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Content

Editor's note[1]

Pedro Duarte Neves

October 2021

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1. This issue of Banco de Portugal Economic Studies includes four studies. The first examines the behaviour of inflation expectations in the euro area over the course of the COVID-19 pandemic. The second features the behaviour of Portuguese households' spending in the first year of the pandemic, using a card transactions database. The third makes a comparison of wealth distribution in Portugal and the euro area, as at 2017. Finally, the fourth study assesses the cost-efficiency of the Portuguese banking system in the past decade.

2. The truly unique nature of the COVID-19 pandemic – characterised by concurrent supply and demand shocks, which differ clearly from usual, the unprecedented reaction in terms of economic policies and finally, the advances and setbacks of the pandemic itself – has resulted in high levels of uncertainty for economic agents and significant adjustments in their behaviour.

Understanding the effects of the pandemic on prices is particularly challenging. Economic recovery in tandem with an increase in inflation has been observed in most advanced economies. The increase in prices has been particularly significant in the United States: the annual change in the Consumer Price Index (CPI) stood at 5.4% in June this year, the highest figure since August 2008; In the same month, the change in the CPI excluding food and energy – commonly referred to as core inflation or underlying inflation – reached 4.5%, the highest since September 1991.[2] The rise in inflation, both in the United States and in most other advanced economies, has been attributed to predominantly temporary factors.

Part of the increase in inflation is caused by base effects, which are the counterpart of price falls in the early stages of the pandemic, associated with the collapse of demand or the decrease in consumption opportunities. In addition, the speed and intensity of the recovery of the economy itself resulted in a number of effects with an impact on prices: (i) tensions in production chains, which led to shortages of important elements in the production process, (ii) adjustments in commodity prices, most notably energy

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1. The analyses, opinions and conclusions expressed in this editorial are entirely those of the editor and do not necessarily coincide with those of Banco de Portugal or the Eurosystem.

2. In August, the annual change in the CPI declined to 5.3% (4.0% for the CPI excluding food and energy).

prices, (iii) very large increases in shipping costs, (iv) labour shortages in specific sectors, (v) effects on some types of goods and services resulting from readjustments of consumption patterns (e.g. used cars and transport services in the United States). In addition and over a longer term, the effect of an adjustment of the currently very high savings rate on prices is unpredictable.

The nature of these different factors tends to make the effects on inflation inherently transitory. Continued high levels of inflation will only be seen if wage growth increases or if inflation expectations are revised above the levels compatible with price stability. Against this background – also taking into account the decisive role of fiscal and monetary policies throughout this crisis – it is crucial to analyse the behaviour of inflation expectations in the course of the current pandemic crisis and also their outlook in the near future.

Inflation expectations are central to the behaviour of economic agents and thus to their consumption, saving and investment decisions. They are therefore an essential element in wage formation and in price formation for goods, services and financial assets. Inflation expectations also play a major role in the monetary policy transmission mechanism and are therefore central to the definition of the monetary policy stance. Inferring inflation expectations – as they are not directly observable – is an essential exercise for central banks to assess the outlook for future inflation developments in the short and medium term; but also over longer horizons and, consequently, to assess the credibility of monetary policy.

3. The first study in this publication – by Gomes, Iskrev and Ribeiro – analyses the behaviour of inflation expectations in the euro area during the COVID-19 pandemic crisis. To this end, the authors use two well-established approaches in the literature: indicators based on the prices of financial market instruments that are indexed to future inflation rates and indicators based on surveys of professional forecasters on future inflation developments.

The main findings of this study are as follows:

(i) In its initial phase, the COVID-19 pandemic was interpreted as a negative shock, predominantly on the demand side and, therefore, inflation expectations decreased, particularly in the short term;

(ii) In the course of 2021, in particular as of early spring, inflation expectations were gradually revised upwards, reflecting the perception that supply-side shocks – stemming, for example, from disruptions in the productive structure and increases in commodity prices – had become predominant;

(iii) Finally, both types of indicators of inflation expectations display a very high degree of dispersion – unprecedented in recent times – on future price developments.

This latter factor is important as it indicates greater unpredictability about future price developments in the euro area. Increased effort is therefore warranted when monitoring the available measures of inflation expectations in the regular exercise of monetary policy. In addition to the indicators reviewed in this study, it is equally crucial to monitor the outlook for prices presented in the expectations indicators, consumer-wise and production-wise (industry, construction and services), as they also provide a complementary perspective.[3]

4. There are, however, more structural reasons that have justified a broader discussion on the outlook for inflation, notably more intense in the United States. On the one hand, the possible impact of the current economic policy mix on prices; on the other, the possible effect of some structural changes, which are gradually occurring, on future price behaviour.

In February this year, in an article in The Washington Post commenting on President Biden's fiscal stimulus programme, the economist Lawrence Summers stated that:[4] "... while there are enormous uncertainties, there is a chance that macroeconomic stimulus on a scale closer to World War II levels rather than normal recession levels will set off inflationary pressures of a kind we have not seen in a generation, with consequences for the value of the dollar and financial stability. (...) there is the risk of inflation expectations rising sharply". A few days later, Paul Krugman responded "When Pearl Harbor is attacked you don't ask how big is the output gap" in a debate organised by Princeton University in which these two economists participated. Recently, in a joint letter[5] dated 15 September, 15 Nobel Laureates concluded that "Because this agenda [i.e. President Biden's American Rescue Plan] invests in long-term economic capacity and will enhance the ability of more Americans to participate productively in the economy, it will ease longer-term inflationary pressures".

This debate has been focused on the dimension of fiscal policy stimuli in the United States. It is therefore not surprising that, in the United States, the discussion on future inflation behaviour, given the current monetary and fiscal policy framework, is one of the most lively and engaging.

But it is also true that medium to long-term structural changes that could already be observed before the pandemic – digitalisation of consumer preferences, emergence of large digital global players, adaptation of the economy to climate transition, automation of various productive activities, changes in the relative weights of major world economic

3. See "Managers' and consumers' price expectations on the rise", in "European Business Cycle Indicators: 2nd Quarter 2021", *European Economy Technical Paper 049 | July 2021*, European Commission.

4. Summers, L.H. "Opinion: The Biden stimulus is admirably ambitious. But it brings some big risks, too", *Washington Post*, 4 February 2021.

5. See *Nobel Prize Letter in Support of Biden Economic Program*.

blocs, population ageing – may also determine the direction of future price behaviour.

In a recent book,[6] Charles Goodhart and Manoj Pradhan argue that underlying demography and globalisation trends could lead to higher inflation and interest rates: "Deflationary headwinds over the last three decades have been primarily due to an enormous surge in the world's available labour supply, owing to very favourable demographic trends and the entry of China and Eastern Europe into the world's trading system. This book demonstrates how these demographic trends are on the point of reversing sharply, coinciding with a retreat from globalization. The result? Ageing can be expected to raise inflation and interest rates (…)".

There are therefore a number of reasons for strengthening the monitoring of inflation expectations and wage expectations, both now and in the medium term, and thus provide a better understanding of the price formation process and anticipate and prevent any abrupt changes in inflation.[7]

5. The study by Cabral, Manteu, Serra and Silva uses a database of purchases made with Portuguese cards to characterise the evolution of consumption expenditure by Portuguese households between January 2020 and February 2021, thus covering the first year of the COVID-19 pandemic. The database, provided by SIBS,[8] contains information on card transactions carried out at ATM/POS terminals within the SIBS network. The features of this database enabled the authors to explore some dimensions of heterogeneity in card payments: by type of good/service (seller's activity sector) and by consumer groups (established on the basis of the average spending per card) and by region/municipality (corresponding to the location in which the card is used the most).

Given the importance of SIBS in electronic payments, that database provides unique conditions to monitor and anticipate the behaviour of aggregate private consumption and to identify some dimensions of heterogeneity. Given its ready availability, the Banco de Portugal uses the database regularly to analyse the economic environment and estimate developments in the economy in real time (commonly referred to as nowcasting). It should also be noted that this database has a relatively unusual level of coverage. Studies of a similar nature for other economies – which are mentioned and summarised in this study of the Banco de Portugal Economic Studies – are largely based

6. Goodhart, C. and Pradhan, M., *The Great Demographic Reversal – Ageing Societies, Waning Inequality, and an Inflation Revival*, Palgrave Macmillan, 2020.

7. For an assessment of the behaviour of inflation expectations in past inflation episodes, see Reis, R. "Losing the Inflation Anchor", *Brookings Papers on Economic Activity*, BPEA Conference Drafts, 9 September 2021. For a more sceptical analysis of the informational content of inflation expectations for future price growth, see Rudd, J.B., "Why Do We Think That Inflation Expectations Matter for Inflation? (And Should We?)", *Finance and Economics Discussion Series 2021-062, Washington: Board of Governors of the Federal Reserve System*, 2021.

8. See https://www.sibsanalytics.com

on less comprehensive databases containing information from one bank or retail chain.

The results of the study document the behaviour of consumers over the course of the pandemic in a highly informative manner. An interesting finding is the increase in the average amount of purchases, which reached approximately 10% when more restrictive lockdown measures were in force (March-April 2020 and January-February 2021). During these periods, significant reductions in the total value of transactions (around 40% in March-April 2020 and around 30% in January-February 2021) were observed.

Behaviours also differed greatly by type of goods and services: an increase in spending on essential goods, a very severe reduction in spending on durable goods during lockdown periods and a highly significant reduction in spending on services, especially those requiring social interaction, where restrictions and fears of infection had the greatest impact.

The group of consumers with the highest average expenditure per card reduced consumption even further than the group with the lowest average expenditure. The authors also used a shift-share analysis which led to the conclusion that the *structure effect* (i.e. differences in the basket consumed) and the *behaviour effect* (i.e. differences in the product/service rates of change) contributed very closely to the differences in the rates of change of the highest and lowest average expenditure groups compared to the rates of change for the country as a whole.

The econometric analysis carried out confirms the differentiated impact of the pandemic on consumption over time and by average expenditure groups. The regional incidence of COVID-19 seems to play a statistically significant role, albeit on a small scale, in consumer spending.

6. The third study in this issue of the Banco de Portugal Economic Studies, by Costa, Farinha, Martins and Mesquita, compares the distribution of household wealth in Portugal and in the euro area. This analysis is based on the 2017 wave of the Household Finance and Consumption Survey (HFCS), developed for the euro area by Eurosystem.[9,10]

The analysis of the 2017 HFCS provides some interesting results:

9. The first wave of the HFCS was conducted in 2010, followed by the 2013-14 and 2017 waves. In Portugal this survey is called *Inquérito à Situação Financeiras das Famílias* (ISFF) and is developed in close collaboration between the Banco de Portugal and Statistics Portugal (INE). The two institutions had already collaborated in the *Inquérito ao Património e Endividamento das Famílias* - IPEF (Household Wealth and Indebtedness Survey) in 1994, 2000 and 2006 and was subsequently replaced by the ISFF.

10. As a matter of fact, the first study on the distribution of wealth in Portugal, using the IPEF survey, was published by the Banco de Portugal in 1996. See Costa Dias, M., "Riqueza e rendimento em Portugal: primeira abordagem do IPEF", *Economic Bulletin*, Banco de Portugal, June 1996.

(i) In 2017, the average wealth of households in Portugal stood at around €162,000, some 30% below the corresponding figure for the euro area average;

in terms of main similarities,

(ii) The dispersion of wealth – measured by the ratio of average wealth to median wealth – was very close in both Portugal and the euro area;

(iii) Real estate ownership – main residence and other real estate – was the most important investment by households, accounting for approximately 67-68% of total assets, in both Portugal and the euro area;

(iv) Total household debt, in both Portugal and the euro area, corresponded to around 12-13% of household wealth, almost all of which is secured by real estate;

(v) The share of households receiving inheritances or gifts was around 28-29% in both Portugal and the euro area;[11]

in terms of main differences,

(vi) In Portugal, 74% of households owned the main residence, above the euro area's 60%;

(vii) Portuguese households' holding of financial assets other than deposits – mainly units in investment funds, debt securities, listed shares and voluntary pension schemes – is significantly lower as a proportion of wealth compared to that of the euro area (3% and 11% respectively).

HFCS data provide a look into the heterogeneity of households – in terms of age, composition, education[12] and income, among other characteristics – to describe the patterns of wealth distribution in a more informative manner. Through an econometric approach, the authors use a counterfactual exercise to assess the relationship between differences in these characteristics and differences in wealth levels in Portugal and the euro area.

7. Ownership of the main residence is one of the central investments of household wealth, as evidenced in the study by Costa, Farinha, Martins and Mesquita. Against this background, developments in house prices are of great importance. In June 2021, house prices[13] recorded – for a number of developed and developing economies – the largest year-on-year increase since June 2005 (9.2%), which was markedly higher than

11. As the authors of the study explain, Italy is not included in the figures for the euro area.

12. The HFCS shows the considerably lower levels of education in Portugal compared to those of the euro area as a whole, particularly significant in the proportion of household reference persons with an educational attainment lower than upper-secondary (65% and 30% respectively).

13. Global House Price Index – Q2 2021, Knight Frank. This publication presents house price indices for 55 developed and developing economies. The average price growth in developed economies was more than double that observed in developing economies, which could be explained by the considerably higher support provided during the pandemic to protect jobs and wages. For Portugal, this indicator uses series from Statistics Portugal.

the increase recorded a year earlier (4.3% in June 2020). Thus, aspects that emerged in the course of the pandemic – such as increased savings and widespread work from home –exacerbated pre-existing elements, such as the historically low level of interest rates and, in several geographies, the housing supply shortage.

This recent price behaviour is yet another example of how the pandemic has significantly influenced the way economies work. A sharp rise in house prices causes (i) positive wealth effects for home owners, (ii) negative income effects for those who are obliged to allocate a larger portion of their income to home loans, (iii) positive income effects for lessors and negative effects for lessees, if the increase in house prices is followed by an increase in rents. This results in very significant redistributive effects for different types of households and for different cohorts, with an impact on the intergenerational distribution of wealth. It is therefore of the utmost importance to continue monitoring the distribution of wealth through databases such as the HFCS.

8. The banking system's low profitability has been repeatedly referenced, notably in the ECB's official publications,[14] as a major vulnerability of the European financial system. This assessment – which was already noticeable before the COVID-19 pandemic – has been the grounds for several analyses and reflections on the efficiency of the European banking system and, at a broader level, on the sustainability and need to adjust banking institutions' own business models.[15]

A recent study[16] by economists from the European Central Bank specifically assesses the efficiency[17] of the euro area banking system, using panel data from a sample of around 1500-2000 banks from 17 countries in the period 2006-17, for different types of business models. This study estimated that cost-efficiency amounted to 84%: in other words, if the median bank operated on the technical efficiency frontier, it could produce the same level of output with 84% of the current costs. Estimates of this magnitude justify the significant adjustments that have been made – in terms of branch rationalisation and digitalisation of business processes – in most euro area countries.

The final study of this publication, by Ribeiro and Tavares, assesses the cost-efficiency of the Portuguese banking system. For this purpose, it uses a sample of 15 banks,

14. See for instance, the Financial Stability Review.

15. In this context, the Single Supervisory Mechanism identified the assessment of supervised banks' business models as a supervisory priority for both 2020 and 2021. In this respect, see Andrea Enria's speech "The many roads to return on equity and the profitability challenge facing euro area banks", of 22 September 2021.

16. "The cost-efficiency and productivity growth of euro area banks", Working Paper Series, No. 2305, ECB, August 2019.

17. One of the studies most often referred to in the literature on the efficiency of the banking system was published by economists of the Banco de Portugal. See Boucinha, M., Ribeiro, N. and Weyman-Jones, T. , "An assessment of Portuguese banks' efficiency and productivity towards euro area participation", Journal of Productivity Analysis, Vol. 39, Issue 2, pp. 177-190, 2013.

corresponding to around two thirds of the assets of the Portuguese banking system, for the 2012-19 period. The estimate obtained in this study for the cost-efficiency of the Portuguese banking system is also 84%. In addition – and also in line with the results of the study by the ECB economists – this inefficiency measure in the allocation of productive resources remained relatively stable over the period considered.

The study by Ribeiro and Tavares also concludes that, in particular during the first half of the period considered, the marginal cost of a loan tended to exceed the interest charged on that loan, i.e. the interest charged was insufficient to cover the explicit costs of that loan. However, the study shows that this was no longer the case in 2018-19, i.e. at the end of the period under study.

Non-technical summary

October 2021

Euro area inflation expectations during the COVID-19 pandemic

Sandra Gomes, Nikolay Iskrev and Pedro Pires Ribeiro

Measures of inflation expectations are regularly tracked by central banks. When shocks hit an economy, it is important to understand if their impact on inflation will be short-lived or long-lasting as this may require different monetary policy responses. Monitoring inflation expectations in the pandemic period entails even larger challenges. There are implications that pressure inflation both upwards (e.g. associated with supply disruptions and higher commodity prices) and downwards (e.g. associated with the fall in demand). The release of pent-up demand as the recovery firms up, supported by the massive policy stimulus in response to the crisis, may also pressure inflation upwards.

We explore market-based measures of inflation expectations, available at high frequency, and survey-based measures of inflation expectations, in particular from the European Central Bank Survey of Professional Forecasters (ECB SPF). This survey provides information about expected inflation at different horizons as well as about the expected real GDP growth and the unemployment rate, offering a more complete picture of the forecasters' perceptions of future economic developments. Figure 1 depicts the evolution of measures of euro area inflation expectations.

Our analyses suggest that initially the disinflationary shock caused by a depressive aggregate demand surpassed supply constraints, thereby leading to a drop in inflation expectations at different horizons. As the recovery took hold, and inflationary pressures associated with supply constraints dominated, the debate about the inflation outlook focused on the temporary *vs*. permanent nature of the observed surge in inflation outcomes and also on to what degree the policy response to the crisis could imply an eventually more persistent rise in inflation.

The analysis of financial market data shows that at the onset of the pandemic crisis in March 2020 there was a significant decrease in the inflation compensation extracted from inflation-linked swap rates, especially at shorter horizons. While the striking decline in these tenors resulted from both the expectation and the risk premium components, in the case of longer-term inflation compensation the risk premium component played a dominant role. There was also an increase in the uncertainty surrounding future inflation outcomes, as illustrated by a rise in the standard deviation of the (risk-neutral) distribution of inflation over 5 years. After the initial drop, forward inflation compensation indicators have followed an upward trajectory. For short-term contracts, the behaviour of the inflation compensation and the risk premium seems to be partially related to the evolution of oil prices. For longer maturities, the increase in the risk

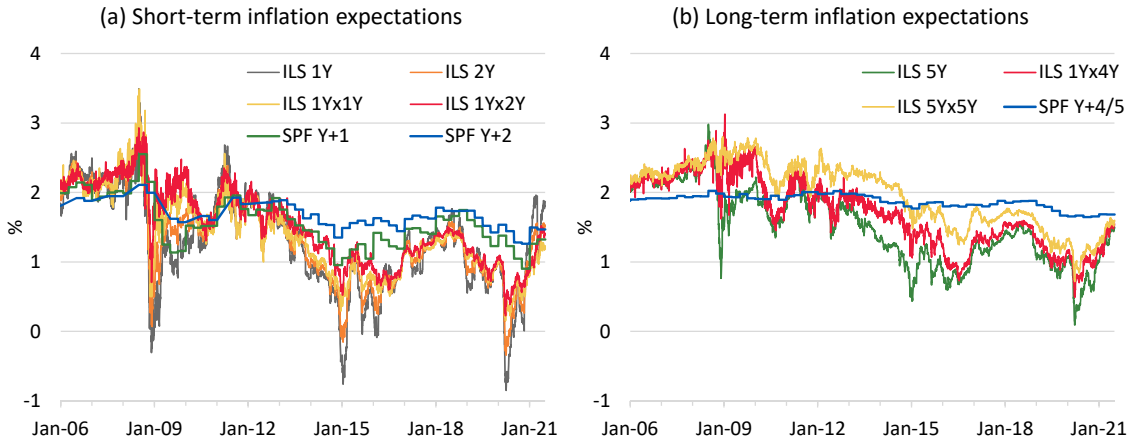

FIGURE 1: Measures of euro area inflation expectations

Sources: Bloomberg, ECB, Refinitiv and authors' calculations. Notes: ILS – inflation linked swaps; SPF Y+4/5 – Survey of Professional Forecasters inflation expectations 4 or 5 calendar years ahead (fixed forecast target), depending on the survey; Last observation: 30 June 2021 for ILS and July 2021 for the ECB SPF.

premium has happened in tandem with a decrease of the risk-neutral probability attached to inflation outcomes below the ECB's inflation aim.

SPF results show that, following the outbreak of the pandemic, professional forecasters viewed the crisis mostly as a demand rather than a supply shock, with a strong negative expected impact of the crisis on GDP growth and inflation. Subsequently, in the 2021 rounds, short-term inflation expectations were revised upwards, given higher commodity prices, some statistical effects and pandemic related supply disruptions. The pandemic outbreak led to a sharp increase in uncertainty, and measures of uncertainty and forecast disagreement based on the SPF reached their highest values in the history of the survey. We also find that the average point forecast of long-term inflation did not change after the pandemic outbreak, suggesting that professional forecasters did not anticipate the crisis to have a persistent effect on inflation. However, examining individual-level forecasts revealed that two-thirds of survey participants revised their long-term inflation forecasts, but disagreed on the sign of the revisions. This result highlights the fact that agents' inflation expectations can be very diverse and, thus, aggregate measures typically used in monetary policy analysis need to be interpreted with caution. The distribution of longer-term inflation expectations have shown an upward movement, though of a limited magnitude and more noticeably in the last survey rounds.

Euro area inflation expectations during the COVID-19 pandemic

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October 2021

Abstract
The COVID-19 pandemic was an unprecedented shock whose effects on inflation are uncertain because of both up and downward pressures on consumer prices interacting to different degrees throughout the pandemic crisis period. In addition, the massive economic policy stimulus as a response to the pandemic raises concerns of a possible surge in inflation with a more persistent nature. Against this background, monitoring inflation expectations is of utmost importance. This article seeks to analyse the behaviour of measures of inflation expectations for the euro area since the outbreak of the pandemic crisis by covering both market-based and survey indicators at different horizons. (JEL: E31, E52, G10)

1. Introduction

Measures of inflation expectations are regularly tracked by central banks to gain an insight into the private sector's assessment of the outlook for inflation and to assess the credibility of monetary policy. When shocks hit the economy, it is important to understand if their impact on inflation will be temporary and eventually short-lived or if they will be long-lasting, namely via their impact on the price and wage setting mechanisms, as this may require different monetary policy responses.

As described in ECB (2011) and Böninghausen *et al.* (2018), inflation expectations indicators play an important role in the large information set analysed by the European Central Bank (ECB) when determining the appropriate monetary policy stance.[1] Inflation expectations are important because they influence private agents' economic decisions and consequently inflation. In addition, financial market participants' inflation expectations are relevant in the pricing of financial instruments and can thus affect

Acknowledgements: The authors thank ECB colleagues for providing the breakdown of ILS rates into inflation expectations and risk premium components analysed in Section 3.2. The authors thank Bruno Freitas, António Antunes, João Amador, Pedro Duarte Neves, Benjamin Böninghausen, Andreea Vladu, and Matjaž Maletič for their comments. The analyses, opinions and conclusions expressed herein are the sole responsibility of the authors and do not necessarily reflect the opinions of Banco de Portugal or the Eurosystem.

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1. This is common to several central banks, namely those having an inflation target such as the US (Bernanke 2007), the UK (Tenreyro 2019) or Canada (Côté 2015).

the transmission of monetary policy. The ECB also monitors indicators of inflation expectations as a way to cross-check the ECB/Eurosystem's projections. Finally, the ECB analyses developments in inflation expectation indicators for longer horizons to assess the confidence of the public in its ability to deliver on its price stability mandate.

Monitoring inflation expectations in the pandemic crisis period entails large challenges. The pandemic is an unprecedented global shock with unusual characteristics and heterogeneous effects across sectors. Understanding its impact on inflation developments is challenging given that there are implications that pressure inflation both up and downwards. On the one hand, downward pressures are associated with the fall in consumption opportunities, though with a reallocation of consumer spending across categories. On the other hand, upward pressures have resulted from supply disruptions both at a national level and in global supply chains, from higher energy and other commodity prices but also from some statistical effects. As the recovery firms up, the release of pent-up demand may also pressure inflation upwards. In addition, the massive economic policy stimulus as a response to the pandemic, in particular the fiscal stimulus, has raised concerns that inflation may surge as a result (Goodhart and Pradhan 2020). Even though these concerns have been more pressing in the US than in the euro area, the significant policy stimulus in the euro area, both monetary and fiscal, makes following closely developments in inflation expectations of the essence.

We document the developments in measures of euro area inflation expectations during the pandemic. We proceed in two steps. First, we examine the behaviour of market-based measures of inflation expectations, which are available at high frequency, and therefore provide timely information about how market participants interpret price developments during the pandemic crisis and its implications for future inflation. Then, we consider survey-based measures of inflation expectations from the ECB Survey of Professional Forecasters (SPF). This survey provides information about expected inflation at different horizons as well as about the expected real GDP growth rate and the unemployment rate and therefore provides a more complete picture of the professional forecasters' perceptions about future economic developments in general, and the COVID-19 shock in particular.

The information analysed, which covers the pandemic period up to mid-2021, suggests that initially the disinflationary shock caused by a depressive aggregate demand surpassed supply constraints, thereby leading to a drop in inflation expectations at different horizons. As the recovery took hold, and inflationary pressures associated with supply constraints dominated, the debate about the inflation outlook shifted to the nature of the observed surge in inflation outcomes, against the background of a markedly accommodative policy, both monetary and fiscal.

The rest of the article is organised in three sections. Section 2 provides an overview of available measures of inflation expectations in the euro area. Section 3 describes the evolution of market and survey-based inflation expectations after the pandemic outbreak in the euro area. The last section offers some concluding remarks.

2. Available measures of inflation expectations

Inflation expectations are not directly observed. Therefore, one needs to find measures that approximate their behaviour. There are two main types of indicators: one based on financial markets data, and another based on surveys generally conducted with professional forecasters, firms or consumers. This section characterises both types of measures of inflation expectations.

An approach to derive inflation expectations builds on the price of financial market instruments indexed to future inflation outcomes, including inflation-linked swaps (ILS), inflation-linked bonds (ILB) and inflation-linked options (ILO).[2] These market-based measures of inflation expectations have the advantage of being available for a wide range of maturities and at a high frequency.

The market for inflation-linked products has grown substantially in past years. At present, zero-coupon inflation swap rates (ZCISR) and break-even inflation rates (BEIR) provide an important source of information regarding market participants' inflation perceptions. Under the risk-neutral measure, the ZCISR must correspond to the average expected inflation rate over the term of the contract in order to make a zero-coupon inflation swap fairly priced. Based on spot rates, it is easy to compute forward inflation swap rates, which provide a view about investors' prospects for inflation for a period starting in the future. For example, the 1Yx2Y ILS rate is the annual (1 year) inflation rate expected 2 years ahead and the 5Yx5Y ILS rate is the average inflation rate over a 5-year period starting in 5 years' time. The latter is a widely used measure of long-term market-based inflation expectations as it is less influenced by cyclical factors.

Market-based indicators of inflation expectations include risk premia. To properly interpret the developments in inflation-linked instruments one has to decompose the inflation compensation demanded in the ILS contract into an expectation component and a risk premium component. The last component may comprise, among others, a liquidity premium and an inflation risk premium (demanded by investors as compensation for the risks surrounding inflation developments over the tenor of the security). This risk premium component may vary across time, but also across the maturity structure, which makes its characterisation challenging.

Decomposing the content of inflation-linked securities into a "true" inflation expectation component and a risk premium component has attracted a lot of attention in the literature (García and Werner 2010; Kajuth and Watzka 2011; Andreasen 2012; Haubrich *et al.* 2012; Hördahl and Tristani 2014; Pericoli 2012; Camba-Méndez and Werner 2017). There are different ways to estimate the risk premium component in market-based measures of inflation expectations. One approach is to use survey-based measures as a direct gauge of the expectations component (because they are not affected

2. An ILS is a contract that involves an exchange of a fixed payment for a payment indexed to realised inflation over a predetermined horizon. ILB are bonds where principal and interest payments fluctuate with the rate of inflation. The difference between the yields of nominal and inflation-linked sovereign bonds of the same maturity is called the break-even inflation rate. ILO can be either a cap or a floor. An inflation cap (floor) is a security that offers investors protection against inflation being higher (lower) than a certain threshold level.

by premia) and obtain the premium component as a difference between inflation compensation in market-based instruments and the survey-based measure of inflation expectations. Another procedure is to estimate both the expectations and the premium component by modelling the inflation swap curve with affine term structure models (ATSM). The identification of the expectations term is conditional on the setup and the modelling assumptions taken, so the estimates of risk premia may differ in terms of the sign, magnitude and dynamics.

ILO are a source of market data about inflation expectations that allows for the assessment of the probability of different inflation outcomes. The probability distributions of inflation extracted from options prices are the so-called risk-neutral probability densities for future inflation outcomes obtained through standard no-arbitrage considerations without making assumptions about investors' risk preferences. Option-implied risk-neutral probability densities are not equivalent to the underlying "physical" probabilities of inflation events, that is, actual probabilities of inflation perceived by market players. This happens because when agents buy or sell options, they consider not only the probability that the option will pay out, but also how much they would value the payout in each state of the world. Even though typically investors are not risk-neutral and thus actual probabilities of inflation tend to incorporate a risk premium component, the analysis of developments in ILO implied-probabilities is still informative, as changes in risk-neutral probabilities and the physical probabilities should be related, especially in periods of reduced financial market turmoil.

Surveys generally provide direct measures of inflation expectations as participants respond to specific questions for this purpose. However, they are available at a lower frequency than market data (usually at a monthly or quarterly frequency). There are several survey-based measures of inflation expectations in the euro area at different horizons. Among the widely used surveys are the ECB SPF, specifically for the euro area, the Consensus Economics and the Eurozone Barometer, both covering a broader set of countries. The type of information available in different surveys differs, namely in terms of the horizons available, the characteristics of the point forecasts' distributions (e.g. mean, median, standard deviation) and the individual forecasters' quantitative assessment of uncertainty surrounding the point forecasts. The ECB SPF is a quarterly survey carried out by the ECB since 1999. The survey rounds take place in the first month of each quarter, i.e. January, April, July and October. The SPF has an important role in the ECB's monetary policymaking information set, as described in ECB (2011) and Böninghausen *et al.* (2018). For information about the SPF see García (2003).

The aforementioned surveys are inquiries of professional forecasters and therefore may be an inaccurate representation of the private sector's expectations. Even though there are also questions on the inflation outlook in surveys of firms and households, usually these have only a short-term focus.[3] Some results in the literature show that there is disagreement among surveys of different types of agents (Mankiw *et al.* 2003; Driver

3. For instance, the European Commission's Business and Consumers Surveys collect consumers' expectations of prices developments in the euro area over the next 12 months.

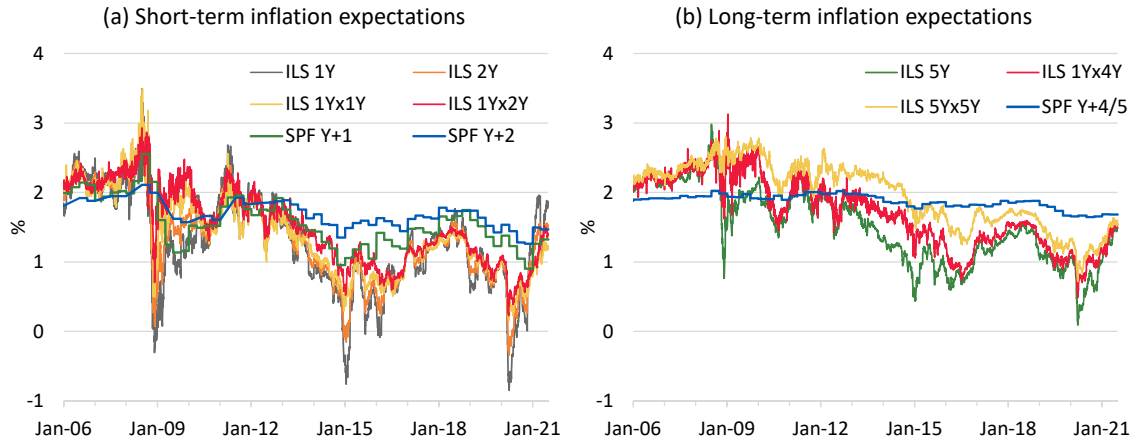

FIGURE 1: Measures of euro area inflation expectations

Sources: Bloomberg, ECB, Refinitiv and authors' calculations. Notes: ILS - inflation linked swaps; SPF Y+4/5 – Survey of Professional Forecasters inflation expectations 4 or 5 calendar years ahead (fixed forecast target), depending on the survey; Last observation: 30 June 2021 for the ILS and July 2021 for the ECB SPF.

et al. 2013; Mokinski *et al.* 2015). Finally, the results of the surveys may be imprecise due to insufficient information among respondents and low sample size. The conclusions may also depend on the wording of the questions, as pointed out by Bruine de Bruin *et al.* (2008).

