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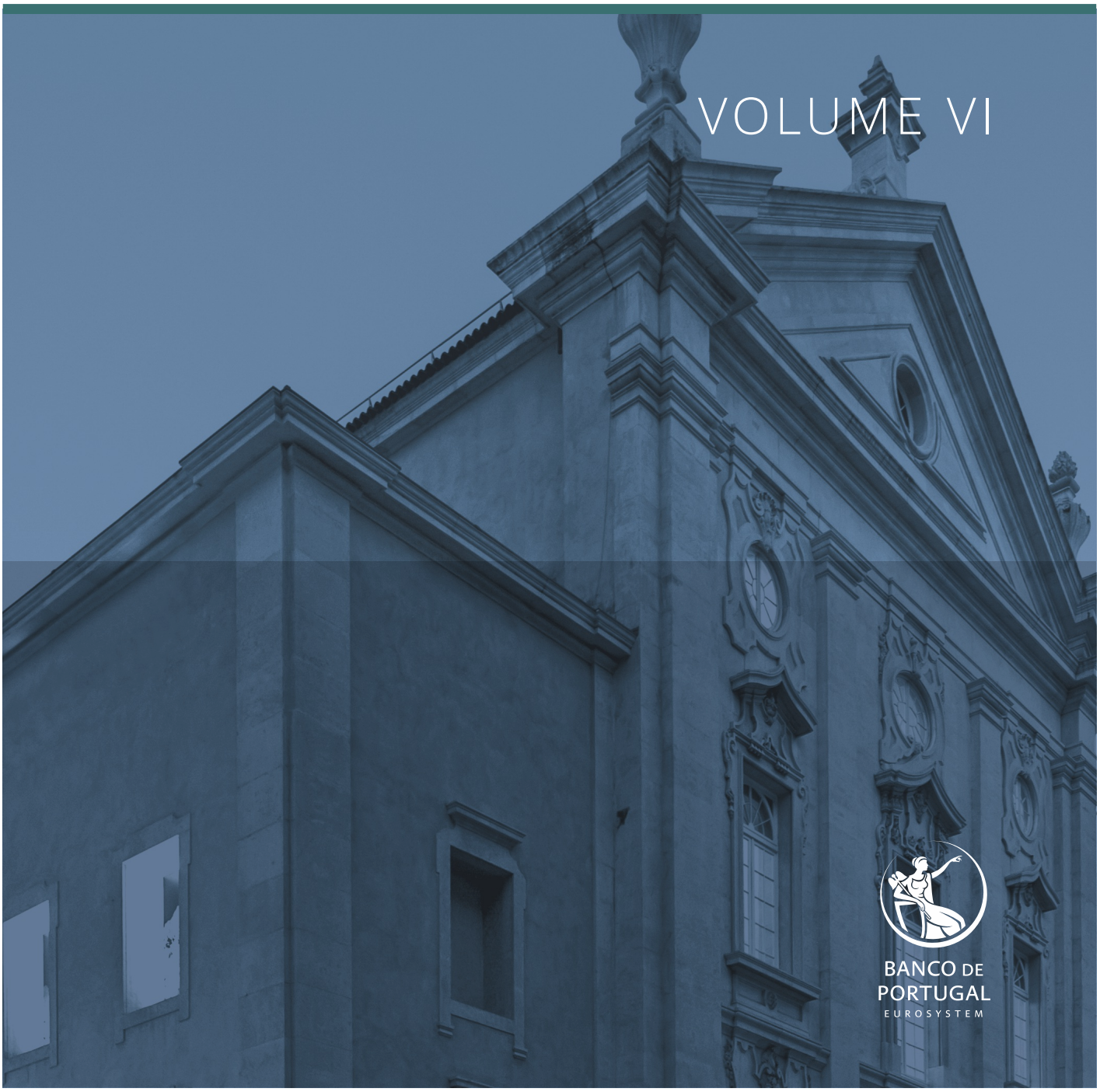

VOLUME VI

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Banco de Portugal Economic Studies

Volume VI

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Content

Editorial

Editor's note[1]

Pedro Duarte Neves

January 2020

The Banco de Portugal Economic Studies aims to contribute to more informed knowledge on the Portuguese economy. This issue presents three studies on inequality, household's wealth and indebtedness, and banking credit. All of which constitute an empirical application to the Portuguese economy, covering the last ten years in particular. Besides a better understanding of the recent past, the three studies provide, through well-established analytical methods, supported views that constitute a contribution to the economic policy debate.

1. Inequality has always had a prominent position on the economic and policy debate, strongly intensified since the Great Recession and the following financial crisis. Ongoing research programmes like the World Inequality Report and the IFS Deaton Review aim to identify the most recent trends and to build a comprehensive understanding of inequalities in the present and near future.

Inequalities exist in many dimensions: disposable income, consumption, hourly wages or earnings, health, education opportunities, living standards in general, and wealth. Inequalities can also be statistically measured in many different and not necessarily coinciding ways: Gini coefficients, ratios of percentiles, shares of income at the top or the bottom, the class of inequality measures proposed by Atkinson which are function of a specific parameter defining aversion to inequality, the generalised entropy measures which include the Theil index; and finally, the study of inter-generational and intra-generational inequalities is another possible dimension of interest.

The paper by Alves, Cardoso and Monteiro constitutes a very relevant contribution to the characterisation of inequality trends in Portugal over the

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1. The analyses, opinions and conclusions expressed herein are the sole responsibility of the editor and do not necessarily reflect the opinions of Banco de Portugal or the Eurosystem.

period 1995-2015. This editorial will focus on their main results on inter-generational and intra-generational (i.e. over the life cycle) inequalities which have been somewhat unexplored dimensions in the Portuguese debate.

Following the seminal work of Deaton (1985)[2] and Browning, Deaton and Irish (1985)[3], they track birth cohorts through successive household surveys; although this method cannot track the same individuals over time – as panel data is simply not available – it can track the full range of relevant statistics of birth cohorts over time. The convenient statistical properties of this method justify how it has been so widely used in many studies of life cycle behaviour.

In line with the literature, Alves, Cardoso and Monteiro conclude that, also in Portugal, income and consumption inequalities increase over the life cycle, with the only – fully understandable – exception that income inequality declines after retirement age. This corresponds precisely to how Deaton[4] described the main results of his work with Christina Paxson: "if a high school class reassembles for its 25th class reunion, the inequality in their standards of living will be much larger than was the case when they graduated", being a possible explanation that "the spread of cohort earnings increases as the cohort ages, because people get different opportunities over life, because they make different use of them, and because these advantages and disadvantages accumulate over time".

Probably more interesting, Alves, Cardoso and Monteiro document a reduction in consumption inequality – that is, younger generations have a lower consumption inequality than older generations – and an equivalent result for income inequality for generations born since the 1950s. As the authors mention, this result differs from the ones observed in the US and the UK, countries in which inequality has registered increases in basically all the dimensions[5]: for both countries younger birth cohorts face higher overall consumption inequality during their working life than similarly aged older cohorts.

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2. Deaton, A. (1985), "Panel Data from Time Series of Cross-Sections", Jornal of Econometrics 30(1-2), 109-126.

3. Browning, M., A. Deaton, and M. Irish, (1985), "A Profitable Approach to Labor Supply and Commodity Demands over the Life-Cycle", Econometrica 53(3), 503-544.

4. Deaton, A., (2014), "Puzzles and Paradoxes: a Life in Applied Economics", in Eminent Economists II, Their Life and Work Philosophies, edited by Szenberg, M. and L. Ramrattan, Cambridge University Press.

5. Evidence from expenditure data for the US and for Britain is provided in Blundell, R. (2014), "Income Dynamics and Life-Cycle Inequality: Mechanisms and Controversies", The Economic Journal, 124 (May), 1705-1753.

