Assessing the economic impact of pandemic outbreaks in Portugal: A bibliometric review

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Abstract

The aim of this dissertation is to present possible scenarios that Portugal may face, in 2 years' time, given the pandemic it is currently facing and, which could be the steps to taken in order minimize the effects of COVID-19 on its economy. In this sense, an introduction will present not only an economic overview of the country, but also the current situation of the influenza outbreak, and the trail it has left so far, so as to define the sector and highlight the importance of this study for the future. In a second phase, a bibliographic review of the various methods used for this type of research was included, as well as guide for structuring a selection of information. Finally, after analyzing the available literature, an ARIMA model was applied for quarterly data on the growth rate of the Gross Domestic Product (GDP), the Consumer Price Index (CPI), which will allow to conclude about inflation, and the unemployment rate. Results show that after the sharp drop and rise in the quarters 2 and 3 of 2020, results point to a stabilization of the economy

Keywords: ARIMA, forecasting, GDP, COVID-19, economic impact, bibliometric review

1. Introduction

Portugal's economy has gained a reputation for being unstable, with cyclical contraction and expansion. Despite this concept of economic cycle being very common when discussing a nation's economy, over the last 10 decades this country has faced an unceasing debt problem and continues to be associated with underperformance and low productivity levels. Its lack of technological enhancement over the years made it impossible to accompany the level of growth and progress of the great powers of Europe. In fact, with the arrival of the Great Recession, in 2008, the country suffered major setbacks and was forced to resort to a bailout program to control its situation. During this time, rigid social measures combined with a reinforcement of its focus in its strengths, the tertiary sector, paved the way for a remarkable recovery, reached in 2019, marked by Portugal's first government surplus in decades.

Having just recently recovered from a major crisis, and with good prospects for the future, an unpredictable event changed the fate of not only this country but also the world. By the end of 2019, an unexpected pandemic outbreak, labelled SARS-CoV-2 – also known as COVID-19 or coronavirus – originated in China, in the city of Wuhan, put a stop to the economy on a global scale forcing major businesses to close or to enter a layoff period. Since the virus has proven to be easily transmitted, activities requiring personal contact had to be interrupted, nonpharmaceutical basic interventions (NPIs), such as quarantining, had to be imposed and working methods had to be adapted and reinvented. Thankfully, technology facilitated this process, and many jobs were saved by videoconference platforms and teleworking. Notwithstanding, the services sector did not experience the same luck. To point out a few of the more obvious examples, hotels and restaurant suffered a major blow. In 2021, national news stations announced a loss of about 90% of turnover in these sectors, compared to 2020. Despite having access to platforms of food delivery, it seemed it was still not enough to maintain catering businesses. Subsequently, people who once lived comfortably faced an imminent shortage of money. Equally, hotel owners and workers saw a major fall on revenue as borders were closed and people were reticent to travel. These difficulties combined with the other's sectors, equally or more affected, and the fact that its major trading partner, Spain, suffered the largest decline in Europe contributed to Portugal being the worst performer in 2020, with its GDP contracting 7,6% in that same year according to the National Institute of Statistics (NIS) and Pordata.

Despite the most recent money aids given by the government and the Recovery and Resilience Plan, doubts remain on the predicted future recession: What are the economic scenarios expected and how will Portugal respond under the COVID-19 pandemic? In order to answer this question, this thesis will attempt to analyze in the most thorough way studies previously carried out on economic projections and pandemics as well as the connections between the two based on previous occurrences. From the outset, not only the controversy arising from this topic is remarkable, since there are many models and combinations of models for this type of study, but also a high degree of uncertainty is associated with it, since it is a science that strives to predict an environment subjected to risks, which can greatly impact the final expected result. Nonetheless, it is though that if it had been possible to foresee the recent crisis, whose origin is financial, its profound impact on the real economy and social well-being, could have been avoided or in the least diminished (Amado, 2019). Withal, the situation the world finds itself in is very particular, and all the more, the amount of research available on Portugal's economic growth and recessions derived from economic shocks is limited. A pandemic of this proportion has not had any precedents to this day in the modern world.

Nonetheless, since the beginning of the pandemic several studies have emerged that explore the macroeconomic consequences of COVID-19, future perspectives and policies (Baldwin et al., 2020; Brunnermeier et al., 2020; Baldwin & Mauro, 2020) . This being said, this new research combined with past one has the potential for making this study very compelling, not only for this time being, but also future developments and studies. This research will provide important contributions to the scientific literature. It gives a complete picture of the published studies on the use of the different available forecasting models covering the theoretical background, methodological development, and empirical findings of the research identified. Furthermore, it will provide guidelines for researchers interested in applying a systematic literature review as a research method.