Given that all existing measures have shortcomings and are imperfect gauges of the (unobserved) "true" inflation expectations, it seems useful to look at several measures of inflation expectations. In the remainder of this article, we concentrate the analysis on ILS and ILO as well as on the ECB SFP. We focus on the ILS as in the euro area the market for ILS is more developed than that for ILB.[4] Among the surveys, we explore the SPF as it provides a wider range of information than other surveys for the euro area.

Figure 1 depicts the evolution of measures of euro area inflation expectations at different horizons based on ILS rates and on the ECB SPF. In the period prior to the pandemic crisis, actual inflation and inflation expectations in the euro area were persistently below 2%. Among the factors potentially explaining this low inflation environment are structural forces such as globalisation, digitalisation and population ageing. Long-run forces may also play a relevant role given that the permanence of interest rates at low levels over a prolonged period and of the expectations that they will persistently remain at low levels may also lead to low inflation outcomes.

4. Currently, various euro area countries, such as Germany, France, Italy and Spain, have sovereign ILB indexed to the euro area HICP (excluding tobacco) that allow for the computation of BEIR. However, in contrast with ILS rates, BEIR can be influenced by non-negligible time-varying liquidity effects and country specific risk premia.

3. The behaviour of euro area inflation expectations during the COVID-19 pandemic crisis

3.1. Inflation-linked financial instruments

When the pandemic shock hit the euro area economy in early-2020, the ILS inflation compensation for several horizons exhibited a marked decrease in the euro area, hitting all-time lows towards the end of March. For various horizons, the magnitude of the monthly drop is only comparable with the falls observed during the global financial crisis. The decline in inflation compensation measures was more marked for shorter horizons, in particular in the case of the 1-year ILS rate, illustrating that, at the onset of the crisis the impact on inflation was mostly seen as concentrated in the shorter term. This steep decline of inflation compensation measures coincided both with the period when severe containment measures were introduced and uncertainty increased considerably, but also with a period when oil prices dropped significantly. It has been argued that movements in the oil price have party driven the co-movement between short- and long-term inflation compensation measures. The strength of this relationship, which has been statistically significant since 2015 in the euro area, recorded an increase after the outbreak of the pandemic crisis, particularly noticeable at shorter horizons.[5] For an analysis of the drivers of inflation expectations, including the role of oil prices see Baumann *et al.* (2021).

After the sharp drop in March 2020, inflation compensation measures have broadly shown an upward trajectory. This is likely partly linked to the recovery in oil prices (though to a lesser extent than the drop in March 2020). In addition, at the end of March 2020, there was the announcement of significant policy measures to respond to the pandemic. In particular, the ECB deployed several measures, including the PEPP (Pandemic Emergency Purchase Programme), that likely contributed to stopping the steep decline in inflation compensation measures. Also, a number discretionary measures with a significant fiscal impact were introduced over time to lend support to the economy, both with a short-term focus to preserve installed productive capacity (e.g. measures aimed at supporting firms' liquidity and the financial situation of households) and with a medium to long-run focus, such as the Next Generation EU recovery package. This increasing trajectory was interrupted after the summer of 2020, especially for expectations regarding inflation over the next year, which likely reflects the worse developments of the pandemic over that period.

Throughout 2021, despite their usual volatility, measures of inflation compensation at different horizons have shown a broadly increasing trajectory along with positive surprises in the releases of euro area economic indicators and rises in the prices of

5. Analysis performed by means of the statistical significance of the rank correlation coefficient between the daily changes of long-term inflation swap rates (5Yx5Y) and changes of short-term rates (1Yx1Y) through a rolling window with 90 days. To analyse the relationship with oil prices, weekly changes of long-term inflation swap rates were regressed on changes of oil prices and the empirical results show that coefficient picked up temporarily in March 2020, amid an already stronger positive relationship registered since mid-2019. These results are available from the authors upon request.

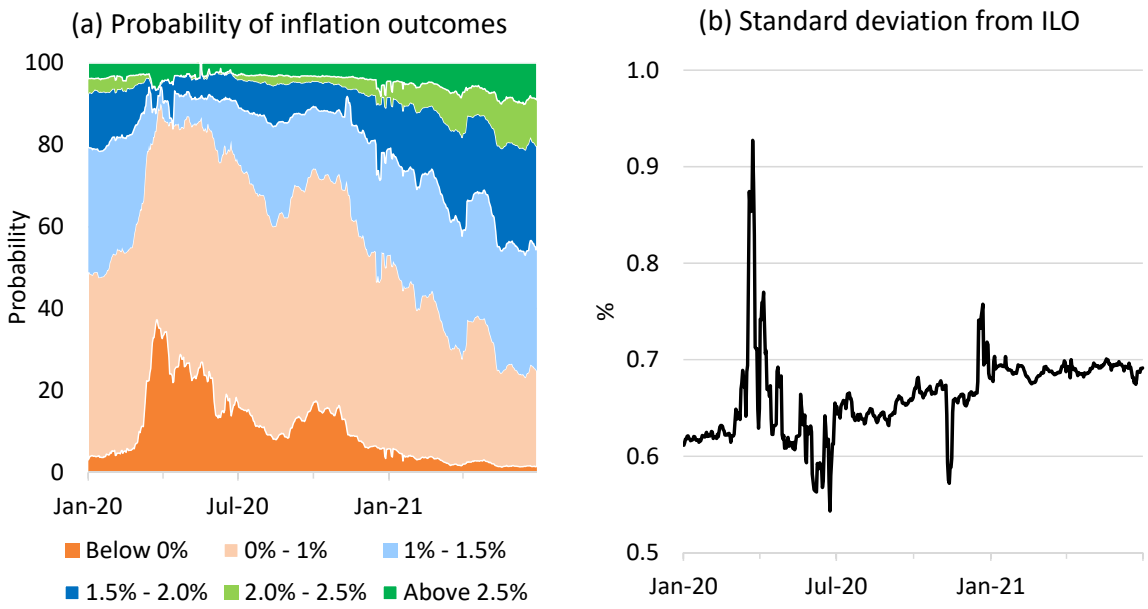

FIGURE 2: Option-implied risk-neutral distribution of average inflation over the next 5 years

Sources: Bloomberg and authors' calculations. Notes: Probabilities implied by 5-year zero-coupon inflation-linked options, smoothed over 5 business days. Latest observation: 30 June 2021.

commodities, including oil. Expectations for inflation over the next year stood for much of the first half of 2021 above expectations for annual inflation 1 and 2-years ahead, as agents saw this increase as mostly temporary. Still, there has been an upward movement of inflation expectations at several horizons, including longer-term expectations (ILS 5Yx5Y). By the end of June 2021, 1 and 2 years ahead annual inflation compensation were hovering around 1.2% and 1.3% respectively, while longer-term inflation compensation measures (5Yx5Y) were at around 1.6%, a level not seen since end-2018/early-2019.

A salient feature of the pandemic period has been an upsurge in uncertainty. This can also be illustrated by exploring ILO that allow us to obtain information about the distribution of expected inflation outcomes. The probability distributions, extracted from ILO under the assumption of risk-neutrality (see Section 2), convey relevant information on changes in investors' evaluation regarding inflation prospects. Figure 2 displays the implied risk-neutral probabilities of expected inflation over the next 5 years for different buckets since 2020 in chart (a), while chart (b) presents the standard deviation of the respective implied distribution.

The standard deviation of ILO-implied distribution of inflation expectations over the next 5 years showed a pronounced increase at the onset of the pandemic crisis, denoting a heightened incertitude surrounding the inflation outlook. Next, from the end of March 2020 to the end of June 2020, the standard deviation registered a significant fall, possibly benefiting from the launch of important policy measures to tackle the crisis. Since then, it has increased somewhat and by mid-2021 it stood at levels somewhat above those seen before the outbreak of the pandemic.

During the pandemic period, there were significant changes in the risk-neutral distribution of inflation expectations over the next 5 years. At the beginning of the pandemic period in the euro area, there was a large increase in the risk-neutral probability that agents attached to low inflation outcomes, in particular below 1%. The probability of deflation (inflation outcomes below 0%) peaked considerably in March/April 2020, reaching levels above those recorded in 2015. The probability of low inflation outcomes gradually fell over the summer of 2020, but increased again in the last quarter of that year, given worse pandemic developments with an intensification of containment measures in response to a strong resurgence in infections. Since the start of 2021, the probability attached to low inflation outcomes over the next 5 years has decreased markedly. In mid-2021, the probability of below zero inflation was negligible, while the probability of having inflation between 1.5 and 2.0% increased noticeably.[6]

3.2. "True" expectations and risk premium

As explained in Section 2, inflation compensation measures are widely viewed by central banks and analists as shedding light on inflation expectations, but they may include non-negligible time-varying risk premia. The "true" inflation expectation and the risk premium components are not directly observable and need to be estimated. This breakdown of the ILS inflation compensation conveys interesting information, not only for the analysis of the estimated ("true") expectation component, but also for the analysis of the risk premium. This component reflects to a large extent a premium requested by investors as compensation for the uncertainty surrounding inflation developments over the horizon of the contract. Given that, in general, agents are not risk-neutral, they require a compensation for the uncertainty regarding the pay-off of any security, in particular developments in inflation.[7]

In this section, we explore this decomposition based on a methodology that follows Joslin *et al.* (2011) applied to ILS rates adjusted for the indexation lag as in Camba-Méndez and Werner (2017) and that is used in Böninghausen *et al.* (2018). This type of methodology is widely used in the literature (Haubrich *et al.* 2012; Vicente and Kubudi 2018) and consists of applying an ATSM to the term structure of ILS rates in order

6. The mass of risk-neutral probability associated with tail events may show considerable differences compared to survey-based distributions, such as SPF probabilities. This can in part reflect the fact that risk-neutral probabilities tend to overstate physical probabilities for adverse outcomes and vice versa for non-tail events. Investors tend to be risk-averse so risk-neutral probabilities reflect both preferences towards risk and the physical probability of different inflation outcomes. Risk-averse investors are willing to pay a premium to protect themselves against the disutility associated with particularly adverse outcomes. Note also that the ILO-based distribution refers to inflation over the next 5 years whereas the SPF refers to inflation expectations 4/5 years ahead and that the agents responding to the SPF and those that participate in the ILO market are not necessarily the same.

7. The risk premium component implicit in ILS to a great extent should correspond to an inflation risk premium, as other types of premia (e.g. a liquidity premium) are likely to be of little importance, in particular in periods without significant stress in financial markets.

to disentangle the inflation compensation into the expectation and the inflation risk premium components.[8]

Figure 3 reports the breakdown of inflation compensation extracted from ILS into expectations and inflation risk premium components for short-term (1Yx1Y) and long-term (5Yx5Y) contracts.

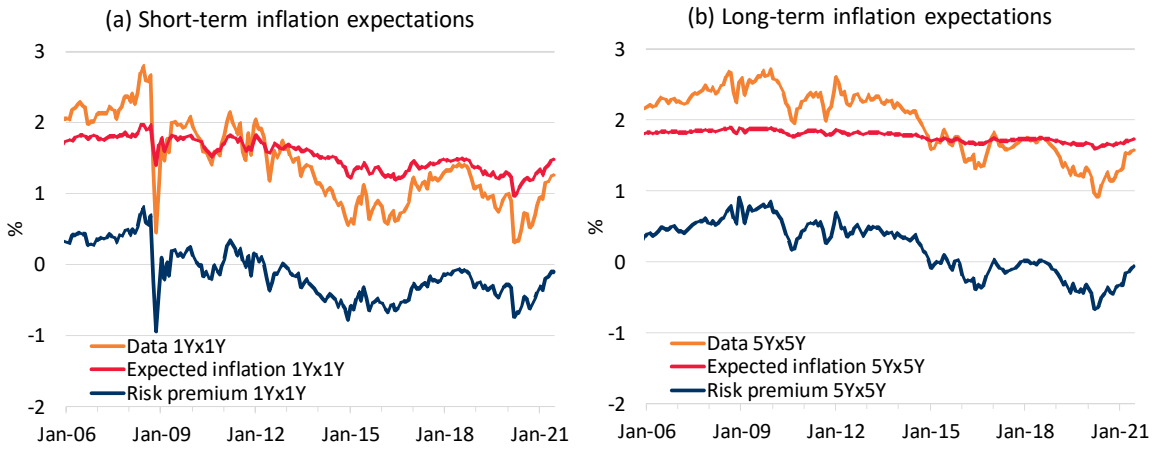

FIGURE 3: Estimates of the expectations and inflation risk premium components of ILS rates

Source: ECB staff calculations. Notes: Estimates based on two affine term structure models following Joslin *et al.* (2011) applied to ILS rates adjusted for the indexation lag as in Camba-Méndez and Werner (2017). Last observation: June 2021.

At shorter maturities, the dynamics in inflation compensation throughout the pandemic period has reflected developments in both the inflation compensation and the premium components, though the changes in the premium are larger. After the drop of both inflation expectations and inflation risk premium in March 2020, one can observe a broadly upward trajectory in both components, to levels above the pre-pandemic ones. At longer horizons, developments in inflation compensation measures were mostly due to changes in the premium component. Even though the long-term inflation expectation component has shown limited variation over the whole sample, it is noteworthy that after a very gradual downward trajectory over the last decade, since April 2020 it has shown a consistent increase, reaching levels above pre-pandemic ones.[9]

8. Despite being widely used, one should bear in mind the caveats of this approach when interpreting results. In particular, the model used — based on principal components of ILS rates and estimated following the method of Joslin *et al.* (2011) — assumes that the unconditional level of inflation expectations is aligned with the average across all long-run inflation survey forecasts collected since the onset of the euro area, i.e. 1.9%. In addition, forward rates, such as the 5Yx5Y expected inflation, also depend on the speed of convergence to the long-run mean, which is determined by the estimated degree of persistence. Given that unit root tests soundly reject the stationarity of the ILS data over the sample period, the degree of persistence is likely to be underestimated, and therefore the estimated ATSM-based expectations converge to the long-run mean too quickly.

9. The limited variation of the expectation component is in line with the survey based long-run inflation expectations, even though this survey data is not used in the estimation.

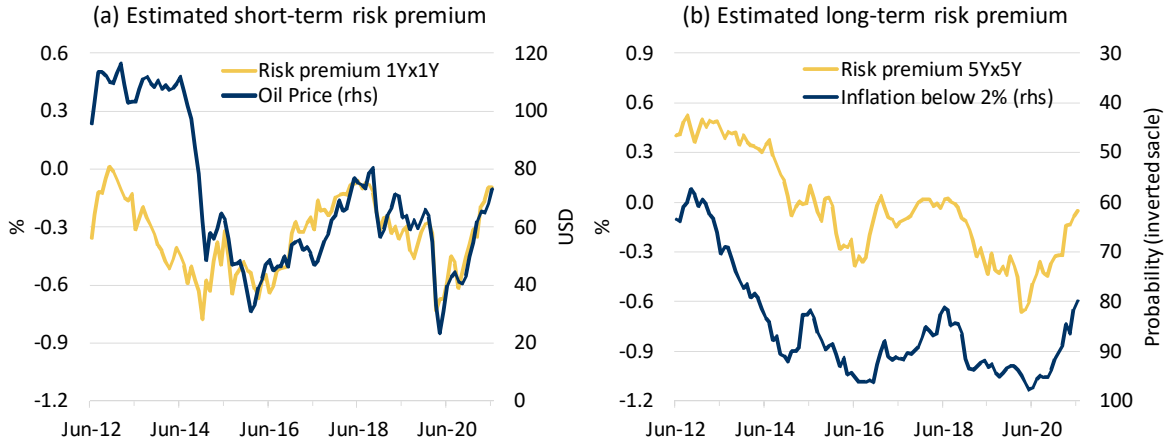

FIGURE 4: recent developments in the inflation risk premium

Sources: Bloomberg, ECB staff calculations and authors' calculations. Notes: Estimates of risk premia based on two ATSM following Joslin *et al.* (2011) applied to ILS rates adjusted for indexation lag as in Camba-Méndez and Werner (2017). Oil price and probability of inflation below 2% shown as monthly averages. Probability of inflation outcomes over 5 years extracted from ILO. Last observation: June 2021.

The fact that the estimated inflation risk premia (at both short and long maturities) are negative suggests that agents are more worried about low inflation outcomes than high outcomes. This has been seen in the euro area for several years. After an initial drop with the outbreak of the pandemic, the premia have become less negative, which suggests that investors have become less worried with low/negative inflation. This is in line with the presumable temporary nature of the COVID-19 shock. But, if the inflation risk premium is mainly driven by the perceived uncertainty surrounding the behaviour of inflation over the life of the contract, the impact of the pandemic crisis seems to be more reasonably reflected in shorter-term contracts. The estimated risk premium in inflation compensation embedded in ILS 1Yx1Y also seems to evolve in tandem with oil prices (chart (a) of Figure 4). Regarding longer-term horizons, in the years prior to the pandemic crisis, there was a decline in the 5Yx5Y inflation premium because agents were worried about a scenario of persistently low inflation (signalling risks in terms of the ability of the central bank to fulfil its price stability mandate), as suggested by the fact that the drop in the inflation risk premium occurred in parallel to an increase in the probability that (risk-neutral) agents attach to low inflation rates over the next 5 years (chart (b) of Figure 4). Since March 2020, this probability has also decreased concurrently with the premium becoming less negative. The consistent increase in the premium for longer-term horizons is more challenging to relate to the pandemic developments *per se*, as the effects of the pandemic crisis should be mostly transitory even if persistent (and long-run effects may exist but are harder to anticipate), but should be seen in light of the policy response to the pandemic crisis.

3.3. Survey based expectations

In this section, we evaluate the impact of the COVID-19 crisis on inflation expectations of professional forecasters. The data come from the ECB SPF. The survey data from the 2020 rounds of the SPF are particularly useful to study how the pandemic affected expectations of professional forecasters at the early stages of the pandemic crisis period since it provides multiple forecasts for the same set of forecast targets, made before and after the beginning of the pandemic. Specifically, the COVID-19 pandemic outbreak in the euro area occurred between the first (January) and second (April) rounds of the survey. One of the features of SPF is that, during a given year, survey participants are asked for forecasts of the same set of fixed targets, for example, average inflation in the current calendar year or the next one. Hence, using SPF results from 2020, we can see how professional forecasters' beliefs responded to the pandemic outbreak and then evolved over the course of 2020. In addition, we present results from the available 2021 editions of the survey in order to illustrate some notable changes in the evolution of inflation expectations that have occurred recently, following the upward surprises in observed inflation in the first half of 2021.

3.3.1. Aggregate forecasts

We plot in chart (a) of Panel (I) of Figure 5 the average point forecasts for inflation in 2020, 2021, 2022, and in the longer term (2024 or 2025, depending on the survey) for the surveys published in 2020.[10] Overall, the COVID-19 pandemic outbreak had a significant impact on the slope of the profile of inflation expectations published throughout 2020, with shorter-term expectations being revised downwards significantly more than the longer-term ones. Expected inflation for 2020 was revised down by 0.8 percentage points between the first and second 2020 rounds, and by almost an additional 0.15 percentage points in the next two survey rounds (July and October). Forecasts for 2021 and 2022 were also revised down in the 2020 survey rounds after the outbreak of the pandemic, by about 0.5 and 0.25 percentage points over the same period, cumulatively, but these revisions were more evenly spread out over the course of the year. The average longer-term expectations for inflation in 2024/25 remained essentially unchanged throughout 2020, signalling the expected temporary nature of the impact of the pandemic shock on inflation developments.[11]

Chart (b) of the same figure shows aggregate point forecasts for core inflation (i.e. inflation excluding energy, food, alcohol and tobacco) in the surveys released in 2020, which displayed similar dynamics to that of headline inflation, except for the significantly smaller revisions in the forecasts for 2020. The comparison of charts (a) and (b) suggests that a significant part of the revision in the inflation outlook for 2020 had to

10. SPF participants are asked to provide forecasts for a longer-term horizon which is set as 4 calendar years ahead in the first and second survey rounds, and 5 calendar years ahead in the third and fourth rounds.

11. In the January and April surveys, the average expected inflation for 2024 was 1.657% and 1.669%, respectively, and the figures for 2025 in July and October 2020 surveys were 1.648% and 1.656%.

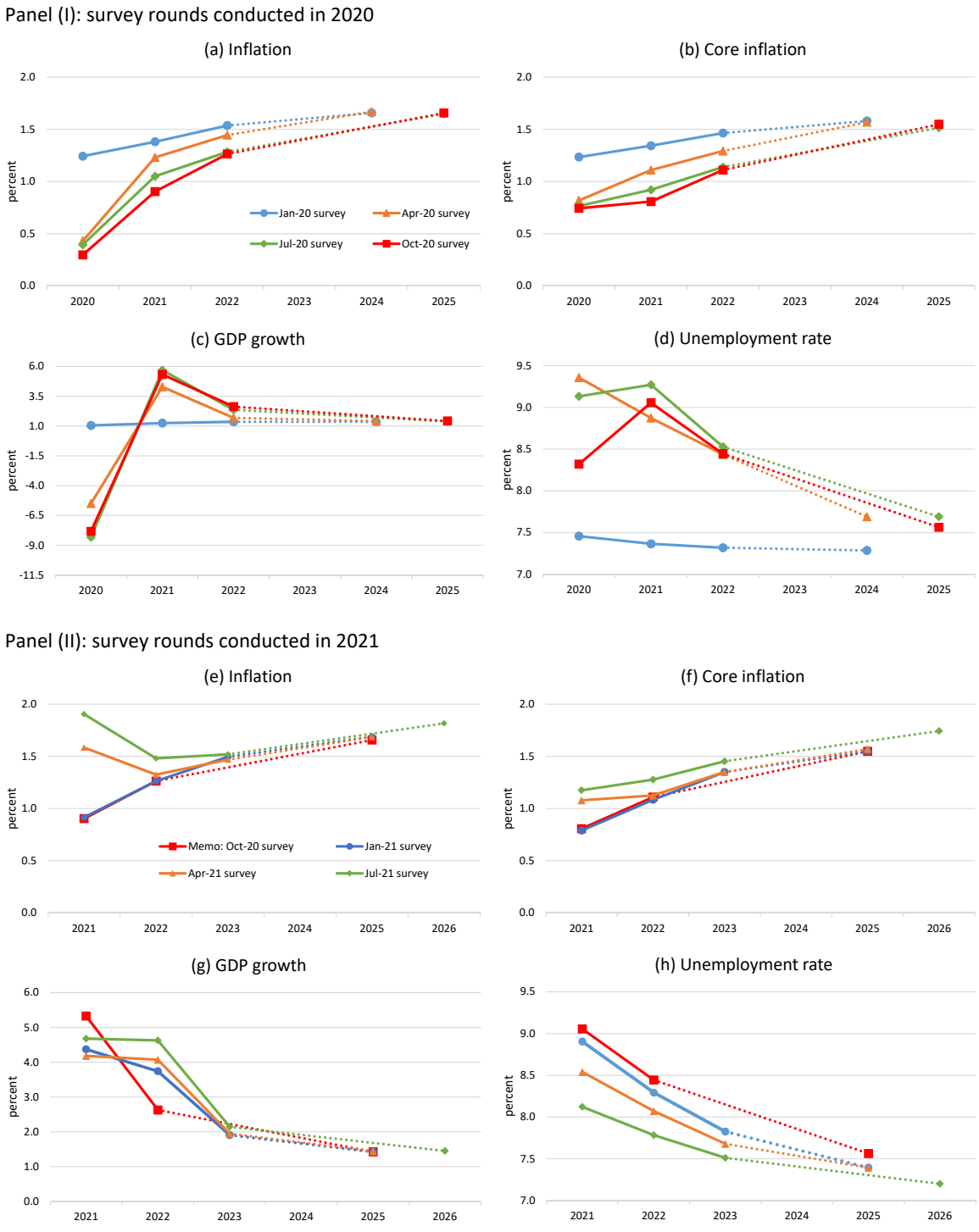

FIGURE 5: Average point forecasts
Sources: ECB and authors' calculations.

do with the expected effect of the pandemic on the prices of energy, food, alcohol and tobacco. The revisions in core inflation expectations can be related to survey participants' expectations about the effect of the pandemic on the real economy. This is confirmed by

charts (c) and (d), which show aggregate forecasts for real GDP growth and the rate of unemployment for the 2020 survey rounds. Expectations for both variables were revised in a direction consistent with a perceived large negative economic shock, with the real GDP growth rate for 2020 being revised between the January and the April of 2020 surveys by more than 6 percentage points, and the rate of unemployment being revised upwards by close to 2 percentage points. The profile of forecasts for both variables indicated expectations for an economic rebound to take place, with growth expectations for 2021/22 being revised upward relative to those in the January 2020 round, while longer-term expectations remained virtually unchanged. For the unemployment rate, a decrease was expected to take place after the significant increase following the outbreak of the pandemic, although to an average longer-term level somewhat above the one expected in the January 2020 survey. In the July and October 2020 surveys, expectations for real GDP growth in 2020 were revised down further, while the expected rebound in 2021/22 was raised. In the case of the unemployment rate, the expected increase in 2020 was revised downwards significantly.

As of the time of writing, three surveys rounds of the SPF have been published in 2021. The additional information they provide allows us to examine the more recent developments in expectations, and to compare them to the forecasts made in the initial wake of the pandemic. Panel (II) of Figure 5 shows the average point forecasts for 2021, 2022, 2023, and in the longer term (2025 or 2026, depending on the survey) for the three survey rounds published in 2021 (for comparison the last survey round of 2020 is also included). As seen in chart (e), significant upward revisions of the expected inflation rate in 2021 occurred in the April and July rounds of the survey, initially by almost 0.7 percentage points, and then by an additional 0.3 percentage points. As a result, the expected 2021 inflation rate stands above the forecast for this year made before the outbreak. The forecasts of core inflation were also revised upward, but to a lesser extent, and remain below the rate expected before the outbreak. Headline and core inflation expectations for 2022 were also revised in the July survey round but remain close to and below the rates expected before the outbreak. Among the main factors behind the expected increase in inflation, the survey participants pointed at the higher than expected realized inflation in the first months of 2021, related to supply chain bottlenecks and shortages, as well as the stronger than anticipated rebound in oil prices and improved economic outlook.[12] The expected improvement in the real GDP growth rate in 2022 can be seen in chart (g). Also notable is the increase in longer-term expectations for both headline and core inflation at the July survey in 2021. In particular,

12. This information is from a part of the survey results which is not publicly available and is summarized in the ECB's report about the survey results, available in the ECB's website.

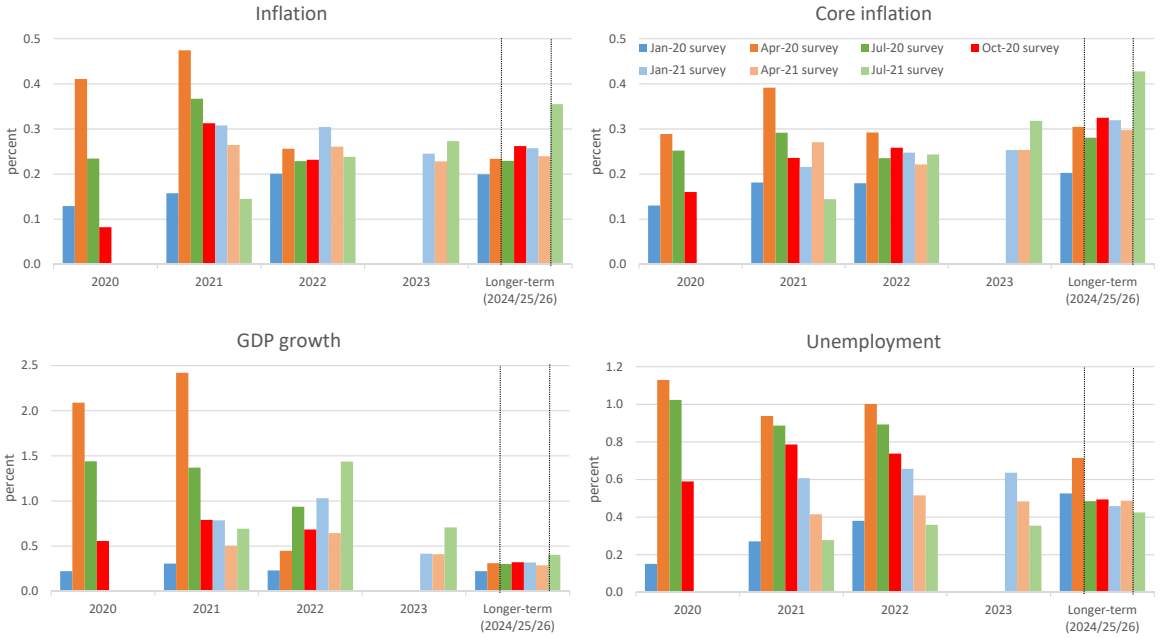

FIGURE 6: SPF forecast disagreement

Sources: ECB and authors' calculations. Note: Standard deviation of individual point forecats across SPF participants for each variable in each year.

the value above 1.8% for headline inflation is the highest level for that horizon since the beginning of 2019.[13,14]

The pandemic has been associated with a significant increase in economic uncertainty. There are two common ways to measure the uncertainty in survey forecasts – using the disagreement across survey participants and using the aggregate forecast probability distributions. Figure 6 shows measures of forecast disagreement given by the standard deviation of individual point forecasts. Disagreement for all forecasted variables increased significantly after the outbreak of the pandemic, especially for the 2020 and 2021 forecast horizons. Over time, disagreement about shorter-term forecasts decreased, as more data became available. In the 2020 survey rounds, the level of disagreement remained above the one observed in the pre-pandemic forecasts for most variables and horizons. In the 2021 rounds included in the analysis (up to July), disagreement continued to edge down. For medium to longer-term horizons, disagreement recorded smaller variations, except for expected headline and core inflation in the July round, reflecting the existence of two outliers.

Figure 7 reports measures of aggregate uncertainty, given by the standard deviation of the aggregated probability distribution of expectations. The aggregated probability

13. The reported figures are for average point forecasts which are sensitive to outliers, and in the July survey there were two point forecasts that deviated significantly from the rest of the participants. Using the median instead, which is more robust to outliers, results in a value of 1.8%

14. The July survey was conducted before the announcement of the press conference reporting the outcome of the ECB's strategy review.

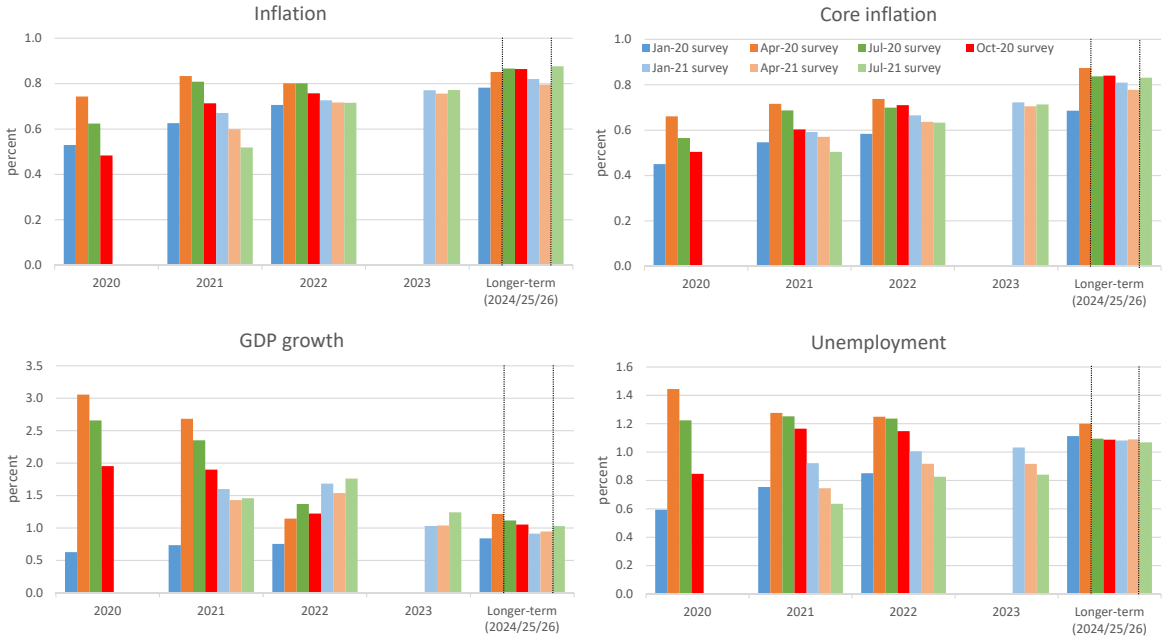

FIGURE 7: SPF aggregate forecast uncertainty

Sources: ECB and authors' calculations. Notes: Standard deviation of the aggregated probability distribution for each variable in each year. Each aggregated probability distribution is obtained by averaging the individual distributions of the survey participants.

distribution is obtained by averaging the individual distributions of the survey participants. These distributions are expressed in terms of the probabilities assigned to the future values of the forecasted variables being within specific intervals. Therefore, the probability distributions provide information about the uncertainty surrounding the point forecasts (as opposed to the disagreement across point forecasts). The standard deviation of the aggregated probability distribution (aggregate uncertainty) depends on the standard deviations of the individual probability distributions (individual uncertainty) and also on the standard deviation of the individual point forecasts (disagreement). So, it conveys additional information compared to the disagreement measure described in the previous paragraph. Still, it shows qualitatively the same patterns as the disagreement measures in Figure 6. Aggregate uncertainty increased with the outbreak of the pandemic, but then recorded a decrease throughout the survey rounds for shorter-term horizons for most variables, a notable exception being expectations for the real GDP growth rate in 2022. Uncertainty regarding longer-term horizons showed much smaller variations.