As relevant as the examination of the evolution in inequality over time for consumption and income, it is the analysis of the mitigating or smoothing factors, which include so many dimensions as credit markets, labour supply, taxation, welfare benefits, formal insurance, transfers, etc. Alves, Cardoso and Monteiro explore three of those dimensions – public transfers, number of workers in the household and access to credit – presenting preliminary evidence on a possible role in reducing inequality.

2. The Portuguese Household Finance and Consumption Survey, whose 2017 data has just been released, is part of a Eurosystem project that collects harmonised household level data across euro area countries to conduct studies on monetary policy and financial stability issues. Although the survey is focused on household's assets and liabilities, it also includes a very broad dataset on income, consumption and savings, with a very rich characterisation on socio-demographic variables at household level. This Eurosystem project is in its third wave, having covered the years of 2010, 2013 and 2017. The Portuguese experience in these surveys – developed in a very fruitful cooperation between Banco de Portugal and the Statistics Portugal (INE) - started much earlier, with the Households' Wealth and Indebtedness Survey: the first edition took place in 1994 and was followed by the 2000 and 2006 surveys. Over the last 25 years the staff of Banco de Portugal has presented very thorough analytical description and research on, amongst other aspects, assets and liabilities of the Portuguese households.

The paper by Costa, Farinha, Martins and Mesquita uses the Household Finance and Consumption Survey to provide a very complete description of the financial situation of Portuguese households for the main asset components, portfolio allocations and liabilities. It also provides very insightful information on wealth distribution by different households which, as is well known, is much more unequal than income distribution: as Angus Deaton stated[6], "Inequality in wealth is driven by a process that accumulates an accumulating process, and grows even more rapidly".

Amongst many other important results, this paper illustrates – in a much more informative way than the most commonly reported aggregate statistics - the sizable reduction in household indebtedness over the 2010-2017 period. Aggregate figures indicate that Household debt over disposable income declined by 26 percentage points from 2010 to 2017[7]. The Household Finance

6. Deaton, A., (2014), "Puzzles and Paradoxes: a Life in Applied Economics", in Eminent Economists II, Their Life and Work Philosophies, edited by Szenberg, M. and L. Ramrattan, Cambridge University Press.

7. The December 2019 Financial Stability Report shows that total household debt was 128 per cent of disposable income in 2010, 102 per cent in 2017 and 97 per cent in June 2019.

and Consumption Survey contains information that provides an extremely rich characterisation of this reduction across households. The change has not been that great in the proportion of households with debt - which decreased a meagre (and not statistically significant) half percentage point from 2010 to 2017, from 46.2 to 45.7 per cent - but in the amounts of debt for most households. The median debt level for indebted households declined markedly from €59,400 to €35,000, in real terms; the median debt service to income ratio declined from 20.3 per cent to 14.4 per cent; finally, the median debt to income ratio dived from 224.4 per cent to 132.6 per cent.

3. In recent years the stock of NPLs in EU banks decreased markedly, reflecting several initiatives at national and European levels. In spite of that, NPL levels still remain above those registered in the US and the UK, for instance, and are still higher in countries more affected by the double-dip recession. A 2015 IMF Staff Discussion Note[8]claimed that persistently high NPLs hold down credit growth and economic activity as they impair – through additional capital requirements, reduced profitability and higher funding costs – the bank lending channel. The paper by Marques, Martinho and Silva included in this issue of the Banco de Portugal Economic Studies constitutes a very relevant contribution to this debate for, at least, four reasons.

Firstly, the Portuguese banking sector has been particularly hit by high levels of NPLs, as a result of the unprecedented severity of the double-dip recession. Secondly, the authors cover a 10 years period, which is a sufficiently long time horizon to also include the post-crisis period, and therefore allow for the analysis of the crucial role of the economic cycle on the evolution of NPLs. As a third reason, the authors take advantage of the very rich granular data drawn from the Portuguese Central Credit Register (CCR) which allows, amongst other aspects, tracking over time individual bank-firm credit relationships and matching of individual characteristics of non-financial corporations with firm specific variables available in complementary datasets. Finally, the authors employ a commonly used econometric strategy to disentangle the roles of credit demand and credit supply, taking advantage of the high prevalence of Portuguese firms with multiple bank relationships.

The paper concludes that there is no evidence that NPL ratios per se constrained bank loan supply to performing corporates in the period 2009-2019, a result that holds for both the crisis and the post crisis periods. In addition, the regressions are conditioned on three bank-level controls – associated with capital, liquidity and risk profile factors – that turned out to have the

8. "A Strategy for Resolving Europe's Problem Loans", IMF Staff Discussion Note, September 2015.

expected signs in the regressions. Therefore, the paper by Marques, Martinho and Silva constitutes a very important contribution to the ongoing debate on the possible effects of nonperforming loans in the overall functioning of the economy.

Non-technical summary

January 2020

A characterization of income and consumption inequality in Portugal

Nuno Alves, Fátima Cardoso, Nuno Monteiro

This article aims to characterize the consumption and income inequality in Portugal. The analysis is based on the Household Expenditure Surveys conducted between 1995 and 2015. According to these data, income inequality showed a slight upward profile over the first decade under analysis and a slight downward profile in the second decade. In turn, consumption inequality recorded a marked decrease over the two decades (see Chart below).

Based on a set of assumptions, it is possible to identify the contribution to this evolution of inequality of one component related to the household life cycle and another associated with the differences across cohorts. In line

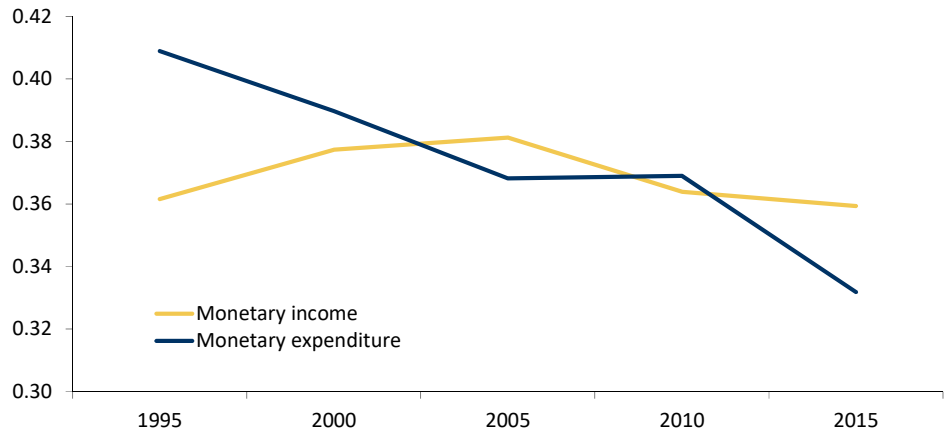

FIGURE 1: Evolution of income and expenditure inequality in Portugal | Gini coefficients

Sources: Statistics Portugal (HBS) and authors´ calculations.
Note: Calculations include households whose reference person age is between 25 and 74 years old.

with the literature, it is concluded that income and consumption inequality in Portugal increases over the life cycle. This result is associated with the accumulation of positive and negative shocks by households over time. In the case of income, inequality decreases in age groups after the retirement age.

With regard to the evolution of inequality across cohorts, the article identifies a decrease in consumption inequality throughout all cohorts under analysis. Newer generations thus have lower consumption inequality compared to previous generations when they were the same age. In the case of income, the downward trend in intergenerational inequality is only observed for cohorts born from the 1950s onwards. The article explores the possibility that this reduction in inequality, particularly in consumption, may be related to a reinforced role of income and consumption smoothing mechanisms in Portugal in recent decades. The article presents descriptive evidence supporting this conclusion, particularly with regard to the public transfer system, the participation in the labor market of the various household members and the access of households to the credit market.

