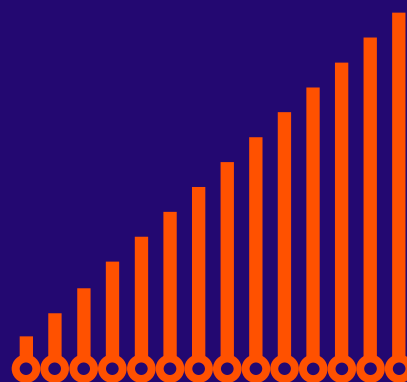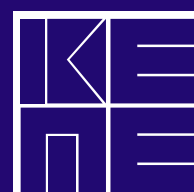# GREEK ECONOMIC OUTLOOK

- **Recent (macro-)economic developments**

- **Fiscal developments**

- **Human resources and social policies**

- **Special topics**

KEΠE

GREEK

Economic Outlook

Contents

Executive Summary

The Greek economy is recovering rapidly

After a dramatic recession of 9.0% (according to the revised data of ELSTAT) in 2020, the Greek economy shows a "V-type" significant recovery. Essentially what we see is a verification of the "spring theory". And it is not just the data of the last quarter that verifies this estimate. The estimates of foreign and domestic investors and banks raise the growth rate of 2021 to around 8%, much higher than the revised 6.1% of the government: at 7.5% the National Bank of Greece; at 7.8% UBS, Oxford Analytics and Moody's Analytics; at 7.9% KEPE (see section 1.3); at 8% IOBE; at 8.5% Capital Economics and at 8.6% Scope Ratings. It is now clear that state support of about 40 billion euros saved the economy's productive base, significantly increased deposits and kept unemployment at 13.9% in August 2021, which is the lowest level in 11 years.[1]

What are the main drivers of growth?

The main drivers of growth (during the first half of the year), are fixed capital investments (11.8%), public consumption (7.0%), exports of goods & services (5.8%) and private consumption (4.7%) (see section 1.1).

Investments

Recently, there has been an increase in various business agreements and investments, such as that of Digital Realty (the largest manufacturer of Data Centers in the world), Pfizer in Thessaloniki, CISCO and the shipbuilding group Fincantieri (Elefsina Shipyards, following the successful completion of the tender for the Scaramanga Shipyards with the bidder, Mr. Prokopiou). Essentially, what is observed is that the investment funds are looking for a place in the Greek market, precisely because they see that the next period is very positive. This is also confirmed by the successful processes of selling 100% of DEPA Infrastructure to Itaglas for 733 million euros, the concession of Egnatia Odos to the GEK-TERNA-Egis Projects consortium for 35 years, for a total benefit of 2.8 billion euros, and the acquisition of 49% of HEDNO by Macquarie, for 2.1 billion euros.

Exports

In Greece, the effects of the pandemic on exports were manifested in the second quarter of 2020, with a relatively mild negative rate of change, while in the third and even more so in the fourth quarter of the year, the country recorded a significant recovery in exports. By contrast, the EU has seen an average drop in exports of goods since the first quarter, with the situation deteriorating rapidly in the second quarter, but with some first signs of a marginal recovery emerging towards the end of the year. In relation to the prospects of the Greek export sector for the year 2021, the developments in the international environment are expected to create more favorable conditions for the development of Greek exports of goods. Based on the evidence so far, the European and global economies are recovering this year, boosting international trade. At the same time, the needs for pharmaceutical products are expected to remain increased, while oil prices are higher than last year, which, combined with increased demand, is expected to significantly enhance the value of Greek exports.

Inflation: the biggest risk for the recovery of the Greek economy

In recent months, we have seen an increase in the prices of almost all goods (see section 1.2). The increases are particularly noticeable in energy (gas, electricity, oil) as well as in transport and raw materials. For example, the price of oil rose to about $84 per barrel, more than four times higher than that recorded in the midst of the pandemic (about $20 per barrel in April 2020). The prices of electrical items have increased by 60% since the beginning of the year. The cost of a container has skyrocketed from €1,500 last year to €12,000 this year. The rise in the price level in commodities, and especially in energy, that has taken place in recent months may significantly burden family budgets, ultimately squeezing the purchasing power of households. The Greek government, in an effort to curb the effects of price increases on households, has already taken measures to support society against the nega-

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1. <https://www.statistics.gr/el/home>

tive effects of the energy crisis, such as increasing the heating allowance (from 36% for households without children, up to 68% for households with three children) and in broadening the eligibility criteria to cover a larger percentage of households (over one million, compared to about 707 thousand households in 2020). At the same time, as the government had announced at the Thessaloniki International Fair, a subsidy will be given for household electricity bills, while a similar policy is expected to be applied to gas consumption bills. The budgetary cost of the subsidies of electricity bills is expected to amount to €326 million, and the cost of the heating allowance to €168 million. In addition, the prime minister announced during the Thessaloniki International Fair policies that lower the tax burden and support incomes and business (e.g., the extension of the exemption from the special solidarity contribution in 2022, the reduction of insurance contributions in the private sector, the reduction of corporate tax from 24% to 22%, the extension of the application of reduced VAT rates on transport, coffee and non-alcoholic beverages, cinemas and the tourist package by June 2022, etc.).

*Inflation creates uncertainty for businesses and households as well as a big question mark: Is **the return of inflation a temporary phenomenon** due to the faster adjustment of demand relative to supply to a post-pandemic normality, **or a structural change with more permanent characteristics** linked to the pursuing expansionary fiscal and monetary policy at the international level?*

A careful analysis of the global data leads to the conclusion that the inflationary pressures observed internationally *are due to many different cyclical factors, all of which, however, appeared in the current situation, which will gradually decline*. E.g., the sharp drop in the price level last year due to the pandemic, combined with the rise in prices this year; the dynamic warming of economies after the lifting of restrictive measures, combined with the creation of stocks by companies to avoid future shortages; the imbalance between supply and demand in some sectors due to disruption in the global supply chain as well as to climate change (e.g., very hot summer and no winds in Europe, fires in Siberia, increased demand for air conditioners in Asia). Added to this is the (hasty?) change in the energy mix in the European Union, combined with the intention to move to a production model based more on renewables and less on traditional energy sources (e.g., lignite, coal and oil), which led to an increase in the price of carbon dioxide emission allowances paid by energy producers. This resulted in an increase in production costs, which is then passed on to both the wholesale and retail markets.

Will the current recovery course take on the characteristics of sustainable development?

Once the risk of inflation is overcome, the current recovery must take on the characteristics of lasting sustainable development, especially in light of the country's exit from enhanced supervision in 2023, and the country must return to investment grade as quickly as possible. The conditions for this to happen are the following:

First, the effective absorption of Recovery Fund resources and the continuation of reforms

The effective absorption of the resources of the Recovery Fund and the NSRF will help to fill the huge investment gap of the last decades in the country. It is a necessary, but insufficient condition. It is the reforms that are the sufficient condition for the current recovery to have the characteristics of sustainable development. Greece has made significant progress in recent years, implementing structural reforms that can strengthen the medium-term growth prospects of the economy. However, there are still some significant obstacles to achieving sustainable and strong growth.

The intensification of reforms, especially in the fields of **Education, Justice and Public Administration**, will increase the productivity of capital, making investments more efficient. The government is not alone in this effort: a large section of society is calling for change, and the government is called upon not to deny their expectations. Millions of parents are interested in the school results of their children, and thousands of teachers, despite the demands of their union leaders, would like to know the preferences of parents and children, the consumers of the service they provide. Millions of citizens and hundreds of investors are interested in doing their business quickly without unnecessary travel and wasteful spending. A universal application of evaluation is necessary in the State as well as a fundamental change of the evaluation system of judges that will be based solely on their performance.

Second, the restoration of fiscal balance

Despite the strong recovery, Greece's budget deficit and debt increased through the crisis and remain high (see sections 2.1 and 2.2). The sharp rise in the public debt ratio makes the economy vulnerable to new negative external shocks. Interim measures should be extended for as long as necessary in order to avoid the effects of their abrupt withdrawal. However, there

is no room for easing the longer-term targets for primary surpluses, which are a prerequisite for financing needs for the next decade to remain manageable. If Greece quickly "covers" its deficit, and given its high cash flow, the loss of access to the ECB's quantitative easing after the end of the PEPP, if decided, will not necessarily be a concern for the markets.

Related to the above issue is the *fight against tax evasion*. A recent report by the European Parliament reveals the great scourge of tax evasion in European countries, with Greece unfortunately emerging as a "champion" in the Eurozone.[2] The report estimates that **Greece loses 6 billion euros a year in tax evasion.** This amount brings it first in losses among the Eurozone countries and second overall in the EU, behind Romania. According to the report, the VAT revenues that our country could have received in 2020 were 21 billion euros. The amounts that ended up in the state coffers were about 15 billion euros, i.e., there is a huge loss in VAT revenues of 6 billion euros or 28.5%. This amount corresponds almost 2.5 times the income from ENFIA. This is the so-called "VAT gap", which reflects the difference between the expected and the actual receipts from VAT; and as the data show, almost 1 in 3 euros is not collected, with tax compliance at 68%. According to the report, none of the EU states collects 100% of VAT receipts. However, Greece could achieve higher rates; when it entered the EMU and until the Olympic Games, the tax compliance rates on the VAT front reached 81%. *If, from the 6 billion euros that the country loses from the VAT receipts, it received 4 billion euros, then the way would be opened for brave tax relief measures as well as for the abolition of the taxes imposed in the years of the memoranda.* Tax evasion in Greece has always been great, as has the informal economy. However, in recent years, its level, especially in the field of VAT, has increased. Probably this is due to the high tax rates and the reduction of incomes that push the market and its citizens to "black" transactions.

Finally, ensuring the liquidity of banks

Recently, the financial indicators of banks have improved significantly, as compared to March 2016. The stock of non-performing loans (NPLs) has decreased by 50% and more, mainly through securitizations utilizing the Asset Protection Program ("Hercules"). Banks were able to eliminate their reliance on the Liquid Assistance Facility (ELA) and regain access to wholesale financing markets by issuing unpaid high repayment bonds and capital instruments. Two systemic banks have also resorted to capital markets and successfully carried out share capital increases in 2021. At present, banks have sufficient liquidity and security capital reserves to allow them to lend to the real economy. *However, the percentage of Non-Performing Loans in total loans remains the highest in the euro area* and is a deterrent to credit expansion, especially to small businesses, which are characterized by a higher credit risk.

Professor PANAGIOTIS LIARGOVAS
Chairman of the Board and Scientific Director of KEPE

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2. <https://www.europarl.europa.eu/RegData/etudes/STUD/2021/694215/EPRS_STU(2021)694215_EN.pdf>

1.1. The evolution of the aggregate demand components after the second lockdown

1.1.1. Introduction – Domestic & external demand

Yannis Panagopoulos

In this section, using the existing recorded macroeconomic data, we proceed to the analysis of the current developments of the Greek economy. The first thing we observe, based on the results of Table 1.1.1, is mainly the reversal of the "economic environment" from the first to the second quarter of 2021. More specifically, the recession of the economy, in the first quarter of 2021, was replaced by explosive growth in the second quarter of the same year. Analytically, from -2.3%, the economy grew to 16.2%. On the other hand, on a semi-yearly basis, we also observed a serious reversal in the growth rate of the economy. Thus, from a recession of 7.17%, in the first half of 2020, we moved to growth of 6.97% in the corresponding half of 2021.

As far as the factors that contributed to the evolution of the explosive GDP growth are concerned, in the second quarter of 2021 (16.2%), on an annual basis (y-o-y), we should note the existence of high positive rates of change in all individual macroeconomic factors. More specifically, the biggest positive rate of change was recorded by exports of goods and services (22.6%), followed, in decreasing order, by private consumption (13.2%), fixed capital formation (12.9%) and public consumption (6.1%). Special mention should be made for the high positive sign, over the same period, concerning imports of goods and services (22.5%).

In terms of the semi-yearly period, we have the same positive picture with only smaller rates of change, due to the negative contribution of Q1 2021. More specifically, fixed capital formation (11.8%), public consumption (7.0%), exports of goods & services (5.8%) and private consumption (4.7%) contributed, in diminishing order, to the recorded semi-yearly growth of 2021 (6.97%) (Table 1.1.1.).

Domestic demand also recorded a similar growth for Q2 2021 (Figure 1.1.1). Based on the existing components, in the GDP growth (using seasonally adjusted data), private consumption was the most positive component, with a much higher proportion than those of fixed capital formation and public consumption (8.99 vs. 1.53 and 1.36, respectively).

As far as the external sector is concerned, in relation to the domestic demand, during the second quarter of 2021, the comparatively more important positive role of domestic demand is emphasized compared to the negative international one, which mainly includes the balance of goods and services (11.19 vs. -1.23, respectively) (see Figure 1.1.2). In the same quarter, a positive contribution of the change in inventories is also recorded for the GDP growth (9.76).

Regarding the trend of the Economic Sentiment Index (ESI), as a proxy of future demand, it is known that, like some other leading indices, it offers valuable information from both business and household perspectives. It is also an important indicator for the economy and can be used for the predictions relating to the future of GDP growth. As demonstrated by Figure 1.1.3, in January 2021 and until the latest recorded numbers (August 2021), the ESI moved upwards. More specifically, from 90.7 points in January 2021, it has so far reached 113 points. This is yet another indication of the reversal of the serious negative impact that the Covid-19 pandemic created on business & household expectations last year.

Next, a more detailed discussion follows on the contribution of the trade balance of goods and services (external sector) with respect to the GDP recession, for 2020.

Balance of goods and services

The contribution of the external sector (exports minus imports) to GDP growth, for the second quarter of 2021, as already mentioned above, is generally considered slightly negative (-1.22 points) and to some extent reflects the continuing impact of the Covid-19 pandemic on the economy.

Starting from total exports, it should be noted that they increased in the second quarter of 2021, at a rate of

TABLE 1.1.1 Basic macroeconomic figures

(% rates of change with seasonally adjusted data, at constant prices)

	2019 Q2	2019 Q3	2019 Q4	2020 Q1	2020 Q2	2020 Q3	2020 Q4	2021 Q1	2021 Q2	A´ semester 2020	A´ semester 2021
Private consumption	0.80	1.70	2.80	0.80	-14.60	-1.20	-4.10	-3.70	13.20	-6.91	4.73
Public consumption	7.70	-1.20	-0.80	1.40	-2.60	4.80	7.30	8.10	6.10	-0.61	7.07
Fixed capital investment	-18.70	2.70	-3.90	-4.20	3.60	0.10	4.40	10.60	12.90	-0.31	11.78
Demand*	0.30	-0.20	2.00	1.10	-9.80	4.10	-4.00	-1.40	15.49	-4.37	7.03
Exports of goods and services	6.00	5.90	-1.10	-2.20	-27.60	-25.60	-16.20	-10.90	22.60	-14.91	5.82
Exports of goods	2.60	5.70	-3.00	2.70	-3.30	4.30	13.70	8.70	17.06	-0.27	12.90
Exports of services	8.90	9.60	-0.70	-6.60	-52.80	-52.70	-41.90	-34.40	28.77	-29.66	-2.81
Imports of goods and services	1.90	3.20	2.20	0.90	-15.00	-5.50	-8.00	-3.30	22.50	-7.03	9.59
Imports of goods	2.40	2.70	-1.00	0.90	-12.90	-1.60	-1.70	-2.10	19.71	-6.01	8.78
Imports of services	0.60	5.10	9.20	3.10	-16.00	-18.10	-30.60	-8.48	35.15	-6.43	13.33
GDP	2.30	1.60	1.00	-0.40	-13.90	-10.03	-6.85	-2.26	16.20	-7.17	6.97

Source: National Accounts, ELSTAT.

* Without change of inventories.

FIGURE 1.1.1
Components of domestic demand*
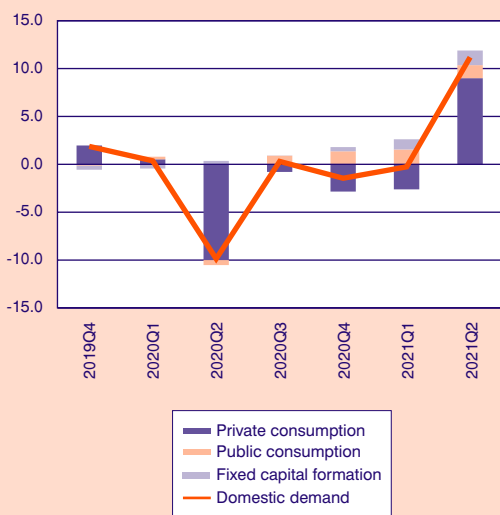
Source: *National Accounts,* ELSTAT.
* Data processing by the author.

FIGURE 1.1.2
Domestic and net external demand*
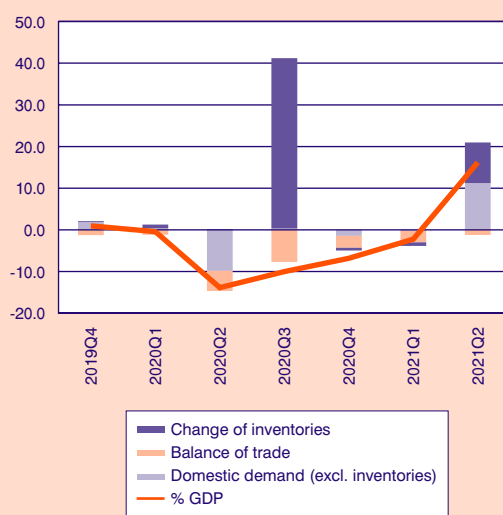
Source: *National Accounts,* ELSTAT.
* Data processing by the author.

FIGURE 1.1.3
Economic Sentiment Index
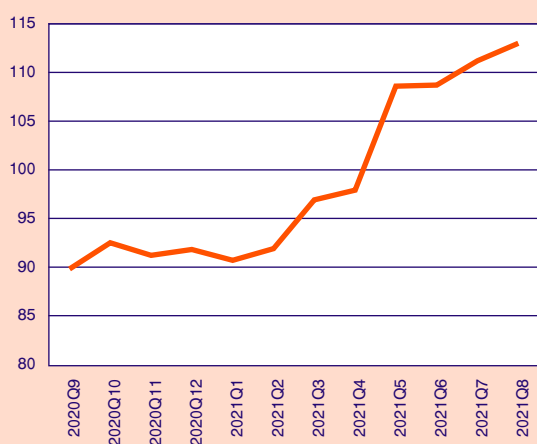
Source: EUROSTAT.

FIGURE 1.1.4
Sub-components of external demand*
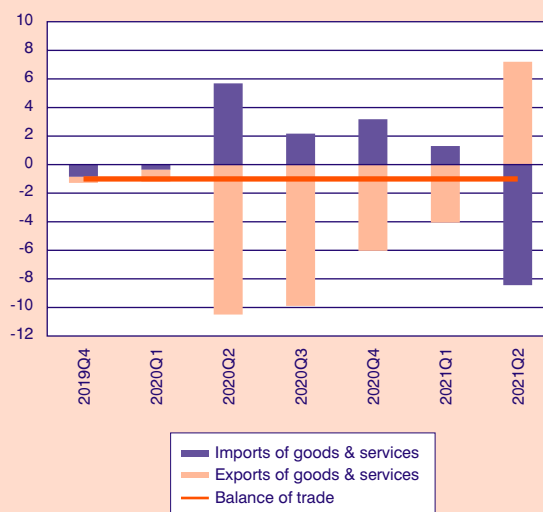
Source: *National Accounts,* ELSTAT.
* Data processing by the author.

22.6%. More specifically, services, which constitute the relatively smaller part of exports in billions of euros, showed an increase of 28.7%, while goods, which were the larger part of exports, showed a smaller increase of 17.0% for the same period.

As far as imports of goods and services are concerned, in contrast to the structure of exports, they are more balanced as a distribution, recording a corresponding quarterly increase of 22.5%. More specifically, imported services showed a large increase of 35.7%, while, on the other hand, in imported goods, the quarterly increase was less than that of services, at 19.7%.

The only "positive" element of the contribution of the balance of goods and services to the GDP growth rate,

in Q2 2021, is its recorded decrease compared to Q1 (-1.23 and -2.8, respectively). In fact, as shown by the corresponding histograms of Figure 1.1.4, there is a reversal of the picture of the two components with a positive contribution of exports and a corresponding negative contribution of imports to the GDP growth (7.2 and -8.4, respectively). But this small difference in the size of the two components gives the overall negative contribution of the balance of goods and services to the GDP growth rate for Q2 2021 (-1.23).

1.1.2. Private consumption and investment

Konstantinos Loizos

1.1.2.1. Private consumption

Rising trend in private demand components despite the second lockdown

Based on quarterly, seasonally adjusted *National Accounts,*[1] private consumption of households and

NPISH[2] increased to 31,763 million euros in current prices during the second quarter of 2021, from 30,470 million euros in the first quarter of the same year and 29,558 million euros in the fourth quarter of 2020. However, in terms of chain-linked volumes (reference year 2015), private consumption fell to 30,525 million euros in the second quarter of 2021 compared to 30,641 million euros in the first quarter of the same year and 30,853 million euros during the last quarter of the previous year. On the other hand, percentage changes[3] with respect to the previous quarter, according to seasonally adjusted chain-linked volumes, despite being negative during the last three quarters, fell from -1.9% in the fourth quarter of 2020 to -0.7% in the first quarter of 2021 and -0.4% in the second quarter of the same year. Moreover, with respect to the corresponding quarter of the preceding year, despite negative, but decreasing percentage changes in the last quarter of 2020 and the first quarter of 2021 (-4.1% and -3.7% respectively), we observe a significant positive percentage change of 13.2% during the second quarter of 2021, which coincides with the second lockdown phasing out.

FIGURE 1.1.5

Evolution of private consumption and other components of demand as a percentage of GDP
(expenditure approach) (seasonally adjusted data in current prices)
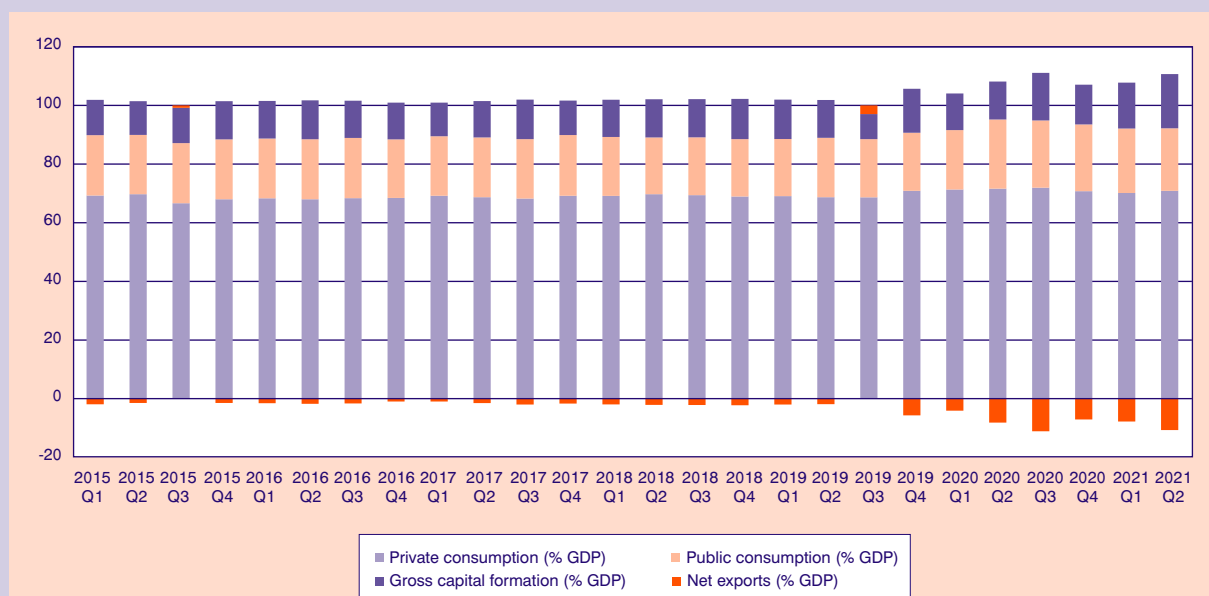
Source: ELSTAT, data processing by the author.

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1. *Quarterly National Accounts,* Press release, ELSTAT, September 7, 2021.

2. Non-profit institutions serving housholds.

3. Percentage changes are calculated using the formula $\frac{X_t - X_{t-1}}{X_{t-1}}$.

In addition, private consumption as a percentage of Gross Domestic Product, increased in the second quarter of 2021 since, from 70.77% of GDP in the fourth quarter of 2020 and 70.16% in the first quarter of 2021, it rose to 70.87% in the second quarter of this year (Figure 1.1.5 above). On the contrary, public consumption decreased from 22.77% in the fourth quarter of 2020 to 21.98% of GDP in the first quarter of 2021 and 21.34% in the second quarter. Moreover, there was a significant increase in gross capital formation (fixed capital and changes in inventories) as a percentage of GDP between the fourth quarter of 2020 and the second quarter of 2021 (13.56% in the fourth quarter of 2020, 15.65% in the first quarter of 2021 and 18.50% in the second quarter of 2021). However, the negative figure of net exports as a percentage of GDP expanded from -7.10% in the fourth quarter of 2020 to -7.79% in the first quarter of 2021 and -10.70% in the second quarter of 2021. Overall, we observe a recovery of domestic demand, mainly due to the contribution of private consumption and investment, along with a corresponding fall in public consumption, especially during the second quarter of 2021, which is identified with the second lockdown phasing out.

Recovery of retail trade, especially during the second quarter of 2021

Figure 1.1.6 depicts the evolution of retail trade in terms of percentage changes with respect to the corresponding months of the previous year, according to the monthly data provided by ELSTAT. The overall index exhibited two main trends: During the fourth quarter of 2020 and the first quarter of 2021, negative percentage changes prevailed (-4.78% and -1.44%, respectively, on average) whilst in the second quarter of 2021, there was a clear rising trend (21.18% on average). The same trends are evident in automotive fuel, which present, on average, negative percentage changes in the last quarter of 2020 (-18.65%) and the first quarter of 2021 (-13.45%) and a positive change in the second quarter of 2021 (9.22%). There is a different situation in Food and Other items concerning the first two quarters, but the trend remains positive. Hence, we observe a positive average percentage change in Food during the fourth quarter of 2020 (8.27%), slightly negative in the first quarters of 2021 (-0.62%) and positive again in the second quarter of 2021 (8.27%). To the contrary, Other items except

FIGURE 1.1.6

Percentage changes in the seasonally adjusted overall volume index and the main sector indices in retail trade
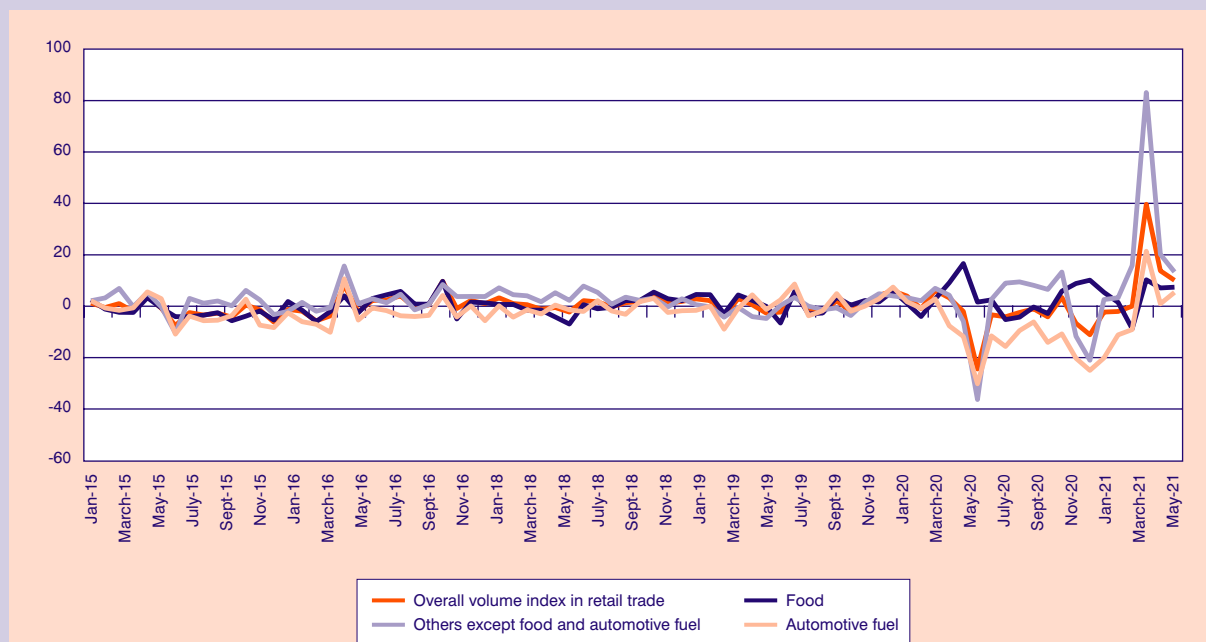
Source: ELSTAT, data processing by the author.

