Department of Business and Management

Master's Degree in Corporate Finance

Thesis in "International Financial Economics"

"Macroeconomic implications of Coronavirus Pandemic: The common EU response to COVID-19 crisis."

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Academic Year 2019/2020

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Ai Sacrifici di mio padre, e all'Amore di mia madre.

INTRODUCTION

Covid-19 pandemic has determined a crisis unexpected and unforeseen. The scale and scope have been unprecedented in history. Understanding the COVID-19 shock nature and the macroeconomic implications involved is critical to determine the optimal policy response. So, the aim of this thesis is to test the hypothesis that the current crisis is a negative "Keynesian supply shock", and then, based on this outcome, and to identify a possible strategy to counter the ongoing recession. Based on the evidence emerged, the main point of this research is analyzing the policy implemented at European Communitarian level, showing that a coordinated and collaborative EU policy is necessary to overcome an obstacle of unprecedented scale and global reach**.** The key economic questions addressed in the paper are: What is the nature of the COVID-19 shock, and how does it differ from previous global contractions? What are the economic impacts of the COVID-19 shock on macroeconomies and households? Given its nature and these impacts, how should policymakers respond?

The work is divided into four chapters. The first chapter presents the dynamics that characterize financial crises. The second explore the implications of a pandemic influenza outbreak on the global economy. The third argues that the economic crisis, associated with the COVID-19 pandemic, is predominantly a supply shock that causes changes in aggregate demand that are even bigger than the initial contraction in supply. The four presents the jointly optimal health and macroeconomic policy and the measures undertaken at Community level to face the economic recession.

In the first chapter, we study financial crises from a theoretical point of view. Given the complexity of the phenomenon in question, we try to delineate a more defined physiognomy presenting in review different schools of thought that have tried to explain this issue. After having reviewed the different approaches, we present the main factors explaining financial crises. Finally, we identify the real and financial implications on the economic system.

In the second chapter, despite the manifest uncertainty, this study attempts to define some economic insights and quantify the potential economic consequences of influenza pandemics. The fundamental insight is that if a pandemic happens, the economic consequences are potentially very massive and severe across countries. To quantify these results, the analysis is carried out through a range of four possible epidemiological scenarios: mild, moderate, severe, and ultra-severe. The framework of our quantitative study is the Asia Pacific G-Cubed Model. This approach summarizes the global economic model and tries to understand and quantify the micro and macro effects of the pandemic. The perspective is mainly focused on the shocks affecting the economic system during an influenza pandemic. These shocks are introduced to

stimulate and testing the various scenario. The main ones concern the workforce, market supply and demand, premium risk in different countries, and the costs of the production and business sector. The purpose of this chapter is not to predict the ongoing Coronavirus recession impact on the global economy. Instead, we try to offer some food for thoughts on how to interpret what might happen in the future.

The third chapter mainly focuses on identifying the nature of the COVID-19 economic global pandemic and how it differs from previous global crises. Based on the first chapter achievement, we show how this global and common shock differs essentially from the last global recession, namely from the 2008 Global Financial Crisis. We then turn to display the differences between the COVID-19 shock and Standard supply shocks. Finally, we study whether a shock that starts from the demand side can be transmitted to the demand side, to an even greater extent. Namely, when is it that a supply shock determines a demand shock even more significant than the initial supply shock and whether the crisis in question has this characteristic.

In the last chapter, we investigate a relationship of complementarity between public health policies and stabilization of aggregate demand. Within such a crisis, a combination of health policies, social insurance policies, and monetary policies is needed to re-establish the economic system. The starting point of this research is examining the fiscal policy measures when epidemic supply shocks are Keynesian. We next extent the model to consider jointly optimal heath and macroeconomic measure to counter the pandemic recession. So, we introduce in the model the public health component, considering the health concern more explicitly, and think about optimal policy in this new environment. Finally, we study the international dimension of the problem, policy coordination, and response.

CHAPTER 1: Global Financial crises: causes, impact, and real and financial implications

1.1 Explaining Financial Crises

Financial crises have always characterized the economy, defined as a global aggregate of goods, commodities, and capital. Such events impact the economic sphere, suddenly and unexpectedly. Although they are not new phenomena but have always characterized the market dynamics, a real understanding has not yet been defined.

In a financial crisis, asset prices suffer a substantial decline in their value, entrepreneurs and consumers are incapable of repaying their debts, and financial institutions are subject to liquidity shortages. A financial crisis leads to panic and, consequently, a bank run, during which investors either sell their assets and turn them into cash or suddenly withdraw their savings from bank accounts. A such irrational attitude is justified by the belief that if they were to leave them in possession of the banking system, their savings would fail together with the financial institutions. Other circumstances that trigger a financial crisis are the outbreak of a speculative financial bubble, a stock market collapse, a sovereign default, or a currency crisis. A financial crisis may be

circumscribed to a specific financial institution, a single economy, a particular region, or it may condition the global economy.

Based on this preliminary description, given the complexity of the phenomenon in question, we try to delineate a more defined physiognomy. To achieve this objective, we will rely on various studies on this subject. The various models presented do not report the economic systems theorized in their entirely but focus exclusively on the aspects characterizing financial crises.

This field of study necessarily requires a preliminary clarification concerning the different approaches that describe the market dynamics. Historically, different models have been articulated that assign a different role to money and the interaction between economic agents. Depending on the perspective and the role assigned to it, financial crises have a significance. We can distinguish three macro groups of crisis patterns.

The first group belongs to the neoclassical paradigm. In neoclassical theory, there is a dichotomy between real and nominal variables. Money is not neutral in the short term and, therefore, the monetary dimension could move away from the real sphere. Therefore, agents will tend to respond to changes in prices and quantities of money, modifying their supply decisions. In the long run, instead, taking up the above theory, money loses that component of non-neutrality and, therefore, a direct relationship between currency (monetary dimension) and macroeconomic performance (real dimension) is re-established. Therefore, the monetary dimension, at least for

a certain period, can behave independently of the real sphere. Therefore, in the short and medium-term, monetary policy can create problems, leading, for example, to financial crises.

This dichotomy, theorized by the neoclassical school, is harshly criticized by Keynes, who, in contrast, formulates a model of a monetary production economy. Within this approach, monetary policy is the center of the economic system, and financial crises and economic imbalances are determined within the order of a monetary production economy. This system completely revolutionizes the concept of money and, therefore, the behavior of operators acting within the market. According to Keynes (1933), "the main reason why the problem of crises is unsolved, or at any rate why this theory is so unsatisfactory, is to be found in the lack of what might be termed a monetary theory of production. […] The distinction which is normally made between a barter economy and a monetary economy depends upon the employment of money as a convenient means of effecting exchanges — as an instrument of great convenience, but transitory and neutral in its effect. It is regarded as a mere link. It is not supposed to affect the essential nature of the transaction from being, in the minds of those making it, one between real things, or to modify the motives and decisions of the parties to it. Money, that is to say, is employed, but is treated as being in some sense neutral."[1] Within this quote, the change of perspective from the previous thought clearly emerges: the money loses that neutrality component. In fact, the author continues "I am saying that booms and depressions are phenomena peculiar to an economy in which — in some significant sense which I am not attempting to define precisely in this place — money is not neutral"[2]. So, a first step to understand the Keynesian theoretical approach, and therefore the economic and financial crises, is to focus on the real essence of money. An economy, characterized by expansive and depressive phases so strong to destabilize the market, does not present that element of neutrality theorized by the neoclassical conception. According to Keynes, such a shift is necessary to define a more conscious study of the phenomenon. Later in the discussion, we will resume, more specifically, his thought.

The third macro-economic approach focuses exclusively on financial crisis analysis. These theories provide not an overview or systemic view, but a single, isolated explanation of these phenomena. One of the most widely used models is the behavioral finance. This branch of study

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[1] John Maynard Keynes, 1933, "*A monetary theory of production*". This article by J.M. Keynes was first published without a title in 1933 in Gustav Clausing, editor, Der Stand und die nächste Zukunft der Konjunkturforschung: Festschrift für Arthur Spiethoff, Munich: Duncker & Humboldt, pp.123-125. It was reprinted as "On the Theory of a Monetary Economy" in the Nebraska Journal of Economics and Business, vol. 2, No. 2 (Fall, 1963), pp.7-9. It was reproduced with the title "A Monetary Theory of Production" in D. Moggridge, editor, 1973, Collected Writings of John Maynard Keynes, vol. XIII - The General Theory and After, Part I - Presentation, 1973, London: Macmillan, pp.408-411.

[2] Ibidem

focuses exclusively on the psychology of economic operators. This theory is based on aspirations, cognition, emotions, and culture. It does not consider the various implications at the micro and macro level. The behavior of agents drives the market.

After presenting the groups mentioned above, let us look more specifically at the theorized dynamics.

We begin our analysis by taking Knut Wicksell (1898, 1906) as a reference. According to the latter, capitalist economies move from the interaction between two rates of return: the natural rate of interest, namely the interest rate of the real sphere, theorized by the neoclassical school, in a condition of equilibrium, and the money interest rate.

In this system, three are the main conditions that determine these rates. First, we must assume that the capital market, defined by the neoclassical paradigm, exists. Moreover, investments and savings should be connected, and there should be no money. Then, we suppose that the Central Bank sets the money interest rate.

Given these rates, two dynamics take place. If the money interest rate is below the natural interest rate, then a cumulative investment process result. This process drives inflationary pressure. In this case, the economy will enter an overheating phase, which will not be corrected until the central bank stops inflationary expansion by raising interest rates. In the opposite situation, the money interest rate is higher than the natural interest rate, and then a deflationary contraction is triggered.

The development process of the capitalist system, in this perspective, is defined as a sequence between expansions and contractions. A period of uncontrolled expansion determines the instability and fragility of the entire economic system. Therefore, the conclusion of this phase is the forthcoming of a contraction. An excessively sudden and intense decrease will create imbalances within the financial system.

In the following years, a multitude of economists replicated the Wicksell's model of cumulative inflationary and deflationary phases. Among these we find, Hayek (1929, 1931). The key issue within the Hakey's system is the interaction between savings and net investment.

In the neoclassical capital market, savings represent the supply of additional credit, while investments mean the demand for credit in the same period. When this relationship exists, the beginning of a credit interaction between companies and households is inevitable. In this economy, the interest rate will be such as to equalize saving and investment.

According to Hayek, instead, a particular aspect of the modern credit system is that the volume of credit granted by banks does not correspond to the size of savings. As a result, loans become independent of savings. In this economy, several factors can determine an investment level increase without a proportional rise in saving level. Since the credit system is "elastic," an

expansion in credit demand is not necessarily driven by long-term fundamentals. This aspect, therefore, leads to the emergence of speculative bubbles. This process determines the independence of the economic system from the real sphere for a limited period. An expansion, however, not financed by a proportional increase in savings, leads to an "artificial" credit system, which will not be able to reach the long-term rate of return required as the marginal productivity determines this in equilibrium. Sooner or later, this spiral must end, establishing a phase of contraction, such as to lead to a financial crisis.

Subsequently, as we have already mentioned above, another theorist who made perhaps the most significant contributions to the definition of macroeconomic processes was John Maynard Keynes (1930). Different implications between cost inflation/cost deflation and demand inflation/demand deflation can be traced within his work "Treatise on Money".

First, this traces a relationship between demand inflation and cost inflation. A combination between such factors determine a cumulative expansion. The process is articulated as follows. An economic development drives a demand inflation, which determines undistributed profits for enterprises that, as a result typically, increase their investments[3]. As a consequential result, we see a higher employment rate and higher nominal wages. This process, in turn, boosts the expansionary process.

Then, a second combination that could happen is between demand deflation and cost deflation. A reduction in demand leads to a decrease in output and prices and an increase in the unemployment rate. The latter, in turn, leads to a reduction in nominal wages, which in turn increases the deflationary process. In such circumstances, companies can only report losses. Having reached this point, avoiding a financial crisis is highly complicated. A third combination provides cost inflation and demand deflation. Given the lack of demand, companies are no longer able to cover their costs. This period of stagflation sees a sharp drop in profits for companies. This phenomenon can be expected at the end of a period of expansion, after central banks have tried to combat inflation.

Although Keynes has investigated the different processes that create turbulence within the financial system, he does not propose a real model to describe these phenomena. Minsky completes this piece of research with a theoretical model that follows the Keynesian tradition thinking. The proposed model is described below.

[3] Taking as reference the Keynesian fundamental equation of the value of money $Y = Y_rP = W + Q_N + Q_E$, the national income, equals wages plus normal profit and extra or windfall profits. From national accounting, profits are identical with investment minus household savings. Thus, we get as relationship that $Q_E = I – S_H$. When the level of investment is higher than the level of saving there is excess demand in the market and the price level increases, leading to an inflationary process. In the opposite situation, a lack of demand determines a deflationary result. The more the level of investment exceeds that of savings, the higher is the prices' raise and higher the profits. Those profits used for investing leads to a further demand and even higher profits.

Within this path of analysis, we find two other economists who have made fundamental contributions to the study of these phenomena.

The first of these is Fisher (1911), who elaborates his system based on the modern quantity theory of money, theorized by Hume (1752) and taken up by Ricardo (1817) and followed for centuries in economic research. He claims that an expansion of the quantity of money in circulation leads to a proportional increase in the general level of prices, therefore a significant decrease in the purchasing power of money. Instead, a contraction determines a reduction in the prices by the same percentage. According to him, the money supply has two different effects. In the long term, it does not affect the economic system. While in the short and medium-term, it could create destabilizing results, alternating cycles and phases of prosperity and depression. Optimistic periods generate an expansionary cycle, which can result in speculative bubbles. Speculation drives price inflation, which is usually also closely connected to a massive credit rise. In this perspective, GDP grows, as does the employment rate. When boom comes to an end, price deflation begins—the higher the speculation, and thus the bubble, the greater the deflationary spiral. There are various effects on the economy. The main one is the decrease in nominal wages and, therefore, the difficulty for investors to pay their debts and bonds. Non-performing loans start to grow, panic, and then rush to the bank accounts leads to a sharp drop in prices.

For Friedman (1968) too, money can cause stressing factors to the real economy. In this perspective, monetary policies are determined with the aim to reinforce the neutrality of the money supply.

1.2 Minsky's financial instability hypothesis

As mentioned earlier, Keynes did not present a real model to explain financial crises. This system was dealt with by another economist, Hyman Minsky, who developed the Financial Instability Hypothesis.

Two are the postulates on which his theory is based: first, according to specific financing structures, a particular economy may be stable or uncertain; second, during cycles of economic expansion, a determined economy may move from balanced to financially unsustainable regimes.

1.2.1. The theoretical basis

According to Minsky, a financial system is stable and economically sustainable when its constituent units can meet their financial commitments despite system-wide changes that may affect their operations. These changes concern cash flows, capitalization rates, or payment commitments.

Before going to investigate the causes and results of this process, it is necessary to define which of these units make up the financial system. In this regard, Minsky identifies three types: hedge,

speculative, and ultra-speculative Ponzi units. Each of them has financial commitments. The cash flows generated allow them to repay those. Given the systemic market conditions, incomes are uncertain and closely related to other factors that determine their size and existence. So, depending on the unit, we will have a different income-debt relation.

The first type has adequate cash flows to guarantee the payment of its commitments, both interest and principal. The second type, instead, has sufficient cash flows to ensure the interest payments, but not to repay the principal. Just in the long term, they can meet their commitments entirely. The last type does not have enough cash flow even to cover the payment of interest, either in the short or long term. Therefore, it needs to renew the capital and find new financing for the interest earned.

The economy becomes more fragile when the relative weight of hedge units declines, while that of speculative and Ponzi ones increases. For speculative units, even if incoming cash flows are certain and expected, changes in financial market conditions can increase payment commitments due to changes in interest rates. If those units are not able to roll over the principal after economic market conditions tightened, the group may become troubled. Ponzi units, instead, depend even more on financial market conditions. Since they must capitalize the accruing interest on their balance sheets, an increase in interest rates amplify this process, and the total amount of their payment commitments may soon exceed their incoming cash flows, so that the net worth of a unit becomes negative. So, they cannot repay their debt. Therefore, a change in the market conditions will have a more significant impact on speculative and Ponzi units, which will find it increasingly difficult to repay their debt. Consequently, under this perspective, a weak economic system materializes when the market-weighted share of hedging units decreases in favor of an increase in ultra-speculative units.

Before we go to describe the model, let us dwell on Minsky's theory of investment. This theory is essential to determine the economic activity level and to explain the system behavior during phases of instability. In summary, this theory presents a relationship between the investment decisions made by companies with their financing structure and the willingness of creditors to grant loans to them.

To describe this process of investment determination, Minsky seems to be moving away from the Keynesian perspective and to be more closely related to Tobin's q, according to which the expectations of investors and managers are identical. As a rule, investment decisions are determined by the relationship between the prices of new investments (current output prices) and asset prices (as the valuation of existing investments). Current output prices of investment depend on specific factors: money wages, labor productivity, short-run interest rate, and a profit mark-up. These prices are stable in the short term when capacity utilization is at normal levels. Prices

in asset markets, instead, establish the demand price for new investment. These prices are determined by the present value of expected net cash flows, based on the state of uncertainty and the discount rate used for the valuation. The necessary condition for investment to occur is that the demand price is above the supply price. From a theoretical point of view, this condition is respected until the demand price is equal to the supply one. In the real economy, this point is never reached. So, the investment demand is restricted before this threshold. To understand the main reason for this mechanism, we must take into account the fact that a company can invest without modifying its capital structure as long as the project's investment is determined by the use of free cash flows. A higher level of investment requires additional forms of financing external to the company. The company will be able to repay its debt to the point where the level of cash flow and welfare generated remains stable and certain. Clearly, when the level of income generated is lower than expected, the risk of insolvency increases. Given this interrelation, the greater the risk perceived by the lender, the lesser the investment activity will be. So, as a consequence, a contractionary phase starts. This process is essential to represent the gradual move of the system towards instability.

Another essential part of this model is the Kaleckian relation between profits and investment expenditures. Minsky traces a proportional relationship between investment and profit elements. The higher the former, the greater the latter, which in turn will lead to new investments. However, after reaching the peak of the expansionary cycle, the number of investments decreases, leading to a reduction in cash flows. This further decrease makes it more difficult to repay its bonds, and as a result, we are witnessing an over-indebtedness crisis.

1.2.2. Minsky's financial instability model

Based on these theoretical premises, we can analyze how expansive cycles are generated within an economic system and how phases of stability alternate with periods of financial instability, i.e. as boom turn into a bust.

1.2.2.1 The boom phase – from financial stability to instability

Assuming that the economy has recently gone through a crisis, namely a market collapse determined by a speculative euphoria, both lenders and borrowers are more conservative regarding their investments. They require more guarantees and a higher return. This preservative phase implies a period of consolidation, in which both investments and profits are lower but more stable. So, expectations are satisfied, and debt relationships are respected. This behavior of operators leads to greater confidence at the market level. Thus, borrowers are more positive regarding the ability of their investments to generate a profit, which means that the demand for investment goods increases with even lower security margins. High profits and high safety

margins make lenders more inclined to grant debt. Given the period in question, namely the stability phase, they will experience lower bankruptcy rates, and the number of customers with good creditworthiness increases. Since, for the granting of credit, banks analyze customer history borrowing track, they are willing to lend more efficiently at a lower price. A higher level of investment is, therefore, possible. More placement, as mentioned above, determines higher profits. So, this process has three implications. First, borrowers can cover their past commitments. Second, if these profits assume a permanent character, companies that avoid external financing will have more funds to invest. Third, expectations of future cash flows are higher. These determinants involve a further increase in investments financed from both internal and external funds.

Two further mechanisms are identified. Minsky establishes a relationship of proportionality between the amount of money and the prices of the assets. In this ratio, the first factor determines the second. When the system is in difficulty, and the dynamics within it are uncertain, financial institutions will require more liquidity, which is reflected in the desire to keep more money reserves. This process provides a more robust hedge against insolvency.

Furthermore, Minsky presents an endogenous view of money, so it is determined concerning an increase in credit by banks. Therefore, if the debt to finance investments is provided by bank loans, then we will see an increase in the amount of money, which in the end causes an increase in the demand for assets. So, there will be an increase in prices in the market. This condition generates a boost in confidence, which drives the holding of less and less illiquid assets. As a result, a change in portfolio choices, a shift from the possession of money to non-monetary assets occurs, still increases the prices of the same. Both mechanisms ultimately increase the amount of debt needed to deal with increasingly expensive financing. During an expansionary phase, precautions, margins of coverage, and collaterals required are reduced, and expected receipts exceed payment commitments only slightly and not throughout the whole project. Riskier and less liquid investments take place. As a result, Ponzi and speculative units increases. Therefore, even small deviations from expectations determine the defaults of borrowers. The system drops from a sustainable financial structure to one that is weak.

1.2.2.2. The turning point, the bust, and the crisis

According to this model, the transition takes place when interest rates start to rise. This increase generates a diminution in the net value of the units. The amount of hedging and speculative units decreases, while that of Ponzi units rise. Risky and ultra-speculative institutions are not able anymore to meet their financial commitments. Therefore, units start selling their assets to guarantee those payments. In the same way, banks act. Financial institutions register a lower cash

flows amount since borrowers do not repay their debts. Therefore, the borrowers' creditworthiness falls. This circumstance linked to a rise in interest rates determines an increase in the supply price of investments. Thus, the investment level falls.

Two further mechanisms that decrease even more the investment level are financial distress and the shortage of liquidity. The resultant is a fall both in the asset value and demand price and a decrease in the profits. The latter effect reduces more the asset prices. In that situation, also companies cash flows are lower than budgeted. As a result, more units became speculative, and the default rate increase. Thus, margin, collateral, and guarantees are more required. A general collapse in the system is in motion. Financial factors involved affect not only investment demand, but also consumer demand. The result can only be a depressive phase and an increase in the unemployment rate.

1.3 Asset Price and Credit Booms and Busts

Within this paragraph, we are going to study in detail the pricing trends of assets and the credit cycle. As we have already mentioned, a rapid rise in asset prices creates a speculative bubble, which leads to a financial crisis during its depressive phase. In that situation, the price movements are significantly different compared to the standard economic trends. An expansive phase determined by an excessive euphoria of the market has significantly higher levels in terms of duration, amplitude, and slope of both the credit level and house prices, as well as the equity prices. This growth deviates from fundamentals and presents mechanisms that are unrelated to those suggested by models within a perfect capital market.

In general, there are distortions at the micro and macro levels that lead to crises. Prices can fall sharply due to risk shifting. This mechanism occurs when agents borrow to invest, but the rate of return on such projects is not high enough to guarantee the payment of interest and principal. Another reason is the attitude of managers in the construction of their investment portfolios. As soon as they are remunerated based on a percentage commission on the return on their investments, they will concentrate more funds on riskier but more profitable transactions. Other microeconomic factors, such as interest rate deductibility for household mortgages and corporate debt, worsen the situation.

An increase in the price, an increase in the level of indebtedness of the system, and more significant risk taken by operators in their investments often anticipate a crisis. These processes take place concerning credit expansion. Several factors can drive this credit expansion. These factors include shocks and structural changes in the system, such as in the level of productivity, economic policies, and capital mobility. One factor dramatically amplifies this boom, namely the flow of international capital. Banks have much liquidity, so they give more credit easily to both

companies and individuals. Another aspect that favors this situation is the accommodative monetary policies settled by governments and central banks. The process is structured as follows. Interest rates affect the price of assets and the net wealth of borrowers. Such circumstances change the lending conditions. Therefore, credit will be granted more quickly and in greater quantity.

As mentioned in the previous paragraph, the natural response to this situation is a depressive phase. This phase has considerably higher levels in terms of duration, amplitude, and slope of both the credit level and house prices, as well as the equity prices. Therefore, the economic downturn will have a duration, but above all, a more significant impact than a normal declining phase of the economic cycle

1.4 A general financial crises model

Having reviewed the significant theories regarding financial crises, we can outline some standard features and properties.

Firstly, as we have seen, in all models, crises occur due to a financially unsustainable expansionary phase. Within this, overheating in asset markets leads to asset price inflation. Besides, excessive investment and inflationary developments in production drive an overcapacity. The degree of development of these factors determines the impact of the crisis on economic activity. The most severe disasters occur when the expansionary phase links with a speculative bubble, driven by a credit expansion.

Secondly, the drivers of an economic crisis are objective and subjective feedback mechanisms. Examples of such factors are the expansion in asset and product market prices, wealth effects, changes in income, real interest rates effects, effects on cash flows. During an expansion phase, market conditions stimulate demand when investments increase. So, through a multiplicative spiral, the investment will increase further. At the same time, an increase in demand leads to higher profits for companies, which allows more internal financing and, therefore, more investment.

Concerning these objective mechanisms, there are also some subjective ones. The state of confidence increases as well as expectations for the future. Optimism, given the prosperous phase of the market, transcends. Then, on the market, news begins to circulate to justify this situation, leading to an increase in asset prices. Besides, expectations, expressed as an expected rate of return, are more optimistic, still pointing to new investments. So, we are seeing an expansion of GDP, at the same time, a lower rate of unemployment. This effect means higher nominal wages, higher demand, more investment, but above all, higher asset prices. These prices reach excessive levels. This phenomenon is a clear sign that euphoria is clouding the assessments of economic

agents and distorting the market. Given the circumstance, operators who do not have long-term horizons and are not interested in fundamentals are acting. Their only objective is to speculate and profit from this disproportionate price increase. Clearly, not all operators have such behavior. However, given the conditions of euphoria and market growth, speculators operate, not caring about the investment itself but only about the profit resulting from this unjustified increase in asset prices.

Thirdly, the expansion cycle is driven by exogenous forces, as a low-interest rate, enough external or internal financing funds, and a high expected rate of return for investment. During this phase, banks reduce their credit constraints and start to provide more funding.

Finally, in all the models mentioned, the financial system is elastic. Taking as reference, for example, the Wicksell model, the credit expansion is endogenously created by the market, since the central bank must put in place a determined interest rate policy. In the Keynes model, instead, as theorized in his book "The General Theory of Employment, Money and Interest", the elasticity is determined through certain assumptions. In general, such elasticity is implicitly or explicitly assumed. This feature spreads the ability to create endogenous credit that expands the boom phase. During the expansion cycle, different issues arise. Undoubtedly the most important is the fact that all institutions in the financial system increase their share of gross debt. Indebtedness in all fields grows, as does the risk of both lenders and borrowers. So, the economy shifts from a stable to an uncertain situation. As the price of assets continues to rise, they reach a level that is no longer sustainable. Therefore, a phase of contraction is inevitable. The main issue in that phase is the increase in both the number and amount of non-performing loans.