The pandemic outbreak triggered historically high levels of both forecast disagreement and uncertainty for headline and core inflation, GDP growth and unemployment. The increase was especially marked for real GDP growth and for the unemployment rate expectations. For instance, both uncertainty and disagreement about GDP growth expectations in the April 2020 round were more than 3 times larger than the previous record that occurred in the April 2009 survey round. Compared to the 2019 levels, the rise in disagreement in 2020 was more than 13-fold, while uncertainty

rose more than 5-fold. In contrast, disagreement and uncertainty surrounding headline inflation in April 2020 were between 30% and 50% larger than the previous record from 2012. The observation that the rise in uncertainty and disagreement about inflation expectations was relatively small, compared to GDP growth and unemployment expectations, does not change when we consider other forecast horizons.

3.3.2. *Individual forecasts*

As seen earlier, the COVID-19 pandemic outbreak caused a significant increase in disagreement among SPF respondents. Focusing on aggregate measures, such as the average point forecasts, may obscure existing heterogeneity in the way professional forecasters interpreted the nature and consequences of the COVID-19 shock. Therefore, in this section we consider the inflation expectations of individual forecasters.

FIGURE 8: SPF individual inflation forecasts

Sources: ECB and authors' calculations. Note: Each dot represents a forecast for a specific year by a survey participant.

Figure 8 shows the individual SPF point forecasts for inflation reported in the 2020 and 2021 (up to July) survey rounds. Focusing on the results of the rounds published in 2020, there is a clear downward shift of the distributions of the shorter-term forecasts following the COVID-19 pandemic outbreak, consistent with the patterns seen in Figures 5 and 6. The downward shift is most obvious in the case of the 2020 inflation forecasts, where 86% of the April 2020 forecasts and 100% of the July and October forecasts are strictly below the minimum of the January point forecasts. At the same time, while the aggregate forecasts for inflation in 2021 and 2022 decreased post-COVID-19, there appears to be some disagreement among forecasters, especially in the April

and July surveys, on whether the effect will be positive or negative. Note that there are forecasts in those surveys that are above the respective maximum point forecast from the pre-pandemic survey. The same observation applies to the forecasts for longer-term inflation reported throughout the 2020 rounds - there are point forecasts in the April and later 2020 surveys, which are above the pre-pandemic values. This suggests that some forecasters may have revised upward their forecasts for inflation in 2021 and the following years. However, this is not necessarily true because the panel of survey participants often changes between surveys. For instance, it is possible that the highest 2021 inflation forecasts in the April survey were provided by participants who did not participate in the January round. Therefore, next we examine the forecasts only of those forecasters who participate in both survey rounds.

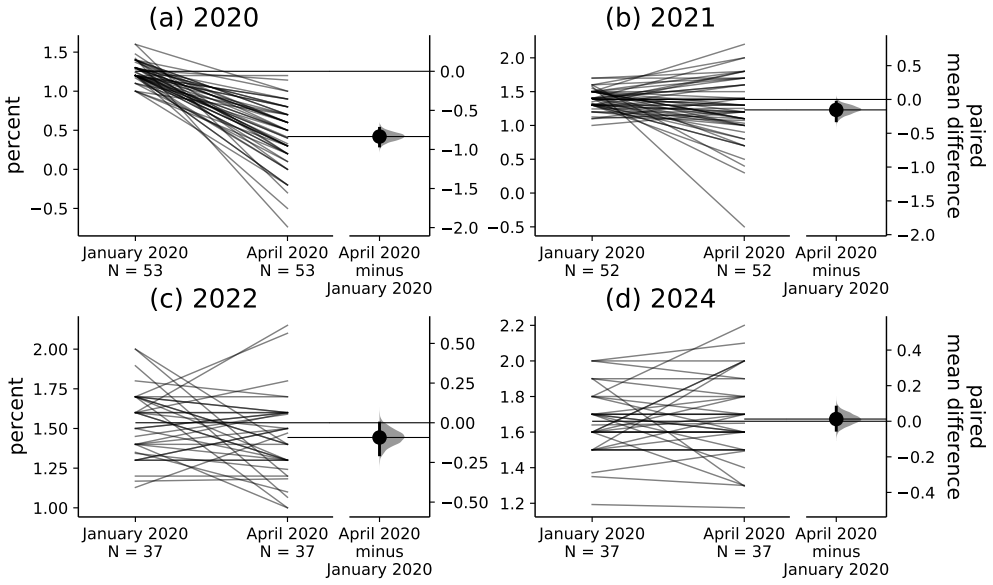

FIGURE 9: Revisions of individual inflation forecasts between the January and April 2020 SPF rounds

Sources: ECB and authors' calculations. Notes: The distributions of the paired mean revisions are obtained by bootstrap. The left-hand side of each chart presents the forecast revisions and the right-hand side displays the distribution of the estimated mean revision with a 95% confidence interval.

Figure 9 shows how individual inflation forecasts changed between the January and April 2020 surveys. The left-hand side of each chart presents the forecast revisions and the right-hand side displays the distribution of the estimated mean revision with a 95% confidence interval.[15] It should be noted that not every survey participant provides forecasts for all horizons in a given survey, which explains why the number of paired forecasts is different for different forecast horizons. The results show that only for inflation in 2020 there was a complete agreement among professional forecasters that

15. The mean revision is estimated with the sample average of the individual revisions. It is an estimate of the "true" unobserved mean revision, and is therefore a subject of estimation uncertainty. We use the bootstrap technique to estimate the sampling distribution of the estimated mean and its 95% confidence interval.

the pandemic outbreak would cause a lower inflation rate than the one anticipated previously. About a third of the participants increased their expectations for inflation in 2021, 2022, and 2024, and between 10% and a third of them kept their forecasts unchanged. Nevertheless, as the majority of forecasters lowered their inflation forecasts for 2021 and 2022, it can be said that most forecasters expected the COVID-19 shock to have a negative impact on inflation over that time span, consistent with the aggregate results displayed in panel (I) of Figure 5. For longer-term inflation expectations, however, there is no such consensus view – the average expectation did not change because a third of the forecasters revised their expectations upwards, and another third revised them downwards. The average revision in either direction was about 0.2 percentage points, and as a result, the overall average change in forecasts was close to zero, as seen above in chart (a) of Panel (I) of Figure 5.

As may be expected, there is a significant, although not complete, overlap between the forecasters who raised their inflation expectations for 2021 and 2022 in the April 2020 round on the one hand, and for 2024, on the other hand. In particular, half of the forecasters who increased their 2021 forecasts, and more than 60% of the forecasters who increased their 2022 forecasts also raised their 2024 forecasts. Most of the remaining forecasters kept their longer-term inflation forecasts unchanged, and only a few lowered them. Therefore, a common characteristic of this group of forecasters is their belief in the persistent positive effect of the COVID-19 shock on inflation, after the initial negative impact. Another common belief is that similarly to the inflation forecasts, there is also disagreement among forecasters about the sign of the impact of the COVID-19 crisis on expected real GDP growth. In particular, 38% of the forecasters increased their 2024 growth forecast in April relative to January, and 22% lowered their forecasts. As with long-term inflation expectations, the forecast changes cancel each other, leading to the nil impact on the aggregate forecast, seen in Figure 5. Again, there is a significant overlap between forecasters who raised both their long-term expectations of inflation and GDP growth – around 60% of the forecasters who increased one of these forecasts from January to April also increased the other with most of the remaining keeping it constant and very few changing inflation and GDP growth 2024 forecasts in opposite directions.

It is important to point out that raising expectations about future real GDP growth rates after the pandemic outbreak does not mean that forecasters interpreted the shock as having a positive impact on economic activity. All forecasters predicted a strong negative effect of the crisis on real GDP in 2020. Similarly, there was a consensus that the economy will rebound in the following years. There was disagreement regarding the speed and extent of the recovery, with some forecasters expecting a more rapid and short-lived recovery, while others predicted a slower and more prolonged one. Forecasters who revised up their longer-term growth forecasts are mostly from the latter group. However, for the vast majority of forecasters, the expected level of future real GDP remains significantly below the one anticipated before the COVID-19 crisis.

Similarly to the aggregate results in Figure 5, there are some notable differences between the individual inflation point forecasts from the 2020 and 2021 editions of the survey, displayed in Figure 8. In particular, the expectations for inflation in 2021 show

a clear upward shift in the three 2021 rounds. The same pattern is also visible, although less pronounced, in the case of the forecasts for 2022, particularly in the April and July rounds. In fact, there is a reduction in the number of forecasters with expectations below 1% (from 8.5% in January to 5% in April and 0% in July). In addition, in the July survey, there is an increase in the fraction of forecasters whose expectations are above 1.5% (34.5% compared to 8% in April and 15% in January). While longer-term expectations have remained relatively stable throughout the pandemic period, there was some upward movement in the distribution of individual point forecasts in the 2021 July round. This observation remains even when we discard the two outliers, or restrict the sample of forecasters to only those who participated in all 2021 surveys.[16]

4. Final remarks

The outbreak of the COVID-19 pandemic has had a major impact on the euro area as well as the global economy. In this article we document the effect of the pandemic crisis on inflation expectations in the euro area, using data from financial markets and surveys of professional forecasters. Following developments in inflation expectations is of paramount importance for monetary policy, whose aim in the euro area is to maintain price stability.

The analysis of financial market data shows that at the onset of the pandemic crisis in March 2020 there was a significant decrease in the inflation compensation extracted from ILS rates, especially at shorter horizons. While the striking decline in these tenors resulted from both the expectation and risk premium components, in the case of longer-term inflation compensation the risk premium component played a dominant role. There was also an increase in the uncertainty surrounding future inflation outcomes, as illustrated by a rise in the standard deviation of the risk-neutral distribution of inflation over the next 5 years. After the initial drop, forward inflation compensation indicators have followed an upward trajectory. For short-term contracts, the behaviour of the inflation compensation and the risk premium seems to be partially related to the evolution of oil prices. For longer maturities, the surge in the risk premium has happened in tandem with a decrease of the risk-neutral probability attached to inflation outcomes below the ECB's inflation objective.

The information from financial market instruments linked to inflation is complemented by survey-based inflation expectations. Even though the ECB SPF is only available at a quarterly frequency, the larger array of information available from this survey presents a useful complement to the market-based measures of inflation expectations. Three main messages emerge from our analysis of the SPF data. First, professional forecasters initially viewed the COVID-19 crisis mainly as a demand rather than a supply shock. While both demand and supply-side factors were at play, on net, the expected impact of the crisis on real GDP growth and inflation was strongly negative,

16. In fact, the two outliers seen in the July 2021 distribution of longer-term inflation in Figure 8 did not participate in the previous survey round.

consistent with a perceived dominant demand shock. As the pandemic unfolded, the supply side effects started to dominate. Second, there was a significant uncertainty increase in response to the pandemic. Indeed, all measures of forecast uncertainty and disagreement among survey participants reached their highest values in the history of the survey. Third, we find that using aggregate forecast measures can be misleading. In particular, the average point forecast of long-term inflation did not change after the pandemic outbreak, suggesting that professional forecasters did not anticipate the crisis to have a persistent effect on inflation. However, examining individual-level forecasts reveals that two-thirds of survey participants revised their long-term inflation forecasts, but disagreed on the sign of the revisions. This result highlights the fact that agents' inflation expectations can be very diverse and, thus, aggregate measures typically used in monetary policy analysis need to be interpreted with caution.

Professional forecasters and financial market participants are not the only economic agents whose inflation expectations matter for the conduct of monetary policy. Expectations of households and firms are equally, if not more, important as these agents are the ones who make spending, saving and investment choices. They also set prices and wages. Thus, monetary policy transmission is strongly affected by the decisions of households and firms, which in turn are influenced by their expectations of future inflation. Data on those expectations for the euro area as a whole is not available.[17] Nevertheless, it seems safe to assume that households' and firms' expectations are generally different from those of professional forecasters and financial market participants, and may have reacted differently to the COVID-19 crisis.

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Non-technical summary

October 2021

Consumption expenditure during the COVID-19 pandemic: an analysis based on Portuguese card transaction data

Sónia Cabral, Cristina Manteu, Sara Serra and Cátia Silva

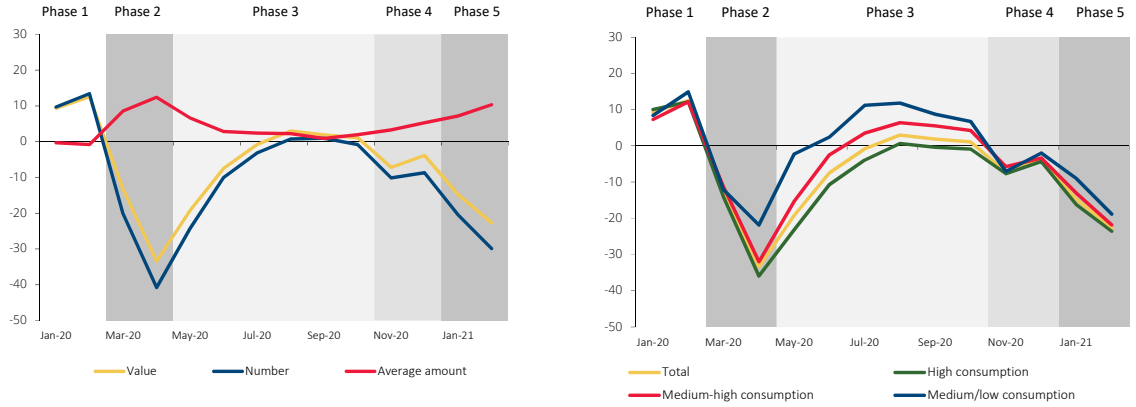
The COVID-19 pandemic implied significant and abrupt changes in private consumption. The negative impact of this exogenous shock was felt through several channels, including the impossibility of consuming some goods and services during two lockdowns and the lack of confidence. This article analyses the evolution of consumption until February 2021 using a database of card purchases, with a breakdown by type of goods and services, consumption groups and municipalities. The results are in line with those obtained for other countries, in particular regarding the change in consumption baskets and the different impacts across consumption groups and regions.

The total value of payments with domestic cards fell by 23.3% year-on-year during the first lockdown (March-April 2020), recovering to an average rate of 2% in August-October 2020 (Figure 1(a)). Subsequently, the worsening of the pandemic and consequent containment measures led to a new declining profile until February 2021. The second lockdown (January-February 2021) had a somewhat weaker impact on card payments compared to the first one (decline of 18.7%). Over time, firms and consumers adapted, creating or reinforcing alternative channels of distribution like direct home delivery. The number of transactions showed a behaviour similar to the value of payments, but with stronger declines during lockdowns (30.2% and 25.1%, respectively, in the first and second), pointing to lower shopping frequency and an increase in the average amount purchased.

The shock had very differentiated effects by types of goods and services. Expenditure in essential goods increased during the most critical period of the pandemic. Durable goods - which by their nature allow their acquisition to be more easily postponed - registered a sharp fall during lockdowns (37% in the first and 16% in the second), but also a marked recovery between them (average rate of change of 4.4% in June-October 2020). On the other hand, in services that require social interaction and for which intertemporal substitution of consumption is difficult, expenditure fell sharply (45.3% in the first lockdown) and the recovery was slow, given that year-on-year rates of change never returned to positive territory in the period under analysis.

The analysis by consumption groups (Figure 1(b)) shows that the largest negative impact was seen in the highest consumption group. Contrastingly, the reduction in expenditure was less pronounced and the subsequent recovery stronger in the lowest consumption group. A shift-share analysis reveals that the structure effect associated

with the basket of goods and services consumed explained about half of the difference in the rates of change of these two groups vis-à-vis the national average. The behavioural responses reinforced those patterns, likely reflecting differences in the incidence of remote working and in consumption needs related to lifestyle adjustments imposed by the pandemic. Furthermore, the more muted impact for the low consumption group suggests that income protection and support measures to the most vulnerable households were effective.



(A) Total value, number and average amount (B) Value by consumption group

FIGURE 1: Payments with Portuguese cards | Year-on-year rate of change, in percentage

Notes: The shaded areas correspond to different phases of the pandemic, with darker shading corresponding to periods of stricter containment measures. Phase 1: January-February 2020; Phase 2: March-April 2020; Phase 3: May-October 2020; Phase 4: November-December 2020; Phase 5: January-February 2021.

Our results show statistically significant differentiated impacts between lockdown and non-lockdown periods. However, there are no statistically significant differences between the magnitude of the effects in the two lockdowns. There is also evidence that the number of monthly new COVID-19 cases in each municipality is negatively associated with card payments, but less so as the number of cases rises. Nevertheless, these effects are very small, possibly because consumption is more driven by the perception of risk and by actual containment measures, of which confirmed cases are an imperfect proxy.

Consumption expenditure during the COVID-19 pandemic: an analysis based on Portuguese card transaction data

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Abstract
The objective of this article is to assess developments in private consumption in Portugal during the first year of the COVID-19 pandemic, using detailed information on domestic card payments. Similarly to the literature for other countries, we find evidence of asymmetrical impacts across types of goods and services purchased, consumption groups and regions. These appear to reflect differences in the impact of containment measures, agents' mobility and change in consumption habits. A statistically significant although small role can be attributed to the incidence of the virus itself. (JEL: D12, E21)

1. Introduction

The COVID-19 pandemic implied significant and abrupt changes in private consumption in Portugal. This exogenous shock impacted the economy from March 2020 onwards and was felt through several channels, including the impossibility of consuming goods and services, as a result of direct restrictions to activity in trade and services sectors, and the effects via lack of confidence. From the end of the second quarter of 2020 until October, there was a recovery in private consumption. A new wave of the virus prompted new restrictions in the last months of 2020 and especially in the beginning of 2021, with additional negative impacts on consumption.

This article examines developments in private consumption during the first year of the pandemic, using information on purchases made with Portuguese payment cards until February 2021, with a breakdown by type of goods and services consumed, consumption groups and municipalities. Card transaction data allow for an almost real-time monitoring of consumption expenditures. Given the relevance of timely and

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reliable information on the current state of the economy, this type of data has been used previously in Banco de Portugal for economic analysis and nowcasting (e.g., Rodrigues and Esteves 2010, Esteves 2011, Duarte *et al.* 2017, Lourenço and Rua 2021).

Our main results are in line with the evidence observed in other countries. We find marked differences in expenditure developments across types of goods and services consumed, across consumption groups and across regions. The services sector, the high consumption group and the Lisbon region were the most affected by the shock. The more pronounced impact in the latter two reflects to some extent a structure effect associated with the higher share of services' consumption in this group/region, but was reinforced by behavioural responses. Regression results corroborate these findings and also those on the differential impacts over time, in particular the effects of the two waves of the virus. There was an abrupt fall in the value of payments during the first lockdown, which was followed by a period of slow recovery where impacts became less negative. By the end of the year, spending decreased again. While the impact of the second lockdown seems to have been less marked compared to the first one, those differences are not statistically significant.

The article is organised as follows. Section 2 discusses some of the related literature that frames this study. Section 3 describes our database. The detailed analysis of the evolution of Portuguese card payments across different sectors, consumption groups and regions is reported in Section 4. Section 5 complements the previous section by estimating some multivariate regressions. Section 6 concludes.

2. Related literature

Since the outbreak of the pandemic, a recent and growing literature has resorted to high-level transaction data to examine the evolution of consumption expenditures in different countries. Several papers analysed consumer spending during the COVID-19 pandemic in the United States using this type of data (e.g., Bachas *et al.* 2020, Baker *et al.* 2020, Chetty *et al.* 2020 and Dunn *et al.* 2020). Other papers used data on electronic payments to study consumer spending in China (Chen *et al.* 2020), Denmark (Andersen *et al.* 2020), France (Bounie *et al.* 2020), the Netherlands (Golec *et al.* 2020), Spain (Carvalho *et al.* 2020), Switzerland (Kraenzlin *et al.* 2020), the United Kingdom (Hacioglu-Hoke *et al.* 2021 and Davenport *et al.* 2020), among others.

Overall, there is a striking similarity in the responses of consumer spending across countries in the initial months of the pandemic. There is a common finding of a large reallocation of expenditure across categories of goods and services. Spending on essential goods increased during the outbreak of the pandemic. In contrast, expenditure on services that require physical interactions declined sharply. This great heterogeneity in the severity of the shock by sector of activity is unprecedented when compared with previous recessions. The subsequent recovery was also not uniform by sector (Bounie *et al.* 2020, Hacioglu-Hoke *et al.* 2021 and Davenport *et al.* 2020). In most countries, there were also regional differences in the responses of consumer spending, particularly

during the outbreak period (e.g., Carvalho *et al.* 2020, Golec *et al.* 2020 and Kraenzlin *et al.* 2020).

The evidence that reductions in expenditures during the pandemic were greater among higher-income consumers is common to various studies (e.g., Chetty *et al.* 2020, Hacioglu-Hoke *et al.* 2021, Bounie *et al.* 2020). As discussed by Bachas *et al.* (2020) for the US and Crawford *et al.* (2020) for the UK, a possible explanation for the finding of a larger spending decline among higher-income individuals is that their basket features a larger share of non-essential goods and services, whose consumption is typically either easier to postpone or whose provision has been disrupted the most. An additional reasoning is provided by Chetty *et al.* (2020) that find that higher-income households apparently self-isolate more, perhaps by working remotely or because they have larger living spaces.

As far as we know, there are at least three studies that use detailed transaction data and a differential approach to examine how private consumption in Portugal was affected by the COVID-19 pandemic. Eichenbaum *et al.* (2020) use a detailed database of consumption expenditures from the Portuguese tax authorities until May 2020 and find that older consumers reduced spending more than younger ones.

Our article is mostly related to Carvalho *et al.* (2020a,b), who also use data on electronic payments from SIBS to model the impact of the pandemic on consumer spending in Portugal. Carvalho *et al.* (2020a) find a massive causal effect of the pandemic in March and April 2020, showing that the sign and magnitude of the impact varies considerably across sectors. Carvalho *et al.* (2020b) complement and update the previous study until August 2020, concluding that the impact is less severe after May, but year-on-year rates of changes in August are still below pre-pandemic levels. They also show that the crisis is concentrated on more central and urban municipalities.

Our main contribution is to use a database with a greater sectoral detail and with an additional dimension, by consumption group, which can be interpreted as a proxy for a distribution of consumption expenditure. In addition, our data extends up to February 2021, allowing the analysis of the recovery phase of consumption and the new decline in the end of 2020 and beginning of 2021.

3. Database

The database used in this article was provided by SIBS Forward Payment Solutions, the main payment cards processor in Portugal, and covers all purchases made through the physical *Multibanco* terminal network (point of sale (POS) terminals and ATMs) with cards issued in Portugal. In the SIBS original data, the unit of observation is an anonymised debit or credit card and, hence, an individual can be overrepresented if he/she has multiple cards. In 2019, this network accounted for 85% of the retail payment transactions processed in the national system, so these data cover the overwhelming majority of payments carried out with Portuguese cards. The selection of transactions with only Portuguese cards is the one that best approximates the national accounts' private consumption concept.

The dataset only includes operations that involve physical terminals. Therefore, it excludes homebanking operations and online purchases, except those for which the order is submitted online but actual payment is made in an ATM. The database also excludes cash withdrawals. These are necessary limitations in order to allow for the identification of both the regional location of the operation and the sector of activity of the seller. Cash withdrawals and online trade evolved in opposite directions during the pandemic, with the former falling and the second rising in importance. This type of substitution between payment methods may have been asymmetric across sectors, consumption groups or even municipalities, constituting a potential limitation of the analysis.

The database made available to us groups together individual card transactions into monthly observations by sellers' sector of activity, according to the Portuguese industrial classification Rev 3 (*Classificação Portuguesa das Actividades Económicas*, Portuguese acronym: CAE); by municipality (total of 308 municipalities); and by quartile of average card expenditure. Hence, an observation in this article refers to a sector-municipality-group of consumption-month-year information. The municipalities correspond to the place of highest usage of the card over the previous 12 months.

The analysis looks at three consumption groups, based on quartiles of cards ordered by their average expenditure at national level over the previous 12 months: Group A – high consumption, given by the fourth quartile; Group B – medium-high consumption, given by the third quartile, and Group CD – medium/low consumption, aggregating the 50% of cards with the lowest consumption. The average monthly spending per card in 2019 corresponds to 726, 292 and 148 euros, respectively, for groups A, B and CD. As expected, the large majority of spending belongs to groups A and B (67.7% and 20.7% in 2019 respectively) with a much smaller amount accounted for by group CD (11.5% in 2019).

Part of the card transactions included in the database relates to business-to-business activity and not to private consumption expenditure. In order to minimise this issue, only payments associated with retail trade and services activities were considered in our sample. These sectors represented around 90% of all card payments in 2019. Moreover, the analysis of card expenditure is carried in nominal terms, not considering any adjustment for price developments.

Despite potential caveats of the database, the evolution of card payments is very much in line with private consumption: the correlation between the year-on-year rates of change of a longer series of the values of cards' transactions and the national accounts' series of residents' consumption is around 80% in the period 2002-19. The close relationship occurs despite card expenditure accounting for only 38% of the value of private consumption. Hence, card payments appear to capture particularly well the most cyclical portion of consumption. The data also mirror well the structure and distribution of consumption expenditures. Results from the Household Expenditure Survey (*Inquérito às Despesas das Famílias* Portuguese acronym: IDEF), provide detailed information on households expenditure and income used in private consumption weights in national accounts (see, for example, Alves *et al.* (2020)). The structure of the sample used in this article is broadly similar to the one in IDEF, across types of goods

and services consumed and the shares of consumer expenditure and monetary income corresponding to the groups considered (A, B and CD).

Finally, in the regressions of Section 5, we use the monthly average of new COVID-19 cases in each municipality, computed from the data of the dashboard of COVID-19 of the Public Health Authority (*Direcção-Geral da Saúde*, Portuguese acronym: DGS) compiled by `https://github.com/dssg-pt/covid19pt-data`.

4. The evolution of Portuguese card payments during the pandemic

For the purpose of structuring the analysis, we divide the period under review into 5 phases, taking into account the main containment measures in place in each time period. Phase 1 corresponds to the pre-pandemic period of 2020, January and February, as the first confirmed COVID-19 case in Portugal was reported on March 2, 2020. Phase 2 covers the first mandatory lockdown in March and April 2020. During the state of emergency (19 March to 2 May 2020), the mobility of citizens was severely restricted and teleworking was mandatory whenever possible. Retail trade and service establishments were closed, with the exception of those associated with basic needs. Phase 3, from May to October of 2020, corresponds to a gradual de-confinement period. Throughout May and June, a phased lifting of the restrictions took place, although some measures were never fully lifted. The Metropolitan Area of Lisboa (A.M. Lisboa) kept restrictions for longer due to a more unfavourable epidemiological evolution. Phase 4 applies to November and December 2020 and corresponds to a period of increasing tightness of restrictions, given the progressive rise in the number of cases. In early November, a new state of emergency was declared, and measures became regionally segmented: for high risk municipalities (amounting to about 70% of population at the time), partial lockdowns were imposed and teleworking became again mandatory. Finally, phase 5, January and February 2021, is characterised by a second mandatory lockdown, similar in stringency to the lockdown of early 2020 (phase 2).

The decline in private consumption during the pandemic crisis was much larger than suggested by its usual determinants, in particular disposable income. Nominal private consumption declined by 6.4% in 2020, while disposable income decreased by 0.7%, which translated into a significant increase in the household savings rate (to 12.8%, a maximum since 2002). The abrupt developments in private consumption during this period point to the relevance of explanatory factors directly associated with the pandemic, such as fear of contagion and the consequent search for social distancing, as well as restrictions on personal mobility and on various economic activities.

The total value of payments with domestic cards fell by 13.3% year-on-year in March and 33.4% in April (Figure 1; detailed monthly tables are included in Appendix A). Over the following months, there was a gradual recovery, from a negative rate of change of 19.2% in May to slightly positive ones in August-September 2020 (all rates of change in this article refer to the same period of the previous year). Subsequently, the worsening of the pandemic and consequent containment measures led to a new declining profile. The second lockdown had a somewhat weaker impact on card payments compared to

the first one, with a 18.7% decline in January-February 2021. There is evidence that firms and consumers have adapted, creating or reinforcing alternative channels of distribution like direct home delivery. The number of transactions showed a similar behaviour to payment values but with stronger declines during periods with more restrictions (30.2% and 25.1%, respectively, in the first and second lockdowns), reflecting a lower shopping frequency and an increase of the average amount of each purchase.

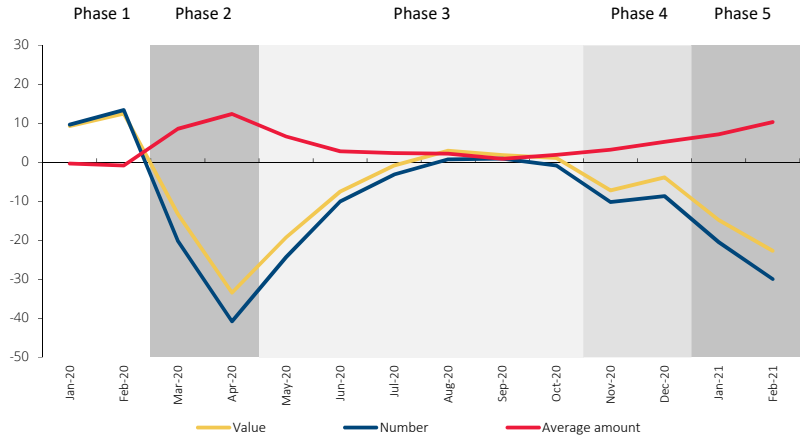

FIGURE 1: Payments with Portuguese cards - Total value, number and average amount | Year-on-year rate of change, in percentage

Notes: The shaded areas correspond to different phases, with darker shading corresponding to periods of stricter containment measures. Phase 1: January-February 2020; Phase 2: March-April 2020; Phase 3: May-October 2020; Phase 4: November-December 2020; Phase 5: January-February 2021.

The pandemic implied also a significant change in the consumption basket. Across broad expenditure categories, expenditure on durable goods and services declined quite strongly in phase 2, while card spending on non-durable goods remained broadly stable (Table 1). The recovery in phase 3 was incomplete for services, while expenditure on goods stood above levels recorded a year earlier. In phase 5, there was a broad-based decline, but of a smaller scale than in the first lockdown in the case of durable goods and services. Card spending on non-durable goods declined during this phase, which had not happened in phase 2. However, this sector showed greater resilience over the period under analysis, which was largely driven by developments in food expenditure. Food purchases increased substantially during the first lockdown, especially in smaller-sized establishments, which are likely to have benefited from the advantages of proximity (Figure 2). Aside from the substitution of restaurant trips for home-cooked meals, the increased spending on food in the first lockdown is likely to have been inflated by hoarding behaviour. Consumption of products from pharmacies and parapharmacies also increased sharply during the first lockdown, likely reflecting new demand for disinfectants and personal protection equipment.