FIGURE 1.1.7
Confidence indicators in retail trade

Legend:
— Seasonally adjusted retail confidence indicator
— Seasonally adjusted consumer confidence indicator
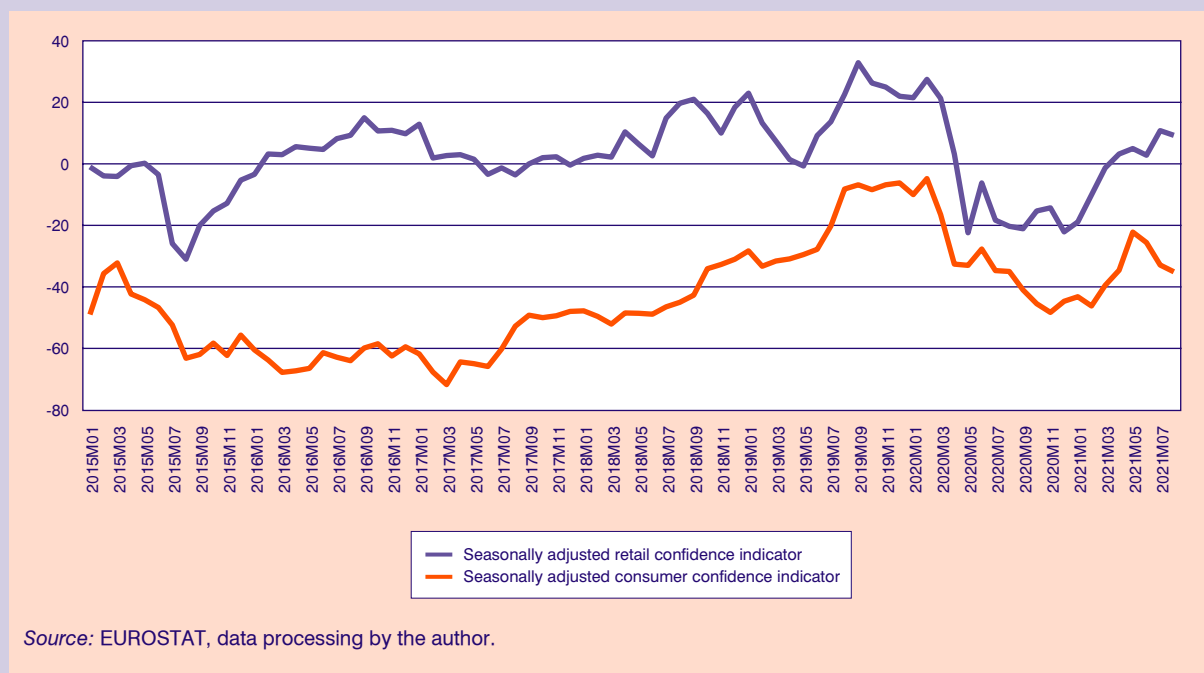
Source: EUROSTAT, data processing by the author.

food and automotive fuel presents a negative average percentage change in the fourth quarter of 2020 (-6.46%), but a significantly positive change for the next two quarters, especially for the second quarter of 2021 (7.23% and 38.88%, respectively). This data indicate a recovery in retail trade and, in particular, during the gradual opening up of the economy from April 2021 onwards.

Despite fluctuations in consumer confidence, expectations in retail trade recovered

Confidence indicators published by EUROSTAT (Figure 1.1.7) show evidence of stabilization as of September 2020 for the retail confidence indicator and from November of the same year for the consumer confidence indicator. Secondly, beginning from the first months of 2021, a rising trend appears, which continues at least until July 2021 for the retail confidence index, whilst it reverses itself from June 2021 as far as the consumer confidence indicator is concerned. However, consumer hesitation does not appear to affect significantly retailers' expectations, despite their slight fall in August 2021.

1.1.2.2. Investment

Rising trend in total investment and in most of its components despite the second lockdown

Gross fixed capital formation in current prices increased to 5,355 million euros during the second quarter of 2021 from 5,139 million euros in the first quarter of the same year and 4,433 million euros in the fourth quarter of 2020. Correspondingly, in terms of chain-linked volumes, there is an increase in gross fixed capital formation to 5,281 million euros in the second quarter of 2021 from 5,062 million euros in the first quarter and 4,870 million euros in the last quarter of the previous year. Furthermore, this rising trend is corroborated by mere inspection of percentage changes both with respect to the preceding quarter (2.7%, 3.9% and 4.3% for the fourth quarter of 2020 and the two first quarters of 2021, respectively) and with respect to the corresponding quarter of the preceding year (4.4%, 10.6% and 12.9% for the last quarter of 2020, the first quarter of 2021, and the second quarter of 2021 respectively), according to the seasonally adjusted chain-linked volumes.

Moreover, the evolution of the contribution of investment and its components to GDP (Figure 1.1.8) was

FIGURE 1.1.8

Gross fixed capital formation as a percentage of GDP (overall and by asset)

(seasonally adjusted data in current prices)

Intellectual property products (% GDP)
Other machinery and equipment, weapon systems (% GDP)
Information Communication Technology (ICT) equipment (% GDP)
Transport equipment (% GDP)
Cultivated biological resources (% GDP)
Other buildings and structures (% GDP)
Dwellings (% GDP)
Gross fixed capital formation (% GDP) (right-hand axis)
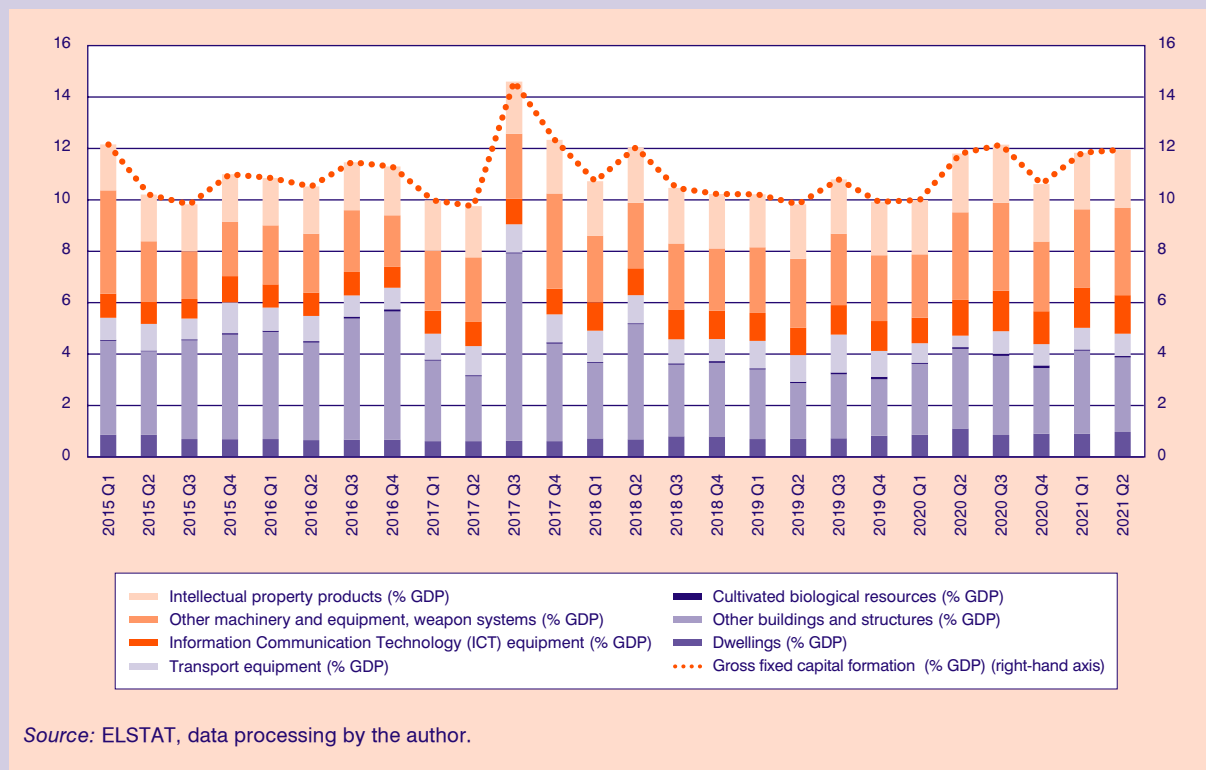
Source: ELSTAT, data processing by the author.

FIGURE 1.1.9

Machinery, transport equipment and buildings as a percentage of gross fixed capital formation

Machinery and transport equipment (% gross investment)
Buildings (% gross investment)

Source: ELSTAT, data processing by the author.

FIGURE 1.1.10
Construction confidence indicator

Source: EUROSTAT, data processing by the author.
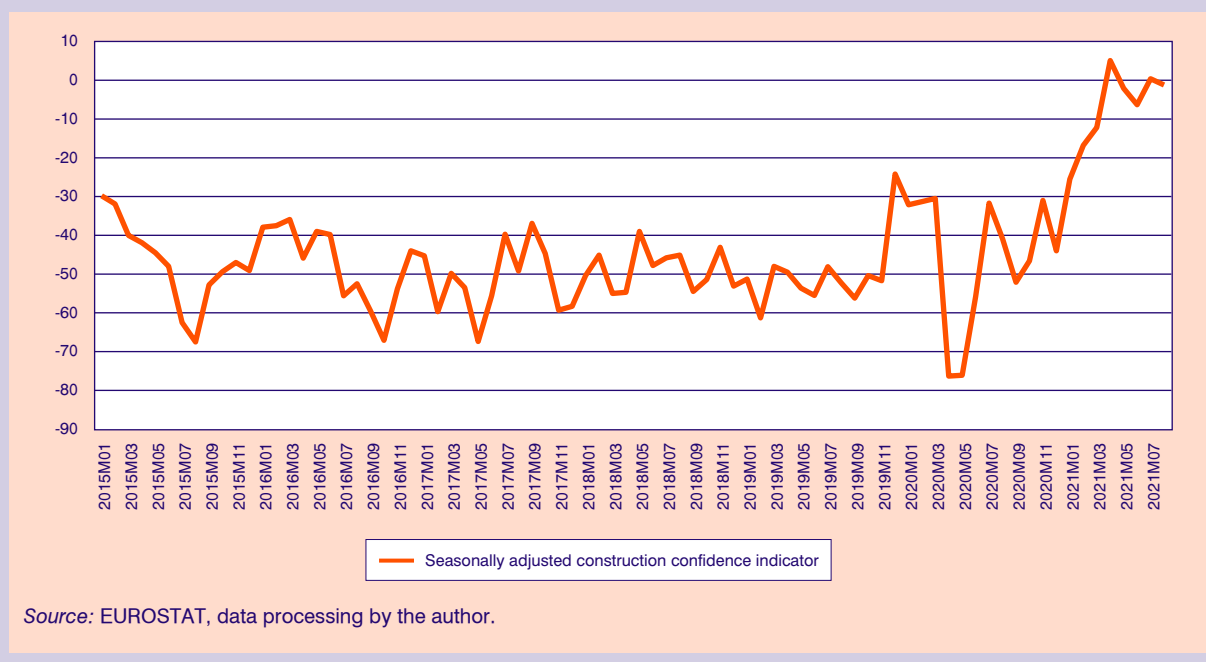
positive overall during the period under examination, with the only exemption being the negative values in the last quarter of 2020. Gross fixed capital formation as a percentage of GDP exhibited positive percentage changes with respect to the preceding quarter (11.47% and 0.98%) during the first two quarters of 2021, despite a negative percentage change (-12.59%) in the last quarter of 2020. As far as its components are concerned, machinery and transport equipment as a percentage of GDP, despite a negative percentage change of -17.93% in the last quarter of 2020, recovered both in its overall measure (13.15% and 5.55% during the first two quarters of 2021) and in most of its individual components, registering positive percentage changes. On the contrary, the evolution of the overall measure for buildings as a percentage of GDP is not so clear since, regardless of a negative percentage change in the last quarter of 2020 (-11.97%), there appears to be a positive percentage change in the first quarter of 2021 (19.46%), but a negative one in the second quarter (-6.38%), even with a positive contribution of dwellings (6.73%) in this last quarter.

Machinery and transport equipment still predominates buildings

Focusing on the two main components of gross investment, the data verifies the increased weight of machinery and transport equipment as a percentage of

fixed gross capital formation at the expense of buildings, which we observe as of the third quarter of 2018. The share of machinery and transport equipment in total gross fixed capital formation remained higher than that of buildings, both in each one of the last three quarters individually (2020Q4, 2021Q1 and 2021Q2) and on average (46.55% for machinery and transport equipment, as opposed to 33.76% for buildings).

In spite of small fluctuations, expectations in the construction sector remain optimistic

The evolution of business expectations in the construction sector is depicted in Figure 1.1.10. It appears that small fluctuations from May 2021 and after were not able to affect in a significant way the rising trend and the related optimism that prevailed as of the beginning of the current year. It is worth noting that this trend appears in the construction confidence indicator regardless of the falling share of buildings in total gross investment, probably indicating that the construction sector might have a more active role in economic recovery in the immediate future.

1.1.2.3. Conclusions

The preceding analysis showed that the Greek economy both during and at the end of the second lockdown had generally a positive performance. On the one

hand, we observed rising trends in the components of private demand and the corresponding fall in public consumption. Specifically, one must note the positive trend in gross investment along with a significant recovery in retail trade, especially during the second quarter of 2021. On the other hand, confidence in both retail trade and constructions remained at high levels despite small fluctuations and consumer hesitance. The above, along with the immunity wall built through extended vaccinations, are an asset for the course of the Greek economy in the face of a possible new pandemic wave. However, the preceding analysis has not examined the effect on total demand of the tourist season, which covers the third quarter of the year.

1.2. Rising energy prices and increased demand exert inflationary pressures on the Greek and euro area economies

Emilia Marsellou

Greece

The gradual reopening of countries all over the EU, as the epidemiological situation has improved due to the successful vaccination campaigns, has led to inflationary pressures. These pressures in the headline HICP are mainly attributed to higher energy price inflation, reflecting a sizeable upward base effect, especially as regards natural gas and heating oil, as the containment measures have eased and mobility has risen. According to the latest estimates of the European Central Bank,[1] other factors besides the developments in the field of energy that contribute to the inflationary pressures and are of a temporary nature are the one-off re-opening effects on service prices, as firms adapt to new regulations related to the COVID-19 pandemic, and increases in input costs related to supply bottlenecks that emerged as a result of the stronger than anticipated increase in demand given the uncertainty and asymmetry in the reopening of different sectors in different countries.

Specifically, for the case of Greece, according to the Hellenic Statistical Authority (ELSTAT), the National CPI in September 2021 recorded an annual increase of 2.2%. Energy prices that started rising in February 2021 gradually intensified, while increasing demand began to affect prices from June onwards with the lifting of the restrictive measures, which can be observed from the evolution of the core CPI (Table 1.2.1). The

TABLE 1.2.1 Inflation in Greece (%)

	Headline inflation (Greece)	Core inflation (Greece)	Harmonized inflation (Greece)	Core Harmonized inflation (Greece)
2020:M8	-1.9	-1.4	-2.3	-2.4
2020:M9	-2.0	-1.6	-2.3	-2.6
2020:M10	-1.8	-1.4	-2.0	-2.2
2020:M11	-2.1	-1.8	-2.1	-2.3
2020:M12	-2.3	-2.0	-2.4	-2.5
2021:M1	-2.0	-1.3	-2.4	-2.3
2021:M2	-1.3	-1.0	-1.9	-2.1
2021:M3	-1.6	-2.8	-2.0	-3.2
2021:M4	-0.3	-1.6	-1.1	-2.3
2021:M5	0.1	-1.7	-1.2	-3.0
2021:M6	1.0	-0.5	0.6	-0.7
2021:M7	1.4	-0.5	0.7	-1.1
2021:M8	1.9	-0.3	1.2	-0.7
2021:M9	2.2	0.1	1.9	0.2

Source: ELSTAT.

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1. ECB (Sept. 2021), ECB staff macroeconomic projections for the euro area.

FIGURE 1.2.1
Annual changes in CPI sub-categories (September 2021)

Source: ELSTAT.
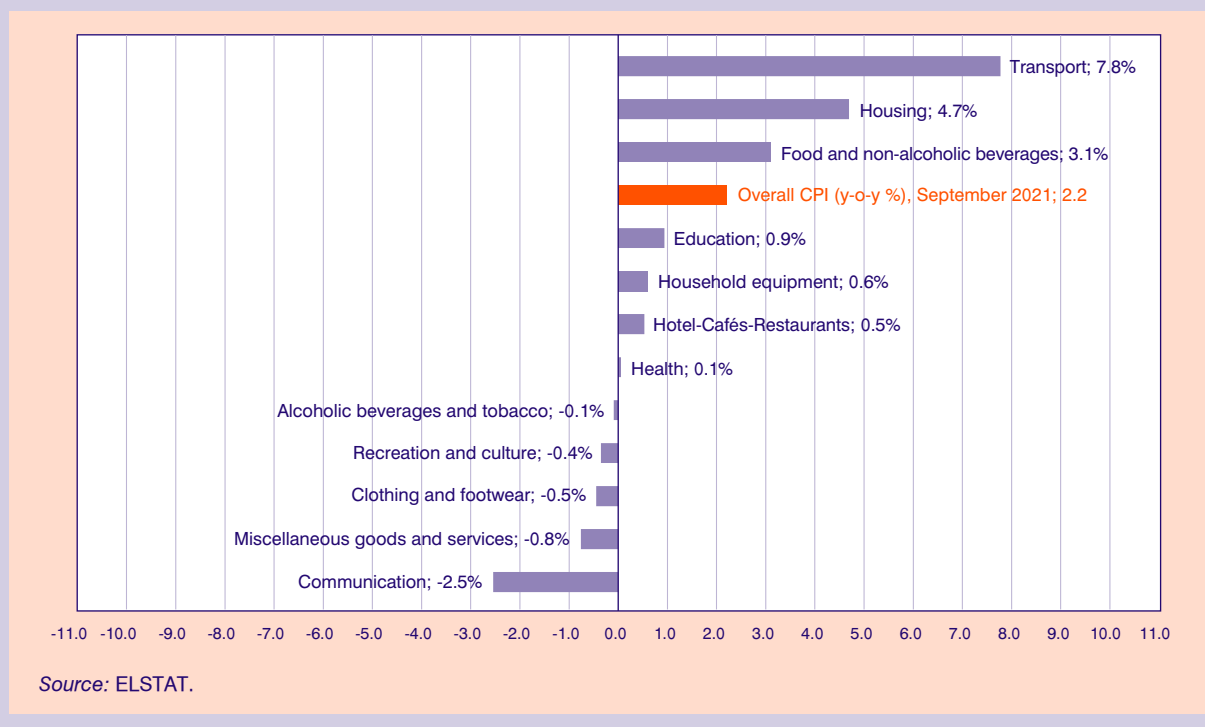
latter has declined, with lower rates since June 2021, and for the first time since the outbreak of the pandemic (March 2020), reached a positive sign in September 2021 (0.1%). At a similar pace, headline HICP increased by 1.9%, and the core HICP increased by 0.2%.

More specifically, the annual increase of the General CPI in September 2021, by 2.2%, is a combined result of the following changes in the price indices of sub-groups of goods and services. More specifically, increases were recorded by:

- **3.1% in the group Food and non-alcoholic beverages.** This increase is mainly attributed to the rise in the prices of bread (+2.6%), lamb and goat (+17.5%), fresh fish (+7.9%), eggs (+3.5%), olive oil (+18.4%), other edible oils (+14.0%), fresh fruit (+1.2%), fresh vegetables (+21.1%) and chocolates-chocolate products (+4.4%). This increase was partly offset by the decrease, mainly, in the prices of breakfast cereals (-4.5%), pork (-2.6%), dried, salted, or smoked meat (-3.9%), yoghurt (-2.7%) and jams-marmalades-honey (-2.9%).

- **4.7% in the group Housing.** This increase is mainly attributed to the increase in the prices of electricity (+0.8%), natural gas (+108.5%) and heating oil (+28.9%).

- **0.6% in the group Household equipment.** This increase, which is mainly attributed to the increase in the prices of domestic services (+2.8%), was partly offset by the decrease, mainly, in the prices of household textiles (-2.0%) and household appliances and repair (-1.6%).

- **0.1% in the group Health.** This increase, which is mainly attributed to the increase in the prices of medical, dental and paramedical services (+0.8%) and hospital care (+0.6%), was partly offset by the decrease in the prices of pharmaceutical products (-1.1%).

- **7.8% in the group Transport.** This increase is mainly attributed to the rise in the prices of fuels and lubricants (+18.1%),[2] new motorcars (+2.4%) and tickets for passenger transport by air (+20.9%).[3]

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2. In more detail: Diesel +22.2%, Gasoline +18.2%, Other fuels +23.7% and Lubricants +0.6%.

3. The consumer price sub-indices of the rest of the Transport categories (Tickets for passenger transport by railway, Tickets of passenger transport by road and Tickets of combined passenger transport) remained constant.

TABLE 1.2.2 Annual changes in CPI sub-categories, January-September 2021

Groups of goods and services	Jan	Feb	March	Apr	May	June	July	Aug	Sept
1 Food and non-alcoholic beverages	-0.4	-0.5	-0.3	-1.2	-0.2	0.4	1.7	3.0	3.1
2 Alcoholic goods and tobacco	-0.4	0.1	-0.5	-0.1	-0.3	-0.2	0.0	-0.4	-0.1
3 Clothing and footwear	-3.5	-0.1	-16.9	-1.1	-5.0	0.5	-1.4	-2.6	-0.5
4 Housing	-3.4	-1.9	0.1	1.9	3.2	4.0	4.2	4.4	4.7
5 Household equipment	-2.2	-2.2	-1.7	-1.2	-1.4	-0.8	-0.7	-0.5	0.6
6 Health	-1.2	-1.1	-1.1	-1.0	-1.3	-1.3	-0.8	-0.5	0.1
7 Transport	-5.7	-4.3	-0.8	2.3	4.6	6.7	5.8	6.7	7.8
8 Communication	-2.1	-1.8	-1.6	-1.4	-1.7	-1.8	-2.7	-2.6	-2.5
9 Recreation and culture	-0.6	-0.3	-0.3	-1.0	-0.8	-1.0	-0.8	-0.7	-0.4
10 Education	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
11 Hotels-Cafés-Restaurants	-0.6	-0.4	-0.5	-0.9	-1.6	-0.8	-0.3	0.2	0.5
12 Miscellaneous goods and services	-2.4	-1.7	-1.4	-2.4	-1.8	-2.1	-1.2	-1.1	-0.8
General Index	**-2.0**	**-1.3**	**-1.6**	**-0.3**	**0.1**	**1.0**	**1.4**	**1.9**	**2.2**

Source: ELSTAT.

- **0.9% in the group Education.** This increase is mainly attributed to the rise in the prices of fees of secondary education (+1.4%).

- **0.5% in the group Hotels-Cafés-Restaurants.** This increase is mainly attributed to the rise in the prices of restaurants-confectioneries-cafés (+0.7%) and hotels-motels-inns (+9.5%).

On the other hand, prices decreased in the following groups of goods and services:

- **-0.5% in the group Clothing and footwear.** This decrease is mainly attributed to the fall in the prices of clothing and footwear.

- **-2.5% in the group Communication.** This decrease is mainly attributed to the fall in the prices of telephone services (-2.5%).

- **-0.1% in Alcoholic goods and tobacco.** This decrease is mainly attributed to the fall in the prices of wines (-2.6%).

- **-0.4% in the group Recreation and culture.** This decrease is mainly attributed to the fall in the prices of major durables for outdoor recreation (-1.3%).

- **-0.8% in the group Miscellaneous goods and services.** This decrease is mainly attributed to the fall in the prices of other appliances and articles for personal care (-1.1%) and motor vehicle insurance (-1.9%).

The Euro Area

The euro area annual inflation rate was 3.0% in August 2021; in September 2021, it is expected to be 3.4%, according to the flash estimates from Eurostat (PR 1/10/2021). According to the European Central Bank, the inflationary pressures exerted since Spring 2021 are expected to be of a temporary nature and last until the end of 2021, while inflation will gradually de-escalate in the first half of 2022.[4] Growing inflationary pres-

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4. A number of forecasts from both international organizations and private sector institutions (ECB, Euro Zone Barometer, Consensus Economics, IMF, Survey of Professional Forecasters, European Commission and OECD) estimate that, in 2021, inflation in the euro area will range between 1.8% and 2.2%, while in 2022, it is expected to de-escalate with average inflation well below 2.0% (1.3% and 1.7%).

FIGURE 1.2.2
HICP in the euro area, annual change (2015=100)

Source: ELSTAT (* flash estimates).
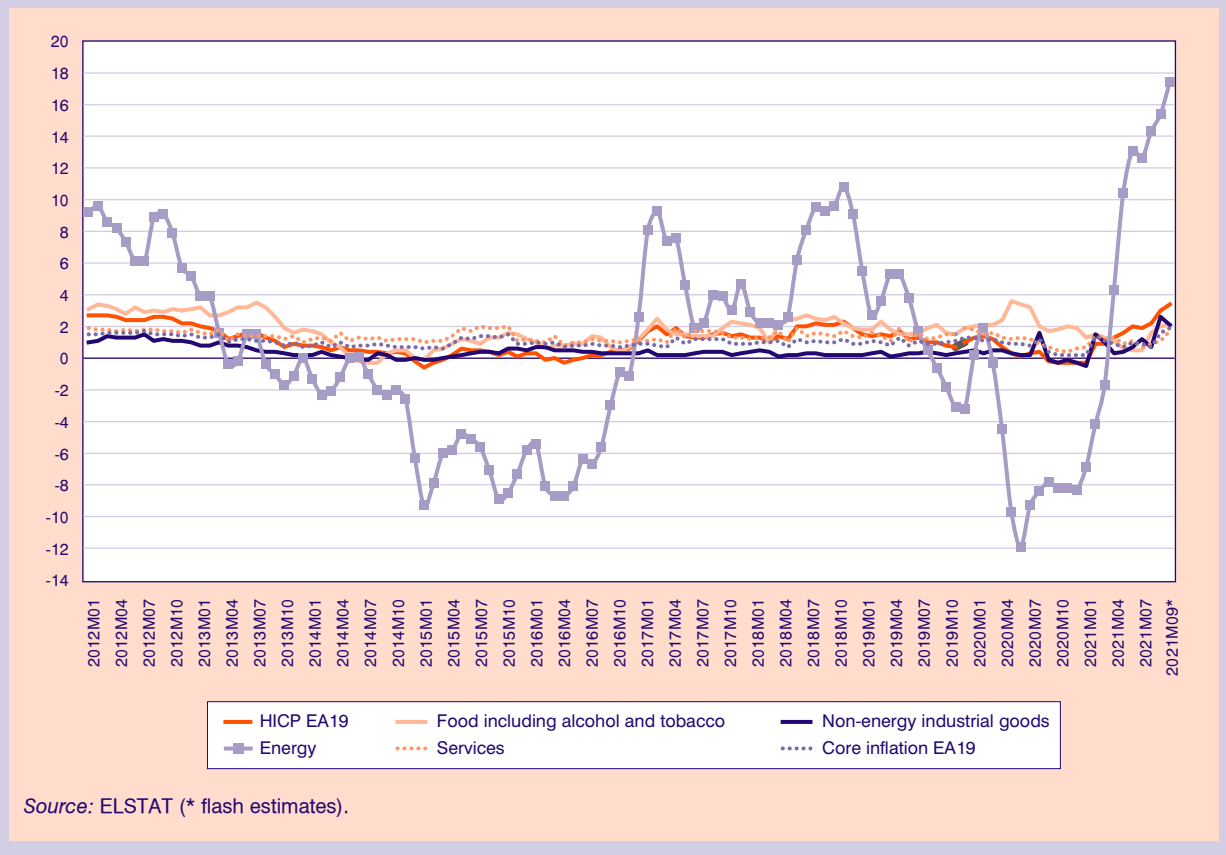
sures are due to (a) the strong base effect of the recovery in energy prices, which have declined significantly since the outbreak of the COVID-19 pandemic and the mobility restrictions; (b) the one-off increased costs of certain sectors reopening, which reflects energy costs, on the one hand, and the cost of adapting to new regulations and standards of behavior to limit the transmission of COVID-19, on the other; and c) bottlenecks in local and global supply chains due to stronger than anticipated demand recovery.