Given the current health crisis, it will be interesting to assess how a country like Portugal, highly dependent on its services sector, will react to a possible lasting economic shock. It is expected that, based on articles published in the past years, trends and economic forecasting models, suitable for comprehending the consequences of this new pandemic on the Portuguese's economic horizon, will be possible to identify.

2. Sector Contextualization

Assessing the behavior of a national economy requires the use of a set of macroeconomic factors that will grant the evaluation and design of economic policies, formulation of judgments, expectations as well as decisions. Among the many indicators, the Gross Domestic Product (GDP) has certainly been the one most resorted to at a global scale, serving not only for monitoring growth, but also, to determine the effect of inflationary trends in production gains and the amount of gross income produced that is used for consumption, investment or savings (Giannetti et al. 2015).

GDP allows to understand the behavior of the economy, and its past records to examine past recessions. By mere observation of past economic crisis, and as will be exemplified in the next chapter, they often follow periods of expansion and optimism and can rise from errors on behalf of monetary authorities that provide money to an economy. Economic shocks are equally responsible for the rise of recessions. A major shock in any sector will quickly spread to a macroeconomic level given their interconnectedness. Unanticipated events such as wars or epidemics, as the one the world is currently facing, can directly affect the demand and production of a country, ultimately weakening its economy. Although most recessions are brief, recovery periods tend to be quite extent as proven by The Great Recession that hit Portugal in 2008 and dragged on until 2013 (Figure1).

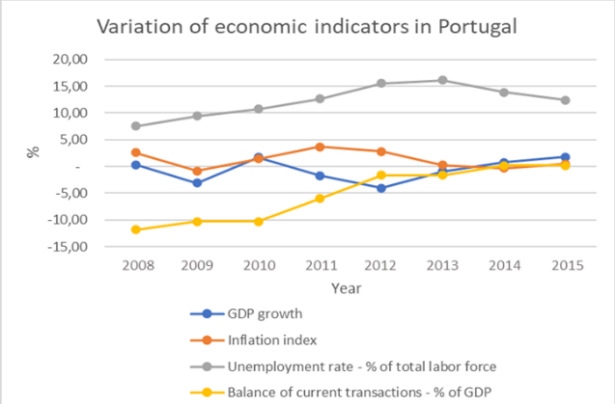

Figure 1 – Graphical representation of the variation of some of Portugal's main economic indicator (PORDATA; The World Bank)

Furthermore, the tertiary sector accounts for 70% of Portugal's workforce. Despite being a substantial number, research stands by the fact it is not necessarily positive since it does not involve high-skill and technological activities. Major tertiary sector activities comprise non-tradable services such as hotels, restaurants, public administration. This being established, it is easy to understand the potential that a pandemic, that forced general lockdowns, has, to create a huge crisis.

2.1. Previous pandemics

Pandemics have occurred in different stages of history and their frequency has been rising since the 2000. According to many researchers, the crisis we are going through was practically inevitable (Garrett,

2007; Keogh-Brown et al., 2008; Fan et al, 2018). The available evidence from prior outbreaks provides information that can help speculate on the implications of COVID-19.

One could say the most similar, past, pandemic to the one the world is witnessing today is the 1918 flu. A large number of nations saw an economic growth during World War I, however, its aftermath combined with the 'Spanish flu' made the perfect recipe for sunk businesses and a symbolical diminished workforce. A research conducted by Barro, Ursúa and Weng (2020) focused on this flu's death rate and consequent economic outcomes – considering a macroeconomic disaster a cumulative decline over one or more adjacent years by 10% or more in real per capita GDP or real per capita consumption. In total, 20 countries experienced this kind of disasters. This pandemic ultimately lead to a 6 and 8 percent declines for GDP and private consumption, respectively. Furthermore, it was concluded that the inflation rates escalated. Dahl et al. (2020) found that the 1918 pandemic resulted in a V-shaped recession leading to a persistent increase in poverty rates and a reduction in the return on capital.

Years later, the 'Asian Flu' only caused a reduction of output of around 1 to 3,5% of GDP (Sixty-fourth World Health Assembly 2011) and the 'Hong Kong' flu caused even slighter damage to the economy, as no loss was registered (The World Bank, 2021). The 2009 outbreak was surrounded by much uncertainty since it happened during The Great Recession and so economic losses deriving from it are not as clear to determine.

Thus far, COVID-19 induced a fall of Portugal's GDP of 7,6% in 2020 (Pordata 2021). Service exports and private consumption experienced a steep rise in savings due to a closure of businesses. The hopes of the beginning of a recovery were put down by the resurgence of infections that brought new restrictions towards the end of 2020, weakening GDP growth and adding pressure to businesses that were already hanging by a thread. With the introduction of a more stringent lockdown in mid-January 2021, GDP was projected to fall again in the first quarter of 2021, before starting to hopefully recover as of the second quarter of the year, with a major rebound in the summer months, but risks remain significant due to the country's large dependence on foreign tourism. In full-year terms, major organizations predict GDP to grow by 4.1% in 2021 and 4.3% in 2022 if all goes accordingly. Pent-up consumer demand and the expected surge in business sentiment are projected to drive the economic recovery.