The objective and subjective mechanisms presented above serve not only to explain the expansive phase but also the declining stage. In this circumstance, a valuable device is the relationship between falling asset prices, financial problems of speculators, sudden sales to generate liquidity, and insolvency problems. Quick and substantial sales amplify the decline in prices and create additional problems for speculative units. The higher the sales, the greater the depreciation. There are two effects of this process: the destruction of equity and the decline in collateral values. Therefore, banking institutions will increase their requirements, both in terms of creditworthiness and in conditions of premium return. In the end, investments will be more and more challenging to make, given the reduced availability of credit. The decline in market demand, lower wealth, given the cut in nominal salaries, and lower consumption leads to losses for companies. These, in turn, will produce less, so we will have an increase in the unemployment rate. This spiral results in deflationary trends. If this process is linked to a high degree of indebtedness of the system, the most brutal objective mechanism happens. In this situation, central banks become mere spectators when they have already brought interest rates to zero.

Monetary policies cannot fall below this level.

1.5 Real and Financial Implications of crises

Although crises differ in many aspects, the implications and consequences of both macroeconomic and financial levels are common among them. Despite the fundamental differences characterizing each crisis, macroeconomic variables always follow the same path. During periods of turbulence in the markets, consumption, investments, and the level of production show a significant decrease. Financial variables, such as the level of asset prices and credit, also follow the same trends.

Since crises have high costs on economic activity, they have a substantial impact on the economic system. Their main result is a recession. The particular aspect is that financial crises often trigger a recession worse than the standard business cycle. The average duration is about twice as long, and the decline in output level is higher, as well as the cumulative losses, concerning pre-crisis levels, are more massive. So, these have much worse effects than those that would have resulted from recessions that occurred within a normal economic cycle. The main reason is that these crises are associated with a significant decrease in the primary macroeconomic aggregates. So, the resulting recessions lead to a much more substantial decline in the level of consumption, investment, and production than normal recessions. The fall in the level of consumption is about seven to ten times greater. In recessions that are part of the economic cycle, the growth rate of consumption decreases but never below zero.

As we have already reported, there is also a sharp decline in the output level. As historical analysis suggests, several global crises suggest such evidence. For example, the global financial crisis has led to the worst recession since World War II. In 2009, world GDP per capita fell by about two percentage points. Two further recessions, which had highly negative impacts, were recorded in 1982 and 1991. While GDP per capita grew by about 2% each year, during these crises, it fell by 0.8 and 0.2.

Financial crises are costly in terms of the expenses they involve. In support of this statement, for example, the disasters in the banking system cost 23% of GDP during the first four years of recession. The budgetary cost of restoring a balanced economic system is 6.8% of GDP. They can reach 40% of GDP, as in Chile and Argentina in the early 1980s and then in Indonesia in the 1990s. As this example suggests, resolution costs tend to be higher for emerging markets than for advanced economies. Debt crises are just as, if not more expensive. They foresee a decline in the level of GDP by about 3-5 percentage points in the first year and between six and twelve after eight years.

Even sudden stop crises are highly expensive. There is a great deal of evidence found, taking the

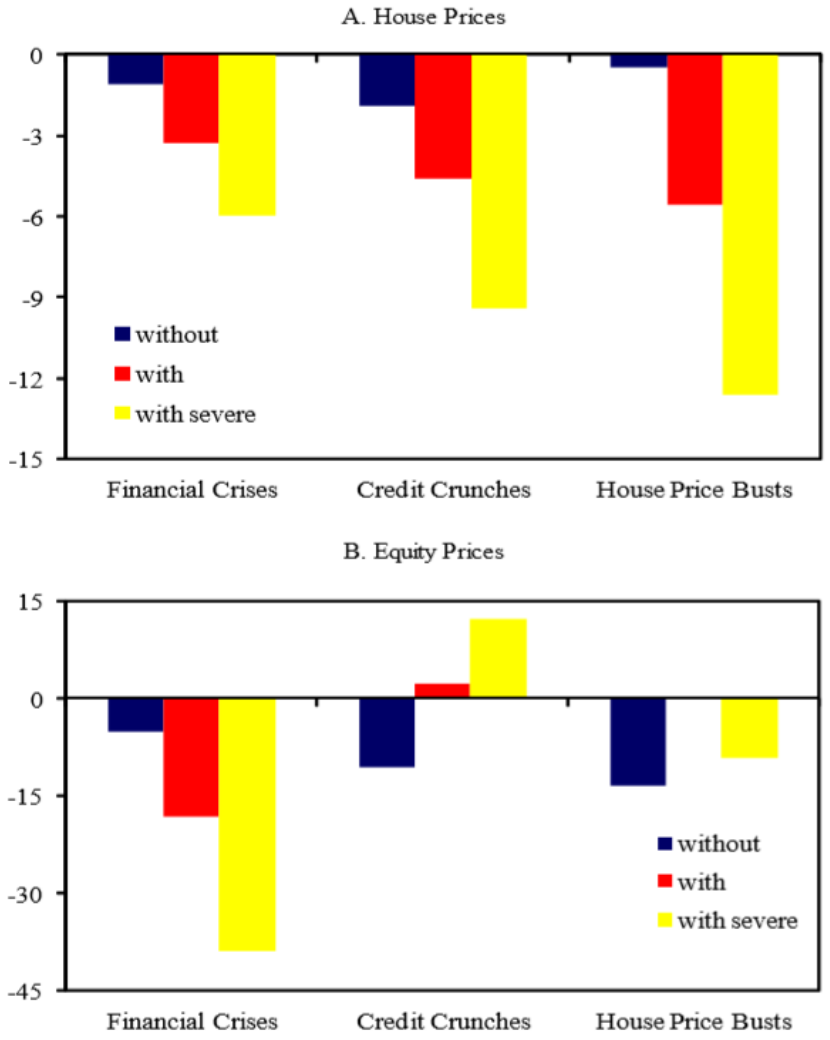
emerging markets as a reference and the twenty years between 1975 and 1997 as a time reference. The currency crises reduce the output by 2-3%, while the sudden stops by 6-8% during the first year of crisis. The cumulated loss is also thinner. In the following three years, the percentage oscillates between 13 and 15%.

The combination of the costs of restructuring the financial system and a fall in the economy leads to a significant increase in public debt. In fact, during financial crises, tax revenues decrease, and the expenditure of the state apparatus increases. The result of this, which is determined by expansionary economic policies and lower tax revenues, makes the latest crises more costly for advanced economies than for the emerging markets, 21.4 compared to 9.1 of GDP.

1.5.1. Financial Effects of Crises

This section tracks the development of economic variables during a crisis. As already mentioned, both the level of credit and the price of assets decrease. This diminution happens at a much higher rate than under normal conditions. As Figure 1.1 shows, credit falls by 7%. House prices declines by about 12%, and the price of equity even above 15% (Claessens, Kose and Terrones, 2011).

Figure 1.1: Financial Implications of Crises, Crunches, and Busts[4]



Source: Stijn Claessens, M. Ayhan Kose, 2013, *"Financial Crises: Explanations, Types, and Implications"*, IMF Working Paper.

The price of assets, including exchange rates, equity and house prices, and the level of credit show the same properties and a similar time lag in crises affecting both emerging and advanced economies. What changes between these two different economies is the duration and impact that tends to be higher in the former than in the latter.

The common aspect of financial crises is the lack of credit. The level of concessions is shallow, both by banks and by all financial institutions. This behaviour characterizes the economy's

[4] Notes: Each panel shows the median change in respective variable during recessions associated with indicated financial events. Disruptions (severe disruptions) are the worst 25% (12.5%) of downturns calculated by amplitude. A recession is associated with a (severe) credit crunch or a house price bust if the (severe) credit crunch or house price bust starts at the same time or one quarter before the peak of the recession. A recession is associated with a financial crisis if the crisis starts at the same time of the recession or one year before or two years after the output peak preceding the recession. Severe financial crises are the worst 50% of financial crises as measured by output decline during the recession. The sample includes data for 23 advanced countries and covers 1960-2011.

reprisals. The various sectors will have a slow recovery and growth rate, concerning the few credit concessions made by financial institutions. Crises are associated with large downward corrections in financial variables. An extensive research program has analyzed the evolution of financial variables around crises both credit and asset prices tend to decline or grow at much lower rates during crises and disruptions than they do during standard economic periods, confirming the boom-bust cycles in these variables discussed in previous sections.

Furthermore, sectors more dependent on external finance grow relatively less, and more financially dependent activities (such as investment) are curtailed more (Kannan, 2009). Micro evidence for individual countries also shows that financial crises are associated with reductions in investment, R&D, and employment, and firms passing up on growth opportunities (Campello, Graham, and Harvey, 2010). Collectively, this suggests that the supply of credit following a financial crisis can constrain economic growth.

CHAPTER 2: Global Macroeconomic Consequences of pandemic crisis

2.1 Pandemic risk

The term pandemic indicates a situation that crosses national borders and affects the entire population. Semantically speaking, this term, which comes from the Greek pan demos, means the whole community. Therefore, this event must involve more countries on more than one continent to materialize.

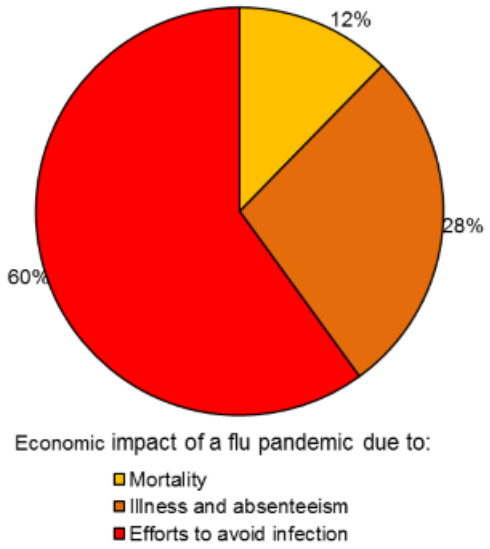
The economic impact of this event is closely linked to the social impact. Indeed, pandemics create massive global problems, depending on their intensity.

There are four possible scenarios, which historically have been traced: mild effect, recorded during the Hong Kong epidemic of 1986-69; moderate, Asian fever in 1957; severe, Spanish illness in 1918-19; ultra-severe. Historically, the toughest epidemic was that of 1918. This one counts about 50-100 million dead, but on a world population of about 2 billion. The global economic impact was highly negative. The change in global GDP between 1918 and 1919 was minus 4.8%, equal to three trillion dollars. A moderate impact accounts for half the losses. In the following paragraphs, we will focus more on the description of these scenarios, showing the various characteristics and results. In general, however, pandemics have shocking impacts on the economic system.

In this regard, the OECD ranks this risk among the major global catastrophic ones, scoring it higher even than that of a terrorist war. By pandemic risk, we mean the expected value of the economic, social, and health imbalances that arise as a result of the pandemic.

About 30-40% of the population is affected by this event. Therefore, the response and behavior at the social level has a high impact on the economic system. Panic, inadequate information, and social distancing greatly aggravate the situation. This event has very high costs, as Figure 2.1 shows. 60% depends on a decrease in both supply and demand for goods and services. 28% depends on the reduction of the level of production. The latter effect is determined by absenteeism in the workplace, caused by the spread of contagion.

Figure 2.1: Pandemic cost distribution



Source: World Bank, 2008.

One of the characterizing aspects of this phenomenon is that the initial pandemic shock mainly affects the level of labor force and consumption. As we have already mentioned, one of the most substantial costs is precisely the reduction in the production level. This effect is the natural response to the decrease in the employment rate. As the virus spreads, an increasing part of the population is infected. So, a pandemic will affect the public health, and therefore the workforce will necessarily decrease. In the end, two are the main results we witness: the labor-supply contraction, as a result of the virus's spread, and a decrease in aggregate demand, as the main effect of a drop in consumer and business confidence. Based on the relationship between the increase in infection, the reduction in the workforce, and thus the contraction in supply and aggregate demand, the countries subject to the most challenging social conditions are those most struck.

This phenomenon has a global nature and therefore involves and concerns several countries at the same time. It is unthinkable to hypothesize a response that is single and unique for each country. The situation is recovered if the intervention is carried out in a cooperative and coordinated manner. Therefore, the international institutions provide standard management rules, risk management principles, and goals at the international level. Those guidelines assume a communitarian and long-term character. The public authorities ensure that the investments and performance of the countries concerned are directed in this perspective. An adequate and permanent infrastructure is required to oppose this phenomenon. The national and global health system is geared not only to the potential treatment of the epidemic, but above all, to prevention. Risk awareness is the cornerstone of the process. From this perspective, the project to reduce pandemic risk starts. There are two main actions: risk prevention and mitigation. Through global risk monitoring, the level of prevention and preparation is further implemented.

The main objective is a global, non-exclusive, and non- rival benefit. All countries should be determined to pursue it. Globalization and interconnection between countries make the benefit, as well as the contagion, transferable. Therefore, implementing measures aimed at containing and resolving these phenomena should be in everyone's interest.

While infectious diseases can be seen as a natural hazard, namely an event harmful to man and determined by forces exogenous to him, a pandemic is a disaster that is largely the result of man's actions. Therefore, investigating this phenomenon, conceiving it only as a health problem, is a mistake. Such a conception underestimates the total risk associated with such a condition. As a result, measures, and responses to counteract the tremendous economic effects will be inadequate. In fact, the greatest negative results are recorded not only at the health level, but also at the economic sphere, but above all at the social level. In the next paragraph we will analyze exactly this issue.

2.1.1. Economic Impact

A pandemic produces a significant impact on both the national and international financial systems. The main result is a fall in aggregate demand. This effect is a result of a decrease in the level of consumption and lower confidence at the business level. This system, therefore, also involves a fall in the supply of goods and services. As we have seen, depending on the intensity of the pandemic, we have four cases: the mild scenario expects a decrease in global GDP of 0.7 percentage points; the moderate situation of 3.1; the severe scene can reach 4.8; this threshold can be exceeded in the ultra-severe scenario. This relationship is not only theoretical, but a positive correlation between economic growth and health has been empirically traced. That is why, during pandemics, we do not see growth but recessions.

There are several costs associated with this situation, both direct and indirect. The principal direct one is the increase in medical expenditure and support materials. More in general, all the costs of doing business are higher. So, investments are lower. A negative correlation has been found between the increase in the consumption of healthcare materials and the level of investments. The supply chains are changing, and therefore efficiency, which characterizes the labor market, is strongly affected. We also have future losses linked to the mortality rate and chronic disability following these pandemics.

Several effects have an impact on the market. We have a significant reduction in the level of consumption, so as mentioned, production costs increase, and the supply of goods and services decreases. It is necessary to re-evaluate the country risk. It is an estimation that significantly affects the risk premium, and therefore all the investment analyses are closely related to this measure. Moreover, the main impacts do not concern mortality, but the social system.

Phenomena such as absenteeism at work, the closure of schools and recreation centers, the decrease in production, and the emergency crowding of hospitals are the main results of this phenomenon. As reported, pandemics reduce labor supply—the natural reaction to the spread of contagion. As a result, about 30-40% of the labor force freezes, and dependent labor activities are strongly affected.

As we have mentioned, this situation involves the world in its entirety. Countries are extremely connected, starting with trade, tourism, labor, capital, and exports. Nevertheless, the developing countries are the most affected. Emerging economies base their development more on labor than on capital. Thus, this situation has a more significant negative impact on domestic revenues. The effect is positively related to the degree of exposure and dependence on the international environment. These regions also face more incredible difficulty, given an already compromised economic and social situation. Several factors allow the pandemic to have a more fertile environment: malnutrition, precarious sanitary conditions, limited access to the health system, almost zero prevention and mitigation, low level of knowledge and research, low level of information, and high population density. This degrading situation is not only a problem for these countries, but for everyone. As we have shown, commitment and operability require global coordination. A country that suffers from a weak health and veterinary system jeopardizes the whole chain.

In addition to this, there are several channels of infection and development of the epidemic. Globalization has made the world more interconnected and interdependent. Supply chains are integrated, industries are part of ecosystems and networks. Trade and human mobility are simplified and facilitated. However, all these achievements of modernity make economies more vulnerable to pandemic risk.

So, pandemics have massive effects on economies. Three are the main results: a significant drop in consumption of goods and services, a large raise in business operating costs, and a re-evaluation of country specific risks that is reflected in higher risk premiums. In order to analyze and quantify these determinants, in the next paragraph, we present a model that highlights and focuses these results.

2.1.2. Asia Pacific G-Cubed Model

The model is based on twenty countries and six production and consumption sectors (McKibbin and Sidorenko, 2006). Each sector produces only one imperfect substitute good. So, we have a total of one hundred and twenty goods produced in one hundred and twenty sectors. The inputs used are capital, labor, and materials, both local and international. Several agents are present in this system.

Let us analyze their behavior within the model, as mentioned above, underlining the characteristics and constraints to which they are subject.

Box 1: Countries and Sectors

Countries:
United States
Japan
United Kingdom
Canada
Australia
New Zealand
Europe
Indonesia
Malaysia
Philippines
Singapore
Thailand
China
India
Taiwan
Korea
Hong Kong
Other Non Oil Developing countries
Eastern Europe and Former Soviet Union
OPEC

Sectors:
Energy
Mining
Agriculture
Durable Manufacturing
Non-Durable Manufacturing
Services

Companies objective is maximizing their market value. This measure is conditioned by variable inputs and their level of investment.

Families supply labour and save money, so they consume goods and services. The operators of the economic system are subject to a utility function. This is always maximized. The only constraint is that the present value of the consumption is equal to the sum of the initial financial assets and the wealth.

Labour is a factor characterized by perfect mobility between sectors, but immobility between regions. Thus, the nominal value of wages is equal between industries, but different between areas. In the long term, the labour supply is completely inelastic. This factor is determined by the rate of population growth, an assumed as exogenous. In the short-term, on the other hand, the level of wages is adjusted concerning two main factors: current and expected inflation and labour demand concerning labour supply. The rigidity of nominal wages, in the short term, can result in two outcomes: unemployment, if the level of nominal fees is too high compared to labour market

conditions, over employment, if the level of nominal wages is lower than the long-term equilibrium.

Government expenditure on goods and services is assumed to be exogenous. This amount is allocated in fixed proportions between products and services. The total expense of the government is equal to the sum of the purchase of goods and services, payment of interest rates on the debt, and investment tax credits. Revenues, on the other hand, are equal to the sum of sales taxes, corporate taxes, and private individuals' taxes.

The various regions are connected by the flow of goods and services. This level is determined by the demand for imports. The asset market is perfectly integrated between countries.

The flow of capital in this model takes two forms: portfolio investment or direct investment. These forms of financing are perfectly substitutable. Therefore, the decision is taken about the expected rate of return. The demand for money is derived from the aggregate value of the output and the short-term nominal interest rates. The money supply is determined concerning the balance sheet of the central bank. This factor is exogenous, depending on the level of interest rates set by the central bank in the region. The interest rates at time t are determined based on the value at time t-1. This value is determined by the difference between the desired and current inflation rate and the difference between the desired and real output growth rate.

Central Banks can determine several economic policies.

Based on this theoretical framework, we are going analysing the main shocks affecting the the economic system during an influenza pandemic. These shocks are introduced to stimulate and testing the various scenario. The main ones concern the workforce, market supply and demand, premium risk in different countries, and the costs of the production and business sector. The purpose of this chapter is not predicting the ongoing Coronavirus recession impact on the global economy. Rather, we try to offer some food for thoughts on how to interpret what might happen in the future.

2.1.3. Shocks

Pandemics impact the economic system by causing multiple and different shocks. Within this section, the focus is aimed at identifying the components and the outcome of these elements. The main ones concern the workforce, market supply and demand, premium risk in different countries, and the costs of the production and business sector.

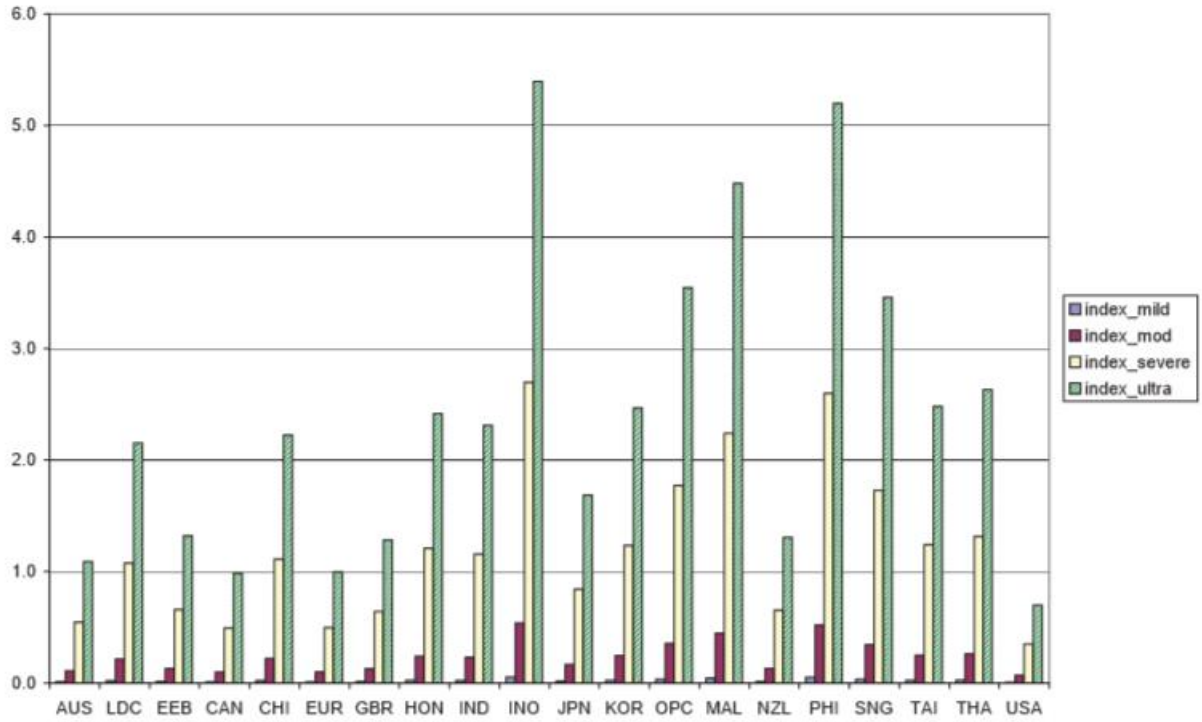
The epidemic shock is analysed and traced within four different scenarios. There are two leading indicators: the geographical indicator and the health policy index.

The first index consists of two main components. The international element describes the ease with which the virus spreads across countries. In particular, this identifies the number of days the

infection takes to transmit from the beginning to the maximum peak of contagion between countries. The second component is the internal component that describes the population density and, therefore, the capacity to spread within the individual state. This factor is determined as a weighted average of population density in rural areas and main urban centres. A positive correlation has been found between population density and ease of infection. The higher the first factor, the higher is the second. In this perspective, the geographical index is the weighted average between the international and domestic factors. The second component describing the epidemic shock and, therefore, the contagion and mortality rate is the health policy index. This indicator represents the effectiveness and readiness of the health system's response to the pandemic. It is determined as a weighted average of the resources allocated to health care and the specific resources established in response to the epidemic.

By multiplying the two indices described, the mortality rate is determined. This factor has been analysed within the four scenarios (Figure 2.2). In mild epidemics it is 0.007%, in moderate epidemics 0.007%, in severe epidemics 0.35% and in ultra-epidemic 0.70%.

Figure 2.2: Mortality rate under each scenario



Source: Warwick J McKibbin, Alexandra A. Sidorenko, 2006, "*Global Macroeconomic Consequences of Pandemic Influenza*", CAMA Centre for Applied Macroeconomic Analysis.

Another factor affected enormously by the pandemic is the workforce. The impact on this component depends on the previous index level: the contagion index. This index is the sum of two parts: the mortality rate and the percentage of economic losses resulting from absenteeism.

This element is easy to quantify. Assuming a contagion rate of 30%, ten sick days for each affected worker, five days per week of employee work, the loss is 10/(52*5)*0.30 = 1.15%.

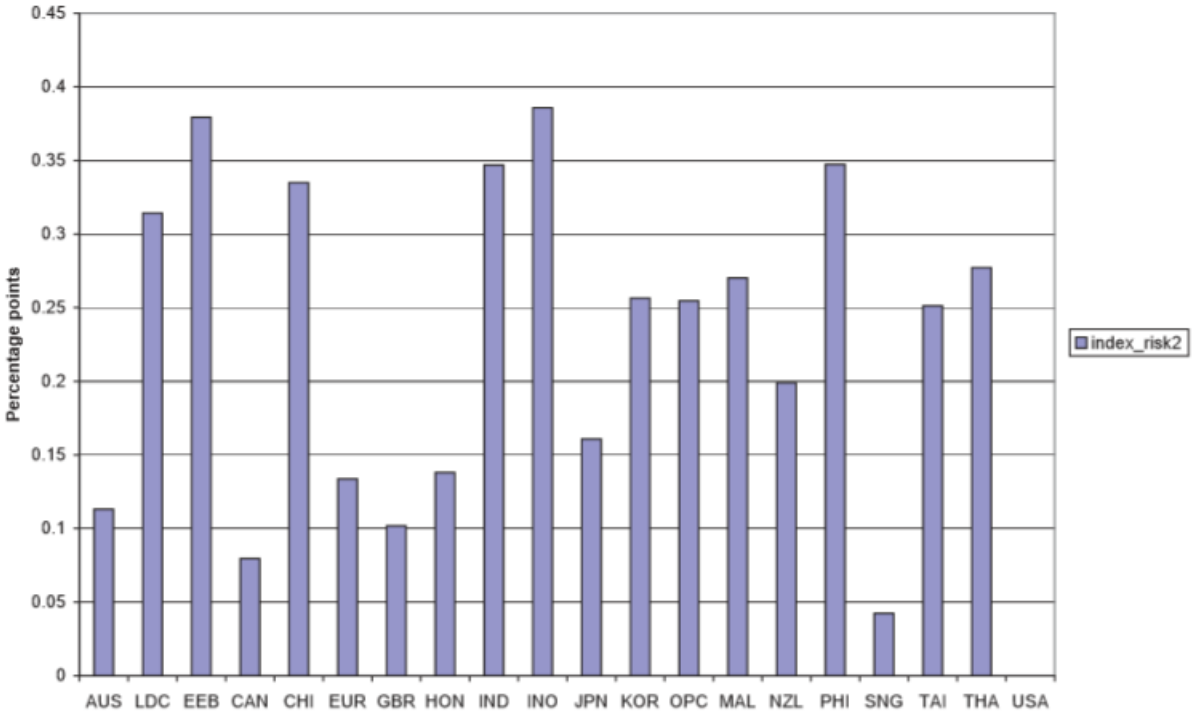
The epidemic also increases the country risk and, thus, the risk premium demanded by investors. This index is the average of three components: quality of government response, health policy index, and financial risk index.