A characterization of income and consumption inequality in Portugal

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January 2020

Abstract
This paper aims to characterize the evolution of household income and consumption inequality in Portugal between 1995 and 2015. In this period, income inequality showed an upward profile in the first decade and a downward path afterwards, while consumption inequality decreased significantly over the entire period. Based on a pseudo panel, we estimate the role of the life cycle and of the different cohorts in explaining household inequality. In line with the literature, it is concluded that income and expenditure inequality increases over the life cycle. In turn, there is a decrease in inequality in successive cohorts in Portugal, particularly in the case of consumption. The article suggests that the strengthening of income and consumption smoothing mechanisms in the Portuguese economy may have contributed to this evolution. (JEL: D12, D15, D31, E21, E24)

Introduction

Inequality is increasingly a central theme in economic analysis. In the new emerging consensus in the literature, knowledge about the heterogeneity of agents and the distribution of income, wealth and consumption are necessary conditions to understand the sources of economic fluctuations, the transmission of economic shocks and the impact of public policies on economic welfare (Blundell, 2014; Kaplan and Violante, 2018).

This article aims to contribute to the characterization of the evolution of household income and consumption inequality in Portugal in the last two decades. The article is part of a growing but still limited literature on the determinants and implications of economic inequality in Portugal (Cantante, 2019; Costa *et al.*, 2020; Banco de Portugal, 2018). The analysis is based on

Acknowledgements: The authors are thankful for the suggestions and comments of Cláudia Braz, Sónia Costa, Luísa Farinha, Pedro Duarte Neves, Hugo Reis and participants in an internal seminar of the Economics and Research Department of Banco de Portugal. 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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the five Household Expenditure Surveys conducted by Statistics Portugal between 1995 and 2015.

The paper presents a breakdown of income and consumption inequality over the life cycle of households and across the various cohorts covered by the surveys (from the 1920s to the 1990s). The decomposition is performed based on a pseudo panel constructed for this purpose. In line with the literature, an increase in income and consumption inequality over the life cycle of households in Portugal is identified. In the case of income, inequality decreases in the higher age groups after retirement age. Regarding the evolution of inequality in intergenerational terms, the data point to a decrease in consumption inequality across all cohorts under analysis. Specifically, when comparing the different generations when they were the same age, the recent cohorts systematically present lower consumption inequality. In the case of income, the trend of intergenerational decrease in inequality is only observed for cohorts born after the 1950s. The decrease in income and consumption inequality makes the Portuguese economy an especially interesting case study. In particular, the Portuguese economy contrasts with the US and the UK, characterized in the recent past by a significant increase in income inequality and, albeit to a lesser extent, consumption inequality (Blundell, 2014; Heathcote *et al.*, 2010).

The relationship between income and consumption inequality depends on the nature of shocks affecting household income and on the existence of income and consumption smoothing mechanisms. A thesis consistent with the decline in consumption inequality in Portugal is that the role of these smoothing mechanisms increased in recent decades. This paper explores evidence concerning three of these mechanisms: the public transfer system, the labour supply of the various household members, and household access to the credit market (Heathcote *et al.*, 2014; Blundell, 2014). The article provides evidence of a reinforced role of these mechanisms over the past two decades. However, the available data do not allow quantifying the contribution of each of these mechanisms, so this analysis is essentially descriptive in nature.

The remainder of the article is organized as follows. The following sections present the databases used and characterize the evolution of income and consumption inequality in Portugal over the last two decades. Next, a decomposition of inequality over the life cycle and across cohorts is presented. An interpretation of the results emphasizing the smoothing mechanisms of income and consumption precedes the conclusions of the article.

Data

The main source used in this article is the Household Budget Survey (HBS). This survey is held every five years by Statistics Portugal. The survey provides detailed information on household expenditure, which is used in the

calculation of private consumption weights, both for national accounts and for calculating the consumer price index. Additionally, it provides information on household income. This combination of income and expenditure information makes this survey an important source for analyzing inequality in Portugal. This article uses the microdata underlying the last 5 surveys, corresponding to the period from 1995 to 2015 (Statistics Portugal, 1997, 2002, 2008, 2012, 2017)[1].

Total income and expenditure of households correspond to the sum of the monetary and non-monetary components[2]. Household monetary income includes labour and pension income, property and capital income, social transfers other than pensions and private transfers, and is net of income taxes and social contributions. Household monetary expenditure includes all purchases of goods and services. The surveys also include information on so-called non-monetary expenditure (which coincides with non-monetary income): self-consumption (self-produced goods), self-supply (goods and services consumed freely in households' firms), owner-occupied imputed rents (estimated value of house rent when the household owns the house or has free accommodation), payments and salaries received in kind.

To simplify the analysis, the expenditure data is assumed to refer to the calendar year corresponding to the largest collection period covered by each survey, even if the collection period does not exactly coincide with the calendar year. For example, in the case of HBS 2015/2016 it is assumed that expenditure data refer to the year 2015. In addition, income data in each survey refer to the calendar year prior to the collection period, which explains why the time reference for income data precedes the one of expenditure (for example, in the case of HBS 2015/2016, income refers to 2014).

In this article, expenditure and income data correspond to data per household and per equivalent adult. The calculation of the variables per equivalent adult is based on the modified OECD equivalence scale, which assigns a weight of 1.0 to the first adult in the household, 0.5 to the remaining adults and 0.3 to each child (individuals under the age of 14 are considered children of the household). The use of this equivalence scale aims to take into account the existence of economies of scale within households, so that the variables calculated per equivalent adult tend to represent a better measure of economic well-being. All aggregated data presented (unless explicitly stated otherwise) refer to households in the population as a whole, corresponding

1. The latest wave of this survey, from 2015/2016, features data collected between March 2015 and March 2016 from a sample representative of households living in Portugal. The statistical results of this survey, as well as the methodology and questionnaires, are available from Statistics Portugal (2017). The number of households responding to the 2015/16 survey was 11,398, involving 26,889 individuals.

2. The households' total expenditure concept in this survey is close to that of households' final consumption expenditure of the national accounts. In similar way, total income concept is close to the one of household disposable in national accounts framework.

to extrapolated data based on a sample weight attributed to each household. In addition, expenditure and income data, in particular average and median values, are presented in real terms, using the consumer price index as deflator[3] and 2015 as the price reference year.

The survey database also includes some variables that characterize households and the respective individuals. The households´ characteristics (age group, year of birth, education level) are assumed to be the characteristics of the reference person in the household[4].

Trends in income and consumption inequality in Portugal

In this section, we present evidence on the evolution of income and expenditure inequality in Portugal over the last two decades. Table 1 presents, besides the average and median values, some indicators related to the distribution of income and expenditure, which allow the analysis of the evolution of inequality between 1995 and 2015. These measures are presented for both monetary and total aggregates[5].

One of the most widely used inequality indicators in the literature is the Gini coefficient, which synthesizes the asymmetry of the whole distribution and can take values between 0 (when all households have the same income or expenditure value) and 1 (when expenditure or income is concentrated in a single household). Other measures, such as percentile ratios, are based on comparing values at different points in the distribution and, in particular, between the distribution´s extremes. For example, the p90/p10 ratio is the ratio between the 90th percentile value and the 10th percentile value of a given distribution and the p90/p50 ratio is the ratio of the 90th percentile value over the distribution median. In turn, the S90/S10 ratio is the ratio between the share of the 10% of households with the highest values and the share of the 10% of households with the lowest values for each variable. Taking the Gini coefficient as a reference, Figure 1 summarizes the evolution of monetary income and monetary expenditure inequality in the period under review. From Table 1 and Figure 1, several relevant facts can be highlighted.

In the case of expenditure, there is a significant decrease in inequality over the period under review. For example, for monetary expenditure, the

3. As a simplification, all aggregates were deflated using the total national consumer price index, not considering details by region and product.