The historical data presented allows to identify aspects all outbreaks have in common which, in turn, allows to conclude that the economic activity is mostly impacted in the short-term by: i)avoidance reaction due to social distancing measures, ii) direct costs (mostly medical), iii)large indirect cost (those linked to production) and iv) subsequent effects (disruption of services)(Roy, 2020). Despite the similarities witnessed, there is a trait, not related to the disease itself, but to the time in which it appeared, that traces the differences between these outbreaks.

2.2. The Long-term effects on the various sectors

To deepen this analysis the sectors most affected by the pandemic were analyzed (Brodeur et al., 2020).

In the **aviation sector** the fall in airport revenues globally is determined to be $39.2 billion in the second quarter of 2020 and around $97 billion for the entire 2020. According to ANAC (2020), in Portugal alone, the civil aviation sector suffered losses of 1.5 billion euros in 2020.

As for the **oil industry**, Galp, a leading multinational energy corporation, headquartered in Lisbon, registered a fall of 5% in the first quarter of 2020 in its operating results due to the contraction caused by the COVID-19 pandemic and the confinement measures in the Iberian Peninsula, which caused the price of oil to fall and caused sharp drops in demand for energy by businesses and consumers. The fall in oil prices have resulted in fluctuations in the market for bonds, equities and non-oil commodities.

The **tourism sector** has always been severely affected by pandemics and macroeconomic shocks. The sector is responsible for 18.6% of total jobs in the country, taking into account the direct, indirect and induced effects. In places like the Algarve, Madeira and the Azores, tourism represents more than 20% of GDP and local jobs. The year before the pandemic Portugal reached 70 million tourist overnight stays, yet in 2020 and 2021 combined this number was no more than 63 million. In pre-pandemic times this sector was expected to grow 4% in 2020 and 2021 each.

In the past, **healthcare** has not been much affected by crisis and economic slowdown. Regardless of whether the economic conditions are favorable or not, people need healthcare, however the COVID-19 pandemic control measures encouraged people to stay at home under lock-down preventing people from getting the treatment they needed, which in turn gave rise to a loss of jobs on the sector.

3. Methodology for conducting a Literature Review

The preparation of macroeconomic forecasts is an essential aspect of policy making. As organizations seek to minimize risks and maximize utilities, they turn to forecast for decision making and planning (Hyndman, 2011 & Petropoulos et al., 2022). The variety of forecasting applications asks for a diverse set of methods to face real-life challenges. Several studies list a step-by-step method to conduct economic forecasting exercises, where the literature review stage takes center stage.

The logic behind the steps taken in this paper follows the PRISMA 2020 guidelines. It was created by an international network of healthcare-based collaborators, seeking to strengthen and streamline the methodological rigor and quality of systematic literature reviews. It may be useful for critical appraisal of published systematic reviews, however it is not a quality assessment instrument to gauge the quality of a systematic review (Hutton, Catalá & Moher 2016). It allows readers to assess strengths and weaknesses, permits replication of review methods and a structure and format for the realization of the review. It is expected to improve the reporting of a systematic review and grant a transparent selection process of articles, as it consist of a checklist and flowchart, which depicts the flow of information while mapping out the number of records identified, included and excluded, and the reasons for exclusions.

The aim of the literature review is to clarify the method to be followed in order to carry out a rich analysis directed towards Portugal's economic forecasting giving emphasis to GDP projections. This research will, therefore, allow for a comprehension of recent work done on economic forecasting models, and scenario building. Recent studies conducted by Palmatier, Houston and Hulland (2018), Paul and Criado (2020) and Donthu et. al (2021) shed light to 3 main categories of systematic literary reviews. The articles point out domain-based, theory-based and method-based reviews, while also referring to a 4th additional category – the meta-analytical – which has been increasingly popular.

Within the domain-based type, a bibliometric review appears to be the best course of action to initiate the systematic review as it examines collections of knowledge within and across disciplines. It uses statistical tools to establish trends and citations and/or co-citations regarding a chosen sector, by year, country, author, journal, method, theory, and research problem. Citation analysis focuses on the quantitative assessment of citation patterns within the literature.

In this sense, a search was carried out over the databases of the Scopus and Web of Science platforms, which focused on the titles, abstract and keywords of the articles and reviews published since 2004, which confirmed the growing interest in economic forecasting models and the economic impact of COVID-19 (Figure 2) and consequently, the need to define the next steps, given the emergence of the pandemic. This study made it possible to gather a total of 149 documents that were later subjected to a second analysis regarding the relationship between them. Through a network visualization it was possible to conclude that forecasting models appear to be the direction the research is headed and where opportunities might arise.

