Japan.

Eichengreen, B., and O'Rourke, K. (2010). A tale of two depressions: What do the new data tell us?. *VoxEU,* 8 March. Viewed 31 January 2022. Available at: https://voxeu.org/article/tale-two-depressions-what-do-new-data-tell-us-february-2010-update

Engemann, K. M. (2013). Banking Panics of 1931-33. *Federal Reserve History*, 22 November. Viewed 17 December 2021. Available at: https://www.federalreservehistory.org/essays/banking-panics-1931-33

European Central Bank (2004). *The Monetary Policy of the ECB*, European Central Bank. Viewed 12 February 2022. Available at: https://www.ecb.europa.eu/pub/pdf/other/monetarypolicy2004en.pdf

European Central Bank (2010a). "The ECB's response to the financial crisis", *ECB Monthly Bulletin*, October.

European Central Bank (2010b). “Monetary and Financial Developments”, *ECB Monthly Bulletin*, June.

European Central Bank (2015). “The Governing Council’s Expanded Asset Purchase Programme”, *ECB Monthly Bulletin*, Issue No. 1.

European Central Bank (2018). Monetary policy decisions, European Central Bank, 14 June. Viewed 12 January 2022. Available at: https://www.ecb.europa.eu/press/pr/date/2018/html/ecb.mp180614.en.html

European Central Bank (2020a). ECB announces new pandemic emergency longer-term refinancing operations, European Central Bank, 30 April. Viewed 11 January 2022. Available at: https://www.ecb.europa.eu/press/pr/date/2020/html/ecb.pr200430_1~477f400e39.en.html

European Central Bank (2020b). ECB announces €750 billion Pandemic Emergency Purchase Programme (PEPP), European Central Bank, 18 March. Viewed 11 January 2022. Available at: https://www.ecb.europa.eu/press/pr/date/2020/html/ecb.pr200318_1~3949d6f266.en.html

European Central Bank (2020c). Monetary policy decisions, European Central Bank, 10 December. Viewed 11 January 2022. Available at: https://www.ecb.europa.eu/press/pr/date/2020/html/ecb.mp201210~8c2778b843.en.html

European Central Bank (2020d). Monetary policy decisions, European Central Bank, 12 March. Viewed 11 January 2022. Available at: https://www.ecb.europa.eu/press/pr/date/2020/html/ecb.mp200312~8d3aec3ff2.en.html

European Central Bank (2020e). Monetary policy decisions, European Central Bank, 4 June. Viewed 11 January 2022. Available

at: https://www.ecb.europa.eu/press/pr/date/2020/html/ecb.mp200604~a307d3429c.en.html

European Central Bank (2021a). The euro area bank lending survey – Fourth quarter of 2020, European Central Bank, January. Viewed 18 February 2022. Available at: https://www.ecb.europa.eu/stats/ecb_surveys/bank_lending_survey/html/ecb.blssurvey2020q4~e89c77d212.en.html

European Central Bank (2021b). How does the ECB's asset purchase programme work, European Central Bank, 25 August. Viewed 11 February 2022. Available at: https://www.ecb.europa.eu/ecb/educational/explainers/tell-me-more/html/app.en.html

European Central Bank (2021c). What is forward guidance?, European Central Bank, 8 July. Viewed 11 February 2022. Available at: https://www.ecb.europa.eu/ecb/educational/explainers/tell-me-more/html/app.en.html

European Central Bank (2022). The euro area bank lending survey - Fourth quarter of 2021, European Central Bank, January. Viewed 18 February 2022. Available at: https://www.ecb.europa.eu/stats/ecb_surveys/bank_lending_survey/html/ecb.blssurvey2021q4~43deabc06e.en.html

European Central Bank (n.d.). Central Bank Liquidity Lines. Viewed 11 February 2022. Available at: https://www.ecb.europa.eu/mopo/implement/liquidity_lines/html/index.en.html

European Central Bank (n.d.). ECB mission, European Central Bank. Viewed 12 February 2022. Available at: https://www.ecb.europa.eu/ecb/orga/escb/ecb-mission/html/index.en.html

European Commission (2020). EU budget: European Commission welcomes the adoption of the EU's long-term budget for 2021-2027, European Commission, 17 December. Viewed 12 January 2022. Available at: https://ec.europa.eu/commission/presscorner/detail/en/IP_20_2469

European Commission (2022). SME Support, Recovery And Resilience Scoreboard Thematic Analysis, January 2022. Viewed 18 February 2022. Available at: https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/assets/thematic_analysis/3_SME.pdf

Fama, E. F. (1970). "Efficient Capital Markets: A Review of Theory and Empirical Work", *Journal of Finance*, Vol. 25, No. 2, pp. 383–417. Available at: https://doi.org/10.2307/2325486

Families First Coronavirus Response Act. H.R.6201 - 116th Congress (2019-2020) (2020, March 18). Available at : https://www.congress.gov/bill/116th-congress/house-bill/6201

Federal Reserve (2008). FOMC statement of December 16, 2008, Federal Reserve, 16 December. Viewed 4 January 2022. Available at: https://www.federalreserve.gov/newsevents/pressreleases/monetary20081216b.htm

Federal Reserve (2012a). FOMC statement of December 12, 2012, Federal Reserve, 12 December. Viewed 4 January 2022. Available at: https://www.federalreserve.gov/newsevents/pressreleases/monetary20121212a.htm

Federal Reserve (2012b). FOMC statement of September 13, 2012, Federal Reserve, 13 September. Viewed 4 January 2022. Available at: https://www.federalreserve.gov/newsevents/pressreleases/monetary20120913a.htm

Federal Reserve (2015). What is forward guidance, and how is it used in the Federal Reserve's monetary policy?. Federal Reserve, 16 December. Viewed 11 February 2022. Available at: https://www.federalreserve.gov/faqs/what-is-forward-guidance-how-is-it-used-in-the-federal-reserve-monetary-policy.htm

Federal Reserve (2016). Term Auction Facility (TAF). Federal Reserve, 16 February. Viewed 4 January 2022. Available at: https://www.federalreserve.gov/regreform/reform-taf.htm

Federal Reserve (2020). FOMC statement of March 15, 2020, Federal Reserve, 15 March. Viewed 10 January 2022. Available at: https://www.federalreserve.gov/monetarypolicy/files/monetary20200315a1.pdf

Federal Reserve (2021a). The Fed Explained: What the Central Bank Does, Federal Reserve System Publication.