4. The household reference person is typically the individual with the greatest proportion of total net annual income in the household.

5. Given the objective of integrating life-cycle and cohort analysis over time, this article has not considered households whose reference person is under 25 years of age or over 74 years of age. Results for inequality indicators calculated on the basis of total households would be very similar.

	Monetary income					Monetary expenditure				
	1994	1999	2004	2009	2014	1995	2000	2005	2010	2015
Mean (euros)	9504	11241	12099	12423	11179	8248	9112	8783	10196	9258
Median (euros)	7546	8710	9215	9624	8709	6234	6992	7065	8102	7606
p90/p10	5.0	5.4	5.3	5.0	5.0	7.2	6.5	5.6	5.8	4.6
p90/p50	2.3	2.4	2.5	2.4	2.3	2.6	2.6	2.4	2.4	2.2
p50/p10	2.2	2.2	2.1	2.1	2.2	2.7	2.5	2.4	2.4	2.1
S90/S10	10.2	11.4	11.6	10.2	11.0	15.6	13.4	11.8	11.7	8.7
Gini coefficient	0.361	0.377	0.381	0.364	0.359	0.409	0.390	0.368	0.369	0.332
	Total income					**Total expenditure**				
	1994	1999	2004	2009	2014	1995	2000	2005	2010	2015
Mean (euros)	11104	13039	15032	15482	14470	9793	10859	11628	13212	12533
Median (euros)	8795	10294	11795	12482	11994	7518	8617	9587	10913	10695
p90/p10	4.8	4.9	4.5	4.2	4.1	6.4	5.5	4.4	4.5	3.8
p90/p50	2.3	2.3	2.3	2.2	2.1	2.6	2.4	2.2	2.2	2.0
p50/p10	2.1	2.1	2.0	1.9	2.0	2.5	2.3	2.0	2.1	1.9
S90/S10	9.6	9.7	9.2	8.1	8.2	13.1	11.0	8.5	8.3	6.7
Gini coefficient	0.354	0.358	0.350	0.331	0.322	0.390	0.364	0.330	0.328	0.296

TABLE 1. Inequality measures of household income and expenditure in Portugal: 1995-2015

Sources: Statistics Portugal (HBS) and authors´ calculations.
Note: Calculations include households whose reference person age is between 25 and 74 years old.

Gini coefficient decreased from 0.409 in 1995 to 0.332 in 2015. The percentile ratios suggest that this reduction in inequality occurred in both the upper and lower tails of the distribution. This development contrasts with that observed in the case of income inequality, particularly in the case of monetary income inequality, which has an initially rising and then decreasing profile over the two decades[6]. This profile results from the evolution of inequality in the upper tail of the distribution. The path of income inequality calculated on the basis of the HBS is in line with the one computed with the Statistics Portugal´s Survey on Income and Living Conditions (SILC), although the level of inequality in the HBS is slightly higher than the one found with EU-SILC (Rodrigues *et al.*, 2016; Statistics Portugal, 2017).

The decrease in income and consumption inequality contrasts with the evidence commonly analyzed in the literature, namely in the case of the US. However, evidence available to EU countries suggests that this decline in income and consumption inequality is a phenomenon observed in several

6. Between 2009 e 2014, the slight increase in the S90/S10 ratio is associated with a further fall in lower incomes during the crisis period, in a context of rising unemployment (Banco de Portugal, 2018).

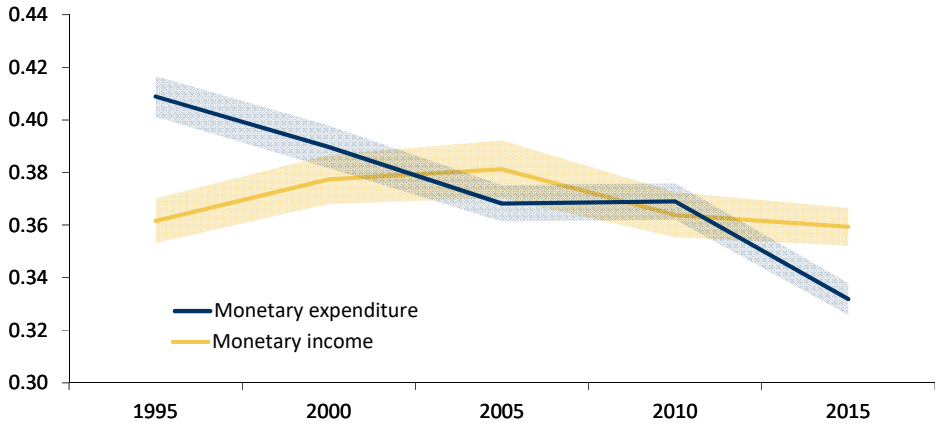

FIGURE 1: Income and expenditure Gini coefficients in Portugal

Sources: Statistics Portugal (HBS) and authors´ calculations.
Notes: The reference period for income corresponds to the year preceding that of expenditure (year shown in the figure). Shading represents the 90% confidence intervals calculated with the svylorenz command in STATA (Jenkins, 2015). Calculations include households whose reference person is in the 25-74 age group.

countries[7]. At the end of the period under review, and in terms of international comparison, income and consumption inequality in Portugal ranked in the upper third of European Union countries.

The results in Table 1 show that non-monetary components contribute to reduce income and expenditure inequality between households[8]. However, the evolution over time is broadly similar whether monetary or total aggregates are used. Focusing on the most recent data for 2015, the indicators suggest that expenditure inequality is lower than income inequality. This result may be justified by the existence of consumption smoothing mechanisms against income shocks (Deaton and Paxton, 1994; Blundell, 2014). However, at the beginning of the period under analysis (up to the 2000 survey), the evidence pointed to a higher level of inequality in the case of

7. For income statistics, see https://ec.europa.eu/eurostat/data/database. For consumption, see Eurostat´s experimental statistics, available for the years 2010 and 2015, in https://ec.europa.eu/eurostat/web/experimental-statistics/income-consumption-and-wealth.

8. This result is not surprising since a key component of non-monetary expenditure and non-monetary income are the imputed rents associated with owner-occupied housing services, which are broadly consumed by households, particularly in Portugal where the weight of own housing is very high.

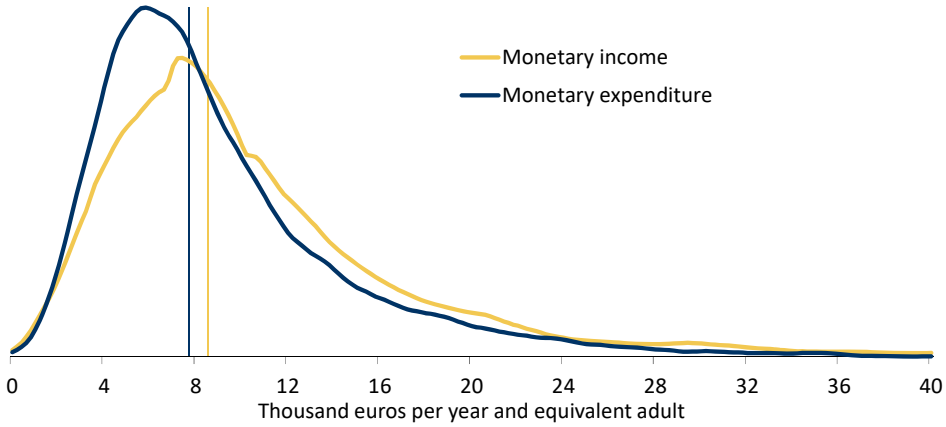

FIGURE 2: Density function of monetary income (in 2014) and monetary expenditure (in 2015) distributions

Sources: Statistics Portugal (HBS) and authors´ calculations.
Notes: Kernel density estimation. The vertical lines correspond to the median of each of the distributions. Calculations include households whose reference person is in the 25-74 age group. The vertical lines indicate the median of each of the variables.

expenditure. This result is difficult to explain, but not unique in the literature (Blundell and Preston, 1998; Krueger *et al.*, 2010)[9].