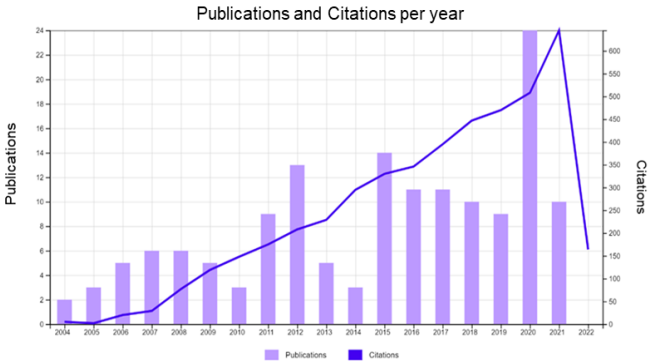

Figure 2 – Web of Science publications per year from 2004 until 2021

Finally, it is also worth noting that when researching for the keywords 'GDP forecast' and 'Economic impact of COVID-19', no articles were obtained. Just as zero results were produced when specifying one of the most used models in the field, 'ARIMA' and the 'Economic Impact of COVID-19', which from the outline indicates a gap.

Having concluded this research, not only confirms the need and tendency of this type of study, but it becomes possible to form the literary review.

4. Literature Review on Economic forecasting

Forecasting models

Clements and Hendry (2004) defined forecast as being any statement about the future. 'Such statements may be well founded, or lack any sound basis; they may be accurate or inaccurate on any given occasion, or on average; precise or imprecise; and model-based or informal'. Elliott & Timmermann (2008) define economic forecasting as the process of attempting to predict the future condition of the economy using a combination of extensively followed indicators. Many authors have made this their focal point of study (Chen & Yang, 2004; Becker et al., 2007; Pesaran, 2014; Salisu et al., 2022). It often implies building statistical models with indicators as outputs, in order to bring forth a future GDP growth rate. Forecasting represents the first step towards creating and implementing fiscal and monetary policies.

Literature acknowledges the uncertain nature of this type of study. Economic agents fluctuate unpredictably, hence the complexity of the economy, as it is dependent on many external factors (Patrícia & Santos, 2020). It must be depicted as a flawed science. In fact, past crises have been neglected, either because of outside pressure or because of personal beliefs and judgment and theory conceptions from forecasters (Clements & Hendry, 2012). On that account, it would be plausible to associate a probability to an economic forecast.

There were distinguished two types of forecasting methods: Qualitative forecasting and quantitative forecasting. The latter one includes

univariate model, which is understood as the modeling of evolutionary or historical patterns identified in a single time series while. The most prominent univariate models include the **Random Walk (RW) model** - assumes that in each period the variable takes a random step away from its previous value, and the steps are independently and identically distributed in size, for instance, it suggests that changes in stock prices have the same distribution and are independent of each other – and the **autoregressive (AR)**, which gives rise to the **ARMA** and **ARIMA** models (Brooks, 2008). Several articles display studies applied to GDP forecasting that favor the use of the ARIMA model. Yang et al. (2016) and Abonazel and Abd-Elftah (2019) argue that this model is more effective and accurate, therefore producing the most objective forecast of GDP.

Still within this category, the multivariate model focuses on modeling the evolutionary or historical patterns of several time series (Garcia, 2020). Amado (2019), makes reference to multivariate models including the **Solow model**, which makes GDP depend on the total productivity of the factors and quantities used from the factors of GDP, capital and labor, the **VAR model**, whose main obstacle is the proliferation of coefficients, and the **Bridge model**, where GDP is modeled as a function of past values and ones available on a monthly basis and a transformation can be applied to change to quarterly data (Mariano and Murasawa, 2004), which in turn can be used for "real-time" forecasting allowing to update the projections as soon as data becomes available. Moreover, **Dynamic factor models**, which can analyze information sets consisting of large numbers of macroeconomic, financial, and sectoral variables, where the potential number of variables is far in excess of the number of observations. It synthesizes the relationships between a set of macroeconomic variables of interest and their lags (Stock & Watson, 2001). Besides these more scientific models, Turner (2016), admits a diversity of models, linear and non-linear, that analyze past patterns without assuming that the present will repeat itself and at the same time identify patterns that repeat or are constant. **Dynamic Stochastic General Equilibrium (DSGE)** models which are constructed on the basis of explicit micro foundations with optimizing agent, and regardless of being originally used for policy analysis, these models have been used for forecasting, producing similar results to the ones of VAR models. This model can avoid the problem deriving out of the Lucas Critique. Not only it incorporates a role for monetary policy, making it appealing to central banks, but also can make use of the powerful solution methods of nonstructural models, given their decision rules are usually well approximated by linear rules (Fernández-Villaverde, 2010).