The first component is, in turn, determined by three factors: government effectiveness, regulatory quality, and control over corruption. If a country showed a high degree of efficiency, proper regulation, and a low degree of corruption, this index would be positive and elevated. The third component plays a central role in this analysis and, since its relevance, the index rationale is based on several propositions. First, we should consider the fact that global shocks have two modes of transmission: physical and via the financial markets. As these are integrated, shocks are easily transmitted.

Then, countries with a more robust and sustainable economic structure are better able to face these periods of crisis. A positive correlation has been found between financial strength and country growth. The countries that suffer most in economic terms are those with structural problems and high levels of debt. The last component that causes domestic crises during pandemics, and so should be taking into account in the valuation of the country's riskiness, is the exposure degree to foreign capital.

Based on the previously described indices, the countries most affected in this analysis are the countries of Eastern Europe, the Soviet Union, India, and the Philippines. Singapore, on the other hand, performs well, given its strong financial structure.

Figure 2.3: Most affected countries weighted relative to the United States

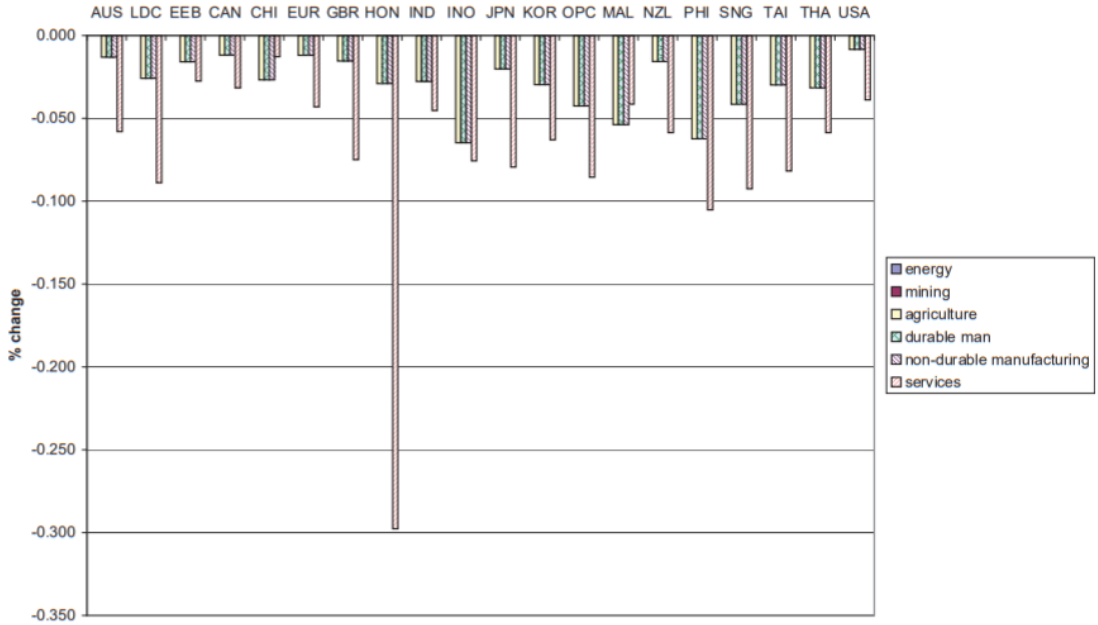


Source: Warwick J McKibbin, Alexandra A. Sidorenko, 2006, "*Global Macroeconomic Consequences of Pandemic Influenza*", CAMA Centre for Applied Macroeconomic Analysis.

Another element affected by pandemics is the level of demand. Changes in revenue, welfare, and relative prices lead to changes in consumption decisions. Due to the pandemic, we register an exogenous shift in consumer preferences. As direct result, the system shows a relative change in the overall level of spending.

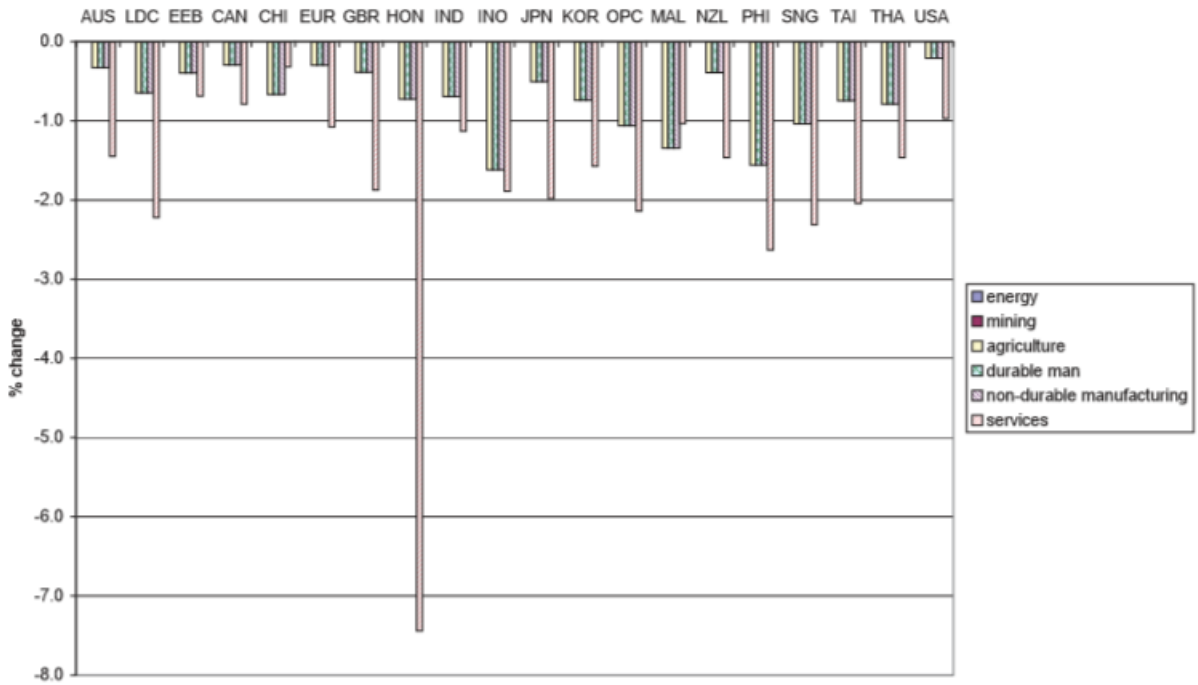
This unspent money, however, is not lost, but saved for future consumption. As figures Figure 2.4 and 2.5 shows, demand losses range from a minimum of 0.3% during mild crises to 7.5% in severe crises.

Figure 2.4: Demand shock – mild scenario



Source: Warwick J McKibbin, Alexandra A. Sidorenko, 2006, "*Global Macroeconomic Consequences of Pandemic Influenza*", CAMA Centre for Applied Macroeconomic Analysis.

Figure 2.5: Demand shock – severe scenario



Source: Warwick J McKibbin, Alexandra A. Sidorenko, 2006, "*Global Macroeconomic Consequences of Pandemic Influenza*", CAMA Centre for Applied Macroeconomic Analysis.

2.2. Conclusions and insights on the pandemic crisis

This chapter explores the implications of a pandemic influenza outbreak on global economy. Despite the manifest uncertainty, this chapter has attempted to define some economic insights and quantify potential economic consequences of influenza pandemics. If a pandemic shock happens this research suggests the economic consequences are potentially very massive and severe across countries.

Before getting to the heart of the matter, it is fundamental understanding what means a pandemic. As we have shown in the first paragraph, the term pandemic defines an event beyond national borders and affects the entire global population. So, the main character of this definition is that such an event concerns several countries, and continents, at the same time. The spread of the current Covid-19 virus testifies and precisely presents this property. Therefore, from the beginning of its outbreak, understood its scope, this event was immediately labeled as a pandemic. Taking September 8th as a reference date, 229 were the involved and affected states: within these countries 7 037 391 were still active cases, 899 586 cases had determined the death of the patient, while the recovered ones amounted to 19 730 044. The magnitude of the numbers reported underlines that the shock under examination is essentially a pandemic.

Once we get these results, we have started our analysis trying to understand the economic impact of a pandemic.

To quantify these results, the analysis is carried out through a range of four possible epidemiological scenarios: mild, moderate, severe, and ultra-severe. The study shows as even a mild pandemic produces severe effects on global economic output. As shown, this scenario reports severe costs for global economy. Historically, a mild pandemic has registered the death of 1.4 million lives and recorded a loss of approximately 0.8% of global GDP in economic output. Increasing the scale of the pandemic, increases the economic impact. In the worst scenario, namely the ultra-severe, the global economic slowdown registers over 142.2 deaths and a global GDP loss of 12.6%. In summary, COVID-19 could have quite important repercussions for the financial system.

Once determined these dynamics, we have tried to understand and quantify the micro and macro effects of the pandemic. To achieve this objective, our analysis takes as reference the Asia Pacific G-Cubed Model. This approach summarizes the global economic model that is the framework of our quantitative study. The focus of our approach is mainly directed to the shocks affecting the economic system during an influenza pandemic. These shocks are introduced to stimulate and testing the various scenario. The main ones concern the workforce, market supply and demand, premium risk in different countries, and the costs of the production and business sector. The main

result has been a drop in the labour force due to an increase in mortality and illness, an increase in the cost of doing business, a shift in consumer preferences, a re-evaluation of country risk premiums.

Based on this preliminary study, we have tried to understand the main features of this phenomenon and the economic implications. As we have shown inside the study, an economic crisis, triggered by a pandemic, produces a significant impact on both the national and international financial systems. The main results we have found exhibit: a significant drop in the aggregate demand, due to a massive contraction in the consumption level and business confidence, a massive fall in the supply of goods and services, due to a considerable reduction in the level of labor force and the production. The central mechanism that testifies this result is the following: due to the virus spread, the people got sick, so they cannot go working. As a direct result, we witness a reduction in the employment rate. Since the lack of assembled workforce, a reduction in the production level is necessary evident. To contain the disease, governments have determined social distancing and lockdown measures. As a result, we get a general fall in the aggregate supply of goods and services. On the other side, the less work determines less income, so we have a reduction in consumption and spending level. The main result is a consequential recession.

The purpose of this chapter is not predicting the ongoing Coronavirus recession impact on the global economy. Rather, we try to offer some food for thoughts on how to interpret what might happen in the future.

CHAPTER 3: Macroeconomic implications of COVID-19 pandemic

3.1. 2008 Global Financial crisis and Covid-19 global pandemic

Financial crises have always marked the performance of the global economy. The crises of 1873, 1929, and 2008 are emblematic cases of the severe economic impact crises had in the past. What is shared among all these events is the fact that they are inextricably linked to the financial system.

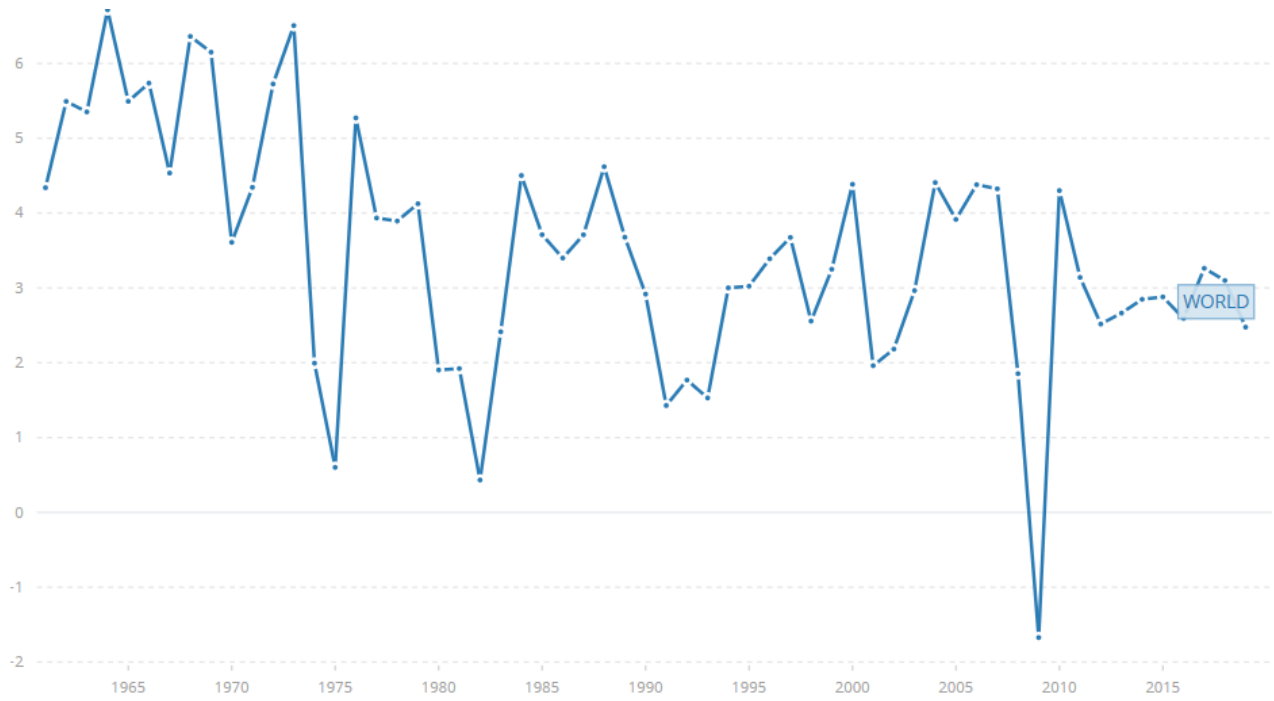
Specifically, these crises have demonstrated a direct relationship between the performance of the real economy and the stability of the financial sector. The economic cycle can be amplified by financial dynamics, leading to high pro-cyclicality and an accumulation of systemic risk during economic downturns.

Taking as a reference to the Great global crisis of 2007-2008, we can see as the financial system is the core of the crisis. In 2008, a global recession, known as the Great Recession, began in the United States of America, and it spread worldwide. Historically, this crisis is comparable in duration and impact only to the Great Depression of the 1930s.

Two are the main dynamics that determined this event: sub-prime mortgages and the existence of an unsustainable business model of the financial system. The business model in question envisaged that the bank's role was to create exposures, i.e. to grant loans and then distribute them to the financial network. The idea was to provide as much credit as possible. Such lending would have supported the growth of the economy. However, uncontrolled lending only increased irresponsible consumption. With the sub-prime debts, a particular maneuver was also carried out: so-called "securitizations." This process involved the use of derivatives, through which the bundled loans were sold to financial institutions around the world. This process led to a geographical spread of the crisis, impacting various economies around the world. Low-rated mortgages were distributed through bonds called Asset-Backed Securities (ABS) and Mortgage-Backed Securities (MBS). These instruments were highly rated by rating agencies. Thus, investors around the world were attracted by good returns and low risk. Another tool, the so-called Credit Default Swaps (CDS), i.e. assurances on the possible default of previous devices, amplified the dynamics and effects of the crisis. An uncontrolled granting of credit and, therefore, an endemic level of the system's debt accompanied a real estate bubble. The bubble was stimulated through a phenomenon called "financial accelerator". The demand for real estate has been kept high and constant through financing for the purchase of houses. Prices were, therefore, continually rising. The growth in prices led to more credit being granted by banks; the asset used to cover the debt, i.e. the property, was an asset of increasing value. The financial institutions,

however, overlooked one aspect of the mechanism, namely that the rising prices were overvalued. The property value increased due to the over-sized credit level being granted. For such reason, when the real estate bubble burst, the asset value recognized as collateral for the loans was not consistent with the value of the property. The conclusion of this process is straightforward. Mortgage payments began to fall short, so the real estate market began to collapse. The chain that started from the United States impacted the global financial market. Globalization and the integration of capital proved to be fertile ground for the spread of the crisis. The subprime crisis in America soon spread throughout the world. Both developed and developing economies faced a sharp contraction in demand and the recession that followed. Most financial and credit institutions found themselves exposed to broad and profound losses. The adverse balance sheet exposures were exacerbated by the subsequent closure of both short and very short-term credit lines. At the time when the supply of such instruments was narrowed down, a liquidity crisis was the immediate result. Within the financial system, there were no such high levels of liquidity to meet the demand of all the various institutions. Several financial institutions failed: the bankruptcy of the prestigious American investment bank, Lehman Brothers, is a clear example of the strong impact of the crisis. This crisis was almost fatal and definitive for the financial system. Profound levels of debt and the lack of market regulation, linked to the easy granting of credit, led to the collapse of the global economic system. Figure 2.1 represents the development of the worldwide GDP growth rate from 1965 to 2015. As can be seen, during the year of the crisis, the negative peak was historically the highest. The world GDP has recorded a contraction and a growth rate of around minus 2%

Figure 2.1: Global GDP growth rate 1965-2015



Source: Worldbank.

At the exact moment when these circumstances became unsustainable, the markets imploded. When debtors could no longer afford to repay their debts, the consequences soon had a domino effect on all agents of the economic system. Investors and families were the most affected. Savings and investments significantly reduced their value. Thousands of investors and families lose all their savings and investments. Thousands of companies, reporting unsustainable levels of debt and following a sharp contraction in demand, went bankrupt. The banking system was also shaken to its foundations. Consumption collapsed, and aggregate demand in general contracted. The inevitable consequence of this crisis was the future of one of the most severe and profound recessions ever, until the coronavirus global pandemic. The situation described represents the same situation we have expressed in the previous chapter. When a speculative bubble bursts, we see a fall in asset prices and credit levels. Soon, the banking system is affected, as was the entire production and supply chain.

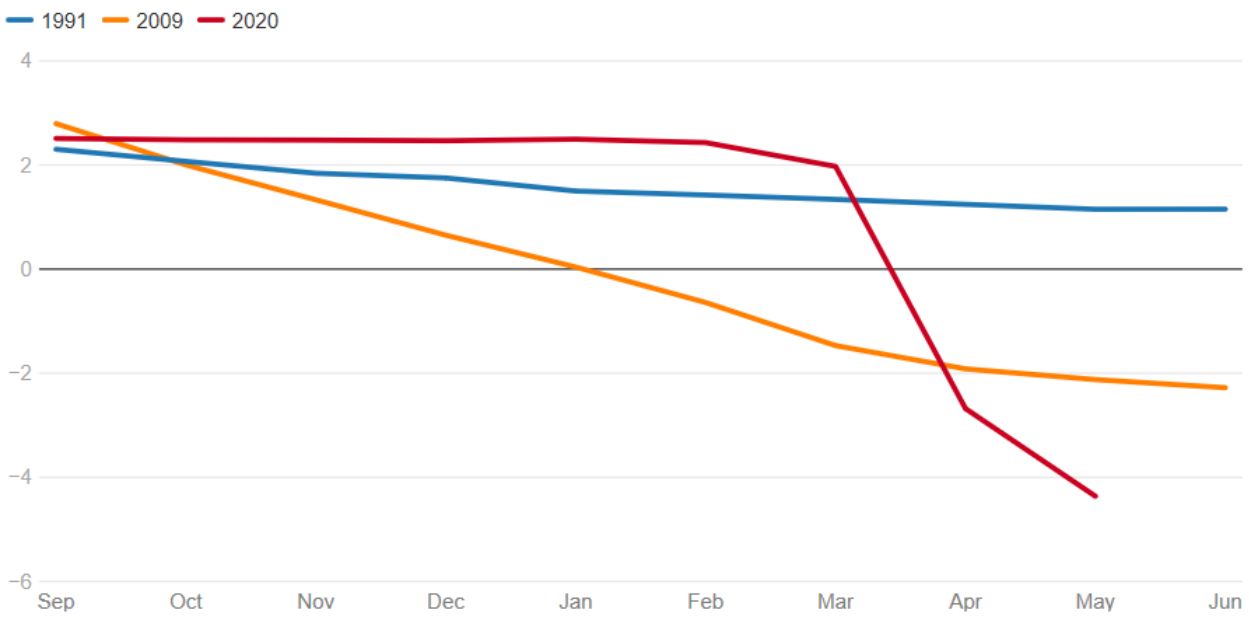
There are critical differences between the global crisis of 2008 and the one we are experiencing today. As we have seen, the former is a result of monetary and financial turmoil. The causes must be found within the economic system. The interaction of market agents triggered it. The crisis has leveraged the weakness of the financial system. Massive maturity mismatches, unrealistic bank capital, regulatory fragmentation, widespread regulatory arbitrage, and significant weight of liabilities in the balance sheet are the fundamental factors of the crisis. Therefore, the global financial crisis is a typical endogenous crisis. The COVID-19 turmoil, on the other hand, has a

real nature: the disease following the coronavirus contagion. This shock does not have the previous characteristics: it is not intrinsic to the system, but exogenous.

Therefore, the origins are different. So are the consequences. During the crisis of 2008, it is the aggregate demand that suffers a contraction. Economic agents because of the loss of jobs and the reduction in income contracted consumption. In the current situation, on the other hand, the priority of governments has been to fight and contain the virus. To safeguard the health of citizens, restrictive measures have been taken against social groups. The first lockdown measures were born in the epicenter of the crisis, China. These measures have affected global markets, with the West referring to China itself for most of the production chain. In this first chin, therefore, the supply side was the hardest hit. The second phase of the crisis itself then saw the same measures of distancing, and social restriction adopted unconditionally throughout the world. So, if at first the supply side of production contracted, during the second phase, both supply and demand fell sharply. Consumption was directly impacted negatively by the containment measures.

Ultimately, this crisis is different in both dynamics and results from all the financial crises the world has experienced. While the disasters that have affected the financial system have had a far-reaching impact on aggregate demand, this crisis has a different nature. Taking as a reference the studies (Benguria, Taylor, 2020), developed over the last two hundred years of history, we see how financial crises are inherently negative demand shocks. In the coronavirus pandemic, instead, two are the main dynamics involved: a negative supply shock and a negative demand response. Workers within the shutdown sectors of the economy because of the restrictive measures have lost their spending power. The action has led to a contraction in demand in all those sectors not directly affected. Lockdown measures, on the other hand, have also changed the supply side. Even high-performance businesses had to stop operating. Such a circumstance has determined frightening effects, involving, as already mentioned, all the operators of the global economic system. Although it does not have the same structural weaknesses in terms of market dynamics, it does not mean that the effects are less severe. As can be seen in the following figure, the recession resulting from this event was even more reliable and more potent than the one recorded in 2008.

Figure 2.2: The historically fastest and deepest recessions



Source: Worldbank.

What we are going to investigate, therefore, is whether this deep recession has resulted from a more significant fall in demand than the initial supply shock.

3.2. COVID-19 shock and Standard supply shocks

The Coronavirus crisis also differs from those crises that arise first and foremost on the supply side. Before getting to the heart of the matter, it is good to define the concept of an aggregate supply shock. Essentially, we represent under this label a change in the total supply of goods and services. This shock can be either positive or negative. In general, it is a situation that affects our ability to produce. Historically, there have been many shocks to the economic system that have impacted the market's ability to deliver. Most of these events have been linked to wars, natural disasters, or dynamics affecting the workforce.

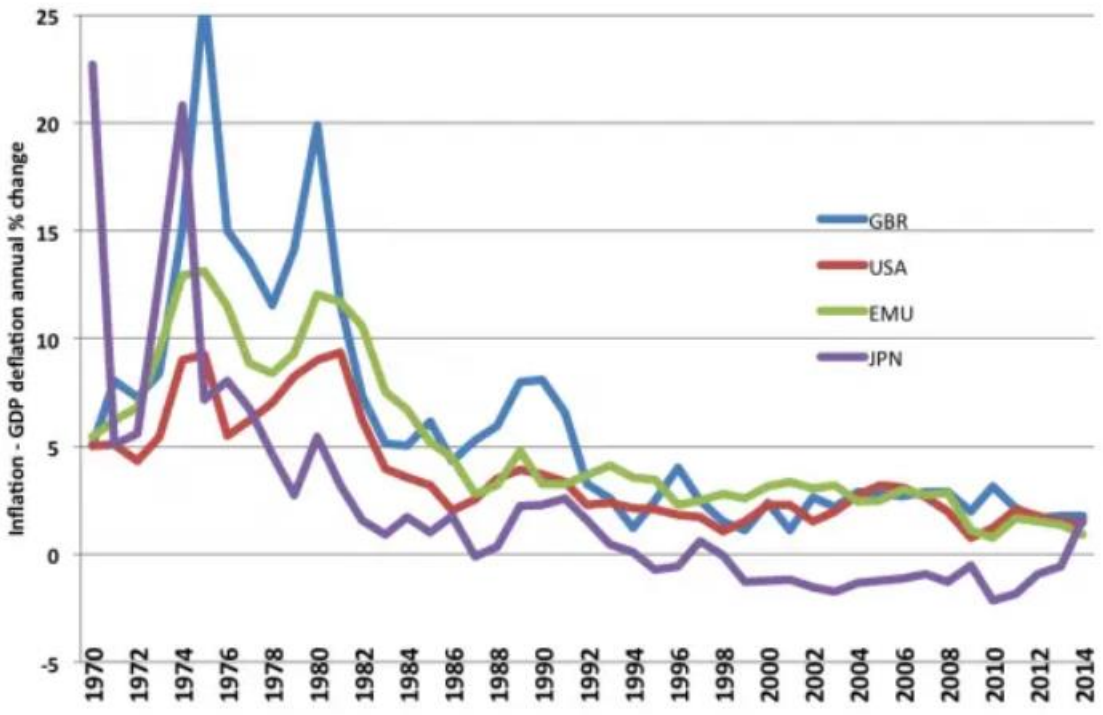
Taking as reference the supply shocks of the 1970, many economists (Phillips, Friedman and Phelps) have tried to explain the relationship between inflation and unemployment. The models have been attempting to understand the impact of food prices, oil prices and other microeconomic elements on this trade-off.