Specifically, according to Eurostat, the driving factor of inflation in the euro area is the ongoing upward movement in energy prices, with the sub-index reaching 17.4% in September, up from 15.4% in August, followed by the non-energy industrial goods sub-

index, which rose at a slower pace, from 2.6% in August to 2.1% in September. The food-alcohol-tobacco sub-index reached 2.1% in September, up from 2.0% in August, and the services sub-index 1.7%, up from 1.1%.

Among the euro area member states, the countries with the highest inflation in August 2021 were Estonia and Lithuania (5.0%) and Belgium (4.7%). On the other hand, the countries that showed lower inflation are Malta (0.4%), Greece (1.2%) and Portugal (1.3%). According to the flash estimates of Eurostat (1/10/2021) for September 2021, the countries with the highest inflation remain Estonia and Lithuania with 6.4% and 6.3%, respectively, followed by Slovakia with 5.1%, while the lowest inflation was recorded by Malta, Portugal and Greece with 0.7%, 1.3% and 2.1% respectively.

1.3. Factor model forecasts for the short-term prospects in GDP

Factor Model Economic Forecasting Unit
Ersi Athanassiou, Theodore Tsekeris, Ekaterini Tsouma

The current section presents the updated short-term forecasts of KEPE concerning the evolution of the rate of change of real GDP in Greece for 2021,[1] based on KEPE's dynamic structural factor model.[2] The underlying time series database used to estimate the model and produce the forecasts includes 126 variables,[3] covering the main aspects of economic activity in the country on a quarterly basis and spanning the time period from January 2000 up to June 2021.

As pointed out in the more recent issues of the *Greek Economic Outlook*, the extraordinary and constantly changing conditions caused by the COVID-19 pandemic significantly complicate the conduct of projections concerning the course of real GDP, due to both the ensuing uncertainty and the continuous alternation between periods of the implementation of restraining measures and periods of the partial and gradual lifting of restrictions. In addition, the technical forecasting procedure followed does not allow any direct consideration of policy measures that could potentially have major effects on economic activity, especially from the second quarter of 2021 onwards, such as the disbursement and progressive utilization of the Recovery and Resilience Facility funds.[4]

According to the factor model econometric estimates presented in Table 1.3.1 and having incorporated published (provisional) data up until the second quarter of 2021,[5] the mean annual rate of change for 2021 is projected at 7.9%, and the mean rate of change for the second half of 2021 is forecasted at 8.8%. The respective forecasts reflect, first, the significant recovery of the economy, compared to the previous year, in which the economic recession triggered by the pandemic reached -7.8% in terms of the mean annual rate of change of real GDP. Second, they constitute a considerable upward revision —compared to the preceding factor model forecasts[6]— of the rates of change for 2021 as a whole and for the second half of the year, which were both estimated at 4.7%. The implied recovery is further mirrored in the estimated quarterly rates of change (as compared to the respective quarters of the previous year) for the third and fourth quarters of 2021, which are forecasted at 11.5% and 6.1%, re-

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1. The date of the forecast is September 23, 2021.

2. A detailed description of the model can be found in Issue 15 (June 2011, pp. 19-20) of KEPE's scientific journal entitled *Greek Economic Outlook*. See <https://www.kepe.gr/images/oikonomikes_ekselikseis/issue_15enb.pdf>.

3. The database incorporates both real economy and nominal variables, as well as a considerable number of variables reflecting expectations and assessments of economic agents, as reported in earlier issues of the *Greek Economic Outlook*. The seasonal adjustment of the time series is carried out by use of the Demetra+ software, using the TRAMO/SEATS filter.

4. Note that the implementation of the dynamic factor model does not involve the explicit estimation of any effects caused by policy measures (policy neutral model), while the model itself is not suitable for a straightforward analysis of the impact caused by huge shocks, such as the COVID-19 pandemic, which create abnormal economic conditions and lead to sudden and extreme (away from the trend-determined course) shifts in GDP. Still, the model implicitly takes into account any impact, through the incorporation of the economic variables updated to the most recent period of reference (second quarter of 2021). Recall that the forecasts are obtained on the basis of a small number of 'factors', which summarise the information provided by a large number of explanatory variables, employing the procedure of principal components, with the aim to preserve as much of the variability of the underlying economic series as possible. Hence, in the current conjuncture, any assessment of the provided forecasts should be subject to the degree to which all short-run fluctuations in real economic activity are reflected and should, further, take into account the increased heterogeneity in the dynamic response of the economic series, in combination with the occurrence of outliers. In addition, the underlying data sample, which relies on quarterly data with a hysteresis of one quarter, does not mirror the most recent significant changes on a daily or weekly basis. All the aforementioned limitations might, in the current juncture, affect the forecasting performance of the factor model employed.

5. According to the most recent ELSTAT *Quarterly National Accounts* publication, dated September 7, 2021.

6. With respect to the preceding factor model forecasts, recall that, due to the non-availability of detailed data from the Quarterly Labour Force Survey for the first quarter of 2021 at the time of conducting the forecasts, the underlying data sample did not, by way of exception, include five variables related to individual subcategories of employment and unemployment aggregates, which are otherwise used as standard practice.

TABLE 1.3.1 Real GDP rate of change *(%, y-o-y)*

Quarters	2021	
	2021Q3	2021Q4
Quarterly rate of change	11.54 [11.22 , 11.85]	6.14 [5.65 , 6.63]
Second-half mean rate of change	8.84 [8.44 , 9.24]	
Mean annual rate of change*	7.90* [7.70 , 8.10]	

Note: Values in brackets indicate the lower and upper boundaries of the 95% confidence interval of the forecasts.

* The mean annual rate of change incorporates the officially available (provisional) data for the first and second quarters of 2021, on a seasonally adjusted basis.

spectively, and exceed in both cases the respective rates of change of the previous forecast (6.6% and 2.8%, respectively). Note that the observed gradual unwinding of growth rates — when also taking into account the 16.2% rate of change for the second quarter of 2021 published by ELSTAT— towards the end of the year is somehow anticipated, given the corresponding evolution of the contraction during 2020, mounting in the second quarter and de-escalating afterwards.

The above-presented forecasts for the course of real GDP in 2021 reflect the rebalancing of economic conditions, inasmuch as the deep 2020 recession seems to be largely counterbalanced by the projected expansion in 2021. The respective development results from the improved epidemiological situation and the implied gradual reestablishment of the smooth operation of economic activity from the second quarter of 2021 onwards, following the strict implementation of measures to protect human health earlier in 2021 and the advancement of the vaccination programme in the country. The aforementioned favourable outlook for 2021 is reflected in the noteworthy positive course — during the second quarter of 2021— of the majority of the economic variables and indicators (on a non-seasonally and non-calendar adjusted basis) underlying the forecast.

In more detail, all GDP main components recovered considerably during the second quarter of 2021, compared to the respective quarter of 2020. Private consumption expenditure, consumption expenditure by the General Government, overall investment, and exports of goods and services recorded significant — and in most cases double-digit (except for the General Government consumption expenditure) — positive rates of change. A marked increase characterised most of the

individual investment sub-categories. Remarkably favourable developments were indicated by the evolution of the industrial production index, in terms of the general index and all the sub-indexes, as well as the turnover index in industry, for the overall market and both the external and the internal markets, with double-digit positive rates of change in the second quarter of 2021 (as compared to the respective quarter of 2020) in all cases. Similar developments characterised retail trade, with double-digit positive rates of change in the overall volume index and seven of the underlying sub-indexes (and single-digit positive rates of change in the cases of the *supermarkets* and *automotive fuel* subcategories). Construction and building activity also recorded a rising course, as indicated by the markedly favourable developments in the production indexes in construction and the considerable upswing in private building activity in terms of volume on the basis of permits issued. Similar dynamics in the same positive direction characterised the General Index of the Athens Stock Exchange, passenger car licenses, the turnover index for motor trade (*wholesale and retail trade, repair of motor vehicles and motorcycles*), the turnover index in wholesale trade, transport receipts and, in particular, travel receipts, which recorded an impressive rebound (607.8%), as compared to the second quarter of 2020. An improvement was further registered in terms of cost/price competitiveness, as implied on the basis of the majority of the underlying relevant indicators, while positive developments characterised spreads, which declined significantly, as compared to the respective quarter of 2020 (note that they recorded an increase, compared to the first quarter of 2021). With regard to indicators reflecting agents' expectations and assessments of the course of the economy, developments during the second quarter of 2021, as compared to

the respective quarter of the previous year, were exceptionally favourable, with the positive developments in export expectations for the months ahead, business expectations in construction and new orders in recent months in industry standing out.

With reference, finally, to the domestic labour market conditions in the second quarter of 2021, there were positive signals from an increase in both total employment and employment in the primary and tertiary sectors (despite the marginal decline in employment in the secondary sector), as well as from a moderation in both total and long-term unemployment (although there was a modest increase in the newly unemployed).

The projected course of real GDP in 2021 might develop according to a less or more favourable scenario —than indicated by the above-presented forecasts— depending on the effects of a number of crucial and dynamic factors, a number of which continue to be directly intertwined with the evolution of the pandemic. All these factors will determine, among other things, demand and supply dynamics, Greece's export performance, investment and saving decisions by households and enterprises, employment and unemployment aggregates and, hence, income, as well as financial conditions and fiscal aggregates.

Factors that could potentially operate in the positive direction include: (a) the predominance of a favourable scenario with reference to the evolution of the pandemic during the second half of 2021, on the basis of greater progress in the field of vaccinations and lower infection rates, that would imply the creation of a secure environment for the unfolding of economic activity, on domestic and international levels, (b) the extension of targeted support measures, in order to preserve the support for businesses and employment, in all sectors deemed necessary and (c) the initiation of the National Recovery and Resilience Plan, by making use of the Recovery and Resilience Facility resources, in order to boost investment and complete crucial structural reforms with the aim to transform and promote innovation in the Greek economy.

Factors that could potentially operate in the negative direction include: (a) the high degree of uncertainty with respect to the short-term evolution of the pandemic, which could cause, among other things, a further withholding in major economic aggregates, (b) any potential adverse development with respect to the pandemic towards the end of the year, severe enough to once again negatively affect economic activity in the country, (c) the expected impact on production costs and final consumer prices of price increases in food and raw materials and the upsurge in transportation costs, and (d) any unwarranted development in the direction of an aggravation of geopolitical tensions and a deterioration of the prevailing conditions with respect to migration waves.

1.4. Positive messages from the Greek capital market

Fotini Economou

1.4.1. Introduction

The ongoing health crisis that began in early 2020 continues to create an environment of uncertainty about its outcome and the potential impact a new peak may have on the economy and society. Nevertheless, the Greek economy shows significant signs of recovery, with positive prospects based on significant macroeconomic figures/indicators. These developments were followed by the recent upgrade of Greece's credit rating, on September 17, 2021, by the rating agency DBRS Morningstar, from BB (Low) to BB (with a positive outlook), following the upgrade by the rating agency Scope Ratings from BB to BB+ (with a stable outlook) on September 10, 2021.

In this context, the Greek stock market completed the first eight months of 2021 with a positive sign for the majority of indices and other stock market data, with the medium capitalization stocks standing out. At the same time, government bond yields remained at low levels, making it possible to raise funds at low cost, while the picture was also positive for the institutional management sector in the first half of 2021.

This article presents the course of the Greek stock market since the beginning of 2021 with emphasis on key stock market indices and data. In addition, the course of the bond market and the institutional management sector is presented. Finally, the last section of the article summarizes and concludes.

1.4.2. The recent course of the stock market since the beginning of 2021

The data of the Athens Stock Exchange (ATHEX) for the recent course of the stock market indicate the medium capitalization as the protagonist of the returns at an eight-month level. More specifically, according to ATHEX data (Table 1.4.1), the Athex Composite Share Price Index increased by 14.11%, reaching 923.15 points at the end of August 2021 from 808.99 points

at the end of December 2020, and reached an annual high during August 2021. The FTSE/Athex Large Cap Index followed a similar course, recording an increase of 14.45% and reaching 2,214.27 points at the end of August 2021 from 1,934.64 points at the end of December 2020. In the same period, the FTSE/ATHEX Mid & Small Cap Factor-Weighted Index increased by 37.59%, and the FTSE/Athex Mid Cap Index recorded a return of 37.01%.

The course of the sector indices was also particularly positive, with the FTSE/Athex Technology and FTSE/Athex Industrial Goods & Services recording the highest returns of 59.42% and 33.98%, respectively. FTSE/Athex Telecommunications, FTSE/Athex Basic Resources, FTSE/Athex Travel & Leisure and FTSE/Athex Construction & Materials followed, with returns of over 20% (28.56%, 24.60%, 21.25% and 20.56%, respectively). Moreover, negative returns were recorded by the FTSE/Athex Personal Products (-2.84%) and FTSE/Athex Consumer Goods & Services (-3.67%).

According to ATHEX data (2021), the market capitalization of the ATHEX (assets under custody of domestic and foreign investors in total listed equities with the participation of the Financial Stability Fund) reached €56.22 billion at the end of August 2021, increased by 5.8% compared to the end of the previous month (€53.13 billion). The participation of foreign investors was 62.8% and 37.2% for domestic investors. Note that foreign investors recorded inflows for the fourth consecutive month, with inflows of €29.8 million in August 2021. In addition, foreign investors made 50.2% of transactions in August 2021, recording a decrease from 61.6% of the previous month (Figure 1.4.1).

Moreover, according to ATHEX data (2021), the value of transactions for the whole market reached €1,004.45 million in August 2021, reduced by 33.12% compared to the previous month, which was at €1,501.83 million. However, the value of transactions increased by 57.39% compared to August 2020, which was at €638.18 million. More specifically, focusing on equities, the cash value of settled transactions of equities for the eight months of 2021 amounted to €12.09 billion, higher compared to the eight months of 2020, which was at €10.74 billion. According to the data of August 2021, the cash value of settled transactions of equities decreased to €0.97 billion compared to the

TABLE 1.4.1 Prices and returns for selected indices of the ATHEX (31/12/2020-31/8/2021)

	31/8/2021	31/12/2020	Year min	Year max	Year change (%)
FTSE/ATHEX Mid & Small Cap Factor-Weighted Index	4,298.59	3,124.15	2,996.13	4,351.02	37.59%
FTSE/Athex Mid Cap Index	1,517.17	1,107.38	1,026.21	1,532.23	37.01%
Athex All Share Index	230.88	187.55	175.88	232.71	23.10%
Hellenic Mid & Small Cap Index	1,427.77	1,202.50	1,110.37	1,442.42	18.73%
FTSE/Athex Large Cap	2,214.27	1,934.64	1,718.82	2,259.27	14.45%
Athex Composite Share Price Index	923.15	808.99	726.02	931.94	14.11%
FTSE/Athex Technology	1,741.42	1,092.34	1,043.00	1,768.24	59.42%
FTSE/Athex Industrial Goods & Services	3,929.63	2,932.95	2,762.19	3,996.37	33.98%
FTSE/Athex Telecommunications	4,685.27	3,644.51	3,294.37	4,734.07	28.56%
FTSE/Athex Basic Resources	7,667.65	6,153.83	5,233.31	8,597.84	24.60%
FTSE/Athex Travel & Leisure	2,100.61	1,732.48	1,540.34	2,174.23	21.25%
FTSE/Athex Construction & Materials	3,328.79	2,761.06	2,565.75	3,422.77	20.56%
FTSE/ATHEX Real Estate	5,678.87	4,825.18	4,187.35	5,770.64	17.69%
FTSE/Athex Energy	3,460.60	2,964.77	2,835.10	3,724.35	16.72%
FTSE/Athex Food & Beverage	11,470.27	9,885.18	9,045.03	12,311.96	16.04%
FTSE/Athex Utilities	5,306.94	4,602.67	4,264.97	5,410.79	15.30%
FTSE/Athex Retail	56.27	49.57	46.54	58.68	13.52%
FTSE/Athex Banks	565.88	518.99	405.46	639.42	9.03%
FTSE/Athex Insurance	2,056.78	1,909.42	1,885.00	2,192.44	7.72%
FTSE/Athex Financial Services	793.66	763.95	679.98	843.74	3.89%
FTSE/Athex Personal Products	8,786.95	9,043.89	8,270.74	9,116.06	-2.84%
FTSE/Athex Consumer Goods & Services	7,496.62	7,781.92	6,939.31	9,231.17	-3.67%

Source: Daily official list of trading activity of the ATHEX (31/8/2021 and 31/12/2020).

previous month, which was at €1.47 billion, although it increased compared to August 2020, which was at €0.64 billion (see Figure 1.4.2).

Finally, the KEPE GRIV implied volatility index, i.e., the so-called "fear" index, also recorded a decrease. The KEPE GRIV index reflects the uncertainty of the derivatives market participants about the expected short-term course of the Greek market and is calculated on the basis of the FTSE/ATHEX Large Cap options prices. The KEPE GRIV index decreased in August 2021, reaching 24.26% on 31/8/2021 from 25.31% on 30/7/2021, close to the level it had at the end of December 2020, at 23.97% on 31/12/2020. The index remained below its historical average level (since January 2004) for the Greek market, which stands at 32.77%, while the average daily value of the index also decreased in August 2021, reaching 24.49% from 24.81% in July 2021. The evolution of the index reflects a decrease in uncertainty for the expected short-term course of the Greek market.

FIGURE 1.4.1
Participation of foreign and domestic investors in the total transaction value of the ATHEX (%)
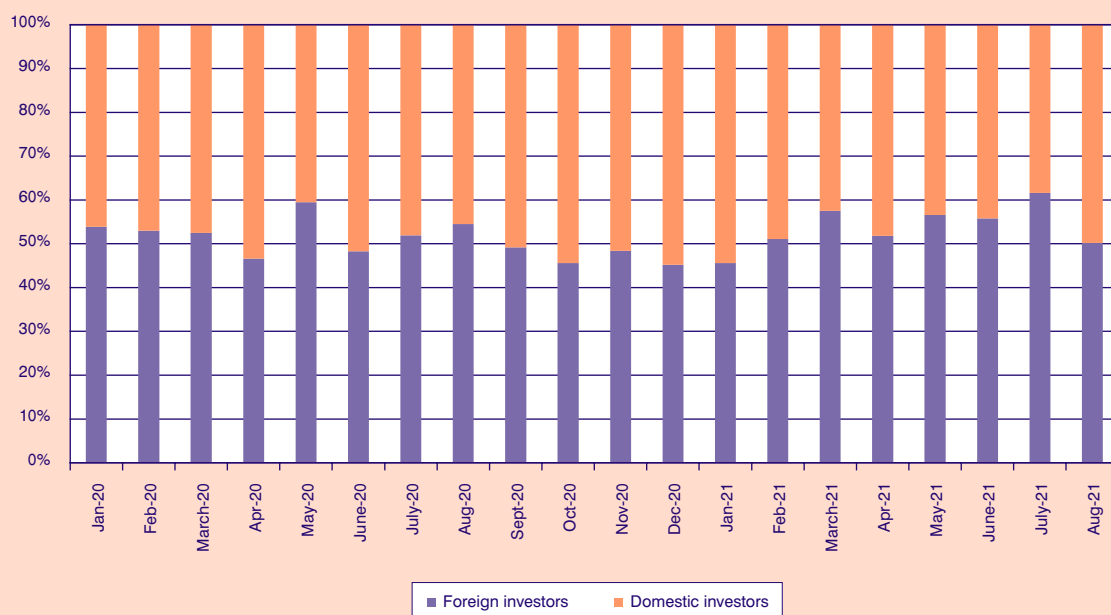
Source: Athens Exchange Group, Monthly Statistics Bulletin AxiaNumbers, Securities Market, December 2020, March 2021 up to August 2021.

FIGURE 1.4.2
Cash value of settled transactions, January 2020-August 2021 (in million €)
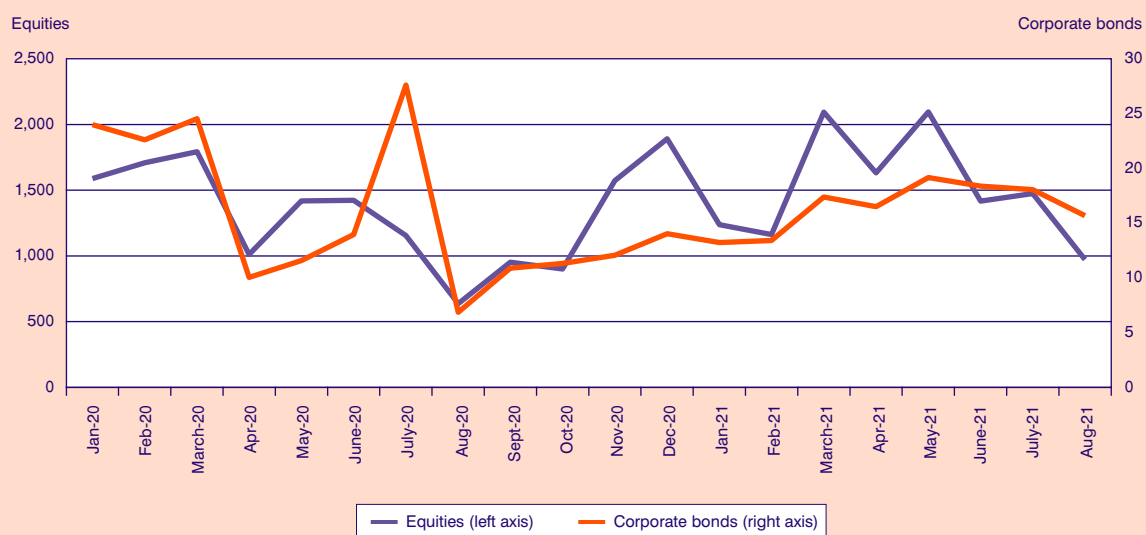
Source: Athens Exchange Group, Monthly Statistics Bulletin AxiaNumbers, Securities Market, December 2020 and August 2021.

1.4.3. Greek Government T-bills, Greek Government bonds and corporate bonds

During the period under examination, the successful issues of the Greek Government continued, making it possible to raise funds at low borrowing costs. As shown in Table 1.4.2, the yields of all issues of 13-, 26- and 52-week Government T-bills issued in 2021 were negative.

According to Bank of Greece data, the yields on Greek Government bonds with maturities of 3, 5, 7, 10, 15 and 20 years were reduced in August 2021 compared to December 2020, with the largest decrease observed in the 7-year Greek government bonds, while the yields on the 30-year bonds increased slightly (Table 1.4.3). Focusing on the course of the 10-year bond yield, it reached a new historically low level in August 2021, with the average monthly yield remaining at levels below 1% throughout the eight months of 2021 (Figure 1.4.3). It is also worth mentioning the successful simultaneous reissue of 5-year and 30-year bonds of September 2021, from which a total of €2.5 billion was raised (€1.5 billion from the 5-year and €1 billion from the 30-year bond). The reissue of the 5-year bond (0% coupon) had a yield of 0.02%, which is a new re-

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TABLE 1.4.2 Greek Government T-bills yields (issues from January 2021 to the beginning of September 2021)

Auction date	13 weeks	Auction date	26 weeks	Auction date	52 weeks
4/8/2021	-0.40%	25/8/2021	-0.39%	8/9/2021	-0.31%
7/7/2021	-0.40%	28/7/2021	-0.39%	9/6/2021	-0.31%
5/5/2021	-0.40%	30/6/2021	-0.39%	10/3/2021	-0.22%
7/4/2021	-0.32%	2/6/2021	-0.36%		
3/2/2021	-0.32%	28/4/2021	-0.32%		
5/1/2021	-0.32%	31/3/2021	-0.24%		
		24/2/2021	-0.28%		
		27/1/2021	-0.28%		

Source: Ministry of Finance.

TABLE 1.4.3 Monthly average yield (%) of Greek Government benchmark bonds (Dec. 2020-Aug. 2021) for maturities of 3, 5, 7, 10, 15, 20 and 30 years

Maturity (years)	3	5	7	10	15	20	30
December 2020	-0.12	-0.06	0.32	0.63	0.89	0.99	1.08
January 2021	-0.13	-0.02	0.33	0.65	0.94	1.05	1.16
February 2021	-0.10	0.08	0.37	0.81	1.07	1.17	1.28
March 2021	-0.11	0.10	0.44	0.91	1.22	1.37	1.58
April 2021	-0.16	-0.01	0.33	0.89	1.22	1.52	1.93
May 2021	-0.13	0.17	0.38	0.99	1.27	1.49	1.99
June 2021	-0.22	0.07	0.20	0.81	1.00	1.22	1.69
July 2021	-0.32	-0.08	0.07	0.70	0.85	1.07	1.52
August 2021	-0.38	-0.18	-0.06	0.59	0.70	0.91	1.36

Source: Bank of Greece.

Source: Bank of Greece, Greek Government benchmark bond yields.

Note: There is no observation for July 2015 due to the bank holiday.
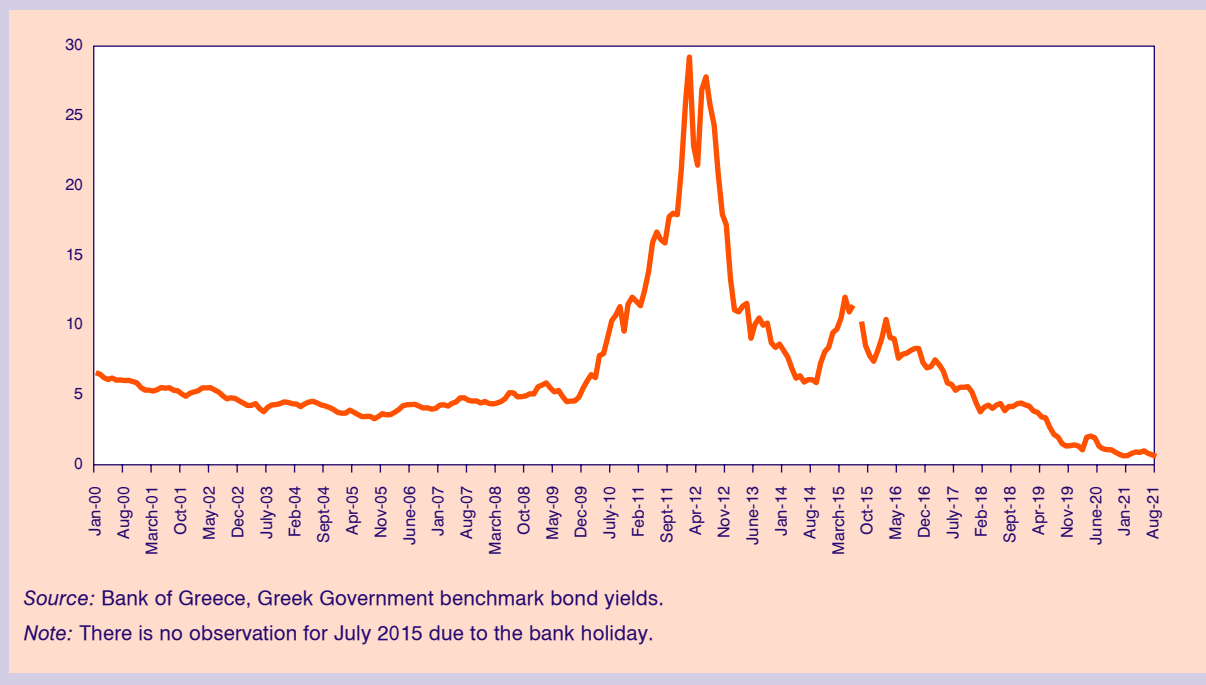
cord low, and the reissue of the 30-year bond (coupon 1.875%) had a yield of 1.675%, lower than the respective issue of March 2021, which was at 1.956%.

Moreover, according to ATHEX (2021) data, the course of the corporate bond indices was also positive. The Hellenic Corporate Bond Price Index[1] recorded a return of 2.67%, while the Hellenic Corporate Bond Index[2] had a return of 4.75% for the first eight months of 2021.[3] In addition, even though the cash value of the settled transactions of corporate bonds decreased to €131.76 million in the first eight months of 2021, from €141.15 million in the corresponding period of 2020, the cash value of the settled transactions in August 2021 was at €15.67 million, i.e., higher compared to August 2020, which was at €6.87 million (see Figure 1.4.2).