Federal Reserve (2021b). Monetary Policy: What Are Its Goals? How Does It Work?, *Federal Reserve*, 29 July. Viewed 12 February 2022. Available at: https://www.federalreserve.gov/monetarypolicy/monetary-policy-what-are-its-goals-how-does-it-work.htm

Federal Reserve Act, Sect. 13(3), 12 U.S.C. § 343 (1932). Available at: https://www.federalreserve.gov/aboutthefed/section13.htm

Federal Reserve Act, Sect. 2A, 12 U.S.C. § 225a (1977). Available at: https://www.federalreserve.gov/aboutthefed/section2a.htm

Federal Reserve Bank of New York (2020). Statement Regarding Treasury Securities, Agency Mortgage-Backed Securities, and Agency Commercial Mortgage-Backed Securities Operations, Federal Reserve Bank of New York, 10 June. Viewed 10 January 2022. Available at: https://www.newyorkfed.org/markets/opolicy/operating_policy_200610

Federal Reserve Bank of St. Louis (n.d.). TED Spread (DISCONTINUED) [TEDRATE], *FRED, Federal Reserve Bank of St. Louis*. Viewed 31 January 2022. Available at: https://fred.stlouisfed.org/series/TEDRATE.

Fischer, S. (2021). *Comparing the Monetary Policy Responses of Major Central Banks to the Great Financial Crisis and the COVID-19 Pandemic*, GCFB Research Paper, November 2021. Viewed 13 January 2022. Available at: https://gcfp.mit.edu/wp-content/uploads/2021/11/Monetary-Policy-Research-Paper-Stanley-Fischer-Nov2021.pdf

Fishback, P. (2010). “US Monetary and Fiscal Policy in the 1930s”, *Oxford Review of Economic Policy*, Vol. 26 No. 3, pp. 385-413. Available at: https://doi.org/10.1093/oxrep/grq029

Fishback, P. and Kachanovskaya, V. (2015). The Multiplier for Federal Spending in the States During the Great Depression. *The Journal of Economic History,* Vol. 75, No. 1, pp. 125-162. doi:10.1017/S0022050715000054

Fishback, P. V. and Wallis, J. J. (2012). *What was new about the New Deal?*, NBER Working Paper No. w18271. Available at: https://www.nber.org/system/files/working_papers/w18271/w18271.pdf

FISHER SEES STOCKS PERMANENTLY HIGH; Yale Economist Tells Purchasing Agents Increased Earnings Justify Rise. SAYS TRUSTS AID SALES Finds Special Knowledge, Applied to Diversify Holdings, Shifts Risks for Clients. *New York Times*, 16 October 1929. Viewed 30 September 2021. Available at: https://www.nytimes.com/1929/10/16/archives/fisher-sees-stocks-permanently-high-yale-economist-tells-purchasing.html

Fisher, I. (1930). *The Stock Market Crash--and After*. Macmillan.

French, D. (2006). “The Dutch monetary environment during tulipmania”, *Quarterly Journal of Austrian Economics,* Vol. 9, No. 1, pp. 3-14.

Friedman, M. and Schwartz, A. J. (1963b). “Money and Business Cycles”, *The Review of Economics and Statistics*, Vol. 45 No. 1, pp. 32–64. Available at: https://doi.org/10.2307/1927148

Friedman, M., and Schwartz, A. J. (1963a). *A monetary history of the United States, 1867-1960* (Vol. 14). Princeton University Press.

Frontline (2002), “Dot Con” http://www.pbs.org/wgbh/pages/frontline/shows/dotcon/etc/synopsis.html

Galbraith, J. K. (2009). *The great crash 1929*. Houghton Mifflin Harcourt.

Garber, P. M. (1989). "Tulipmania", *The Journal of Political Economy*, Vol. 97, No. 3, pp. 535-560. Available at: http://www.jstor.org/stable/1830454

Garber, P. M. (1990). "Famous First Bubbles", *The Journal of Economic Perspectives*, Vol. 4 No. 2, pp. 35–54. Available at: http://www.jstor.org/stable/1942889

Garber, P. M. (2000). *Famous first bubbles: The fundamentals of early manias*. Cambridge, MIT Press.

Gibson, H. D., Hall, S. G., and Tavlas, G. S. (2012). "The Greek financial crisis: Growing imbalances and sovereign spreads", *Journal of International Money and Finance*, Vol. 31, No. 3, pp. 498-516.

Gocaj, L. and Meunier, S. (2013). "Time Will Tell: The EFSF, the ESM, and the Euro Crisis", *European Integration*, Vol. 35, No. 3, pp. 239–253. Available at: http://dx.doi.org/10.1080/07036337.2013.774778

Goldman, D. (2010), 10 big dot.com flops. *CNN Money.* Viewed 6 October 2021. Available at : https://money.cnn.com/galleries/2010/technology/1003/gallery.dot_com_busts/index.html

Gou, M., Richardson, G., Komai, A. and Park, D. (2013). Banking Acts of 1932. *Federal Reserve History*, 22 November. Viewed 16 December 2021. Available at: https://www.federalreservehistory.org/essays/banking-acts-of-1932

Greene, S. (2013). Emergency Banking Act of 1933. *Federal Reserve History*, 22 November. Viewed 20 December 2021. Available at: https://www.federalreservehistory.org/essays/emergency-banking-act-of-1933

Greenspan, A. (1996). The challenge of central banking in a democratic society, a speech before The American Enterprise Institute for Public Policy Research, Washington D.C., *Federal Reserve*. Viewed 7 October 2021. Available at: http://www.federalreserve.gov/boarddocs/speeches/1996/19961205.htm.