Taking classical theory as a reference, real factors influence real prices. So, a standard supply shock (e.g. oil shocks years) tends to create an excess and not a contraction in demand. If the aggregate supply, i.e. the ability of the economy to determine goods and services, contracts, and aggregate demand does not contract as much, markets forecast is an excess of demand. This excess leads to an inflationary push.

Now we try to see these mechanisms in concrete terms. Following the example mentioned

above, we know that in 1973 the Kippur War began. So, the Arab countries associated in OPEC opted to support the position of Egypt and Syria, by applying oppressive measures to Israel and its Western partners. The selling price of oil exports increased by 25%. Moreover, they decided utterly to stop the crude oil trade with the United States, Japan, and Holland in 1975. As a reaction, on the commodities market, the price per barrel rose from $2.59 in 1973 to $18 in 1979. As a result, inflation levels were very high for the entire decade (Figure 2.3).

Figure 2.3: Annual inflation rate in the major capitalist economies during the 1970s.



Source: WorldBank.

The historical moment we are experiencing, and the situation linked to the coronavirus, is unique. Compared to the previous examples, the shock in this circumstance does not arise from market dynamics, but from an extraordinary situation: the spread of a virus. As a socially disruptive event, it could be assimilated into a conflict of war. As we shall see, however, the dynamics and the results of this phenomenon are extremely far apart.

Since this crisis is directly linked to the spread of Covid-19, at the government level, a balance had to be struck between health and social policies, aimed at preserving the health of citizens, and economic systems. The decision to prevent any kind of contact between individuals is justified precisely by this logic: to reduce the number of infections. The crisis in question was first and foremost recognized as a global humanitarian crisis. Thousands of doctors and nurses have been involved in the front line, risking their lives to combat the virus. Companies and institutions, on the other hand, have sought to work synergistically to support the families of the victims and the communities most affected. To counter the spread of the epidemic, most countries

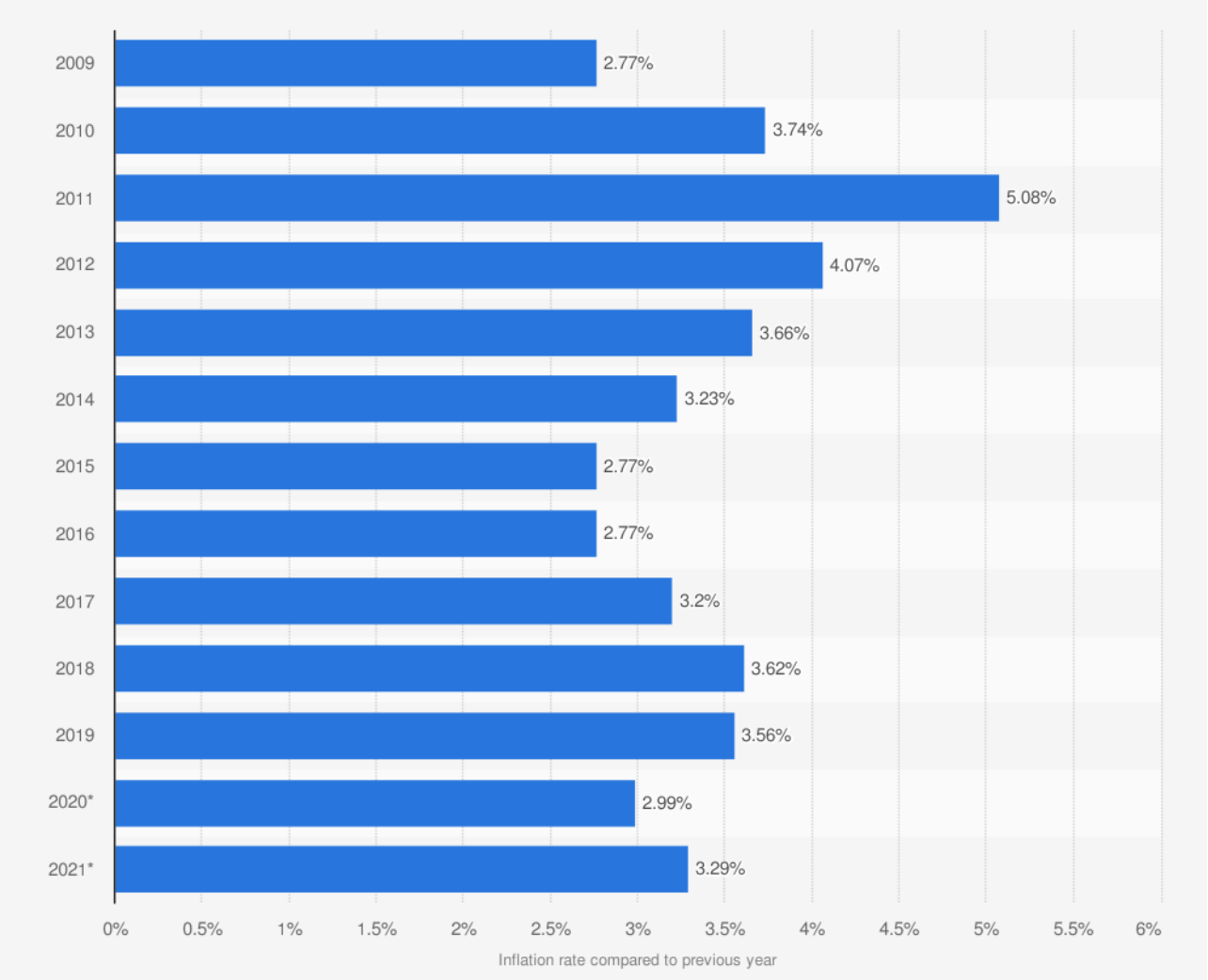
have decided to adopt highly restrictive social distancing policies. Citizens have, therefore, been banned from moving freely. Companies, even healthy and performing ones, had to stop production. Thousands, millions of workers worldwide have lost their jobs. This situation has led to a rapid fall in demand and one of the most severe recessions in recent years.

There are two main determinants of preventive health measures taken at a global level: the first is a strong negative impact on domestic production, a decline recorded by all countries affected by the virus; the second is an unprecedented global shortage in both supply and demand due to the decrease in the production chain.

This situation is, therefore, unique. The dynamics involved are unprecedented in history. Although lockdown measures mostly lead to a contraction in production supply, the crisis in question differs from the standard supply shocks. As we can see from the following figure (Figure 2.4), the main difference is the fact that the global inflation rate decreases. So, in 2020, we are witnessing a deflationary spiral contrary to the above example.

Figure 2.4: Global inflation rate from 2009 to 2021

(compared to previous year)



Source: Statista 2020.

This type of supply shock is linked to a lockdown, and therefore to closures of a series of exercises. So, it has the opposite effect on the relationship between supply and demand. This event, therefore, creates a situation where there is a lack of demand and deflationary pressure, instead of an inflationary one that is the typical outcome of a supply shock.

3.3. Keynesian supply shocks model

Based on the assumption that supply and demand are two dynamics that affect each other, a shock in one side of the market influences the other. Our analysis presents the characteristics and mechanisms that, while acting on the supply side, end up conditioning the demand side.

The starting point is straightforward, given the situation as described above, workers, losing income, contract consumptions. However, the central question is when this pattern creates a more than proportional fall in aggregate demand. What we want to investigate within this chapter is whether a shock that starts from the demand side can be transmitted to the demand side, to an even greater extent: when is it that a supply shock determines a demand shock even more significant than the initial supply shock and whether the crisis in question has this characteristic. We then want to identify under what conditions it is possible that a trauma, purely on the supply side, can lead to a fall in demand.

Taking Keynes' theory of supply shock as a reference, we label as a "Keynesian supply shock" (Guerrieri, Lorenzoni, Straub, and Werning, 2020), a clash that triggers variations in aggregate demand to a greater extent than the initial supply shock. To have this circumstance, two are the essential ingredients of the system: complementarity between goods, but also between sectors and incomplete markets. The rise in the unemployment rate and the closure of several companies over an extended period amplify the recession. As we will see within the discussion, in an economy with only one sector, a supply shock is never Keynesian. While, under the aforementioned conditions, in a multisectoral economy, a Keynesian shock is possible.

In such circumstances, the main point is understanding one central question: what the trend of the interest rate is. This question can be analyzed from two alternative but complementary points of view. The first is to ask in what direction the interest rate itself is moving. So, if we are looking for full employment as objective, we need a comprehensive or restrictive policy. The second point of view is based on the conviction that, despite the monetary policy adopted, the rate does not change. So, the question is whether, if the rate remains fixed, we have unemployment or inflation. The moment it moves upwards, without any intervention, then we have an excess of demand. If, on the other hand, the interest rate falls, without any policy intervention, then we have a lack of demand.

We will carry out this research within two scenarios. The first scenario presents a complete

market, within which representative agents operate. The second is an incomplete market, in which heterogeneous agents work. In both models, as reported above, we try to analyze the trend of two indicators: the pattern of the natural interest rate and the change in the output level, when the real interest rate is unable to move in symbiosis with the natural interest rate. Based on this analysis, we can understand if the shock falls within the Keynesian typology or if standard characteristics are present. In the first case, the interest rate increases. The supply shock determines a fall in aggregate demand less than the initial impact. In the second case, demand decreases more than the fall in supply.

3.3.1. Single Sector

The starting point for our analysis is a one-sector economy, i.e. an economy characterized by a single sector. Within this scenario, a supply shock never falls within the Keynesian typology. This conclusion is right both within an economy composed of representative agents and within an incomplete market. Within the model, a supply shock never causes such a substantial impact on demand that it dominates the fall in initial supply.

Taking as reference an infinite horizon economy, consumers have standard severable preferences represented by the utility function:

$$\sum_{t=0}^{\infty} \beta^t U(c_t)$$

where:

ct: consumption

$U(c) = \frac{c^{1-\sigma}}{(1-\sigma)}$ is a standard CES utility function with intertemporal elasticity (EIS) σ^{-1}

Consumers have standard preferences with a discount factor β. Suppose, then, there is a fixed endowment of labor, so then there is no choice of labor supply. Everybody in the model have η units of labor, with η > 0, and everybody is supplying that.

Suppose there is a linear technology:

$$Y_t = N_t$$

Therefore, η units of labor are transformed in η units of goods and services.

Then suppose that there is a temporary reduction in labor supply. This situation represents the recent lockdown measures. To safeguard workers operating in sectors exposed to public contact, φ > 0 of them is disabled to go to work in the period t = 0. This measure is taken because of the awareness that the COVID-19 is transmitted through contact. Therefore, since operators are not safeguarded and protected in the workplace, they must necessarily stay at home. Being a one-time shock, in time t = 1, the situation is re-established, and agents are entitled to return to work. The system then regains its natural balance.

3.3.1.1. Complete and Incomplete Markets

Within the complete market scenario, we see at the time $t = 0$ a temporary reduction labor supply. At the steady-state level, the output is equal to η. At t_0, there is a shock in the system, essentially a fraction φ of people cannot work anymore. Therefore, we get a reduction in labor supply, and its level passes from η to $(1 - \varphi)\eta$. The natural output, namely the production of full employments, is getting down.

Under the lockdown measures, the more contacted intense sectors cannot operate. To produce goods and services in those sectors, people need to get in close contact with customers. So, they could be entering in touch with an infected person and, in turn, allow the virus to spread more widely. Nevertheless, there is a part of the economy that could still be operating. Not precisely in the usual conditions, but it can perform.

This situation is a temporary shock. As we have already mentioned, this is a one-period shock. So, in t_1, the pandemic will be gone, and the situation will reach the average level. This process affects not only the level of output but also the level of consumption.

Through the following function, we get optimality condition for consumers:

$$1 + r_0 = \frac{1}{\beta} \frac{U'((1-\varphi)\eta)}{U'(\eta)} > \frac{1}{\beta}$$

The real rate is given by the ratio of marginal utility in period zero ($t = 0$) and the following one ($t = 1$). In period 0, there is less consumption than tomorrow. As we have shown, during the shock, we have a drop in consumption. So, today there is less consumption than tomorrow. Since the consumptions contract, every agent in the system would like to borrow to have economic and financial resources when the crisis will be over, and as consequence, the real interest rate rises above its previous level of $1/\beta$ This direction of the natural interest rate shows that there is no shortage of demand. Demand drops less than supply. In the one-sector economy with complete markets, the negative supply shock raises the natural interest rate and increases excess demand.

We can validate this logic through the following experiment. We assume nominal rigidities in the level of wages, and nominal prices equal to nominal wages $P_t = W_t$, with real wage $w_t = 1$. In this situation, if labor demand drops below the labor endowment, wages levels remain unchanged. This circumstance means that theoretically in the system there can be unemployment. Assuming full employment as Central Banks goal, and assuming that the real interest rate remains at its steady-state level $1/\beta - 1$, the condition for consumption is

$$U'(c_0) = \beta * \frac{1}{\beta} * U'(\eta)$$

Therefore, aggregate demand is entirely unaffected, while aggregate supply drops to $(1 - \varphi)\eta$. In this economy, if interest rates did not increase, the economic system would register an excess

of labor demand and an increase in the nominal wage level. So, central banks raise interest rates to counter the inflationary push.

This result fits in a complete market. In this system, nobody needs to cut consumption just because they lost their job or because they have no money or a tiny portion of liquid assets. However, if we put together the consumers in this model with some that have different characteristics, namely consumers that do not have many liquid resources, do not find easy to borrow, and just lose much income due to the shock, maybe the sum of all these behaviors is going to be contractionary, meaning that the demand will fall more.

Contrary to expectations, the result does not change even within the second scenario. We label as incomplete markets, the case with markets that present uninsurable income risk and budget constraints, creating differences in marginal propensities to consume. Just the fact of having incomplete markets, only the point of having heterogeneous consumers, limited insurance, limited financial markets is not going to be sufficient to undo these results. The supply shock reduces people income and cuts consumption. However, for consumption to decrease more than the dropping in income, the marginal propensities to consume (MPC) should be more significant than 1. When we introduce heterogeneous agents, consumers cut their spending more than the representative agents. Nevertheless, they have a higher marginal propensity to consume; this value is not bigger than 1. Therefore, there is an essential reduction in output, a massive contraction in income, a substantial drop in the level of consumptions, but this contraction is not more extensive as the contraction in income.

The question now is whether the results are different in a multisectoral economy.

3.3.2 Multisector

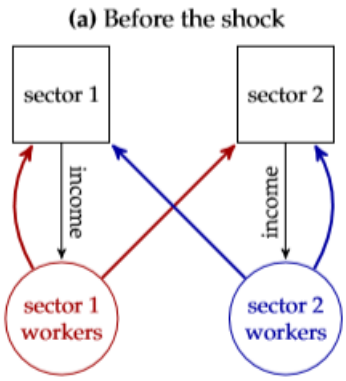
Within a real and complex economy, there are multiple sectors. Therefore, we now take as a reference to a marketplace within which there is more than one sector. In this system, we try to analyze how the performance of one sector conditions the performance of another. More precisely, we try to identify how the effect of lockdown measures, acting on a specific sector, determine negative results for the rest of the economic system. To be more precise, taking as an example the crisis due to the coronavirus, the restrictive measures have profoundly altered the operations of sectors that require extensive contact with people and the public. There are, in fact, sectors that are immediately shutdown. Since people are no longer free to leave their homes, they are directly affected. This situation inevitably also affects industries that are not directly involved. The entire economy is compromised. At this point, the main question is understanding and investigating consumer behavior. By spending less on certain goods and services, which are no longer available, we try to understand whether this leads them to spend on other stuff or not.

The starting point for our analysis is the belief that when the crisis hits specific sectors accurately, we see a contraction in overall spending. As certain types of goods and services are no longer available, general consumption decreases. A first explanation for this behavior is that: by increasing shadow prices, consumption is seen as more expensive and therefore falls. From another point of view, however, the scarcity of certain goods leads to a shift in consumer preferences. These two alternative forces determine the capacity of the system to maintain full employment and, therefore, the natural level of output or not within the sector shutdown.

As we have already mentioned, the direct effect of lockdown is to stop the activity in contact-intensive businesses (e.g restaurants, gym, hotels). As consumers spend less on these items, two are the main consequences: they spend more on substitute goods (e.g food prepared at home, take out); they spend less on complement goods (e.g sports clothing, luggage). If complementarities are strong enough, they will spend less overall, and the recession will spread.

Although some sectors are shut down, others continue to operate. Taking as example the sports equipment industry, we see as the demand for these factors is going to be down even though workers could continue to produce under safe conditions. In fact, because of the restrictive measures, people cannot go out for the sport. Therefore, the demand for such goods decreases.

Figure 2.5: How adverse supply shocks can lead to demand shortages, the system before the shock



Source: Guerrieri, Lorenzoni, Straub, and Werning, 2020 "Macroeconomic implications of COVID-19: Can negative supply shocks cause demand shortages?", National Bureau of economic research.

Figure 2.5 shows this logic, represents, our simplified economy. The Panel a illustrates the situation before the shock. There are workers in both sectors, and they produce goods. Although the economy is much more complicated, we can already see from this frame how there is much interaction between those sectors. Workers receive income in the industry where they work on, and they spend in both industries. When the lockdown measures are adopted, segment 1 is shutdown. So, people can no longer buy goods and use services under safe conditions. The question now is understanding how the income of these two guys is redirected in spending in the

sector 2.

As we will see, due to the measures mentioned above, the reduction in the level of employment takes place within a complete market, within which representative agents therefore operate. A necessary condition for this to happen is that the intertemporal elasticity is higher than the substitution elasticity, but not higher than 1. We could see this logic from another point of view. Assuming that the goods of the two sectors are complementary Hicks goods, a lower marginal consumption of the good within the shutdown sector decreases the marginal utility function even of the good produced in the industry not directly affected by the restriction measures.

Instead, within the second scenario, i.e. within incomplete markets, we will see how the unaffected sectors are equally affected. We witness a sharp contraction of the workforce even within those sectors not directly affected, as they are not based on direct contact between individuals, by the restrictive measures. Workers working within the collapsed areas are losing their jobs, so their income is falling. Their consumption will decrease as well, having limited credit and high MPCs. To counteract this relationship, workers within the non-affected sector should sustain the level of consumption by increasing spending within those sectors that still perform well. For such behavior to take place, a high degree of substitution between goods and sectors is necessary. If this is not the case, aggregate demand will contract more than the initial supply shock. The employment rate in the non-affected industry would, therefore, decrease.

Taking as before an infinite horizon economy, consumers have now standard severable preferences represented by the utility function:

$$\sum_{t=0}^{\infty} \beta^t U(c_{1t}, c_{2t})$$

where:

$$U(c_{1t}, c_{2t}) = \frac{1}{1-\sigma}\left(\phi^{\rho} c_{1t}^{1-\rho} + (1-\varphi)^{\rho} c_{2t}^{1-\rho}\right)^{\frac{1-\sigma}{1-\varrho}}$$

The factor $1/\rho$ represents the elasticity substitution between the two goods (e.g intratemporal elasticity), while the factor 1/σ represents the intertemporal elasticity substitution.

In this case, as mentioned, we have two sectors: sector 1 and sector 2. Assume that a portion of φη workers are operating in the first sector and$(1-\varphi)\eta$ are working in sector 2. Then, assume that workers in the rest of the industry just must stay home.

Also, in this scenario, as in the one-sector economy, there is a fixed endowment of labor, so then there is no choice of labor supply in their respective industry. Everybody in the model have η units of labor, with $\eta > 0$.

Suppose there is a linear technology:

$$Y_{jt} = N_{jt}$$

Therefore, η units of labor are transformed in η units of goods and services.

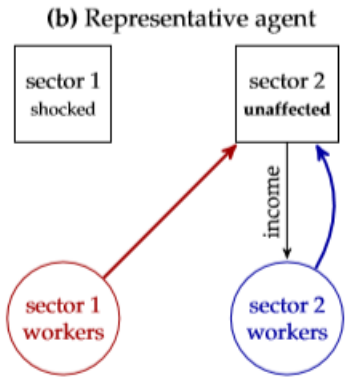
3.3.2.1 Complete and Incomplete Markets

Some sectors are immediately shutdown (e.g restaurants, gym, hotels). They are affected directly in the moment we have the lockdown, since people cannot leave home. Therefore, at date $t = 0$, a labor supply shock happens. Operativity in sector 1 shuts down, so

$$c_{10} = Y_{10} = n_{10} = 0$$

In this system, the apparent consequence is the fact that sector 1 does not reach longer the full employment. So, we try to understand the effects on industry 2: the direction of the natural interest rate to keep the total employment in the unaffected sector. As before, this is a one-time shock, and tomorrow goes away at $t = 1$. Figure 2.6 illustrates that workers in industry 1 redirect their expenditure to the sector not affected by the restriction measures and, therefore, operative. What we need to understand now is whether this volume of spending is sufficient to keep the system in balance and not lead to a contraction in demand more considerable than the initial supply shock.

Figure 2.6: How adverse supply shocks can lead to demand shortages in a representative agent system



Source: Guerrieri, Lorenzoni, Straub, and Werning, 2020 "Macroeconomic implications of COVID-19: Can negative supply shocks cause demand shortages?", National Bureau of economic research.

Within the complete market scenario, the natural interest rate is represented by the equation:

$$1 + r_0 = \frac{1}{\beta} \frac{U_{c2}(0, c_2^*)}{U_{c2}(c_1^*, c_2^*)}$$

If goods are not perfect substitute, the equation has another form:

$$(1 - \phi)^{\frac{\rho - \sigma}{1 - \varrho}} < 1$$

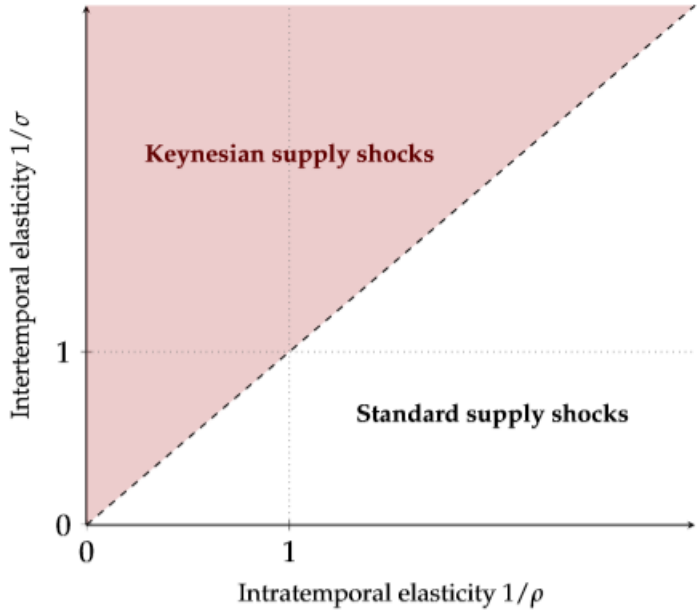
The equation represents in what direction the natural interest rate goes, if we want to keep full employment in sector 2, still keep consumption of goods at the level of which we can produce

even though there is no more sector 1. Then the condition for dropping the natural interest rate, the requirement for the lack of demand in the economy after the shock is going to look like the new equation. Clearly, this relation is linked to the collapse, but crucially is represented by the difference between ρ and σ. If $\rho > \sigma$ or $1/\rho < 1/\sigma$, this number is smaller than 1. Therefore, in the multisector economy with representative agents, the natural interest rate falls. The adverse supply shocks determine a contractionary effect.

Indeed, ρ controls the degree of complementarity between the two goods. So, when ρ is large or $1/\rho$ is small, the products are relatively complemented. This situation means that, when people can no longer consume good 1, consumers do not want to consume good 2. The marginal utility of product 2 reduces. Therefore, the contraction in sector 1 acts as a negative demand shock for good in the unaffected area. Central banks cut the interest rate level to keep full employment in industry 2. Reducing the interest rate keeps consumption at the same level, even though there is no more sector 1.

$1/\sigma$ represents, instead, the intertemporal elasticity substitution. To have the same result, this parameter must be high. The pandemic shock is a shock that increases the shadow prices of a bunch of good. This process is not like inflation. When the system registers an inflationary spiral, agents expect prices to continue to rise in the future. This parameter represents more a today spiking in price levels. In a one-time shock, in which therefore the prices are high today, and low tomorrow, people shift consumption to the future. Since prices are extremely high today, people save money and keep that amount for tomorrow, the time that the shock is away. Therefore, high Interporal elasticity substitution means a high willingness to save when agents are shocked in one sector of the economy. Figure 2.7 shows the region where the Keynesian supply shock can rise. Therefore, necessary conditions to have a negative supply shock are an intertemporal elasticity sufficiently high and an intratemporal elasticity low enough. If $1/\sigma$ is bigger than $1/\rho$, the system has an excess deficient demand.

Figure 2.7: When are supply shocks Keynesian with a representative agent system?



Source: Guerrieri, Lorenzoni, Straub, and Werning, 2020 "Macroeconomic implications of COVID-19: Can negative supply shocks cause demand shortages?", National Bureau of economic research.

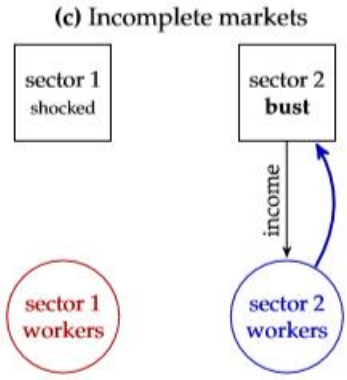
In conclusion, in a multisectoral economy, a Keynesian supply shocks can happen if and only if the following condition is fulfilled:

$$\frac{1}{\rho} < \frac{1}{\sigma}$$

Introducing incomplete markets, we see how workers in affected sectors lose their income and cut back spending in all areas. It is hard for this kind of people keeping their expenditures at the first level.