The remainder of the article will focus on the analysis of monetary aggregates, as usual in this literature, since non-monetary components are harder to quantify as they are not based on market prices. [10]

Figure 2 shows the distribution of household monetary expenditure and monetary income for the most recent data (HBS 2015). It can be seen that a large part of households are concentrated at low values in the distribution, both in the case of income and expenditure. Additionally, the distribution presents a very long right tail, implying that the mean distribution is significantly higher than the median (Table 1). A more detailed characterization of expenditure and income inequality in 2015 can be found in Banco de Portugal (2018), where indicators of inequality by age group, region, education level and income and expenditure deciles are presented.

9. In the case of Portugal, this result is also obtained in Gouveia and Tavares (1995), with data from the household budget survey for 1980 and 1990.

10. Note that the results would be qualitatively similar if total aggregates were used instead.

An analysis of inequality over the life cycle and across cohorts

Evidence on inequality by age and cohort

In an analysis of household income and consumption inequality, it is important to consider the role that some household characteristics and their evolution over time may play in driving aggregate outcomes. In particular, the population share in terms of household age is typically cited as a crucial factor in consumption and income behavior, both in terms of their average levels (Alexandre *et al.*, 2019) and in terms of inequality (Deaton and Paxton, 1994; Blundell and Preston, 1998). This is due to the accumulation of shocks over the household's life cycle. Examples of permanent income shocks may be a workplace promotion or a loss of income due to transitioning to long-term unemployment. The generational characteristics of households also play a crucial role. Individuals from different generations entered the labour market at different times and faced a distinct set of shocks, influencing their path over the life cycle. In this context, other characteristics, such as the degree of qualification of individuals, may also influence overall inequality.

The aggregate indicators presented in the previous section are based on cross-sectional information for several years. Aggregate developments over time thus mix the evolution of households of each generation (cohort) over time and the differences in the characteristics of the participants in each survey. One way to circumvent the fact that surveys do not contain a panel dimension is to construct a pseudo panel by combining cohort and age data by taking advantage of information on household characteristics in each survey (Deaton, 1997). This way it is possible to track cohorts over time.

The 5 surveys used in this article allow us to track each cohort for a maximum of 20 years. Cohorts and age groups were constructed as 5-year intervals, considering age groups between 25 and 74 years[11]. Figures 3 and 4 show the Gini coefficients of monetary income and monetary expenditure for each cohort and by age group. This graphic analysis illustrates some traces of the inequality of different cohorts throughout the life cycle. An econometric analysis of this evidence will be presented in the following section.

Figure 3 shows an upward profile of monetary income inequality over the working life cycle and a reduction after retirement age (65 years onwards)[12]. This result is in line with the literature, where the accumulation of shocks results in increased income and consumption inequality over the life cycle

11. Thus, the first age group is 25 to 29 years old and the last is 70 to 74 years old. In the case of cohorts, the first bracket (younger cohort) refers to generations born between 1986 and 1990 (only with observations in the 2015 survey) and the last to individuals born between 1921 to 1925 (only with observations in the 1995 survey).

12. For a similar analysis for expenditure and income averages by cohort and age, see Banco de Portugal (2018).

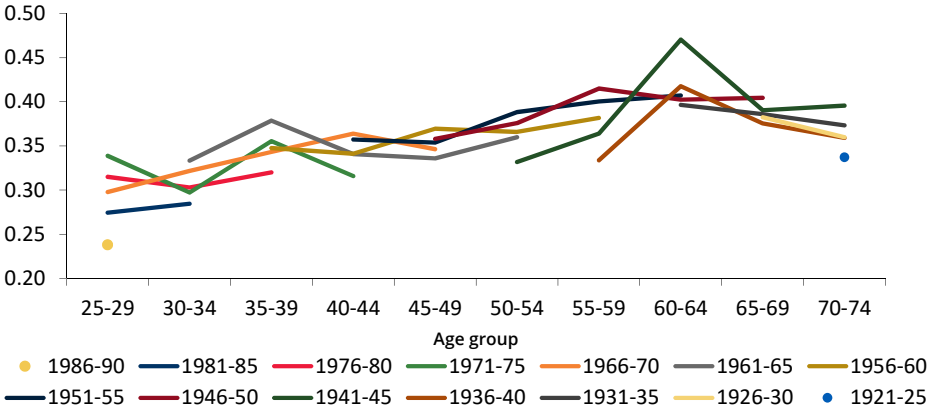

FIGURE 3: Gini coefficient of monetary income for each cohort by age group

Sources: Statistics Portugal (HBS) and authors´ calculations.
Note: Age groups and cohorts were defined at 5-year intervals, as described in footnote 11.

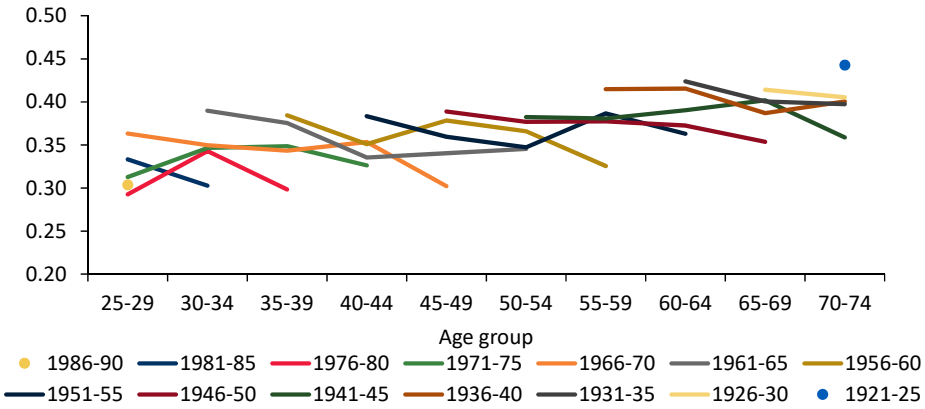

FIGURE 4: Gini coefficient of monetary expenditure for each cohort by age group

Sources: Statistics Portugal (HBS) and authors´ calculations.
Note: Age groups and cohorts were defined at 5-year intervals, as described in footnote 11.

(Deaton and Paxton, 1994; Aguiar and Hurst, 2013). Regarding the values of inequality across cohorts, the figure does not show a clear pattern of change across the different generations when they were the same age.

The graphical analysis of monetary expenditure inequality (Figure 4) is different from that of monetary income. On the one hand, inequality through

the life cycle does not depict a clear pattern, since the Gini coefficient for each cohort sometimes has a generally downward path across surveys. On the other hand, comparative results across cohorts seem to suggest that younger cohorts have lower expenditure inequality than previous cohorts at the same age.

It is important to highlight that this analysis only allows a partial and limited view of these age and cohort effects, especially as these characteristics interact with others, including the time dimension. Since the pseudo panel tracks cohorts across various editions of the HBS, observations may be affected by survey-specific effects, such as measurement errors. At the same time, the observations of a given cohort in various surveys may represent different households of that group with very different characteristics.

One of the structural features that changed over time in Portugal was the educational level, reflecting the fact that younger cohorts gradually show higher levels of education than previous cohorts. In Banco de Portugal (2018) , information on Gini coefficients by educational groups (considering only 2 levels of educational attainment) suggests a positive association between educational level and income inequality in the last two decades[13]. Additionally, with regard to monetary expenditure, there is no apparent relationship between educational attainment and inequality in the last two decades. Increased workforce education thus may have contributed to an increase in income inequality. Given the evidence in Figure 1, other factors may have contributed in the opposite direction, which will be explored in the next section of the article.