As regards durable goods, the expenditure recovery during phase 3 was favoured by the need to adapt to new routines, like teleworking, remote schooling and indoor entertainment. These needs boosted expenditure in office and information

	Weight	Year-on-year rate of change				
	2019	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Total	100	10.9	-23.3	-3.6	-5.4	-18.7
By type of good/service						
Durable goods	15.4	5.9	-37.2	1.4	1.5	-16.0
Non-durable goods	43.2	13.2	0.7	7.8	0.5	-4.3
Services	41.3	10.2	-45.3	-16.4	-15.7	-34.6
By consumption group						
Group A – high consumption	67.7	11.1	-25.0	-6.4	-5.9	-19.9
Group B – medium-high consumption	20.7	9.7	-21.6	0.3	-4.4	-17.4
Group CD – medium/low consumption	11.5	11.7	-16.8	6.4	-4.5	-14.1
By NUTS II region						
Alentejo	5.5	10.9	-13.8	5.9	3.2	-7.9
Algarve	5.1	10.9	-20.8	-2.9	-2.7	-16.8
R.A. Açores	2.1	11.5	-20.2	-1.1	1.2	-3.5
Centro	24.3	11.6	-19.5	1.2	-0.3	-13.5
A.M. Lisboa	32.2	9.7	-29.6	-11.2	-12.2	-28.4
R.A. Madeira	1.9	11.7	-20.3	-0.9	0.6	-8.2
Norte	29.0	11.4	-22.0	-1.2	-5.2	-16.4

TABLE 1. Value of payments with Portuguese cards | Year-on-year rate of change, in percentage

Notes: Durable goods include expenditure on information and communication technology (ICT) equipment, office machinery and equipment, optical and photographic equipment, decor and home equipment, building materials and DIY supplies, household appliances, sports, recreation and leisure supplies, games and toys, books and records, vehicles and accessories. Non-durable goods include expenditure on food (e.g. super and hypermarkets, grocery stores, butchers, fish shops, among others), clothing and footwear, perfume and cosmetics, pharmacies and parapharmacies, and petrol stations. The expenditure in super and hypermarkets is included in the food component. NUTS II refers to the second level of the Nomenclature of Territorial Units for Statistics, 2013. Phase 1: January-February 2020; Phase 2: March-April 2020; Phase 3: May-October 2020; Phase 4: November-December 2020; Phase 5: January-February 2021.

and communication equipments and in sports and recreation goods, in addition to building materials and DIY (Figure 2). Spending in vehicles is likely to have benefited from an increased preference for individual means transportation, in detriment of public transport services that had persistent and significant negative rates. This is also corroborated by the recovery in fuel consumption. Services took the largest toll from the pandemic, given that some were practically closed during lockdowns. In-person services consumption, such as hotels, restaurants, and leisure, culture and sports, showed substantial decreases. While the first two sectors recovered strongly during phase 3, containment measures and fear of contagion continued to impair the latter. Phase 4 was characterized by a slightly higher reduction in total payments than phase 3, reflecting developments in non-durable goods (supermarkets). Expenditures related to hotels and restaurants also recorded strong declines in their rates of change between phases 3 and 4. During the second lockdown, the majority of sectors showed negative rates in the amount of payments, but declines were less marked than in the first one. The most notable difference concerns health services, where payments decreased almost 60% in March-April 2020 while barely falling in January-February 2021.

Spending behaviour during the first year of the pandemic varied by consumption group. Results show that the lowest consumption group (group CD) was the one that reduced spending the least during lockdowns and whose expenditure recovered the

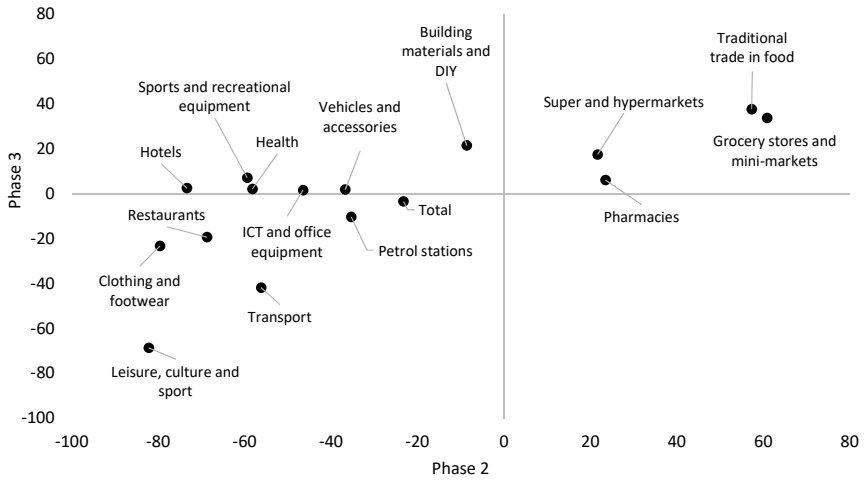

FIGURE 2: Value of payments with Portuguese cards by type of good/service in phases 2 and 3 | Year-on-year rate of change, in percentage

Note: Phase 2: March-April 2020; Phase 3: May-October 2020.

most in phase 3 (Table 1). Contrastingly, and in line with findings for other countries, the largest negative impact was seen in the amounts spent by the highest consumption group (group A). This group maintained negative or virtually nil rates of change in consumption during the period under analysis. Differences in monthly rates of change of payments across groups were stronger in April 2020 and in much of phase 3 and more muted during the second lockdown. The impact of the second lockdown was less marked than the first for all consumption groups.

A shift-share analysis was performed for the three consumption groups by type of good/service consumed, broken down in 23 categories. This type of analysis decomposes the difference in the rate of change of total expenditure of a consumption group relative to the national average (Total Effect) into two terms: (i) the Structure Effect, which captures the influence of differences in the structure of consumption of the group vis-à-vis the overall economy; (ii) the Behavioural Effect, which assesses, for each type of good/service consumed, how different are the rates of change of the consumption group from the national average. The behavioural effect aims to capture the reaction to government-imposed restrictions and to the pandemic risks. The description of the methodology and the detailed results are included in Appendix B.

The structure effect explains about half of the difference in the rates of change of groups A and CD vis-à-vis the overall economy average, while for group B this share amounts to about one-third (Figure 3). The high consumption group has a higher share of services and durable goods in its consumption basket (Table A.2). Given that services decreased the most over the period under analysis, this has a stronger impact on total spending of the high consumption group. A symmetrical reasoning can be derived from expenditure on food items, which weighs more on the low-consumption basket than in other groups. In fact, the strongest contribution to the positive structure effect of group CD comes from non-durable goods, most notably from supermarkets.

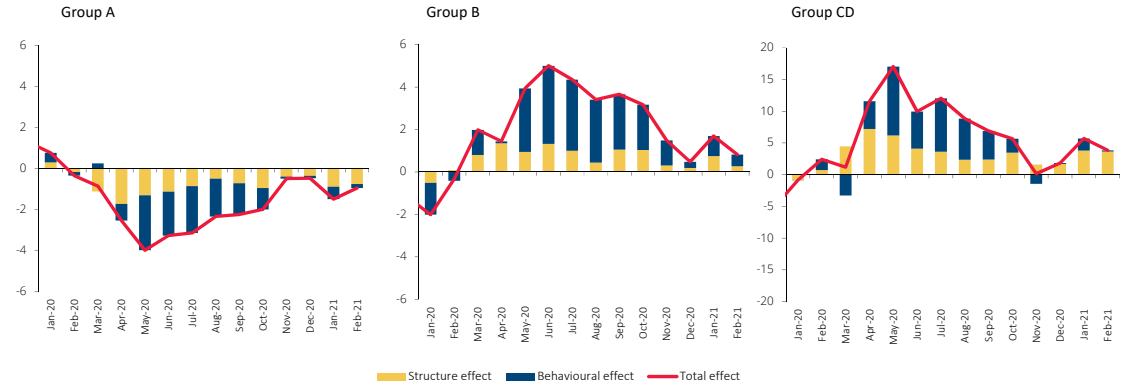

FIGURE 3: Value of payments with Portuguese cards by consumption group - Shift-share analysis | In percentage points

Notes: The total effect corresponds to the difference between the rate of change of total expenditure of a consumption group and the national average and is decomposed into the structure and behavioural effects. The description of the methodology used and the detailed results are included in Appendix B.

During most of the period under analysis, the behavioural effect reinforces the structure effect. However, comparing April 2020 and February 2021, the months more affected by lockdowns, the behavioural effect is smaller in February both in absolute terms and in comparison to the structure effect for consumption groups A and CD.

Over the whole period, a positive behavioural effect stands out in the case of group CD and is likely related to a lower incidence of remote work in this group, along with a change in consumption habits. Fuel consumption contributed consistently to the positive behavioural effect in group CD, signalling higher mobility for this group. According to Statistics Portugal, the proportion of workers in teleworking was lower in some sectors that tend to pay below-average wages.[1] Durable goods also contributed to the positive behavioural effect of group CD, especially from April to August. This stems from expenditure carried out by this group to adjust to the pandemic, with a stronger reliance on personal transport and a more housebound way of living. Employment and income protection policies are likely to have played a key role in supporting spending for this group.

The behavioural effect for group A is broadly negative across spending categories and time. This points to a common driver in behaviour. In fact, there is evidence in the literature that higher income individuals tend to self-isolate more, which besides higher fear of contagion, may also reflect more remote working (Chetty *et al.* 2020 and Eichenbaum *et al.* 2020).

There are also regional differences in card spending patterns. A.M. Lisboa stands out as the region with systematically below average rates of change, while Alentejo is consistently above the national average (Table 1). One factor contributing to these differences is the structure of regional consumption by sector, with a higher than average

1. https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_destaques&DESTAQUESdest_boui=493705905&DESTAQUESmodo=2&xlang=pt.

weight of services in A. M. Lisboa and of non-durable consumption in Alentejo. During the second lockdown, all regions showed smaller declines than during the first one, with Madeira and Açores faring much better in phase 5 than in phase 2, due to a more favourable pandemic situation and less stringent restrictions. On the contrary, the decline in A. M. Lisboa was the closest to the first lockdown.

5. Regression analysis

The descriptive analysis of the previous section is strongly suggestive of the key results emerging from the data. In this section, we further explore and quantify the impact of the pandemic on cards' payments in a multivariate framework. However, no causal inference can be withdrawn from the regression results.

We estimate the following equation at municipality-sector-consumption group level with monthly data from January 2019 to February 2021:

$$Y_{isct} = \beta_0 + \beta_1 y20\text{-}21 + \sum_{j=2}^{5} \beta_j phase_j + \beta_6 covid_{it} + \beta_7 covid_{it}^2 + \gamma_i + \gamma_s + \gamma_c + \varepsilon_{isct}, \quad (1)$$

where Y_{isct} is the monthly year-on-year rate of change of the outcome variable defined for municipality i, sector s and consumption group c, in each monthly period t from January 2019 to February 2021. The outcome variable may either be the total amount of money spent or the number of card payments. $y20\text{-}21$ is a dummy variable taking the value 1 for the years of 2020 and 2021. $phase_j$, with $j = \{2, 3, 4, 5\}$, are the four phase dummies to be estimated, with $phase_1$ defined as the base level. Given the inclusion of the $y20\text{-}21$ dummy, the estimated parameters for the phase dummies are interpreted as differences in percentage points in relation to the average year-on-year rate of change of $phase_1$. $covid_{it}$ is a vector that includes the monthly average number of new confirmed cases per municipality i and $covid_{it}^2$ is its quadratic term, which was included to capture possible non-linear relations. γ_i are municipality fixed effects (308 municipalities), γ_s are sector fixed effects (23 sectors) and γ_c are consumption group fixed effects (3 groups). ε_{isct} is the error term. Robust standard errors are clustered at the NUTS III and period t (pair month-year) level.[2] Overall, standard errors are adjusted for 51 clusters (25 NUTS III and 26 monthly periods). As an outlier treatment, we winsorised the top and bottom 1 percentiles of the dependent variables. Given the differences in terms of dimension of the various municipalities, sectors and consumption groups, all regressions are weighted according to the respective value of the outcome variable in the same month of 2019.

Columns (1) to (4) of Table 2 include the regression estimates using as dependent variable the monthly rate of change for the total amount of money spent. Starting with the total sample, there is a negative impact in every phase considered, but

2. NUTS III refers to the third-level of the Nomenclature of Territorial Units for Statistics, 2013. In Portugal, there are 25 NUTS III regions.

the effect peaks during lockdowns. All else constant, phase 2 (March-April 2020) is associated with a decrease in average rate of change of 33.9 pp when compared with phase 1. In the second lockdown (phase 5), there was a decline of 26.8 pp vis-à-vis the pre-pandemic period of 2020. However, the differences between lockdowns are not statistically significant. In contrast, there is evidence of statistically significant differentiated impacts when we compare lockdowns with non-lockdown periods.

	Value of transactions				Number of transactions			
	Total	Group A	Group B	Group CD	Total	Group A	Group B	Group CD
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
phase 2	-33.860***	-35.969***	-30.717***	-27.788***	-41.132***	-41.130***	-39.639***	-43.168***
	(6.837)	(7.282)	(7.232)	(4.266)	(7.084)	(6.943)	(7.427)	(7.146)
phase 3	-13.880***	-17.021***	-8.601**	-4.555	-16.935***	-17.791***	-13.732***	-18.439***
	(3.614)	(3.581)	(3.854)	(4.346)	(4.229)	(3.688)	(4.686)	(5.914)
phase 4	-13.497***	-15.067***	-10.227***	-10.751***	-16.067***	-16.462***	-13.607***	-17.996***
	(2.048)	(1.786)	(2.710)	(3.663)	(2.343)	(1.803)	(2.901)	(4.117)
phase 5	-26.786***	-29.037***	-23.190***	-20.712***	-31.754***	-32.054***	-29.660***	-33.462***
	(4.424)	(3.892)	(5.350)	(6.142)	(5.460)	(4.676)	(5.964)	(7.485)
$covid$	-0.005***	-0.004**	-0.007***	-0.008***	-0.007***	-0.005***	-0.009***	-0.013***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.004)
$covid^2$	0.000**	0.000*	0.000***	0.000**	0.000**	0.000**	0.000***	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	548 264	183 885	183 118	181 261	548 268	183 885	183 120	181 263
Adj. R^2	0.293	0.322	0.287	0.232	0.450	0.480	0.435	0.417

TABLE 2. Change in the value and number of card transactions, total, January 2019 - February 2021

Notes: Results of weighted least squares regression of Equation (1) using the levels of the outcome variable in the same months of 2019 as weights. The reported number of observations refers to the unweighted count. All regressions include a constant and the vectors of municipality, sector and consumption group fixed-effects, when applicable. See the main text for more details. Standard errors in parenthesis are clustered at the regional and month-year level and are robust to heteroscedasticity. Stars indicate significance levels of 10% (*), 5% (**), and 1%(***).

Despite having a small magnitude, there is also statistical evidence that the monthly number of new COVID-19 cases in each municipality is negatively associated with the dependent variable. We also found evidence of a positive quadratic effect, albeit very small, which indicates that this relation becomes a bit less negative as the number of cases increases. This supports the idea that people tend to change less their consumption behaviour as they get used to living in a high incidence environment, becoming less sensitive to the fear of contagion. Another possibility is that the major adjustments in behaviour took place when the number of cases was still moderate, leaving less room for further changes as cases increase.

Looking at the individual regressions, the fact that phase 2 always displays the highest negative estimate is common to all consumption groups. Next, coefficients associated with phase 3 are smaller, which indicates a gradual but incomplete return to "normal life" after the first lockdown period. Afterwards, the tightening of restrictions in phase 4 and the new lockdown in early 2021 (phase 5) translate again into more negative parameters. All phase dummies are negative and statistically significant, except

the one of phase 3 for the low consumption group. The high consumption group reduced the value of card payments the most in all phases. Lastly, COVID-19 variables are statistically significant in all groups.

Comparing the estimates of the regressions in value and in number of Table 2, all coefficients are more negative in columns (5) to (8), pointing to a more negative impact of the pandemic in the number of payments than on their monthly value. Once again, lockdown periods show the most abrupt falls. The rate of change of the number of card transactions during phase 2 reduced by 41.1 pp vis-à-vis phase 1. The decline in the number of card payments in all phases is common to the three consumption groups. Again, the COVID-19 variables are statistically significant in all cases.

Given that some sectors had distinct behaviours during the pandemic, specific regressions were estimated for some of them. The two cases that we further explore are the food sector – which includes super and hypermarkets, grocery stores and mini-markets, and traditional trade in food – and the sector of petrol stations.

The food sector is interesting since it allows us to quasi-directly infer about people's fear, given that these stores were open even during lockdowns. Goods sold in these establishments are mostly essential ones and given that there are online alternatives to physical shopping, people could opt whether to go outside and get exposed to the virus or not. Coefficients of the phase dummies for the value spent are mostly positive meaning that people tended to spend more money on food, when compared to the pre-pandemic period (Table 3, columns (1) to (4)). Nonetheless and broadly speaking, the estimates were mostly only statistically significant in phase 2, with the exception of the low consumption group whose coefficient for this phase is not significant. In contrast, there is strong statistical evidence of a decline in the number of visits to food stores (Table 3, columns (5) to (8)). The combination of these two factors in phase 2 - the increase in the amount of money paid and the decrease in the number of payments - signals that individuals optimised their visits to these stores, by increasing the average amount of each purchase. This may have reflected the desire to reduce exposure to the virus but also some hoarding phenomena in these goods.

The sector of petrol stations is also an interesting case to study because it allows some inference about people's mobility. Table 4 shows that almost all phases have associated negative and significant impacts for all consumption groups. In terms of value of transactions, estimates for the various groups are very similar in phase 2, which is a plausible result because during the first lockdown people stood mostly at home. Looking at the evolution of all coefficients of the phase dummies, it can be inferred that, in phases 3 and 4, there was some increase in mobility since the impact on the rates of change became less negative. Overall, spending of the low consumption group on petrol stations was the least affected: the coefficients of phase 3 in terms of value and of phases 3 and 4 in terms of number are not statistical significant. Hence, it seems that the low consumption group was the one that displayed higher rates of mobility, which is consistent with less remote work possibilities for this group.

	Value of transactions				Number of transactions			
	Total	Group A	Group B	Group CD	Total	Group A	Group B	Group CD
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
phase 2	9.625***	9.780***	14.254***	3.124	-21.708***	-20.362***	-18.776***	-28.508***
	(2.614)	(3.194)	(3.247)	(4.857)	(4.834)	(4.922)	(5.196)	(4.455)
phase 3	3.351	1.071	10.260***	2.133	-10.179***	-10.122***	-5.287	-16.047***
	(3.225)	(2.620)	(3.554)	(5.157)	(2.860)	(2.048)	(3.387)	(4.542)
phase 4	-1.550	-1.978	4.168	-7.715*	-10.424***	-9.676***	-5.998*	-17.755***
	(3.266)	(2.815)	(4.071)	(4.460)	(2.458)	(1.927)	(3.114)	(3.608)
phase 5	2.903	2.408	8.991*	-3.578	-13.648***	-12.561***	-9.421**	-21.484***
	(4.717)	(4.086)	(4.936)	(6.797)	(3.708)	(2.793)	(4.016)	(5.817)
$covid$	-0.009***	-0.008***	-0.010***	-0.009***	-0.009***	-0.006***	-0.010***	-0.012***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.004)
$covid^2$	0.000***	0.000***	0.000***	0.000**	0.000***	0.000***	0.000***	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	71 819	24 011	23 969	23 839	71 819	24 011	23 969	23 839
Adj. R^2	0.198	0.162	0.324	0.284	0.233	0.230	0.194	0.308

TABLE 3. Change in the value and number of card transactions, food sector, January 2019 - February 2021

Notes: Results of weighted least squares regression of Equation (1) using the levels of the outcome variable in the same months of 2019 as weights. The reported number of observations refers to the unweighted count. All regressions include a constant and the vectors of municipality, sector and consumption group fixed-effects, when applicable. See the main text for more details. Standard errors in parenthesis are clustered at the regional and month-year level and are robust to heteroscedasticity. Stars indicate significance levels of 10% (*), 5% (**), and 1%(***).

	Value of transactions				Number of transactions			
	Total	Group A	Group B	Group CD	Total	Group A	Group B	Group CD
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
phase 2	-44.622***	-44.601***	-45.324***	-42.985***	-38.836***	-41.308***	-36.120***	-31.398***
	(9.898)	(10.018)	(9.855)	(9.595)	(5.895)	(6.225)	(5.600)	(5.333)
phase 3	-19.547***	-21.799***	-17.790***	-3.770	-12.354***	-16.646***	-9.313**	6.112
	(3.793)	(3.908)	(3.976)	(4.915)	(3.276)	(3.181)	(3.543)	(4.832)
phase 4	-23.146***	-24.900***	-21.528***	-11.869***	-15.646***	-19.086***	-13.196***	-1.644
	(2.194)	(2.655)	(1.512)	(3.135)	(0.900)	(0.981)	(0.795)	(3.013)
phase 5	-32.028***	-34.003***	-29.861***	-21.129***	-27.014***	-30.616***	-24.428***	-13.240***
	(2.641)	(2.838)	(3.150)	(4.336)	(2.777)	(2.553)	(3.023)	(4.479)
$covid$	0.002	0.003	-0.002	-0.005***	-0.004**	-0.003*	-0.004***	-0.008***
	(0.003)	(0.004)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
$covid^2$	-0.000	-0.000	0.000	0.000	0.000	0.000	0.000*	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	24 013	8 008	8 007	7 998	24 013	8 008	8 007	7 998
Adj. R^2	0.326	0.328	0.355	0.211	0.384	0.425	0.355	0.190

TABLE 4. Change in the value and number of card transactions, petrol stations, January 2019 - February 2021

Notes: Results of weighted least squares regression of Equation (1) using the levels of the outcome variable in the same months of 2019 as weights. The reported number of observations refers to the unweighted count. All regressions include a constant and the vectors of municipality, sector and consumption group fixed-effects, when applicable. See the main text for more details. Standard errors in parenthesis are clustered at the regional and month-year level and are robust to heteroscedasticity. Stars indicate significance levels of 10% (*), 5% (**), and 1%(***).

6. Concluding remarks

This article describes the impact of the pandemic on consumption expenditure in Portugal using a detailed database of card purchases until February 2021. The heterogeneity of the response of consumer spending to the shock is important for policy makers, allowing for more targeted policy design. The results of the analysis are in line with and complement the findings of recent empirical literature for other countries and for Portugal.

The shock had very differentiated effects by type of goods and services, reflected in the change in the basket consumed by Portuguese households. The consumption of essential goods increased during the beginning of the pandemic. Durable goods - which by their nature allow their acquisition to be more easily postponed - registered a sharp fall but also a marked recovery between lockdowns. On the other hand, in service sectors that require social interaction and for which intertemporal substitution of consumption is difficult, expenditure fell sharply and the recovery was slow. The impact was also differentiated at a regional level, with Lisboa always showing the lowest rates of change throughout the first year of the pandemic.

By consumption groups, we find that the reduction in expenditure was more pronounced and the subsequent recovery slower for the high consumption group compared to the low consumption group. The analysis suggests that these differences between groups are related to differences in their consumption baskets, in the incidence of remote working and in adjustment needs in life style imposed by the pandemic. The more muted impact for low consumption group suggests that income protection and support measures to the most vulnerable households were effective.

The econometric results confirm the descriptive findings of different impacts of the pandemic on consumption over time and by consumption group. The regional incidence of COVID appears to play a statistically significant although small role in the results, possibly because consumption is more driven by the perception of risk and by actual containment measures, of which confirmed cases are an imperfect proxy.

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Appendix A: Detailed tables

	Weight 2019	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Total	100	9.3	12.5	-13.3	-33.4	-19.2	-7.5	-0.8	3.0	1.9	1.1	-7.2	-3.8	-14.8	-22.7	10.9	-23.3	-3.6	-5.4	-18.7
Durable goods	15.4	4.7	7.3	-28.8	-45.9	-15.5	6.0	4.3	3.5	4.6	3.9	-2.8	5.3	-12.2	-20.1	5.9	-37.2	1.4	1.5	-16.0
Non-durable goods	43.2	10.5	16.2	8.2	-6.9	1.1	4.2	10.3	9.2	11.3	10.7	-0.3	1.1	0.0	-8.6	13.2	0.7	7.8	0.5	-4.3
Services	41.3	9.8	10.7	-31.8	-59.0	-38.3	-25.5	-13.5	-2.3	-8.6	-10.8	-16.1	-15.2	-31.3	-37.9	10.2	-45.3	-16.4	-15.7	-34.6
Food items	26.5	13.2	20.2	27.5	23.3	27.5	15.5	21.2	16.4	16.1	18.6	9.2	9.8	16.2	10.7	16.7	25.4	19.2	9.5	13.4
Super and hypermarkets	23.8	12.8	19.8	24.0	19.2	25.1	13.3	19.4	15.5	14.0	16.7	7.0	7.2	13.6	8.7	16.2	21.6	17.3	7.1	11.1
Grocery stores and mini-markets	1.1	17.9	24.0	61.7	60.0	44.6	32.2	34.6	24.4	34.1	32.9	30.0	36.3	44.9	30.4	21.0	60.8	33.7	33.6	37.5
Traditional trade in food	1.5	16.8	24.2	56.8	57.7	51.5	36.9	38.6	24.7	37.7	37.3	28.9	27.9	35.7	26.9	20.5	57.3	37.6	28.3	31.2
Pharmacies and parapharmacies	2.8	6.3	12.4	40.6	5.7	-4.5	6.0	9.1	10.3	12.4	3.4	1.8	-4.9	-3.4	-10.8	9.2	23.5	6.0	-1.6	-7.0
Health	2.9	11.5	9.1	-37.7	-79.6	-36.1	11.4	7.6	11.5	17.9	4.9	10.9	6.0	-4.8	-1.7	10.3	-58.3	2.0	8.5	-3.3
Passenger transport, vehicle rental	0.7	-4.3	4.3	-37.9	-76.5	-60.9	-46.0	-40.1	-30.4	-35.6	-39.4	-46.7	-45.1	-55.0	-73.3	-0.2	-56.2	-42.0	-45.9	-64.2
Petrol stations	5.8	9.5	9.0	-20.6	-49.8	-30.3	-14.8	-6.8	-5.8	-0.2	-4.2	-14.2	-10.4	-18.1	-25.2	9.3	-35.4	-10.4	-12.2	-21.6
Hotels and accommodation	1.1	8.4	32.8	-52.4	-92.6	-78.4	-33.8	3.8	36.5	25.4	12.4	-40.9	-33.3	-55.9	-77.8	20.2	-73.4	2.4	-36.7	-67.6
Restaurants	9.2	4.4	11.0	-56.5	-81.7	-61.4	-32.1	-10.6	-1.4	-3.1	-6.6	-33.7	-28.9	-55.0	-70.5	7.7	-68.7	-19.4	-31.0	-62.9
Leisure, culture and sport	1.9	11.3	3.1	-68.1	-95.5	-91.0	-73.5	-71.3	-61.0	-55.8	-57.9	-63.6	-58.6	-75.2	-88.0	7.2	-82.2	-68.8	-61.0	-81.4
ICT, office machinery and equipment	1.6	8.3	11.0	-33.6	-60.3	-28.3	6.3	9.0	9.9	11.5	-2.4	-4.9	-4.4	-23.8	-16.3	9.6	-46.5	1.5	-4.7	-20.1
Electrical appliances and decor	6.2	-4.1	-2.1	-38.6	-45.7	-16.3	-6.4	-11.0	-9.2	-10.2	1.8	-3.7	9.9	-5.4	-16.1	-3.2	-42.1	-8.5	3.5	-10.4
Construction materials and DIY	2.4	9.5	15.5	-8.9	-8.4	21.5	28.0	21.8	20.4	21.2	15.5	6.7	16.6	3.1	3.2	12.4	-8.7	21.4	11.5	3.2
Sports and recreational equipment	1.6	7.5	12.8	-43.6	-75.3	-27.3	12.2	16.4	11.4	10.3	13.9	-3.7	4.3	-25.4	-60.8	10.0	-59.4	7.0	1.1	-42.5
Vehicles and accessories	3.7	12.8	12.0	-20.0	-54.1	-29.3	8.5	11.8	8.6	13.8	-1.5	-6.3	-6.5	-20.8	-26.5	12.4	-36.8	1.7	-6.4	-23.5
Clothing, footwear, perfume and cosmetics	5.7	3.5	8.7	-63.2	-95.4	-71.0	-27.6	-15.9	-7.7	-4.4	-9.2	-31.0	-21.3	-53.4	-89.5	5.8	-79.6	-23.3	-25.2	-69.8

TABLE A.1. Value of payments with Portuguese cards by type of good/service | Year-on-year rate of change, in percentage

Notes: Durable goods include expenditure on information and communication technology (ICT) equipment, office machinery and equipment, optical and photographic equipment, decor and home equipment, building materials and DIY supplies, household appliances, sports, recreation and leisure supplies, games and toys, books and records, vehicles and accessories. Non-durable goods include expenditure on food (e.g. super and hypermarkets, grocery stores, butchers, fish shops, among others), clothing and footwear, perfume and cosmetics, pharmacies and parapharmacies, and petrol stations. The expenditure in super and hypermarkets is included in the food component. The database does not allow the distinction by type of goods acquired in these stores. It is possible to acquire another type of goods in these establishments, including some durable ones, but the sale of food products is dominant in this activity. Phase 1: January-February 2020; Phase 2: March-April 2020; Phase 3: May-October 2020; Phase 4: November-December 2020; Phase 5: January-February 2021.

	Weight 2019	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Total	100	9.3	12.5	-13.3	-33.4	-19.2	-7.5	-0.8	3.0	1.9	1.1	-7.2	-3.8	-14.8	-22.7	10.9	-23.3	-3.6	-5.4	-18.7
Group A - high consumption	67.7	10.1	12.2	-14.1	-35.9	-23.2	-10.7	-3.9	0.7	-0.4	-0.9	-7.7	-4.3	-16.2	-23.6	11.1	-25.0	-6.4	-5.9	-19.9
Group B - medium-high consumption	20.7	7.3	12.2	-11.3	-32.0	-15.3	-2.5	3.6	6.4	5.5	4.3	-5.7	-3.3	-13.1	-21.8	9.7	-21.6	0.3	-4.4	-17.4
Group CD - medium/low consumption	11.5	8.4	14.9	-12.1	-21.8	-2.2	2.5	11.2	11.8	8.8	6.8	-7.1	-2.0	-9.1	-18.8	11.7	-16.8	6.4	-4.5	-14.1
By type of good/service																				
Group A - high consumption	100																			
Durable goods	15.4	4.8	7.7	-27.9	-46.9	-18.6	3.8	2.5	1.8	4.3	3.6	-2.0	5.8	-13.0	-21.5	6.1	-37.3	-0.2	2.1	-17.1
Non-durable goods	39.9	10.9	15.3	7.8	-10.1	-3.2	1.6	6.5	6.3	9.0	8.1	-1.0	0.1	-1.7	-9.9	13.0	-1.2	4.7	-0.4	-5.7
Services	44.7	11.3	11.0	-30.7	-57.7	-39.8	-27.6	-14.8	-3.5	-9.9	-11.3	-15.6	-14.0	-30.4	-35.9	11.1	-44.2	-17.6	-14.8	-33.2
Group B - medium-high consumption	100																			
Durable goods	15.3	5.4	9.8	-29.0	-46.1	-11.3	10.5	8.8	6.9	6.8	6.5	-2.0	6.8	-10.9	-20.2	7.5	-37.4	5.1	2.7	-15.3
Non-durable goods	48.2	8.6	15.1	10.2	-6.2	3.4	8.0	14.2	12.7	14.9	13.9	1.9	2.0	1.4	-6.7	11.7	2.0	11.2	1.9	-2.6
Services	36.5	6.4	9.4	-33.6	-62.2	-36.8	-22.4	-12.1	-0.7	-6.9	-10.3	-17.3	-18.8	-33.7	-42.5	7.9	-47.8	-15.0	-18.0	-38.1
Group CD - medium/low consumption	100																			
Durable goods	15.7	3.5	0.9	-33.4	-39.5	-3.5	10.8	7.6	6.9	2.1	1.1	-8.3	0.3	-9.9	-11.4	2.2	-36.4	4.3	-3.9	-10.6
Non-durable goods	53.9	11.8	21.4	6.8	5.7	16.8	9.5	21.3	16.6	15.7	16.5	-0.5	4.0	5.1	-6.4	16.6	6.3	16.0	1.9	-0.9
Services	30.4	5.2	10.5	-36.6	-62.5	-29.0	-14.9	-3.7	6.4	0.4	-7.9	-18.1	-17.7	-34.3	-45.2	7.9	-49.3	-8.7	-17.9	-39.9

TABLE A.2. Value of payments with Portuguese cards by consumption group | Year-on-year rate of change, in percentage

Notes: Durable goods include expenditure on information and communication technology (ICT) equipment, office machinery and equipment, optical and photographic equipment, decor and home equipment, building materials and DIY supplies, household appliances, sports, recreation and leisure supplies, games and toys, books and records, vehicles and accessories. Non-durable goods include expenditure on food (e.g. super and hypermarkets, grocery stores, butchers, fish shops, among others), clothing and footwear, perfume and cosmetics, pharmacies and parapharmacies, and petrol stations. The expenditure in super and hypermarkets is included in the food component. The database does not allow the distinction by type of goods acquired in these stores. It is possible to acquire another type of goods in these establishments, including some durable ones, but the sale of food products is dominant in this activity. Phase 1: January-February 2020; Phase 2: March-April 2020; Phase 3: May-October 2020; Phase 4: November-December 2020; Phase 5: January-February 2021.