Figure 2.8 shows that workers in the affected sectors lose their income, and they cut back their spending in all the areas. Workers in industry 1 lose their income, and they must cut spending. So, Workers in sector 2 have lower MPC. They are relatively more prosperous, but in this case, their extra expense is not going to be enough to maintain full employment.

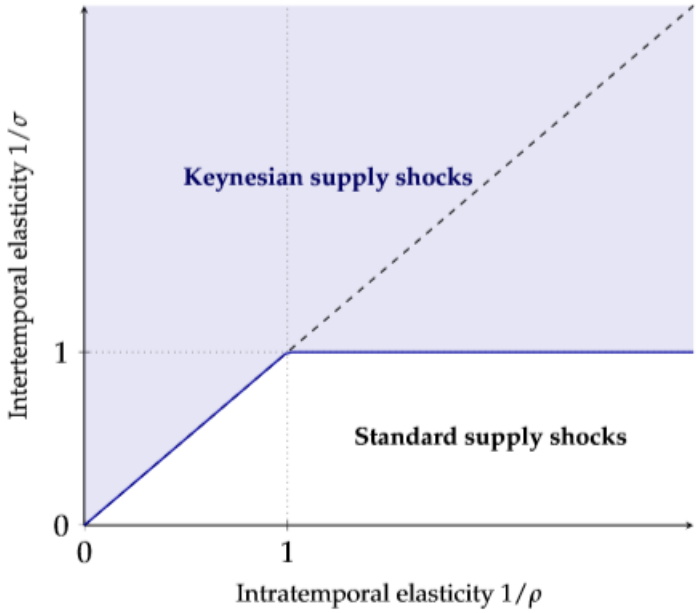
Figure 2.8: How adverse supply shocks can lead to demand shortages in an incomplete market



Source: Guerrieri, Lorenzoni, Straub, and Werning, 2020 "Macroeconomic implications of COVID-19: Can negative supply shocks cause demand shortages?", National Bureau of economic research.

Figure 2.9 illustrates the response of the model to a one-time shock. Before introducing incomplete markets, the region where we get the declining demand was just the red zone in Figure 2.7. The fact that people are imperfectly insured, and people with low income have a higher MPC, expand that region. Once we introduce heterogeneous agents, the area grows. The crucial observation is that incomplete markets magnify the effect of having multiple sectors with limited substitutability between goods.

Figure 2.9: When are supply shocks Keynesian with incomplete markets?



Source: Guerrieri, Lorenzoni, Straub, and Werning, 2020 "Macroeconomic implications of COVID-19: Can negative supply shocks cause demand shortages?", National Bureau of economic research.

To derive this result, we focus the analysis on the natural interest rate dynamics. In this scenario, a random fraction μ of households has a borrowing constraint, while all of households have the same initial financial wealth $a_{i0} = 0$

The variable c_{1t} denotes the consumption of goods 1, while c_{2t} the consumption of goods 2. In this economy, the natural interest rate relationship is determined by the following expression

$$1 + r_0 = \frac{1}{\beta} \frac{U_{c2}(0, c_{20})}{U_{c2}(c_{11}, c_{21})}$$

where

$$c_{20} = (1 - \phi)\eta$$

and

$$c_{11} = \phi(1 - \phi\mu)\eta$$
$$c_{21} = (1 - \phi)(1 - \phi\mu)^{\sigma}$$

Substituting this results in the previous equation, we get as result that

$$1 + r_o = \frac{1}{\beta}(1 - \varphi)^{\frac{\rho - \sigma}{1 - \varrho}}(1 - \phi\mu)^{\sigma}$$

Notice that the right-hand side of the expression, when $\phi = 0$, is equal to $1/\beta$.

The condition by which the negative supply shock determine a contraction in the natural interest rate is

$$\frac{1}{\sigma} > \frac{1 - \mu}{1 - \phi\mu} * \frac{1}{\rho} + \frac{\mu(1 - \phi)}{1 - \phi\mu}$$

If this inequality is satisfied, a drop in the production in sector 1 increases the marginal utility in sector 2, acting as a negative demand shock for good 2. So, to incentive consumptions of goods 2 and to keep the full employment condition, the Central Bank drops the interest rate.

If the interest rate is fixed by the Central Bank at $1/\beta - 1$, the ratio of labor demand to labor supply in the sector not affected, namely sector 2, is

$$\frac{\eta_{20}}{\eta} = (1 - \phi\mu)(1 - \varphi)^{\frac{1\rho - \sigma}{\sigma 1 - \varrho}}$$

Under the previous condition, the supply shock is Keynesian: demand falls below supply, determining a recession in sector 2. Compared to an economy with complete markets, a fraction μ of sector 1 agents cut their spending one-for-one with their income loss. This cut in spending weighs on aggregate demand above and beyond the spending response of unconstrained agents. Thus, aggregate demand falls more with incomplete markets.

Finally, we get to the core message of this study: it is possible to get supply shocks that ends up contracting demand more. It is possible to have a supply shock that causes deflation and not inflation. In this particular scenario, two are the natural forces that determine this result: limited

substitution between goods and limited insurance for people in affected sectors.

3.4 The results of Covid-19 recession

The first signs of the pandemic that would affect the world were recorded in December 2019 in Wuhan, China. Since then, the virus has spread and infected many countries around the world. Although the epicenter was in China, the spread was rapid and profound. After more than 84.292 deaths in China and about 34.968 in India and 154.259 in the USA, the coronavirus has spread throughout the Old Continent. With 285.430,000 cases and almost 28,443 victims, Spain leads this particular ranking of deaths, followed by Italy and Germany. In this regard, the World Health Organization has immediately declared a state of global pandemic.

The first quarter of 2020 saw the global spread of Covid-19, a disease caused by the SARS-CoV-2 virus, belonging to the Coronavirus family. This influenza strain comes in several forms, with increasing health aspects. From a simple cold, it can become pneumonia. In the most severe cases, it even causes the death of the patient. So, governments have been faced with a choice: safeguarding the health of citizens at the expense of the economy or being more concerned about economic rather than social policies. This trade-off was resolved by giving priority to the social rather than the economic aspect. Governments have, therefore, taken restrictive measures to contain the spread of the virus.

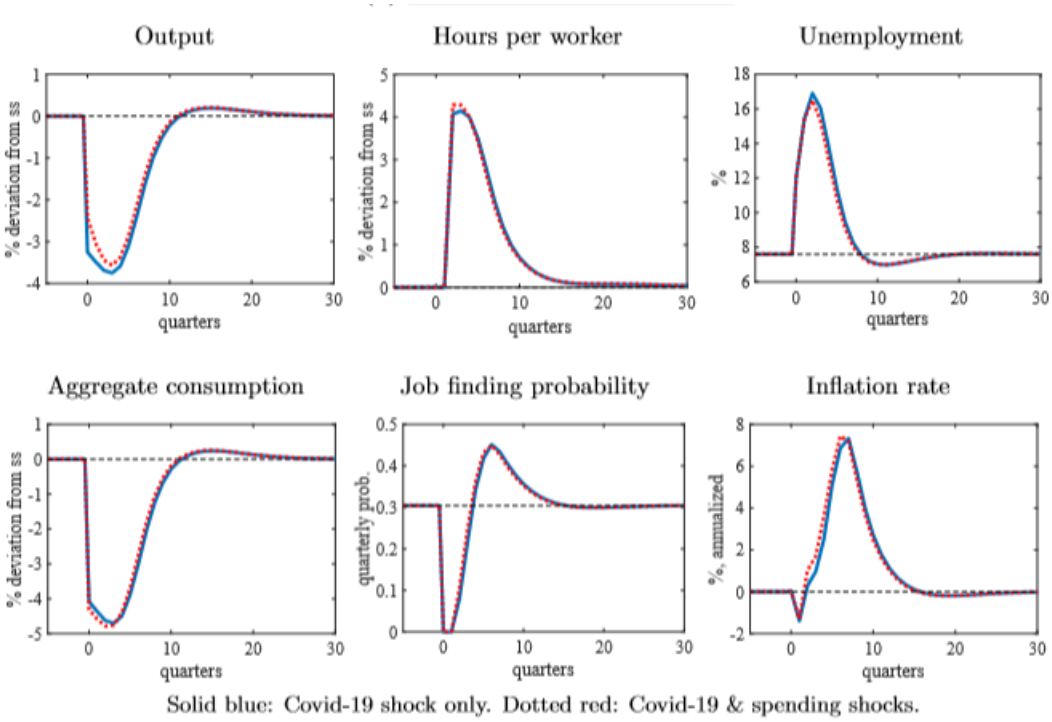
This phenomenon has been identified as a “White Swan” (Taleb, 2020), a factor difficult to forecast but predictable. What are unpredictable are the consequences of the virus outbreak, a sudden and impacting event, which has radically changed the habits and expectations of all citizens. The entire global economy is subject to a danger: collapse following a rapid and deep crisis. This crisis has given rise to one of the fiercest recessions in recent years. An individual affected by the disease cannot work. Therefore, a profoundly affected community experiences a contraction in employment, productivity, and thus generates less wealth. If we relate this factor to social distancing measures, which have prevented millions of workers from going to work, then the crisis is amplified. The epidemic period, therefore, leads to an inevitable contraction of the market. The pandemic has affected the world production chain, hence trade flows and, more generally, the entire aggregate supply. On the other hand, since consumers are unable to spend, aggregate demand is also reduced. This circumstance determined the crisis for Covid-19, the worst of the modern epidemics, and the various financial and economic crises that have occurred in recent years.

The question we have tried to answer is whether the restrictive lockdown measures, linked to today’s pandemic, lead to a shock in supply or demand. As we have seen, both sides of the market are involved. There is a general belief: this event initially presented itself as a shock on the supply

side and then moved to the demand side, generating an even more substantial impact than the initial shock alone. The deflationary spiral that took place gave rise to a great recession. The characteristics reported allow us to label crises as a Keynesian supply shock (Lorenzoni, Straub, Warriors, and Werning, 2020).

Figure 2.10 represents the impact of the coronavirus crisis through the blue line. Taking as reference the model theorized by Albertini, Auray, Bouakez, and Eyquem (2020), we can observe the shock transmission mechanism and the dynamics effect of the Covid-19 outbreak. After hitting its maximum of 17%, the unemployment rate remains above its steady-state level for about 2 years. Such a high level in the above indicator leads to a contraction in aggregate consumption of up to 4.7%. In addition, the output level is reduced considerably, and the hours per worker increase dramatically. As a conclusion of this process, the job-finding probability remains below its average level for four quarters. Focusing on the inflation rate dynamics, we can witness as, in the first three quarters after the global pandemic, the inflation level decrease. This result suggests a more massive contraction in aggregate demand than in total supply. This conclusion is consistent with our research: the Covid-19 pandemic embodies the Keynesian supply shocks definition.

Figure 2.10: the effects of Covid-19 recession



Source: Albertini, Auray, Bouakez, and Eyquem 2020, "Taking off into the Wind: Unemployment Risk and State-Dependent Government Spending Multipliers".

CHAPTER 4: The common EU response to COVID-19

4.1. The policy response

Covid-19 pandemic is spreading fast, and it has having a profound impact on the global economy. This crisis has determined a shock unexpected and unforeseen. The scale and scope have been unprecedented in history. The shutdown of several sectors and business lines has damaged the world's production system. The consequences of this crisis are extremely severe for the entire global economy. The impact of this shock is likely to be particularly onerous for poorer households and for those countries where social safety nets are weak, and supply chains may be less robust.

Understanding this epidemic by investigating all aspects of it, it is necessary to determine the best possible response. In the previous chapter, there have been several questions that we have raised and that we have tried to answer. The main issues concerned the nature of this crisis, how it differs from previous ones, the economic impact of this shock both at the micro and macro-economic level. Based on these preliminary studies, it is now appropriate to ask how policymakers can respond.

Estimating the nature of the crisis is the starting point of designing policy responses. For this reason, this is the debate we have tried to discuss in the previous chapter. In particular, the question was if the epidemic crisis linked to lockdown measures was a supply shock or a demand shock. What we have shown is that the COVID-19 turmoil is a "Keynesian supply shock" (Guerrieri, Lorenzoni, Straub, and Werning, 2020): a collapse that starts from the supply side and can transmit to the demand side.

We have shown under what conditions it is possible that a turmoil, that is predominantly a supply shock, can cause a shortage of demand. More specifically, we have exhibited that a trauma can cause a contraction in demand that is even bigger than the initial contraction in supply. However, as we have demonstrated in the previous chapter, during the current and ongoing crisis, instead of having inflationary pressure, which is the typical outcome of a supply shock, we are witnessing a deflationary spiral. This result is significant because it informs the way we think about the policy response to the crises. The distinctive characteristics of this global economic turmoil, caused by a pandemic, and the consequential supply-side shock have made it necessary to extend the usual macroeconomic policy toolbox. In this circumstance, macroeconomic policies revolve around one big issue: which is the best optimal response? Therefore, should the policy aim to stimulate spending? In particular, the question is whether we want to do an expansionary policy and encourage people to spend more or not.

Before getting to the heart of the matter, it is necessary to make a digression to understand the intrinsic nature and the real essence of the implemented responses. This excursus defines the theoretical foundations of our work.

Two are the main dimensions of the policy response. There is one dimension that we can think of as disaster relief (Paul Krugman, 2011). Suppose a hurricane happens. Some people lose their homes. Therefore, policies want to provide support to these people so that they can live. The motivation for these kinds of measures is clear: namely, when an emergency occurs, citizens and households lose their income, and they are in a tough situation for a while, so governments need to provide some help. This aid is the disaster relief part of the policy.

Compared to the previous example, the shock that has hit the global economy essentially has the same characteristics of natural, terrible, and unexpected event. The matrix of both phenomena is common: they are socially and economically disruptive event. To prevent the coronavirus spread, a significant part of the economy has been shut down. Globally, most workers were impeached within the service provision. For this type of activity, social distancing measures have had a catastrophic effect from a financial point of view. Pleasure and hospitality activities have also been closed. Retail sales have also suffered significantly. Millions of workers, the global workforce, and the labor market, in general, have been subjected to a disaster of unprecedented size and effect. To restore the economic environment, from the very first moments of the crisis, governments and central banks around the world acted quickly. Some governments have put in place a sizeable fiscal package. At the same time, the central banks helped by providing liquidity to the economic system. Unemployment insurance, aid to small businesses, and more are just some of the measures already implemented. Regardless of the specific measures implemented locally and internationally, the disaster-relief nature of the responses implemented is explicit. The mutualistic and aid-oriented aspect of the solutions is evident.

The other dimension of the policies is whether we should stimulate the economy. Obviously, the two dimensions are related. If we provide help people that had lose their income, they spend more. So, there is a stimulus element also within a disaster relief policy. The open question is understanding if the stimulus element is desirable or this is going cause inflation pressure and potential distortions. This trade-off means we need to understand whether it is necessary to compensate a bit. Give some money to people in trouble, but overall have a bit of tightening of the overall policy stance to balance the inflationary pressure.

Before getting to the core of the discussion and then going to analyze the various policies that can be implemented, it is necessary to discuss a crucial point: the impact of a disaster relief policy on the overall government budget. The following analysis is crucial to understand the scale and the scope of the implemented solutions at the government level.

In the early 2000s, there was a very heated debate between Eric Cantor, member of the House of Representatives for the State of Virginia, and Paul Krugman, the eminent economist. According to the first, any disaster relief must be compensated by cuts in government spending elsewhere. The latter, on the other hand, presents a diametrically opposed thesis. According to this, the government budget should be seen as a trade-off between income and expenses, like those made by a family. On the one hand, there are all kinds of activities that the government handles. So, within the state budget, we find the various items of expenditure that vary "from dropping bombs for freedom to providing dental care to children". Each of these jobs has a specific marginal benefit for every extra dollar spent. This marginal benefit decreases with each additional expense. On the other hand, there are all the revenues the governments collect. However, one should consider the fact that the revenues gathering has a cost: direct, i.e. money withdrawn from taxpayers, indirect, i.e. the possible reduction of incentives resulting from higher tax rates.

Each expenditure (e.g additional dollar spent on bombs, dental work, national parks, soup kitchens) should have the same marginal welfare benefit.

Now suppose a disaster happens. The event raises the marginal benefit of the disaster relief. The appropriate measure, in this case, is moving all the marginals to maintain the equivalence between them. Therefore, the government should cut the other chapters of expenditure and increase the tax burden. The latter measure is intended to prevent a scenario where there are only cuts in expenditure to compensate for the imbalance. Moreover, the government can borrow money. So, according to Krugman, it should, therefore, manages its balance sheet in terms of present value discounted, not year-on-year. This solution means that the budget constraints should include not just present, but also future expenses and taxes. A disaster, such as a war, is a one-shock event. So, it is temporary. For this reason, a reasonable response could be increasing taxes and reducing expenditure in the future. Rather than cutting spending immediately, the government should provide a remedy, increasing its deficit.

Based on this model, therefore, a disaster relief policy can be implemented by the government, without any kind of immediate constraint on its budget.

In the following section, we try to analyze the various response policies to the global pandemic. One proposed solution to counter the current Covid-19 recession is fiscal stimulus. So, we are going to examine this approach when the negative supply shock presents Keynesian characters. In this situation, two main remedies are proposed: standard government spending and transfer programs, such as unemployment insurance benefits.

4.2 Fiscal policy when epidemic supply shocks are Keynesian

In macroeconomics, the expression fiscal policy denotes one of the government's lines of action within budgetary policy. It is determined to meet the main objectives of the public budget. This macroeconomic field is mainly based on studies carried out by Keynes. According to this, starting from the assumption that economic recessions arise from a contraction in consumption and investment levels, it suggests an appropriate fiscal policy as a primary response to sustain aggregate demand. This instrument is considered capable of stabilizing the economic cycle and regulating the financial system.

Four are the main determinants of aggregate demand: consumer spending, business investment spending, net government spending, and net exports. Consumers and investors are the most conditionable economic agents from a psychological and emotional point of view, and factors such as pessimism, uncertainty, and fear determine their level of spending. They are, therefore, the agents most variable and exposed to changes in the economic system. Excessive and irrational euphoria can lead to overheating of the economic system and an inflationary spiral, while intense pessimism can lead to severe recession. Fiscal policy, the level of taxation and public spending is a crucial tool to offset the excesses and shortcomings of these economic agents. The goal of this tool is, therefore, to stabilize the economy.

So, one could believe that fiscal policy measures are sufficient in keeping aggregate demand up, also during a shock that starts from the supply, and transmitted to demand-side, can be even larger. We demonstrate that this is a misconception. First, during a "Keynesian supply shock"" (Guerrieri, Lorenzoni, Straub, and Werning, 2020), economic agents have a low marginal propensity to consume. Second, even more surprising, the standard Keynesian model within this system does not work. Therefore, we are going to prove that fiscal policy interventions, in this situation, is less effective than in the model without that kind of asymmetric shock.

Taking as reference the pure traditional fiscal policy, an expansive public spending policy represents the increase in the purchase of goods and services by the government. So, if we do fiscal policy just by expanding public consumption G, namely buying goods and services in the sectors where goods and services are produced, the government policy determines a significant increase in the level of consumption (Galí et al., 2007, Farhi and Werning, 2016, Auclert et al., 2018, Bilbiie, 2019). Therefore, the fiscal policy measure would be successful because the standard kind of multiplier argument increases goods and services consumption in the economy. Then, the worker's income is going up, and they will spend it. So, we will have a second-round consuming effect, a third-round and so on.

Taking as reference the model theorized by Guerrieri, Lorenzoni, Straub, and Werning, the government determines the public expenditure chapters G_t, the level of taxes T_{jt}, targeted by sector, and the public debt level B_t, subject to spending and budget constraints. So,

$$G_t + T_{1t} + T_{2t} + (1 + r_{t-1})B_t = B_{t+1}$$

The steady-state equilibrium is $G = T_1 = T_2 = B = 0$

In this environment, we assume two main fiscal policies to face the ongoing recession. The first, namely the traditional government spending, provides an increment in G_0, at $t = 0$. Such an increase determines the purchase of goods and services in sector 2, the one still operative. Uniform taxes financially support this measure in future periods $T_{1t} = T_{2t} < 0$. The other maneuver is the transfer program (e.g. unemployment insurance benefits). So, the positive transfers are made, in $t = 1$, to sector 1 operators and consumers. Also, this kind of solution provides for uniform taxes as a financing method.

In the incomplete markets, under government spending G_0 and transfers $T_{1,0}$, the equilibrium employment condition is[5]

$$\frac{\eta_{20}}{\eta} = \frac{G_{20}}{\eta} + \mu\frac{T_{1,0}}{\eta} + (1 - \varphi\mu)(1 - \varphi)^{\frac{1\rho-\sigma}{\sigma 1-\varrho}}$$

The unit government spending multiplier and the transfer multiplier are equal to the average MPC, μ. The chief insight is that both are smaller than predicted by the Keynesian relationship. In a standard recession, the government spending multiplier is equal to 1 / (1− μ), while the transfer multiplier is μ / (1 − μ). In such a particular situation, namely where both demand and supply side is affected, the government multiplier is 1, while the transfer one is μ. Therefore, both measures are missing their amplificant and feedback effect.

Now it is interesting to understand the rationale of such a peculiar mechanism. Taking as reference the previous model, people most affected are in sectors shutdown. As we have already described in the previous chapter, they have the highest marginal propensity to consume. Unfortunately, the multiplier is less intense in this system because the positive government spending is helping workers that do not have the highest MPC, namely the workforce in the still operating part of the economy. Therefore, workers in the shutdown sector do not benefit from any government spending. The other side of the economy could still benefit from direct transfers, but their spending will not return to them as income. The reason is simple: sector 1 is still shut down, so no agent can spend in this sector. Therefore, expenditure by both agents and the government can only be directed to sector 2, the only one still functioning.

Therefore, the typical Keynesian cross-amplification does not work in this kind of recession, and the traditional fiscal stimulus is ineffective. There is no feedback effect from spending on the income of workers in affected sectors, namely those with the highest marginal propensity to

[5] Whereη_{20}/η represents the size of the output drop, while η represents the units of labor produced in the system. $(1 - \varphi\mu)$ describes the total income of the group not shocked or unconstrained household, while μ represents the constrained agents in both sectors. $(1 - \varphi)$ represents the fraction of workers in sector 2.

consume. So, standard government purchases are less powerful. Any type of intervention is less potent in this situation. Even if we have direct help to workers, we are not going to have a multiplier effect. They would be happy. They would spend, but we are not going to get a second round. The sector is still shut down, so they would spend in any other sector.

In conclusion, it means that even if the government disposes of a massive fiscal policy intervention is not easy to flip the sign of the overall effect on aggregate demand. It is still possible that the system recorder a lack in aggregate demand a deflation, even if we do massive fiscal stimulus. The standard Keynesian cross-amplification does not work. Agents with the highest MPC do not benefit from spending by families or the government.

Therefore, the fiscal stimulus alone is not sufficient to cope with the negative economic impact of the pandemic. In the next section, we will try to expand our model, integrating health policies, in order to have the broadest possible perspective. Within the new ecosystem, including the various aspects neglected up to this point, we will try to define a possible strategy that would be efficient and effective to restore the economic system.

4.3 Public Health and Macro Policies

The analysis so far has just assumed that some sectors are shut down. In this section, extending the previous model taken as reference (i.e multisector model), we introduce public health, considering the health concern more explicitly, and think about optimal policy in this new environment.

Assuming a consumer's objective function that includes the heath component, consumer preferences are determined by the following utility function:

$$\sum_{t=0}^{\infty} \beta^t \left(U(c_{1t}, c_{2t}) + h_t\right)$$

where the factor $h_t$represents the consumer's health, with

$$h_t = H(c_{1t}, n_{1t}, Y_{1t}, \xi_t)$$

The ξ_t parameter represents the underlying negative health shock and can register two values: ζ_t in normal conditions and $\varsigma_t$when a pandemic occurs. When the shock happens in standard times, namely $\xi_t = \zeta_t$, the function H is constant. When the system is affected by an ongoing pandemic, namely $\xi_t = \varsigma_t$, the function H is decreasing in c_{1t}, n_{1t}, and Y_{1t}. The underlying assumption of this mechanism is that if agents consume and produce in sector 1, and if their general level of activity is more significant in sector 1, they have a higher likelihood of being affected by the virus. While the variables c_{1t} and n_{1t} are chosen by consumers, the aggregate

activity, Y_{1t}, is taken as given by economic agents. This last factor embodies the negative externality linked to the pandemic, namely more interactions in affected sector, i.e sector 1, determines a faster spread of the virus and, therefore, a higher probability of being infected.

In this economy, our results about the relationship between public health policies and macro stabilization are organized around three main remarks.

The first one is very basic. If the government does not dispose of a stay home policy or any lockdown measure, no sector is in shutdown. In this circumstance, although the shock, both sectors are operative. Despite the lack of lockdown measures, due to the presence of the virus, sectors with intense contact still register a contraction in activities. People reduce the level of consumption and labor supply to limit the contagion probability. So, this downturn can determine unemployment in the system. Since the workforce reduction, there is a waste of resources in the system. However, the use of these resources would increase the virus spread, and that would be bad for the overall economy. Therefore, the first remark is that, when we introduce public health policies that do not imply the total economic closure, unemployment may not be socially inefficient.

We corroborate this logic through the following mechanism. Assume[6] ρ = σ and no change in the interest rate level, so sector 2 is at full employment and $Y_{2t} = (1-\phi)\eta$. The economic system reaches the equilibrium condition, namely $c_{10} = Y_{10} < \phi\eta$, if the following two conditions are respected:

$$U_{C1}(Y_{10}, (1-\phi)\eta) + H_{c1}(Y_{10}, Y_{10}, Y_{10}, \xi) = U_{c1}(c_1^*, c_2^*)$$

and

$$U_{c1}(Y_{10}, (1-\phi)\eta) + H_{C1}(Y_{10}, Y_{10}, Y_{10}, \xi) + H_{n1}(Y_{10}, Y_{10}, Y_{10}, \xi) > 0$$

In terms of good 1, the first equation is the Euler equation. The solution is $Y_{10} < \varphi\eta$ just because agents reduce consumption in good 1 due to $H_{C1} < 0$. The second condition represents a Keynesian wedge, and the disutility from work comes from health costs. This equation is the optimality condition for labor supply, and it implies that it is optimal for consumers to supply $n_{10} = n$ when the private benefit form consumption overcomes the private cost of working. The first component, i.e. the consumption benefits, is captured by the first two equation terms, while the latter, i.e. the private cost of working, is captured by the last term.