Guilloux-Nefussi, S. and Rusticelli, E. (2021). Supply-side disruptions are dragging down the automotive sector, *OECD Ecoscope*, 22 December. Viewed 18 February 2022. Available

at: https://oecdecoscope.blog/2021/12/22/supply-side-disruptions-are-dragging-down-the-automotive-sector/

Hakkio, C. S. (2013). The Great Moderation. *Federal Reserve History*, 22 November. Viewed 18 January 2022. Available at: https://www.federalreservehistory.org/essays/great-moderation

Hamdi, V. and Mousavi, S. M. K. (2014). "A Review On The Efficient Market Hypothesis And Stock Valuation Models", *Indian Journal of Fundamental and Applied Life Sciences*, Vol. 4, No. S1, pp. 865-872. Available at: https://www.cibtech.org/sp.ed/jls/2014/01/jls.htm

Helfferich, K. (1969). Money. Transalted by Louis Infield. New York, Augustus M. Kelley Publishers.

Helper, S. and Soltas, E, (2021) Why the Pandemic Has Disrupted Supply Chains, The White House, written materials, 12 June. Viewed 11 February 2022. Available at: https://www.whitehouse.gov/cea/written-materials/2021/06/17/why-the-pandemic-has-disrupted-supply-chains/

Hernández de Cos, P. (2021). Evaluating the effectiveness of Basel III during COVID-19 and beyond. Keynote address at the *BCBS-Bundesbank-CEPR workshop on evaluating financial regulation*, Bank for International Settlements, 20 April 2021. Viewed 12 February 2022. Available at: https://www.bis.org/speeches/sp210420.pdf

Himmelberg, C., Mayer, C., and Sinai, T. (2005). "Assessing high house prices: Bubbles, fundamentals and misperceptions", *Journal of Economic Perspectives*, Vol. 19, No. 4, pp. 67-92.

History.com editors (2021a). Great Depression History. *History*, 5 October. Viewed 21 December 2021. Available at: https://www.history.com/topics/great-depression/great-depression-history

History.com editors (2021b). New Deal. *History*, 5 October. Viewed 21 December 2021. Available at: https://www.history.com/topics/great-depression/new-deal

Hoover, H. (1952). *The Memoirs of Herbert Hoover-The Great Depression, 1929-1941*. MacMillan.

Hoppit, J. (2002). "The Myths of the South Sea Bubble", *Transactions of the Royal Historical Society*, Vol. 12, pp. 141–165. Available at: http://www.jstor.org/stable/3679343

Horvath, B. L. and Huizinga, H. P. (2011). "Does the European Financial Stability Facility bail out Sovereigns or Banks? An Event Study", *EBC Discussion Paper*, Vol. 2011-031.

International Monetary Fund (2021a). *Policy Responses to COVID-19*, International Monetary Fund. Viewed: 10 January 2022. Available at: https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19

International Monetary Fund (2021b). *Real GDP growth*, International Monetary Fund. Viewed 14 January 2022. Available at: https://www.imf.org/external/datamapper/NGDP_RPCH@WEO/OEMDC/ADVEC/WEOWORLD

International Monetary Fund (2021c). *Regional Economic Outlook for Europe, October 2021*: *The European Recovery: Policy Recalibration and Sectoral Reallocation*, International Monetary Fund. Viewed 14 January 2022. Available at: https://www.imf.org/en/Publications/REO/EU/Issues/2021/10/20/regional-economic-outlook-for-europe-october-2021

International Monetary Fund (2021d). *World Economic Outlook, October 2021: Recovery During a Pandemic*, International Monetary Fund. Viewed 14 January 2022. Available at: https://www.imf.org/en/Publications/WEO/Issues/2021/10/12/world-economic-outlook-october-2021

Irrera, M. and Fregonara, E. (2020). "LA CRISI D'IMPRESA E LA CONTINUITA'AZIENDALE AI TEMPI DEL CORONAVIRUS" in Irrera, M. (Eds.), *Il Diritto Dell'emergenza: Profili Societari, Concorsuali, Bancari E Contrattuali*. REGOLAZIONE, ETICA E SOCIETA' - CENTRO STUDI D'IMPRESA, pp. 18-36.

Jackson, J. K., Weiss, M. A., Schwarzenberg, A. B., Nelson, R. M., Sutter, K. M. and Sutherland, M. D. (2021). *Global economic effects of COVID-19*, Congressional Research Service Report R46270. Available at: https://crsreports.congress.gov/product/pdf/R/R46270

James, J., Sylla, R. (2006). "Interest Rates and Yields", in Carter, S. B., Gartner, S. S., Haines, M. R., Olmstead, A. L., Sutch, R., and Wright, G. (Eds.), *Historical Statistics of the United States: Millennial Edition*, Vol. 3. New York, Cambridge University Press.

Joint Center for Housing Studies of Harvard University (2008). The State Of The Nation's Housing. Viewed 18 January 2022. Available at: https://www.jchs.harvard.edu/sites/default/files/media/imp/son2008.pdf

Jordà, Ò., Schularick, M. and Taylor, A. (2015). *Leveraged bubbles*, NBER Working Paper No. 21486. Available at: https://www.nber.org/papers/w21486

Kahneman, D. and Tversky, A. (1972). "Subjective probability: A judgment of representativeness", *Cognitive Psychology*, Vol. 3, No. 3, pp. 430-454. Available at: https://doi.org/10.1016/0010-0285(72)90016-3

Kang, D. W., Ligthart, N. and Mody, A. (2015). *The European Central Bank: Building a shelter in a storm*, CFS Working Paper Series No. 527, Goethe University Frankfurt, Center for Financial Studies (CFS), Frankfurt a. M.. Available at: http://nbn-resolving.de/urn:nbn:de:hebis:30:3-392969

Kang, D. W., Ligthart, N. and Mody, A. (2016). The ECB and the Fed: A comparative narrative, *VoxEU*, 19 January. Viewed 4 January 2022. Available at: https://voxeu.org/article/ecb-and-fed-comparative-narrative

Kay, G. (2021a). California ports aren't the only ones facing record backlogs of cargo ships — 3 other US ports have hit historic highs, *Business Insider*, 2 October. Viewed 18 February 2022. Available at: https://www.businessinsider.com/us-ports-face-record-backlogs-of-ships-east-coast-2021-10?r=US&IR=T

Kay, G. (2021b). Nearly half a million shipping containers are stuck off the coast of Southern California as the ports operate below capacity, Business Insider, 6 October.