Errors associated with forecasting include the availability and manipulability of the starting point information as well as intentional errors related with potential incentives. They can also derive from the model itself, according to an interview with David Hendry conducted by Ericsson (2017), flaws can come from unobserved terms, observed stochastic variables, and/or deterministic terms. Each of these three components are subjected to three potential problems: estimation uncertainty, mis-specification, and change in the GDP's parameter values.

As displayed in the interview just mentioned, organizations such as OECD, IMF and EC are worldwide known for performing economic predictions. However, these rarely produce the same results either because different models are put to use or different knowledge concerning the same country.

Scenario building and mitigation measures

Within the area of scenario building several authors, namely Alexandr & Mourre (2010) refer to the DSGE model, **QUEST**. As explained by the European Commission, this global macroeconomic model is suitable for macroeconomic policy analysis and research (Varga et al., 2021; Pfeiffer et al., 2020). It is a structural macro-model in New-Keynesian tradition with rigorous microeconomic foundations with full dynamics, whose equations are explicitly derived from intertemporal optimization under technological, budgetary and institutional constraints. It also features nominal and real frictions, as well as financial frictions in the form of liquidity constrained households. Additionally, it incorporates semi endogenous growth features and accumulation of human capital. Model variants have been estimated using Bayesian methods, where probability is used to represent all uncertainty within the model (regarding both input and output), jointly with the Commission's Joint Research Centre (JRC). These dynamic models are used for shock analyses and shock decompositions to access, for instance, the main drivers of growth and imbalances.

Making use of this model and prior to the pandemic Alexandr & Mourre (2010), attempted to assess the strategy to guide the EU out of the economic crisis, to ensure macroeconomic stability, and put in place a structural reform agenda and ultimately demonstrate the benefits policy measures envisioned under Europe 2020 could bring. Such measures enclose the introduction of reforms with a medium- to long term horizon that focus on promoting the sustainability of public finances, enhancing potential growth. For such analysis, several stylized scenarios were constructed. The results presented by this study show that a fiscal consolidation going beyond the minimum requirement prescribed by the SGP is crucial to rein in the increases in public debt, which would approach 100% of GDP by 2020 in the baseline scenario. Hence, it is crucial that consolidation efforts are accompanied by growth-oriented structural reforms, so as to sustain fiscal consolidation and return debt levels to a declining path. Progress in implementing structural reforms under the main priority areas of EU2020 can

generate significant gains in terms of increasing output and creating jobs.

Through a hybrid of DSGE models and CGE models, McKibbin & Fernando (2021) created a set of filters that convert the disease shocks into economic shocks and built 7 different possible outcomes. Results lead to the understanding that the pandemic originated a sharp drop in consumption and investment, and a drop in aggregate demand, that together with risk shocks cause a sharp drop in equity markets. In addition, equity markets are expected to decline due to the rise in risk, as well as the expected economic slowdown and the fall in expected profits. Every scenario proposed had in common the prediction of a V-shaped recovery, with the exception of the unlikely scenario where the pandemic will be persistent and occur every year.

In agreement with previous studies, McKibbin & Fernando (2021), admit a variety of policy responses. In the short term, Central Banks would need to guarantee the disrupted economies continue to function. There is also a fundamental role played by the government as the pandemic will most likely require monetary, fiscal and health policy responses. It is also recognizes that more simple actions, such as social distancing and good hygiene, can be effective and low cost ways to reduce contamination and therefore economic costs. It is also emphasized that longer-term responses will wind up being the most impactful as this type of diseases will continue to pose a threat to the world economy hence global cooperation is essential.

Economic literature has grown rapidly amid COVID-19, and economic models have been linked with epidemiological models (Atkenson, 2020; Alvarez et al., 2020). Daron Acemoglu, Victor Chermozhukp & Ivan Werning (2020), introduced multiple risk groups into the SIR model given the significant differences in both hospitalization and fatality between age groups. After, the trade-off between prioritizing saving lives and improving economic outcomes had to be addressed. The paper concluded that opting for safety-focus policies, limiting mortality rate to more than 0,2%, would account for economic losses of 37,3% of one year's GDP. Contrarily, if economic losses are limited to be no more than 24,8% of one year's GDP, the mortality rate would reach 1,05%.