[6] Where ρ represents the elasticity of substitution among goods, while the factor σ describes the intertemporal elasticity.

So, when we introduce public welfare, the presence of unemployment may not be socially inefficient, as agents do not internalize the externality H:

$$U_{c1}(Y_{10},(1-\phi)\eta)+H_{C1}(Y_{10},Y_{10},Y_{10},\xi)+H_{n1}(Y_{10},Y_{10},Y_{10},\xi)+H_{\gamma 1}(Y_{10},Y_{10},Y_{10},\xi)<0$$

In fact, reducing more the activity in the sector affected, i.e. sector 1, increase the social welfare. As the equation exhibits, the Keynesian wedge, represented by the first three terms, is more than offsets by a Pigouvian wedge, represented by the last term.

In this first part, we have shown that, from a social point of view, unemployment is not inefficient. Now, we try to understand, if once that social distancing and lockdown measures are adopted, the social benefit is more massive. So, if there is a relationship of complementarity between public health policies and aggregate demand stabilization.

Introducing social distancing policies, we analyze the situation where the government determines a shutdown. Assume that sector 2 is completely clean, while, due to the lockdown policy, productivity in sector 1 is stopped. So, while the second kind of activity does not contribute at all to the spread of the virus, the first contributes to a rapid spread of the virus. As we have seen, shutting down sector 1 can cause a negative shock in sector 2. So, public health policies determine a Keynesian supply shock, but macro policies can provide some solutions to balance the negative effect of the first measure.

Assume that $\rho > \sigma$, so as we have already said, there is a recession in sector 2. Consider, then, complete markets. If the following condition is respected

$U_{c1}(0,(1-\phi)\eta)+H_{C1}(0,0,0,\xi)+H_{n1}(0,0,0,\xi)+H_{\gamma 1}(0,0,0,\xi)<0$lockdown measure and sector 1 shutdown are efficient from a social point of view, if the public health benefits are large enough, despite the shock ξ. So, there is a complementarity between public health objectives and macro objectives. If the government applies an optimal health policy, shutting down the sector 1, determining at the same some macro policy to avoid a lack of demand in the other sectors not directly affected by the virus,

Now we are going to examine if the same results apply even in incomplete markets. In this economic environment, three are the main inefficiencies: public health externality, lack of insurance, unemployment. In this economy, the utility function is represented as

$$\int_0^1 [U_{c1}(0,c_{i10})+\partial c_{i10}+U_{c2}(0,c_{i20})\partial c_{i20}]di$$

Where ∂c_{ij0} is the effect of dY_1 on the consumption of consumer i of good j. Assume, then, that government can determine social insurance policy that compensates the workers in the sector shut down.

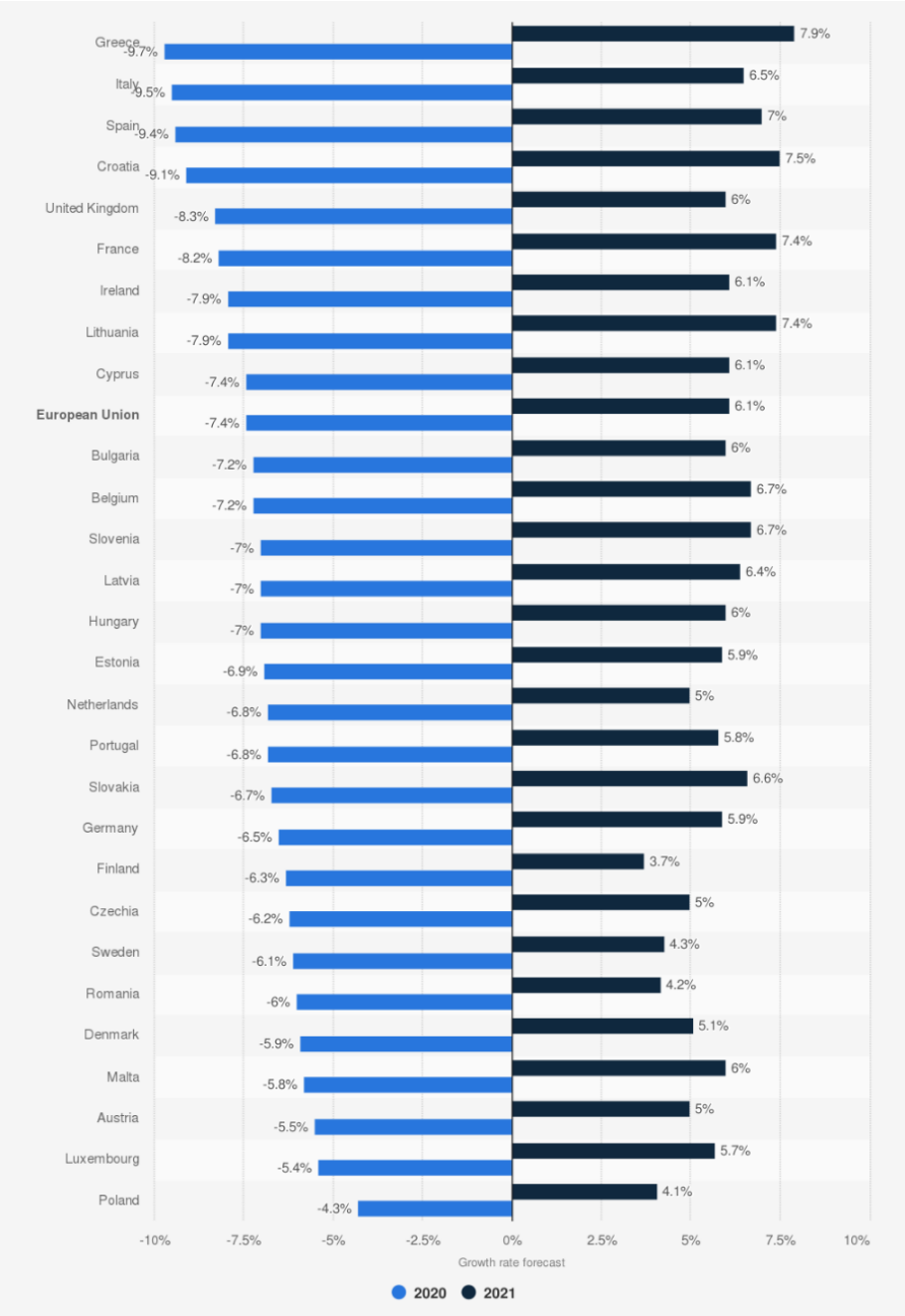
If the government determines a policy that fixes the macro effect, it is shifting the trade-off between economic activity and the spread of the disease. In this way, it is easier to implement public health policy that contracts some sectors very heavily, because at least this result contrasts the undesirable macro effect. So, within incomplete markets, a combination of health policies, social insurance policies, and monetary policies is needed to recover the system: social distancing policies and the total closure of sector 1, a social insurance policy that distributes income from sector 2 to sector 1 workers, and a monetary policy that hits the natural rate. An integrated solution can determine the best solution from both an economic and social point of view.

4.4 The common EU response to COVID-19

Up to this point, we have not considered the international dimension of the problem. We have, both in the previous chapter and in this one, emphasized the complementarity between the different sectors. However, there is also a stable complementarity relationship between the different countries involved. The necessary observation is, therefore, that political coordination and the measures implemented are desirable to stem the devastating impact of the crisis.

Let us see more specific these dynamics. All the major economies of the Old Continent have recorded massive and harmful falls in GDP during the first and second quarters of the year. As the Figure 3.1 shows, the economic crisis has determined a large contraction in real gross domestic product growth rate for the majority of European countries.

Figure 4.1: Real gross domestic product growth rate forecasts in selected European countries from 2020 to 2021



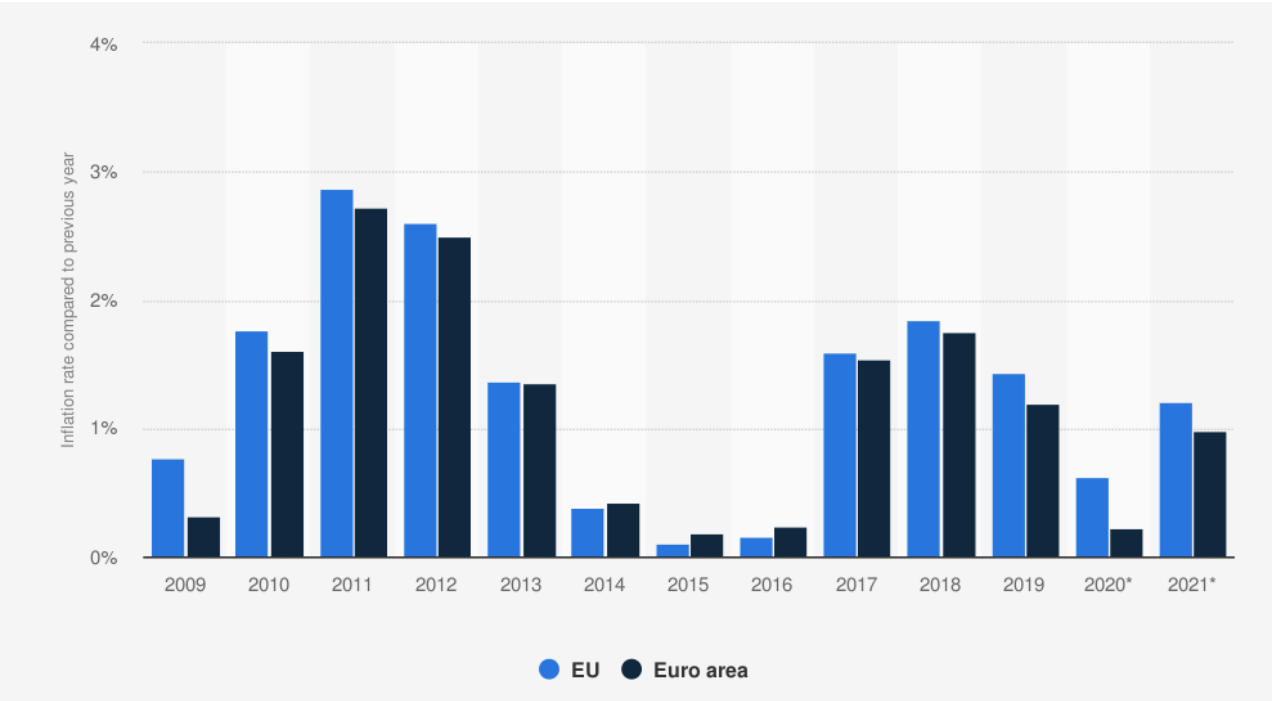
Source: European Commission, "European Economic Forecast, Spring 2020", May 2020

During the second quarter of 2020, the Eurozone economy shrank 12.1 percent. The Euro Area is the second-largest economy in the world, and all the most prominent countries, Germany (29 percent of total GDP), France (20 percent), Italy (15 percent), and Spain (10 percent), have recorded a sharp decline in their GDP. Lockdown measures aimed at preventing the spread of the virus, the fall in aggregate domestic and global demand, and the contraction in the labor market led to an apocalyptic scenario. Hence, the ongoing Covid-19 recession shows two

characterizing aspects: highly destabilizing impact of the economic-financial system, and indiscriminate and global diffusion.

As we have already shown in the previous chapter, one of the most unusual and particular aspects of this shock is the effect it has had on the inflation rate. We have shown how a standard supply shock leads to a relative increase in prices. In this case, however, we have a diametrically opposite effect. As Figure 3.2 below shows, the European inflation rate fell during 2020. This peculiar result empathizes the Keynesian framework of the current crisis.

Figure 4.2: Inflation rate in the European Union and the Euro area from 2009 to 2021 (compared to the previous year)



Source: IMF, "World Economic Outlook Database April 2020", April 2020

This situation occurred as a result of the pandemic. So, the EU necessarily needed to find and adopt a shared strategy to deal with the emergency. Before we get to the heart of the measures and measures taken at the European level, it is worth emphasizing one central point.

The first crucial observation is that at the peak of emergency, when everything is shut down, Virtually, all sectors and businesses are closed, so it is like producing nothing. In this situation, then, the only concern is adopting a disaster relief policy and providing resources to sectors and essential services. Taking as reference a Twitter note of the Nobel Prize-winning economist, Paul Krugman, the coronavirus "isn't a conventional recession; it's more like a medically induced coma, where you temporarily shut down much of the brain's activity to give it a chance to heal".

In this circumstance, to understand the true essence of the policy measures, although it may be a stylized and too simple representation, we may think of the economy divided into two parts: non-essential and essential. The first macro category represents those activities that are not essential so that we can live without them, or activities that promote the spread of the virus. Then there are the essential activities, without which we cannot stay, or which are not risky from an epidemiological and social point of view. Governments around the world have deliberately and appropriately suspended activity and production in non-essential sectors. This type of intervention is like an induced coma. As a result, we shut down most of the brains to save the body. So, we give the system a shock, which is appropriate and proper if we do not want people to die. Activities such as restaurants, gyms, cinemas, and all those sectors where there could be contact have been closed. The reduction of social interactions has been seen as a way to slow down contagion. On the other hand, however, the lockdown measures have led to mass layoffs, leaving millions of citizens around the world short of to buy necessities such as food and medicine, while covering their household bills. Since this situation, several questions arise, such as: What do the unemployed survive within this situation? How do businesses that have been closed survive? The standard answer is a significant aid package, which is a relief. Therefore, workers employed in sectors unable to operate need aid. Considering how much of the economy has been closed, it is understandable that such relief is on a massive scale. The flow of aid and social assistance should be at least proportional to the severity of the virus. The resources and funds allocated at the government level, therefore, should embody the concept of disaster relief mentioned above. Therefore, an emergency policy should be implemented to safeguard the expenditure and consumption of the labor force more without income. A disaster relief policy with a dash of stimulus should be adopted. This policy could restore aggregate demand and avoid a second wave of layoffs. In this way, governments can also avoid another catastrophic consequence: a severe recession. If workers cannot spend and consume, then a recession would then be inevitable. The government should provide funds for even higher spending in the essential sectors. The reason for this policy is that workers in these sectors are saving more and spending less on non-essential goods and services. In conclusion, it is, therefore, necessary a debt-financed disaster relief while the economy is in its medically induced coma. On the basis of this theoretical framework, let us see more precisely the policy response measures adopted.

4.4.1 Covid-19: the EU plan for the economic recovery

Faced with the extent of the economic distress, governments have demanded brave and decisive actions from Europe. In response, the EU mobilized all available resources to help Member States organize their national responses by providing objective information on the outbreak of the

pandemic, practical measures to mitigate it, and actions taken to restore the economic and social consequences of the pandemic. To offset the economic and social hardship caused by the coronavirus outbreak, kick-start European recovery, and safeguard and generate jobs, the European Commission has presented an effective recovery plan for Europe based on exploiting the full potential of the EU budget.

EU leaders agreed on this recovery plan and the Multiannual Financial Framework for 2021-2027, providing guidance on the recovery path out of the crisis and building the foundations for a modern and more resilient Europe. So, the EU is mobilizing massive investment to sustain people and businesses, while Europe struggles with a deep economic recession caused by the Covid-19 epidemic.

The Recovery Fund presented by the European Commission amounts to a total of 750 billion euros, of which 500 billion will be distributed through grants and 250 billion through loans. The entire initiative of the European Commission, i.e. the investment in the future of Europe and the Member States to restart after the Covid-19 emergency, is called "Next generation EU". This measure is structured on three pillars: helping Member States to recover, i.e. fostering investment and reform and promoting a fair transition; stimulating the economy and assisting private investment, i.e. supporting key sectors and technologies, investing in key-value chains, and supporting the solvency of viable companies; learning lessons from the crisis, i.e. strengthening critical programs for future crises and promoting collaboration with global partners.

This solution has been strongly supported by several European governments, particularly by the Italian government, as a joint and shared response to the emergency caused by the COVID-19 pandemic. The financing of the fund was designed by collecting liquidity from the issue of the recovery bonds. These are debt securities, but with a "slight" difference: they are guaranteed by the EU budget 2021-2017, and the ECB itself can buy them. This solution, therefore, consists of a recovery fund associated with the long-term budget of the European Union, from 2021-2027. The historic agreement provides for the use of strong economic and financial measures to determine the recovery and to counter the severe recession.

This act represents the first time in the history of European economic and monetary union that a measure is being implemented that presupposes financial solidarity and pooled debt, guaranteeing it with a budget of 1,074 billion, for an overall economic stimulus of 1,800 billion. This peculiar feature, therefore, embodies the chief insight of this section: the complementarity relationship not just among goods or sectors, but also among countries. The countries most affected by the virus are entitled to the largest share of this fund. Such countries are Italy and Spain in the lead. The "Next Generation EU" is, therefore, Europe's response to the economic

crisis triggered by the Coronavirus. Through this instrument, risk-sharing is common. The debt arising from bonds would therefore be borne by all EU Member States, including those that are not members of the Eurozone, i.e. those that have not adopted the single currency. According to the proposal, it would be repaid through the budget of the European Union, with each country having to allocate a percentage of the budget in proportion to its GDP. Hence, the perspective is only looking to the future without any real mutualization on past debt.

The intention of this digression is not, however, to investigate the program specifically, but to show its true essence and nature. This measure conceptually encapsulates the different inputs of our thesis and enhances our study: the mutualistic and welfare character is evident. The unconventional choice to accumulate the debt and give a common and shared response moves from the awareness that there is not only a relationship of complementarity between goods and services of the different sectors, but more generally also between the various countries. Action is, therefore, needed at a collective level, but above all, at the community level. Clear and evident, given the enormous amount of funds allocated within the measure for subsidies and assistance, is the disaster relief nature of the policy. This measure therefore embodies precisely that disaster relief policy theorized by Krugman. The aim is not just to support the economy itself, but to give it time to work and alleviate the difficulties. It is mostly a disaster relief bill. In the mentioned program, the balance between grants and loans has been shifted strongly in favor of the latter. The central purpose of the measure is to give a massive stimulus to economic recovery, and such a massive package can only be a demonstration of this. There are, in fact, parts of the economy that are still alive, and governments do not want them to collapse because nobody has money to spend. The economic system, therefore, needs a gigantic intervention. The central question at this point is whether these measures, unfortunately, despite its size, can fail in their purpose or breathe new life into the economy.

The measure mentioned is not a stand-alone action, but part of an ecosystem of programs designed to make the union more resilient, facing the challenges triggered by the pandemic.

We have shown how, from a strictly theoretical and abstract point of view, in order to face the recession resulting from the spread of the pandemic, it is necessary to adopt an integrated measure involving health, social and monetary policies. To provide an adequate EU response to the coronavirus crisis, which involves all EU citizens and its global network partners, the European Commission uses a range of instruments.

The intrinsic essence of the shock, due to the Coronavirus, is inextricably linked to the health aspect and the health of the European population. In this respect, the Commission has proposed an ambitious new health program for the period 2021-2027, called EU4Health, which will

contribute significantly to post-COVID-19 recovery by improving the health of EU citizens, increasing the endurance of health systems, and promoting innovation in the health sector. The program will fill the gaps highlighted by the COVID-19 crisis and ensure that EU health systems are sufficiently resilient to cope with new and future health threats. The current Covid-19 pandemic has shown that health should be given higher priority in the future European financial framework. The EU4Health program is, therefore, intended by the European Commission to be the European response to the need to enhance health and crisis management systems that emerged during the COVID-19 emergency. It aims to reinforce EU preparedness for cross-border severe health threats and make health systems stronger and able to cope with epidemics and long-term challenges such as an aging population and inequalities in health status. This measure is also crucial in the light of the expectations of experts and practitioners who forecast a strong second wave of contagion. There are three main priorities in this plan: protecting citizens from serious cross-border health threats, increasing the supply of medicines, improving health systems. In addition to more effective crisis protection and better crisis organization through the strengthening of Member States' health systems and better care, the EU4Health Programme aims to improve health and encourage innovation and investment. The relationship of complementarity, mutualism and coordination between the various countries is not an exclusive component of the Next Generation EU macro measure but rather a common and distinctive mark of the new attitude of the European policymaking. Resuming the words of the Chair of the environment and public health committee, Pascal Canfin, "The Covid-19 pandemic has shown that the EU health policies need to be reinforced. The European Parliament has committed to using EU Health Programme funds to create real added value to protect the future health of Europeans by joining our health forces". Therefore, the Covid-19 outbreak highlighted the need for EU countries to cooperate and coordinate more effectively in crises and strengthen the EU's capacity to respond adequately to new cross-border health challenges.

Then, as we have already proved in the paper, this shock is not only a health crisis, but also a severe economic crisis. The two essential components must necessarily be jointly assessed.

Since small and medium-sized enterprises account for 99% of all businesses in the EU, it is necessary to ensure their survival to determine a full economic recovery. They employ around 100 million people, generate more than half of Europe's GDP, and play an essential role in creating added value in every sector. SMEs provide innovative solutions to climate change, resource efficiency, and social cooperation and enable this innovation to be transmitted to all regions of Europe. They are, therefore, central to the EU's dual transition to a sustainable and digital economy. They are indispensable for Europe's competitiveness and welfare, industrial

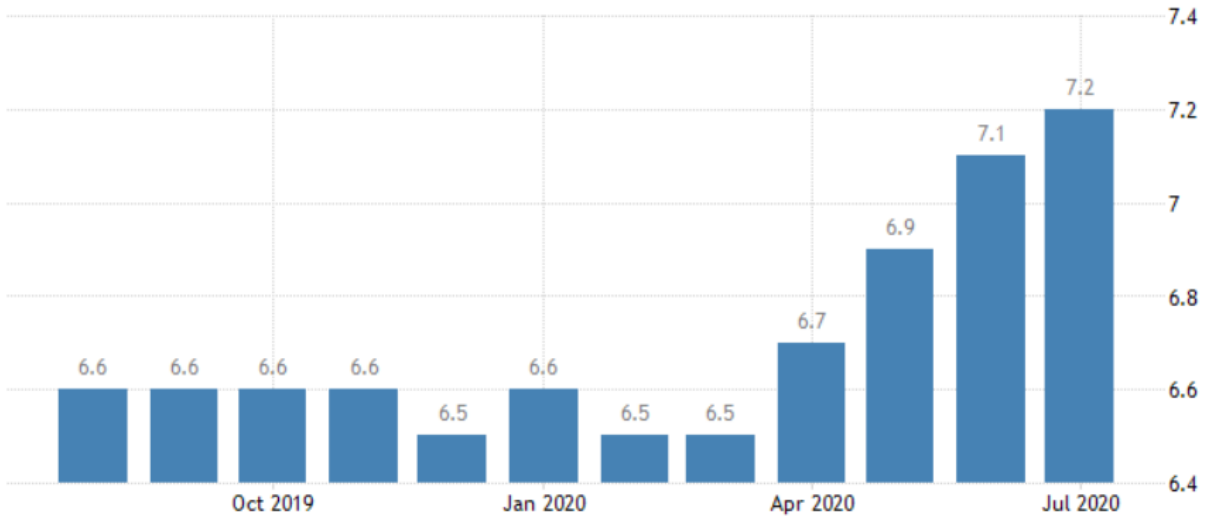
ecosystems, economic and technological sovereignty, and resilience to exogenous shocks. It is, therefore, essential to adopt a recovery strategy aimed at strengthening resilience within European supply chains and ecosystems, restoring consumer and business confidence, boosting investment, and assisting the unemployed back into work. Given the ongoing recession, protecting small and medium-sized enterprises is a priority at the European level. For such a reason, the EU has allocated €1 billion from its European Strategic Investment Fund to stimulate banks and lenders to provide liquidity to more than 100,000 small businesses in Europe.

This assistance aspect assumes even more importance in our continent due to the peculiar production structure we have already mentioned. The European economy is made up of many small and medium-sized enterprises, which, faced with such a deep recession, have mainly been shaken up.

The performance of the companies has inevitably been reflected in the labor market, about the two aspects mentioned above, i.e. health and economic performance. Two main factors determine the failure of the European industrial framework: contraction in the level of aggregate demand and the level of employment.

European companies and businesses are not only experiencing a sharp drop in demand, but also employment. Restrictive and social distancing measures have significantly reduced the aggregate workforce. Moreover, given the high number of infections, millions of infected and sick workers cannot carry out their work. This effect determines a sharp increase in the unemployment rate. Figure 3.3 below shows the level of unemployment in Europe due to the pandemic.

Figure 4.3: EU Unemployment rate



Source: Tradineconomics.

To support workers in the face of the Covid-19 crisis, the EU's "Support mitigating Unemployment Risks in Emergency (Sure)" program provides Member States with financial assistance of up to EUR 100 billion in the form of loans granted on concessional terms to for the preservation of employment. The establishment of a program to protect the European workforce is a further expression of Community solidarity. Member States are working together to support each other by providing additional financial resources through loans.

Over the years, we have seen that the approach taken by the European institutions to tackle the various crises that shook the EU economy has focused on the adoption of broad monetary measures. In this respect, in addition to the various measures implemented by the Commission, the ECB has launched the so-called PEPP, the Pandemic Emergency Purchase Programme. This measure is a non-standard monetary policy, initiated in March 2020 to counter the severe risks to the monetary policy transmission mechanism and the outlook for the euro area posed by the coronavirus (COVID-19) outbreak.

It provides for the purchase by the Central Bank at almost zero interest rates of bonds of public and private entities for a total of 750 billion euros. This program is aimed at all debt instruments already eligible for purchase by the ECB under the APA, with the addition, on an extraordinary basis, of Greek government bonds (excluded from the APA because of their low credit rating). The Board of Directors also stressed the possibility of changing the composition of the portfolio of purchased securities and the duration of the program concerning the future magnitude of the economic shock in the euro area. Under the PEPP, the ECB may, unlike the APA, it is possible purchase bonds above one-third of the total debt of a euro area member state and without limiting such acquisitions to the corresponding share contributed by each country to the ECB's capital. The removal of these constraints, imposed in other quantitative easing programs, will enable the Eurotower to facilitate those countries most affected by the economic crisis and most exposed to speculation on public debt by stemming the increase in the yield on government bonds. In this way, the different business and administrative realities will significantly facilitate accessing the liquidity needed for the recovery.