Viewed 18 February 2022. Available at: https://www.businessinsider.com/shipping-containers-stuck-california-ports-combat-shortages-2021-9?r=US&IR=T

Kemmerer, E. W. (2009). *Gold and the gold Standard*, Ludwig von Mises Institute

Keynes, J. M. (1936). *The General Theory of Employment, Interest and Money*. London, Macmillan.

Kindleberger, C. P. (2000). *Manias, Panics, and Crashes: A History of Financial Crises*. John Wiley & Sons.

Kindleberger, C. P. and Aliber, R. Z. (2005). *Manias, Panics, and Crashes: A History of Financial Crises*. Hoboken, John Wiley & Sons.

Kirsch, D. and Goldfarb, B. D. (2006). "Small Ideas, Big Ideas, Bad Ideas, Good Ideas: 'Get Big Fast' and Dot Com Venture Creation", Robert H. Smith School Research Paper No. RHS-06-049. Available at SSRN: https://ssrn.com/abstract=946446

Knight, A. (2002). "A Bubble on the Mighty Mississippi: An Application of a General Model of Speculative Bubbles to the Mississippi Bubble of 1716-1720", *Major Themes in Economics*, Vol. 4, No. 1, pp.71-94.

Kyle, A. S. and Obizhaeva, A. A. (2019). Large Bets and Stock Market Crashes. Available at SSRN: https://ssrn.com/abstract=2023776

Lafrogne-Joussier, R., Martin, J. and Mejean, I. (2022). Supply chain disruptions and mitigation strategies, *VoxEU*, 5 February. Viewed 11 February 2022. Available at: https://voxeu.org/article/supply-chain-disruptions-and-mitigation-strategies

Laing, J. R. (2005). The Bubble's New Home. *Barron's*, 20 June. Viewed 31 January 2022. Available at: https://www.barrons.com/articles/SB111905372884363176

Lamont, O. and Frazzini, A. (2008). "Dumb Money: Mutual Fund Flows and the Cross-section of Stock Returns", *Journal of Financial Economics*, Vol. 88, pp. 299–322.

LaRocco, L. A. (2021). Satellite images show backlog of containers awaiting export at Port of Yantian after Covid outbreak, *CNBC*, 17 June. Viewed 18 February 2022. Available

at: https://www.cnbc.com/2021/06/17/covid-outbreak-satellite-images-show-container-backlog-at-port-of-yantian.html

Lee, J. Y., and Wilson, N. (1997). *Sterilizing capital inflows*, Vol. 7. Washington, DC, USA: International Monetary Fund.

Levitin, A. J. and Wachter, S. M. (2012). "Explaining the Housing Bubble", *The Georgetown Law Journal*, Vol. 100, No. 4, pp. 1177-1258.

Lewellen, J. (2003). Discussion of "The internet downturn: Finding valuation factors in spring 2000". *Journal of Accounting and Economics*, Vol. 34, No.1-3, pp. 237-247.

Ljungqvist, A. and Wilhelm Jr, W. J. (2003). "IPO pricing in the dot-com bubble", *The Journal of Finance*, Vol. 58, No.2, pp. 723-752.

Lund, S., Mehta, A., Manyika, J. and Goldshtein, D. (2018). A decade after the global financial crisis: What has (and hasn't) changed?, McKinsey Global Institute Executive Briefing, 29 August.

Mackay, C. (1841). *Extraordinary Popular Delusions and the Madness of Crowds*. London, Richard Bentley.

Malkiel, B. G. (1963). "Equity Yields, Growth, and the Structure of Share Prices", *American Economic Review*, Vol. 53, No. 5, pp. 1004-1031.

Malkiel, B. G. (2010). *Bubbles in Asset Prices*. CEPS Working Paper No. 200. Available at: https://gceps.princeton.edu/wp-content/uploads/2017/01/200malkiel.pdf

McDonald, R. L. and Paulson, A. (2015). *AIG in Hindsight*, NBER Working Paper No. w21108. Available at: http://www.nber.org/papers/w21108

Miller, E. (1977). "Risk, Uncertainty, and Divergence of Opinion", *Journal of Finance*, Vol. 32, No. 4, pp. 1151–1168.

Ministero dell'Economia e delle Finanze (2020a). The 'AUGUST' Decree. Southern Italy, businesses and work: € 25 billion to help Italy recover, *Ministero dell'Economia e delle Finanze*, August 26. Viewed 18 February 2022. Available

at: https://www.mef.gov.it/en/inevidenza/Relaunch-Decree-155-billion-for-Phase-two-of-the-Economy-00001/

Ministero dell'Economia e delle Finanze (2020b). 'Liquidity Decree', over €400 billion in guarantees, *Ministero dell'Economia e delle Finanze*, April 6. Viewed 18 February 2022. Available at: https://www.mef.gov.it/en/inevidenza/Liquidity-Decree-over-400-billion-in-guarantees/

Ministero dell'Economia e delle Finanze (2020c). The measures introduced by the Italian government to support families, *Ministero dell'Economia e delle Finanze*, 30 December**.** Viewed 18 February 2022. Available at: https://www.mef.gov.it/en/covid-19/The-measures-introduced-by-the-Italian-government-to-support-families-00001/

Ministero dell'Economia e delle Finanze (2020d). Relaunch Decree, €155 billion for Phase two of the Economy, *Ministero dell'Economia e delle Finanze*. Viewed 18 February 2022. Available at: https://www.mef.gov.it/en/inevidenza/Relaunch-Decree-155-billion-for-Phase-two-of-the-Economy-00001/

Ministero dello Sviluppo Economico (2020). MiSE: le misure per imprese e lavoratori nel Decreto Cura Italia, *Ministero dello Sviluppo Economico*, 18 March. Viewed 18 February 2022. Available at: https://www.mise.gov.it/index.php/it/2040889

Ministero dello Sviluppo Economico (2022). Beni strutturali ("Nuova Sabatini"), *Ministero dello Sviluppo Economico*. Viewed 18 February 2022. Available at: https://www.mise.gov.it/index.php/it/incentivi/impresa/beni-strumentali-nuova-sabatini

Ministero dello Sviluppo Economico (n.d.). Fondo Salvaguardia Imprese, *Ministero dello Sviluppo Economico*. Viewed 18 February 2022. Available at: https://www.mise.gov.it/index.php/it/incentivi/impresa/fondo-salvaguardia-imprese

Mishkin, F. S. (2011). "Over the cliff: From the subprime to the global financial crisis", *Journal of Economic Perspectives*, Vol. 25 No. 1, pp. 49-70.