	Weight 2019	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Total	100	9.3	12.5	-13.3	-33.4	-19.2	-7.5	-0.8	3.0	1.9	1.1	-7.2	-3.8	-14.8	-22.7	10.9	-23.3	-3.6	-5.4	-18.7
Alentejo	5.5	9.1	12.8	-6.1	-21.7	-8.0	2.7	8.3	11.8	10.8	9.4	1.3	4.8	-5.4	-10.6	10.9	-13.8	5.9	3.2	-7.9
Algarve	5.1	8.9	13.0	-10.3	-31.3	-19.5	-6.6	-0.2	4.3	2.4	1.4	-5.3	-0.1	-12.8	-20.9	10.9	-20.8	-2.9	-2.7	-16.8
R.A. Açores	2.1	10.4	12.6	-9.6	-30.5	-16.7	-4.2	2.0	3.5	4.2	5.0	0.9	1.4	-5.8	-1.0	11.5	-20.2	-1.1	1.2	-3.5
Centro	24.3	9.9	13.4	-10.5	-28.6	-13.8	-2.2	3.8	6.8	6.5	5.9	-2.0	1.1	-9.7	-17.4	11.6	-19.5	1.2	-0.3	-13.5
A.M. Lisboa	32.2	7.9	11.7	-17.8	-41.7	-28.9	-15.7	-8.1	-3.4	-5.2	-6.0	-13.9	-10.7	-23.8	-33.0	9.7	-29.6	-11.2	-12.2	-28.4
R.A. Madeira	1.9	10.6	13.0	-7.9	-32.6	-13.9	-4.0	1.7	4.0	2.7	4.7	1.5	-0.1	-8.8	-7.6	11.7	-20.3	-0.9	0.6	-8.2
Norte	29.0	10.3	12.5	-12.9	-31.1	-15.7	-5.1	1.5	4.7	4.0	2.8	-7.4	-3.4	-12.1	-20.8	11.4	-22.0	-1.2	-5.2	-16.4

TABLE A.3. Value of payments with Portuguese cards by NUTS II region | Year-on-year rate of change, in percentage

Notes: NUTS II refers to the second level of the Nomenclature of Territorial Units for Statistics, 2013. The region corresponds to the place of greatest use of each card in the previous 12 months. Phase 1: January-February 2020; Phase 2: March-April 2020; Phase 3: May-October 2020; Phase 4: November-December 2020; Phase 5: January-February 2021.

Appendix B: Shift-share analysis: methodology and detailed results

Shift-share analysis is a decomposition technique widely used in regional studies to quantify an industry/structure effect and a competitive/regional effect on the growth of any variable relative to the national average (see Artige and van Neuss (2014) for a recent discussion). While lacking a theoretical basis, this methodology is useful to identify and describe key features of the data.

In this article, we use this technique to take into account the impact of the consumption baskets on the aggregate results of each consumption group. All shift-share analysis computations were performed at a breakdown level comprising 23 distinct sectors.[3]

According to this formulation, the difference in the year-on-year change of total expenditure of consumption group c relative to the national average in each monthly period t, the Total Effect (TE), is defined as:

$$TE_c = g_c - g_T = \sum_s \theta_{sc} g_{sc} - \sum_s \theta_{sT} g_{sT}, \tag{B.1}$$

where g_c and g_T are percentage monthly year-on-year rates of change in period t of total expenditures of group c and of the total economy, respectively; g_{sc} is the percentage monthly year-on-year rate of change of expenditures in sector s by consumption group c in monthly period t; θ_{sc} is the share of sector s in total expenditure of consumption group c in monthly period $t-12$; g_{sT} and θ_{sT} are the equivalent notions for expenditure at the national level.

If the growth of expenditure of group c is higher (lower) than that of national expenditure, the TE will be positive (negative). This TE can be broken down into two terms: one resulting from the effective difference of growth rates in each individual sector, the Behavioural Effect (BE); and another resulting from the influence of the relative structure of consumption of the group, the Structure Effect (SE).

$$TE_c = BE_c + SE_c \tag{B.2}$$

Behavioural Effect (BE) - It is the difference between the growth rate of expenditure of each group and of national expenditure for each individual sector s in each period t, taking as given the sectoral structure of consumption of the group:

$$BE_c = \sum_s \theta_{sc}(g_{sc} - g_{sT}) \tag{B.3}$$

3. These 23 sectors are: Super and hypermarkets; Grocery stores and mini-markets; Traditional trade in food; Petrol stations; ICT equipment, office machinery and equipment; Electrical appliances and décor; Construction materials and DIY; Sports and recreational equipment; Clothing, footwear, perfume and cosmetics; Pharmacies and para-pharmacies; Vehicles and accessories; Other retail items; Passenger transport and vehicle rental; Hotels and accommodation; Restaurants; Telecommunications; Insurance; Leisure, culture and sport; Public administration, defence and mandatory social security; Education; Health; Personal service activities (hairdressers, spas, etc.); Other services.

Structure Effect (SE) - It determines which part of the total difference in expenditure between group c and the total economy resulted from the relative composition of the consumption basket of the group under analysis:

$$SE_c = \sum_s (\theta_{sc} - \theta_{sT})(g_{sT} - g_T) \tag{B.4}$$

In each period t, the SE will be positive if the consumption basket of group c is relatively more (less) concentrated in sectors that grow above (below) the national average; the SE will be negative if the consumption basket of group c is relatively less (more) concentrated in sectors that grow above (below) the national average.

	Weight 2019	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Group A – high consumption	67.7																			
Total effect		0.8	-0.3	-0.8	-2.5	-4.0	-3.3	-3.1	-2.3	-2.2	-2.0	-0.5	-0.5	-1.5	-0.9	0.2	-1.7	-2.8	-0.5	-1.2
Structure effect		0.3	-0.2	-1.1	-1.7	-1.3	-1.1	-0.8	-0.5	-0.7	-0.9	-0.4	-0.3	-0.9	-0.7	0.1	-1.4	-0.9	-0.4	-0.8
Behavioural effect		0.5	-0.2	0.3	-0.8	-2.7	-2.1	-2.3	-1.8	-1.5	-1.0	-0.1	-0.1	-0.6	-0.2	0.1	-0.3	-1.9	-0.1	-0.4
Group B – medium-high consumption	20.7																			
Total effect		-2.0	-0.3	2.0	1.4	3.9	5.0	4.4	3.4	3.7	3.2	1.5	0.5	1.7	0.8	-1.2	1.7	3.9	1.0	1.3
Structure effect		-0.5	0.1	0.8	1.3	0.9	1.3	1.0	0.4	1.1	1.0	0.3	0.2	0.7	0.3	-0.2	1.1	1.0	0.2	0.5
Behavioural effect		-1.5	-0.4	1.2	0.1	3.0	3.7	3.4	3.0	2.6	2.1	1.2	0.3	0.9	0.6	-1.0	0.6	3.0	0.7	0.7
Group CD – medium/low consumption	11.5																			
Total effect		-0.9	2.4	1.2	11.6	17.0	9.9	12.0	8.8	6.9	5.7	0.2	1.8	5.7	3.8	0.8	6.4	10.1	1.0	4.7
Structure effect		-0.9	0.7	4.5	7.2	6.2	4.1	3.6	2.3	2.4	3.5	1.6	1.7	3.8	3.6	-0.1	5.8	3.7	1.6	3.7
Behavioural effect		0.0	1.7	-3.3	4.4	10.8	5.8	8.4	6.5	4.5	2.2	-1.5	0.1	1.9	0.2	0.8	0.5	6.4	-0.7	1.0

TABLE B.1. Value of payments with Portuguese cards by consumption group - Shift-share analysis | In percentage points

Notes: The structure and behavioural effects are expressed in contributions to the total effect. Phase 1: January-February 2020; Phase 2: March-April 2020; Phase 3: May-October 2020; Phase 4: November-December 2020; Phase 5: January-February 2021.

Non-technical summary

October 2021

Household wealth in Portugal and the euro area

Sónia Costa, Luísa Farinha, Luís Martins and Renata Mesquita

According to the results of the Household Finance and Consumption Survey (HFCS) of 2017, the mean or the median wealth of households in Portugal is almost 30% lower than in the euro area. This differential exhibits a high variability across household groups. In most age, income and wealth groups, the median wealth in Portugal is lower than in the euro area. In the groups between 55 and 74 years old, it is almost half the value of the euro area, and at the highest levels of wealth or income, it is just over 60% of the value of the euro area. In contrast, in the households with lower wealth or income levels and in the youngest age group, the median wealth in Portugal is close to or even higher than in the euro area.

The composition of wealth in the main assets and debts has many common features in Portugal and in the euro area. Real estate properties have a predominant weight, in which the main residence accounts for almost 50% of total assets and the other real estate properties for almost 20%. In addition, both in Portugal and in the euro area, debt represents about 12% of the assets' value and is mostly secured by real estate.

The main residence accounts for around -17 percentage points (pp) of the -30% differential in the mean wealth between Portugal and the euro area. Of these -17 pp, -24 pp are due to the contribution of the mean value of these properties, which is lower in Portugal, and 7 pp are due to the contribution of the percentage of homeowners, which is higher in Portugal (Figure 1). This percentage is 74% in Portugal and 60% in the euro area. The positive contribution of homeownership to the wealth differential is highest in the lowest age group, in the lowest levels of wealth and, to a lesser extent, in the lowest levels of income. The higher percentage of homeowners in the youngest age group in Portugal is related to the fact that young people leave their parents' house later than in the euro area, and more often only when they "start a family".

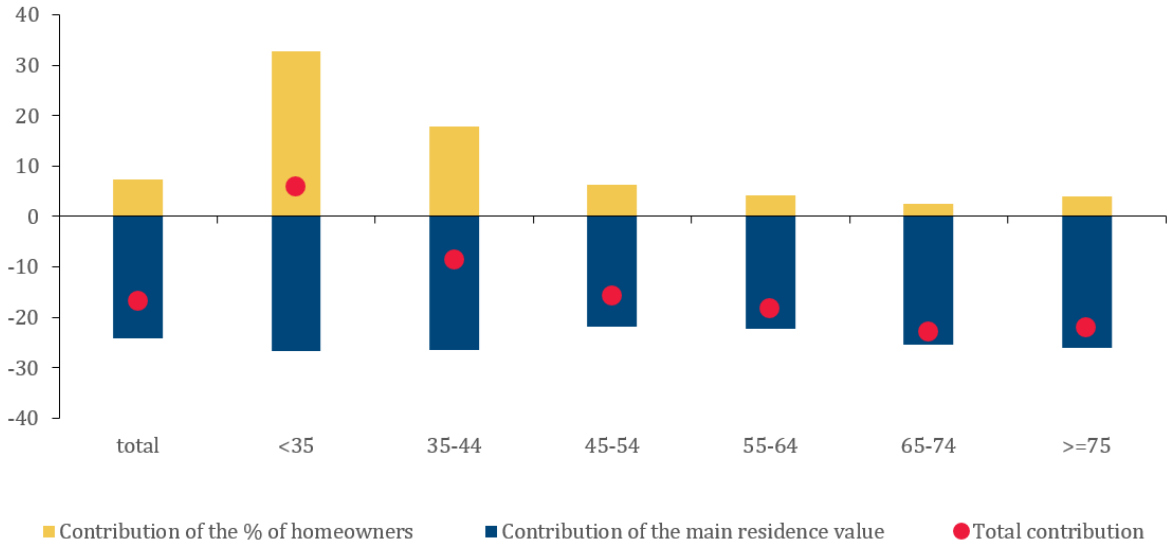

FIGURE 1: Contribution of the main residence to the difference in the mean wealth between Portugal and the euro area, in the overall households and by age groups | Percentage points

Source: HFCS, 2017. Notes: The euro area does not include Portugal. The contribution of the main residence to the percentage difference in the mean wealth between Portugal and the euro area (total contribution) can be decomposed into two components: one that depends on the difference between the percentage of homeowners and another that depends on the difference in the mean value of the main residence for the homeowners, in Portugal and in the euro area.

Household wealth in Portugal and the euro area

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Abstract
Portuguese households are represented across the entire wealth distribution of the euro area, although they are more frequent at intermediate levels. The mean or the median wealth of households in Portugal is almost 30% lower than in the euro area, but this differential exhibits a high variability across household groups. The wealth differential between Portugal and the euro area relates to differences in the composition of wealth and in the household characteristics. Wealth in Portugal compares more favourably with that of the euro area in groups where in Portugal there is a much higher homeownership rate and in those in which the Portuguese households have more individuals and/or older individuals than in the euro area. This occurs in the younger age groups, and in the lower wealth and income quintiles, where the wealth of households in Portugal is close to or even higher than that of euro area households.
(JEL: D10,D31,G30)

1. Introduction

Net wealth per household, i.e., the difference between the value of assets and debts, exhibits a high heterogeneity across countries. In most countries, net wealth per household also exhibits a high dispersion. In Portugal and in most economies, net wealth reaches maximum values in the age groups prior to retirement age and is positively related to income, having a more unequal distribution (Costa *et al.*, 2020). The high inequality in the distribution of wealth means that, in international comparisons, it is important to use information at the household level. This type of data enables to compare the wealth of different types of households, instead of limiting the analysis to mean values of the overall population, which are not representative for most households. This article compares the net wealth of households in Portugal and in the rest of the euro area countries as a whole, taking into account the heterogeneity of households' characteristics.[1]

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1. For simplicity, this article uses the terms net wealth and wealth interchangeably.

The analysis of wealth distribution has been a topic of recent interest by economists, particularly in central banks, reflecting the perception that monetary policy and macroprudential policy cannot be dissociated from the topic of inequality (Banco de Portugal, 2017). The effect of monetary policy on inequality is ambiguous, as it depends on the composition of households' wealth and on the impact of monetary policy on the prices of different assets. This finding stresses the importance of increasing the knowledge on the distribution of wealth, benefiting from the availability of microeconomic data.

The analysis of this article uses data from the Household Finance and Consumption Survey (HFCS), which in Portugal corresponds to the *Inquérito à Situação Financeira das Famílias* (ISFF).[2] The data are from the third wave of the survey, which in most countries was collected in 2017. Given the structural nature of the analysis, the conclusions remain when using data from the two previous waves (collected in 2010 and in 2013/14 in most countries). The HFCS is the only statistical source at the household level with data for wealth and its components comparable across euro area countries. This survey includes detailed data on households' assets and debt. Assets include all valuable assets that the household owns (e.g., real estate properties, vehicles, works of art and jewellery), participation in businesses (e.g., the value of shares of non-publicly traded firms) and financial investments (e.g., deposits, investment fund units, quoted shares, bonds and voluntary pension plans). Debt includes mortgages on real estate properties, non-mortgage loans and all other types of debt (e.g., credit cards and bank overdrafts).

HFCS data show that the distribution of households' wealth differs substantially across euro area countries and that the ranking of countries in terms of wealth per household is different from the ranking in terms of income per household or per capita gross domestic product (HFCN, 2013). The fact that households' wealth depends not only on current macroeconomic conditions but also on past conditions and on several institutional and cultural aspects contributes to this situation. Since data from the first wave of the HFCS became available, several articles have sought to characterize and understand the differences in households' wealth across euro area countries.

This article is in line with the literature that relates differences in wealth levels with household characteristics and wealth composition (Fessler *et al.*, 2014; Lindner, 2015; Mathä *et al.*, 2017; Kaas *et al.*, 2019). The analysis is descriptive and does not take into account all the factors that might affect households' wealth accumulation (e.g., differences in public policies). By focusing on Portugal, this article identifies several aspects not previously documented in the literature regarding the comparison of the wealth of households residing in Portugal and in the rest of the euro area countries as a whole. The results show that differences between countries in the mean or the median wealth of households mask a high heterogeneity. Although the mean or the median wealth in Portugal is around 30% lower than in the euro area, Portuguese households are represented across the entire wealth distribution of the euro area. Additionally, households in some groups, namely the younger, and the lower wealth

2. More details on these surveys can be found on the ISFF page on the Banco de Portugal website.

or income quintiles, have in Portugal levels of wealth close to or even higher than euro area households in the same groups. Second, differences in wealth between Portugal and the euro area are related to differences in the composition of wealth and in households' characteristics. In particular, household wealth in Portugal compares more favourably with that of the euro area in groups where there is a much higher percentage of homeowners in Portugal and in those in which the Portuguese households have more individuals and/or individuals that are older than those in the euro area. These characteristics are potentially responsible for less pronounced differences in wealth levels than those that would result from the lower levels of income and education in Portugal.

Section 2 compares the levels of wealth in Portugal and in the euro area. The first part of the section presents the median and the mean wealth levels for all euro area countries and provides a brief summary of the literature that has sought to interpret these data. In the second part, data for Portugal are compared in more detail with those for the euro area, with households being divided into quintiles of wealth, quintiles of income and age groups. For reasons of simplicity, this analysis, as well as the remainder of the article, focuses on comparing Portugal with the aggregate of the rest of the countries (which will be denominated the euro area). Section 3 characterizes the composition of wealth and analyses the contribution of the different types of assets and debts to the wealth differential between Portugal and the euro area. Section 4 compares households in Portugal and in the euro area in terms of income, composition and other sociodemographic aspects and assesses the relation between differences in these characteristics and differences in wealth levels based on a counterfactual exercise. The last section presents the conclusions.

2. How does household wealth in Portugal compare to that of the euro area?

2.1. Heterogeneity of household wealth across the euro area countries

Wealth per household differs considerably across euro area countries (Figure 1). In 2017, Latvia had the lowest median wealth, with a value of 20 thousand euros, and Luxembourg the highest, with a value of 498 thousand euros. In Portugal, the median wealth was 75 thousand euros, 26% below the median value of the euro area (100 thousand euros). Differences in the level of wealth across countries partially reflect disparities in costs of living. However, purchasing power parity correction is less common in wealth comparisons than in income or consumption comparisons. Therefore, the results presented in this article were obtained without this correction.[3]

In all countries, the mean wealth is significantly higher than the median, which illustrates the high degree of inequality that characterizes the distribution of wealth

3. Wealth correction using a purchasing power parity index generally mitigates the differences between countries, but does not change the article's conclusions.

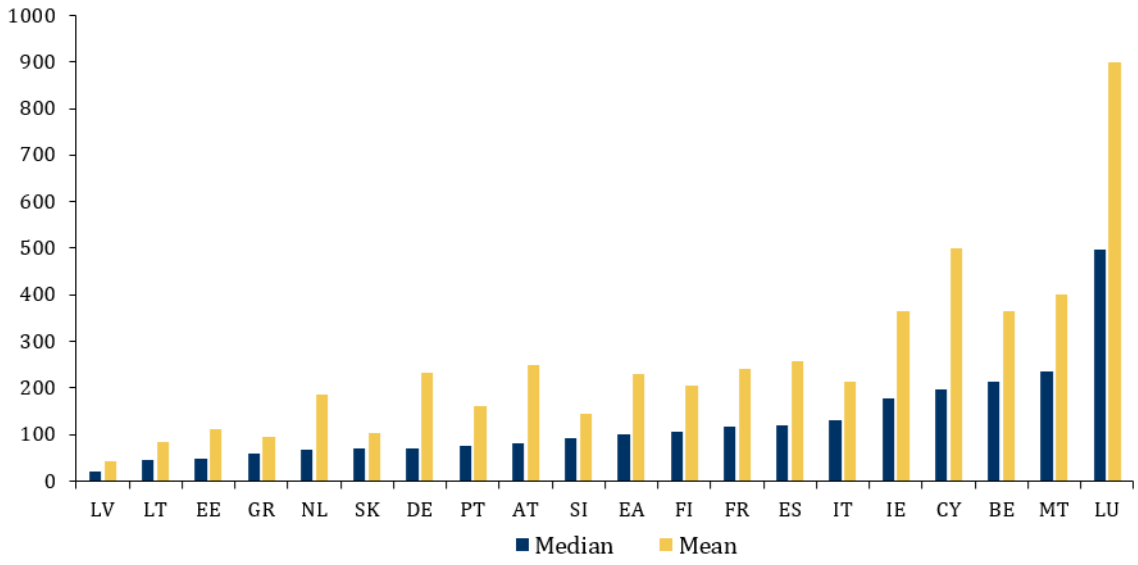

FIGURE 1: Households' net wealth in the euro area countries | Thousands of euros

Source: HFCS, 2017. Notes: The correspondence country-acronyms is as follows: Germany (DE), Austria (AT), Belgium (BE), Cyprus (CY), Slovakia (SK), Spain (ES), Estonia (EE), Slovenia (SI), Finland (FI), France (FR), Greece (GR), Netherlands (NL), Ireland (IE), Italy (IT), Latvia (LV), Lithuania (LT), Luxembourg (LU), Malta (MT) and Portugal (PT). The acronym EA represents the euro area. The euro area does not include Portugal. Countries are ranked by the median net wealth.

within each country. In Portugal, the mean wealth in 2017 was 162 thousand euros, 30% less than the value of the euro area. The ranking of countries based on the mean wealth is identical, but not exactly the same, as that obtained with the median. The fact that different rankings are obtained with the mean or the median means that countries also differ in terms of the degree of inequality. The ratio between the mean and the median wealth, which is one of many possible indicators of inequality, ranges from 1.5 in Slovakia to 3.3 in Germany. In Portugal it stands at 2.2, the sixth highest value among euro area countries and similar to that of the euro area.

Regardless of using the mean or the median, the HFCS data show a ranking of countries by household wealth levels that differs from that obtained with gross domestic product or with disposable income. An example is Germany (and, in the opposite way, Cyprus) which is one of the euro area countries with the highest values of product and income and has a median household wealth much lower than the euro area as a whole and a relatively close mean wealth. These results should be seen taking into consideration the literature that has sought to characterize and understand the differences in the wealth of households across euro area countries.

The conclusions of these articles show that in comparisons across countries it is important to bear in mind that HFCS assets do not include the value of the rights accumulated by individuals on future public pensions, nor of any type of social support. The degree of generosity of social protection schemes (e.g., retirement pensions) differs significantly across countries and this affects the households' decisions on saving and on wealth allocation. Fessler and Schürz (2015) and Roger *et al.* (2020) show that each euro

area country's expenditure on social protection is negatively correlated with household wealth measured by the HFCS and that this correlation changes according to household characteristics.

In this article, as in most of the literature, wealth is not adjusted by household composition, contrary to what is established in the analysis of income distribution. It is considered that this adjustment may not be appropriate given that wealth is largely the result of joint decisions by the various members of the household, which are in many cases relatively independent of the household size. Despite this, levels of wealth are influenced by the households' composition, so that the differences in wealth per household across countries also reflect the fact that there are significant differences in the structure of households, namely in terms of the number of individuals per household. Based on a counterfactual exercise, Fessler *et al.* (2014) show that imposing to all euro area countries a household structure (in terms of number of individuals, gender and age) equal to the euro area average would lead to a significant reordering of countries by household wealth levels, and that this effect changes along the wealth distribution.

From another perspective, several articles emphasize factors that contribute to the imperfect correlation between wealth and household income levels or even savings rates. For example, Moser *et al.* (2016) and Fessler and Schürz (2015) show that, even when controlling for the characteristics of households, wealth is closely related to inheritances and that this correlation varies across countries and along the distribution of wealth. On the other hand, it is important to bear in mind that similar changes in asset prices affect households' wealth differently in different countries (and in each country across different groups) if there are differences in the composition of wealth. In the euro area countries, the percentage of homeowners is very heterogeneous, which largely reflects institutional factors and different fiscal policies (Fatica and Prammer, 2017). Several articles show that homeownership is positively related to the levels of wealth and negatively related to wealth inequality (Lindner, 2015; Mathä *et al.*, 2017; Kaas *et al.*, 2019). The different evolution of real estate prices across euro area countries in the recent decades may have contributed to the fact that in economies with higher increases in these prices there were larger increases in the wealth of the households that own them (Mathä *et al.*, 2017). The positive relationship between the levels of wealth and homeownership may also reflect the fact that a large number of households buy a house by getting a loan and the commitments made to repay the debt are an incentive to saving.

A common conclusion in most studies is that the importance of different factors in explaining the differences in wealth across countries changes according to the type household and, in particular, along the distribution of wealth. In this context, it is interesting to compare wealth in Portugal and in the euro area for different types of households.

2.2. *Comparison of wealth between Portugal and the euro area by household groups*

In this section and in the remaining of the article, households are divided into groups that reflect their position in the respective distributions of wealth and income (in Portugal or in the rest of the euro area) and the age of the household's reference person. The wealth and income groups correspond to the quintiles of these variables.[4] Income corresponds to gross income as net income is not available for all HFCS households. The reference person was selected among the household members according to the definition of Canberra (United Nations, 2011) and corresponds, in most cases, to the person with the highest income in the household.

In Portugal and in the euro area, the median and the mean wealth show the usual profiles (Table 1). First, the increase in wealth along the wealth quintiles is particularly marked in the top quintile, reflecting the high concentration of wealth in a reduced number of households. Second, across the income quintiles, wealth has also an increasing and very pronounced profile in the top quintile, which is in line with the positive correlation between the two variables. Finally, by age groups, the wealth profile reflects the typical life cycle pattern, increasing up to age groups close to retirement age, and decreasing in later ages.

The difference between the level of household wealth in Portugal and in the euro area varies across groups of households. In the two lowest wealth or income quintiles and in the youngest age group, the median wealth in Portugal is close to or even higher than in the euro area. In the remaining groups, as in the overall households, the median wealth in Portugal is close to or even higher than in the euro area. In groups aged 55 to 74 years old it is almost half the value of the euro area and in the two highest wealth or income quintiles it is just over 60% of the value of the euro area. The comparison in terms of means has an identical pattern. The main difference occurs by income quintiles. Contrary to the median, the mean is lower in Portugal than in the euro area in all income quintiles (although the difference has a smaller magnitude at the ends of the distribution than in the intermediate quintiles).

As mentioned, the mean and the median values of wealth are significantly lower in Portugal in most groups of households, with the exception of groups with lower wealth, lower income and younger age. This pattern mainly reflects the comparison with Germany. However, in the case of age, wealth in Portugal compares more favourably in the youngest age group than in the rest of the age groups, also with many of the remaining countries (e.g., with Spain, France and Italy).[5]

4. The quintiles of a variable consist of five groups each with 20% of the households sorted by the values of that variable. For example, the first quintile of net wealth in Portugal (in the euro area) includes the set of 20% of households with the lowest net wealth values in Portugal (in the euro area), i.e. households with a net wealth value below the 20th percentile.

5. The data referred to throughout the article for the euro area countries can be found in the statistical tables of the 2017 wave of the HFCS published on the ECB's website.

	Median		Mean	
	Portugal	Euro area	Portugal	Euro area
Total	74.8	100.4	162.3	231.0
Net wealth percentile				
<=20	0.9	1.1	0.8	-4.6
20-40	33.0	23.8	33.0	26.6
40-60	74.8	99.8	75.6	101.5
60-80	136.6	219.3	139.2	225.0
>80	325.1	524.9	562.9	796.5
Income percentile				
<=20	33.0	18.1	63.6	75.7
20-40	51.2	46.6	79.2	113.4
40-60	64.8	101.6	103.8	178.6
60-80	91.2	148.1	151.6	238.3
>80	183.4	301.5	413.4	538.0
Age of the reference person				
<35	14.1	14.0	70.6	64.5
35-44	62.6	70.0	125.9	157.8
45-54	86.3	130.0	199.2	272.0
55-64	94.6	168.8	206.4	306.1
65-74	87.8	169.5	173.2	299.6
>=75	79.7	114.7	154.4	242.5

TABLE 1. Net wealth in Portugal and in the euro area by households' characteristics | Thousands of euros

Source: HFCS, 2017. Note: The euro area does not include Portugal.

The mean and the median values of wealth mask the high heterogeneity that also exists within each group of households. When Portuguese households are distributed over the euro area quintiles of net wealth, it can be seen that there is a significant number of Portuguese households across the entire distribution of the euro area (Table 2). The highest concentration of Portuguese households occurs in the intermediate quintile (between the 40th and 60th percentile), where almost a third of the households are located. In the two lowest quintiles of the euro area there is a higher concentration of Portuguese households than in the two highest quintiles (41.4% and 26.2%, respectively). It is also interesting to note that there are only values below the diagonal in the bottom quintile, which means that, with the exception of that quintile, Portuguese households belong to a euro area quintile that is equal to or less than the one they belong in Portugal. Finally, in the diagonal the value of the fourth quintile is lower than that of the top quintile (6.1%, compared to 10.4%).

In all income quintiles and all age groups, households in Portugal are also represented in the different levels of wealth of households in the same groups in the euro area (Figures 2 and 3). In most cases, Portuguese households are more frequent around the intermediate levels of wealth of each group, rather than at the ends. However, this

pattern is not observed in the youngest age group. In this group, in which the reference person is under 35 years old, not only the mean level of wealth is similar in Portugal and in the euro area, also the distribution of wealth among households is very similar.

Quintiles of net wealth in Portugal

Quintiles of net wealth in the euro area	<=20	20-40	40-60	60-80	>80	**Total**
<=20	**17.5**	0.0	0.0	0.0	0.0	**17.5**
20-40	2.6	**20.0**	1.3	0.0	0.0	**23.9**
40-60	0.0	0.0	**18.7**	13.8	0.0	**32.5**
60-80	0.0	0.0	0.0	**6.1**	9.6	**15.8**
>80	0.0	0.0	0.0	0.0	**10.4**	**10.4**
Total	**20.0**	**20.0**	**20.0**	**20.0**	**20.0**	**100.0**

TABLE 2. Distribution of the Portuguese households by net wealth quintiles in Portugal and in the euro area | Percentage

Source: HFCS, 2017.

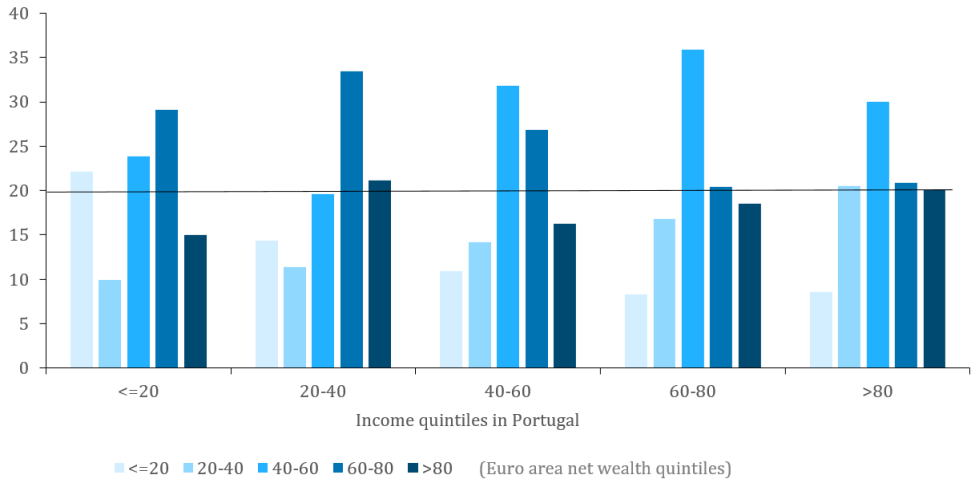

FIGURE 2: Distribution of households in each income quintile in Portugal by the euro area net wealth quintiles | Percentage of total households in each income quintile

Source: HFCS, 2017. Notes: The euro area net wealth quintiles were calculated within each income class, i.e. if the distribution of net wealth in each income group was equal in Portugal and in the euro area, all bars would be 20%. In each income quintile, the sum of the bars is 100%.

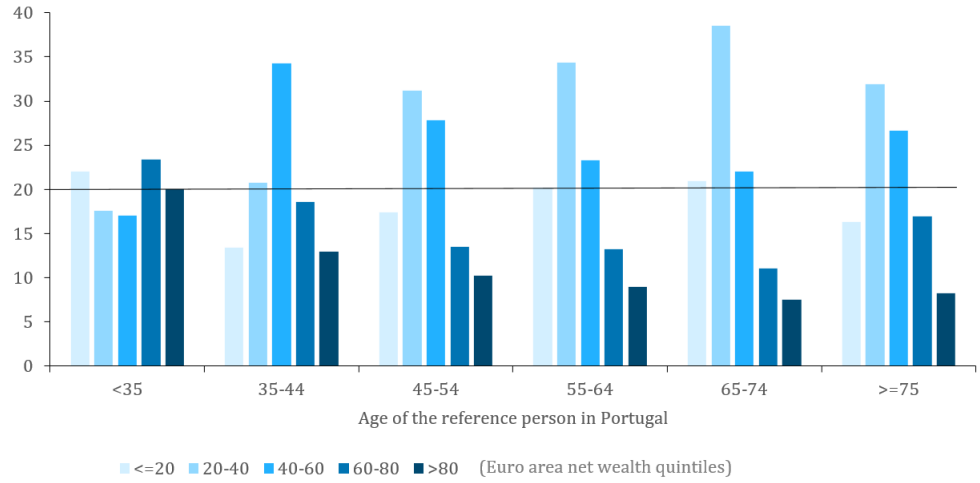

FIGURE 3: Distribution of households in each age group in Portugal by the euro area net wealth quintiles | Percentage of total households in each age group

Source: HFCS, 2017. Notes: The euro area net wealth quintiles were calculated within each age group, i.e. if the distribution of net wealth in each age group was equal in Portugal and in the euro area, all bars would be 20%. In each age group, the sum of the bars is 100%.