Estimation of life cycle and cohort effects

As noted above, life cycle and cohort effects are important dimensions in understanding the aggregate evolution of inequality. However, the calculation of inequality measures by cohort and age brackets does not fully isolate these effects, as it is not possible to observe the different cohorts in each age bracket at the same time.

In this section, econometric techniques are used to estimate age and cohort effects on income and monetary expenditure inequality, isolating them from the time effect (year of the survey). The estimation is based on the pseudo panel data described in the previous section. The time effect includes, for example, cyclical factors affecting the economic situation or specific characteristics of the survey in a given year. The cohort effect includes factors such as the different levels of access to education, the specific conditions experienced by each cohort upon entering the labour market, technological

13. A positive relationship between average levels of education and wage inequality in Portugal is also suggested in Machado and Mata (2005), although for an earlier period (1986-1995).

progress or other shocks that have affected the households of a given generation differently from the others. Age effects include factors related to the life cycle of households, such as the accumulation of shocks in the labour market and the impact of retirement on income and consumption inequality.

The main difficulty in isolating and estimating these effects results from the fact that the variables cohort, age and time / year of survey are perfectly collinear (year of birth = year of survey − age). Thus, the estimation of these effects requires imposing restrictions. In this article, the approach proposed in Heathcore *et al.* (2005) was followed. The estimation uses dummies related to the variables age, cohort and time, to estimate the effects of these 3 variables by pseudo-panel regressions, controlling by pairs of variables. Age dummies were used for all but one reference bracket (in this case the age group of 30-34 years[14]). In the same way, dummies were constructed for the variables related to time (survey year) and cohort (year of birth). In the latter case the reference group corresponds to the generation born between 1921 and 1925.

The approach of Heathcore *et al.* (2005) proposes that effects can be estimated based on the following set of regressions:

$$Var(y_{a,c,t}) = \beta_0^1 + \beta_a^1 D_a + \beta_t^1 D_t + \varepsilon_{a,c,t}^1 \quad (1)$$

$$Var(y_{a,c,t}) = \beta_0^2 + \beta_a^2 D_a + \beta_c^2 D_c + \varepsilon_{a,c,t}^2 \quad (2)$$

$$Var(y_{a,c,t}) = \beta_0^3 + \beta_c^3 D_c + \beta_t^3 D_t + \varepsilon_{a,c,t}^3 \quad (3)$$

where $Var(y_{a,c,t})$ is the variance of the logarithm of the variable[15] (income or expenditure) for the group of households whose reference person belongs to the age group a and cohort c (observed in the period $t = c + a$). D_a and D_c, are vectors that correspond, respectively, to the sets of dummies for the age and cohort, and D_t includes the dummies for the survey year.

Thus, the effect of the life cycle (age) can be estimated alternatively using equation 1, i.e. assuming the existence of time effects and abstracting from the effects of cohort, or equation 2, i.e. assuming cohort effects but abstracting from time effects, since it is not possible to consider the 3 dimensions simultaneously in the same equation.

Equivalently, cohort effects on inequality can be estimated by controlling for age (equation 2) or, alternatively, controlling for the year of the survey (equation 3). It should be noted that the results are sensitive to the hypotheses adopted, as in Heathcore *et al.* (2005).

For the selection of regressions, we consider that it would be crucial to control for the time effect, as the sample includes a limited number of

14. For estimation purposes, the age group of 25 to 29 years was excluded, as this age group typically has significantly fewer observations than the others in each survey. However, results with and without this age group are qualitatively similar.

15. The results of this analysis are robust to the use of other inequality measures, such as the Gini coefficient, the coefficient of variation or percentile ratios.

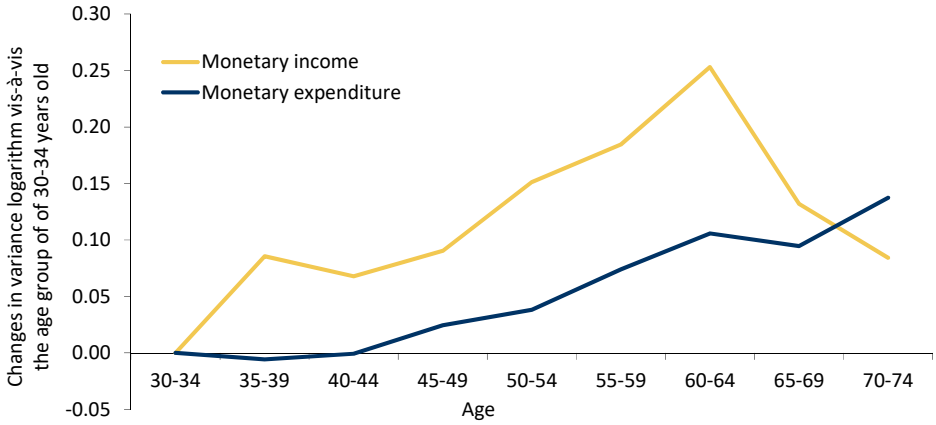

FIGURE 5: Life-cycle effects on income and expenditure inequality (variance of logarithms)

Sources: Statistics Portugal (HBS) and authors´ calculations.
Note: The figure represents, for each age group, the difference in the household income and monetary expenditure variance of logarithms relative to the reference age group (30-34 years).

surveys. Thus, estimates for the life cycle effect come from the regression of the variance of logarithm (of income or expenditure) in the age dummy and the time dummy corresponding to the survey year (equation 1) and the estimates for the cohort effect come from the regression of the same variables in the cohort and time dummies (equation 3). In both regressions the estimates for the survey year dummies coefficients are quantitatively similar. The estimated effects relate to the age or cohort reference groups indicated above (30-34 years and 1921-1925, respectively).

Based on this methodology, the set of estimated coefficients β_a^1 represents the life cycle effect on income and consumption inequality. These coefficients are presented in Figure 5. The dummy coefficient for each age group measures the estimate of the difference in inequality (measured by the income or expenditure variance of logarithms) for that age group relative to the 30-34 years group.

The results suggest that household income and expenditure inequality increases over the life cycle. This result is in line with that suggested in the literature (Blundell, 2014; Deaton and Paxton, 1994). According to life cycle theory, consumption varies over life as a function of permanent income. The accumulation of permanent shocks will tend to be reflected in an increase in income inequality over the life cycle, with expenditure presenting a smoother profile. It should be noted that estimates suggest that around retirement age income inequality starts declining, which is not the case for consumption.

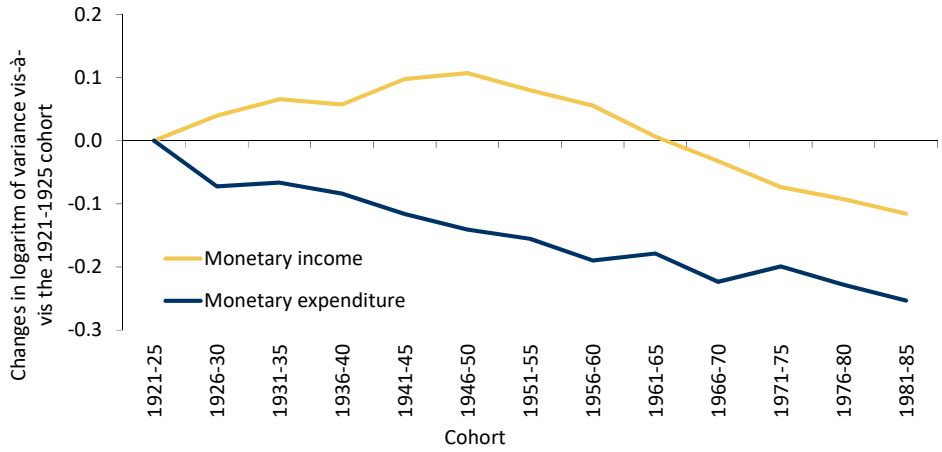

FIGURE 6: Cohort effects on income and expenditure inequality (variance of logarithms)

Sources: Statistics Portugal (HBS) and authors´ calculations.
Note: The figure represents, for each cohort, the difference in household income and monetary expenditure variance of logarithms relative to the reference cohort (generation born between 1921 and 1925).