Mishkin, F. S. and White, E. N. (2002). *US stock market crashes and their aftermath: implications for monetary policy*, NBER Working Paper No. 8992. Available at: https://www.nber.org/papers/w8992

Moen, J. (2001). John Law and the Mississippi Bubble 1718-1720 ". *Mississippi History Now*, archived from the original on March 1, 2006. Viewed 13 September 2021. Available at: https://web.archive.org/web/20160301192346/http://mshistory.k12.ms.us/articles/70/john-law-and-the-mississippi-bubble-1718-1720

Morris, C. (2022). Warning shipping delay problems to continue this year, *BBC*, 27 January. Viewed 18 February 2022. Available at: https://www.bbc.com/news/business-60131947

Morris, J. J. and Alam, P. (2008) Analysis of the Dot-Com Bubble of the 1990s. Available at: https://ssrn.com/abstract=1152412

Mou, J. (2020). "Research on the Impact of COVID19 on Global Economy". *IOP Conference Series: Earth and Environmental Science*, Vol. 546 No. 3, 32043.

Muller et al. (2021). Annual Report on European SMEs of 2020/2021, European Commission. Viewed 18 February 2022. Available at: https://ec.europa.eu/docsroom/documents/46062

Nolen, J. L. (2020a). Fannie Mae, *Encyclopedia Britannica*, April 30. Viewed 19 January 2022. Available at: https://www.britannica.com/topic/Fannie-Mae

Nolen, J. L. (2020b). Freddie Mac, *Encyclopedia Britannica*, April 30. Viewed 19 January 2022. Available at: https://www.britannica.com/topic/Freddie-Mac

Notteboom, T., Pallis, T. and Rodrigue, J. P. (2021). Disruptions and resilience in global container shipping and ports: the COVID-19 pandemic versus the 2008–2009 financial crisis, *Maritime Economics & Logistics*, pp. 1–32. Available at: https://doi.org/10.1057/s41278-020-00180-5

OECD (2009). The effectiveness and scope of fiscal stimulus, *OECD Economic Outlook Interim Report*.

Ofek, E. and Richardson, M. P. (2001). *DotCom Mania: The Rise and Fall of Internet Stock Prices*, NBER Working Paper No. w8630. Available at SSRN: https://ssrn.com/abstract=293243

Office of Thrift Supervision (2008). OTS 08-046 - Washington Mutual Acquired by JPMorgan Chase, Office of Thrift Supervision, 25 September. Viewed 20 January 2022. Available at https://web.archive.org/web/20081104102657/http://www.ots.treas.gov/?p=PressReleases&ContentRecord_id=9c306c81-1e0b-8562-eb0c-fed5429a3a56

Ohanian L. E. (2009). "What—or Who—Started the Great Depression?", *Journal of Economic Theory*, Vol. 144, No. 6, pp. 2310-2335.

Osservatorio CPI (2020). Il decreto Cura Italia: un commento dell'Osservatorio CPI, *Osservatorio CPI*, 19 March. Viewed 18 February 2022. Available at: https://osservatoriocpi.unicatt.it/cpi-archivio-studi-e-analisi-il-decreto-cura-italia-un-commento-dell-osservatorio-cpi

Paige, J. C. (2002). *The Civilian Conservation Corps and the National Park Service, 1933-1942: An Administrative History*, National Park Service Department of the Interior. Viewed 21 December 2021. Available at: https://www.nps.gov/parkhistory/online_books/ccc/index.htm

Park, H. and Van Horn, P. (2013). "Did the Reserve Requirement Increases of 1936–1937 Reduce Bank Lending? Evidence from a Natural Experiment". *Unpublished manuscript*, US Department of Treasury and Southwestern University. Available at: https://conference.nber.org/confer/2014/SI2014/ME/Park_Van_Horn.pdf

Petram, L. (2020). The world's first IPO. *The World First Stock Exchange*, 15 October. Viewed 17 August 2021. Available at: https://www.worldsfirststockexchange.com/2020/10/15/the-worlds-first-ipo/

Piano Nazionale di Ripresa e Resilienza (PNRR). Viewed 18 February 2022. Available at: https://www.governo.it/sites/governo.it/files/PNRR.pdf

PMI Tutoring (2020). Decreto Liquidità 8 aprile 2020 n.23 – Sintesi delle misure sulla liquidità alle imprese, *PMI Tutoring*, 14 April. Viewed 18 February 2022. Available at: https://www.pmitutoring.it/application/files/3415/8684/9955/DL_Liquidita_sintesi_per_PMITUTORING.pdf

PMI.it (2021). Le Piccole e Medie Imprese in Italia, *PMI.it*, 12 November. Viewed 18 February 2022. Available at: https://www.pmi.it/economia/mercati/372150/le-piccole-e-medie-imprese-in-italia.html

Prem Kumar, P. (2021). Intel CEO warns chip shortage to last until 2023 as demand soars, *Nikkei Asia*, 16 December. Viewed 18 February 2022. Available at: https://asia.nikkei.com/Spotlight/Supply-Chain/Intel-CEO-warns-chip-shortage-to-last-until-2023-as-demand-soars

Quinn, W. and Turner, J. (2020). 'No More Boom and Bust': The Subprime Bubble. In *Boom and Bust: A Global History of Financial Bubbles* (pp. 170-192). Cambridge, Cambridge University Press. Available at DOI:10.1017/9781108367677.010

Rakic, D. (2021). "The ECB's Monetary Policy Response to the COVID-19 Crisis", European Parliament Briefing, Policy Department for Economic, Scientific and Quality of Life Policies Directorate-General for Internal Policies, PE 648.787. Viewed 10 January 2022. Available at: https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/648787/IPOL_BRI(2020)648787_EN.pdf

Rappoport, P. and White, E. N. (1993). "Was there a bubble in the 1929 stock market?", *The Journal of Economic History*, Vol. 53 No. 3, pp. 549-574.