Information collected by Pfeiffer et al. (2020), highlights some of the policies studied thus far. According to the authors, traditional stimulus are less effective in a scenario where sectors are shut down. It was found that unemployment insurance benefits favor borrowers, whereas unconditional transfers favor savers. Liquidity assistance programs seem to be effective in case the goal is stabilizing employment in the affected sector. This same study considered two outlines. A shock absent of liquidity constraints predict a V-shaped recession on the premise that higher capacity utilization partly offsets a delayed response of the labor inputs, which, however, remains limited as it is assumed a partial short-run complementarity between capital and labor. Furthermore, investment should not suffer a big impact as investors are expected to foresee the temporary effects of the shock. On the other hand, firm liquidity constraints are expected to lead to a deeper and more U-shaped recession characterized by an increased share of liquidity-constrained firms and generation of a sizable contraction in private investment. The impact from liquidity constraints amplifies the deflationary demand effects. Once the lockdown is lifted, higher capacity utilization and recovering consumption lead to an increase prices. GDP growth falls by 13% below the no-shock path, compared to -8% in the absence of the liquidity constraints. Having this established and given the sharp fall in the gross operating surplus, liquidity constraints substantially prolong the recession, if not addressed appropriately.

Short term results depict and increase in the GDP growth rate and also show that it's growth is 3.5% higher than it would be without the PRR. In the medium term, Portugal's GDP is predicted to have a growth of 4% and resume its previous growth trajectory forecasted in pre-pandemic times. Domestic demand and private consumption seem to be main drivers for this growth. The projections for unemployment suggest a rise to 7,3% in 2021, as a result of the increase of active population, make a recovery in 2022 and continue a downward trajectory as was predicted before the pandemic. Likewise, exports are expected to rise by 8,7% in 2021 reflecting not only the increase in global external demand but also the recovery of tourism which in turn could very well be a reflection of the positive effects of the vaccination process. Finally, the improvement in the confidence of economic agents foresees an acceleration of investment and the reforms provided in the Resilience Program will do the same for public consumption.

5. Forecasting Models Applied to Portuguese GDP

Based on the literature review previously carried out, it was understood that a first approach could be done through one of the most popular models in the area is the ARIMA model. New variants of the model will be presented throughout this chapter that will make it possible to analyze the percentage of growth of real Portuguese GDP in the short term, and to measure the impact that COVID-19 will continue to have on the country, which will in turn allow to ponder on recovery strategies.

The ARIMA model constitutes a method for forecasting or predicting future outcomes based on historical data. It is based on the statistical concept of serial correlation, where the past influences the future. The data is differenced in order to make it stationary. A stationary series has no trend, its variations around its mean have a constant amplitude, and it variates in a consistent fashion. Most economic and market data display trends and

so the aim of differencing is to remove any trends or seasonal structures as they could negatively affect the regression model. The latter condition means that its autocorrelations remain constant over time.

Having established that the ARIMA models work best on large data sets, projections of quarterly growth rates of real GDP were made for the years 2021 and 2022, following said model. GDP is the most used indicator to test the economic health of a country and from its conclusions can be drawn regarding the remaining relevant macroeconomic indicators. The historic data was harvested from the OECD data base (OECD.Stat, 2020). Within the major economic data organizations it was considered the best option since, typically, it presents the most pessimistic scenarios, according to the research carried out in the literature review chapter. What is more, the Lucas Critique states that future development is influenced by projections because expectations are accomplished, therefore, to manage expectations a safer route is to consider modest values. Finally, regarding the observed data, and since the pandemic has shown the unpredictability of the world, it will be analyzed on a quarterly basis so as to obtain results that are as close to reality as possible, as a result of recurrent monitoring (Buturac, 2021).

Because ARIMA models are elaborate and work best on very large data sets, computer algorithms and machine learning techniques are used to compute them. By way of the XLSTAT tool, quarterly values were run since the year 1980, which allows for the inclusion of a relevant number of current samples that include past economic shocks and, therefore, contribute to a faithful forecast of the percentage of economic growth in GDP. For this study , first, the ACF and PACF functions were analyzed using the graphs generated by XLSTAT with a 95% confidence interval.

5.1. Discussion

The model, as expected, was not able to predict the increase and decline peaks caused by the pandemic and reacts differently for different measures, being the unemployment rate the most reliable. This reveals once again the importance of monitoring this indicator in the short term and the uncertainty associated with these projections. Not devaluing all the mathematical work applied to the models developed so far, one can say the only certainty in this type of analysis should be the degree of uncertainty. This is also reflected in the high value of errors (MSE and RMSE) of %Unemployment and %GD growth. Figure 3 displays the results of the predictions.

Before assessing the possible scenarios, it is of great relevance to define the relationship between the GDP growth and other economy primary factors such as the **unemployment rate** and **inflation**.