This measure completes the package of measures aimed at restoring the European economic, financial, and social system. The Recovery Fund set up in this way, together with the ECB's PEPP, could represent a real lifeline for the countries most exposed to the effects of the economic crisis caused by the Covid-19.

4.4.1.1 A brief personal reflection

Up to this point, the analysis has shown that a shock that starts from the supply side can transmit to the demand side, and the turmoil can be even more significant in demand one. We have defined this kind of crisis as "Keynesian supply shock" (Guerrieri, Lorenzoni, Straub, and Werning, 2020). We have demonstrated that to get an event that falls within this specific label, in a simple model of the economy, at least two ingredients are necessary: complementarity across goods and sectors, and it helps if there are incomplete markets. The European example testifies a further step: the complementarity relationship does not only exist across goods and services, but also between countries. According to our thesis the measure implemented demonstrates the cross-border nature of the problem, but also of the solution. So, our crucial observation here is that policy coordination is particularly desirable, and a strong safety net is essential to contrast the economic recession. The coordination between health, monetary and fiscal policy, as well as social insurance policy, is paramount to restore the business and economic environment. The innovative and advisable, not to say recommendable, attitude to cooperate allows to offset the adverse economic effects that would otherwise be determined by the expansions of the crisis and the contagion of the virus. According to our research, a collaborative attitude within the European continent, the redistributive actions between countries and between the various sectors of the economy and population groups clearly reinforces the effects of policies and the response to the influenza pandemic. It is unthinkable to envisage an isolated response state by state to face a global pandemic.

As we have already mentioned, there are two main dimensions to the policy response: we can think the first as disaster relief, while the second as the stimulus package. The two aspects are linked. If we can help people who lost their income, they could sustain their consumption and continue investing. So, there is a stimulus element also within a disaster relief program. Taking as a reference the thought of the Nobel Memorial Prize-winning economist and New York Times columnist, Paul Krugram, the best policy would be implementing a disaster relief policy with a dash of stimulus. Only through such a policy, we can succeed in containing the impact of a crisis that has temporarily eliminated millions of jobs. Through direct aid to the economy that has not yet been shut down, poverty can be contained. Without such intervention, unemployed workers would be forced to cut their spending and consumption in all sectors. This lack would only generate a second wave of the crisis: new cuts, and, therefore, an even more significant economic contraction.

The bottom line is, therefore, the fiscal policy. However, as we have displayed, government spending multiplier can be smaller than usual because there is no feedback effect from spending

on the income of workers in affected sectors. So fiscal measures alone are not enough to counter a crisis of this magnitude.

We have, therefore, demonstrated that there is a positive correlation between public health policies and the stabilization of aggregate demand. Moreover, within incomplete markets, a combination of health policies, social insurance policies, and monetary policies is required to rehabilitate the economic network. Based on this evidence, we personally believe that the measures adopted can truly restore the correct functioning of the economic market. Specifically, there are three main measures in this regard: the “New EU4Health program”, part of the Next Generation EU, to strengthen Europe's health systems and infrastructures for a better response to future major cross-border crises, such as the Coronavirus pandemic; the allocation of €1 billion from the European Strategic Investment Fund to stimulate banks and lenders to provide liquidity to more than 100,000 small businesses in Europe, and the EU's "Support mitigating Unemployment Risks in Emergency (Sure)" program that provides financial assistance for the preservation of employment; the Pandemic Emergency Purchase Programme, namely a new temporary asset purchase programme of private and public sector securities to face the serious risks to the monetary policy transmission mechanism and the outlook for the euro area determined by the outbreak and escalating diffusion of the pandemic.

Therefore, we firmly believe that the unique characteristics of this global economic crisis, triggered by the Coronavirus pandemic and its resulting supply-side shock, has required an expansion of the usual macroeconomic policy toolbox. Besides the operational aspect of the measures, we think that a change of attitude and orientation represents the main significant response to the pandemic. So, regardless of each single program, the crisis has underlined how essential it is for the EU to react in fast and flexible way, implementing a coordinated and integrated response.

In conclusion, our personal chief insight is that policy coordination is particularly appropriate to counter a pandemic, and that a strong safety net, determined by the policy mix described above, is essential to counter the economic downturn.

CONCLUSION

Although financial crises are not new phenomena, but have always characterized the market dynamics, a real understanding has not yet been defined. For such a reason, we present an analysis of financial crises concerning two main questions: What are the main factors explaining financial crises? What are the real and financial sector implications of crises?

First, we have tried to identify the principal elements that characterize this phenomenon. Although the literature has identified some elements leading a crisis, understanding the intrins causes it is still an open question. While fundamentals factor (i.e internal or external shocks, macroeconomic imbalances) have already been defined and analyzed sufficiently, the critical elements of financial turmoil are not yet been identified. Several theories have emerged over the years that have tried to clarify these underlying reasons. The common point among them is that they traced a boom in the price of assets and an excessive development of the credit level as the main driving force behind the crises. So, asset and credit market dynamics have been traced as the main reasons explaining speculative bubbles and financial crises.

The second question concerns the real and financial implications. During a crisis, the economic system registers large output losses and significant contraction in the main macroeconomic variables, namely consumption, investment, and production. Financial variables follow the same patterns. Asset prices and credit record the same dynamics across crises, reporting variations in duration and intensity of the decline.

Once the qualitative and quantitative characteristics of financial crises have been defined, we turn the focus of our research on pandemic crises. We have tried to define the main economic insights and quantify the potential economic effects of the influenza pandemics. The focus of our approach is mainly directed to the shocks affecting the economic system during a pandemic. The main ones concern the workforce, market supply and demand, premium risk in different countries, and the costs of the production and business sector. The main results have been: a drop in the labor force due to an increase in mortality and illness, an increase in the cost of doing business, a shift in consumer preferences, a re-evaluation of country risk premiums. Depending on the intensity of the pandemic, we register four cases: the mild scenario shows a decrease in global GDP of 0.7 percentage points; the moderate situation of 3.1; the severe scene can reach 4.8; this threshold can be exceeded in the ultra-severe scenario, reaching 12.6%. So, increasing the scale of the pandemic increases the economic impact. Two are the main reasons explaining these results: a sizeable labor-supply contraction, due to the virus's spread, and a massive decrease in aggregate demand, as the main effect of a drop in consumer and business confidence.

Based on the previous analysis, we turn our analysis trying to understand the COVID-19 shock

and the macroeconomic implications involved.

The first step of this research focuses on a comparison and correlation analysis between the Coronavirus recession and Global Financial Crises. What we have found is that the current recession is different in both dynamics and results from all the financial crises the world has experienced, including that one of 2008. Taking as a reference the studies (Benguria, Taylor, 2020), developed over the last two hundred years of history, we see how financial crises are inherently negative demand shocks. During the crisis of 2008, it is the aggregate demand that suffers a contraction. Economic agents, because of the loss of jobs and the reduction in income, contracted consumption. In the coronavirus pandemic, instead, two are the main dynamics involved: a negative supply shock and a negative demand response.

Next, we extend our analysis focusing on the main dynamics that characterize Coronavirus supply shock and Standard negative supply shocks, looking for a familiar pattern. Although nature is common, i.e lockdown measures mostly lead to a contraction in production supply, the crisis in question differs from the standard shocks. The main difference is the fact that the global inflation rate decreases. This event creates a situation where there is a lack of demand and deflationary pressure, instead of an inflationary one that is the typical outcome of a supply shock. To understand the nature of this crisis, we extend our analysis presenting the "Keynesian supply shock" theory (Guerrieri, Lorenzoni, Straub, and Werning, 2020)., i.e a supply shock determines a demand shock even more significant than the initial supply shock. We argue that the ongoing crisis, related to the Coronavirus pandemic, presents this feature. Based on the assumption that supply and demand are two dynamics intertwined, a shock in one side of the market influences the other. The theoretical framework is simple: workers, losing income, contract consumptions. However, the central question is when this pattern creates a more than proportional fall in aggregate demand. We show that in a one-sector economy a supply shock never falls within the Keynesian typology. This conclusion is right both within an economy composed of representative agents and within an incomplete market. Within the model, a supply shock never causes such a substantial impact on demand that dominates the fall in initial supply. We continue the analysis considering an economy with multiple sectors. Within this scenario, it is possible to get supply shocks that ends up contracting demand more, namely a Keynesian supply shock. Two forces would induce demand to contract more than supply: complementarity across goods and sectors, and it helps if there are incomplete markets. To test this hypothesis, we have taken as reference the model theorized by Albertini, Auray, Bouakez, and Eyquem. The model's results suggest a more massive contraction in aggregate demand than in total supply. This conclusion is consistent with our research: the Covid-19 pandemic embodies the Keynesian supply shocks definition.

Once we have achieved this result, we have explored what is the best way to intervene, namely what is the optimal policy in the current situation. The bottom line is the fiscal policy. However, as we have seen, government spending multiplier can be smaller than usual because there is no feedback effect from spending on the income of workers in affected sectors. So fiscal measures alone are not enough to counter a crisis of this magnitude.

Since the fiscal stimulus alone is not sufficient to cope with the negative economic impact of the pandemic, we have extended our research, integrating health policies in our model, in order to identify a relationship of complementarity between public health policies and the stabilization of aggregate demand. We have found that within incomplete markets, namely the worst scenario, a combination of health policies, social insurance policies, and monetary policies is required to re-establish the system. So, lockdown measure in contact-intensive sectors and full insurance payments to workers in affected sectors can face and flip the sign of the recession, despite the lower potency of fiscal policy.

Finally, we consider the international dimension of the problem and the policy implemented at European Communitarian level.

Up to this point, the analysis has shown that a shock that starts from the supply side can transmit to the demand side, and the turmoil can be even more significant in demand one. We have defined this kind of crisis as "Keynesian supply shock" (Guerrieri, Lorenzoni, Straub, and Werning, 2020). We have demonstrated that to get an event that falls within this specific label, in a simple model of the economy, at least two ingredients are necessary: complementarity across goods and sectors, and it helps if there are incomplete markets. The European example testifies a further step: the complementarity relationship does not only exist across goods and services, but also between countries. According to our thesis the measure implemented demonstrates the cross-border nature of the problem, but also of the solution. So, our crucial observation here is that policy coordination is particularly desirable, and a strong safety net is essential to contrast the economic recession. The coordination between health, monetary and fiscal policy, as well as social insurance policy, is paramount to restore the business and economic environment. The innovative and advisable, not to say recommendable, attitude to cooperate allows to offset the adverse economic effects that would otherwise be determined by the expansions of the crisis and the contagion of the virus. According to our research, a collaborative attitude within the European continent, the redistributive actions between countries and between the various sectors of the economy and population groups clearly reinforces the effects of policies and the response to the influenza pandemic. It is unthinkable to envisage an isolated response state by state to face a global pandemic.

As we have already mentioned, there are two main dimensions to the policy response: we can think the first as disaster relief, while the second as the stimulus package. The two aspects are linked. If we can help people who lost their income, they could sustain their consumption and continue investing. So, there is a stimulus element also within a disaster relief program. Taking as a reference the thought of the Nobel Memorial Prize-winning economist and New York Times columnist, Paul Krugram, the best policy would be implementing a disaster relief policy with a dash of stimulus. Only through such a policy, we can succeed in containing the impact of a crisis that has temporarily eliminated millions of jobs. Through direct aid to the economy that has not yet been shut down, poverty can be contained. Without such intervention, unemployed workers would be forced to cut their spending and consumption in all sectors. This lack would only generate a second wave of the crisis: new cuts, and, therefore, an even more significant economic contraction.

The bottom line is, therefore, the fiscal policy. However, as we have displayed, government spending multiplier can be smaller than usual because there is no feedback effect from spending on the income of workers in affected sectors. So fiscal measures alone are not enough to counter a crisis of this magnitude.

We have therefore demonstrated that there is a positive correlation between public health policies and the stabilization of aggregate demand. Moreover, within incomplete markets, a combination of health policies, social insurance policies, and monetary policies is required to rehabilitate the economic network. Based on this evidence, we personally believe that the measures adopted can truly restore the correct functioning of the economic market. Specifically, there are three main measures in this regard: the “New EU4Health program”, part of the Next Generation EU, to strengthen Europe's health systems and infrastructures for a better response to future major cross-border crises, such as the Coronavirus pandemic; the allocation of €1 billion from the European Strategic Investment Fund to stimulate banks and lenders to provide liquidity to more than 100,000 small businesses in Europe, and the EU's "Support mitigating Unemployment Risks in Emergency (Sure)" program that provides financial assistance for the preservation of employment; the Pandemic Emergency Purchase Programme, namely a new temporary asset purchase programme of private and public sector securities to face the serious risks to the monetary policy transmission mechanism and the outlook for the euro area determined by the outbreak and escalating diffusion of the pandemic.

Therefore, we firmly believe that the unique characteristics of this global economic crisis, triggered by the Coronavirus pandemic and its resulting supply-side shock, has required an expansion of the usual macroeconomic policy toolbox. Besides the operational aspect of the

measures, we think that a change of attitude and orientation represents the main significant response to the pandemic. So, regardless of each single program, the crisis has underlined how essential it is for the EU to react in fast and flexible way, implementing a coordinated and integrated response.

In conclusion, our personal chief insight is that policy coordination is particularly appropriate to counter a pandemic, and that a strong safety net, determined by the policy mix described above, is essential to counter the economic downturn.

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SUMMARY

INTRODUCTION

Covid-19 pandemic has determined a crisis unexpected and unforeseen. The scale and scope have been unprecedented in history. Understanding the COVID-19 shock nature and the macroeconomic implications involved is critical to determine the optimal policy response. So, the aim of this thesis is to test the hypothesis that the current crisis is a negative "Keynesian supply shock", and then, based on this outcome, and to identify a possible strategy to counter the ongoing recession. Based on the evidence emerged, the main point is analyzing the policy implemented at European Communitarian level, showing that a coordinated and collaborative EU policy is necessary to overcome an obstacle of unprecedented scale and global reach**.** The key economic questions addressed in the paper are: What is the nature of the COVID-19 shock, and how does it differ from previous global contractions? What are the economic impacts of the COVID-19 shock on macroeconomies and households? Given its nature and these impacts, how should policymakers respond?

The work is divided into four chapters. The first chapter presents the dynamics that characterize financial crises. The second explore the implications of a pandemic influenza outbreak on the global economy. The third argues that the economic crisis, associated with the COVID-19 pandemic, is predominantly a supply shock that causes changes in aggregate demand that are even bigger than the initial contraction in supply. The four presents the jointly optimal health and macroeconomic policy and the measures undertaken at Community level to face the economic recession.

CHAPTER 1: Global Financial crises: causes, impact, and real and financial implications

1.1 Explaining Financial Crises

In a financial crisis, asset prices suffer a substantial decline in their value, entrepreneurs and consumers are incapable of repaying their debts, and financial institutions are subject to liquidity shortages. A financial crisis leads to panic and, consequently, a bank run, during which investors either sell their assets and turn them into cash or suddenly withdraw their savings from bank accounts. Other circumstances that identify a financial crisis are the outbreak of a speculative financial bubble, a stock market collapse, a sovereign default, or a currency crisis. This event may be circumscribed to a specific financial institution, a single economy, a particular region, or it may condition the global economy.

Based on this preliminary description, given the complexity of the phenomenon in question, we try to outline a more defined physiognomy. To achieve this goal, we will rely on several studies on this topic. Historically, we can distinguish three macro groups of crisis models. The first

approach identifies this phenomenon, financial crises, as a distressing factor in a fundamentally balanced real economy (Wicksell, Hayek, Schumpeter, Fisher, and the early Keynes). Then, we present approaches in which the dichotomy between the monetary and real spheres is re-examined in the aftermath of a change in perspective from previous currents of thought. In this field, the contributions of Keynes and Minsky are fundamental. Since the former did not present a real model to explain financial crises, this system was addressed by the latter, who developed the Hypothesis of Financial Instability. Two are the main postulates on which his theory is based: first, according to specific financing structures, a particular economy can be stable or unstable; second, during cycles of economic expansion, the economy can go from balanced to financially unsustainable regimes. The third macro-economic approach is behavioral finance. This branch of study focuses exclusively on the psychology of economic operators. It does not consider the various implications at the micro and macro level. Assuming that the agent's behavior drives the market, it focuses just on aspirations, cognition, emotions, and culture of economic agents.

1.3 Asset Price and Credit Booms and Busts

A financial crisis is the synthesis of multiple factors: substantial changes in the level and volume of credit granted, a rapid increase in the price level of assets, an excess level of financial leverage. Although these components can be determined by multiple and different causes, the common pattern of all crises is found in the dynamics involving credit and the price of assets. For such a reason, within this paragraph, we are going to study in detail the pricing trends of assets and the credit cycle. As we have already mentioned, a rapid rise in asset prices creates a speculative bubble, which leads to a financial crisis during its depressive phase. A sharp expansion in the level of credit is another common crisis factor. So, an increase in the asset price, an increase in the level of indebtedness of the system, and more significant risk taken by operators, through rapid credit boom, in their investments often anticipate a crisis.

1.5 Real and Financial Implications of crises

Despite the fundamental differences characterizing each crisis, macroeconomic variables always follow the same path. During periods of turbulence in the markets, consumption, investments, and the level of production show a significant decrease. Financial variables, such as the level of asset prices and credit, also follow the same trends. This contraction happens at a much higher rate than under standard economic periods, confirming the boom-bust cycles in these variables discussed in previous sections.

These dynamics have a substantial impact on the economic system. The particular aspect is that financial crises often trigger a recession worse than the standard business cycle. The average duration is about twice as long, and the decline in output level is higher, as well as the cumulative losses, concerning pre-crisis levels, are more massive.

CHAPTER 2: Global Macroeconomic Consequences of pandemic crisis

2.4 Conclusions and insights on the pandemic crisis

This chapter explores the implications of a pandemic influenza outbreak on global economy. Despite the manifest uncertainty, this chapter has attempted to define some economic insights and quantify potential economic consequences of influenza pandemics. The analysis is carried out through a range of four possible epidemiological scenarios: mild, moderate, severe, and ultra-severe. The study displays as even a mild pandemic produces severe effects on global economic output. Increasing the scale of the pandemic, increases the economic impact

Once determined this result, we have tried to understand and quantify the micro and macro effects of the pandemic. To achieve this objective, our analysis takes as reference the Asia Pacific G-Cubed Model. The focus of our approach is mainly directed to the shocks affecting the economic system during an influenza pandemic. The main ones concern the workforce, market supply and demand, premium risk in different countries, and the costs of the production and business sector. The main result has been a drop in the labour force due to an increase in mortality and illness, an increase in the cost of doing business, a shift in consumer preferences, a re-evaluation of country risk premiums.

Based on this preliminary study, we have tried to understand the main features of this phenomenon and the economic implications. The main insight we have found exhibit: a significant drop in the aggregate demand, due to a massive contraction in the consumption level and business confidence, a massive fall in the supply of goods and services, due to a considerable reduction in the level of labor force and the production. The central mechanism that testifies these dynamics is the following: due to the virus spread, the people got sick, so they cannot go working. As a direct result, we witness a reduction in the employment rate. Since the lack of assembled workforce, a reduction in the production level is necessary evident. To contain the disease, governments have determined social distancing and lockdown measures. As a result, we get a general fall in the aggregate supply of goods and services. On the other side, the less work determines less income, so we have a reduction in consumption and spending level. The main result is a consequential recession.

The purpose of this chapter is not predicting the ongoing Coronavirus recession impact on the global economy. Rather, we try to offer some food for thoughts on how to interpret what might happen in the future.

CHAPTER 3: Macroeconomic implications of COVID-19 global pandemic.

3.1 2008 Global Financial crisis and Covid-19 global pandemic

There are critical differences between the global crisis of 2008 and the one we are experiencing today. The former is a result of monetary and financial turmoil. The causes must be found within

the economic system. Massive maturity mismatches, unrealistic bank capital, regulatory fragmentation, widespread regulatory arbitrage, and significant weight of liabilities in the balance sheet are the fundamental factors of the crisis. Therefore, the global financial crisis is a typical endogenous crisis.

The COVID-19 turmoil, on the other hand, has a real nature: the disease following the coronavirus contagion. This shock does not have the previous characteristic: it is not intrinsic to the system, but exogenous. Therefore, the origins are different. So are the consequences. During the crisis of 2008, it is the aggregate demand that suffers a contraction. Economic agents because of the loss of jobs and the reduction in income contracted consumption. In the current situation, on the other hand, the priority of governments has been to fight and contain the virus. To safeguard the health of citizens, restrictive measures have been taken. The first lockdown measures were born in the epicenter of the crisis, China. These measures have affected global markets, with the West referring to China for most of the production chain. In this first chin, therefore, the supply side was the hardest hit. The second phase of the crisis itself then saw the same measures of distancing and social restriction adopted unconditionally throughout the world. So, if at first the supply side of production contracted, during the second phase, both supply and demand fell sharply. What we are going to investigate, therefore, is whether this deep recession has resulted from a more significant fall in demand than the initial supply shock.

3.2 COVID-19 shock and Standard supply shocks

The Coronavirus crisis also differs from those crises that arise first and foremost on the supply side. Taking classical theory as a reference (Phillips, Friedman and Phelps), a standard supply shock (e.g. oil shocks years) tends to create an excess and not a contraction in demand. If the aggregate supply, i.e. the ability of the economy to determine goods and services, contracts, and aggregate demand does not contract as much, markets forecast is an excess of demand. This excess leads to an inflationary push.

The historical moment we are experiencing, and the situation linked to the coronavirus is unique. Since this crisis is directly linked to the spread of Covid-19, at the government level, a balance has to be struck between health and social policies aimed at preserving the health of citizens and economic systems. There are two main determinants of preventive health measures taken at a global level: the first is a strong negative impact on domestic production, a decline recorded by all countries affected by the virus; the second is an unprecedented global shortage in both supply and demand due to the decrease in the production chain.

Although lockdown measures mostly lead to a contraction in production supply, the crisis in question differs from the standard supply shocks. As we have seen, the main difference is the fact that the global inflation rate decreases. So, in 2020, we are witnessing a deflationary spiral

contrary to the above example. This event, therefore, creates a situation where there is a lack of demand and deflationary pressure, instead of an inflationary one that is the typical outcome of a supply shock.

3.3 Keynesian supply shocks model

Taking Keynes' theory of supply shock as a reference, we label as a "Keynesian supply shock" (Guerrieri, Lorenzoni, Straub, and Werning, 2020), a crisis that triggers variations in aggregate demand to a greater extent than the initial supply shock. To have this circumstance, two are the essential ingredients of the system: complementarity between goods, but also between sectors and incomplete markets.

We will carry out this research within two scenarios. The first scenario presents a complete market, within which representative agents operate. The second is an incomplete market, in which heterogeneous agents work. In both models, as reported above, we try to analyze the trend of two indicators: the pattern of the natural interest rate and the change in the output level, when the real interest rate is unable to move in symbiosis with the natural interest rate. Based on this analysis, we can understand if the shock falls within the Keynesian typology or if it presents standard characteristics. In the first case, the interest rate increases. The supply shock determines a fall in aggregate demand less than the initial impact. In the second case, the interest level decreases, and the demand contracts more than the supply. As we will see within the discussion, in an economy with only one sector, a supply shock is never Keynesian. While, under the conditions mentioned above, in a multisectoral economy, a Keynesian shock is possible.

2.3.1 Single Sector Economy

The starting point for our analysis is a single-sector economy, i.e. an economy characterized by one sector. Within this scenario, a supply shock never falls within the Keynesian typology. This conclusion is right both within complete and incomplete market. So, a supply shock never causes such a substantial impact on demand that it dominates the initial fall in supply.

Taking as reference an infinite horizon economy, consumers have standard severable preferences represented by the utility function:

$$\sum_{t=0}^{\infty} \beta^t U(c_t)$$

where:

c_t: consumption

$U(c) = \frac{c^{1-\sigma}}{(1-\sigma)}$ is a standard CES utility function with intertemporal elasticity (EIS) σ^{-1}

Consumers have standard preferences with a discount factor β. Suppose, then, there is a fixed endowment of labor, so then there is no choice of labor supply. Everybody in the model have η

units of labor, with $\eta > 0$, and everybody supplies that.

Suppose there is a linear technology:

$$Y_t = N_t$$

Therefore, η units of labor are transformed in η units of goods and services.

Then suppose that there is a temporary reduction in labor supply. This situation represents the recent lockdown measures. To safeguard workers operating in sectors exposed to public contact, $\varphi > 0$ of them is disabled to work in the period $t = 0$. This measure is taken because of the awareness that the COVID-19 is transmitted through contact. Therefore, since operators are not safeguarded and protected in the workplace, they must necessarily stay home. Being a one-time shock, in time $t = 1$, the situation is re-established, and agents are entitled to return to work. The system, then, regains its natural balance.

<u>3.3.1.1 Complete and Incomplete Markets</u>

Within the complete market scenario, we see at the time $t = 0$ a temporary reduction labor supply. At the steady-state level, the output is equal to η. At t_0, there is a shock in the system, essentially a fraction φ of people cannot work anymore. Therefore, we get a reduction in labor supply, and its level passes from η to $(1 - \varphi)\eta$. The natural output, namely the production of full employments, is getting down.

As we have already mentioned, this is a one-period shock. So, in t_1, the pandemic will be gone, and the situation will reach the steady-state level. This process affects not only the level of output but also the level of consumption.

Through the following function, we get optimality condition for consumers:

$$1 + r_0 = \frac{1}{\beta} \frac{U'((1-\varphi)\eta)}{U'(\eta)} > \frac{1}{\beta}$$

The real rate is given by the ratio of marginal utility in period zero ($t = 0$) and the following one ($t = 1$).

In period 0, there is less consumption than tomorrow. Since the consumptions contract, every agent in the system would like to borrow to have economic and financial resources when the crisis will be over, and as consequence, the real interest rate rises above its previous level of $1/\beta$. This direction of the natural interest rate shows that there is no shortage of demand. Demand drops less than supply. In the one-sector economy with complete markets, the negative supply shock raises the natural interest rate and increases excess demand.