Rees, D. and Rungcharoenkitkul, P. (2021). Bottlenecks: causes and macroeconomic implications, *BIS Bulletin*, No. 48.

Reid, R. (1997). *Architects of the Web*. Germany, Wiley.

Richardson, G. (2013). The Great Depression, *Federal Reserve History*, 22 November. Viewed 10 December 2021. Available at: https://www.federalreservehistory.org/essays/great-depression

Richardson, G., Komai, A., Gou, M. and Park, D. (2013). Stock Market Crash of 1929. *Federal Reserve History*, 22 November. Viewed 30 September 2021. Available at: https://www.federalreservehistory.org/essays/stock-market-crash-of-1929

Ricketts, L. R. (2011). "Quantitative easing explained", *Liber8 Economic Information Newsletter*, April.

Romer, C. D. (2009). "Back from the Brink", speech to the Federal Reserve Bank of Chicago, Chicago, September 24, 2009. Viewed 24 January. https://eml.berkeley.edu/~cromer/CEA/Back_from_the_Brink2.pdf

Roosevelt, F. D. (1933a). "Fireside Chat 1: On The Banking Crisis". Transcript of speech delivered from the White House, Washington DC, March 12, 1933. https://millercenter.org/the-presidency/presidential-speeches/march-12-1933-fireside-chat-1-banking-crisis

Roosevelt, F. D. (1933b). "First Inaugural Address". Transcript of speech delivered at the United States Capitol, Washington DC, March 4, 1933. https://avalon.law.yale.edu/20th_century/froos1.asp

Rostagno, M., Altavilla, C., Carboni, G., Lemke, W., Motto, R. and Guilhem, A. S. (2021). *Combining Negative Rates, Forward Guidance and Asset Purchases: Identification and Impacts of the ECB's Unconventional Policies*, European Central Bank Working Paper Series No. 2564, June 2021. Available at: https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2564~e02f3aad4c.en.pdf

Sadler, D. (2021). Delivery Times For New Cars Have Increased Significantly, Globe echo, 3 November. Viewed 18 February, 2022. Available at: https://globeecho.com/news/europe/germany/delivery-times-for-new-cars-have-increased-significantly/

Sahay, M. R., Arora, M. V. B., Arvanitis, M. A. V., Faruqee, M. H., N'Diaye, M. P. and Griffoli, M. T. M. (2014). Emerging market volatility: Lessons from the taper tantrum. *International Monetary Fund Staff Discussion Notes*.

Sahm, C. (2021). “COVID-19 Is Transforming Economic Policy in the United States”, *Intereconomics*, Vol. 56, No. 4, pp. 185-190.

Salvadè, A., Courir, E., Silvestri, S., Valle, F., and Angelillis, A. (2020). Italian law decree No. 23/2020 ("Decreto Liquidità"), New provisions involving certain aspects of business law, *Bird&Bird*. Viewed 18 February 2022. Available at: https://www.twobirds.com/en/news/articles/2020/italy/covid19-decreto-liquidita---diritto-societario

Sandrock, J. E., & Reformer, J. L. M. (2013). *John Law’s Banque Royale and the Mississippi Bubble*. Available at : http://www.thecurrencycollector.com/pdfs/John_Laws_Banque_Royale.pdf

Schama, S. (1988). *The Embarrassment of Riches: An Interpretation of Dutch Culture in the Golden Age*. Berkeley, University of California Press, pp. 351-362.

Scharfstein, D. S. and Stein, J. C. (1990). “Herd Behavior and Investment”, *American Economic Review*, Vol. 80, No. 3, pp. 465–479.

Scheller, H. K. (2006). *The European Central Bank: History, Role and Functions*. European Central Bank. Viewed 12 February 2022. Available at: https://www.ecb.europa.eu/pub/pdf/other/ecbhistoryrolefunctions2006en.pdf

Scherbina, A. (2013). *Asset Price Bubbles: A Selective Survey.* IMF Working Paper No. 13/45, International Monetary Fund. Available at: https://ssrn.com/abstract=2229654

Scott, W. R. (1912). *The constitution and finance of English, Scottish and Irish joint-stock companies to 1720*, Vol. 1. Cambridge, Cambridge University Press.

Shachmurove, Y. (2011). “A historical overview of financial crises in the United States”, *Global Finance Journal*, Vol. 22, No. 3, pp. 217-231.

Shan H. (2011). “The Effect of Capital Gains Taxation on Home Sales: Evidence from the Taxpayer Relief Act of 1997”, *Journal of public economics*, Vol. 95, No. 1-2, pp. 177–188. Available at: https://doi.org/10.1016/j.jpubeco.2010.10.006

Sharot, T. (2011). “The optimism bias”, *Current Biology*, Vol. 21, No. 23, 2011, pp. R941-R945. Available at: https://doi.org/10.1016/j.cub.2011.10.030.

Shehata, J., Geraci, E., Gallio, M., Roccazzella, I., Pace, R., and Cioffi, C. (2020). Decreto Liquidità – Interventi in materia di accesso al credito, all’esportazione, all’internazionalizzazione e agli investimenti delle imprese, *PwC TLS*, 9 April. Viewed 18 February 2022. Available at: https://blog.pwc-tls.it/it/2020/04/09/decreto-liquidita-interventi-in-materia-di-accesso-al-credito-allesportazione-allinternazionalizzazione-e-agli-investimenti-delle-imprese/

Shiller, R. J. (2000). *Irrational exuberance*. Princeton, Princeton University Press.