Regarding the cohort evidence, Figure 6 presents the estimated coefficients β_c^3 for the variance of income and expenditure of the various cohorts compared to the cohort between 1921 and 1925.

The figure shows a marked reduction in monetary income inequality for generations born after the 1950s. In the case of monetary expenditure, a reduction in inequality is estimated over all successive generations. This result is different from that documented in the literature for the United States and the United Kingdom (Blundell, 2014)[16].

16. These life cycle and cohort effects were also estimated with an alternative methodology, inspired by Aguiar and Hurst (2013). The authors propose a normalization of the time variable (survey year) to allow the simultaneous inclusion of the three dimensions in the estimation. This transformation, originally proposed by Deaton (1997), assumes that the effects of time are orthogonal to a trend and average zero after normalization, bypassing the collinearity limitation. The methodology of Aguiar and Hurst (2013) has two steps. In a first step, the same regression estimates the life cycle, cohort and time effects on the averages of the expenditure or income variable. Next, cohort and life cycle effects on inequality are estimated through a regression for the variance of the residuals from the previous step. The coefficients obtained with this methodology are qualitatively similar to those presented in this article.

The strengthening of income and consumption smoothing mechanisms

In order to understand the potential causes underlying the decrease in inequality across cohorts reported above, it is useful to refer to the analytical framework presented in Blundell *et al.* (2008). These authors state that the empirical relationship between the evolution of consumption distribution and the evolution of income distribution depends on the degree of persistence of income shocks, on the income smoothing mechanisms and on the degree of "insurance" (smoothing) of consumption vis-à-vis changes in income. As regards the degree of persistence of shocks, it is well known that income shocks are only partially transmitted to consumption. This transmission will be larger (smaller) the more persistent (the more transitory) the income shock is. With regard to household smoothing and risk-sharing mechanisms, the literature emphasizes the role of wealth and savings, tax progressivity, public transfers, intra-family transfers, informal safety nets and access to credit market (Heathcote *et al.*, 2010).

Given this analytical framework, there are several possible interpretations that reconcile the evidence on the evolution of income and consumption inequality in Portugal[17].

One possibility is anchored in the nature of the shocks that affected household income over this period. According to this thesis, the fall in consumption inequality could be rationalized with a lower incidence of permanent shocks on income over the period under review. The slight increase in income inequality in the first decade under review could also be justified by an increase in temporary income shocks, by nature more likely to be smoothed out in agents' consumption decisions. Examples of these temporary shocks are one-off increases in overtime work or a sick leave. In order to test this hypothesis, it would be necessary to have a panel database tracking households over time (Blundell *et al.*, 2008).Thus, it is not possible to analyze this issue with the information available in the HBS sectional data.

A second possibility is that the smoothing mechanisms available to households have increased over these two decades. It should be noted that this thesis can perfectly coexist with the above thesis that the persistence of income shocks changed over this period. Once again, it is not possible to estimate with HBS the structural evolution of the role of these mechanisms in the Portuguese economy. Nevertheless, evidence from HBS can be combined with other statistical sources to characterize the impact of some of these smoothing mechanisms over time. The descriptive analysis below focuses on three "insurance" mechanisms that the literature identifies as central: *(i)* the public transfer system, *(ii)* the labour supply of the various household

17. One possibility would be to simply consider that measurement errors underlying each survey had varied substantially and monotonically over time. This hypothesis does not seem plausible and thus will not be explored here.

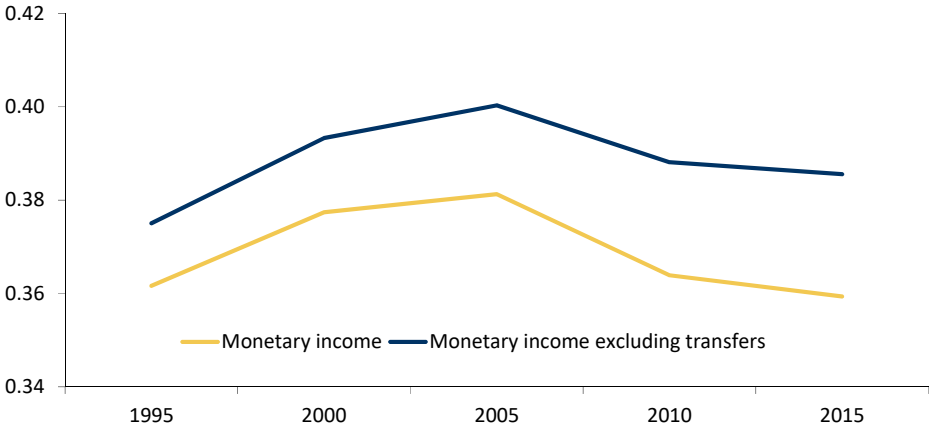

FIGURE 7: Impact of public transfers (excluding pensions) on inequality: Gini coefficients

Sources: Statistics Portugal (HBS) and authors´ calculations.
Note: Public transfers (excluding pensions) include social transfers in support of household, housing, unemployment, sickness and disability, education and training and social inclusion.

members, and *(iii)* household access to the credit market. While the first two mechanisms directly affect income inequality and hence consumption, the latter mechanism directly contributes to the smoothing of consumption in the face of temporary income shocks. In order to reconcile the reduction of inequality - especially of consumption - with the functioning of these smoothing mechanisms, their role needs to have increased over the period under review.

The public transfer system to households

The public transfer system (excluding pensions) contributes to reduce inequality in all economies. In Portugal, between 1995 and 2015, the share of cash transfers in household disposable income increased from about 3.5 per cent to about 5.0 per cent. In turn, the share of transfers in kind increased from about 2.0 to about 2.5 per cent of household disposable income over the same period.

The impact of the increase in public transfers (excluding pensions) on income inequality can be illustrated on the basis of the HBS. Chart 7 shows that the role of social transfers in decreasing income inequality has increased substantially over the past two decades. This result is consistent with their increasing share of household disposable income. Chart 8 shows that the increase in this redistributive role was concentrated on working age

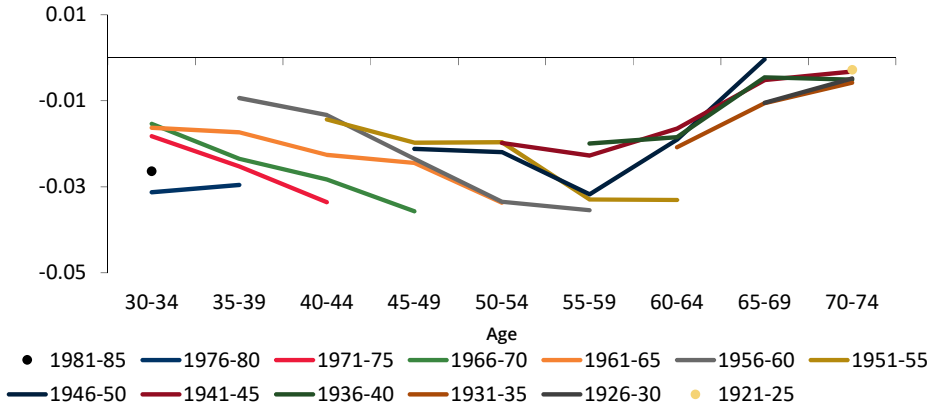

FIGURE 8: Difference between Gini coefficients of monetary income and of monetary income excluding transfers, for each cohort by age group

Sources: Statistics Portugal (HBS) and authors´ calculations.
Note: Negative values indicate that the monetary income Gini coefficient is lower than the monetary income Gini coefficient excluding public transfers (excluding pensions) include social transfers in support of household, housing, unemployment, sickness and disability, education and training and social inclusion.

households. In addition, the effect of these transfers appears to be more pronounced in younger cohorts (compared to previous cohorts when they were the same age).