3. What is the role of wealth components in the comparison of wealth with the euro area?

The HFCS includes detailed information on the components of net wealth. These data have been used to illustrate differences in the composition of wealth across groups of households within a country and between countries (e.g., Costa *et al.* (2020), HFCN (2013) and HFCN (2020)). Additionally, several articles suggest that the composition of wealth, in particular homeownership, is related to wealth levels, even when controlling for several other households' characteristics (Lindner, 2015; Mathä *et al.*, 2017; Kaas *et al.*, 2019). This section analyses the role of the main types of assets and debts in the mean wealth differential between Portugal and the euro area and in the heterogeneity of this differential across groups of households. First, the composition of households' net wealth in Portugal and the euro area is compared. Second, the percentage difference in the mean wealth between Portugal and the euro area is decomposed into two components. This decompositions depends on the weight of each asset or debt in the total net wealth, as well as on the number of households that own them (participation) and on the respective mean value for the households that own them (mean value conditional on participation).

For the households as a whole, wealth composition is very similar in Portugal and in the euro area (Table 3). Both in Portugal and in the euro area, assets include mostly real estate properties and debt is around 12% the value of assets. The main residence weighs almost 50% of total assets and the other real estate properties almost 20%. The importance of real estate is also evident in the debt, since most of it are mortgages on real estate properties. The weight of deposits in total assets is also close in Portugal and in the euro area (respectively, 9% and 8%). On the assets side, one of the main

differences is the fact that, in Portugal, deposits are the majority of financial assets, which is not the case in the euro area. The remaining financial assets, which mainly include investment funds units, debt securities, quoted shares and voluntary pension plans, account for 3% of assets in Portugal and 11% in the euro area. The lesser importance of these assets in Portugal may reflect several factors, including the lower levels of education of the Portuguese population as well as the lesser importance of old age private protection schemes. The counterpart of the lower share of the financial assets in Portugal is the higher importance of businesses (17% and 8% of total assets, respectively, in Portugal and in the euro area). Note that the other financial assets include the shares held by the households in listed firms or in firms in which the households take part only as investors, while businesses include the remaining participation in firms or self-employed activities and are considered in the HFCS as real assets.[6] These two types of assets thus have some common characteristics and their different weights in Portugal and in the euro area may partly reflect differences in classification between countries. On the debt side, the main difference is that mortgages have a slightly higher weight in assets in Portugal than in the euro area.

	Net weath	Main residence	Other real estate properties	Businesses	Other real assets	Deposits	Other financial assets	Total debt	Mortgage debt	Non-mortgage debt
Weight in total assets (%)										
Portugal	87	48	19	17	4	9	3	13	12	1
Euro area	88	49	19	8	5	8	11	12	10	1
Difference (pp)	-1	-1	0	8	0	1	-8	1	2	-1
Mean value (thousand euros)										
Portugal	162	89	35	31	8	17	6	24	23	2
Euro area	231	127	49	22	12	22	29	30	27	4
Difference (%)	-30	-30	-28	42	-35	-20	-81	-21	-16	-58
Contribution of participation (pp)	-	13	11	36	-8	-1	-17	7	27	-9
Contribution of the conditional mean value (pp)	-	-44	-39	6	-27	-19	-63	-27	-43	-49
Contribution to the net wealth difference (pp)										
Total	-30	-17	-6	4	-2	-2	-10	3	2	1
Participation	8	7	2	3	0	0	-2	-1	-3	0
Conditional mean value	-37	-24	-8	1	-1	-2	-8	4	5	1
By memory:										
Participation (%)										
Portugal	-	74	29	14	76	97	23	46	34	23
Euro area	-	60	25	11	85	98	44	42	23	27
Difference (pp)	-	14	5	4	-9	-1	-21	4	11	-5
Mean value conditional to participation (thousand euros)										
Portugal	-	119	121	220	11	18	24	53	66	7
Euro area	-	213	200	207	15	22	65	73	116	13
Difference (%)	-	-44	-39	6	-27	-19	-63	-27	-43	-49

TABLE 3. Difference in the mean net wealth between Portugal and the euro area, contributions from assets and debt

Source: HFCS, 2017. Note: The euro area does not include Portugal.

The fact that the composition of net wealth is similar in Portugal and in the euro area means that the differences in the mean levels of the various assets and debts are identical. In fact, for all major assets, with the exception of businesses, and for both mortgage and non-mortgage debt, the difference in the mean value between Portugal and the euro area is negative and considerable (Table 3). When these differences are

6. For more details on households' businesses in Portugal and in the euro area, see Costa *et al.* (2020b).

decomposed into the contributions of participation and of the conditional mean value, the conclusion is that this is mainly explained by the conditional mean values. This means that net wealth is lower in Portugal than in the euro area because most of the assets have, for the households that own them, much lower values and not because there are fewer households with assets in Portugal or more households with debt. In the case of the real estate properties, which have a dominant weight in wealth, the contribution of participation is even positive since there is a higher percentage of households owning real estate properties in Portugal than in the euro area. In Portugal 74% of the households are homeowners and 29% own other real estate properties, while in the euro area these percentages are 60% and 25%, respectively. These differences favour the value of real estate wealth in Portugal, but not enough to offset the fact that the mean value of real estate owned by Portuguese households is much lower (in the case of the main residence, 119 thousand euros, compared to 213 thousand euros in the euro area). In the financial assets, the participation in deposits is identical in Portugal and in the euro area, but the participation in other assets is much smaller in Portugal. The differential vis-à-vis the euro area of the conditional mean values of any of these assets is negative, having a higher magnitude in the other financial assets than in deposits. In the case of businesses, the higher mean value and weight in wealth in Portugal mainly reflect the higher participation of Portuguese households. Although the conditional mean value of businesses is also higher in Portugal, the magnitude of the difference is small.

Table 3 also includes the contribution of each type of asset and debt to the percentage difference in net wealth between Portugal and the euro area. As expected, given its dominant weight in wealth, the main residence has the major contribution, justifying -17 percentage points (pp) of the -30% differential in the mean wealth of households as a whole. Other real estate properties have a smaller contribution (-6 pp), which mainly reflects their lower weight in wealth. The negative contribution from real estate properties is only slightly offset by the positive contribution from mortgages. This is due to the fact that less than half of the households owning real estate properties have debt, as well as the fact that the conditional mean values of debt are much lower than that of the real estate properties. Financial assets, excluding deposits, also have a very significant contribution (-10 pp) to the difference in wealth between Portugal and the euro area, due to having a much lower mean value in Portugal. This contribution is only partially offset by the positive contribution of businesses (4 pp). The contributions of the remaining components are much smaller.

When households are divided into wealth and income quintiles and age groups, it is also concluded that the composition of wealth has many similarities in Portugal and in the euro area (Table 4). First, the main residence is the main asset in all groups. The weight of the main residence is higher than 50% in all groups except for groups aged over 45 years old and for the top wealth or income quintiles. Second, households in the top wealth and income quintiles have a much more diversified asset structure than the rest. In the wealth of these households, businesses, other real estate properties and, in the euro area also the financial assets excluding deposits, have a much greater importance and weight as a whole more than the main residence in total assets. Finally, in the bottom net wealth quintile and, to a lesser extent, in the second wealth quintile and in the two

younger age groups, debt has a much higher weight in total assets than in the other classes.

	Main residence	Other real estate properties	Businesses	Other real assets	Deposits	Other financial assets		Total debt	Mortgage debt	Non-mortgage debt
					Portugal					
Total	48	19	17	4	9	3	0	13	12	1
Net wealth percentile										
<=20	67	6	1	15	9	2	0	94	79	15
20-40	76	5	1	8	8	1	0	44	42	2
40-60	76	7	2	6	8	1	0	24	22	2
60-80	69	11	3	5	10	2	0	14	13	1
>80	34	25	25	3	10	4	0	6	6	0
Income percentile										
<=20	66	13	7	3	9	2	0	7	6	1
20-40	67	14	4	4	9	1	0	11	10	1
40-60	63	14	8	5	8	3	0	17	16	1
60-80	55	16	12	5	10	3	0	17	16	1
>80	34	24	25	4	10	4	0	11	11	1
Age of the reference person										
<35	51	13	20	8	7	1	0	31	29	2
35-44	57	12	14	6	8	3	0	29	28	1
45-54	44	16	24	5	8	3	0	15	14	1
55-64	44	23	17	4	9	4	0	8	7	1
65-74	46	22	13	4	12	3	0	2	2	1
>=75	48	27	9	2	13	2	0	0	0	0
					Euro area					
Total	49	19	8	5	8	11	0	12	10	1
Net wealth percentile										
<=20	57	7	1	16	12	6	0	134	99	35
20-40	49	5	2	16	19	8	0	39	34	6
40-60	67	8	2	7	10	6	0	25	23	2
60-80	67	11	2	5	9	6	0	13	11	1
>80	40	24	12	3	7	13	0	6	5	1
Income percentile										
<=20	62	15	5	4	9	6	0	8	6	2
20-40	58	16	7	5	8	5	0	8	6	2
40-60	55	15	8	5	9	7	0	10	8	2
60-80	53	18	6	5	9	9	0	13	11	2
>80	41	22	10	4	8	15	0	13	12	1
Age of the reference person										
<35	49	13	9	8	12	9	0	34	29	5
35-44	54	14	9	6	8	9	0	27	24	2
45-54	46	18	14	4	7	10	0	14	12	2
55-64	46	20	10	4	8	11	0	8	7	1
65-74	48	22	5	4	10	12	0	4	3	1
>=75	52	19	1	5	10	13	0	1	1	0

TABLE 4. Assets and debts in Portugal and in the euro area, by household groups | Percentage of total assets

Source: HFCS, 2017. Note: The euro area does not include Portugal.

As regards participation rates and conditional mean values, some of the main conclusions mentioned for the households as a whole remain when the comparison with the euro area is done by groups of households (Tables A1 and A2 in the Appendix).[7] In particular, in practically all cases, the assets and debts mean values conditional on the participation are lower in Portugal. Additionally, in almost all groups, in Portugal the percentage of households owning the main residence, other real estate properties, businesses or having mortgages is higher and the percentage of households owning other financial assets is lower. Despite this common pattern, the magnitude of the differences, especially in the participation rates, is highly variable, which contributes to the heterogeneity of wealth differentials between Portugal and the euro area by household groups.

7. The tables with the results by wealth and income quintiles and by age groups, which gives further details on the analysis carried out, can be found in the Appendix - Additional tables of the article "Household wealth in Portugal and the euro area".

By wealth quintiles, mean net wealth is lower in Portugal than in the euro area in the top three quintiles, but higher in the bottom two quintiles. This is mainly due to the contributions of the main residence and debt (Table 5). In the case of the main residence, although homeownership is higher in all quintiles in Portugal, the difference vis-à-vis the euro area is more noticeable in the two bottom wealth quintiles. In the bottom quintile, this favourable effect is amplified by the effect of debt. Although there are more households in this group with mortgage debt in Portugal, the outstanding amounts of debt for these households are much smaller than in the euro area, generating a much larger positive contribution from debt than in the rest of the quintiles. In fact, in the bottom quintile, contrary to what happens in the remaining, the debt-to-asset ratio is lower in Portugal than in the euro area.

		Contributions (pp)							
	Difference in the mean net wealth (%)	Main residence	Other real estate properties	Businesses	Other real assets	Deposits	Other financial assets	Mortgage debt	Non-mortgage debt
Total	-30	-17	-6	4	-2	-2	-10	2	1
Net wealth percentile									
<=20	116	23	-4	0	-5	-11	-14	67	61
20-40	24	90	2	0	-10	-13	-10	-38	4
40-60	-25	-15	-4	-1	-3	-6	-7	10	1
60-80	-38	-26	-5	0	-2	-3	-6	3	1
>80	-29	-18	-7	6	-1	0	-11	1	0
Income percentile									
<=20	-16	-8	-5	1	-2	-1	-4	1	1
20-40	-30	-11	-6	-4	-3	-2	-5	-2	1
40-60	-42	-17	-7	-3	-2	-4	-6	-2	1
60-80	-37	-20	-9	3	-2	-3	-8	1	1
>80	-23	-17	-4	9	-1	0	-14	4	1
Age of he reference person									
<35	9	6	1	18	0	-6	-12	-1	4
35-44	-20	-9	-7	4	-1	-1	-9	1	2
45-54	-27	-16	-8	5	-1	-1	-9	2	1
55-64	-33	-18	-5	2	-2	-2	-10	2	1
65-74	-42	-23	-9	3	-2	-3	-10	2	0
>=75	-37	-22	-3	4	-4	-2	-12	1	0

TABLE 5. Difference in the mean net wealth between Portugal and the euro area, contributions of assets and debt, by household groups | Percentage and percentage points

Source: HFCS, 2017. Note: The euro area does not include Portugal.

By income quintiles, the mean net wealth in Portugal is lower than in the euro area in the five groups. The magnitude of the difference is however not constant. Household wealth in Portugal is closer to the euro area in the bottom and top quintiles than in middle-income households. In the bottom quintile, the much higher percentage of homeowners in Portugal contributes to this evidence. Furthermore, the conditional mean values of the real estate properties and of the financial assets in this quintile are closer to those of the euro area than in the other quintiles, although still much lower. In turn, at the top of the income distribution, the negative net wealth differential is mostly mitigated by a positive contribution from businesses.

By age groups, the youngest Portuguese households have a higher mean wealth than the youngest households in the euro area. In the remaining age groups, wealth in Portugal is lower than in the euro area and the differential has the highest value in the 65 to 74 age group. This profile closely follows the profile of the contribution of differences

in the main residence, which is favourable to Portugal in the group under 35 years old and negative in the remaining classes. In the youngest Portuguese households, there is still a significant positive contribution of business wealth, which however is offset by the lower mean value of financial assets. In the remaining age groups, the lower levels of wealth are mainly due to the main residence and, to a lesser extent, to financial assets, other real estate properties and other real assets.

The profile of the main residence contribution by age groups follows the differences in participation between Portugal and the euro area. In Portugal, the positive impact on net wealth of a higher homeownership decreases with age, while at the same time the negative contribution of the mean value remains relatively stable. The profile of the contribution of participation reflects the fact that euro area households become homeowners later in life. Both in Portugal and in the euro area, most homeowners in the youngest age group have mortgages, which partially offsets the positive effect associated with the higher homeownership. However, this effect remains significant since among the younger households, in Portugal and in the euro area, about 30% do not have mortgages on their main residence and for those households that have them, on average the outstanding amount of debt only accounts for about 75% of the value of the residence.

From the analysis above, one concludes that, as expected, given its weight in wealth, the main residence is essential to explain the heterogeneity of the mean net wealth differential between Portugal and the euro area by household groups. The contribution of the main residence determines the sign and, in most cases, also the profile of the differences vis-à-vis the euro area. This profile is mainly determined by the difference in homeownership in Portugal and in the euro area. Although the participation in the main residence in all groups is higher in Portugal, the difference vis-à-vis the euro area is much higher in the bottom two wealth quintiles (in the bottom quintile is 14% in Portugal and 7% in the euro area and in the second quintile is 76% in Portugal and 29% in the euro area) and in the youngest age group (45% in Portugal and 27% in the euro area).

Participation in the main residence is higher in Portugal than in most of euro area countries. Among the four largest economies in the euro area, only Spain has a percentage of homeowners identical to Portugal (75.9% in 2017, compared to 74.5% in Portugal). In Germany, France and Italy homeownership is much lower (in 2017, 43.9%, 57.9% and 68.5%, respectively), which partly reflects historical and institutional factors (Eurosystem, 2009). In Portugal, the percentage of homeowners is higher than in these three countries in all age groups and practically in all wealth and income quintiles. Additionally, as with the euro area as a whole, the differences are more marked in the younger age groups and in the lower levels of income and wealth. Homeownership in the two younger age groups is also higher in Portugal than in Spain where, however, there is a higher percentage of homeowners than in Portugal in the age groups from 55 years onwards.

4. What is the role of household characteristics in the comparison of wealth with the euro area?

In each country, there are households with very diverse characteristics, which contributes to the high heterogeneity of wealth within each country. Macroeconomic conditions and institutional or cultural factors contribute to some types of households being more frequent in some economies than in others. The first part of this section compares the characteristics of households in Portugal and in the euro area. In the second part, differences in the characteristics are related to differences in the levels of net wealth. For this purpose, a counterfactual exercise is carried out in which the euro area wealth is estimated by imposing the characteristics of households in Portugal. The analysis is performed for the median, as it is a more robust statistic than the mean, since it is less influenced by extreme values. As in the previous sections, the analysis for the overall households is complemented with an analysis by age groups, income and wealth quintiles.

The characteristics analysed include income, sociodemographic aspects of the reference person (age, gender, marital status and level of education) and the household composition. Other characteristics related to the composition of wealth, such as ownership of the main residence or business ownership (which in the HFCS, in most cases, is associated with the existence of self-employed workers) were not included in the analysis as they were already analysed in the previous section.

Receiving inheritances (or substantial gifts) is another very relevant aspect in determining the level of wealth. In Portugal, as in the remaining countries, the percentage of households that received an inheritance or a gift at some point in the past is positively correlated with wealth. In the bottom wealth quintile, 9% of Portuguese households received inheritances or gifts, which contrasts with 48% in the top quintile. The variable that identifies inheritances or gifts receipt was not, however, included in the results presented in this section because data are not available for Italy. In any case, when performing the counterfactual exercise for the remaining countries, the conclusion is that this variable does not help to explain the wealth differential between Portugal and the euro area, which reflects the identical percentage of households that received inheritances or gifts (29% in Portugal and 28% in the euro area excluding Italy).

In the analysis, income corresponds to the annual income per equivalent adult, which takes into account the composition of the household in terms of the number of adults and children and its effect on consumption.[8] As with total income, this variable is related to the saving capacity of each household, i.e., the capacity to accumulate wealth. The inclusion of income per equivalent adult, instead of total income, makes it possible to isolate the effect of different income levels in the two economies, separating it from the effect arising from differences in the composition of the household. Household type is a categorical variable that divides households into the following groups: one adult;

8. Income per adult equivalent is obtained by dividing the total household income by the number of adult equivalents in each household, according to the modified OECD equivalence scale. This scale assigns a weight of 1 to the first adult in the household, 0.5 to the remaining adults and 0.3 to each child.

several adults; one adult and at least one child; and several adults and at least one child. In this variable, individuals under the age of 25 years, who are not working and who are neither the household representant nor an ascendant, the spouse or partner of the household representant, are considered children.[9]

4.1. Household characteristics in Portugal and in the euro area

In Portugal, the reference person is slightly older than in the euro area (Table 6). When households are divided by age groups, the largest difference in age structure occurs in the youngest class. In Portugal, not only the proportion of households in the group where the reference person is under 35 years old is smaller (9.8%, compared to 14.2% in the euro area) but also, within that group, most individuals are older (median age is 2 years higher) (Table A3 in Appendix). This is largely because young people in Portugal leave later their parents' house. Indeed, the percentage of the population aged between 16 and 34 is also lower in Portugal (according to the HFCS, 24.6%, compared to 25.3% in the euro area), but the difference is much smaller than that in the percentage of households in this age group (-0.7 pp, compared to -4.4 pp). In Portugal and in the euro area, the median and the mean age of the reference person in the various income and wealth quintiles are 50 or more years old and exhibit in global terms a downward trend by income quintiles and an increasing trend by wealth quintiles.[10] In all quintiles of income, except in the third and fourth, and in all wealth quintiles, except in the top one, the age of the reference person is higher in Portugal than in the euro area (Tables A4 and A5 of the Appendix). The largest differences occur in the lowest quintiles of these variables, in particular in the bottom income quintile where the median age of the reference person is 67 in Portugal and 58 in the euro area.

The level of education is one of the aspects in which the Portuguese households differ most from those in the euro area. In Portugal, education levels are significantly lower. In 65% of the households, the level of education of the reference person is lower than the secondary level, which compares with around 30% in the euro area, where households in which the reference person has secondary education prevail. The percentage with tertiary education is around 20% in Portugal and around 30% in the euro area. In general, the level of education decreases with age and increases with net wealth and more sharply with income. The lower level of education of Portuguese households is common across all age groups, income and wealth quintiles. The difference between the percentage of households with less than secondary education in Portugal and the euro area is higher than 35 pp in all age groups from 45 years old onwards, in all income and wealth quintiles, except in the top ones. In the remaining groups, the difference

9. The household representant is a household member who is 16 years old or older whose name is associated to the dwelling selected from the census data.

10. The different profile of income and wealth by age illustrates that the two variables, although having a strong positive correlation, do not show a perfect correlation. One of the aspects that determines this is the fact that in older ages, income suffers a sharp reduction partly as a result of retirement, but wealth is only slightly reduced, always remaining above the levels of younger age groups.

	Overall households	
	Portugal	Euro area
Age (%)		
<35	9.8	14.2
35-44	19.3	16.9
45-54	20.3	20.3
55-64	18.4	18.3
65-74	16.0	14.8
>=75	16.2	15.6
Age (years)		
Median	55.0	54.0
Mean	55.8	54.5
Male (%)	58.2	62.3
Education (%)		
Less than secondary	64.9	29.5
Secondary	15.6	41.5
Tertiary	19.5	29.0
Married (%)	55.4	48.6
Household type (%)		
1 adult	22.4	35.0
Several adults	40.7	35.5
1 adult and child(ren)	5.1	4.7
Adults and child(ren)	31.8	24.8
Income per adult equivalent (thousand of euros)		
Median	10.4	21.5
Mean	14.4	27.4

TABLE 6. Characteristics of households in Portugal and the euro area
Source: HFCS, 2017. Note: The euro area does not include Portugal.

in education levels is lower, but still very high (higher than 10 pp in the case of the education level less than secondary).[11]

In terms of composition, in Portugal there is a predominance of households with several adults (40.7% of the total number of households include several adults and no children and 31.8% include several adults and children). Households with only one adult represent 22.4% and lone parent households 5.1%. In the euro area, the proportion of lone parent households is similar to Portugal. Households with only one adult and no children are however much more common in the euro area (35%), where the two types of households with several adults are less frequent than in Portugal. The greater importance of households with only one adult and no children in the euro area is common to all age groups, income and wealth quintiles. The difference is larger in

11. The significantly lower level of education in the youngest age group in Portugal compared to the euro area may seem surprising given the significant increase in the level of education in Portugal in the recent decades. In fact, for individuals, instead of households, the difference vis-à-vis the euro area is much smaller. This mainly reflects the fact that, in the euro area, in the age group under 35 years old, the level of education is significantly higher in terms of households than in terms of individuals (e.g., in the euro area, the percentage with tertiary education is 37.1% in terms of households and 26.8% in terms of individuals, while in Portugal the two percentages are 26.7% and 21.3%, respectively).

the younger households, in the second and third income quintiles, and in the two lowest wealth quintiles. Both in Portugal and in the euro area, the composition of households across age groups reflects the typical life cycle. Households with children have a maximum weight in the 35-44 age group, households with only one adult in the lower age group and households with multiple adults and no children in the 65-74 age group. In overall terms, households with only one adult have higher weights in the bottom income and wealth quintiles and households with several adults in the top quintiles. This increase in wealth and income with the number of adults reflects a scale effect that is more marked in the case of income than in the case of wealth.

In Portugal, the reference person is married in more than half of the households (55.4%), while in the euro area this occurs in slightly less than half of the households (48.6%). This difference reflects the existence of a higher percentage of households with only one person in the euro area, but also other generational and cultural factors. Both in Portugal and in the euro area, the percentage of households with married people increases a lot from the first to the second age group and decreases in the households where the reference person is 75 years old or more, although to a higher value than that of the youngest. By income and wealth quintiles, the percentage of married people tends to increase. The positive difference vis-à-vis the euro area occurs in almost all age groups and all income and wealth quintiles. The exceptions are the top income quintile, where in Portugal there is a lower percentage than in the euro area, and the youngest age group and the top wealth quintile, where the percentages are similar.

With regard to gender, both in Portugal and in the euro area households in which the reference person is male predominate, with the percentage of these households being lower in Portugal (58.2%, compared to 62.3%).[12] This pattern applies to all households groups with the exception of the bottom income quintile. Both in Portugal and in the euro area, the percentage of males evolves similarly to the percentage of married people, across the age, income and wealth groups, although the differences between groups are much less marked. The smaller percentage in Portugal of households with male reference persons is more visible in households in the top income quintile, in the top two wealth quintiles and in the first two age groups.

Finally, income per equivalent adult is around 50% lower in Portugal than in the euro area, both in the mean and the median values.[13] This applies to all groups of households, with the largest difference being in the intermediate income and wealth quintiles and in the two highest age groups. Income per equivalent adult increases with income and wealth quintiles. By age groups, it increases slightly up to the 54-65 age group and decreases in the next two older groups, reaching the lowest level in the last age group.

12. The fact that in Portugal there is a greater proximity between the participation of men and women in the labour market, as well as the fact that women have higher levels of education and that income increases with the level of education is more marked in Portugal, contribute to this difference.

13. This difference is more marked than in total income (the median and mean are around 43% lower), which reflects the larger size of households in Portugal.

The patterns identified in the comparison with the euro area average reflect not only the comparison with large countries, namely Germany, but are also in line with most the remaining countries.[14]

4.2. Results of the counterfactual exercise

The analysis in section 4.1 makes it clear that net wealth changes with households' characteristics similarly in Portugal and in the euro area. In overall terms, net wealth increases with age, level of education, income per adult equivalent, number of adults in the household and is positively related to whether the reference person is married or male. In Portugal, the levels of income and education are lower than in the euro area and the percentage of households in which the reference person is male is lower, which may contribute to lower wealth levels. The differences in the remaining variables, namely, the higher percentage of households with several adults, the older age of the reference person and the higher percentage of households with married people should have the opposite effect, that is, contribute to higher levels of wealth in Portugal.

In order to quantify these potential effects, a counterfactual exercise was carried out in which the value of the median wealth in the euro area is simulated as if households' characteristics were identical to those in Portugal. This exercise produces results that are very close to those obtained when, alternatively, the median wealth value in Portugal is simulated with the characteristics of the euro area, but it has the advantage of being based on regressions performed with a larger number of observations. In some cases, the conclusions obtained may however differ because the relationship between characteristics and wealth is not exactly the same in the two economies. This type of exercise has a mechanical and partial equilibrium nature, which does not take into account that the characteristics of households are influenced by the macroeconomic and institutional framework and that their relationship with wealth can change when its level changes. The results obtained are therefore merely indicative of possible explanations for the differences in wealth.

In this exercise was used the methodology developed by Firpo *et al.* (2009), which allows performing an Oaxaca-Blinder decomposition for other moments of the distribution other than the mean, using the Recentered Influence Function (RIF).[15] In this method, equations of the RIF for the median wealth as a function of households' characteristics are estimated for Portugal and for the euro area. This estimation enables to decompose the difference in wealth between Portugal and the euro area in the part explained by the difference in the level of households' characteristics (first term on the right side of the equation below) and in the part not explained by this difference, which

14. Among the remaining 18 countries of the euro area: Portugal is the country where the percentage of households in which the reference person has a level of education lower than secondary is the highest; only in Latvia, Lithuania, Slovakia, Estonia and Slovenia the income per equivalent adult is lower than in Portugal; only in Cyprus and Slovakia the percentage of households with only one person is lower than in Portugal; and only in Italy, Slovenia and Greece the reference person is older than in Portugal.

15. The Recentered Influence Function is a transformation that allows to assess the impact at a point in the distribution (e.g., on the median) of a change in the mass of probability of a given observation.

includes the effect of the coefficients and an interaction term (respectively, second and third terms on the right side of the equation):

$$RIF_{PT}^{Median} - RIF_{EA}^{Median} = (\overline{X}_{PT} - \overline{X}_{EA})\beta_{EA} + \overline{X}_{EA}(\beta_{PT} - \beta_{EA}) + (\overline{X}_{PT} - \overline{X}_{EA})(\beta_{PT} - \beta_{EA})$$

where: RIF_i^{Median} is the estimated median for i, $\overline{X}_i$ is the mean value of the households' characteristics of i, β_i are the estimated coefficients of the characteristics in the median wealth equation for i and i=PT or EA, respectively, in the case of Portugal and the euro area.

Table 7 includes the breakdown between the explained and unexplained parts as well as the decomposition of the explained part by each of the households' characteristics. The median wealth is 25 thousand euros lower in Portugal than in the euro area. Differences in the household characteristics potentially explain 16 thousand euros of that amount. More specifically, if the characteristics of the euro area households were replaced by the characteristics of the Portuguese households, but the relationship between the characteristics and wealth remained unchanged, the difference in the median wealth between Portugal and the euro area would be only -9 thousand euros. Income and the level of education are the variables with the most significant contribution. Together, the lower levels of these variables in Portugal possibly justify a median wealth lower in 36 thousand euros. The gender of the reference person in Portugal (smaller percentage of males) has also a negative impact on wealth, but with a small magnitude. The remaining characteristics are, on the contrary, more favourable to wealth in Portugal, mitigating the impact of income and the level of education by 20 thousand euros (the composition of households, age and marital status of the reference person have positive impacts on wealth of 10 thousand euros, 7 thousand euros and 2 thousand euros, respectively).

As seen in section 2, the difference in the median net wealth between Portugal and the euro area is not the same across households' groups. In particular, in the younger age groups and in the lowest income and wealth quintiles, the median wealth in Portugal is close to or even higher than that of the euro area, while in remaining groups it is smaller. In order to analyse whether this heterogeneity could be related to the characteristics, the previous methodology was applied to each group of households.

In all age groups, income and level of education in Portugal have a negative effect on wealth when compared to their level in the same groups in the euro area (Table A6 in the Appendix). As in the case of households as a whole, these negative effects are mitigated by the remaining characteristics of households in Portugal – in groups up to 64 years old by the households' composition, in age groups between 45 and 74 years old by the higher percentage of married reference persons, and in the youngest age group by older reference persons. The combined effect of the Portuguese households' characteristics is however negative in all age groups. This means that if the euro area households had the characteristics of the Portuguese households, they would have a lower level of wealth. Therefore, differences in the characteristics do not seem to be sufficient to explain similar levels of wealth in the youngest age group. When the counterfactual exercise is performed taking Portugal as the reference, i.e., when wealth in Portugal is simulated with the characteristics of the euro area, the conclusion is however that differences in

	Coefficient	Standard deviation
Median net wealth (thousand of euros)		
Portugal	74.86***	2.36
Euro area	99.92***	1.93
Difference	-25.06***	3.07
Explained	-15.79***	3.13
Unexplained	-9.27**	3.79
Explained		
Age	18.44***	5.35
Age^2	-11.02***	3.95
Male	-0.71***	0.25
Educ level less than secondary	-15.01***	1.29
Educ level secondary	2.15***	0.63
Educ level tertiary	-4.78***	0.53
Married	2.38***	0.53
1 adult	5.23***	0.62
Several adults	1.42***	0.34
1 adult and child(ren)	-0.13	0.16
Adults and child(ren)	3.25***	0.54
Income per adult equivalent (thousand of euros)	-17.01***	2.87

TABLE 7. Contributions of households' characteristics to the difference in the median net wealth between Portugal and the euro area

Source: HFCS, 2017. Notes: The euro area does not include Portugal. The table presents the results of the decomposition between the part explained by households' characteristics and the unexplained part of the differences in the median wealth between Portugal and the euro area. The results were obtained with the methodology of Firpo *et al.* (2009) as described in section 4. The model includes age squared to capture the non-linear effects of age on wealth. ***, ** and * indicate that the coefficients are significant with a 99%, 95% and 90% level of confidence, respectively.

age and in the household composition outweigh for the youngest households the effects of income and the level of education, justifying the existence of similar levels of wealth in this group in both economies.

By income quintiles, the set of characteristics in Portugal has a positive impact on wealth in the bottom quintile, non-significant in the second and negative in the last three quintiles (Table A7 in the Appendix). The favourable impact on the bottom quintile mainly reflects the higher mean age of the reference person in Portugal, in a context where income and educational levels have little or no significant impacts. In the second quintile, in addition to age, the composition of households is also favourable in Portugal. However, these positive effects are offset by the negative impact of the lower level of income. In the top three quintiles, both the income and the level of education in Portugal have a negative effect, which is further amplified in the third and fourth quintiles because the reference person is younger in Portugal.