1.4.4. The course of the institutional management sector

The course of the institutional management sector is also positive. According to the Hellenic Fund and Asset Management Association (2021) data for the first half of 2021, the total amount of funds under management amounted to €20.4 billion, recording an increase of 12.63% compared to 31/12/2020. The composition of these funds on 30/6/2021 concerned 48.4% in Undertakings for Collective Investment in Transferable Securities (UCITS), 36.1% in the Asset Management sector, 14.9% in Real Estate Investment Companies (REICs)[4] and 0.6% in Alternative Investment Funds (AIFs).

Focusing on the UCITS managed by Greek Mutual Fund Management Companies, on 30/6/2021, the total assets under management reached €9.85 billion (€7.4 billion in UCITS Law 4099/12 and €2.45 billion in EU UCITS), recording an increase of the total assets of 11.4% compared to the previous quarter and an increase of 21.7% since the beginning of the year. Of these assets, 34% are bond UCITS, 23% balanced, 20% Funds of Funds, 16% equity, 4% money market and 3% specialist. Note that the inflows of funds to UCITS continue for the fifth consecutive quarter, with total inflows since the beginning of the year exceed-

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1. Based on the net price of each bond.

2. Based on the net price, accrued interest and the value of the payments of each bond.

3. Returns on 27/8/2021 according to the daily official list of trading activity of the ATHEX of 31/8/2021.

4. On 31/12/2020 (latest published data), see Hellenic Fund and Asset Management Association (2021).

ing €1.37 billion. In addition, positive returns were recorded by almost all categories of UCITS with the highest returns recorded by Equity Funds – Emerging Markets (17.27%), Equity Funds – Developed Markets (14.43%), Equity Funds – Greece (13.62%) and Equity Funds - Eurozone (12.87%).

1.4.5. Conclusions

The messages that emerge for the Greek capital market from the analysis of the data for the eight months of 2021 are positive. More specifically, the majority of stock indices and other stock market data moved upwards with the medium capitalization standing out, while the sector indices FTSE/Athex Technology and FTSE/Athex Industrial Goods & Services recorded impressively high returns. At the same time, the successful issues of the Greek Government continued at low borrowing costs, reflecting the confidence of the inter-national markets in the Greek economy. Equally positive was the course of the institutional management sector in the first half of 2021. Finally, it is worth noting that the two upgrades of Greece's credit rating by the international rating agencies DBRS Morningstar and Scope Ratings in September 2021 bring the Greek economy closer to its goal of returning to investment grade. However, the challenges posed for the markets by the health crisis remain, as does the uncertainty associated with its outcome and a possible new peak.

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1.5. International environment: Recent developments and prospects of the global economic activity

1.5.1. Trends and developments in the global economy

Aristotelis Koutroulis

Global economic activity continues to recover rapidly on the back of supportive policies and the deployment of effective vaccines against Covid-19. At the same time, the direction of economic policy as well as future developments regarding public health constitute the main sources of uncertainty.

Economic activity

The world economy seems to move along a path of strong recovery with global GDP already exceeding the levels recorded before the outbreak of the global health crisis. The key drivers of the global economic upturn include the deployment of effective vaccines, expansionary economic policies, and the gradual resumption of most productive sectors. (ECB, 2021; IMF, 2021; OECD, 2021).

Though the global economy is expected to grow by 6 percentage points in 2021 (see Table 1.5.1), global GDP last July was 3.5% lower than projected before

TABLE 1.5.1 Real Gross Domestic Product[1,2]
(annual percentage changes)

	2019*		2020*		2021**		2022**	
	IMF	OECD	IMF	OECD	IMF	OECD	IMF	OECD
World economy	2.8	2.7	-3.2	-3.4	6	5.7	4.9	4.5
Advanced economies	1.6	:	-4.6	:	5.6	:	4.4	:
USA	2.2	2.2	-3.5	-3.4	7	6	4.9	3.9
Euro Area	1.3	1.3	-6.5	-6.5	4.6	5.3	4.3	4.6
Japan	0.3	0	-4.7	-4.6	2.8	2.5	3	2.1
United Kingdom	1.4	1.4	-9.8	-9.8	7	6.7	4.8	5.2
Developing economies	3.6	:	-2.1	:	6.3	:	5.2	:
Brazil	1.4	1.4	-4.1	-4.4	5.3	5.2	1.9	2.3
Russia	2	:	-3	-2.5	4.4	2.7	3.1	3.4
India	1	4	-7.3	-7.3	9.5	9.7	8.5	7.9
China	5.8	6	2.3	2.3	8.1	8.5	5.7	5.8

Sources: IMF, *World Economic Outlook, Update,* July 2021; OECD, *OECD Economic Outlook, Interim Report September 2021.*

* Estimations, ** Projections.

Notes: 1. The observed differences between the available macroeconomic projections partly reflect the differences between the macro-econometric models and the data used by each international organization.
2. The sub-group of emerging economies is included in the group of developing economies.

the pandemic (OECD, 2021). Expressed in terms of real income; this amounts to USD 4.5 trillion (in 2015 PPPs) (OECD, 2021).

The geographical distribution of the global economic recovery remains uneven (IMF, 2021). In particular, countries that have managed to effectively control the spread of the pandemic due to improved access to vaccines and countries with enough space for economic policy maneuvers register higher economic growth rates. On the contrary, a weaker recovery is recorded in financially constrained countries or in countries where the process of mass vaccination evolves at a slow pace (OECD, 2021).

Although fiscal spending is expected to moderate over the next year, global GDP is projected to rise by more than 4.5% in 2022 (see Table 1.4.1). Growth is expected to be led by stronger consumer spending that will be financed out of the large stock of accumulated savings (ECB, 2021; EC, 2021; OECD, 2021).

Inflation and Unemployment

In 2021, consumer price inflation in advanced economies and the rest of the world is projected to average 2.4% and 5.4%, respectively. This development primarily reflects the transition of the global economy from negative to positive GDP growth rates. Other factors that have added to the upward pressure on inflation include rising commodity and energy prices, higher transportation costs, and shortages of intermediate goods (EC, 2021; IMF, 2021; OECD, 2021). In 2022, the most likely scenario is that consumer prices will maintain their upward trend. Increased inflation rates are expected to be strongly influenced by rising consumer spending and slow supply adjustment to higher demand (OECD, 2021).

So far, the rise in global economic activity has not been accompanied by a corresponding increase in employment. In some countries, such as the USA, although GDP has returned to pre-crisis levels, average employment (in terms of employed persons) is lower compared to 2019. In other countries, mainly EU member-states, while excessive unemployment was prevented, total working hours remain very low. Differences in the picture of labor markets in the US and Europe partly reflect the different government choices in terms of objectives and tools for intervention in these markets. In Europe, where the main policy objective was to retain jobs, businesses were encouraged to adapt to demand fluctuations by changing employees' working hours. In the US, on the other hand, where companies responded to low demand with layoffs, re-hiring due to the changing economic climate appears to be a rather time-consuming process (OECD, 2021).

The health crisis has brought considerable insecurity and hardships (i.e., job losses, low rewards, and poverty) to certain groups of workers. Young people, women, immigrants, and low-skilled workers are identified as the most vulnerable. The situation is particularly worrisome for the low-skilled workers in low-income developing economies. According to the IMF, the total number of workers crossing the extreme poverty line due to the pandemic is expected to increase by 80 million worldwide (IMF, 2021).

1.5.2. World trade and commodity prices

The volume of global trade (goods and services) is projected to grow by 9.7% in 2021 (see Table 1.5.2). The expansion of the trade volume of global goods during the first half of the year largely owns to the

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TABLE 1.5.2 World trade volume[1]

	Volume of international trade - goods and services (annual percentage changes)			
	2019*	2020*	2021**	2022**
World economy	0.9	-8.3	9.7	7
Advanced economies	1.4	-9.2	8.9	7.1
Developing economies	-0.2	-6.7	11.1	6.9

Source: IMF, *World Economic Outlook, Update,* July 2021.

* Estimations, ** Projections.

Note: 1. The sub-group of emerging economies is included in the group of developing economies.

strong demand for pandemic-related products, medical equipment, and durable goods. Despite supply bottlenecks in manufacturing, trade in manufacturing goods for consumption purposes has been on the rise since last July. As for services trade, it shows signs of gradual recovery. However, its return to pre-pandemic levels remains subject to developments on the public health front (IMF, 2021).

The rebound of global demand in combination with inventory depletion and supply-side disruptions have added considerable pressure on commodity prices. According to the OECD, commodity prices over the July-August period were 55% higher than a year earlier. International oil prices have returned to pre-crisis levels and food prices have already hit a decade high (OECD, 2021). While these price developments favour countries with a large share of exports earnings drawn from commodities, commodity price hikes may have significant detrimental growth effects on commodity importers. Beyond economic risks, rising commodity prices could possibly fuel humanitarian risks. For example, given that acute food insecurity has been on the rise since 2017, the upward trend of agricultural products prices might increase the frequency and severity of food crises in low-income developing economies.

1.5.3. Sources of uncertainty

Nearly one year and a half after the Covid-19 pandemic started, the scientific evidence regarding the end of the pandemic is, at best, mixed. Moments of hope that effective vaccines and herd immunity will bring us closer to this end alternate with moments of pessimism. For economists, the need to continuously recalibrate our expectations about future events, events powerful enough to change the course of the economy for bad or for good, constitutes the ultimate source of uncertainty.

Another important source of uncertainty is related to the choices of national governments regarding the orientation of their macroeconomic policies in the short and medium term. As OECD analysts point out, the current situation requires the adjustment of monetary and fiscal policy to the needs of each national economy. As long as household and business sentiment remains low, it is hard to believe that private expenditures alone can bear the burden of economic recovery. At the same time, rising public debt, and most recently, rising inflation, reminds us that expansionary policies have come at a great cost. The challenges facing many national economic authorities across the globe are quite daunting. Do governments possess the necessary policy tools to keep a balance between supportive policies, on the one hand, and fiscal sustainability and price stability, on the other? If not, which problem is more pressing under the current conditions? There is also the question of whether and how governments facing different challenges will manage to coordinate their policy actions to avoid negative spillovers from policy choices in one country into another.

The large amount of variation in economists' answers to the above questions is indicative of the high degree of uncertainty that surrounds policy responses at this economic conjuncture.

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2. Fiscal developments

State Budget, public debt, and fiscal figures perspectives

Elisavet I. Nitsi

2.1. The 2021 State Budget execution and the 2022 Preliminary Draft State Budget

The 2022 Preliminary Draft State Budget was recently submitted to the Greek Parliament. The Draft, in addition to the 2022 Budget, also contains estimations of both the macroeconomic figures and the execution of the 2021 Budget. Table 2.1.1 presents the State Budget data of 2021 and 2022 as well as the Medium-Term Fiscal Strategy Framework (MTFS) 2022-2025.

The 2021 State Budget execution

For the present year, 2021, and according to the data, the real Gross Domestic Product (GPD) growth rate of the country is estimated to reach 6.1%. This forecast of the Ministry of Finance is based on recent data announced by ELSTAT for the GDP's change in the second quarter of 2021. This estimate is higher than the forecasts of the international organizations, of about 4%, and the MTFS 2022-2025, which predicted a growth rate of only 3.6%. This improvement is mainly due to the recovery of economic activity after the deep crisis owed to the pandemic and is expected to be even more favorable when the country's data on tourism are included, as tourism activities opened mainly in the third quarter. The first data show a very successful tourist season, which is now compared, in financial results, with that of 2019.

The 2021 fiscal figures of the Draft Budget display a deviation from the Budget's forecasts, as it was submitted, while the MTFS 2022-2025 estimates are relatively close. More specifically, revenues are expected at 50.1 billion euros (28.3% of GDP), reduced by 2.4 billion euros or 4.6% compared to the 2021 Budget forecast, and only 415 million euros or 0.8% compared to the MTFS 2022-2025. Accordingly, the expenditures are estimated at 70.7 billion euros (40% of GDP), increased by 3.5 billion euros or 5.2% from the Budget and only 606 million euros or 0.9% from the MTFS 2022-2025. These discrepancies resulted in an increased estimate for the Primary State Budget deficit, according to the ESA, at 15 billion euros (8.5% of GDP), increased by 7 billion euros or 87.7% compared to its 2021 Budget forecast, and 1 billion euros or 7.3% compared to the MTFS 2022-2025 estimate. The figures of the State Budget deficit, according to the ESA of 2021, amounted to 20.6 billion euros (11.7% of GDP), with discrepancies of 5.9 billion euros or 40% and 1 billion euros or 5.2%, respectively. It is important to mention the significant increase of the Public Investment Program's (PIP) expenditures: that is, an increase of 1.6 billion euros or 23.7% compared to the Budget forecast and 350 million euros or 4.4% compared to the MTFS 2022-2025 estimate, which shows an investment orientation, if the expenditure for the pandemic needs were included in the estimation of the MTFS.

Preliminary Draft Budget 2022

Regarding the 2022 Preliminary Draft Budget, the macroeconomic forecast for the country's GDP growth rate is 4.5%, showing a growing Greek economy, due both to the increase in economic activity and to investment spending due to the resources flow into the Greek economy from the Recovery and Sustainability Fund (RSF). However, this forecast is lower than those of the international bodies (OECD and IMF 5%, European Commission 6%) as well as the MTFS 2022-2025 with 6.2%. This downward revision came due only to the high growth of 2021, but also to the fact that the pandemic consequences are expected to affect the economy in 2022. However, overall, the expected growth in 2021-2022 is particularly significant and much higher than the expected average economic growth in EU countries.

In fiscal terms, the Preliminary Draft foresees a significant reduction of the State Budget's deficits with a simultaneous increase of revenues and a reduction of expenditures compared to the estimates for 2021. The

TABLE 2.1.1 State Budget figures, million € on a modified cash basis

	2021			2022	
	Budget Forecast 2021	**MTFS 2022-2025**	**Preliminary Draft Budget Estimate 2022**	**MTFS 2022-2025**	**Preliminary Draft Budget Forecast 2022**
State Budget					
Net Revenue	**52,469**	**50,489**	**50,074**	**54,822**	**54,675**
Taxes *From which:*	47,836	45,530	45,440	49,433	49,519
VAT	17,466	16,998	17,175	18,797	18,752
Excise taxes	6,601	6,594	6,471	7,009	7,049
Regular property tax	2,667	2,620	2,562	2,578	2,502
Personal income tax	10,193	9,585	9,460	10,157	10,111
Business income tax	3,416	2,309	2,348	3,211	3,595
Other current taxes	2,419	2,352	2,170	2,404	2,222
Social contributions	54	55	55	55	55
Transfers	6,842	6,541	6,163	7,164	7,377
Sales of goods and services	656	649	652	726	764
Other current revenue	2,007	2,197	2,568	2,289	2,025
Sales of fixed assets	330	336	36	26	26
Tax refunds	5,256	4,820	4,841	4,290	4,290
Expenditure	**67,184**	**70,071**	**70,677**	**62,994**	**64,335**
Compensation of employees	13,531	13,476	13,444	13,468	13,474
Social benefits	199	194	202	198	219
Transfers	30,804	36,161	37,493	29,548	29,612
Purchases of goods and services	1,084	1,685	2,040	1,202	1,004
Subsidies	80	80	338	80	80
Interest payments (gross basis)	5,700	5,560	5,560	5,600	5,550
Other current expenditure	91	91	89	51	101
Non allocated expenditure (without PIB)	14,094	11,179	9,925	12,214	13,141
Purchase of fixed assets	1,599	1,644	1,586	632	1,153
Public Investment Program (PIP)					
Revenue	4,092	4,800	4,800	4,290	4,290
Expenditure	6,750	8,000	8,350	7,250	7,450

TABLE 2.1.1 (continued)

	2021			2022	
	Budget Forecast 2021	MTFS 2022-2025	Preliminary Draft Budget Estimate 2022	MTFS 2022-2025	Preliminary Draft Budget Forecast 2022
State Budget Primary Balance	-8,015	-14,022	-15,044	-2,572	-4,110
% GDP	-5.2%	-8.1%	-8.5%	-1.4%	-2.2%
State Budget Balance	-14,715	-19,582	-20,604	-8,172	-9,660
% GDP	-8.8%	-11.4%	-11.7%	-4.4%	-5.2%
GDP	171,934	172,089	176,855	184,658	186,479

Sources: Preliminary Draft State Budget 2022, Ministry of Finance.
State Budget Introductory Report 2021, Ministry of Finance.
Medium-Term Fiscal Strategy 2022-2025, Ministry of Finance.

* Deficit (-)/Surplus (+).

State Budget's primary result, according to the ESA, will be restricted to a deficit of 4.1 billion euros (2.2% of GDP), while the total result will be 9.7 billion euros (5.2% of GDP), reduced by 10.9 billion euros or 72.7% and 10.9 billion euros or 53.1%, respectively. More specifically, net revenues, expected to reach 54.7 billion euros (29.3% of GDP), are increased by 4.6 billion euros or 9.2%, while expenditures will reach only 64.3 billion (34.5% of GDP), reduced by 6.3 billion euros or 9% compared to the 2021 figures. The increase in revenue is anticipated to arise from increased VAT and Income Tax collectivity, mainly from businesses, but also Transfers, while the reduced expenditures will come from Transfers (7.9 billion euros or 21% more than in 2021) and secondarily from the Purchase of Goods and Services. An increase in expenditure is expected only by the Appropriations under Distribution, as they are necessary to cover the needs arising from the pandemic as well as the energy crisis that is expected at the end of 2021, until 2022.

However, the submitted Preliminary Draft Budget is expected to be revised in the final draft of the 2022 Budget in November or in the Stability and Growth Plan in April 2022. These revisions concern expected developments that could not be predicted and/or measured accurately in the preparation of the draft, as these developments were simply not apparent at the time. These revisions concern the growth rate of the Greek economy, which is expected to be higher for 2021, but lower for 2022. Relevant revisions have already been made by international organizations (IMF from 5% to 6.5%). An upward revision of GDP growth will result in a revision of revenue; more revenue will arise due to the multiplier.

In addition, an upward revision of spending is expected as additional measures may be needed to contain energy prices, basic inputs and goods and transport costs, as well as measures to address both pandemic and post-pandemic problems and the problems it has created, such as health issues that patients neglected due to the pandemic, but also issues created by the pandemic, such as mental health problems due to restricted mobility and limited economic activity that led to a loss of income and/or labor but also chronic diseases caused by COVID-19 in those who became ill.

2.2. The evolution of Greek public debt, second quarter 2021

According to the latest data available from the General Accounting Office,[1] for the second quarter of 2021, the Central Government's debt amounted to 387.33 billion euros, an increase of approximately 6.5 billion

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1. Public Debt Bulletin, June 2021, General Accounting Office, Ministry of Finance.

euros (1.7%) compared to the previous quarter, 13.3 billion euros (3.6%) in relation to end of the year 2020 and 24.5 billion euros (6.7%) compared to the corresponding quarter of 2020. In addition, cash deposits remained constant compared to the end of 2020. However, cash deposits decreased compared to the previous quarter of 2020 by 783 million euros (4.1%).

The observed increase in debt is due to the issuance of Bonds and Treasury Bills to cover Budget deficits created by increased borrowing to meet both the expenditures to cover the needs created by the pandemic and the reduced revenues due to the economic crisis brought about by the long period of restricted economic activity to reduce mobility in order to restrain the pandemic.

The composition of Central Government debt in the second quarter of 2021 is presented in Table 2.2.1. Based on the type of interest rate, fixed versus floating, the Central Government Debt, on a percentage basis,

amounted to 98.5% and 1.5%, respectively. There is a change in the composition of debt in favor of floating rates as compared to the previous quarter (97.8% and 2.2%), as well as regarding the corresponding quarter of 2020 (96.5% and 3.5%, respectively). An analogous change is observed in favor of the non-tradable to tradable debt, which stood at 23.9% and 76.1%, respectively, over the period considered. Finally, the composition of Central Government debt by currency remained essentially unchanged compared with the previous quarter, 98.9% in euro currency, and shows little variation compared to the same quarter of 2020 (98.1% in euro). Finally, a significant rise of the guarantees provided by the Greek government, at 19.8 billion euros, increased by 5.88 billion euros (42.3%) in comparison to the previous quarter and more than doubled regarding the 2020 corresponding quarter.

The distribution of debt, based on the residual maturity in the second quarter of 2021, is reflected in Table 2.2.2. Short-term Greek government securities (with

TABLE 2.2.1 Central Government debt[1] (in million €)*

Period	2020 (B΄ quar.)	2020 (D΄ quar.)	2021 (A΄ quar.)	2021 (B΄ quar.)
Outstanding Central Government debt	**362,871.42**	**374,005.73**	**380,795.05**	**387,328.87**
Debt by type of interest rate				
Fixed rate[2]	350,170.92	361,663.54	372,417.56	381,518.94
Floating rate[2,3]	12,700.50	12,716.19	8,377.49	5,809.93
Debt by way of trading				
Tradable	74,388.64	79,289.21	86,440.48	92,571.60
Non-Tradable	288,482.78	294,716.52	294,354.57	294,757.27
Debt by currency				
Eurozone	358,879.83	369,891.67	380,033.46	386,554.21
Non-Eurozone currencies	3,991.59	4,114.06	761.59	774.66
Cash deposits of the H.R.[4]	**19,267.30**	**17,891.90**	**18,476.60**	**18,484.40**
Debt guaranteed by the Central Government	**9,862.58**	**14,306.26**	**13,896.65**	**19,776.11**

Source: Public Debt Bulletin, General Accounting Office, Ministry of Finance.

Notes:

1. Central Government Debt differs from General Government Debt (Maastricht definition) by the amount of intra-sectoral debt holdings and other ESA '95 adjustments.

2. Fixed/floating ratio is calculated taking into account: i) interest rate swap transactions, ii) the use of funding instruments by the ESM regarding the loans that have been granted to the Hellenic Republic and iii) the incorporation of the risk metrics of the EFSF's liability portfolio into the Greek debt portfolio.

3. Index-linked bonds are classified as floating rate bonds.

4. Included balance of dedicated cash buffer account, 15,697.3 million euros on 31/03/2021 & 30/06/2021.
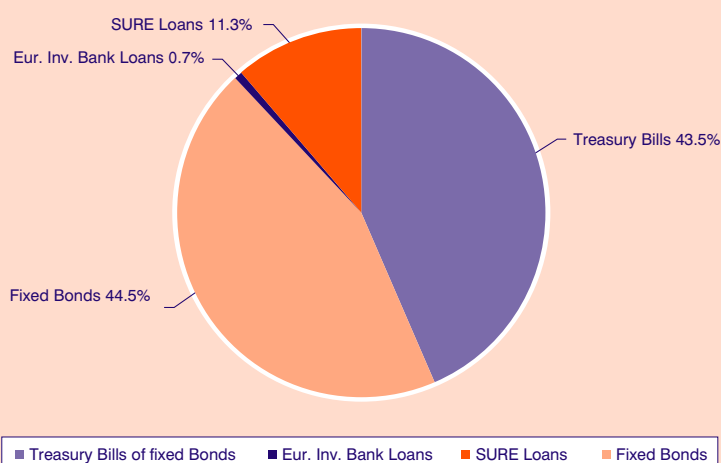
* Estimates.

TABLE 2.2.2 Budgetary Central Government debt by residual maturity* (amounts in million €)

Period	2020 (B´ quar.)	2020 (D´ quar.)	2021 (A´ quar.)	2021 (B´ quar.)
Total volume	362,871.42	374,005.73	380,795.05	387,328.87
Short-term (up to 1 year)	45,868.77	52,461.48	53,464.91	53,053.05
Medium-term (1 to 5 years)	39,938.88	39,861.04	40,722.34	43,327.99
Long-term (more than 5 years)	277,063.77	281,683.21	286,607.80	290,947.83

Source: Public Debt Bulletin, General Accounting Office, Ministry of Finance.

* It concerns the volume of Bonds, Treasury Bills and Short-term Securities and not the total Debt of the Central Administration.

**GRAPH 2.2.1
Composition of new borrowing, A´ Semester 2021**

SURE Loans 11.3%
Eur. Inv. Bank Loans 0.7%
Treasury Bills 43.5%
Fixed Bonds 44.5%

■ Treasury Bills of fixed Bonds   ■ Eur. Inv. Bank Loans   ■ SURE Loans   ■ Fixed Bonds

Source: Public Debt Bulletin, General Accounting Office, Ministry of Finance.

maturity less than one year) represent 13.7% of the total, compared to 11.2% from the medium-term notes (with maturities of one to five years), and 75.1% from long-term issues (maturity after five years) of 14%, 10.7% and 73.5%, respectively, which was the first quarter of 2021. Compared to the same quarter of 2020, an increase in the share of the short-run and a respective decrease in the medium-term securities is exhibited.

The average residual maturity of the total Central Government debt stood at 18.98 years, slightly increased from that of 20.85 years in the corresponding quarter of 2020. It should be noted that the average residual maturity of the total Central Government debt has

tripled since the country's entry to the support mechanism, which amounted to 7.65 years in the second quarter of 2010. Furthermore, regarding the new borrowing of the Greek government during the reporting period, the weighted average maturity rose to 8.45 years, with a significant increase from the level of 4.05 years at which it had formed at the end of 2019.

The new borrowing for the first half of 2021 decomposes to 43.5% of Treasury Bills, 44.5% of fixed bonds, 11.3 in SURE loans and only 0.7% comes from European Investment Bank loans (Graph 2.2.1).

Graph 2.2.2 shows the redemption schedule of the Central Government debt based on the latest pub-

GRAPH 2.2.2
Redemption schedule of Budgetary Central Government debt on 30/6/2021 (amounts in million euro)
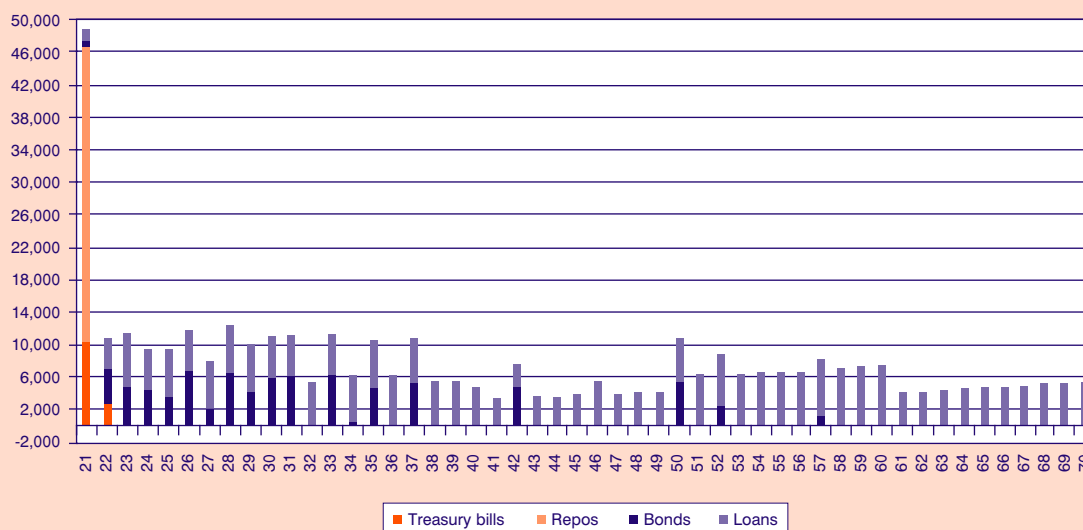
Source: Public Debt Bulletin, General Accounting Office, Ministry of Finance.

Notes: Buy-backs are scheduled for the smoothening of redemptions.
Including extension of EFSF loans agreed on at the Eurogroup of 22-6-2018.

lished data. From the display of newer data, it seems that apart from the current year (2021), the dispersion of the burden of redemption of public debt has now leveled, with few exceptions, at less than 10 billion euros per year until 2070.

2.3. Fiscal figures perspectives

The course of the country's fiscal figures in both the last months of 2021 and 2022 is expected to be positive, as the Greek economy seems to be coping, despite the impact of the pandemic and the economic crisis that followed. Important factors of recovery that were and are expected to be the driving forces for the further improvement of the Greek economy are:

1. The opening of economic activities, despite the evolution of the pandemic, improves expectations for the course of domestic demand, investment, exports, etc., leading to increased GDP growth rates for both 2021 and 2022.

2. The significant growth of tourism, domestic and foreign, which is expected in terms of travel revenues to reach about 80% of that in 2019, if the influx of tourists continues, as shown by the bookings, in the coming months.

3. The extension of the general escape clause of the Stability and Growth Pact for 2022 allows the avoidance of interruptions to the economic recovery from a reduction of the expansionary fiscal policy in the Member States, which allows the Greek government to intervene where necessary and to assist economic activity.