Although Okun's Law (Wen & Chen, 2012) suggests that the relationship between GDP an

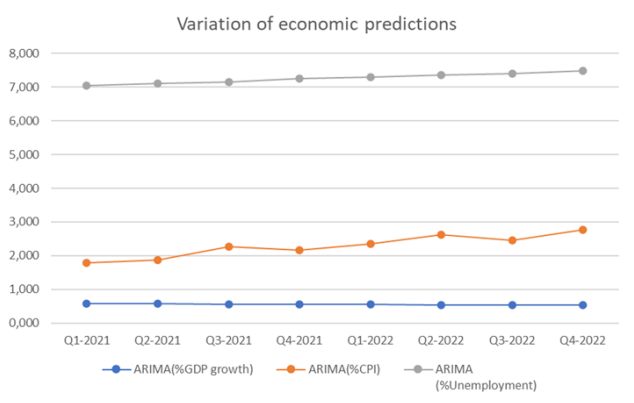

Figure 3: Graphic representation of the quarterly variation of the predictions resulting from the ARIMA models from 2021 to 2022

unemployment rate can be considered to be linear, it is important to note that when employment reaches a substantially low value it could be more costly for the economy. In this situation prices will rise, as aggregate demand will increase faster than supply and companies will be forced to raise wages due to the competitive labor market ultimately leading to a rise in prices for consumers.

The relationship between inflation and economic output (GDP) can be more complex. For instance, if GDP is declining or steady, most companies will not be able to increase their profits. However, too much GDP growth is also dangerous, as it will most likely come with an increase in inflation, which erodes stock market gains by making money less valuable. Most economists today agree that 2.5 to 3.5% GDP growth per year is the most that the economy can safely maintain without causing negative side effects (Sánchez & Liborio, 2012). The effects of inflation are not linear. Over time, the growth in GDP causes inflation which could escalate to hyperinflation quickly becoming cyclical. If more money is spent because people know it will be less valuable in the future, GDP will increase in the short term which will in turn bring further price increases.

The previous projections predict that economic growth will decelerate and return to pre-pandemic levels, assuming that the country will not suffer new restrictions, the pandemic remains under control and other external factors/shocks do not influence the course of the economy. This supports the concept that the pandemic gave rise to a "V" shaped recession, clearly visible in the graphs above, in which a sharp decline was followed by a sharp rise in GDP making it incomparable to that of the Great Recession.

However, in an attempt to anticipate another possible scenario, the possibility of the effects of the pandemic becoming seasonal, with a strong incidence in the 1st and 4th quarter of the year (winter months) could be considered despite being extremely unlikely given the vaccination advances already made. This second scenario is a global slowdown with sectors such as aviation and hotels, restaurants and tourism heavily affected, including the summer season. , and the other sectors to recover until the

end of the second quarter. In this case there would be a sharp drop in stock markets , with a severe impact on the economy in a “U” shape instead of a “V” shape , which implies more time in the reversal on the way to recovery. Consumers would see a slow recovery of confidence and the straightening of global production chains would follow the same path. Global GDP would reflect an international recession, growing less than projected.

5.1.1. Mitigation Measures

For the time being and this particular study, the greatest uncertainty is the fact that no prediction can mirror what consumer behavior will be like. This economic shock caused by the COVID-19 pandemic caused an abrupt closure of many businesses and consequently employment. That being said the course of pandemic will highly depend on what the consumer decides to do, and the levels of confidence shown. After 2020 saw a ‘boom’ in GDP due to the lifting of many restrictions and quarantine this study predicts that is clearly not going to last forever.

As for the policies planned to help mitigate the effects of a possible crisis, based on past experiences and the necessities of the country, 3 major groups can be identified:

1. Knowledge and innovation: the country should not lose focus on this sector and get carried away by uncertainty. Above all, and thinking about technological advances and the creation of new and more jobs attention and investment should be faced towards education spending, not only physical expenses but most importantly increasing effectiveness and quality. In fact, during this time it has never been more critical as many students couldn’t have access to education during the pandemic lockdown. Portugal’s weakness could be said to be this one for many years now, and with the arise of home office working less, but more specialized and prepared, people will be given job opportunities, therefore this matter shouldn’t be disregarded. Additionally, there should be policies to boost private R&D through tax incentives and subsidies on wages of R&D workers.

2. Product markets: encourage higher competition through the services sector (e.g. professional services, network services, retail) since it is such a vital sector for the country’s economic health. In addition, improved business environment, including free entry in market and more efficient exit and reductions and facilitation in administrative and regulatory procedures and certification, making the relationship between companies and the Public Administration more flexible. So far, the Portuguese government has offered monetary aid to maintain the liquidity of many companies whose business abruptly shut down. This quick response from governments and banks are essential to face this type of shock.

3. Labor markets: reforms of tax-benefit systems such as reductions in the generosity of long-run unemployment benefits and eligibility conditions. Fixing aggregate wage targets compatible with macro productivity developments, price stability and external competitiveness and, finally, tax system reforms aimed at reducing distortions and disincentive effects for low-skilled/wage earners.