By wealth quintiles, the households' characteristics seem to be less related to differences in the wealth levels. The impact of the characteristics is non-significant in the bottom three quintiles. In the top two quintiles, the impact is negative due to the effect of income and education level (Table A8 in the Appendix).

5. Conclusion

This article compares the levels of households' wealth in Portugal and in the euro area, taking into account the heterogeneity of the wealth distribution and composition. From this analysis, the following main conclusions emerge:

The mean or the median wealth of households in Portugal is around 30% lower than in the euro area, but this differential shows a high variability across households' groups

Portuguese households are represented across the entire wealth distribution of the euro area, although they are more frequent in the lower quintiles, particularly in the intermediate wealth quintile. This situation leads to significantly lower mean and median wealth levels in Portugal. This is true both for households as a whole and for most wealth or income quintiles and age groups. However, some groups, namely the youngest and the bottom income or wealth quintiles, have levels of wealth close to or even higher than the same groups in the euro area.

The composition of wealth has many common features in Portugal and in the euro area

Real estate has a dominant weight in wealth. The main residence weighs almost 50% of total assets and the other real estate properties almost 20%. Additionally, debt, which is around 12% of the assets, are mostly mortgages. The weight of deposits in total assets is slightly below 10%. The composition of wealth by wealth and income quintiles and age groups also has many common features in Portugal and in the euro area. In all groups, the main residence is the main asset, but in the top wealth or income quintile its weight is lower, reflecting a more diversified asset structure. In the bottom net wealth quintile and, to a lesser extent, in the second net wealth quintile and in the two younger age groups, the debt to assets ratio is much higher than for the rest. The main difference in the wealth composition between Portugal and the euro area consists of a higher weight of the financial assets, excluding deposits, in the euro area and a higher weight of businesses in Portugal.

Most assets and debts have, for the households that own them, much lower values in Portugal than in the euro area

Mean wealth is lower in Portugal mainly because the mean values of most assets, for the households that own them, are much lower. This effect is partially offset by the also lower mean debt values and by the fact that in Portugal there is a higher percentage of households that own some of the main assets, namely the main residence

The higher homeownership favours wealth in Portugal compared to the euro area and the effect is greater in the youngest age group and in the households with lower levels of wealth or income

Given the dominant weight in total assets, differences in the main residence are fundamental to explain the wealth differential between Portugal and the euro area. In Portugal, in all wealth or income quintiles and in all age groups, homeownership is higher than in the euro area. Participation in the main residence determines the sign and, in most cases, also the profile of the differences in wealth vis-à-vis the euro area across households' groups. The positive contribution of household participation to the

wealth difference in Portugal vis-à-vis the euro area is higher in the bottom two wealth quintiles, in the youngest age group and, to a lesser extent, in the bottom two income quintiles. To a large extent, this justifies that these groups in Portugal have levels of wealth close to or even higher than euro area households in the same groups.

The highest percentage of young homeowners in Portugal is related to the fact that Portuguese young people leave their parents' house later

The highest difference in the main residence participation in the youngest age group, than in the remaining groups, is related to the fact that in Portugal, more often, young people leave their parents' house only when they "start a family" or when they already have a more stable family situation and have had more time to accumulate wealth, which promotes house purchasing. Differences in households' characteristics confirm this situation. In the euro area, in the youngest age group, the most frequent category is households with only one person, while in Portugal it is households with adults and children. Additionally, the reference person in this class is on average older in Portugal than in the euro area.

The households' composition and the age of the reference person favour the levels of wealth per household in Portugal, but the lower levels of education and income more than offset this effect in most households' groups

In Portugal, the reference person is slightly older than in the euro area and households typically include a larger number of adults. These characteristics are generally associated with higher levels of wealth per household. The mean and median wealth in Portugal is thus possibly higher than that which would exist if households were in these respects identical to those in the euro area. Lower income and lower educational level in Portugal have however the opposite effect and, in most cases, they dominate compared to the effect of the remaining characteristics.

Lower-income households have significantly older people in Portugal than in the euro area, which contributes to wealth levels closer to those in the euro area

In general, the groups in which the households' wealth in Portugal compares most favourably with the euro area are also those in which the Portuguese households differ most from the euro area in terms of the age of the reference person and the number of individuals. Age differences are particularly marked in the income quintiles. In the two bottom income quintiles, the higher level of the median wealth in Portugal than in the euro area reflects, in part, the fact that in Portugal households with lower income have older people and therefore had more time to accumulate wealth.

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Appendix

Additional tables from the article "Household wealth in Portugal and in the euro area"

	Main residence	Other real estate properties	Businesses	Other real assets	Deposits	Other financial assets	Mortgage debt	Non-mortgage debt
				Portugal				
Total	74	29	14	76	97	23	34	23
Net wealth percentile								
<=20	14	3	4	52	89	12	13	31
20-40	76	18	7	70	97	16	40	27
40-60	92	24	11	82	98	20	42	23
60-80	96	35	16	86	99	23	37	17
>80	96	66	33	92	100	45	40	15
Income percentile								
<=20	60	18	7	44	86	12	10	10
20-40	68	25	6	67	97	13	21	19
40-60	75	25	13	84	99	19	35	28
60-80	83	31	18	92	100	29	49	30
>80	86	46	27	94	100	43	55	26
Age of the reference person								
<35	45	13	14	75	98	26	33	32
35-44	77	24	21	89	99	30	64	34
45-54	77	29	20	86	97	27	52	29
55-64	80	34	16	81	96	29	32	22
65-74	78	36	7	73	95	16	11	15
>=75	76	33	4	48	93	9	1	4
				Euro area				
Total	60	25	11	85	98	44	23	27
Net wealth percentile								
>=20	7	2	2	64	94	19	7	38
20-40	29	8	5	84	99	38	14	28
40-60	78	22	8	89	98	40	32	26
60-80	91	31	12	93	99	49	31	24
>80	94	59	24	96	100	72	32	22
Income percentile								
>=20	45	14	5	64	92	20	7	19
20-40	50	19	7	83	98	28	12	22
40-60	59	23	10	90	99	41	19	29
60-80	68	27	11	93	100	56	31	34
>80	78	40	20	95	99	72	46	32
Age of the reference person								
<35	27	9	7	80	98	43	20	39
35-44	56	19	14	88	97	46	40	36
45-54	64	28	17	89	98	51	36	35
55-64	70	32	13	90	98	50	23	28
65-74	71	32	5	86	98	39	11	17
>=75	66	25	2	74	98	31	3	7

TABLE A1. Participation in assets and debt in Portugal and in the euro area | Percentage of total households in each group

Source: HFCS, 2017. Note: The euro area does not include Portugal.

	Main residence	Other real estate properties	Businesses	Other real assets	Deposits	Other financial assets	Mortgage debt	Non-mortgage debt
				Portugal				
Total	119	121	220	11	18	24	66	7
Net wealth percentile								
<=20	64	26	4	4	1	2	80	6
20-40	60	16	10	7	5	5	63	5
40-60	82	28	16	8	8	7	53	7
60-80	117	48	29	10	16	15	59	7
>80	211	227	445	21	57	48	86	10
Income percentile								
<=20	75	48	63	4	7	13	39	6
20-40	88	51	57	5	9	9	43	4
40-60	104	69	83	7	10	18	56	6
60-80	121	92	124	11	18	16	60	6
>80	187	237	422	21	45	39	92	11
Age of the reference person								
<35	115	98	141	11	8	4	87	7
35-44	131	87	120	12	15	17	79	5
45-54	136	129	278	13	18	26	62	7
55-64	122	149	237	11	21	30	47	9
65-74	104	111	329	9	21	38	31	6
>=75	97	127	390	5	21	30	42	7
				Euro area				
Total	213	200	207	15	22	65	116	13
Net wealth percentile								
>=20	110	42	6	3	2	5	196	13
20-40	75	29	14	8	9	10	108	9
40-60	116	50	29	10	14	22	99	11
60-80	188	88	45	15	24	33	94	13
>80	364	343	409	30	61	155	139	23
Income percentile								
>=20	114	88	73	6	8	24	69	8
20-40	145	103	115	8	11	23	61	10
40-60	183	134	168	12	17	36	87	11
60-80	217	182	139	16	25	42	100	13
>80	327	330	331	27	48	127	157	21
Age of the reference person								
<35	180	142	118	10	12	20	142	12
35-44	206	163	136	14	18	41	129	14
45-54	229	212	257	15	22	63	108	15
55-64	220	209	239	16	27	75	97	14
65-74	212	207	269	16	31	93	88	10
>=75	193	189	178	15	24	105	77	9

TABLE A2. Mean values of assets and debt in Portugal and in the euro area for the households that have them | Thousands of euros

Source: HFCS, 2017. Note: The euro area does not include Portugal.

	Age groups of the reference person											
	<35		35-44		45-54		55-64		65-74		>=75	
	Portugal	Euro area	Portugal	Euro area	Portugal	Euro area	Portugal	Euro area	Portugal	Euro area	Portugal	Euro area
Age (years)												
Median	31.0	29.0	40.0	40.0	49.0	49.0	59.0	59.0	69.0	69.0	81.0	81.0
Mean	30.1	28.7	39.8	39.7	49.5	49.5	59.4	59.3	69.4	69.2	80.7	80.7
Male (%)	53.6	60.9	59.5	67.0	60.3	66.2	62.2	63.6	60.7	63.7	50.0	50.7
Education (%)												
Less than secondary	39.1	15.5	40.4	18.4	62.3	23.1	71.0	28.7	80.5	39.4	90.6	54.1
Secondary	34.3	47.4	25.6	42.4	16.7	46.6	13.3	43.7	5.3	37.5	3.7	29.8
Tertiary	26.7	37.1	34.0	39.1	21.0	30.2	15.7	27.6	14.2	23.0	5.8	16.1
Married (%)	25.4	24.7	55.8	51.2	64.9	56.1	63.8	58.4	63.8	55.7	43.2	39.8
Household type (%)												
1 adult	19.6	44.2	11.2	22.2	10.4	24.0	20.8	31.0	27.6	38.4	49.2	56.6
Several adults	25.0	25.3	14.0	13.8	28.4	23.8	59.1	51.7	67.6	58.6	49.9	42.3
1 adult and child(ren)	6.4	5.7	11.5	10.0	9.4	8.4	1.8	2.4	0.3	0.4	0.0	0.1
Adults and child(ren)	49.1	24.9	63.2	54.0	51.8	43.7	18.4	14.9	4.4	2.5	0.9	1.0
Income per adult equivalent (thousand of euros)												
Median	10.8	20.2	11.9	21.6	11.2	23.2	11.4	24.0	9.0	21.7	7.5	18.1
Mean	13.3	23.8	15.6	27.0	15.6	30.9	16.6	31.0	13.4	26.9	10.8	22.8

TABLE A3. Households' characteristics in Portugal and in the euro area, by age group

Source: HFCS, 2017. Note: The euro area does not include Portugal.

	Income percentiles									
	≤ 20		20 to 40		40 to 60		60 to 80		80 to 100	
	Portugal	Euro area	Portugal	Euro area	Portugal	Euro area	Portugal	Euro area	Portugal	Euro area
Age (years)										
Median	67.0	58.0	61.0	57.0	50.0	55.0	49.0	52.0	52.0	51.0
Mean	63.9	55.9	59.0	56.9	52.5	55.1	50.9	52.6	52.4	51.8
Male (%)	42.6	45.6	55.4	55.4	62.4	63.1	68.0	71.2	62.8	75.7
Education (%)										
Less than secondary	86.2	50.2	81.5	42.6	69.7	28.6	58.4	18.5	28.6	8.4
Secondary	9.0	35.0	12.0	41.0	18.0	47.2	20.7	48.2	18.2	36.0
Tertiary	4.8	14.8	6.5	16.4	12.3	24.1	20.9	33.3	53.2	55.6
Married (%)	29.4	24.3	49.7	37.3	57.6	47.2	69.7	61.0	70.4	72.4
Household type (%)										
1 adult	57.4	64.2	26.3	48.6	11.2	34.6	8.7	19.5	8.4	9.5
Several adults	27.1	19.0	47.1	27.8	49.3	38.3	41.5	44.7	38.4	46.8
1 adult and child(ren)	4.3	6.1	9.9	7.2	5.1	5.7	3.3	3.0	3.1	1.8
Adults and child(ren)	11.2	10.7	16.6	16.4	34.4	21.4	46.5	32.8	50.1	42.0
Income per adult equivalent (thousand of euros)										
Median	4.5	7.8	7.5	15.6	10.2	21.5	14.5	28.8	27.4	47.9
Mean	4.3	7.7	8.0	15.6	10.8	22.5	15.2	30.9	33.9	59.6

TABLE A4. Households' characteristics in Portugal and in the euro area, by income quintiles

Source: HFCS, 2017. Note: The euro area does not include Portugal.

	Net wealth percentiles									
	≤ 20		20 to 40		40 to 60		60 to 80		80 to 100	
	Portugal	Euro area	Portugal	Euro area	Portugal	Euro area	Portugal	Euro area	Portugal	Euro area
Age (years)										
Median	49.0	46.0	52.0	48.0	56.0	54.0	58.0	57.0	58.0	60.0
Mean	51.1	48.6	54.8	50.6	56.6	55.7	58.2	57.7	58.2	59.7
Male (%)	53.7	52.5	55.5	58.6	58.7	62.0	59.2	67.1	64.1	71.4
Education (%)										
Less than secondary	74.5	39.5	72.2	28.0	69.4	34.9	64.6	28.9	43.7	16.3
Secondary	17.5	45.7	15.8	46.3	16.3	37.5	12.6	41.2	15.8	36.9
Tertiary	8.0	14.9	12.0	25.8	14.4	27.5	22.8	29.8	40.5	46.8
Married (%)	35.0	30.1	49.1	35.9	59.7	50.0	62.8	58.8	70.3	68.4
Household type (%)										
1 adult	32.2	50.2	26.2	44.5	21.2	32.7	19.1	27.8	13.4	19.9
Several adults	30.3	19.7	35.8	28.9	44.2	37.2	46.1	42.3	47.0	49.4
1 adult and child(ren)	8.0	9.5	5.5	5.3	5.6	4.1	3.2	2.5	3.3	2.2
Adults and child(ren)	29.5	20.6	32.5	21.4	29.0	25.9	31.6	27.4	36.2	28.4
Income per adult equivalent (thousand of euros)										
Median	7.3	13.9	9.0	19.2	10.0	19.9	12.1	24.6	18.0	35.4
Mean	8.2	16.2	11.3	21.9	12.0	23.8	15.5	29.5	25.1	45.5

TABLE A5. Households' characteristics in Portugal and in the euro area, by net wealth quintiles

Source: HFCS, 2017. Note: The euro area does not include Portugal.

	Age groups of the reference person											
	<35		35-44		45-54		55-64		65-74		>=75	
	Coefficient	Standard deviation	Coefficient	Standard deviation	Coefficient	Standard deviation	Coefficient	Standard deviation	Coefficient	Standard deviation	Coefficient	Standard deviation
Median net wealth (thousand of euros)												
Portugal	14.7***	3.70	62.85***	4.27	86.44***	6.06	95.07***	6.11	88.03***	5.72	80.04***	6.18
Euro area	14.04***	1.07	70.08***	3.52	130.01***	4.68	168.73***	5.38	169.65***	5.04	114.78***	4.43
Difference	0.66	3.87	-7.24	5.58	-43.57***	7.54	-73.66***	8.47	-81.62***	7.75	-34.74***	7.35
Explained	-3.67**	1.69	-17.82***	4.21	-44.79***	6.38	-50.43***	8.06	-49.98***	6.87	-16.9***	5.53
Unexplained	4.33	3.67	10.58*	5.90	1.22	7.86	-23.23**	9.89	-31.64***	8.62	-17.84**	8.18
Explained												
Age	1.98***	0.58	0.36	0.76	0.03	0.66	0.08	0.31	0.21	0.41	-0.01	0.13
Male	-0.13	0.17	-0.19	0.53	-0.92	0.66	-0.28	0.47	-0.10	0.37	-0.37	1.42
Educ level less than secondary	-2.66***	0.61	-9.16***	1.62	-29.27***	3.24	-33.5***	4.27	-22.33***	2.94	-9.19***	2.49
Educ level secondary	0.07	0.18	0.67	0.75	2.57	1.79	-2.14	2.06	0.99	2.17	3.10	1.91
Educ level tertiary	-1.23***	0.45	-2.36**	1.12	-7.71***	1.64	-8.59***	1.65	-5.08***	1.20	-3.83***	0.99
Married	0.00	0.03	0.30	0.41	2.41*	1.26	2.24*	1.24	8***	2.73	0.55	0.77
1 adult	1.48***	0.49	3.65***	0.91	6.52***	1.60	6.21***	1.74	1.26	2.33	1.02	1.86
Several adults	-0.03	0.35	0.04	0.30	0.91	0.59	3.39**	1.36	3.23	2.07	3.28	2.17
1 adult and child(ren)	-0.07	0.21	-0.47	0.54	-0.35	0.51	0.35	0.32	-0.01	0.06	-0.03	0.05
Adults and child(ren)	1.53***	0.54	4.47***	1.33	5.36***	1.71	2.39*	1.34	-0.80	0.66	0.08	0.25
Income per adult equivalent	-4.61***	1.07	-15.14***	2.84	-24.33***	4.03	-20.56**	8.60	-35.35***	4.51	-11.5***	4.24

TABLE A6. Contributions of households' characteristics to the difference in the median net wealth between Portugal and the euro area, by age groups

Source: HFCS, 2017. Notes: The euro area does not include Portugal. The table displays the results of the decomposition between the part explained by households' characteristics and the unexplained part of the differences in the median wealth between Portugal and the euro area. The results were obtained using the methodology of Firpo *et al.* (2009) as described in section 4. ***, ** and * indicate that the coefficients are significant with 99%, 95% and 90% level of confidence, respectively.

	Income percentiles									
	≤ 20		20 to 40		40 to 60		60 to 80		80 to 100	
	Coefficient	Standard deviation	Coefficient	Standard deviation	Coefficient	Standard deviation	Coefficient	Standard deviation	Coefficient	Standard deviation
Median net wealth (thousand of euros)										
Portugal	33.09***	3.61	51.6***	4.11	64.98***	4.63	91.37***	5.80	183.54***	9.51
Euro area	17.71***	1.05	46.37***	2.40	101.49***	4.47	148.19***	5.29	301.67***	7.52
Difference	15.38***	3.61	5.23	4.77	-36.51***	6.47	-56.83***	8.04	-118.13***	11.63
Explained	7.08***	1.12	-8.89	6.27	-33.85***	11.78	-53.55***	13.07	-24.82**	10.23
Unexplained	8.31**	3.51	14.12*	7.21	-2.66	11.99	-3.27	13.39	-93.31***	13.39
Explained										
Age	9.61***	2.48	13.18**	5.93	-43.79***	14.90	-39.46**	17.54	19.25	16.87
Age^2	-2.42	2.18	-8*	4.11	35.18***	11.35	34.55***	13.13	-10.49	10.31
Male	0.02	0.06	0.00	0.19	-0.18	0.68	0.25	0.44	-2.87	1.90
Educ level less than secondary	-2.2***	0.49	-2.79**	1.31	-6.08**	2.45	-9.64***	3.22	-16.54***	3.41
Educ level secondary	0.88**	0.36	2.6***	0.99	4.53***	1.64	1.31	1.72	2.71	2.23
Educ level tertiary	-0.94***	0.21	-1.6***	0.46	-3.59***	0.88	-3.6***	1.03	-2.31	2.10
Married	0.36	0.22	2.72**	1.19	3.33**	1.50	1.43	1.05	-0.04	0.33
1 adult	0.48**	0.21	7.35***	1.86	3.51	3.25	3.93**	1.95	0.70	0.93
Several adults	0.57***	0.22	3.92***	1.14	2.74**	1.07	-0.62	0.58	1.00	1.42
1 adult and child(ren)	0.08	0.07	-0.32	0.28	0.23	0.50	-0.13	0.36	0.22	0.49
Adults and child(ren)	0.03	0.08	0.05	0.47	4.33**	1.76	8.91***	2.44	5.1**	1.99
Income per adult equivalent	0.60	0.44	-25.98***	6.89	-34.06**	14.18	-50.49***	14.24	-21.54***	5.98

TABLE A7. Contributions of households' characteristics to the difference in the median net wealth between Portugal and the euro area, by income quintiles

Source: HFCS, 2017. Notes: The euro area does not include Portugal. The table displays the results of the decomposition between the part explained by households' characteristics and the unexplained part of the differences in the median wealth between Portugal and the euro area. The results were obtained using the methodology of Firpo *et al.* (2009) as described in section 4. ***, ** and * indicate that the coefficients are significant with 99%, 95% and 90% level of confidence, respectively.

	Net wealth percentiles									
	≤ 20		20 to 40		40 to 60		60 to 80		80 to 100	
	Coefficient	Standard deviation	Coefficient	Standard deviation	Coefficient	Standard deviation	Coefficient	Standard deviation	Coefficient	Standard deviation
Median net wealth (thousand of euros)										
Portugal	0.92***	0.14	33.1***	1.64	74.87***	1.24	136.64***	2.34	325.33***	7.41
Euro area	1.1***	0.08	23.83***	0.50	99.75***	0.87	219.17***	1.52	523.96***	5.86
Difference	-0.18	0.16	9.28***	1.73	-24.88***	1.53	-82.53***	2.66	-198.62***	9.53
Explained	-0.02	0.08	0.37	0.60	0.86	0.99	-5.34***	1.59	-35.66***	6.14
Unexplained	-0.15	0.17	8.91***	1.76	-25.74***	1.57	-77.19***	3.01	-162.96***	10.32
Explained										
Age	-0.22**	0.11	2.8***	0.96	0.70	0.77	0.98	1.51	-14*	7.76
Age^2	0.21*	0.11	-1.89**	0.81	-0.33	0.56	-0.76	1.18	9.23	6.35
Male	0.00	0.00	-0.03	0.04	-0.08	0.09	-0.38	0.26	0.16	0.89
Educ level less than secondary	-0.06	0.04	-0.54	0.37	0.18	0.44	-1.61*	0.83	-11.2***	2.75
Educ level secondary	-0.04	0.03	0.00	0.21	0.03	0.26	-0.45	0.54	1.71	1.59
Educ level tertiary	0.00	0.01	-0.17	0.11	0.05	0.18	-0.21	0.17	-3.1***	1.11
Married	0.00	0.01	-0.05	0.19	0.47*	0.26	0.04	0.20	0.02	0.34
1 adult	0.02	0.02	0.42**	0.19	0.25	0.23	0.49	0.35	0.97	1.25
Several adults	0.01	0.02	0.17*	0.09	-0.07	0.13	0.08	0.15	-0.28	0.39
1 adult and child(ren)	0.00	0.00	0.00	0.03	0.01	0.05	-0.02	0.04	-0.27	0.35
Adults and child(ren)	0.01	0.02	0.22*	0.13	0.07	0.09	0.26	0.20	2.09*	1.26
Income per adult equivalent	0.04	0.04	-0.57	0.46	-0.43	0.72	-3.76***	1.46	-20.98***	5.31

TABLE A8. Contributions of households' characteristics to the difference in the median net wealth between Portugal and the euro area, by net wealth quintiles

Source: HFCS, 2017. Notes: The euro area does not include Portugal. The table displays the results of the decomposition between the part explained by households' characteristics and the unexplained part of the differences in the median wealth between Portugal and the euro area. The results were obtained using the methodology of Firpo *et al.* (2009) as described in section 4. ***, ** and * indicate that the coefficients are significant with 99%, 95% and 90% level of confidence, respectively.

Non-technical summary

October 2021

Revisiting Portuguese banks' efficiency and productivity

Nuno Ribeiro and Inês Tavares

The assessment of cost efficiency in the Portuguese banking system between 2012 and 2019 shows that there is room for efficiency gains, similarly to what is observed in the European banking system. These pressures on profitability represent a vulnerability to financial stability, in particular in the current low interest rate environment and the increased materialization of credit risk due to the pandemic crisis. In this context, the continuation of the efforts to rationalise branch networks and the digitalization of business processes are crucial to boost productivity and enhance profitability in the near future.

The estimation of a cost frontier suggests that Portuguese banks' marginal costs in the production of loans and other earning assets decreased. Even though this decline was mainly driven by the behaviour of interest rates (which results from the methodological choice of including the financing costs in the aggregate of costs under consideration), the marginal costs associated with real resources allocated to financial intermediation still exhibited a declining trend. Furthermore, and contrarily to what happened in the latter years under analysis, the interest income on an additional loan was not enough to cover the associated cost during the majority of the sample period. This is justified by the adjustment processes observed in the beginning of the period and by the exacerbated cost of funding recorded in the wake of the sovereign debt crisis.

Portuguese banks could have produced the same output while incurring only 84% of their actual costs, a value that is similar to that found in other studies for the European banking system. This estimate, which reflects the distance at which banks stand from the cost frontier representing best practices, did not change significantly over time. This suggests that structural long-term factors (for example, location, client structure, macroeconomic development and, to a lesser extent, regulation) play a bigger role for inefficiency than time-varying factors. Additionally, shifts in the cost frontier brought about by the adoption of more efficient production techniques were not observed during the period under consideration. In this context, the efficiency gains associated to the digitalization and the rationalization of the branch network should have been compensated, at least partially, by set-up costs in the adoption of new technologies and by the investment in back-office activities, such as credit risk assessment and compliance. Moreover, it was not found evidence for the existence of increasing returns to scale, implying that scale increases through acquisitions do not seem to be advantageous.

Total factor productivity increased 4.9% between 2012 and 2019, posting relevant positive changes in the first years. However, total factor productivity growth slowed down throughout the period, reaching negative values in the last two years. These results are summarized in Table 1, which includes the contribution of cost efficiency changes, technological progress and returns to scale to total factor productivity change. Despite not being statistically significant during the period under analysis, technological progress has been the main driver for the total factor productivity growth observed, particularly in the beginning of the period.

Year	Cost efficiency change (pp)	Technological progress (pp)	Returns to scale (pp)	Total factor productivity change (%)
2013	0.04	2.50	1.03	3.58
2014	0.00	1.41	0.33	1.74
2015	1.24	0.85	-0.21	1.88
2016	0.04	0.22	0.14	0.40
2017	0.95	-0.61	-0.01	0.33
2018	-0.72	-0.92	-0.16	-1.80
2019	-0.10	-1.23	0.06	-1.27

TABLE 1. Total factor productivity change decomposition

Source: Authors calculations.
Notes: Total loans are used to compute weighted means. To compute the technical efficiency change, a constant sample was considered for every two adjacent years.

Revisiting Portuguese banks' efficiency and productivity

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Abstract
The inefficient allocation of banks' resources is pointed out as a vulnerability of the banking system from a financial stability point of view, being its assessment of the outmost importance. In this work, the performance of the Portuguese banking system between 2012 and 2019 is assessed. Concretely, through the estimation of a translog cost frontier, total factor productivity growth is computed and decomposed into the effect of cost efficiency, technological progress and returns to scale. For this purpose, banks are assumed to choose the cost minimizing combination of labour, capital and interest bearing debt to produce loans and other earning assets. It is possible to conclude that the distance at which banks operated from the frontier remained constant throughout the period under consideration, suggesting that structural long-term factors play a bigger role for inefficiency than time-varying factors. Further, despite not being statistically significant, technological progress has been the main driver for the total factor productivity growth observed, particularly in the beginning of the period. Additionally, evidence for the existence of constant returns to scale during this period was found. (JEL: C23, D24, G21)

1. Introduction

The inefficient allocation of banks' resources is pointed out as a major drag on their profitability and, consequently, is considered a vulnerability from a financial stability point of view. In fact, even in case banks are monitoring risks adequately, low levels of profit generation capacity raise concerns regarding banks' ability to withstand possible future shocks, which might deteriorate their capital position and cause a reduction in lending to the economy. Therefore, besides allowing banks to provide a wide range of financial services, their smooth functioning is necessary for the intermediation of funds, which is crucial for both the financial system and the real economy. Assessing banks' performance is thus of the utmost importance, and it is even more relevant given the existing low interest rate environment and the expected increased materialization of credit risk due to the current pandemic crisis.

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In this work, the performance of the Portuguese banking system between 2012 and 2019 is assessed, capturing its developments since the peak of the sovereign debt crisis. Concretely, this study intends to answer the following questions through the estimation of a cost function: (i) what is the level of banks' cost inefficiency - i.e. how far banks stand away from the best practices – and how does it compare with common accounting based measures?; (ii) what drives banks' marginal costs and margins?; and (iii) what is the level of total factor productivity growth in the period under analysis and how is it decomposed into the effect of cost efficiency, technological progress and returns to scale? By doing this, it is possible to better understand whether changes in total factor productivity were driven by catching up to the cost frontier, by shifts in the frontier itself or by movements along the frontier. The methodology is, therefore, particularly appealing because it allows for the estimation of these three effects within the same econometric framework.

The literature on the cost efficiency of Portuguese banks includes the work by Boucinha *et al.* (2013), Mendes and Rebelo (1999), Canhoto and Dermine (2003), Pinho (2001) and Pinho and Lima (2008). These studies cover the period between 1987 and 2006. Hence, existing literature is complemented with this work by extending the analysis to a more recent period. The approach taken is similar to that followed in the majority of these papers in that a translog cost function is estimated using Stochastic Frontier Analysis (SFA). In contrast, in Canhoto and Dermine (2003) a non-parametric frontier was estimated using Data Envelopment Analysis (DEA).

Even though all works but the one by Mendes and Rebelo (1999) found that banks' efficiency has increased over the period under analysis, they are not aligned on efficiency levels due to differences in the empirical and theoretical approaches to the modelling of banks' activity. Additionally, some studies do not allow for conclusions concerning technological progress, since the frontier is assumed to be constant over time. Nevertheless, while Mendes and Rebelo (1999) found evidence for the existence of technological recess in the period between 1990 and 1995, Boucinha *et al.* (2013) concluded that technological progress has shifted the cost frontier downwards throughout the period between 1992 and 2006, being the latter the main driver for the increase in productivity recorded in that period. Moreover, both the papers by Mendes and Rebelo (1999) and by Boucinha *et al.* (2013) concluded that scale economies contributed to increase banks' performance.

In what concerns the efficiency of European banks, Maudos *et al.* (2002) found that profit efficiency is lower than cost efficiency, considering a sample period between 1993 and 1996[1]. Interestingly, they also concluded that there is considerable variability in efficiency levels in the banking systems of the European Union, being this variability greater in terms of profit efficiency than in terms of cost efficiency. Nitoi and Spulbar (2015), in turn, used a heteroscedastic stochastic frontier model to investigate differences in cost efficiency of banks in six Central and East European countries over the period

1. A bank is the more cost (or profit) efficient, the closer its actual costs (or profits) are to the industry best practices.

from 2005 to 2011. They found that all banking systems in their sample recorded an increase in efficiency until 2008. However, they noticed that efficiency either stagnated or declined after 2009.

Focusing now on the identification of shifts in best practices, Altunbas *et al.* (1999) concluded that the rate of reduction in the costs of European banks due to technological progress increased between 1989 and 1996.

Huljak *et al.* (2019), in turn, noticed that, for euro area countries, total factor productivity increased between 2006 and 2017, even though at a decreasing pace. Technological progress was pointed out as the main driver for total factor productivity growth, followed by technical efficiency. Furthermore, they disentangled permanent and time-varying inefficiency and showed that the largest part of bank inefficiency in the euro area stems from persistent inefficiency. Lastly, they argued that, given the need to boost productivity and enhance profitability in the euro area banking sector, and since they found evidence for the existence of scale economies, possibly mergers and acquisitions should be intensified, along with banks' efforts in areas such as the rationalisation of branch networks and the digitalisation of business processes.

Finally, yet importantly, Oliveira (2017) uses SFA to characterize the production function of financial intermediation in Europe between 2000 and 2013 and concluded that, while there is ambiguous evidence on productivity growth, inefficiency of financial intermediation has been increasing over time, possibly driven by the least efficient banks. In addition, while increasing returns to scale were limited to smaller banks, scope savings were found to be robust across all models for the average bank. Interestingly, the main contribution of this work was to show that conclusions on the level of cost efficiency depend on the choice of the indicator for the bank-specific cost of funding.

This article proceeds as follows: Section 2 presents the methodology for the estimation of Portuguese banks' cost function and the data used. Section 3 contains the empirical results of this work and is divided into 6 subsections concerning the estimation results, marginal costs and margins, cost efficiency, technological progress, scale economies and total factor productivity change, respectively. Finally, Section 4 concludes.