4. The investment orientation of both the State Budget for 2021, with the increase of the expenditures of the PIP, and the Preliminary Draft Budget for 2022, which is based both on the dynamic recovery of the year 2021 and on the flow into the Greek economy from the Recovery and Sustainability Fund (RSF).

5. The monetary policy of the European Central Bank (ECB), which, through the Pandemic Emergency Purchase Program, facilitates Greece by keeping borrowing costs low. This policy is expected to continue until at least March 2022, while even after the end of the program, the ECB intends to reinvest these bonds in its portfolio at least until the end of 2023, a period when the Greek economy is expected to recover investment grade so as the Greek bonds will be included in the regular Asset Purchase Program of the ECB.

On the contrary, there are sources of uncertainty that, if confirmed, will lead to a slowdown in the recovery of the Greek economy. Sources of uncertainty are:

1. The course of the pandemic. If the outbreak of cases, deaths and illnesses as well as the slow-down of vaccinations are not addressed, it will lead to overwhelming the health system and, consequently, the need to take new measures and restrictions.

2. The evolution of the inflation rate due to the ap-preciation of international energy prices and other productive inputs that will lead to increases in the prices of basic goods and transport costs and, as a result, to a reduction in disposable income.

3. The activation rate of the investment support schemes financed by the Recovery and Sustain-ability Fund. Any delay in the disbursement of funds from the Fund may slow down the planned investments and thus lead to a slowdown in the economic recovery.

4. The evolution of geopolitical factors (Eastern Med-iterranean, Turkey, immigration, etc.) that could be an important obstacle to the development of the Greek economy.

3. Human resources and social policies

3.1. Recent developments in key labour market variables

Ioannis Cholezas

3.1.1. Introduction

Following the reduced economic activity in 2020 due to Covid-19 and the associated measures to protect public health, the economy seems to be recovering in 2021, with positive effects on the labour market. The analysis of the first six months of 2021, using the Labour Force Survey, shows that considerable increases in employment are recorded in the second quarter of the year. However, employment in the second quarter of 2021 (2021Q2), both in terms of the number of the employed and the hours worked, still falls behind the respective quarter in 2019, a year which is used as a benchmark considering the unusual drop in economic activity in 2020. Moreover, the analysis by industry suggests a strong contribution of the public sector, which is likely not economically sustainable. Combining these facts with continuous changes in public health due to the virus's new variants and the alarming developments in the economy associated with inflationary pressures and an increase in debt to GDP ratio in Greece,[1] we need to be alert for what lies ahead.

3.1.2. Employment

The employment rate for individuals aged 15-64 stands at 57% in 2021Q2, 1.2 percentage points greater than 2020Q2 and 0.1 percentage points smaller than 2019Q2. Respectively, the number of the employed

aged 15-64 increased compared to 2020Q2 by 59.2 thousand, but remains smaller than 2019 by 62.1 thousand. In the first six months of this year, the number of the employed was smaller by approximately 89 thousand compared to 2020 and by 135 thousand compared to 2019. The big loss of jobs in the first quarter of the year (-237.4 thousand) contributed significantly to this result. Therefore, employment has still not recovered from the losses recorded in the second quarter of 2020 due to the pandemic, despite the strong rebound in the second quarter of 2021 (+285 thousand new jobs compared to 2021Q1 and +59.2 thousand compared to 2020Q2).[2]
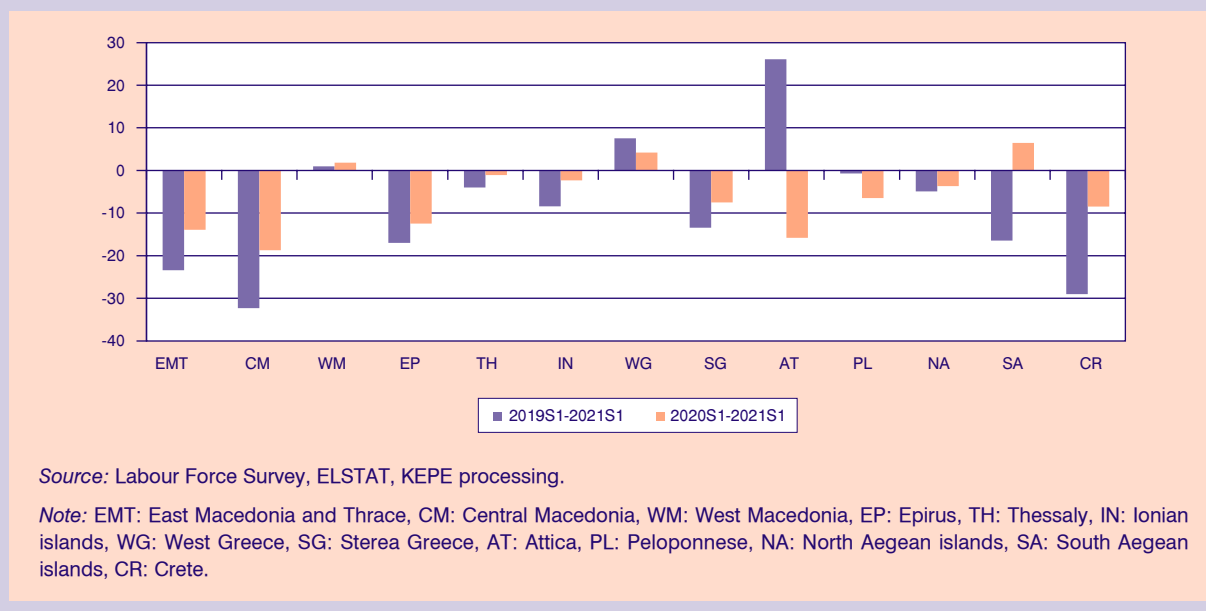
Focusing on different population groups reveals that in the first six months of 2021, the number of employed women decreased faster than the number of employed men aged 15-64 (51.5 thousand vs. 37.5 thousand) compared to 2020.[3] Moreover, the number of employed women decreased more in the first quarter of the year, while the recovery that followed in the second quarter was slightly stronger for men (36.4 thousand or +1.7% and 22.9 thousand or +1.4%). On the other hand, the number of employed individuals aged 30-64 decreased by 53.9 thousand in the first six months, while the number of employed individuals aged 15-29 decreased by 35.2 thousand. When the total number of employed in each age group is considered, it becomes obvious that the reduction among younger individuals is greater, since it represents a -0.07% decrease vs. a -0.02% decrease of individuals aged 30-64. It should also be noted that in the second quarter of the year, the number of young employed continued to decrease, while the number of employed individuals aged 30-64 increased by 62.9 thousand. Most of these changes in employment are probably due to the different distribution of employed individuals across industries, since there is often gender

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1. According to ELSTAT data, the general price index in Greece for August 2021/August 2020 increased by 1.9% when, last year, for August 2020/August 2019, it decreased by -1.9%. Moreover, based on Eurostat, the debt to GDP ratio in 2020 went up to 206.6% from 180.5% in 2019.

2. Even in terms of annual change, the number of the employed grew by 1.6% in period 2020Q2-2021Q2 compared to 2.3% in period 2019Q2-2020Q2.

3. However, in relevant terms, the changes were almost identical, i.e., -0.03% for women and -0.02% for men.

FIGURE 3.1.1
Changes in employed individuals by region (aged 15-89, in thousand)

Source: Labour Force Survey, ELSTAT, KEPE processing.

Note: EMT: East Macedonia and Thrace, CM: Central Macedonia, WM: West Macedonia, EP: Epirus, TH: Thessaly, IN: Ionian islands, WG: West Greece, SG: Sterea Greece, AT: Attica, PL: Peloponnese, NA: North Aegean islands, SA: South Aegean islands, CR: Crete.

and age segregation in some industries, like tourism. In any case, younger individuals seem to suffer more damage from the reduced economic activity.

The impact of the pandemic is unequally spread across regional labour markets (Graph 3.1.1). There are fewer employed individuals in most regions in the first six months of 2021 (2021S1) compared to previous years. The biggest losses compared to 2020 are recorded in Central Macedonia (CM), East Macedonia and Thrace (EMT) and Crete (CR). Small employment gains are recorded in West Macedonia (WM), West Greece (WG) and the Aegean islands (AI). The quarter-on-quarter analysis seems to verify the recovery of the labour market. Therefore, while in the first quarter of 2021 the number of employed individuals increased compared to 2020Q1 in almost all regions, the opposite is true in the second quarter, which is dominated by increases everywhere with the exception of Epirus (EP) and East Macedonia and Thrace (EMT). On the other hand, the number of the employed in Attica has increased between 2019S1 and 2020S1, but it subsequently decreased between 2020S1 and 2021S1.[4] Should these trends persist in the following months, they must be thoroughly explored in order to detect the causes

behind them and to avoid delaying the recovery in these regions. On the other hand, West Greece (WG) stands out due to a steady increase in the number of the employed in the first six months in both years. Breaking down these changes into quarters reveals that employment gains during the second quarter in the region over-compensated for the losses in the first quarter. This may be not sustainable; hence, it would be wiser to wait for the whole year before jumping to conclusions.

Table 3.1.1 presents changes in the number of employed individuals aged 15-89[5] by industry in the first six months of 2021. Most new jobs were created in *Public administration and defence, compulsory social security, etc.* (45.6 thousand) followed by *Professional, scientific and technical activities* (29 thousand) and *Agriculture, forestry and fishing* (18.8 thousand). The first industry is dominated by the public sector as an employer. This means that the finding cannot be generalised to the entire economy. Perhaps an even more important fact is that only six in ten industries have a positive sign, which points more to stabilisation and less to an increase (<0.5%). There are big industries in terms of the number of employed individuals that re-

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4. The increased demand for certain occupations during the pandemic, e.g., nurses and delivery workers, despite the weakened economic activity in 2020, is probably responsible for this finding.

5. The definition for employed individuals changed in 2021. Instead of referring to individuals aged 15+ it now refers to individuals aged 15-89. Given the small number of employed individuals over the age of 89 this change is not likely to cause inconsistencies in comparisons over time.

TABLE 3.1.1 Employed individuals by industry of economic activity in the first semester (aged 15-89, in thousand)

	2021S1	2019S1-2021S1	Δ%	2020S1-2021S1	Δ%
Total	**3,770.2**	**-115.0**	**-3.0**	**-78.1**	**0.0**
Agriculture, forestry and fishing	444.1	-17.0	-3.7	18.8	0.0
Mining and quarrying	10.5	-1.4	-11.8	-0.9	-0.1
Manufacturing	373.7	1.9	0.5	-1.5	0.0
Electricity, gas, steam and air conditioning supply	35.7	6.7	22.9	3.7	0.1
Water supply, sewerage, waste management and remediation activities	17.5	-15.1	-46.3	-10.7	-0.4
Construction	135.1	-13.3	-9.0	-3.6	0.0
Wholesale and retail trade, repair of motor vehicles and motorcycles	676.6	-4.6	-0.7	-28.9	0.0
Transportation and storage	203.0	2.6	1.3	-12.8	-0.1
Accommodation and food service activities	255.0	-107.8	-29.7	-70.1	-0.2
Information and communication	99.7	-6.0	-5.7	-0.7	0.0
Financial and insurance activities	75.9	-8.0	-9.5	-6.0	-0.1
Real estate activities	6.8	1.1	18.4	1.5	0.3
Professional, scientific and technical activities	248.1	29.2	13.3	29.0	0.1
Administrative and support service activities	72.7	-16.6	-18.6	-12.6	-0.1
Public administration and defence, compulsory social security	380.1	33.7	9.7	45.6	0.1
Education	314.7	-11.8	-3.6	-18.7	-0.1
Human health and social work activities	280.6	34.3	13.9	18.3	0.1
Arts, entertainment and recreation	42.9	-10.9	-20.2	-13.5	-0.2
Other service activities	77.9	-2.9	-3.6	-9.8	-0.1
Activities of households as employers	18.2	-7.7	-29.6	-3.2	-0.1
Activities of extraterritorial organizations and bodies	2.2	-1.4	-38.6	-2.0	-0.5

Source: Labour Force Survey, ELSTAT, KEPE processing.

corded a decline in employment; take *Wholesale and retail trade* (-28.9 thousand), for instance. *Accommodation and food service activities* (-70.1 thousand) is amongst the industries that recorded the biggest decreases in the number of the employed. However, it should be noted that any differences compared to the employment level in 2020 are relatively small (see the last column in Table 3.1.1). On the other hand, compared to the first semester of 2019, when some sort of normality is assumed, seven industries in 2021 have bigger numbers of employed individuals, while the remaining still fall short of the 2019 levels, sometimes considerably so. *Food and accommodation services* is such an example amongst big employers (-29.7%), while *Water supply, sewerage, waste management and remediation activities* is another one amongst small employers. Therefore, it would be reasonable to conclude that employment still falls short its pre-pandemic level, especially in those industries that suffered more because of it.[6] Moreover, a large part of the positive developments rely on the public sector.

The frequency of absence from work decreased in 2021 compared to 2020, especially in the second quarter. Compared to 2019, there are still frequent absences from work, but there is convergence to the pre-pandemic level. In particular, in the first quarter of 2021, the share of employed individuals who were absent from work is higher by 5.5 percentage points compared to 2019. However, this difference shrank in the second quarter to 1.5 percentage points (Table 3.1.2). The developments are similar in weekly hours worked. While the number of hours increased in both quarters compared to 2020, compensating for reductions due to the pandemic and suspension of work in many firms, people are still working fewer hours compared to 2019: specifically 2.6 hours per week in the first quarter and 0.6 hours per week in the second quarter (Table 3.1.2). Therefore, both absence from work and weekly hours worked suggest that the labour market is getting back to normal.

One last index that reflects changes in employment caused by the pandemic is the share of employed individuals aged 15-64 who work from home. According to the official Eurostat[7] data, the share of those working from home increased to 7% in 2020 from 2-3% in the previous years, i.e., more than doubled. However, given the benefit of increased flexibility for workers as-

sociated with working from home, it seems reasonable to conclude that the respective share in Greece falls short compared to the rest of the European Union, since the EU27 average increased to 12% in 2020 from approximately 5% in previous years. Potentially, the recent legislative acts presented in the previous issue of the *Greek Economic Outlook* will contribute to the increase in the share of the employed working from home, although getting back to normal may be associated with a return to the workplace in the following months.

An aspect of employment that should not be ignored is labour market slack, which is also known as unmet demand for labour. This aspect of employment is stud-

TABLE 3.1.2 Indices measuring the impact of the pandemic on the labour market

	Absence from work* (%)	Weekly hours worked
2019a	3.3	38.2
2019b	2.0	39.4
2019c	6.9	38.5
2019d	2.8	39.1
2020a	9.2	35.5
2020b	22.3	30.3
2020c	8.6	38.4
2020d	11.6	35.3
2021a	8.8	35.6
2021b	3.5	38.8
2019a-2021a	5,5	-2,6
2019b-2021b	1,5	-0,6
2020a-2021a	-0,4	0,1
2020b-2021b	-18,8	8,5

Source: ELSTAT, Labour Force Survey Press Releases, first and second quarter 2021, KEPE processing.

* As a share of the employed.

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6. Data from ELSTAT verify that the gross added value in constant prices of the previous year went down by -21.5% (2020 vs. 2019) in the wider industry *Wholesale and retail trade, etc., Transportation and storage, Accommodation and food service activities*, while in *Arts, entertainment and recreation, repair of household goods and other services,* it went down by -25.6%, which is the biggest recorded decrease.

7. At the time of writing, the most recent data referred to 2020. See <https://ec.europa.eu/eurostat/web/products-datasets/-/lfsa_ehomp>.

ied using an index. The numerator of this index equals the sum of the unemployed, the part-time workers who would prefer working longer hours,[8] those who are willing to work, but are not currently looking for a job and those who are looking for a job, but are not readily available to work. The first two groups are included in the labour force, but the last two are not. By including them, one gets the extended labour force, which is used as the denominator in the index of the labour market slack. According to the published Eurostat data,[9] Greece, along with Italy and Spain, is amongst the countries with the highest index of unmet demand for labour in the EU27. All three countries stood between 25% and 26% in the first quarter of 2021, when the EU27 average stood at 15.6%. Unsurprisingly, the number of the unemployed is the biggest contributor to this index. Especially in Greece, over 65% of the numerator consists of unemployed individuals, when in Spain the respective share does not exceed 60%, and in Italy it fluctuates over time around 40%. Moreover, the index is usually bigger for women, especially in Greece, where the gender difference exceeded 11 percentage points in 2021a. In conclusion, unmet demand for labour is another challenge that must be dealt with mostly because it represents the inadequate use of the human capital available in the country and the waste of a valuable factor of production.

3.1.3. Recent developments in paid employment

Using ERGANI's August report, this section attempts to analyse the evolution of paid employment in Greece in the first eight months of 2021. Note that, over time, most employed individuals are paid employees. For example, in 2021b paid employees constituted 67.8% of total employed individuals, while the average share in period 2011-2021 was 65.4%.

In August 2021, the number of paid jobs declined, ending an eight-month positive balance, i.e., more jobs hires than layoffs, which started in December 2020. Therefore, the number of paid employment jobs decreased by 9,875 compared to an increase of 4 thousand in August 2020. The performance of paid employment in a single month is probably not the safest

measure to assess its course. Interestingly, the performance of paid employment in the first eight months of the year (January-August) is more satisfactory, since 265 thousand more jobs have been created.[10] This means that 150 thousand more jobs were created in the first eight months in 2021 than the respective period in 2020, but 20 thousand jobs fewer than 2019. Therefore, it seems that paid employment has been recovering in 2021, even though it has not yet achieved the performance of 2019. The difference with the previous year can be decomposed to 147.7 thousand more hires and 1.7 thousand fewer layoffs, although quits increased in 2021 by approximately 68 thousand. This means that firms dismissed fewer paid employees in 2021. It could also be the outcome of fewer temporary job contracts expiring, since fewer were initially signed due to the uncertainty associated with the pandemic.[11]

One of the outcomes of the pandemic discussed in the previous issue of the *Greek Economic Outlook* is the increase in the share of new full-time job contracts due to the serious consequences on industries that more often employ people with flexible job contracts. The picture painted in Table 3.1.3 is that during the pandemic, the share of new flexible job contracts decreased. Overall, proportionally, more full-time job contracts were signed in the first eight months of 2021 (56.6% vs. 50.7%) than 2020. A closer look, though, reveals that for the past two years the gap has been narrowing over time. For instance, in July, the share of new full-time job contracts is almost equal to last year's, but in August, it dropped below last year's level.

The conversions of full-time job contracts to flexible types of contracts marginally exceeded 19.3 thousand in the first eight months of 2021 compared to almost 41 thousand in 2020 and approximately 30.6 thousand in 2019. The reduction in the number of conversions is a positive development so far, as the employed maintained the terms of work intact. Moreover, there has been a big decrease (-87.6%) in the number of job contract conversions without the consent of the employee, which had more than doubled in 2020 (-147.4%). There is also a difference in the composition of job contract conversions, which seems to resemble more the composition in 2019: conversion of

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8. According to the Labour Force Survey, over half of the part-time employed would prefer to work full-time, but are unable to find such a job.

9. At the time of writing, the most recent data referred to 2021a. See <https://ec.europa.eu/eurostat/databrowser/view/LFSI_SLA_Q__custom_1311644/default/table?lang=en>.

10. When the jobs created (i.e., hires) are more than the jobs destroyed (i.e., the sum of layoffs, terminations of temporary contracts and quits), the balance of paid employment flows is positive. In the opposite case, the balance is negative.

11. Eurostat's data about the share of employees with a temporary job contract reveal a reduction from 14.1% in the third quarter of 2019 to 9.1% in the first quarter of 2021.

TABLE 3.1.3 New jobs by type of contract

	2020				2021			
	FT (%)	PT (%)	RT (%)	Total	FT (%)	PT (%)	RT (%)	Total
January	46.4	41.9	11.7	177,632	66.9	29.4	3.7	96,868
February	43.8	42.5	13.6	183,602	64.4	31.2	4.4	98,428
March	56.0	36.8	7.2	103,002	64.0	31.3	4.7	104,302
April	66.8	29.1	4.0	48,555	58.5	35.5	5.9	126,362
May	55.5	36.9	7.6	99,257	58.4	35.0	6.6	255,987
June	49.8	40.7	9.5	238,353	54.6	38.4	6.9	311,649
July	51.7	39.1	9.2	306,808	51.1	39.9	9.0	288,893
August	51.2	40.9	7.9	160,583	50.7	40.5	8.8	183,068
Total	**50.7**	**39.8**	**9.6**	**1,317,792**	**56.6**	**36.6**	**6.9**	**1,465,557**

Source: ERGANI reports, KEPE processing.

Note: FT: full-time job contract, PT: part-time job contract, RT: work in rotation contract.

full-time to part-time contracts represented 76.2% of the total number of conversions (compared to 72.1% in 2019 and 53.6% in 2020). This is another fact which seems to suggest that the labour market is returning to normal.

Focusing a bit more on part-time employment, the data from the Labour Force Survey show a decline in the share of part-time employees, which approached or even exceeded 20% at the end of 2020 and the beginning of 2021, showing how much stronger the impact of the pandemic was on part-time employment. As a consequence, the share of part-time employees dropped to 8.2% in 2021b vs. 8.7% in 2019b and 9.2% in 2020b. The fact that the share of part-time employees who would prefer working full-time fell in 2021 to lower than 55% is interesting and optimistic. Especially when one considers that in previous years it stood at more than 60%, even nearing 70% in 2016. However, it would be wise to wait and see how the market will develop in the following months in order to reach safer conclusions.

3.1.4. Unemployment

Contrary to employment, unemployment is steadily decreasing, which is a good thing. A possible explanation may involve the government measures implemented to protect employment; they may have prevented layoffs, but they did nothing to encourage hires. Fewer layoffs have probably contributed to the reduction of the unemployment rate to 15.9% in the second quarter of 2021 for individuals aged 15-64. The unemployment rate is not only lower than the past two years, i.e., 2019b and 2020b, but it converges to levels seen back in 2010d and 2011a. Undoubtedly, this is encouraging. However, there are still issues that are alarming, like the increased unemployment risk facing certain population groups. For instance, the unemployment rate for women in 2021b (20.1%) is higher than for men by 7.5 percentage points. Similarly, the unemployment rate for youth aged 15-29 is more than double that of individuals aged 30-64 (30.3% vs. 13.4%). It is difficult to imagine how much worse the situation would be had there been fewer labour market policies targeting youth. It should be noted, though, that the gap has widened since 2019, which means that at least some part of it should be attributed to the pandemic and the stronger impact it had on youth.

A decrease in the unemployment rate is often accompanied by a decrease in the number of the unemployed, and this is the case lately (Graph 3.1.2). The reduction seems to have slowed down over the past year, but the most interesting finding has to do with the differences across population groups. The number of unemployed women decreased almost at the same pace with that of men in period 2019-2020 (-13.4% vs.

FIGURE 3.1.2
Number of unemployed (in thousand)

Source: Labour Force Survey, ELSTAT, KEPE processing.
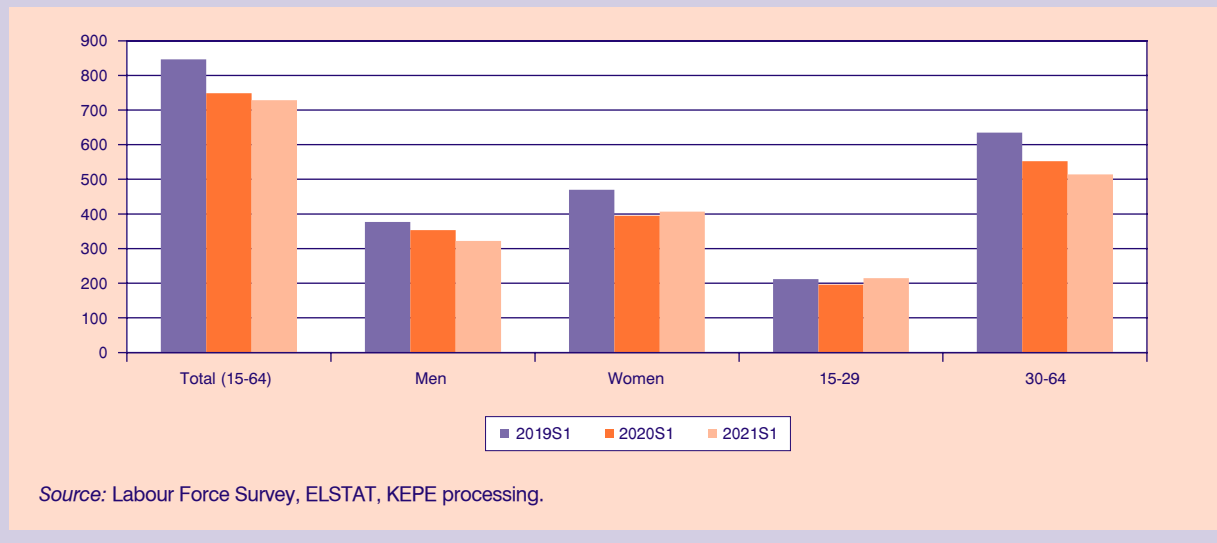
-14.6%). But, over the past year, the number of unemployed women went up while the number of unemployed men continued to drop. This difference is probably characteristic of the greater challenges women are facing in their effort to get a job, even though it has become easier to do so than a few years back. The situation is similar as far as youth aged 15-29 are concerned. The number of unemployed young people has been steadily increasing, despite the recovery of economic activity and the strengthening of tourism activities. Also note that in the first semester of 2021, the number of unemployed youth increased by 9.3% when the number of the unemployed aged 30-64 decreased by 6.9%. These findings are in accordance with the changes in the number of the employed discussed above.

3.2. Comparing income inequality indices between 2010 and 2019 in Greece

Vlassis Missos

3.2.1. Introduction

The study on income inequality in the EU is largely based on data referring to household income which, by the application of a standard statistical procedure, is converted into individual income. More precisely, the individual *disposable* (after taxes and other contributions have been deducted) income is extracted by an "equivalence scale" generated through a given formula, the outcome of which is used for the allocation of the total household income to its members. These types of scales or *weights* are based on assumptions concerning the number of adults and underage —or economically dependent— members comprising the household. Thus, the term "equivalized disposable income" is better to be interpreted as a statistical measure of real "income", under the assumption that the total household earnings are allocated among its members, irrespective of whether or not they contribute towards its acquisition (economically inactive or unemployed). Over the last few years, the mainstream approach has followed the OECD "modified equivalence scale", adopted also by Eurostat.[1]

As it has also been referred to elsewhere, the current analysis is based on calculations concerning the basic income inequality indices of the personal distribution, as it is extracted by using the data of the sample Survey of Income and Living Conditions (SILC). SILC is independently conducted by each national statistical authority under the supervision of Eurostat. The data collection process follows a common set of rules and methodologies that are applied by all EU countries,

thus offering the opportunity of compiling comparable indices for the study of inequality among the relevant economies. Due to the time-consuming process required for collecting, reviewing and completing the data-entry phases, the published survey is marked by a considerable time lag. For example, during the time this article was written, the most recent data available for Greece were derived from the 2020 SILC survey (i.e., publicly available in 2020) referring to the income earned in 2019. In what follows below, the 2019 SILC inequality indices for Greece are compared with those of 2011 (2010 income), while the regional poverty rates are compared with those of 2018 (2017 income).

3.2.2. Inequality indices

The measurement of income inequality is examined with reference to various simplistic or more intricate indices such as the *Gini* coefficient, Mean Logarithmic Deviation (L), Theil (T), Squared Coefficient of Variation (C^2) and the *Atkinson* inequality index – calculated for several values of the inequality-aversion parameter, ε. The above indices have been used in most recent articles concerning the study of income inequality in Europe and in other industrialized countries. The high degree of acceptance among researchers is based on a series of satisfied properties. The most important ones are: a) "anonymity", which states that all permutations of personal labels are regarded as distributionally equivalent,[2] b) the "population principle", stating that an income distribution is to be regarded as equivalent to a distribution formed by replications of it, c) "scale invariance" and d) the "principle of transfers", which states that the new distribution generated by two opposite deformations is more unequal than the original one.[3]

The commonly used inequality indicators mentioned above focus on different aspects of inequality and may provide for a well-balanced analysis of income distribution.[4] Due to their analytical structure and formation,

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1. Hagenaars, A., K. de Vos & M.A. Zaidi (1994), *Poverty Statistics in the Late 1980s: Research Based on Micro-data*, Office for Official Publications of the European Communities. Luxembourg.