We can validate this logic through the following experiment. We assume nominal rigidities in the level of wages, and nominal prices equal to nominal wages $P_t = W_t$, with real wage $w_t = 1$. In this situation, if labor demand drops below the labor endowment, wages levels remain unchanged. This circumstance means that theoretically, in the system, there can be

unemployment. Assuming full employment as the Central Banks goal, and if the real interest rate remains at its steady-state level $1/\beta - 1$, the condition for consumption is

$$U'(c_0) = \beta * \frac{1}{\beta} * U'(\eta)$$

Therefore, aggregate demand is entirely unaffected, while aggregate supply drops to $(1 - \varphi)\eta$. In this economy, if interest rates did not increase, the economic system would register an excess of labor demand and an increase in the nominal wage level. So, central banks raise interest rates to counter the inflationary push.

Contrary to expectations, the result does not change even within the second scenario. We label as incomplete markets, the case with markets that present uninsurable income risk and budget constraints, creating differences in marginal propensities to consume. Just the fact of having incomplete markets, only the point of having heterogeneous consumers, limited insurance, limited financial markets is not going to be sufficient to undo these results. The supply shock reduces people income and cuts consumption. However, for consumption to decrease more than the dropping in income, the marginal propensities to consume (MPC) should be more significant than 1. When we introduce heterogeneous agents, consumers cut their spending more than the representative agents. Although they have a higher marginal propensity to consume, this value is not bigger than 1. Therefore, there is an essential reduction in output, a massive contraction in income, a substantial drop in the level of consumptions, but this contraction is not more extensive as the contraction in income.

The question now is testing whether the results are different in a multisectoral economy.

3.3.2 Multisector Economy

Within a real and complex economy, there are multiple sectors. Therefore, we now take as reference a marketplace within which there is more than one sector. In this system, we try to analyze how the performance of one sector conditions the performance of another. More precisely, we try to identify how the effect of lockdown measures, acting on a specific sector, determine negative results for the rest of the economic system.

As we have already mentioned, the direct effect of lockdown is to stop the activity in contact-intensive businesses (e.g restaurants, gym, hotels). As consumers spend less on these items, two are the main consequences: they spend more on substitute goods (e.g food prepared at home, take out); they spend less on complement goods (e.g sports clothing, luggage). If complementarities are strong enough, they will spend less overall, and the recession will spread.

Taking as before an infinite horizon economy, consumers have now standard severable preferences represented by the utility function:

$$\sum_{t=0}^{\infty} \beta^t U(c_{1t}, c_{2t})$$

where:

$$U(c_{1t}, c_{2t}) = \frac{1}{1-\sigma}(\phi^{\rho} c_{1t}^{1-\rho} + (1-\varphi)^{\rho} c_{2t}^{1-\rho})^{\frac{1-\sigma}{1-\varrho}}$$

The factor $1/\rho$ represents the elasticity substitution between the two goods (e.g intratemporal elasticity), while the factor $1/\sigma$ represents the intertemporal elasticity substitution.

In this case, as mentioned, we have two sectors: sector 1 and sector 2. Assume that a portion of $\varphi\eta$ workers are operating in the first sector and$(1-\varphi)\eta$ are working in sector 2. Then, assume that workers in the rest of the industry just must stay home.

Also, in this scenario, as in the one-sector economy, there is a fixed endowment of labor, so then there is no choice of labor supply in their respective industry. Everybody in the model have η units of labor, with

$\eta > 0$.

Suppose there is a linear technology:

$$Y_{jt} = N_{jt}$$

Therefore, η units of labor are transformed in η units of goods and services.

2.3.2.1 Complete and Incomplete Markets

Some sectors are immediately shutdown (e.g restaurants, gym, hotels). They are affected directly in the moment we have the lockdown, since people cannot leave home. Therefore, at date $t = 0$, a labor supply shock happens. Operativity in sector 1 shuts down, so

$$c_{10} = Y_{10} = n_{10} = 0$$

the apparent consequence is the fact that sector 1 does not reach longer the full employment. So, we try to understand the effects on industry 2: the direction of the natural interest rate to keep the total employment in the unaffected sector. As before, this is a one-time shock, and tomorrow goes away at $t = 1$.

Within the complete market scenario, the natural interest rate is represented by the equation:

$$1 + r_0 = \frac{1}{\beta}\frac{U_{c2}(0, c_2^*)}{U_{c2}(c_1^*, c_2^*)}$$

If goods are not perfect substitute, the equation has another form:

$$(1-\phi)^{\frac{\rho-\sigma}{1-\varrho}} < 1$$

The equation represents in what direction the natural interest rate goes if we want to keep full employment in sector 2. If $\rho > \sigma$ or $1/\rho < 1/\sigma$, this number is smaller than 1. Therefore, in the multisector economy with representative agents, the natural interest rate falls, and a Keynesian

supply shocks can happen if and only if the following condition is fulfilled:

$$\frac{1}{\rho} < \frac{1}{\sigma}$$

The adverse supply shocks determine a contractionary effect.

Indeed, ρ controls the degree of complementarity between the two goods. So, when ρ is large or $1/\rho$ is small, the products are relatively complemented. This situation means that, when people can no longer consume good 1, consumers do not want to consume good 2. The marginal utility of product 2 reduces. Therefore, the contraction in sector 1 acts as a negative demand shock for good in the unaffected area. Central banks cut the interest rate level to keep full employment in industry 2. Reducing the interest rate keeps consumption at the same level, even though there is no more sector 1.

$1/\sigma$ represents, instead, the intertemporal elasticity substitution. This parameter represents the willingness to save when agents are shocked in one sector of the economy.

Taking as reference incomplete markets, we have displayed that this scenario magnifies the effect of having multiple sectors with limited substitutability between goods. In this economy, two are the main forces that determine this result: limited substitution between goods and limited insurance for people in affected sectors.

Finally, we get to the core message of this study: it is possible to get supply shocks that ends up contracting demand more. It is possible to have a supply shock that causes deflation and not inflation.

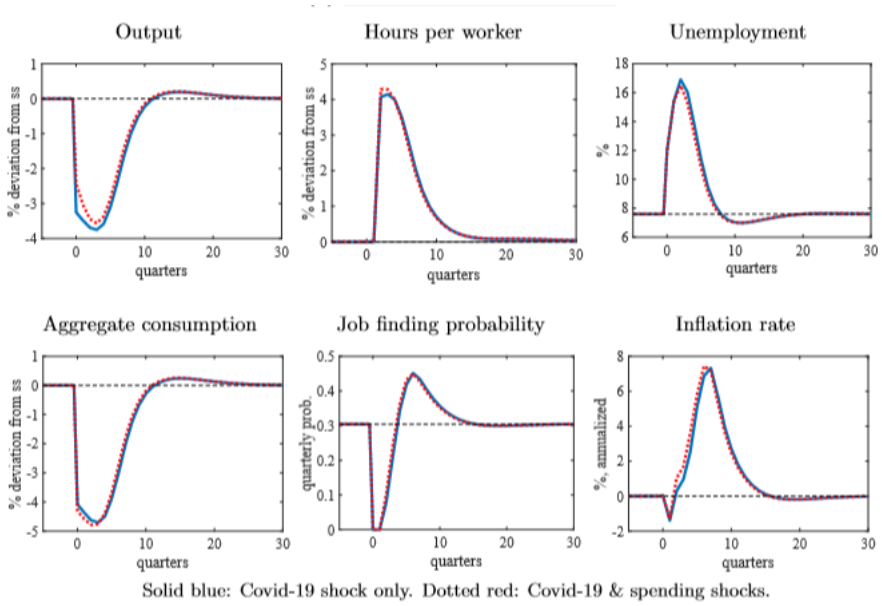
3.4 The results of Covid-19 recession

The question we have tried to answer is whether the restrictive lockdown measures, linked to today's pandemic, lead to a shock in supply or demand. As we have seen, both sides of the market are involved. There is a general belief: this event initially presented itself as a shock on the supply side and then moved to the demand side, generating an even more substantial impact than the initial shock alone. The deflationary spiral that took place gave rise to a great recession. The characteristics reported allow us to label the crisis as a Keynesian supply shock (Lorenzoni, Straub, Warriors, and Werning, 2020).

The following 2.1 represents the impact of the coronavirus crisis through the blue line. Taking as reference the model theorized by Albertini, Auray, Bouakez, and Eyquem (2020), we can observe the shock transmission mechanism and the effect of the dynamics of the Covid-19 outbreak. After hitting its maximum of 17%, the unemployment rate remains above its steady-state level for about two years. Such a high level in the above indicator leads to a contraction in aggregate consumption of up to 4.7%. Besides, the output level is reduced considerably, and the hours per worker increase dramatically. As a conclusion of this process, the job-finding

probability remains below its average level for four quarters. Focusing on the inflation rate dynamics, we can witness as, in the first three quarters after the global pandemic, the inflation level decrease. These results suggest a more massive contraction in aggregate demand than in total supply. This conclusion is consistent with our research: the Covid-19 pandemic embodies the Keynesian supply shocks definition.

Figure 2.1: the effects of Covid-19 recession



Source: Albertini, Auray, Bouakez, and Eyquem 2020, "Taking off into the Wind: Unemployment Risk and State-Dependent Government Spending Multipliers".

CHAPTER 4: The common EU response to COVID-19 crisis

4.1. The Policy response

Estimating the nature of the crisis is the starting point of designing policy responses. For this reason, this is the debate we have tried to discuss in the previous chapter. In particular, the question was if the epidemic crisis linked to lockdown measures was a supply shock or a demand shock. What we have shown is that the COVID-19 turmoil is a "Keynesian supply shock" (Guerrieri, Lorenzoni, Straub, and Werning, 2020): a collapse that starts from the supply side and can transmit to the demand side.

We have shown under what conditions it is possible that a turmoil, that is predominantly a supply shock, can cause a shortage of demand. More specifically, we have exhibited that a trauma can cause a contraction in demand that is even bigger than the initial contraction in supply. However, as we have demonstrated in the previous chapter, during the current and ongoing crisis, instead of having inflationary pressure, which is the typical outcome of a supply shock, we are witnessing a deflationary spiral. This result is significant because it informs the way we think about the policy response to the crises. The distinctive characteristics of this global economic turmoil,

caused by a pandemic, and the consequential supply-side shock have made it necessary to extend the usual macroeconomic policy toolbox. In this circumstance, macroeconomic policies revolve around one big issue: which is the best optimal response?

One proposed solution to counter the current Covid-19 recession is fiscal stimulus. So, we are going to examine this approach when the negative offer shock presents Keynesian characters. In this situation, two main remedies are proposed: standard government spending and transfer programs, such as unemployment insurance benefits.

4.2 Fiscal policy when epidemic supply shocks are Keynesian

In macroeconomics, the expression fiscal policy denotes one of the government's lines of action within budgetary policy. This macroeconomic field is mainly based on studies carried out by Keynes. According to this, starting from the assumption that economic recessions arise from a contraction in consumption and investment levels, it suggests an appropriate fiscal policy as a primary response. This instrument is considered capable of stabilizing the economic cycle and regulating the financial system.

So, one could believe that fiscal policy measures are sufficient in keeping aggregate demand up, also during a shock that starts from the supply, and transmitted to the demand-side, can be even larger. We demonstrate that this is a misconception. First, during a "Keynesian supply shock"" (Guerrieri, Lorenzoni, Straub, and Werning, 2020), economic agents have a low marginal propensity to consume. Second, even more surprising, the standard Keynesian model within this system does not work. Therefore, we are going to prove that fiscal policy interventions, in this situation, is less effective than in the model without that kind of asymmetric shock.

Considering the pure traditional fiscal policy, an expansive public spending policy represents the increase in the purchase of goods and services by the government. So, if we do fiscal policy just by expanding G, namely buying goods and services in the sectors where goods and services are produced, the government policy determines a significant increase in the level of consumption (Galí et al., 2007, Farhi and Werning, 2016, Auclert et al., 2018, Bilbiie,2019). Therefore, the fiscal policy measure would be successful because the standard kind of multiplier argument increases the goods and services degree in the economy. Then, the worker's income is going up, and they will spend it. So, we will have a second-round consuming effect, a third-round and so on.

Taking as reference the model theorized by Guerrieri, Lorenzoni, Straub, and Werning, the government determines the public expenditure chapters G_t, the level of taxes T_{jt}, targeted by sector, and the public debt level B_t, subject to spending and budget constraints. So,

$$G_t + T_{1t} + T_{2t} + (1 + r_{t-1})B_t = B_{t+1}$$

The steady-state equilibrium is $G = T_1 = T_2 = B = 0$

In this environment, we assume two central fiscal policies to face the ongoing recession. The first, namely the traditional government spending, provides an increment in G_0, at $t = 0$. Such an increase determines the purchase of goods and services in sector 2, the one still operative. The other maneuver is the transfer program (e.g unemployment insurance benefits). So, positive transfers are made, in $t = 1$, to sector 1 operators and consumers.

In this scenario, the chief insight is that both the government spending multiplier and the transfer multiplier are smaller than predicted by the Keynesian relationship. In a standard recession, the government spending multiplier is equal to $1 / (1- \mu)$, while the transfer multiplier is $\mu / (1 - \mu)$. In such a particular situation, namely where both demand and supply side are affected, the government multiplier is 1, while the transfer one is μ. Therefore, both measures are missing their amplificant and feedback effect.

Now it is interesting to understand the rationale of such a peculiar mechanism. Taking as reference the previous model, people most affected are in sectors shutdown. As we have already described in the previous chapter, they have the highest marginal propensity to consume. Unfortunately, the multiplier is less intense in this system because the positive government spending is helping workers that do not have the highest MPC, namely the workforce in the still operating part of the economy. Therefore, workers in the shutdown sector do not benefit from any government spending. The other side of the economy could still benefit from direct transfers, but their spending will not return to them as income. The reason is simple: sector 1 is still shut down, so no agent can spend in this sector. Therefore, expenditure by both agents and the government can only be directed to sector 2, the only one still functioning.

Therefore, the typical Keynesian cross-amplification does not work in this kind of recession, and the traditional fiscal stimulus is ineffective. There is no feedback effect from spending on the income of workers in affected sectors, namely those with the highest marginal propensity to consume.

4.3 Public Health and Macro Policies

The analysis so far has just assumed that some sectors are shut down. In this section, we extend the previous model. We introduce public health, considering the health concern more explicitly, and think about optimal policy in this new environment.

Assuming a consumer's objective function that includes the heath component, consumer preferences are determined by the following utility function:

$$\sum_{t=0}^{\infty} \beta^t \left(U(c_{1t}, c_{2t}) + h_t\right)$$

where the factor $h_t$represents the consumer's health, with

$$h_t = H(c_{1t}, n_{1t}, Y_{1t}, \xi_t)$$

The ξ_t parameter represents the underlying negative shock and can register two values: ζ_t in normal conditions and $\varsigma_t$when a pandemic happens.

In this economy, the results about the relationship between public health policies and macro stabilization are organized around three main remark.

The first one is very basic. If the government does not dispose of a stay home policy or any lockdown measure, no sector is shutdown. In this circumstance, although the shock, both sectors are operative. Despite the lack of lockdown measures, due to the presence of the virus, sectors with intense contact still register a contraction in activities. People reduce the level of consumption and labor supply to limit the contagion probability. So, this downturn can determine unemployment in the system. Since the workforce reduction, there is a waste of resources in the system. However, the use of these resources would increase the virus spread, which would be bad for the overall economy. Therefore, the first remark is that, when we introduce public health policies that do not imply the total economic closure, unemployment may not be socially inefficient.

In this first part, we have shown that, from a social point of view, unemployment is not inefficient. Now, we try to understand, if once that social distancing and lockdown measures are adopted, the social benefit is more massive. So, if there is a relationship of complementarity between public health policies and aggregate demand stabilization.

Introducing social distancing policies, we analyze the situation where the government determines a shutdown. Assume that sector 2 is completely clean, while, due to the lockdown policy, productivity in sector 1 is stopped. So, while the second kind of activity does not contribute to the spread of the virus, the first contributes to a rapid spread of the virus. As we have seen, shutting down sector 1 can cause a negative shock in sector 2. So, public health policies determine a Keynesian supply shock, but macro policies can provide some solutions to balance the negative effect of the first measure.

Assume[7]1 that $\rho > \sigma$, so as we have already said, there is a recession in sector 2. Consider, then, complete market economy. If the following condition is respected

$$U_{c1}(0, (1-\phi)\eta) + H_{C1}(0,0,0,\xi) + H_{n1}(0,0,0,\xi) + H_{\gamma 1}(0,0,0,\xi) < 0$$

[7] Where ρ represents the elasticity of substitution among goods, while the factor σ describes the intertemporal elasticity.

The lockdown measures and sector 1 shutdown are efficient from a social point of view. So, there is a complementarity between public health objectives and macro objectives. If the government applies an optimal health policy, shutting down the sector 1, determining some macro policy to avoid a lack of demand in the other sectors not directly affected by the virus, these measures are efficient.

Now we are going to examine if the same results apply even in incomplete markets. In this economic environment, three are the main inefficiencies: public health externality, lack of insurance, unemployment. In this economy, the utility function is represented as

$$\int_0^1 [U_{c1}(0, c_{i10}) + \partial c_{i10} + U_{c2}(0, c_{i20})\partial c_{i20}]di$$

In this scenario, if the government determines a policy that fixes the macro effect, it is shifting the trade-off between economic activity and the spread of the disease. In this way, it is easier to implement public health policy that contracts some sectors very heavily, because at least this result contrasts the undesirable macro effect. So, within incomplete markets, a combination of health policies, social insurance policies, and monetary policies is needed to recover the system: social distancing policies and the total closure of sector 1, a social insurance policy that distributes income from sector 2 to sector 1 workers, and a monetary policy that hits the natural rate. An integrated solution can determine the best solution from both an economic and social point of view.

4.4 The common EU response to COVID-19

Up to this point, we have not considered the international dimension of the problem. We have, both in the previous chapter and in this one, emphasized the complementarity between the different sectors. However, there is also a stable complementarity relationship between the different countries involved. The necessary observation is, therefore, that political coordination and the measures implemented are desirable to stem the devastating impact of the crisis.

All the major economies of the Old Continent have recorded massive and harmful falls in GDP during the first and second quarters of the year. The economic crisis has determined a large contraction in real gross domestic product growth rate for the majority of European countries. Then, as we have already shown in the previous chapter, one of the most unusual and particular aspects of this shock is the effect it has had on the inflation rate. We have shown how a standard supply shock leads to a relative increase in prices. In this case, however, we have a diametrically opposite effect. The European inflation rate fell during 2020. This peculiar result empathizes the Keynesian framework of the current crisis.

Faced with the extent of the economic distress, governments have demanded brave and decisive action from Europe. In response, the EU mobilized all available resources to help Member States organize their national responses by providing objective information on the outbreak of the pandemic, practical measures to mitigate it, and actions taken to restore the economic and social consequences of the pandemic. To offset the economic and social hardship caused by the coronavirus outbreak, kick-start European recovery, and safeguard and generate jobs, the European Commission has presented an effective recovery plan for Europe based on exploiting the full potential of the EU budget. EU leaders agreed this recovery plan and the Multiannual Financial Framework for 2021-2027, providing guidance on the recovery path out of the crisis and building the foundations for a modern and more resilient Europe.

The Recovery Fund presented by the European Commission amounts to a total of 750 billion euros, of which 500 billion will be distributed through grants and 250 billion through loans. The entire initiative of the European Commission, i.e. the investment in the future of Europe and the Member States to restart after the Covid-19 emergency, is called "Next generation EU". This act represents the first time in the history of European economic and monetary union that a measure is being implemented that presupposes financial solidarity and pooled debt, guaranteeing it with a budget of 1,074 billion, for an overall economic stimulus of 1,800 billion. This peculiar feature, therefore, embodies the chief insight of this section: the complementarity relationship not just among goods or sectors, but also among countries. The countries most affected by the virus are entitled to the largest share of this fund. Such countries are Italy and Spain in the lead. The perspective of this program is only looking to the future without any real mutualization on past debt.

The measure mentioned is not a stand-alone action, but part of an ecosystem of programs designed to make the union more resilient, facing the challenges triggered by the pandemic.

The intrinsic essence of the shock, due to the Coronavirus, is inextricably linked to the health aspect and the health of the European population. In this respect, the Commission has proposed an ambitious new health program for the period 2021-2027, called EU4Health, which will contribute significantly to post-COVID-19 recovery by improving the health of EU citizens, increasing the resilience of health systems, and promoting innovation in the health sector. Three are the main priorities of this plan: protecting citizens from serious cross-border health threats, increasing the supply of medicines, improving health systems.

Then, as we have already shown in the paper, this shock is not only a health crisis, but also a severe economic crisis. The two essential components must necessarily be jointly assessed. Since small and medium-sized enterprises account for 99% of all businesses in the EU, it is necessary

to ensure their survival to determine a full economic recovery. They employ around 100 million people, generate more than half of Europe's GDP, and play an essential role in creating added value in every sector. Given the ongoing recession, protecting small and medium-sized enterprises is a priority at the European level. For such a reason, the EU has allocated €1 billion from its European Strategic Investment Fund to stimulate banks and lenders to provide liquidity to more than 100,000 small businesses in Europe.

The performance of the companies has inevitably been reflected in the labor market, regarding the two aspects mentioned above, i.e. health and economic performance. To support workers in the face of the Covid-19 crisis, the EU's "Support mitigating Unemployment Risks in Emergency (Sure)" program provides Member States with financial assistance of up to EUR 100 billion in the form of loans granted on concessional terms to for the preservation of employment. The establishment of a program to protect the European workforce is a further expression of Community solidarity. Member States are working together to support each other by providing additional financial resources through loans.

In this respect, in addition to the various measures implemented by the Commission, the ECB has launched the so-called PEPP, the Pandemic Emergency Purchase Programme. This measure is a non-standard monetary policy, initiated in March 2020 to counter the severe risks to the monetary policy transmission mechanism and the outlook for the euro area posed by the coronavirus (COVID-19) outbreak.

This measure completes the package of measures aimed at restoring the European economic, financial, and social system. The Recovery Fund set up in this way, together with the ECB's PEPP, could represent a real lifeline for the countries most exposed to the effects of the economic crisis caused by the Covid-19.

A BRIEF PERSONAL CONCLUSION

Up to this point, the analysis has shown that a shock that starts from the supply side can transmit to the demand side, and the turmoil can be even more significant in demand one. We have defined this kind of crisis as "Keynesian supply shock" (Guerrieri, Lorenzoni, Straub, and Werning, 2020). We have demonstrated that to get an event that falls within this specific label, in a simple model of the economy, at least two ingredients are necessary: complementarity across goods and sectors, and it helps if there are incomplete markets. The European example testifies a further step: the complementarity relationship does not only exist across goods and services, but also between countries. According to our thesis the measure implemented demonstrates the cross-border nature of the problem, but also of the solution. So, our crucial observation here is that

policy coordination is particularly desirable, and a strong safety net is essential to contrast the economic recession. The coordination between health, monetary and fiscal policy, as well as social insurance policy, is paramount to restore the business and economic environment. The innovative and advisable, not to say recommendable, attitude to cooperate allows to offset the adverse economic effects that would otherwise be determined by the expansions of the crisis and the contagion of the virus. According to our research, a collaborative attitude within the European continent, the redistributive actions between countries and between the various sectors of the economy and population groups clearly reinforces the effects of policies and the response to the influenza pandemic. It is unthinkable to envisage an isolated response state by state to face a global pandemic.

As we have already mentioned, there are two main dimensions to the policy response: we can think the first as disaster relief, while the second as the stimulus package. The two aspects are linked. If we can help people who lost their income, they could sustain their consumption and continue investing. So, there is a stimulus element also within a disaster relief program. Taking as a reference the thought of the Nobel Memorial Prize-winning economist and New York Times columnist, Paul Krugram, the best policy would be implementing a disaster relief policy with a dash of stimulus. Only through such a policy, we can succeed in containing the impact of a crisis that has temporarily eliminated millions of jobs. Through direct aid to the economy that has not yet been shut down, poverty can be contained. Without such intervention, unemployed workers would be forced to cut their spending and consumption in all sectors. This lack would only generate a second wave of the crisis: new cuts, and, therefore, an even more significant economic contraction.

The bottom line is, therefore, the fiscal policy. However, as we have displayed, government spending multiplier can be smaller than usual because there is no feedback effect from spending on the income of workers in affected sectors. So fiscal measures alone are not enough to counter a crisis of this magnitude.

We have therefore demonstrated that there is a positive correlation between public health policies and the stabilization of aggregate demand. Moreover, within incomplete markets, a combination of health policies, social insurance policies, and monetary policies is required to rehabilitate the economic network. Based on this evidence, we personally believe that the measures adopted can truly restore the correct functioning of the economic market. Specifically, there are three main measures in this regard: the “New EU4Health program”, part of the Next Generation EU, to strengthen Europe's health systems and infrastructures for a better response to future major cross-border crises, such as the Coronavirus pandemic; the allocation of €1 billion from the European

Strategic Investment Fund to stimulate banks and lenders to provide liquidity to more than 100,000 small businesses in Europe, and the EU's "Support mitigating Unemployment Risks in Emergency (Sure)" program that provides financial assistance for the preservation of employment; the Pandemic Emergency Purchase Programme, namely a new temporary asset purchase programme of private and public sector securities to face the serious risks to the monetary policy transmission mechanism and the outlook for the euro area determined by the outbreak and escalating diffusion of the pandemic.

Therefore, we firmly believe that the unique characteristics of this global economic crisis, triggered by the Coronavirus pandemic and its resulting supply-side shock, has required an expansion of the usual macroeconomic policy toolbox. Besides the operational aspect of the measures, we think that a change of attitude and orientation represents the main significant response to the pandemic. So, regardless of each single program, the crisis has underlined how essential it is for the EU to react in fast and flexible way, implementing a coordinated and integrated response.

In conclusion, our personal chief insight is that policy coordination is particularly appropriate to counter a pandemic, and that a strong safety net, determined by the policy mix described above, is essential to counter the economic downturn.