2. Methodology and data

The literature aimed at studying banks' production typically differs in how deposits are modelled and in whether the financial structure is taken into account through the inclusion of equity.

Regarding the modelling of deposits, and according to the *intermediation approach*, the definition of cost includes deposit-based debt (with its price being part of the cost function) and, consequently, deposits are treated as inputs. Banks' main activity is, therefore, to grant loans and invest in securities and other assets using deposits

and other funding as inputs, along with physical capital and labour[2]. Contrarily, the so-called *production approach* stresses the role of deposits in providing immediacy of transaction and payment services and the fact that physical resources are consumed in their production. Concretely, according to the latter approach, deposit-based debt would be treated as an output, being its quantity, rather than its price, included in the cost function.

In this work, following Boucinha *et al.* (2013), the intermediation approach is adopted, emphasising the role of deposits as sources of loanable funds in the intermediation process[3]. It should be mentioned that this approach allows for a more comprehensive definition of banks' costs, not limiting the measurement of efficiency to operational costs. In this way, the fact that some banks might be willing to bear higher operational costs (for example, with employees and equipment) in order to attain lower funding costs is taken into account.

Turning now to the question of the inclusion of equity as an input, most studies in the literature do not assign equity capital a role in the technology of intermediation and, consequently, the cost function fails to control for its level[4]. The reason for this is that it is difficult to obtain a price for this input. However, controlling for the price of other inputs, excluding equity could spuriously indicate that banks which rely more on equity are more efficient. Consequenlty, and in line with Boucinha *et al.* (2013), equity was tentatively included as a fixed input (being its price excluded from the cost function). Regulatory and rating/reputation issues, as well as the fixed costs associated to common equity issuances, may lead banks to have a higher level of equity than that yielded by the static cost minimization problem, justifying the treatment of equity as a fixed input. Nevertheless, evidence that a higher level of equity was associated with lower costs with the other inputs when controlling for the price of these inputs was not found. Along these lines, a negative value for the shadow cost of equity was obtained, which is not plausible since that would mean that bank shareholders would have to pay to hold equity[5]. Therefore, banks' financial structure was neglected by excluding equity from the analysis.

Banks are assumed to choose the amount of labour (L), funding (F) and physical capital (K) that minimizes the sum of its respective costs ($w_L L + w_F F + w_K K$) subject to the production of a given amount of loans (y_1) and other earning assets (y_2). Hence, the cost function $C(y_1, y_2, w_L, w_F, w_K)$ results from:

2. Capital is referred as "physical capital" for ease of exposition and to avoid confusion with the measure of capital in the funding structure, even though it includes intangibles, as well as tangible assets.

3. To motivate their choice, Boucinha et al. (2013) compute the elasticity of total costs deducted of interest paid on deposits to the level of deposits for the Portuguese banking system. If this elasticity is positive (negative), deposits should be modelled as outputs (inputs).

4. See Hughes *et al.* (2001) for more details.

5. The shadow cost of equity is given by the symmetric of the derivative of the cost function with respect to equity. Even though there are not many studies in the literature including equity in the cost function, Oliveira (2017) also obtained a negative value for this estimate for a sample of European banks.

$$\min_{L,F,K} \quad (w_L L + w_F F + w_K K) \tag{1}$$

$$s.t. \quad P(L,F,K) \quad \geq \quad y_1 + y_2, \tag{2}$$

where the price of labour (w_L) is computed as the ratio between labour costs and the average number of employees, the price of funding (w_F) is defined as the ratio between the flow of interest paid and the average stock of interest bearing liabilities, and the price of physical capital (w_K) is proxied by the ratio between the sum of depreciation and other general administrative costs (excluding labour) and the average stock of tangible and intangible assets[6].

It should be emphasized that loans and other earning assets are considered *net of impairments*. By doing so (instead of considering gross amounts), differences in both the level and the quality of banks' screening and monitoring in lending activities are taken into account, which are reflected in different intensity of materialisation of credit risk. Ultimately, impaired assets are a non-income producing item in banks' balance sheet and impairments measure the expected non-recoverable part of it. Nevertheless, it was not possible to take into account other differences in banks' management that might affect their efficiency. Concretely, while banks might target diverse loan segments (with, for example, different levels of monitoring costs and risk associated to mortgages, consumer loans, SME and large corporate loans), total (customer) loans were considered as a single homogeneous product. This might be a particularly relevant limitation since the heterogeneity of output has a bearing in the definition of the production possibility frontier. To overcome this problem, the output would have to be disaggregated into different categories of loans, which, in this case, is not feasible given the sample size and the required increase in the number of parameters to be estimated. However, it was not found evidence in the sample that investment banks and consumer credit banks are associated with differentiated cost efficiency levels. Further, both types of banks exhibit considerable dispersion around the overall sample mean.

In order to account for poor managerial performance (due to agency problems, for example), as well as for random factors that affect this performance, and for measurement error in the variables used in the estimation, each bank i's observed costs at time t can be written as:

$$C_{i,t} = C(y_{1,t}, y_{2,t}, w_{L,t}, w_{F,t}, w_{K,t}) \exp(v_{i,t}) \exp(u_{i,t}), \tag{3}$$

where $v_{i,t}$ is a random error assumed to follow an *i.i.d.* $N(0, \sigma_v^2)$ distribution that reflects both the effect of random uncontrollable shocks and measurement error. Thus, $C(y_{1,t}, y_{2,t}, w_{L,t}, w_{F,t}, w_{K,t}) \exp(v_{i,t})$ constitutes the stochastic frontier and $C(y_{1,t}, y_{2,t}, w_{L,t}, w_{F,t}, w_{K,t})$ the deterministic part of it. $u_{i,t}$, in turn, is a non-negative random variable which measure cost inefficiency. Following Battese and Coelli (1992), $u_{i,t}$ is defined as:

6. For factor prices calculation purposes, and for each year t, simple averages between the value of the relevant variable at the end of period t and the same value at the end of period $t-1$ are computed.

$$u_{i,t} = u_i \exp(-\eta(t - T_i)), \tag{4}$$

where u_i is assumed to follow an *i.i.d.* truncated normal distribution, $N^+(\mu, \sigma_u^2)$, T_i is the last available period for bank i and η is a decay factor. μ and η are parameters to be estimated. Given this specification, if η is statistically different from zero, inefficiency is considered to vary monotonically throughout time. Even so, and as a result of the specification in equation (4), the ranking of banks in terms of cost-inefficiency is preserved throughout the sample period. Otherwise, if η equals zero, inefficiency is considered to be time-invariant, and in that case, the parameter η is constrained to zero, so as to maximize the degrees of freedom in the estimation. It should also be mentioned that, according to the specification presented, inefficiency is firm specific.

Applying a natural log transformation to equation (3), the main equation to be estimated using SFA models may be expressed as:

$$\ln(C_{i,t}) = \ln(C(y_{1,t}, y_{2,t}, w_{L,t}, w_{F,t}, w_{K,t})) + v_{i,t} + u_{i,t}. \tag{5}$$

Once again, following Boucinha *et al.* (2013), the cost function is estimated using a translog functional form, which is a second order local approximation to the solution of the cost minimization problem for the average bank. This functional form is very popular in the literature, as it represents a balance between flexibility and parsimony. Indeed, while providing a good local approximation to the true cost function, it allows us to avoid multicolinearity problems and to preserve degrees of freedom, which is particularly relevant given the relatively small number of observations in the sample. Equation (5) for outputs r, s and inputs m, n can then be rewritten as:

$$\begin{aligned}
\ln(C_{i,t}) = {} & \gamma_0 + \gamma_t t + \frac{1}{2}\gamma_{t,t} t^2 + \sum_r \gamma_{t,r} \ln(y_{r,i,t}) t + \sum_m \gamma_{t,m} \ln(w_{m,i,t}) t \\
& + \sum_r \gamma_r \ln(y_{r,i,t}) + \sum_m \gamma_m \ln(w_{m,i,t}) + \frac{1}{2} \sum_r \sum_s \gamma_{r,s} \ln(y_{r,i,t}) \ln(y_{s,i,t}) \\
& + \frac{1}{2} \sum_m \sum_n \gamma_{m,n} \ln(w_{m,i,t}) \ln(w_{n,i,t}) + \sum_m \sum_r \gamma_{m,r} \ln(w_{m,i,t}) \ln(y_{r,i,t}) \\
& + v_{i,t} + u_{i,t},
\end{aligned} \tag{6}$$

with

$$
\begin{aligned}
&\gamma_{m,n} = \gamma_{n,m}, \quad \forall m, n \\
&\sum_m \gamma_m = 1 \\
&\sum_m \gamma_{m,r} = 0, \quad \forall r \\
&\sum_n \gamma_{m,n} = 0, \quad \forall m, n \\
&\sum_m \gamma_{t,m} = 0.
\end{aligned}
\tag{7}
$$

It should be noted that the theoretical restrictions stemming from duality theory are imposed. Namely, symmetry is imposed as a result of the specification of the estimated equation, whereas linear homogeneity in prices is obtained by normalizing input prices and total cost by w_K.

Additionally, it should be mentioned that, in order to facilitate the interpretation of the parameters of the model, the data are expressed as deviations from the overall sample mean, so that the first order coefficients correspond to the elasticities evaluated at the sample mean.

The database comprises an unbalanced panel of yearly data on a consolidated basis including the major Portuguese banks between 2012 and 2019[7]. Concretely, the sample is composed of 15 banks and, for each year, it covers at least 68% of total loans, 66% of total assets and 76% of total deposits in the Portuguese banking system[8]. All data was retrieved from BankFocus by Moddy's Analytics and Bureau Van Dijk (BvD).

3. Empirical results

In this section, the main results of this work are presented. Concretely, through the estimation of a cost function, detailed in Subsection 3.1, banks' marginal costs and margins are studied in Subsection 3.2. Subsection 3.3 proceeds with the analysis of the evolution of a measure of cost efficiency. Subsections 3.4 and 3.5 examine the existence of technological progress and scale economies, respectively. Finally, in Subsection 3.6, total factor productivity change is computed and decomposed into the effect of cost efficiency, technological progress and returns to scale throughout the sample period.

7. The choice of consolidated accounts instead of solo basis unconsolidated data allows to include in the same economic unit all banks and other financial institutions belonging to the same banking group. Notwithstanding this advantage, both domestic and international activity are being considered, which are less likely to potentially share the cost base.

8. Novo Banco is excluded from the sample due to its recent strong restructuring process.

3.1. Cost frontier estimation

Table 1 presents cost frontier estimation results, underlying the estimation of equation (6) in Section 2. In accordance with what was mentioned in the previous section, since variables are expressed as deviation from the overall sample mean, it is possible to focus directly on single parameters to assess relevant elasticities at the sample mean. Hence, for simplicity, cross terms with no direct interpretation are omitted in the Table.

	(1)	(2)
$\ln(w_L)$	0.4367***	0.4070***
	0.0761	*0.0804*
$\ln(w_F)$	0.4220***	0.4434***
	0.0893	*0.0954*
$\ln(y_1)$	0.6326***	0.6259***
	0.0439	*0.0549*
$\ln(y_2)$	0.3163***	0.3247***
	0.0480	*0.0623*
$\ln(y_1)\ln(y_2)$	-0.0695*	-0.0849*
	0.0408	*0.0506*
t	-0.0112	0.0046
	0.0250	*0.0259*
η	-0.0404	
	0.0538	
Number of observations	82	82
Number of parameters	25	24
Log-likelihood	61.20	59.82
μ	0.1916	-1.1757
γ	0.8234	0.9700
σ^2	0.0464	0.2900
σ_u^2	0.0382	0.2813
σ_v^2	0.0082	0.0087

TABLE 1. Cost frontier estimation results

Notes: The constant and most cross terms were omitted.
Robust standard errors in italics.
$*p < 0.1, **p < 0.05, ***p < 0.01$

In the first regression presented in Table 1, the estimate for bank specific cost inefficiency is allowed to vary throughout time (see equation (4)). However, since η is not statistically significant, it is constrained to zero in regression (2). This being said, the analysis of results that follows is based on the specification underlying column (2).

It is worth to mention that, given the number of observations in the sample, the small number of degrees of freedom constitutes a limitation of this work, particularly when compared to Huljak *et al.* (2019), which deals with a much larger sample. However, it should be born in mind that the degrees of freedom in this work are of the same order of magnitude of the ones in previous studies for the Portuguese market cited in Section 1 (see for instance Boucinha *et al.* (2013)). Still related to this point, it was assessed whether it was advantageous to estimate such a large number of parameters using a translog functional form versus a Cobb-Douglas one - much simpler, yet much more restrictive. Concretely, a Wald test on the joint significance of the non-direct parameters of the translog cost function was performed and the latter were found to be significant at the 1% level.

In line with economic intuition, the elasticity of cost with respect to each of the input prices is positive. In addition, the sum of the estimates of the two outputs (y_1 and y_2) is close to one, suggesting the existence of close to constant returns to scale at the sample mean. This is confirmed by a formal test presented further ahead. It should also be emphasized that the value of the estimated parameter associated with loans is about twice the value of the estimated parameter associated with other earning assets, which indicates that providing additional loans is more resource consuming than it is to invest in other assets due to the screening and monitoring costs involved in granting loans. The coefficient of the interaction term between the two outputs, in turn, is negative, pointing to the existence of scope economies in the joint production of loans and other earning assets. Furthermore, there are not statistically significant technological changes affecting banks' cost structure at the sample mean, as can be inferred from the estimated parameter associated with the time trend. Finally, it is worth to mention that, through the analysis of the parameter γ, it is possible to infer that most of the total error's variance is accounted for by cost inefficiency rather than by the classical random error, reinforcing the importance of assessing banks' performance.

3.2. Marginal costs and margins

Bank specific marginal cost estimates for both the production of loans and the production of other earning assets can be obtained as follows:

$$mc_{r,i,t} = \frac{\partial C_{i,t}}{\partial y_{r,i,t}} = \frac{C_{i,t}}{y_{r,i,t}} \frac{\partial \ln(C_{i,t})}{\partial \ln(y_{r,i,t})}. \tag{8}$$

The first two time series presented in Table 2 are based on the estimated parameters for the cost function and are constructed by aggregating the individual estimates for marginal costs, using each bank's market share in loans as weights. The same weights are used to aggregate all the measures presented hereafter.

Given the decline in interest rates registered during the period under analysis (column 3) and the relevance of funding costs in banks' cost structure, the estimated decrease in marginal costs was already expected. However, it is relevant to understand whether there are other explanations for this decrease and, in particular, how non-financial marginal costs evolved during this period. For this purpose, so-called *real resource marginal costs* (columns 5 and 6) were computed, which are obtained by deducting the estimated marginal costs (columns 1 and 2) for each bank by the corresponding price of funding (column 4). As shown in the last two columns of Table 2, the latter are considerably more stable than total marginal costs, suggesting that the behaviour of interest rates is indeed the main driving factor for the fall in marginal costs (even though the real resource marginal cost of loans still exhibits a declining trend).

Year	Marginal cost of loans (1) (%)	Marginal cost of other earning assets (2) (%)	Short-term money market interest rate (3) (%)	Implicit price of funding (4) (%)	Real resource marginal cost of loans (5) (%)	Real resource marginal cost of other earning assets (6) (%)
2012	4.76	4.56	0.57	2.87	1.89	1.69
2013	4.22	4.39	0.22	2.40	1.81	1.99
2014	3.85	4.09	0.21	2.18	1.67	1.91
2015	3.03	3.12	-0.02	1.60	1.48	1.57
2016	2.62	3.05	-0.26	1.17	1.46	1.89
2017	2.43	2.99	-0.33	0.91	1.52	2.07
2018	2.15	2.60	-0.32	0.81	1.34	1.79
2019	1.85	2.13	-0.36	0.67	1.19	1.47

TABLE 2. Marginal cost estimates

Note: Total loans are used to compute weighted means.

Table 3 allows us to analyse the evolution of banks' price-cost margin on loans throughout the sample period. A measure for the latter was obtained by subtracting the marginal cost of loans from the implicit interest rate on loans, which was computed using data on banks' loan related interest income and stock of outstanding loans.

Year	Marginal cost of loans (1) (%)	Implicit interest rate on loans (2) (%)	Margin on loans (3) (%)	Cost of risk (4) (%)
2012	4.76	3.65	-1.10	1.61
2013	4.22	3.15	-1.06	1.12
2014	3.85	3.21	-0.64	1.42
2015	3.03	2.73	-0.30	0.87
2016	2.62	2.59	-0.03	1.88
2017	2.43	2.41	-0.02	0.38
2018	2.15	2.45	0.30	0.32
2019	1.85	2.42	0.57	0.23

TABLE 3. Margin on loans estimates

Note: Total loans are used to compute weighted means.

As shown in Table 3, the interest income on an additional loan was not enough to cover the associated cost during the majority of the period under analysis. In fact, in the wake of the sovereign debt crisis, the cost of funding, including retail deposits, was exacerbated, while the pricing of credit did not adjust immediately. Furthermore, several banks went through adjustment processes in the beginning of the sample period which eventually slowed down over time, incurring in higher costs in the first years. Contrarily, in the last year of the sample period, the interest income on loans was estimated to cover not only the funding cost, but also the cost of risk (column 4)[9].

3.3. Cost efficiency

The cost efficiency of a given bank can be defined as the ratio between the minimum cost it would operate with assuming no inefficiency exists (which is given by the stochastic frontier) and the cost level with which it operates:

9. The cost of risk is computed as the ratio between loan impairments and the amount of outstanding loans.

$$CE_{i,t} = \frac{E[C|u_{i,t} = 0, X_{i,t}]}{E[C|u_{i,t}, X_{i,t}]} = \frac{C(y_{1,t}, y_{2,t}, w_{L,t}, w_{F,t}, w_{K,t}) \exp(v_{i,t})}{C_{i,t}} \in (0, 1), \qquad (9)$$

where $X_{i,t}$ are the regressors underlying column (2) of Table 1 (see Subsection 3.1). It is worth to refer that this measure lies between 0 and 100%, being higher values associated with higher efficiency levels. Intuitively, a fully efficient bank would have an efficiency level of 100%, indicating that its actual cost is exactly on the cost frontier.

Table 4 presents aggregate estimates for the cost efficiency measure between 2012 and 2019, and also for the entire period.

Year	CE (%)
2012	83.81
2013	83.22
2014	83.31
2015	84.35
2016	84.38
2017	85.17
2018	84.56
2019	84.47
2012-2019	**84.10**

TABLE 4. Cost efficiency

Note: Total loans are used to compute weighted means.

The overall estimate for cost efficiency in this period stands at 84%, suggesting that Portuguese banks could have produced the same output while incurring only 84% of their actual costs[10]. Some heterogeneity was found across banks, with estimated cost efficiency ranging from 66% to 98% in the period under analysis. However, it is possible to infer that the distance at which banks stand from the cost frontier representing best practices did not change significantly over time, which suggests that structural long-term factors (for example, location, client structure, macroeconomic development and, to a lesser extent, regulation) play a bigger role for inefficiency than time-varying factors[11]. This is consistent with the final (time invariant) specification for the model.

In order to understand to which extent this measure of cost efficiency adheres to other common accounting based measures, Figure 1 illustrates the relationship between the former, on the one hand, and operational cost to core income (CCI) and operational cost to total assets (CA), on the other, for all the banks in the sample in 2019[12].

According to what was expected, the cost efficiency measure presented in this work is negatively correlated with these accounting measures, usually computed to assess the

10. Similar values were found in previous studies with comparable methodologies, namely 83% in Boucinha *et al.* (2013) for the Portuguese market in the 1990-2006 period, and 84% in Huljak *et al.* (2019) for the median bank in the euro area in the 2006-2017 period.

11. Huljak *et al.* (2019) reach the same type of conclusion by disentangling time-varying and persistent inefficiency.

12. Core income was computed as the sum between net interest income and net fees and commissions. Core income (rather than total income) was considered to abstract from extraordinary financial gains/losses.

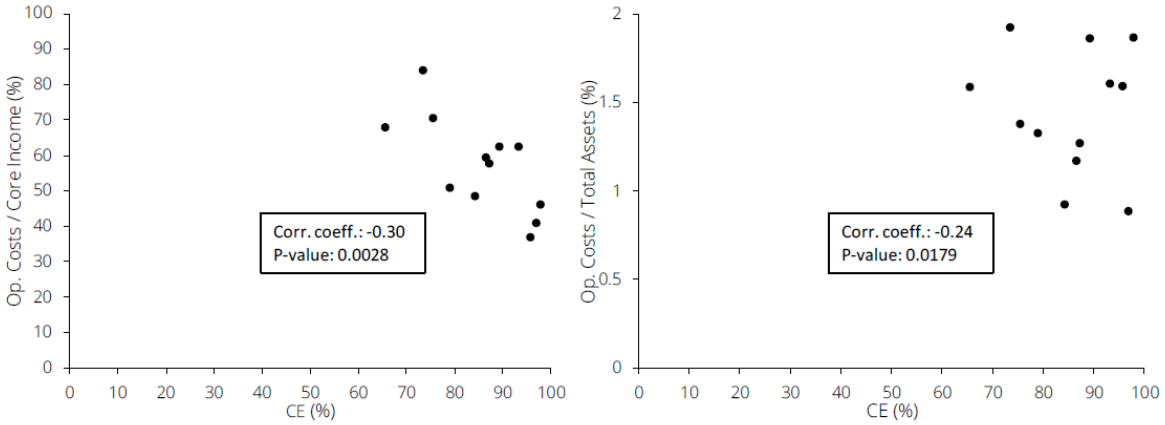

FIGURE 1: Cost efficiency vs other common efficiency measures

quality of banks' management. Concretely, the correlation coefficient between these two measures and the cost efficiency measure stands at -0.30 (statistically significant at the 5% level) and -0.24 (statistically significant at the 10% level), respectively. It should be born in mind, however, that these measures consider only operational costs, while cost efficiency includes a more comprehensive definition of banks' costs.

Despite being common to use accounting indicators to proxy efficiency in the banking sector, it is worth to refer that, as pointed by Huljak *et al.* (2019), these indicators have considerable shortcomings. While the CA ratio is strongly dependent on the business model of the institutions and their size, the CCI ratio is highly dependent on the income component, which, besides being affected by the degree of market power, is also influenced by credit risk, further distorting the measurement of efficiency. In fact, a bank that grants loans to a riskier counterpart will demand a higher interest rate than another which is equally efficient but more risk-averse[13].

3.4. Technological progress

In this subsection, the existence of technological progress - *i.e.*, shifts in the cost frontier brought about by the adoption of more efficient production techniques – is examined. The latter are given by the symmetric of the semi-elasticity of total cost with respect to the time trend[14]:

$$TP_t = -\frac{\partial \ln(C)}{\partial t}, \tag{10}$$

13. Even though there is a positive relationship between the rate charged on loans and the one paid on interest-bearing liabilities, which could attenuate the distortion from higher risk-taking, that relationship is neither one-to-one nor constant throughout time.

14. This measure underestimates technological progress when the quality/variety of products increases throughout time. This might be relevant in the sample period, notably due to the increased customization in the pricing of credit, which results from banks' more sophisticated models for credit risk assessment.

being positive values associated with technological progress, while negative values characterize a period of technological regression.

Table 5 presents estimates for technological change between 2012 and 2019, and also for the entire period. Interpreting the value for 2012, for example, it is possible to say that, in this year, Portuguese banks operating according to the industry's best practices could produce the same output as in 2011 incurring 2.9% lower costs. Even though total cost reducing technological progress was not statistically significant during the period under analysis, the rationalization of branch networks (which are more intense in both physical capital and labour inputs) seems to have been fruitful in the first half of the sample period, despite banks' simultaneous investment in back office activities, for instance in credit risk assessment and compliance domains. Tentatively, the latter factor may be behind the apparent slight technological recess in the latter years of the sample, as stricter and more comprehensive regulatory demands represent a cost increasing change in the environment in which banks operate. However, the resulting reputational benefits stemming from avoiding financial instability justify the incurrence in these costs.

Year	**Technological progress (1) (%)**	**P-value (H0: $TP = 0$) (2)**
2012	2.92	0.56
2013	2.09	0.64
2014	0.73	0.86
2015	0.96	0.81
2016	-0.53	0.89
2017	-0.69	0.85
2018	-1.16	0.75
2019	-1.30	0.77
2012-2019	**0.41**	**0.78**

TABLE 5. Technological progress

Note: Total loans are used to compute weighted means.

3.5. Scale economies

This subsection proceeds by assessing the presence of scale economies, which is a particularly relevant topic since it allows us to infer on the adequacy of the market structure from a technological point of view. A measure of scale economies in a multiproduct firm is obtained by summing up the elasticities of total cost with respect to each output:

$$SE_{i,t} = \sum_{r} \frac{\partial \ln(C_{i,t})}{\partial \ln(y_{r,i,t})}. \tag{11}$$

In the presence of scale diseconomies, the value for this measure is higher than one, while it is lower than one in the presence of scale economies.

As shown in Table 6, the period under analysis is characterized by constant returns to scale in statistical terms. However, numerical results point to the existence of scale diseconomies in the first half of the period, implying that costs would change more

than proportionally to banks' size. In this case, deleveraging processes turn out to be advantageous from a cost reducing perspective, as shown in the next subsection.

Year	Scale economies (1)	P-value (H0: $SE = 1$) (2)
2012	1.07	0.65
2013	1.05	0.71
2014	1.04	0.76
2015	1.02	0.91
2016	1.01	0.96
2017	0.99	0.93
2018	0.97	0.80
2019	0.95	0.68
2012-2019	**1.01**	**0.90**

TABLE 6. Scale economies

Note: Total loans are used to compute weighted means.

It should born in mind, however, that the definition of cost underlying this analysis does not include the cost of equity. Thus, the measure of scale economies presented above is actually a measure of cash flow cost economies, which is likely to overestimate the true scale parameter. In fact, any increase in output must be exclusively financed by interest bearing debt, implying that total costs might be forced to increase more than would be necessary if banks could also use equity.

3.6. Total factor productivity change

In this subsection, the results presented in Subsections 3.3, 3.4 and 3.5 are brought together by decomposing total factor productivity (TFP) change into the contribution of cost efficiency change, technological progress and returns to scale, which correspond to catching up to the cost frontier, shifts in the frontier itself over time and movements along the frontier, respectively.

The decomposition that follows is borrowed directly from Bauer (1990), being its terms associated with previously mentioned effects:

$$\begin{aligned}\ln(\frac{TFP_{i,t}}{TFP_{i,t-1}}) = \ln(\frac{CE_{i,t}}{CE_{i,t-1}}) \\ + \frac{1}{2}(-\frac{\partial \ln(C_{i,t})}{\partial t} - \frac{\partial \ln(C_{i,t-1})}{\partial t}) \\ + \frac{1}{2}\sum_{r}[(\varepsilon_{r,i,t}\frac{1-SE_{i,t}}{SE_{i,t}} + \varepsilon_{r,i,t-1}\frac{1-SE_{i,t-1}}{SE_{i,t-1}})\ln(\frac{y_{r,i,t}}{y_{r,i,t-1}})].\end{aligned} \tag{12}$$

Table 7 summarizes the results for total factor productivity change during the period under consideration.

Year	Cost efficiency change (1) (pp)	Technological progress (2) (pp)	Returns to scale (3) (pp)	Total factor productivity change (4) (%)
2013	0.04	2.50	1.03	3.58
2014	0.00	1.41	0.33	1.74
2015	1.24	0.85	-0.21	1.88
2016	0.04	0.22	0.14	0.40
2017	0.95	-0.61	-0.01	0.33
2018	-0.72	-0.92	-0.16	-1.80
2019	-0.10	-1.23	0.06	-1.27

TABLE 7. Total factor productivity change decomposition

Note: Total loans are used to compute weighted means. To compute the technical efficiency change, a constant sample was considered for every two adjacent years.

Total factor productivity increased 4.9% between 2012 and 2019, with relevant positive changes in the initial years of the sample. Nevertheless, total factor productivity growth slowed down throughout the period, reaching negative values in the last two years.

Despite not being statistically significant, technological progress has been the main driver for the total factor productivity growth registered, particularly in the beginning of the period, with an annual average of 0.3 pp over the period comprised between 2011 and 2019[15]. Furthermore, even though the sample period is characterized by constant returns to scale in statistical terms, changes in scale efficiency also contributed positively to total factor productivity change in 2013 due to the existence of scale diseconomies, in conjunction with the strong deleveraging registered after the sovereign debt crisis. Throughout the period under analysis, scale efficiency changes contributed, on average, 0.2 pp per year to total factor productivity change[16]. In turn, the contribution of variations in cost efficiency to the annual total factor productivity change amounted to 0.2 pp, on average[17].

4. Concluding remarks

The inefficient allocation of banks' resources is pointed out as a vulnerability of the banking system from a financial stability point of view, being its assessment of the outmost importance. In this regard, the performance of the Portuguese banking system

15. Boucinha *et al.* (2013) also point technological progress as the most relevant factor driving total factor productivity growth for the period between 1992 and 2006, standing, on average, at 2.2 pp a year. The latter result is stronger than the one presented in this work and should be read against a background of intense liberalization, consolidation and privatization. On its turn, Huljak *et al.* (2019) estimate that the annual rate of technological progress amounted to 2.4 pp over the period from 2006 to 2017.

16. Once again, comparing with two previous studies that apply similar methodology, Boucinha *et al.* (2013) found the scale effect to equal 1.5 pp, on average, for the period from 1992 to 2006 (which included significant consolidation in the Portuguese banking system), while in Huljak *et al.* (2019) this estimate for euro area banks stood at around 0.25 pp, on average, during the 2006-2017 period.

17. Cost efficiency remained virtually unchanged in Boucinha *et al.* (2013) and its contribution to total factor productivity growth in the euro area was negative in the 2006-2017 period (and decreased from -0.8 pp in 2006 to -1.95 pp in 2017), as reported in Huljak *et al.* (2019).

between 2012 and 2019 is assessed, capturing its developments since the peak of the sovereign debt crisis. Concretely, through the estimation of a cost function, banks' marginal costs and margins are examined. Additionally, total factor productivity growth is computed and decomposed into the effect of cost efficiency, technological progress and returns to scale. The methodology is, therefore, particularly appealing because it allows for the estimation of these three effects within the same econometric framework. It is worth to refer, however, that, given the number of observations in the sample, the small number of degrees of freedom constitutes a limitation of this work. For the purpose of the analysis described above, banks are assumed to choose the cost minimizing combination of labour, capital and interest bearing debt to produce loans and other earning assets. This being said, total (customer) loans were considered as a single homogeneous product, which is a drawback since the heterogeneity of output has a bearing in the definition of the production possibility frontier.

Portuguese banks' marginal costs in the production of loans and other earning assets decreased during the period under consideration. In turn, real resource marginal costs, which are obtained by deducting the estimated marginal costs for each bank by the corresponding price of funding, were found to be considerably more stable, suggesting that the behaviour of interest rates is indeed the main driving factor for the fall in marginal costs. Furthermore, and contrarily to what happened in the latter years under analysis, the interest income on an additional loan was not enough to cover the associated cost during the majority of the sample period. This is justified, on the one hand, by the adjustment processes observed in the beginning of the period and, on the other hand, by the exacerbated cost of funding recorded in the wake of the sovereign debt crisis, together with the absence of sufficient adjustment in the pricing of credit.

The aggregate estimate for cost efficiency in the sample period lies close to 84%, suggesting that Portuguese banks could have produced the same output while incurring only 84% of their actual costs. This estimate, which reflects the distance at which banks stand from the cost frontier representing best practices, did not change significantly over time, suggesting that structural long-term factors (for example, location, client structure, macroeconomic development and, to a lesser extent, regulation) play a bigger role for inefficiency than time-varying factors. Therefore, structural policies that improve time-invariant efficiency of the Portuguese banking system should be considered, such as policies promoting digitalization in the economy. Concerning cost reducing technological progress, it was not statistically significant throughout the period. Moreover, it was not found evidence for the existence of increasing returns to scale in statistical terms, implying that scale increases through acquisitions do not seem to be advantageous.

Finally, total factor productivity increased 4.9% between 2012 and 2019, registering relevant positive changes in the first years. However, total factor productivity growth slowed down throughout the period, reaching negative values in the last two years. Despite not being statistically significant during the period under analysis, technological progress has been the main driver for the total factor productivity growth observed, particularly in the beginning of the period. Furthermore, changes in scale efficiency also contributed positively to total factor productivity change in 2013 due to the existence of

scale diseconomies (although not statistically significant), in conjunction with the strong deleveraging registered after the sovereign debt crisis.

Overall, similarly to what was found for banks in other European countries Huljak *et al.* (2019), Portuguese banks have room to improve in what concerns their cost efficiency. That said, the efforts that banks have made in areas such as the rationalisation of branch networks and the digitalization of business processes are crucial to boost productivity and enhance profitability in the near future.

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