2. This property requires that the ordering principle uses only the information about the income variable and not about, for example, some other characteristic that may be discernible in a sample.

3. For a detailed presentation, see Cowell F. A. (2000), "Measurement of inequality", in Atkinson A. B. & Bourguignon F. (eds.), *Handbook of Income Distribution*, vol. 1, Amsterdam: North-Holland.

4. See Alfonso H., LaFleur M. & Alacrón D. (2015), "Inequality Measurement", Development Issues No. 2, Development Strategy and Policy Analysis Unit, UN/DESA.

each of these indices portrays a different level of sensitivity on income transfers made in each part of the distribution. Thus, the level of change is expressed through a particular social welfare function.[5] Also, inequality indices do not all respond in the same way to income transfers between groups on opposite ends as they do in other parts of the income distribution. For example, income transfers that take place in the middle parts of the distribution are better expressed through the *Gini* index rather than the *Theil*. Alternatively, when they occur at the highest rankings of income, their effect is displayed more through changes on C^2, whereas the lowest parts are articulated in L. Lastly, the *Atkinson* index sensitivity is based on the value of the parameter ε –decided by the researcher. The higher the value of ε, the more sensitive the index is to changes at the lowest end of income distribution. In a similar way, a higher value stands for a greater social willingness to accept lower incomes in exchange for a more equal distribution.

Furthermore, total inequality can also be interpreted and explained through the differences that exist between and within distinct non-overlapping population groups (divided by their employment status, their age or their level of education). This can be done by using a broad family of measures, such as L, T and C^2, which form the "Generalised Entropy" class of measures and which are known for their feature of decomposability, i.e., breaking total inequality down into its components (population sub-groups) to explain the aggregate.

3.2.3. Main results

Table 3.2.1 depicts the main results of the basic income inequality indices for Greece. All calculations come from the 2011, 2018 and 2020 SILC (referring to incomes of 2010, 2017 and 2019) micro-databases. Between 2010 and 2019, both *Gini* and *Gini (pensions excluded)* appear to have contracted. On the other hand, the *Gini before all transfers* (pensions and others) has increased, reflecting the enduring and augmenting need for social protection. Furthermore, as the last column of Table 3.2.1 indicates, indices that appear to be highly sensitive to the upper edge of the income distribution suggest that the level of inequality has risen. On the other hand, the rest of the indices

suggest that the overall level of dispersion of personal incomes has fallen.

Within the same period, the upper bound of the first, poorest, income decile of the population, calculated in current prices, has decreased by 14.3%. In the same manner, the upper bound of the fifth decile of the population has contracted by 20.1% and the ninth, by 24.2%. As a consequence, the total level of distances between deciles has shortened and all incomes have been pressed downwards. This crucial finding, along with the rest of the results, indicate that the dispersion within the upper income groups is greater than that which exists in the lower ones.

Accordingly, the poverty threshold in Greece has also fallen by one-fifth, whereas the official rate of poverty has decreased from 21.4% in 2010 to 17.7% in 2019. An interesting aspect is revealed by investigating the difference between the various rates of poverty. Between 2010 and 2019, the *poverty rate* and the *poverty rate after transfers* (pensions excluded) are decreased, whereas the *poverty rate before all transfers* is estimated to go upwards. The different levels of outcomes that exist between the above-mentioned indices underline the importance of social transfers in adjusting the overall level of inequality lower. Clearly, during the investigated period, social protection expenditures in Greece have increased their relative importance in supporting the level of disposable income.

In addition, the last part of the table presents the regional poverty rates, offering some indication of the spatial allocation of inequality. The official level of poverty has decreased in Attica, the South Aegean, Crete, Epirus, Thessaly and the Ionian Islands. In particular, the Ionian Islands and Crete appear to have a substantial decrease in the level of poverty. Moreover, significant parts of northern and central Greece show an opposite trend.

3.2.4. Conclusions

Between 2010 and 2019, overall income inequality in Greece decreased. However, as a general result, incomes have gravitated towards a lower level of median/average income, whereas the level of "distances" among the higher incomes has increased. Higher incomes, as opposed to lower ones, appear to have shown a greater concentration. The average differenc-

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5. Each assumption and definition affects the manner in which inequality is measured. See Papatheodorou Ch. (2004), "Conceptual and methodological issues on the measurement of economic inequality: alternative interpretations and its consequences", in Petmezidou M. & Papatheodorou Ch. (eds.), *Poverty and Social Exclusion,* Athens, Exandas (in Greek).

TABLE 3.2.1 Income inequality indices, overall population, 2010, 2017 and 2019, Greece

	2010	Differences	2017	2019	Differences	Percentage change 2010-2019
Gini	33.5		-	31.1		
		2.1*			3.0*	
Gini (pensions excluded)	35.6		-	34.1		
		16.3*			20.5*	
Gini before all transfers (pensions and others)	51.9		-	54.6		
Mean log deviation (*L*)	19.7			17.9		-9.3%
Theil	19.2			18.0		-6.3%
Squared coefficient of variation (C^2)	25.4			28.1		10.5%
Atkinson ($A_{\varepsilon=0.5}$)	9.1			8.4		-8.1%
Atkinson ($A_{\varepsilon=2}$)	43.8			48.1		9.7%
Upper income 10%	4,762		-	4,080		-14.3%
		6,223**			4,697**	
Upper bound of the 5th income decile	10,985		-	8,777		-20.1%
		10,661**			7,628**	
Upper bound of the 9th income decile	21,646		-	16,405		-24.2%
Poverty threshold	6,591		-	5,266		-20.1%
Poverty rate	21.4%		-	17.7%		
		3.4*			5.9*	
Poverty rate after transfers (pensions excluded)	24.8%		-	23.6%		
		20.1*			26.0*	
Poverty rate before all transfers (pensions and others)	44.9%		-	49.6%		

	2010	Differences	2017	2019	Differences	Percentage change 2010-2019
Regional poverty rate						
Attica	-		15.4	12.5		
North Aegean	-		20.8	21.3		
South Aegean	-		17.5	15.7		
Crete	-		20.4	14.0		
Eastern Macedonia and Thrace	-		21.8	25.8		
Central Macedonia	-		18.9	21.7		
Western Macedonia	-		24.8	21.8		
Epirus	-		20.1	16.9		
Thessaly	-		21.6	18.3		
Ionian Sea	-		17.2	11.2		
Western Greece	-		24.5	27.4		
Sterea Ellada	-		19.1	19.9		
Peloponnese	-		19.0	20.6		

Source: Surveys of Income and Living Conditions, ELSTAT, author's calculations.

* In percentage points.
** In euros.

es among the higher incomes has decreased and the relative position of the lower 10% of the population has further deteriorated (see $A_{\varepsilon=2}$ in Table 3.2.1). As far as the level of differences among regions, the poverty rate is found to be varied. The role of social protection acquires a decisive role, as the impact of social transfers and pensions in lowering poverty becomes more important.

Mapping GDP-linked bonds: the case of the Greek economy

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Abstract

We develop and present a simplified model, alternative to the pricing of GDP-linked bonds. Its main philosophy is to map these specialized debt products to normal fixed income securities. This process makes them better understood and attractive to market participants. The key feature of GDP-linked bonds is that their coupons are related to the economic growth of the issuers. As a result, designing and mapping these instruments requires macroeconomic modelling of basic economic growth parameters, such as the output gap of the issuing country. This is done in this article for the case of Greece, and mapping the various indexed bond products is performed through Monte Carlo simulations. The model can also be applied to other countries, provided that the data is adjusted. The pricing of these products, incorporating also default issues, is a complicated matter.

Keywords: GDP-linked bonds, plain vanilla bonds.

JEL classification: G12, G38.

1. Introduction

The term GDP-linked bonds refers to bonds whose repayments are not fixed, but are indexed to the country's economic situation and, more specifically, to the Gross Domestic Product (GDP). The idea of issuing this kind of debt instruments is not new. However, in recent years, a significant increase in debt levels has been witnessed in advanced and emerging economies around the world. The main reason seems to be the economic recession, which affected the debt/GDP ratios for the majority of countries. As a result, the idea of replacing conventional methods with instruments related to the country's economic situation becomes more and more accepted and the dynamics of GDP-linked bonds become stronger.

Several influential academics have made a strong case for issuing GDP-linked bonds over the past two and a half decades, for instance Shiller (1993), Borensztein et al. (2004), Blanchart, Mauro & Acalin (2016). Their message is gradually filtering into policy circles. Some central banks, such as the Bank of England, have been active in exploring the potential for such instruments (see Benford, Best & Joy 2016). International organisations, including recently the IMF, have provided a nuanced, but overall supportive assessment of the prospects for state-contingent debt instruments (International Monetary Fund [IMF] 2017). As a sign of rising interest, policy makers of the G20 (2017) countries held a discussion on a "compass" for GDP-linked bonds.

Debt instruments related to a country's output are widely considered as stabilizers for debt sustainability. Indeed, in this case, payments are automatically related to the sovereign's ability to pay. Consequently, according to Abbas et al. (2019), when revenues are weak and the economy faces some downturn, the payments fall significantly. Instead, in conventional bonds, payment remains stable, imposing further constraints in the economy and leading to a vicious cycle. Thus, from this point of view, GDP-linked bonds are an attractive tool, since they allow fiscal space during

recessions and reduce the probability of default, which is extremely costly for both issuers and bondholders.

The common view on GDP-linked bonds is (Abbas et al. (2019)) that they combine attractive properties in principle with practical challenges that explain their limited take-up so far. GDP-linked bonds offer an in-built mechanism to stabilise public debts in an environment of uncertainty. This is especially valuable where indebtedness is at sustainable, but high levels, and winding down debt through conventional adjustment takes time. Investors, on their side, are interested in a reduction of the risk of outright default. In addition, some investors may find appealing an instrument guaranteeing returns linked to average growth, given their needs and the nature of their liabilities. However, GDP-linked bonds have not been used so far in advanced economies, and their occasional use in debt restructuring contributes to a perception that GDP-linked bonds are an instrument for debt-distressed countries only.

This can be attributed to the problems associated with GDP-indexed bonds. First, GDP-linked bonds introduce the temptation by the issuing country to alter the GDP statistics to reduce payments. In addition, a country that knows that its growth determines its payments may seek to grow less. These two factors add to the risk premium imposed on the GDP-indexed bonds, increasing the cost and reducing the savings associated with them. An even more important problem with GDP-indexed bonds is their financial structure. A GDP-indexed bond can be designed in many ways. The more complex the design, the more difficult to price and the lower the value.

By reducing the debt service in bad times (and the reverse), GDP growth risk is transferred from the debtor country to the creditor, who, in turn, needs to hedge it, or pool it under some particular investment benchmark. The problem is that growth risk is exotic, difficult to price and hedge properly (no financial instrument has a high correlation to real growth) and, therefore, costly for investors. As a result, the investor universe for these bonds is narrow and highly speculative, which, again, adds to the cost of the debt.

However, there have been a few experiences, mainly in the context of debt restructurings, with instruments sharing some features of GDP-linked bonds and primarily taking the shape of non-tradable instruments (International Monetary Fund [IMF] 2017). No sovereign has yet issued a GDP-linked bond with complete and symmetric risk sharing between sovereigns and private investors –falling with lower GDP and rising with higher GDP (see Benford, Best & Joy (2016), OECD (2017)). The most successful experience of state-con-

tingent debt securities is inflation-linked bonds, which were first launched in the 1980s. Today, these instruments represent 7% of government debt overall in OECD countries (OECD, 2017), but this share reaches a quarter of government debt in the UK, and above 10% in Italy and France.

Current times may slowly become more propitious (Abbas et al. (2019)) to the notion of GDP-linked bonds, including in advanced economies and, notably, European countries. The economic conditions and the fiscal outlook have recently improved across EU countries, in liaison with a broadening recovery. Nevertheless, public debt levels are high as a legacy of the crisis, while long-term growth prospects remain uncertain. Policy makers must guarantee debt sustainability in that environment. GDP-linked bonds can efficiently contribute to that objective by reducing risks of disruptive crises through smooth adjustments. GDP-linked bonds may also increase short-run budget flexibility and cross-border risk sharing, especially when a significant share of debt is foreign owned. These benefits, in terms of long-run solvency and resilience to shocks, have a particular relevance for euro area countries. In addition, GDP-linked bonds may be an indirect, but effective means to incentivise economic reforms. In sum, in the post-crisis environment, the case for GDP-linked bonds may be stronger than before, motivating further analysis of their implications.

As mentioned above, the familiarity of markets, investors, sovereigns, etc. with this type of debt instrument is crucial for its further development and acceptance. Towards this direction, the first, and probably the biggest, issue that has to be addressed is the pricing of these bonds. While in the conventional bonds where things are clear and easily understood by the majority of the participants, the pricing of GDP-linked bonds is a sophisticated matter. To date, few attempts have been made for developing a pricing framework for these bonds (see Borensztein et al. (2004), Chamon & Mauro (2006), Ruban, Poon & Vonatsos (2008), Shiller (1993), Shiller, Ostry and Benford, eds. (2018).

Borensztein et al. (2004) simulate the effects of GDP-indexed bonds under different assumptions about fiscal policy reaction functions and their output effects and find that they could substantially reduce the likelihood of debt/GDP paths becoming explosive. Chamon & Mauro (2006) present a different way of pricing growth-indexed bonds. They start with the observation that there is a tendency of emerging markets to be "debt intolerant" and to default when their debt/GDP ratio exceeds a certain value. As a result, their approach is based on a default-trigger rule for the debt/GDP ratio. Ruban, Poon & Vonatsos (2008) obtain prices and default profiles

for vanilla bonds and various GDP-linked structures that could be issued by emerging market sovereigns. Shiller (1993), Shiller, Ostry and Benford, eds. (2018) present a collection of articles on the rationale and design of GDP-linked bonds.

In this article, we present a model for pricing GDP-linked bonds and apply it to the case of the Greek economy. The GDP of the sovereign is modelled appropriately as the superposition of a trend and a cyclical component which follows the Ornstein-Uhlenbeck process. In order to make the indexation of the GDP-linked bonds more transparent, we map them to plain vanilla bonds. We use historical data of the Greek economy over the past 60 years and decompose the Greek GDP, according to the proposed model, into a trend and a cyclical component. We use this decomposition to index GDP-linked bonds by using various pricing scenarios. Our study can be used in principle to price GDP-linked bonds for any economy should the economic data be properly adjusted. In the course of our study, another interesting future of GDP-linked bonds emerges: The curves giving to these bonds the corresponding yield of a plain vanilla bond contain some important information about the economy of the country issuing the GDP-linked bonds (about Greece in the case under consideration). The specifics are given in Section 5.

This article is organized as follows: In Section 2, we develop a model for the GDP of the sovereign. In Section 3, we analyze the correspondence between a GDP-linked bond and a plain vanilla bond. In Section 4, we use historical data for Greece over the past 60 years and decompose the Greek GDP time series over these years into a trend and a cyclical component. In Section 5, we apply several pricing scenarios of a GDP-linked bond to the case of Greek economy. In Section 6, we make a few comments regarding the implementation of a GDP-linked bond. In Section 7, we conclude the article and outline future directions for research. Finally, in the Appendix, we give the bare essentials of the Hodrick-Prescott filter, which isolates the cyclical component of an economic time series.

2. Model description

In this section, we develop a simple structural model for GDP-linked bonds that relates debt cash flows to the dynamics of macroeconomic variables.

For simplicity, we will assume that all the market debt of the sovereign is represented by one bond, denominated in foreign currency, and that we are concerned with valuing this bond. After initial time $t = 0$, there is no further issuance of debt. Our next assumption is

that the sovereign's assets that can be devoted to debt service at time t are a function of the potential output (or output trend) at that time.

Potential output is typically defined as a measure of sustainable output in the economy, in which the intensity of resource use is not adding to or reducing inflationary pressure. It is also a measure of the real GDP trend, where the influence of short-term shocks and the business cycle has been removed.

The motivation behind this assumption is that higher sustainable growth makes it possible to accumulate greater resources to service debt. It can also be related to the additional borrowing capacity available to the sovereign, should new debt be used to service old debt in order to avoid default. We denote potential real output (real GDP trend) at time t in domestic currency by $\overline{Y}_t$.

Actual real GDP in domestic currency at time t, which we denote by Y_t, is related to potential GDP through the output gap. The output gap at time t, G_t, is defined as the ratio of actual to potential output, so that

$$\overline{Y}_t = G_t Y_t. \qquad (2.1)$$

We assume that $\overline{Y}_t$ satisfies

$$d\overline{Y}_t = \mu \overline{Y}_t dt. \qquad (2.2)$$

Intuitively, μ determines the expected long-run sustainable growth rate.

By taking logarithms at both sides of (2.1), we obtain

$$\ln \overline{Y}_t = \ln G_t + \ln Y_t.$$

We assume that the logarithm of G_t, hereafter denoted by g_t, follows an Ornstein-Uhlenbeck process

$$dg_t = -k g_t dt + V dW_t \qquad (2.3)$$

where $k > 0$, $V > 0$ are constants and W_t denotes the Wiener process. In economic terms, V drives the severity of the business cycle, or temporary booms and contractions, while k determines its length.

The Ornstein-Uhlenbeck process is a temporally homogeneous Gauss-Markov process. Temporally homogeneous means that the probability distributions are unaffected by translations of the t-axis. In fact, it is the only nontrivial process that satisfies these three conditions, up to allowing linear transformations of the space and time variables. More importantly, it is a mean-reverting process, which means that it tends to drift towards its mean function over time. It is precisely this last property that makes it appropriate to model GDP because its fluctuations in the vicinity of the trend

Y_t are driven, even by the sovereign policy if this is necessary, towards their mean value.

Implementation of the model described in Section 2 faces the same basic issue that Burns and Mitchell (1946) did fifty years ago: How should one isolate the cyclical component of an economic time series? In particular, how should one separate business-cycle elements from slowly evolving secular trends and rapidly varying seasonal or irregular components? The solution of the problem involves defining what one means by the business cycle and transforming or filtering the macroeconomic series to coincide with this definition. In Appendix A, we revise the so-called Hodrick-Prescott filter for decomposing a time series into growth and cyclical components.

We next use model (2.1), (2.2) and (2.3), in order to index bonds linked to the GDP of Greece. The first step towards this goal is to map GDP-linked bonds with the plain vanilla bonds.

3. Correspondence of GDP-linked bonds with the plain vanilla bonds

The characteristic features of a growth-indexed bond are not always easy to understand. As mentioned in the introduction, this is one of the reasons this kind of bond is not very common. It has also been suggested that the indexation of these bonds should take as simple a form as possible. In this section, we develop a methodology for analyzing the correspondence between a GDP-linked bond and a plain vanilla bond. The expectation is that both issuers and investors would have a better understanding of the value of the bond and gain some familiarity with this instrument.

We recall that plain vanilla bonds are the most basic and standard version of bonds. They have the following characteristic features: (a) fixed coupon rate, i.e., the payment obligations of the issuer are standard, (b) fixed and predetermined time of coupon payment, (c) fixed and predetermined date of maturity and (d) fixed face value of the bond. Hence, plain vanilla bonds are easily understood by both issuers and investors. Consequently, establishing a correspondence between plain vanilla bonds and GDP-linked bonds is expected to improve our understanding of and enhance our familiarity with this financial instrument.

We start now with a GDP-linked bond. We assume that the sovereign issues a bond of face value equal to 1 with a 20-year horizon. (Many papers have argued that bonds of this type should be perpetual and involve more than one business cycle (see [17]). This is ben-

eficial for both issuers and investors). The bond depends on an index, namely g_t. Thus, the coupon rate δ_t of the bond is a function f of g_t: $\delta_t = f(g_t)$. (We refer to Section 5 for the analysis of several scenarios concerning the function f). Therefore, investors receive a coupon $\delta_t = f(g_t)$ in year t, which is connected to the growth rate of the economy.

It is clear that the feedback the bondholders receive depends on a sequence:

$$\bar{G} = (g_{t_1}, g_{t_2}, \ldots, g_{t_{20}}) \in \mathbb{R}^{20}$$

which we call a *path*. From Section 2, we know that g_t follows a stochastic process. Consequently, the path $\bar{G}$ is also stochastic and cannot be predicted.

We now consider a plain vanilla bond with a constant internal rate of return (IRR) equal to r. Then, the following equation can be established:

$$1 = \frac{f(g_{t_1})}{1+r} + \frac{f(g_{t_2})}{(1+r)^2} + \ldots + \frac{1+f(g_{t_{20}})}{(1+r)^{20}} \qquad (3.1)$$

We fix a path $\bar{G} = (g_{t_1}, g_{t_2}, \ldots, g_{t_{20}}) \in \mathbb{R}^{20}$. Then, the above equation can be solved, and we can obtain the value of IRR r of the vanilla bond for the specific path $\bar{G}$, $r = F(\bar{G}, f)$. The value of r depends on the path $\bar{G}$ as well as on the indexation scenario f that has been chosen for the GDP-linked bond.

However, the paths $\bar{G}$, i.e., years when the economy faces some crisis or has a bump, follow some stochastic process. To overcome this obstacle, we use Monte Carlo simulations in order to run a range of possible paths and, then, to calculate the expected value over all paths. The final result is an equation of the form:

$$r = \mathbb{E}_{\bar{G}}\big(F(\bar{G}, f)\big) = R(f). \qquad (3.2)$$

Equation (3.2) describes the internal rate of return (IRR) of a plain vanilla bond that corresponds to the indexation scenario f of the growth-indexed bond that has been chosen. Since, these GDP-linked bonds take into account the years of recession, when the payments are smaller, and the years of positive growth, when the payments are bigger and compensate for the "bad" periods, the next inequality should hold:

$$\min f \leq r \leq \max f.$$

4. Data analysis and implementation of the model for the Greek economy

In our research, we gathered historical data for Greece over the past 60 years. Figure 1 shows the real GDP. From this diagram, with the use of the Hodrick-Prescott filter, the logarithm of the GDP series is broken down

into a trend $\ln Y_t$ and a cyclical component $\ln G_t = g_t$ shown in Figures 2 and 3, respectively.

The cyclical part corresponds to a stationary process which, in continuous time, may be modelled by an Ornstein-Uhlenbeck process as described in equation (2.4). The discrete analogue of this process is the autoregression model AR(1) of order 1 and is obtained as follows: we consider dt to be equal to 1 period time, and we replace dg_t with $g_{t+1} - g_t$. Hence, we have:

$$g_{t+1} = g_t - k \cdot g_t + V(W_{t+1} - W_t)$$

FIGURE 1
Gross Domestic Product (GDP) of Greece from 1960-2010
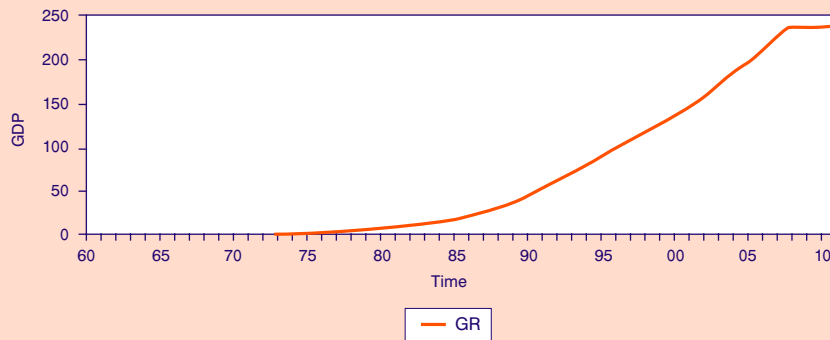
FIGURE 2
The trend of the logarithm of the GDP of Greece
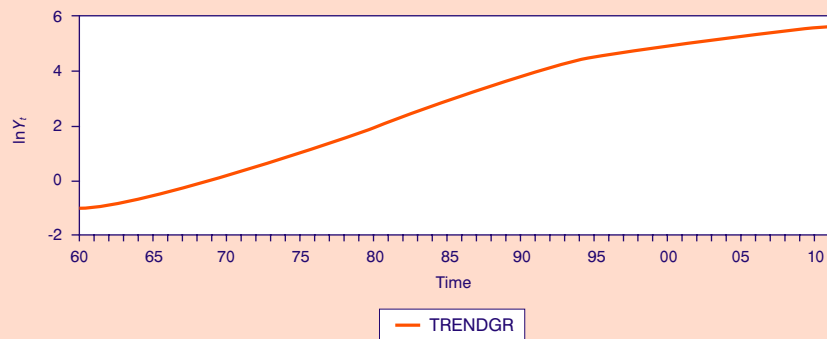
FIGURE 3
**The cyclical part gt of the logarithm of GDP (output gap)**
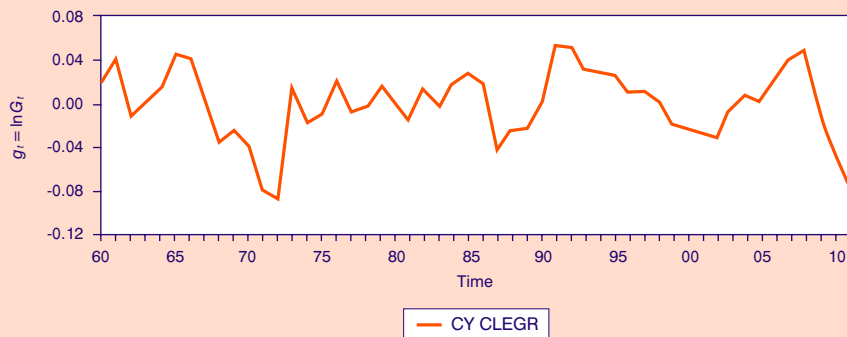
TABLE 1 Autoregression analysis for the output gap g_t

Dependent Variable: CYCLEGR
Method: Least Squares
Date: 06/21/21 Time: 16:44
Sample(adjusted): 1961 2011
Included observations: 51 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CYCLEGR(-1)	0.597504	0.122319	4.884791	0.0000
R-squared	0.322979	Mean dependent var		-0.000342
Adjusted R-squared	0.322979	S.D. dependent var		0.032744
S.E. of regression	0.026942	Akaike info criterion		-4.370852
Sum squared resid	0.036293	Schwarz criterion		-4.332973
Log likelihood	112.4567	Durbin-Watson stat		1.698354

FIGURE 4
Two scenarios for the output gap g_t in a 20-year horizon
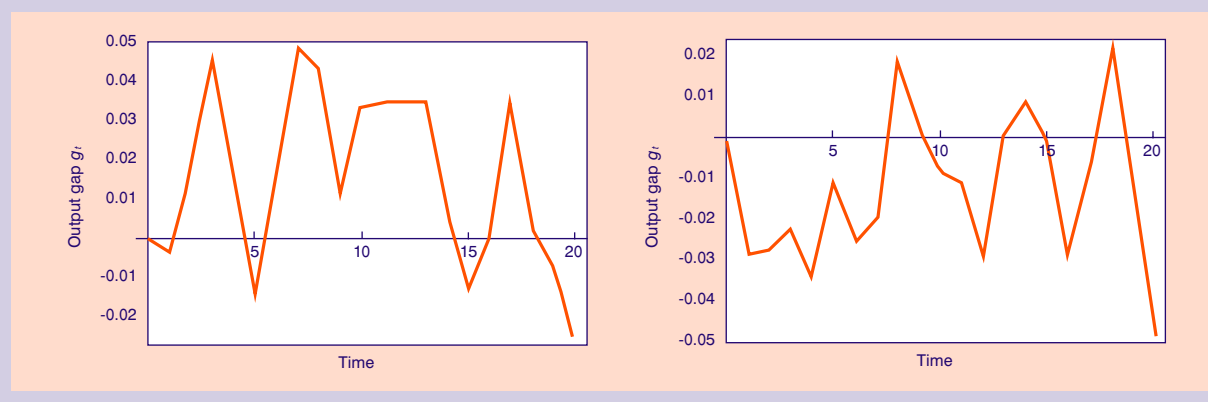
or equivalently,

$$g_{t+1} = (1-k) \cdot g_t + V(W_{t+1} - W_t). \qquad (4.1)$$

The process described in Equation (4.1) was fitted to the macroeconomic data of the Greek economy and the results are depicted in Table 1.