6. Conclusions

In an unprecedented moment of contemporary history, many economists wonder what the consequences of COVID-19 will be for macroeconomic variables over time and when will the economy be able to bounce back. Conducting an economic forecast has proven to be a challenging task, especially when the amount of available information is so overwhelming. It becomes increasingly important to make the correct selection of relevant articles and methods that can bring value to further investigations. A comparative review has been made of the rich variety of forecasting methods. It is recognized that there are many different types of forecasting problems, requiring different treatment. As a result there is no direct or certain answer for the title of the paper. The choice of most appropriate method for a particular situation depends on a variety of considerations, of which forecasting accuracy is only one relevant criterion. In fact, more or less, models will always be faced by external factors that will make them deviate from reality. This is also why a shorter-term and consistently frequently analysis should be put ahead of long-term ones.

As in many other countries, Portugal has experienced an unprecedented social situation. Social distancing reduced the consumers’ confidence by keeping consumers at home, wary of discretionary spending and pessimistic about the long-term economic prospects, which in turn caused a reduction of consumption of goods and services. People have developed new habits as consumers, workers, students, citizens and as family members. Some of these transformations will be transient, while others may persist. The Pandemic experience provides an opportunity to accelerate desirable changes, for instance many companies now behold the opportunity of saving costs by maintaining teleworking . This infectious disease will also most likely cause household wealth will fall, savings to increase, and consumption spending to decrease further. Supply-side disruptions are also a consequence of COVID-19. It has kept production halted, while negatively impacting supply chains, labor demand, and employment, leading to prolonged periods of lay-offs and rising unemployment.

Previous pandemics, such as the 1918 Spanish Influenza, the 1958 Asian Influenza, the 1968 Hong Kong Influenza, and the 2002 SARS outbreak, have shed light to possible outcomes. During said diseases, economies have experienced ‘V-shaped’ recoveries, whereby aggregate output is displaced and quickly recovers to its pre-crisis path. However, the COVID-19 economic recovery is not expected to be straightforward. This time preventive measures will prevail for a much longer time. Probably, even if

no containment measures were implemented, a recession would occur anyway, fueled by the precautionary and/or panic behavior of households and firms faced with the uncertainty of dealing with a pandemic as well as with an inadequate public health response.

The ARIMA model, being a model that takes into account past values, provided with a good estimate of the future. After a fast recovery, it predicts that the economy will continue to grow but at a much moderate state, considering the effects of the pandemic residual. International organizations as OECD, World Bank and MF have access to more developed tools to make this type of projections. Despite not being identical, it is clear that the trend of the projections is the same, that is, a deceleration in growth after a V-shaped recovery. Only time will be able to tell the level of accuracy of each forecast. Nonetheless, future research could focus on the comparison of the different tools available to appraise the fitness of each. In addition and because of the fact the world's view of the measure of a country's well-being is changing, research could be conducted on a broader indicator, such as the GPI. It is not yet fully developed, and it has some limitation, but it could represent a great evolution from GDP to characterize a country.

The chain impact provoked by such event proved once more that the modern economy is a complex web of interconnected parties: employees, firms, suppliers, consumers, and financial intermediaries. Everyone is someone else's employee, customer, lender. There is a huge degree of inter-connectiveness and specialization of productive activities, a breakdown in the supply chains and the circular flows will have a cascading effect: households do not get paid and, hence ,reduce their consumption and savings levels. The decrease in savings reduce investment ultimately diminishing the capital stock. Households reduce their demand for imports, which in turn reduces income for the rest of the World, and hence the country's exports decrease. The demand/supply shocks cause disruption in domestic and international supply chains. All of the previous shocks and disruptions lead to a fall in output – causing reductions in the usage of the factors of production.

Ultimately, the intensity of the shock is determined by the underlying epidemiological properties of COVID-19, consumer and firm behavior in the face of adversity, and public policy responses. The biggest task at hand for the government will be related to managing the reopening of the economy and society. Public authorities need to set clear rules on health and safety in the workplace, take steps to minimize the risk of contagion, and adopt rules and regulations to increase trust in face-to-face business transactions. Measures should be reviewed and adapted as events unfold. In addition the economic and social tensions derived from COVID-19 will have to be addressed by the government and in the process hopefully seize the beneficial changes. More equitable and sustainable policies will help to increase public trust in institutions. Politicians and policymakers will also be able to learn lessons from the pandemic experience in order to make the economy and society more inclusive and sustainable. Frequent and open communication with citizens, transparency, well-founded policies, social dialogue and institutional cooperation have led to great adherence and acceptance by the population of containment measures, during the recovery this behavior must be maintained. It could be a great opportunity for the country to show its value and strength.

7. References

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