Shiller, R. J. (2002). “Bubbles, Human Judgment, and Expert Opinion”, *Financial Analysts Journal*, Vol. 58, No. 3, pp. 18–26. Available at https://www.jstor.org/stable/4480389

Shiller, R. J. (2006)."Long-Term Perspectives on the Current Boom in Home Prices.", *The Economists' Voice*, Vol. 3, Issue 4.

Shiller, R. J. (2008). *The subprime solution : How today's global financial crisis happened, and what to do about it*. Princeton University Press.

Shleifer, A. and Vishny, R. W. (1997). The limits of arbitrage. *The Journal of finance*, Vol. 52, No. 1, pp. 35-55.

Sibert, A. (2010) The Greek sovereign debt crisis and the Eurosystem, European Parliament. Viewed January 31 2022. Available at: https://annesibertbuiter.com/Quarterly%20Dialogue/QD2010June.pdf

Siripurapu, A. (2021). What happened to supply chains in 2021?, *Council on Foreign Relations*, 13 December. Viewed 12 February 2022. Available at: https://www.cfr.org/article/what-happened-supply-chains-2021

Sirkin, G. (1975). “The Stock Market of 1929 Revisited: A Note”, *The Business History Review*, Vol. 49 No. 2, pp. 223–231. Available at: https://doi.org/10.2307/3113701

Smith, A. (2020). "The European Central Bank's Securities Markets Programme (ECB GFC)," *The Journal of Financial Crises*, Vol. 2, No. 3, pp. 369-381. Available at: https://elischolar.library.yale.edu/journal-of-financial-crises/vol2/iss3/15

Smith, C., Hodgson, C. and Lockett, H. (2020). US Stocks Set Record High as Investors Look to New Administration, *Financial Times*, November 24, 2020. Available at: https://www.ft.com/content/433048a5-c489-4ddd-aebdd56fb8f3edfc.

Snodgrass, E. (2021). Satellite images show congestion at Los Angeles and Long Beach ports this year compared to 2020 and 2019, *Business Insider*, 19 October. Viewed 18 February 2022. Available at: https://www.businessinsider.com/satellite-images-show-congestion-at-the-port-of-long-beach-2021-10?r=US&IR=T

Sperling, J. G. (1962). *The South Sea Company: an historical essay and bibliographical finding list*. Boston, Baker Library, Harvard Graduate School of Business Administration.

Spotton, B. (1997). "Financial Instability Reconsidered: Orthodox Theories versus Historical Facts", *Journal of Economic Issues*, Vol. 31, No.1, pp. 175-196. Available at DOI: 10.1080/00213624.1997.11505896

Strauss-Kahn, M. O. (2020). "Can we compare the COVID-19 and 2008 crises?", *SUERF Policy Note*, No. 164, May 2020. Viewed: 14 January. Available at: https://www.suerf.org/docx/f_dfdfab9941ac833a0c364aa2e608185e_13389_suerf.pdf

Tabellini, G. (2015). The main lessons to be drawn from the European financial crisis, *VoxEU*, 7 September. Viewed 12 February 2022. Available at: https://voxeu.org/article/main-lessons-be-drawn-european-financial-crisis

Taylor, J. B. (2009). *Getting Off Track-How Government Actions and Interventions Caused, Prolonged, and Worsened the Financial Crisis*, Hoover Institution Press.

Temin, P. and Voth, H. J. (2004). "Riding the South Sea Bubble", *American Economic Review*, Vol. 94, No. 5. Available at: https://ssrn.com/abstract=485482

Temin, P. and Voth, H.- J. (2003). "Riding the South Sea Bubble", *American Economic Review*, Vol. 94, No. 5. Available at SSRN: https://ssrn.com/abstract=485482

Thompson, E. A. (2007). "The tulipmania: fact or artifact?", *Public Choice*, Vol. 130, No. 1/2, pp. 99-114. Available at: www.jstor.org/stable/27698044.

Treaty establishing the European Community (EC Treaty) (Amsterdam consolidated version) [1997] *OJ C 340,* 10 November, pp. 173–306

Trichet, J.-C. (2009). "The financial crisis and the response of the ECB". Transcript of speech delivered at the University of National and World Economy, Sofia, Bulgaria June 12, 2009. Viewed 5 January 2022. Available at: https://www.ecb.europa.eu/press/key/date/2009/html/sp090612.en.html

Truman, E. M. (2009). Policy Responses to the Global Financial Crisis, *Peterson Institute for International Economics*, 3 June. Viewed 4 January 2022. Available at: https://www.piie.com/commentary/speeches-papers/policy-responses-global-financial-crisis

Tumpel-Gugerell, G. (2009). "The European response to the financial crisis". Transcript of speech delivered at the Bank of New York Mellon Mellon Headquarter, New York, October 16, 2009. Viewed 5 January 2022. Available at: https://www.ecb.europa.eu/press/key/date/2009/html/sp091016_1.en.html

Tversky, A., and Kahneman, D. (1974). "Judgment under Uncertainty: Heuristics and Biases", *Science*, Vol. 185, No. 4157, pp. 1124-1131. Available at: http://www.jstor.org/stable/1738360.

U.S. Bureau of Labor Statistics (2008a). "The employment situation: August 2008", Bureau of Labor Statistics. Viewed 24 January. Available at: https://www.bls.gov/news.release/archives/empsit_09052008.pdf

U.S. Bureau of Labor Statistics (2008b). "The employment situation: November 2008", Bureau of Labor Statistics. Viewed 24 January. Available at: https://www.bls.gov/news.release/archives/empsit_12052008.pdf

U.S. Bureau of Labor Statistics (2022). Seasoned Unemployment Rate, *BLS Data Viewer*, retrieved 1st February 2022 from https://beta.bls.gov/dataViewer/view/timeseries/LNS14000000

U.S. Department of Labor (1999). *Issues in Labor Statistics*. Viewed 4 October 2021. Available at: https://www.bls.gov/opub/btn/archive/computer-ownership-up-sharply-in-the-1990s.pdf

U.S. Joint Economic Committee. *The Economic Outlook* (S. HRG. 113–62; Date 22 May 2013). Government Printing Office. 113th Congress, 1st session.