The dependent variable CYCLEGR refers to g_t, and CYCLEGR(–1) indicates that we make an autoregression analysis with g_{t-1}. The result shows that the coefficient, i.e., the coefficient $1-k$ of equation (4.1), equals $0.597504 \approx 0.6$. It follows that $k \approx 0.4 = 40\%$. Furthermore, the standard error (S.E.) of regression (which is equal to 0.026942) is an estimate of the standard deviation of the "true noise" in g_t, i.e., of the term $V(W_{t+1} - W_t)$. It is now known that, if W_t is a Wiener process, then $W_{t+1} - W_t$ follows the normal distribution

with mean 0 and variance $t + 1 - t = 1$. Consequently, $V(W_{t+1} - W_t) \sim N(0, V^2)$ and, hence, its standard deviation is equal to V. Hence, $V = 0.026942 \approx 0.027$. Therefore, this analysis suggests that the parameters of the continuous process may be estimated as $k = 40\%$ for the mean reverting coefficient and $V = 2.7\%$ for the volatility of the model.

This process allows the production of numerous fictitious output gap scenarios for a twenty-year horizon. For instance, Figure 4 presents two of these scenarios, which were randomly chosen.

Simulations can be run over a range of these scenarios (for example, 106 such scenarios), where several bond indexations can be considered. Then, one can consider the expected value over all these paths and to decide upon the contract design and the parame-

ters of the GDP-linked bonds. The main pricing scenarios for the GDP-linked bonds are presented in the next section.

5. Bond indexation and scenarios

The pricing and the contract design for GDP-linked bonds are not as clear as the corresponding tasks for the case of vanilla bonds. However, these issues have to be addressed and familiarity will contribute to the acceptance of growth-indexed bonds.

In this section, we revise several scenarios, which have been proposed by the authors cited in the bibliography, for designing the contract of a GDP-linked bond. We also apply them to the case of Greece. We study their equivalence with plain vanilla bonds and analyse the obtained results. As it has been suggested, the pricing of a bond should be as simple as possible to be easily understood.

5.1. Scenario 1: We start with a very simple bond indexation, given by:

$$\delta_t = \begin{cases} 0, & \text{if } g_t < 0 \\ c, & \text{if } g_t \geq 0. \end{cases}$$

The above formula can be written in a more compact form, as follows: $\delta_t = c \cdot \dfrac{sign(g_t)+1}{2}$, where for any real number x, $sign(x)$ denotes the sign of x, and we also make the convention $sign(0)=1$ (i.e. $sign(x)=1$ if $x \geq 0$ and $sign(x)=-1$ otherwise). Indeed, if $g_t \geq 0$, then $sign(g_t)=1$, hence $c \cdot \dfrac{sign(g_t)+1}{2} = c \cdot \dfrac{1+1}{2} = c$. Similarly, if $g_t < 0$, then $sign(g_t)=-1$, hence $c \cdot \dfrac{sign(g_t)+1}{2} = c \cdot \dfrac{-1+1}{2} = 0$.

In this scenario, sovereigns have to pay a constant coupon c in year t, if the dynamics in the economy are positive, i.e., when $g_t > 0$. This coupon is constant and does not depend on how big the value of g_t is. Otherwise, there is recession ($g_t < 0$), then investors receive a zero coupon in year t.
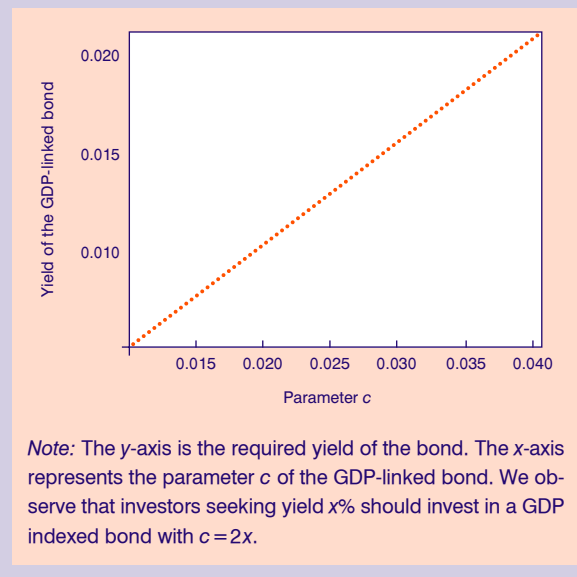
The pay-off function $\delta_t = f(g_t) = c \cdot \dfrac{sign(g_t)+1}{2}$ is quite simple in this scenario, and its graph is shown in Figure 5.

5.1.1. Equivalence with vanilla bonds. In this case, we can repeat the procedure of Section 3 and obtain the correspondence between vanilla bonds and GDP-linked bonds described in that section. More precisely, in this scenario, a path is actually given by a sequence:

FIGURE 5
The graph of the pay-off function

$\delta_t = c \cdot \dfrac{sign(g_t)+1}{2}$, **of the first scenario,**

with $c = 0.04$

Note: The x-axis shows g_t, while the y-axis shows the coupon rate.
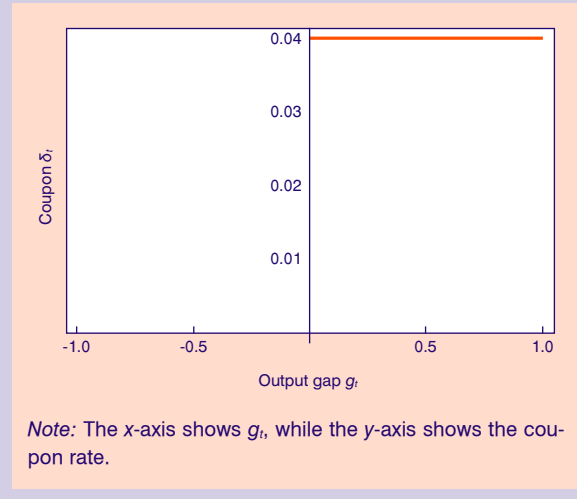
FIGURE 6
Correspondence between a GDP-linked bond, pricing with the first scenario, with the IRR of a plain vanilla bond

Note: The y-axis is the required yield of the bond. The x-axis represents the parameter c of the GDP-linked bond. We observe that investors seeking yield x% should invest in a GDP indexed bond with $c = 2x$.

$$\bar{G} = (a_1, a_2, ..., a_{20}) \in \{0,1\}^{20}.$$

In other words, $a_t = 1$ means that the economy is on the rise and investors receive a positive coupon c. On the other hand, $a_t = 0$ implies $g_t < 0$ and a zero coupon for bondholders. Thus, equation (3.1) takes the form

$$1 = \frac{a_1 \cdot c}{1+r} + \frac{a_2 \cdot c}{(1+r)^2} + ... + \frac{1 + a_{20} \cdot c}{(1+r)^{20}}.$$

For every path of g_t, the coupon scheme of the GDP-linked bond and the equivalent IRR were calculated. Finally the mean IRR for all scenarios was calculated for a fixed coupon c (of the GDP-linked bond). The relation of the coupon c of the GDP-linked bond and the equivalent rate of an ordinary bond is depicted in Figure 6 above. This implies that for the given historic characteristics of the Greek economy, a rational investor seeking yield x% would be ready to invest in a GDP-linked Greek bond provided the coupon rate for the good periods is of size 2x%.

The aforementioned remark, a consequence of the fact that the slope of the straight line in Figure 6 is 2, carries important information for the course of the Greek economy in the coming years. In particular, it turns out that the dynamics of the economy is such that the good years to come (positive output gap g_t) are equal to the bad years to come (negative output gap g_t). This amounts to the fact that in the good periods, the investor is going to receive a coupon 2x% to compensate for the bad periods.

5.2. Scenario 2: We now proceed with an indexation similar to the previous one, but a bit more sophisticated. In this scenario, the bondholder receives at year t a coupon δ_t given by the following expression (see [7]):

$$\delta_t = \max\{0, a\% + g_t\},$$

where a is a positive number called the *lag* of the bond. This number has to be specified in the contract design process between the issuer and the bondholder.

Therefore, with respect to this scenario, the country issuing the bond pays no coupon if $a + g_t < 0$, i.e., when GDP declines by more than a%. When g_t exceeds the threshold -a, then the sovereign has to pay a coupon to its creditors equal to $a + g_t$. The bigger the g_t, the bigger the coupon. We also notice that there is no upper boundary for δ_t, that is, in years when a significant increase in GDP is witnessed, the sovereign has to pay a large coupon. The pay-off function is shown in Figure 7. The lag a of the bond enables the creditor to be paid even in the "bad" periods of the economy; the larger the a, the more "bad" periods the creditor is being paid. Such an option might be more appealing to some creditors as more "risk-free".

5.2.1. Equivalence with vanilla bonds. Fixing the lag a%, we use simulations over a range of possible scenarios for the growth rate g_t in a 20-year horizon. For every scenario, the equivalent IRR was calculated and then the mean value of IRR was calculated for all possible scenarios. The result is given in Figure 8. The x-axis of the diagram represents the values of a, while the y-axis gives the corresponding yield of the GDP-linked bond.

FIGURE 7

The graph of the pay-off function $\delta_t = \max\{a + g_t, 0\}$, of the second scenario, with $a = 0.05$

Note: The x-axis shows g_t, while the y-axis shows the coupon rate.
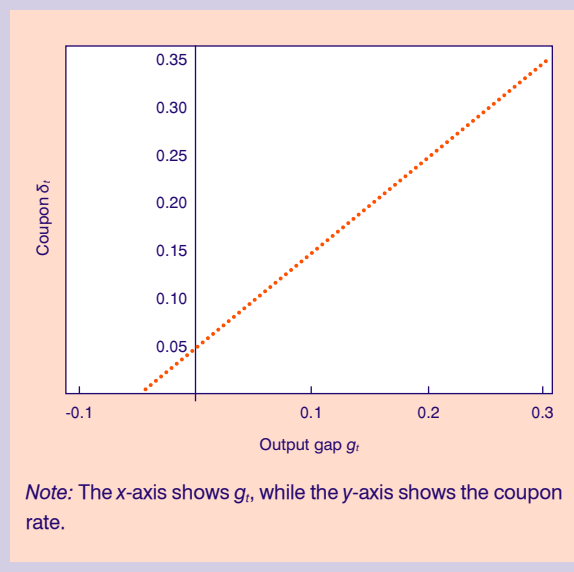
FIGURE 8

Correspondence between a GDP-linked bond, pricing with the second scenario, with the IRR of a plain vanilla bond

Note: The y-axis is the required yield of the bond and the x-axis represents the parameter a of the GDP-linked bond.
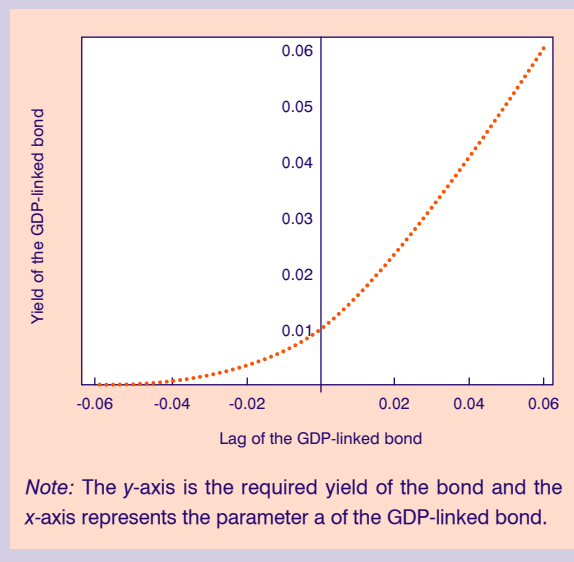
5.2.2. Analysis and discussion. From this scenario several interesting remarks emerge. First of all, let us consider the case $a = 0$. In this scenario, the pay-off function takes the form $\delta_t = \max\{0, g_t\}$. Therefore, the coupon depends only on the diversion from the trend g_t. If $g_t \geq 0$, investors receive a coupon equal to g_t, whereas if $g_t < 0$, then sovereigns have to pay no coupon.

In Figure 8, we observe that the yield of this GDP-linked bond is relatively small and equal to 1%. This result contains some information about the macroeconomic features of the Greek economy. The conclusion that can be derived is that in a 20-year horizon, the dynamic of the GDP is small on average. Years when g_t is big may be followed by periods where g_t is small and vice versa. Consequently, the yield of the GDP-linked bond is low.

Another observation is that when $a > 0.01$, the diagram of Figure 8 becomes linear and the function that is described is close to the line $y = x$. Therefore, if investors seek to achieve a yield equal to 6%, then they should agree on lag $a = 6\%$. That is, the sovereign has to pay no coupon when its GDP declines by 6% or more, whereas it has to pay a coupon $6\% + g_t$ if $g_t > -6\%$. (For instance, if $g_t = 0$, then $\delta_t = 6\%$, while for $g_t = 2$, it follows that $\delta_t = 8\%$).

5.3. Scenario 3: In our third scenario, the indexation of the growth-indexed bond is given by the expression:

$$\delta_t = \delta_* + b \cdot \max\{0, g_t + a\}.$$

Compared to the previous pricing scenario, the above formula contains two further characteristics. Firstly, a minimum coupon δ_* (called the *floor* of the bond) has to be paid every year regardless of the economic growth or recession. An extra coupon is paid when the economic growth g_t exceeds some contractually specified threshold $-a$. Secondly, the (also predefined) positive number b has been introduced in the above formula. This parameter multiplies the extra coupon and, thus, it determines the proportion of the growth of real GDP that will be paid to the investors. Bigger values of b induce more sensitivity to the coupon δ_t. We call b the *slope* or *gradient* of the bond.

This scenario, which involves a minimum coupon δ_*, clearly reduces insurance for issuers. However, it is more attractive to investors, who may insist on the presence of the floor δ_*. The pay-off function for this scenario is presented in Figure 9.

Finally, we note that the parameters of the bond (i.e., δ_*, b and a) can be seen in the above graph of the function g_t. More precisely, the floor δ_* is equal to the distance of the horizontal line from the x-axis. The lag a is placed at the point where the slope of the graph changes. Finally, the parameter b is equal to the gradient of the non-horizontal line of the graph.
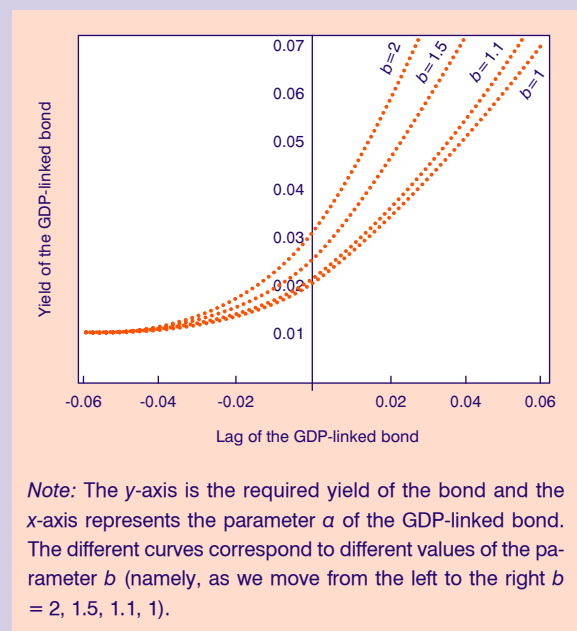
5.3.1. Equivalence with vanilla bonds. Figure 10 shows the equivalence between a GDP-linked bond, which has been designed with the third scenario, and a plain vanilla bond. This figure has also been obtained using Monte Carlo simulations over a range of 20-year paths for g_t and considering the mean value over these paths.

5.3.2. Analysis and discussion. The present scenario seems to be one of the basic tools for our analysis of GDP-linked bonds, since it can reveal several proper-

FIGURE 9

The graph of the pay-off function $\delta_t = \delta_* + b \cdot \max\{a + g_t, 0\}$ of the third scenario

Note: The x-axis shows g_t, while the y-axis shows the coupon rate.
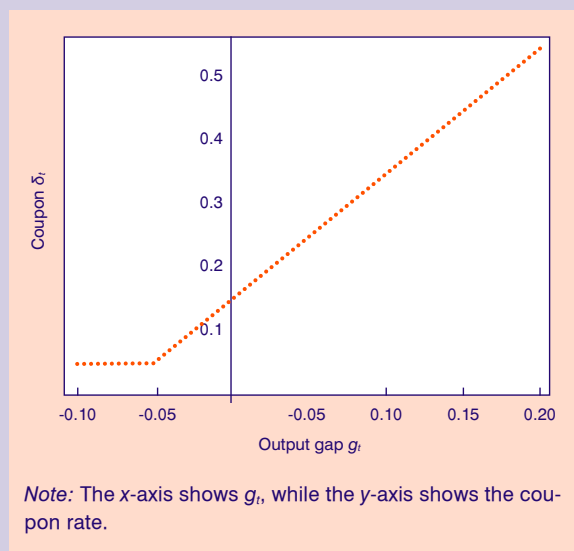
FIGURE 10

Equivalence between a GDP-linked bond, pricing with the third scenario, with the IRR of a plain vanilla bond

Note: The y-axis is the required yield of the bond and the x-axis represents the parameter a of the GDP-linked bond. The different curves correspond to different values of the parameter b (namely, as we move from the left to the right b = 2, 1.5, 1.1, 1).

ties of this instrument. First of all, assume that investors want to achieve a yield equal to 5%. Drawing the horizontal line from the point (0, 0.05) in Figure 10, we see that it meets each diagram at a single point. Every point corresponds to a triple (δ_*, a, b). For instance, in the example under examination, we have the points (0.01, 0.02, 2), (0.01, 0.03, 1.5), (0.01, 0.04, 1.1) and (0.01, 0.043, 1). These triples create different GDP-linked bonds. We now investigate the two extreme points. Of course, several intermediate points can be considered.

- Let us first consider the case $\delta_* = 0.01$, $a = 0.02$ and $b = 2$. Then, the coupon at year t is given by the formula $\delta_t = 0.01 + 2 \cdot \max\{0, 0.02 + g_t\}$. Therefore, the sovereign pays the floor $\delta_* = 0.01$ when its economy declines by 2% or more. Otherwise, it has to pay a coupon given by the previous formula. Consequently, this indexation reduces the pressure on the economy during the "bad" periods. However, because of the slope $b = 2$, the coupon increases rapidly in "good" periods. For example, when $g_t = 0.02$, then $\delta_t = 9\%$. Therefore, when revenues are high, a large part of them should be used to pay off the bond. Hence, they cannot be invested in other activities that would probably contribute to further economic growth.

- The other extreme point in the above diagram corresponds to the triple $\delta_* = 0.01$, $a = 0.043$ and $b = 1$, that is, the coupon is given by $\theta_t = 0.01 + \max\{0, 0.043 + g_t\}$. Therefore, this scenario puts more pressure on the economy during the periods of recession. For example, if $g_t = -3\%$, then the sovereign still has to pay more than the floor $\delta_* = 1\%$, namely $\theta_t = 2.3\%$, whereas in the previous case, we have $\delta_t = 1\%$. On the contrary, during good periods, this bond provides more flexibility to the sovereign. For example, when $g_t = 2\%$, the coupon is equal to $\theta_t = 7.3\%$, instead of $\delta_t = 9\%$ of the previous case.

Summarizing, we can observe that, while the yield of the bond remains the same (equal to 5%), this result can be achieved with several scenarios. Moving from the left curve of Figure 10 towards the right one, we transpose the pressure on the economy from the "good" periods to the "bad" ones and vice versa. Indeed, as we move from the left to the right, b diminishes; therefore, the yield of the bond remains the same as we move from the left to the right only if the coupon pays in deteriorating economic conditions, i.e., only if a increases. We note that large positive values of a imply that the sovereign pays even in "bad" periods of the economy, whereas small negative values of a imply that the sovereign pays in "good" periods of

the economy. This explains, in particular, why all the curves in Figure 10 converge for small negative values of a. Consequently, this type of bond gives policy makers the opportunity to choose the best scenario (according to other macroeconomic features of the economy), while the result for the bondholders will remain invariant.
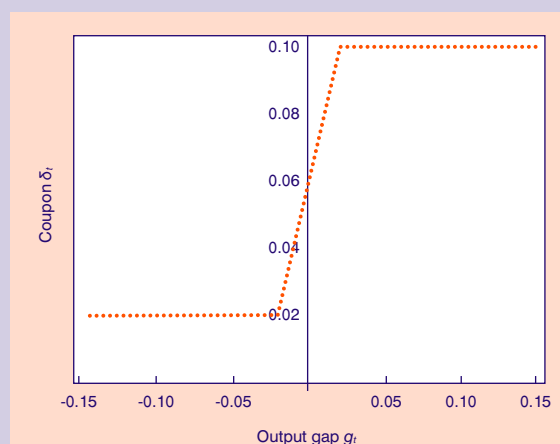
Two final remarks for this scenario: Firstly, we observe that if the lag a is zero, then the yield of the bond has raised from 1% (see Scenario 2) to 2-3%. This increase is due to the minimum coupon $\delta_* = 1\%$ and to the slope $b \in [1, 2]$. Secondly, there is no upper boundary for δ_t. Consequently, if the growth rate g_t is very high, the coupon that the sovereign is obliged to pay will be exceptionally high as well. Therefore, the country will have to service the loan, instead of investing its revenues into other profitable activities. This drawback can be solved with the next scenario.

5.4. Scenario 4: In order to address the issue mentioned above, we can design the following coupon:

$$\delta_t = \min\{\delta_* + b \cdot \max\{0, g_t + a\}, \delta_M\}.$$

In this case, δ_M is the maximum coupon that the sovereign is willing to offer. We call δ_M the *cap* of the bond. In Figures 11 and 12, we present the graph of the function δ_t and the equivalence of a GDP-linked bond with a plain vanilla bond (obtained with Monte Carlo simulations over possible paths of g_t). Given the curves of

FIGURE 11
The graph of the pay-off function
$\delta_t = \min\{\delta_* + b \cdot \max\{a + g_t, 0\}, \delta_M\}$, of the fourth scenario

Note: The x-axis shows g_t, while the y-axis shows the coupon rate.

Note: The *y*-axis is the required yield of the bond and the *x*-axis represents the parameter α of the GDP-linked bond. The different curves correspond to different values of the parameter *b* (from left to right: $b = 2$, 1.5, 1.1, 1).
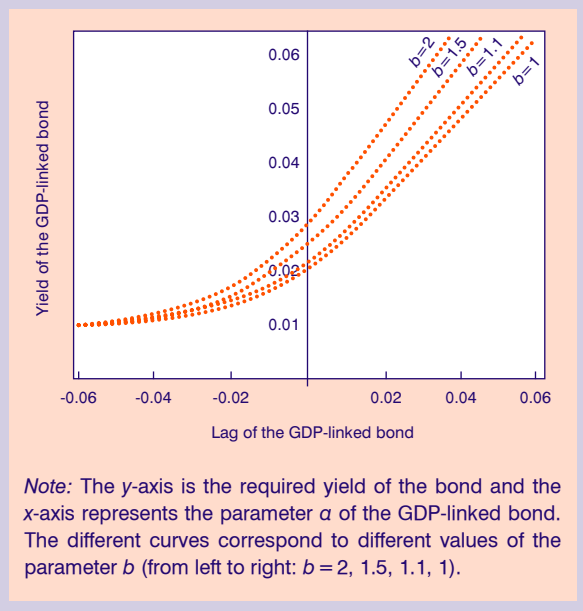
Figure 12, we observe that the analysis of Scenario 3 also applies here.

5.5. Scenario 5: Finally, in the aforementioned scenarios, one can observe that δ_t is linear with respect to g_t. However, this is not obligatory, and one may consider non-linear dependence. For example, one may define (see [5]):

$$\delta_t = \delta_* + b \cdot \sqrt{\max\{0, g_t\}}$$

where *b > 0*. In the equation above, δ_* is the floor, i.e., the minimum coupon payment. An extra coupon has to be paid in year *t* if the growth rate g_t is positive. The positive constant *b* determines the elasticity of the coupon to g_t. Because of the square root, a positive value of g_t enforces a bigger increase in the coupon δ_t compared to the previous linear scenarios (recall that the cyclical part g_t is given as a number between 0 and 1).

5.6. Scenario 6: During the decades preceding the economic crisis of 2007-2009, many countries witnessed high growth rates for many consecutive years. In this case, a GDP-linked bond service is more expensive than a plain vanilla bond service. As mentioned in the introduction, many policy makers are not attracted by growth-indexed bonds, because they seem costlier than the usual ones. In this case, the following indexation can be proposed:

$$\delta_t = \begin{cases} \delta_t^i, & t \in [0, t_0] \\ 0, & t = t_0 - 1, t_0, \quad \text{if } g_t > g^* \text{ for all } t \in [0, t_0 - 2] \end{cases}$$

where t_0 is the horizon of the bond and δ_t^i, $i = 1, 2, 5$ is the bond indexation of any of the previous five scenarios. Therefore, if the economy goes exceptionally well for many years, then the last two years, the investor receives a zero coupon.

6. Contract design and implementation of a GDP-linked bond

The whole contract of a GDP-linked bond must be designed very carefully and in great detail. The imple-

FIGURE 13

(a) The graph of the pay-off function δ_t of the fifth scenario
(b) Equivalence between a GDP-linked bond, pricing with the fifth scenario, with the IRR of a plain vanilla bond
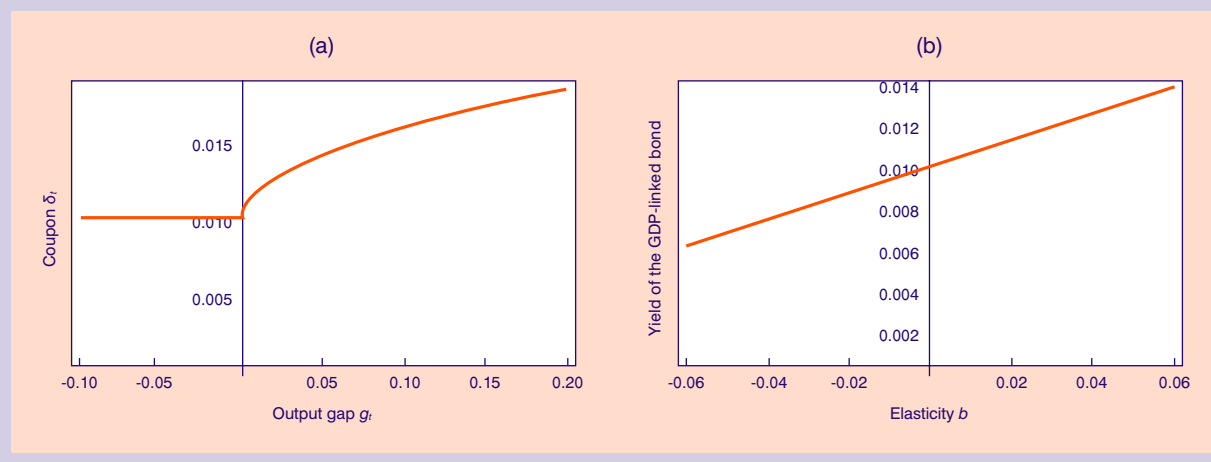
mentation of these bonds to the market place implies that several topics have to be clarified, and a plethora of parameters have to be specified. In this section, we describe two key steps concerning the implementation of a GDP-linked bond to the market.

- *Indexation parameters of the bond*. The first key step of a GDP-linked bond is the selection of the indexation. The analysis of the previous sections reveals that there is a range of possible scenarios with different characteristics. Firstly, the investor decides upon the yield that they must receive, and the pay-off function giving the coupon rate δ_t. Then, some parameters have to be chosen (see, for example, scenarios 3 or 4 of the previous section). Each parameter selection corresponds to a different pay-off method. For example, the investors may prefer to have a small lag and a big slope (which implies that they will receive bigger payments in good periods), or they may prefer a larger lag with smaller slope (which means that they receive some payment even in years of recession, but in good periods their coupons will be smaller). The key characteristic of growth-indexed bonds is that they offer a wide range of choices to investors.

  However, the issuer of the bond may not agree on the design and choices of the investors. Therefore, we have three cases: (a) The country designs the whole coupon and the characteristics of the bond. Then, it presents the product to the market and investors may accept or reject it. (b) Investors design the bond based on the desired yield and their preferences about the payment method. Then, the country has the choice to accept the bond or not. (c) In the majority of cases, however, there is a trade-off between the country and the market and the indexation parameters are determined after negotiations and discussions.

- *Pay-off procedure of the bond*. After the two parties have agreed on the indexation parameters, the contract that is going to be signed must also describe the payment method of the bond. The coupon is not fixed, but depends on the cyclical part g_t of the country's GDP. Therefore, g_t of the year t must be known so that the coupon δ_t can be calculated. To this end, the first step is to determine, in the beginning of the contract, the trend $\overline{Y}_t$ of the country's Gross Domestic Product. The trend should be calculated using the macroeconomic characteristics of the country. The sovereign should present historical data of the economy as well as the method for calculating the trend $\overline{Y}_t$ of the GDP. Then, every year, the cyclical part

g_t has to be calculated. The method of calculation should be agreed upon. For instance, it may be conducted either by the official or the private sector. An issue that may occur is that, in any country, there is a delay in the measurement of the real GDP. In some cases, the annual GDP is revised even after some years. However, a big delay in the calculation of the coupon may imply that the sovereign has already entered a period of recession and is unable to pay a big coupon. Therefore, the time when the calculation should take place must also be agreed upon.

- *Other aspects of the bond*. Needless to say, the contract design of a GDP-linked bond is not restricted to the previous two steps. Several other negotiations should take place and several other parameters should be agreed upon. For instance, issues related to the validity of the data should be addressed as well as the legal rights of the investors in the case where the sovereign is unable to fulfil its obligations. For more issues related to the design of a growth-indexed bond, we refer to [17].

7. Conclusions

The 2007-2009 mortgage crisis and the subsequent crisis in the Eurozone put the economies of developing countries under pressure. Furthermore, the recent COVID-19 pandemic reduced unexpectedly the prospects of the global economy. During the next years, other challenges may also occur. For instance, countries all over the world may have to address severe problems due to the climate change.

Many institutions, scientists and economists argue that it is high time we considered new types of bonds, that is, bonds connected with economic growth. It is generally accepted that instruments of this type reduce the probability of default, which is costly for all parties involved (i.e., sovereigns and bondholders). Consequently, they should be studied, and their mechanism should be understood as well and as quickly as possible.

In the present work, we studied exclusively the case of GDP-linked bonds. Several other options can also be considered, for instance inflation-indexed, export or commodity-indexed, wage-indexed bonds, etc. A combination of these products is also possible and may provide the ideal results. However, GDP-linked bonds have the advantage that they are easier to understand. Furthermore, data concerning the national GDP are regularly published and forecasts are available from both the official and the private sectors.

Additionally, in all parts of this article, we have assumed that only the coupons of the bonds are related to the dynamics of the economy and the principal remains fixed. There are also studies where both the principal and the coupon are indexed to GDP. In this scenario, the debt to GDP ratio remains stable. However, many investors seek principal protection and, hence, in many cases only an annual coupon can be connected to the economic situation of the country. Furthermore, we have assumed that the principal will be paid at the end of the bond. Therefore, we did not give some definition of default, and we did not examine the case where the sovereign is unable to pay its obligations. This is a significant part in every contract design of a bond; however, we believe that it does not affect the purposes of the present work.

Our primary purpose was to analyze several indexation scenarios for a GDP-linked bond. We used historical data of the Greek economy; however, analogous processes can be applied to other economies as well (provided that the data are available). Furthermore, we investigated the expected yield of the bond and their equivalence with a plain vanilla bond. This methodology makes this instrument more accessible to the parties involved in the issue of the bond (i.e., issuers as well as investors). In our work, we exploited several indexation scenarios which involve a plethora of parameters. They have floors, slopes, lags and caps. Any change in these parameters imposes changes to the bond. The bond that emerges may transpose the pressure on the economy from the bad periods to the good ones or vice versa. From a wide range of indexation scenarios, we chose six basic methods and analyzed their equivalence with the yield of a plain vanilla bond.

The analysis we performed revealed several interesting properties of this instrument. Firstly, this type of bond can be used as a measure for the macroeconomic behaviour of the country's economy and carries information for its dynamics in the next economic cycle. Secondly, GDP-linked bonds

a) reduce the probability of default, which is a costly scenario for both bondholders and issuers;

b) give the opportunity to sovereigns to choose and organize their own policy. Debt repayments fall in periods of recession and are higher in good periods, while the yield of the bond for the investors remains fixed;

c) protect the country's economy from unexpected phenomena, like the recent pandemic or a natural disaster.

Appendix A. Decomposing into growth and cyclical components

Different methodologies have been proposed over the years (see e.g., Hodrick (2020) and references therein) for decomposing a time series into growth and cyclical components. The one better suited for GDP time series is the well-known Hodrick-Prescott (HP) filter (Hodrick & Prescott (1997)). The HP filter decomposes a time series, y_t, into a *growth* or *trend* component, $\bar{y}_t$, and a *cyclical* component, C_t:

$$y_t = C_t + \bar{y}_t. \qquad (A.1)$$

It is understood that in the problem under consideration

$$y_t \equiv \ln Y_t, \quad \bar{y}_t \equiv \ln \bar{Y}_t, \quad C_t \equiv g_t. \qquad (A.2)$$

The Hodrick-Prescott (HP) filter (for a series y_t) consists of specifying an adjustment rule whereby the trend component of the series y_t moves continuously and adjusts gradually. Formally, the unobserved trend component $\bar{y}_t$ is extracted by solving the following minimization problem

$$\sum_{t=1}^{N} (y_t - \bar{y}_t)^2 + \lambda \sum_{t=2}^{N} \left((\bar{y}_t - \bar{y}_{t-1}) - (\bar{y}_{t-1} - \bar{y}_{t-2}) \right)^2 \qquad (A.3)$$

for $\bar{y}_t$. Thus, the objective is to select the trend component that minimizes the sum of squared deviations from the observed series, subject to the constraint that changes in $\bar{y}_t$ vary gradually over time. The coefficient λ is a positive number that penalizes changes in the trend component. The larger the value of λ, the smoother the resulting trend series. The usual practice is to set λ equal to 100 with annual data series (Agenor (2004), p. 361).

It is convenient to express the objective function (A.3) in matrix form:

$$(y - \bar{y})^T (y - \bar{y}) + \lambda \bar{y}^T \nabla^{2T} \nabla^2 \bar{y} \qquad (A.4)$$

where y and $\bar{y}$ are N×1 vectors of the original data and the trend and ∇^2 denotes the *2nd* difference matrix (Mohr 2005). The solution (Danthine & Girardin 1989) of this optimisation problem follows from the first order conditions in matrix form:

$$\bar{y} = (I + \lambda \nabla^{2T} \nabla^2)^{-1} y, \qquad (A.5)$$

$$C = y - \bar{y}. \qquad (A.6)$$

Let $y_{[1,t]}$ be a time series $y_1, y_2, \ldots, y_t$ in years 1 to t: Equations (A.2), (A.5) and (A.6) yield

$$\bar{y}_{[1,t]} = (I + \lambda \nabla^{2T} \nabla^2)^{-1} y_{[1,t]}, \qquad (A.7)$$

$$g_t = y_t - \bar{y}_t. \qquad (A.8)$$

Equation (A.7) is a kind of smoothing operation which eliminates the cyclical component from $y_{[1,t]}$ and gives the trend $\bar{y}_{[1,t]}$. Equation (A.8) is an immediate consequence of equation (2.3) and expresses the difference of the logarithms of the trend of GDP $\bar{y}_t$ and the real GDP y_t.

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An estimate of international receipts and the turnover of the hotel and food sectors during the second year of the pandemic

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Abstract

This article examines the new developments concerning the economic performance of the tourist industry (expressed by economic variables such as the international receipts and the turnover of accommodation and food services) achieved under the pressure of the continuing pandemic crisis. The results of this research show that international receipts for 2021 are estimated to vary between 8.3 and 9.4 billion euros, with the corresponding losses estimated between 8.8 and 9.9 billion euros compared to 2019, the last "normal" year for tourism. In addition, use of the Consumer Price Index (CPI) weight structure leads to the conclusion that, for 2021, the shares attributed to international and domestic tourists in the total turnover of accommodation and food sector services are approximately the same compared to those of year 2020.

Keywords: Accommodation and catering, non-resident travel receipts, coronavirus, COVID-19, price indices, weighting factors, Greek economy.

JEL classification: E39, Z30, Z32

Introduction

At the beginning of 2020, the outbreak of the COVID-19 pandemic constituted an enemy to all countries alike, which, judging by the results we have already experienced, were heavily affected both socially and economically. As far as the Greek economy is concerned, the pandemic crisis halted its recovery, causing its real GDP to contract by as much as 8.2%, mainly as a result of the reduction in private consumption and exports of services. Once business operations were restricted or closed down altogether to the public, the impact on various sectors of the economy varied widely and those affected most included hotel and accommodation, catering, tourism, transportation, cultural activities and retail trade services.

The gradually and continuously improving management of the pandemic was a decisive factor on the part of the governments all around the world in their effort to contain the spread of the virus and thus to put an end to this global health crisis. This was made possible because, given time, the pandemic related research produces results that could be used both for dealing with it and for preventing it. The aforementioned proper management is estimated to be the key to the gradual fading of the pandemic and ensuring a stable path to recovery. Given the dynamic rebound of the Greek economy in the second quarter of 2021, which confirms that the losses to economic activity as a result of the pandemic will be recovered faster than initially estimated, it appears that the economic performance of the tourist sector will be one of the key factors that will decide the rate of growth of the economy as a whole for year 2021 (Rodousakis and Soklis, 2021).[2]

This short article is based on a previously published study of Kasimati, Kondelis and Lagopoulos (2020) and has the following structure. The first section uses in-

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2. There are studies in the bibliography both for Greece and Europe that examine issues of direction and causality in the economic relation between tourism and economic growth with mixed results and with no prevalence of a specific directional causal relationship (for more details, see Rodousakis and Soklis (2021), Kasimati (2011), Song and Wu (2021) and Antonakakis et al. (2015).

formation on the structure of weights of the CPI and the Harmonized Consumer Price Index (HICP) in order to estimate, first, the part of the Accommodation and Food sectors' turnover that is due to international visitors and that which is due to domestic tourism, and second, how this allocation is affected by the pandemic crisis. The second section presents an analysis of the international receipts up to June 2021, published by the Border Survey of the Bank of Greece. In addition, based on three different scenarios, international receipts are estimated on a monthly basis for the second half of 2021, along with the total losses in the payments of the non-residents compared to 2019. The last section of the article contains the conclusions of this work.

1. The turnover of the Accommodation and Food sectors: breakdown by source of spending (international vs domestic tourists) and projected path for 2021

The turnover of the two main components of the tourist industry (that is, *accommodation* services and *food* services) was considerably lower in 2020 compared to the corresponding figure for the year 2019. This can be attributed to the decrease in demand for those services as tourist flows were substantially decreased, contributing thus to the contraction of GDP. According to ELSTAT (2021), the turnover of accommodation services for 2020 amounted to 2,371,365,548 euros and that of food services to 4,084,227,880 euros. The recorded decline in 2020 compared to 2019 in percentage terms reached 66.8% for accommodation services and 37.2% for food services.

We use the information contained in the weight structure of certain categories of interest of the CPI and the HICP in order to come up with an estimate of the breakdown of the turnover of both accommodation and food services, according to their source: interna-

tional as opposed to domestic tourists. It should be borne in mind at this point that both the aforementioned indexes contain essentially the same categories of goods and services and that their difference lies in the fact that they use a different weight structure.

The weight structure of the CPI is based primarily on the Household Budget Survey (HBS). On the other hand, while the weight structure of the HICP is based on the same survey, it additionally involves data and information from the *National Accounts* in order to integrate the structure of the expenditure of international tourists as well. As a result, tourist spending is incorporated in the HICP, but not in the CPI. With that in mind, comparing the weight coefficients of the two indexes for hotel accommodation and food services, we establish the following differences in the two indexes:

From Table 1, it can be concluded that international tourists account for 81.28% of the accommodation services turnover, while the corresponding participation rate in the food services turnover amounts to 30.34% (based on 2020 data).

With the aid of the shares established in Table 1, we present in Table 2 the breakdown of the total value of the turnover for each of these two sectors into two parts, according to its source: one that can be attributed to international tourists and one that can be attributed to domestic tourists.

Based on ELSTAT (2021), the turnover of accommodation services during the first quarter of 2021 amounted to 97,977,317 euros and during the second quarter to 596,430,723 euros, recording annual changes of -59.2% and 452.3%, respectively, when compared to the turnover of the same quarters of the previous year (2020). As a result, the turnover for the accommodation sector for the first half of 2021 totaled 694,408,040 euros, posting a 99.6% increase compared to the first six months of the previous year.

TABLE 1 CPI and HICP weights of certain items for 2020

Sector	HICP	CPI	Difference (units)	Difference as a percentage of HICP
Food (and beverage) services	138.08‰	96.19‰	41.89	30.34%
Accommodation services	33.40‰	6.25‰	27.15	81.28%

Source: ELSTAT data, authors' own calculations.

TABLE 2 Breakdown of the 2020 turnover of accommodation services enterprises and of food services enterprises according to the origin of tourists (international and domestic)

Services	Turnover 2020 (in euros)	Non-resident visitor participation	Turnover attributed to international visitors (in euros)	Turnover attributed to domestic visitors (in euros)
Accommodation enterprises	2,371,365,548	**81.28%**	1,927,459,407	443,906,141
Food and beverage enterprises	4,084,227,880	**30.34%**	1,238,959,984	2,845,267,897

Source: ELSTAT data, authors' own calculations.

As far as the food services sector is concerned, the recorded turnover for the first and second quarters of 2021 amounted to 460,584,614 and 1,042,303,819 euros, respectively, leading to a change of -52.5% and 62.3% when compared to the corresponding quarters of the previous year. Hence, the total turnover of the food services sector for the first two quarters of 2021 amounted to 1,502,888,433 euros, down by 6.8% compared to the same time period of the previous year.

Finally, a scenario is adopted for the accommodation services turnover that we believe is most likely to prevail given, on the one hand, the actual data available so far (that is, for the first half of 2021) and, on the other hand, the estimates for the already completed summer months (for which there are no official data as of yet). Based on the economic performance of the tourist sector up to this date, the scenario we adopt is rather optimistic, claiming that the accommodation services turnover attributed to international tourists will level at 200%, while that of domestic tourists will be 120% (both compared to the previous year). The turnover values for this scenario are exhibited in Table 3.

It becomes apparent from Table 3 that the scenario we adopted above enabled us to predict the turnover for the accommodation and catering sectors for the year 2021 as a whole. Subsequently, since we (already) have the official turnover data for the first half of the year, the turnover for the second half of the year was obtained as the difference of the two.

According to Table 4, the increase in the accommodation services turnover in 2021, compared to the previous year, is projected at around 85% while that

TABLE 3 Estimated turnover for 2021

Services	2020 Turnover (in euros)	Turnover estimate due to international tourism (200% of 2020) (in euros)	Turnover estimate due to domestic tourism (120% of 2020) (in euros)	Total turnover estimate for 2021 (in euros)	Percentage change compared to 2020
Accommodation enterprises	2,371,365,548	3,854,918,814	532,687,369	4,387,606,183	85.0%
Food and beverage enterprises	4,084,227,880	2,477,919,967	3,414,321,476	5,892,241,443	44.3%

Source: ELSTAT data, authors' own calculations.

TABLE 4 Estimated turnover for each half of 2021

Time period	Accommodation turnover in 2020	Accommodation turnover in 2021	Annual percentage change compared to 2020	Food turnover in 2020	Food turnover in 2021	Annual percentage change compared to 2020
1st Half	347,971,595	694,408,040	99.6%	1,612,487,913	1,502,888,433	-6.8%
2nd Half	2,023,393,953	3,693,198,143	82.5%	2,471,739,967	4,389,353,010	77.6%
Annual	2,371,365,548	4,387,606,183	85.0%	4,084,227,880	5,892,241,443	44.3%

Source: ELSTAT data, authors' own calculations.

of food services is around 44%. The increase for the total of the two sectors as a whole reaches 59%. Still, compared to 2019, the total turnover in year 2021 falls short by 24.6%.

2. Non-resident travel receipts in 2021

During the decade beginning with 2010, Greece experienced a record-high increase in incoming tourist flows, with the latter more than doubling by the end of that period (in particular, we had 15 million incoming tourists in 2010 and 31 million in 2019). The upward trend in the number of international tourists was nevertheless strongly reversed in the face of the pandemic, diminishing by as much as 76.5% on an annual basis in 2020, due to, on the one hand, the government measures restricting transportation as well as economic activity (local lockdowns), and, on the other, a considerable percentage of people decided to put off traveling for fear of being infected with Covid-19. As a result, the number of international tourists that visited Greece in 2020 reached almost 7.4 million, with the incoming flows reaching their peak (of 67% total arrivals for year 2020) in the time interval between July and October. Despite the stronger, on average, increase in incoming non-resident arrivals in Greece compared to the rest of Europe, the decrease in arrivals in the rest of the European countries was nevertheless milder in 2020 (70% on an annual basis).

One explanation for this, among others, is that the bulk of the incoming non-resident tourists arrive in Greece by air (non-resident arrivals in Greek airports represent well over two-thirds of total tourist arrivals in the coun-

try). As far as non-resident receipts, Greece recorded 4.32 billion euros for year 2020, a figure considerably smaller (76.2% lower, to be specific) than that of the previous year. The aforementioned total non-resident receipts could be further distinguished into those originating from EU-27 countries, which amounted to 2.858 billion euros (down by 68.9% compared to the previous year), as well as into those originating from non EU-27 countries, amounting to 1.452 billion euros (down by 82% compared to the previous year). In all, tourist activity as expressed by non-resident receipts receded in the year 2020 to 23.8% compared to the previous year.

The rest of this section centers around estimating the demand for tourist services for Greece in year 2021 by focusing specifically on non-resident receipts. For the first half of 2021(for which there are published data available), non-resident receipts recorded a 63% increase compared to 2020, but at the same time, they posted a 78% decrease compared to 2019. For the second half of 2021, the estimation of non-resident receipts on a monthly basis involves the use of three scenarios, defined as follows: (a) pessimistic –assumes a 54% decrease in non-resident receipts, which implies that only 46% of 2019 non-resident receipts will be realized in 2021, (b) baseline –assumes a decrease of 51% and (c) optimistic –assumes a reduction of 48%. The above three scenarios are based on airline data regarding the scheduled number of international flights as well as the airline plans for international passenger seats into Greece.[3] The percentage change of 2021 non-resident receipts compared to their 2019 levels, according to each one of the three scenarios for both the published data (available through June 2021)

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3. For details concerning the methodology, see Kasimati, Kondelis and Lagopoulos (2020).

and the monthly estimates for the second half of 2021, are shown in Figure 1.

The future prospects concerning the economic performance of the tourist sector seem encouraging if the available non-resident receipts' data for 2021 (as a percentage of their 2019 counterparts) are compared against the corresponding data for year 2020. This comparison shows that a considerable part of the decrease in non-resident receipts during 2020, compared to 2019, has been recovered. Taking into account the published (first half of the year) as well as the estimated (second half of the year) non-resident receipts' data for 2021, based on the baseline scenario, Figure 2 depicts the percentage change in monthly non-resident re-

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FIGURE 1

Non-resident travel receipts in 2021: three scenarios (percentage change with respect to 2019)
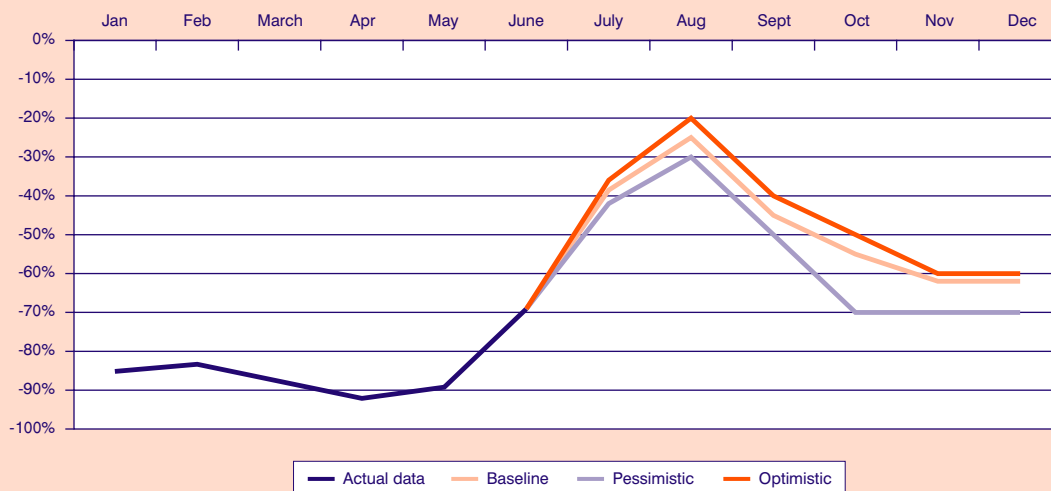

Source: Border Survey of the Bank of Greece and authors' own calculations.

FIGURE 2

Travel receipts in 2021: percentage change with respect to 2019, under the baseline scenario
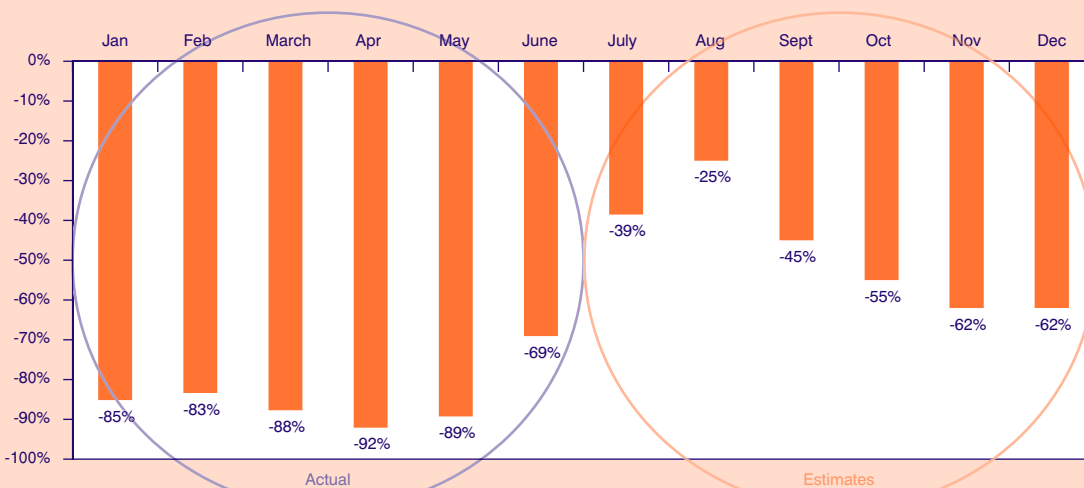
Source: Border Survey of the Bank of Greece and authors' own calculations.

FIGURE 3
Travel receipts (in euros)

Percentage of 2019 receipts recovered

Source: Border Survey of the Bank of Greece and authors' own calculations.

Note: Data for 2019 and 2020 are based on the Border Survey of the Bank of Greece. The data for 2021 are our own estimates based on the baseline scenario.
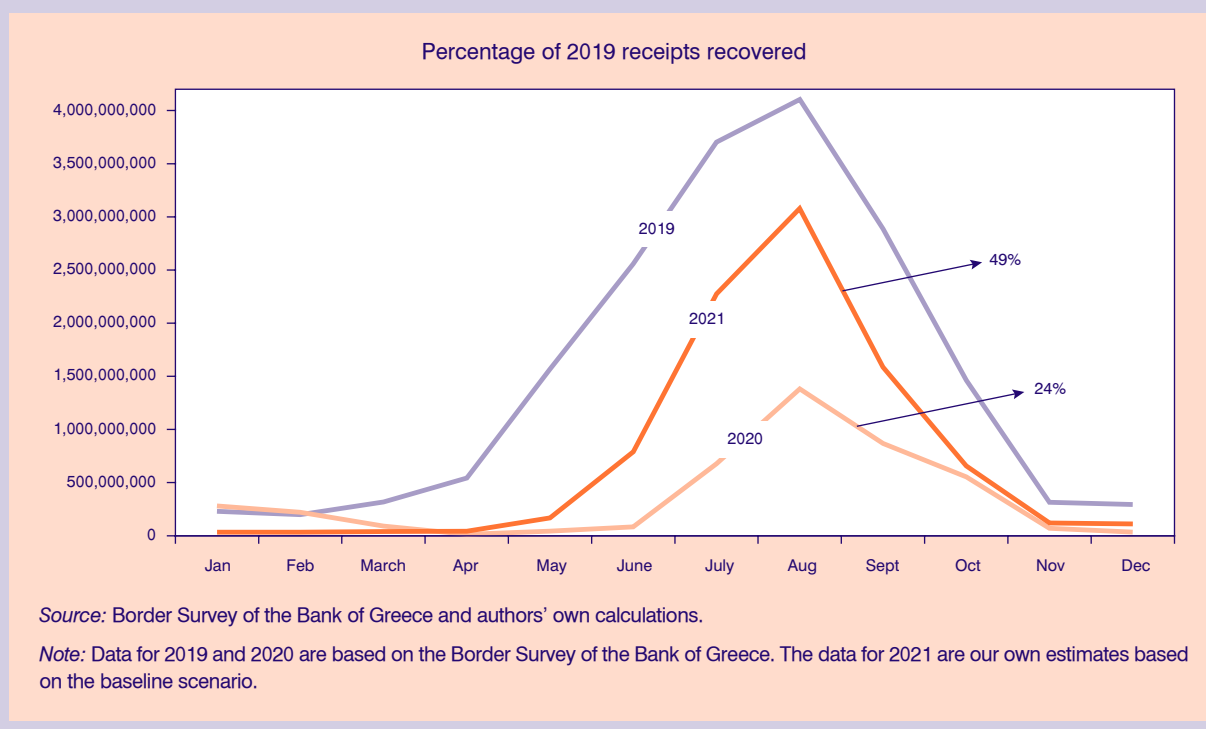
ceipts for year 2021 compared to year 2019. It should be pointed out that non-resident receipts during July and August 2021 are expected to have an even better performance compared to that of the first half of the same year.

Assuming the pandemic conditions for September 2021 until the end of 2021 follow a similar path to the one we experienced last year, non-resident receipts in 2021 are expected to recover the 2019 level by as much as 46% to 52% (Figure 3). As a result, the level of non-resident receipts in 2021 is expected to range between 8.3 and 9.4 billion euros, while our baseline scenario calls for a level of 8.9 billion euros.

According to a recent study (NBG, 2021), non-resident receipts in 2021 are expected to grow, reaching 50% of their 2019 levels. A necessary condition for this expectation to be fulfilled is that the trend in the current plan of scheduled flights at high capacity for September and partly for October will eventually be realized through effective pandemic control. At the same time, in a study by Rodousakis and Soklis (2021), it is estimated that if non-resident receipts in 2021 reach 50% of their 2019 level, this will, *ceteris paribus*, result in an increase in GDP by 2.9%, in employment by 3.19% and in total imports by 2.21%.

3. Conclusions

As we approach the completion of two years since the beginning of the pandemic, we have enough data and information to analyze at least its direct impact on the tourist sector and the economy in general. Analysis of economic variables related to tourism reveal the contribution of this article in as much as, on the one hand, the turnover of the accommodation and food services sector is broken down and distributed according to its origin to either international or native tourists. On the other hand, an estimation of the international receipts for the year 2021, is presented, based on three scenarios. In summary, the main points of this article are the following:

- According to available data for the first half of 2021 non-resident tourist receipts for that period recorded an increase of 63% with respect to 2020, but, at the same time, an even greater decrease of 78% with respect to 2019.

- Despite the relatively good management of the pandemic on the part of the government, Greece suffered a considerable reduction of non-resident travel receipts in 2020 compared to 2019, reaching as much as 76.2%. Nevertheless, it is expected in 2021 to recover a good part of the lost ground,

which ranges between 46% and 52% (always compared to 2019 and conditional on the fact that pandemic conditions for the rest of the year will resemble those of the same period of the previous year).

- Based on three scenarios (pessimistic – baseline – optimistic), non-resident tourist receipts for year 2021 are expected to range between 8.3 and 9.4 billion euros.

- Taking into account the weighting factors of the CPI and the HICP (and in general the methodology used in the HBS), an estimate of the breakdown of the turnover of accommodation and food services was computed according to the origin of its source: domestic or international. The shares computed based on the 2020 HBS are the following: For accommodation services, the international tourists' share is 81.28%, and the domestic tourists' share is 18.72%. For food services, the international tourists' share is 30.34%, and the domestic tourists' share is 69.66%. The great dissimilarity of the shares makes it absolutely clear that a change in the behavior of international or domestic tourists because of the pandemic will have a highly dissimilar impact on the tourist revenues from each category.

The accumulated experience during the last two years, which were strongly characterized by the pandemic, showed beyond any doubt the power of the tourist sector to either promote economic growth or cause the economy to slow down under different conditions. That knowledge also helped reestablish the need for the diversification and broadening of the economic model of Greece, strengthening other sectors of the economy so that together with the tourist sector, they can all simultaneously lead to a more balanced growth path.

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