Unoki, K. (2013). *Mergers, acquisitions, and global empires: Tolerance, diversity, and the success of M&A*. New York, Routledge, pp. 39-64.

US Bureau of the Census (1975). *Historical Statistics of the United States, 1790 to the Present*, Washington, DC, Government Printing Office.

Van den End, J.-W., de Haan, J. and Kearney, I. (2015). "Quantitative easing (QE) in the Euro area: an exposition". *Zeitschrift Für Staats- Und Europawissenschaften (ZSE) / Journal for Comparative Government and European Policy*, Vol. 13, No. 1, pp. 87–98. Available at: http://www.jstor.org/stable/26165456

Van der Veen, A. M. (2012). *The Dutch Tulip Mania: The Social Foundations of a Financial Bubble*, unpublished manuscript, College of William and Mary. Available at: http://www.maurits.net/Research/TulipMania.pdf

Velde, F. (2009b). "Was John Law's System a bubble? The Mississippi Bubble revisited." In J. Atack & L. Neal (Eds.), *The Origins and Development of Financial Markets and Institutions: From the Seventeenth Century to the Present* (pp. 99-120). Cambridge: Cambridge University Press. Available at DOI:10.1017/CBO9780511757419.005

Velde, F. R. (2009a). "The Recession of 1937: a Cautionary Tale", *Economic Perspectives*, Vol. 33, No. 4, pp. 16-37.

Voiland, A. (2021). Waiting to Unload, *NASA Earth Observatory*, 15 October. Viewed 18 February 2022. Available at: https://earthobservatory.nasa.gov/images/148956/waiting-to-unload

Waiwood, P. (2013). Recession of 1937-38. *Federal Reserve History*, 22 November. Viewed 11 February 2022. Available at: https://www.federalreservehistory.org/essays/recession-of-1937-38

Wanniski, J. (1983). *The way the world works*. Simon and Schuster.

Weinberg, J. (2013a). Federal Reserve Credit Programs During the Meltdown. *Federal Reserve History*, 22 November. Viewed 4 January 2022. Available at: https://www.federalreservehistory.org/essays/fed-credit-programs

Weinberg, J. (2013b). The Great Recession and Its Aftermath. *Federal Reserve History*, 22 November. Viewed 4 January 2022. Available at: https://www.federalreservehistory.org/essays/great-recession-and-its-aftermath

Weinberg, J. (2013c). Support for Specific Institutions. *Federal Reserve History*, 22 November. Viewed 4 January 2022. Available at: https://www.federalreservehistory.org/essays/support-for-specific-institutions

Wheaton, W. and Nechayev, G. (2008). "The 1998-2005 housing "bubble" and the current "correction": What's different this time?", *Journal of Real Estate Research*, Vol. 30, No. 1, pp. 1-26.

Wheelock, D. (2006). "Monetary Policy", in Carter, S. B., Gartner, S. S., Haines, M. R., Olmstead, A. L., Sutch, R., and Wright, G. (Eds.), *Historical statistics of the United States: Millennial edition*, Vol. 3. New York, Cambridge University Press.

Wheelock, D. C. (1992). "Monetary policy in the Great Depression: What the Fed did, and why", *Federal Reserve Bank of St. Louis Review*, Vol. 74 No. 2, pp. 3-28.

Whelan, K. (2019). Recommendations for the ECB's Monetary Policy Strategy Review, *Monetary Dialogue Papers*, December 2019, European Parliament. Viewed 30

January 2022. Available at: https://www.europarl.europa.eu/cmsdata/189492/WHELAN-original.pdf

White, E. N. (1990). "The stock market boom and crash of 1929 revisited", *Journal of Economic perspectives*, Vol. 4 No. 2, pp. 67-83.

Wiggins, R. Z., Piontek, T. and Metrick, A. (2019). "The Lehman Brothers Bankruptcy A: Overview," *The Journal of Financial Crises*, Vol. 1, No. 1, pp. 39-62. Available at: https://elischolar.library.yale.edu/journal-of-financial-crises/vol1/iss1/2

World Health Organization (2020). WHO Director-General's opening remarks at the media briefing on COVID-19, World Health Organization, 11 March. Viewed 7 January 2022. Available at: https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020

Zoppè, A. and Dias, C. (2019). "The European Stability Mechanism: Main Features, Instruments and Accountability", European Parliament Briefing, Economic Governance Support Unit, PE 497.755. Viewed 7 January 2022. Available at: https://www.europarl.europa.eu/RegData/etudes/BRIE/2014/497755/IPOL-ECON_NT(2014)497755_EN.pdf

Sitography

BBC News, https://www.bbc.com/news

Bloomberg, https://bloomberg.com

Britannica, https://britannica.com/

Bureau of Labor Statistics, https://www.bls.gov/

Business Insider, https://www.businessinsider.com/

CNN, https://cnn.com

Consob, https://consob.it

Corporate Finance Institute, https://corporatefinanceinstitute.com/

Drewry, https://www.drewry.co.uk/

European Central Bank, https://www.ecb.europa.eu/

European Commission, https://ec.europa.eu/

EUROSTAT, https://ec.europa.eu/eurostat

Federal Reserve Bank of St. Louis, https://stlouisfed.org/

Federal Reserve Economic Data, https://fred.stlouisfed.org/

Federal Reserve History, https://federalreservehistory.org

Financial Times, https://www.ft.com/

McKinsey & Company, https://www.mckinsey.com/

Ministero dell'Economia e delle Finanze, https://www.mef.gov.it/index.html

Ministero dello Sviluppo Economico, https://www.mise.gov.it/

Nasdaq Data Link, https://data.nasdaq.com/

OECD, https://www.oecd.org/

Planet, https://www.planet.com/

Statista, https://www.statista.com/

The Guardian, https://theguardian.com/international

The New York Times, https://nytimes.com/

UNCTAD, https://unctad.org/

Wall Street Journal, https://www.wsj.com/

Wikipedia, https://wikipedia.org

World Bank, https://www.worldbank.org/en/home

World Economic Forum, https://www.weforum.org/

Yahoo Finance, https://finance.yahoo.com/