Household labour supply

A higher participation of household members in the labour market typically contributes to reducing income inequality and, as a consequence, consumption inequality. The fact that more than one household member participates in the labour market decreases income inequality between households especially when individual incomes are not closely correlated among household members. For example, in the face of idiosyncratic labour market shocks that affect one individual, other family members can offset part of the shock through increased labour market participation (Alves and Martins, 2015). In the HBS data, the inequality of household labour income (plus pensions) is lower than the inequality of labour income (plus pensions) calculated at the individual level (Chart 9)[18]. This conclusion is the same for

18. These results were obtained applying the OECD equivalence scale to the households and to the respective individuals. The conclusions would be similar without the equivalization of incomes.

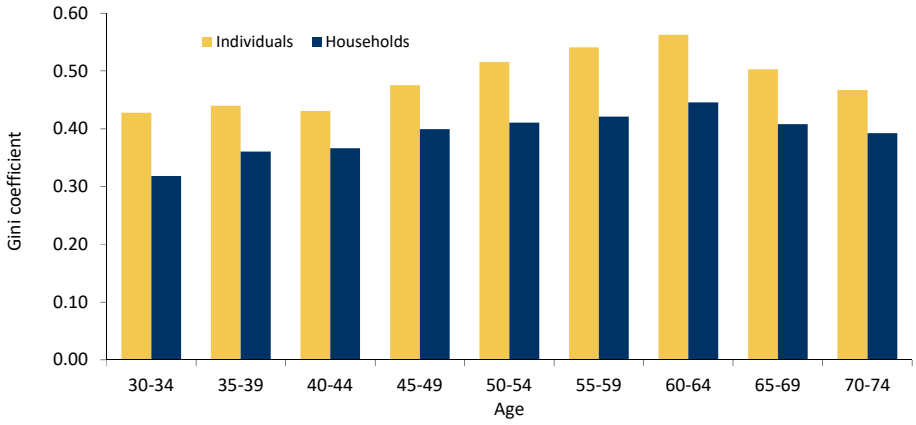

FIGURE 9: Gini coefficient of income from labour and pensions in 2015

Sources: Statistics Portugal (HBS) and authors´ calculations.
Notes: For each age group the Gini coefficient of individual and household income in 2015 (including zero incomes) was calculated. In the individual income calculations, each individual was included in the age bracket corresponding to the age of his household reference person. Household income corresponds to the aggregation of individual incomes. All calculations include individuals aged 25-74.

all age groups[19]. This suggests that the aggregation of individual incomes at the household level contributes to reducing inequality in Portugal.

In this context, a striking fact of the Portuguese economy in recent decades is the increasing participation of women in the labour market (Banco de Portugal, 2019). Between 1998 and 2015, the female participation rate (15-64 years) in the labour market increased from about 62 per cent to about 70 per cent. Together with the evidence from Chart 9, it is plausible that this higher female participation contributed to reducing household income inequality in Portugal. However, this is a tentative and partial equilibrium conclusion (for general equilibrium analyzes, see Heathcote *et al.*, 2017; Blundell *et al.*, 2016).

Credit market participation

An important source of consumption smoothing against temporary income shocks comes from credit market participation. In fact, access to credit markets allows smoothing out situations in which temporary income shocks make household liquidity constraints binding (Blundell, 2014). These constraints are

19. Due to lack of data on individual incomes, it is not possible to replicate these computations to the HBS surveys before 2010, which prevents an intertemporal analysis of this issue.

particularly binding in lower-income households but may also arise in high-income households (Kaplan *et al.*, 2014). Over the past two decades, household participation in the credit market has increased substantially in Portugal for all income brackets (Table 2)[20]. This increase was also observed for all age groups. This conclusion is robust whether considering access to any type of credit or just non-mortgage credit. In this period the increased participation in the credit market may have thus contributed to reducing consumption inequality in Portugal by allowing consumption decisions to be smoothed out in the face of temporary income shocks.

Income percentiles	% of households holding debt		% of households holding non-mortgage debt	
	1994	2013	1994	2013
≤ 10	9.3	36.6	4.7	17.9
10-25	15.8	45.7	5.9	21.4
25-50	21.8	54.8	7.6	25.9
50-75	33.6	69.3	11.4	31.0
75-90	40.8	75.6	15.5	28.5
> 90	35.1	78.0	14.0	25.6
Total	26.7	60.7	9.8	26.1

TABLE 2. Credit market participation

Sources: Households' Wealth and Indebtedness Survey (1994) and Portuguese Household Finance and Consumption Survey (2013).
Note: Calculations for households whose reference person is younger than 65 years old.

Conclusions

This paper sought to characterize the evolution of household income and expenditure inequality in Portugal in the period 1995-2015. Based on a pseudo panel, the role of the life cycle in household inequality and the evolution of this inequality across cohorts was estimated. A striking feature in the Portuguese economy is the decrease in consumption inequality in successive cohorts. The article suggests that the strengthening of income and consumption smoothing mechanisms in the Portuguese economy may have contributed to this evolution.

20. The authors thank Sónia Costa and Luísa Farinha for the computations underlying Table 2.

This article opens avenues to several studies on the estimation and study of the factors underlying the evolution of income and consumption inequality in Portugal. These structural factors also provide insights on future developments of inequality. These include the ageing population, the increasing participation of women in the labour market, improved educational attainment of individuals and the potential reinforcement of insurance networks available to households. The joint modeling of these elements is a demanding challenge for future research.

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Non-technical summary

January 2020

Portuguese Household Finance and Consumption Survey: results for 2017 and comparison with the previous waves

Sónia Costa, Luísa Farinha, Luís Martins, Renata Mesquita

The Portuguese Household Finance and Consumption Survey (ISFF, the acronym for *Inquérito à Situação Financeira das Famílias*), collects, through an interview with a representative sample of households living in Portugal, detailed information on wealth, debt, income, consumption and savings, demographic and social aspects, as well as attitudes and expectations. This article presents an analysis of the ISFF third wave results, whose interviews took place in 2017, and includes a comparison with the two previous waves, conducted in 2010 and 2013. The analysis focuses on the distribution of net wealth (real assets + financial assets - debt) and its components.

In 2017, the mean net wealth per household was 162.3 thousand euros. The median value, which is less affected by extreme values, was 74.8 thousand euros. The large difference between the mean and the median values of net wealth reflects the high inequality that usually characterises the distribution of this variable. In real terms, mean net wealth increased between 2013 and 2017, reversing the reduction between 2010 and 2013. The median value also decreased between 2010 and 2013 and increased between 2013 and 2017, but remained in 2017 lower than 2010. The analysis in this article suggests that in the period between 2010 and 2017 there were no major changes in the degree of inequality of net wealth in Portugal. However, by household groups, some differentiation in net wealth changes has taken place in this period.

By age groups, households' net wealth follows the usual pattern, aligned with the life-cycle, i.e., it increases with age up to retirement age, and decreases thereafter, more gradually, as shown in the chart below. In 2017 the median net wealth of households whose reference person is between 55 and 64 years old was around 95 thousand euros, almost seven times more than that of households in the youngest group. In 2017, net wealth in the youngest group or in the groups between 45 and 64 years old was significantly lower than net wealth of the households in the same groups in 2010 (57% lower, in the age group below 35 years, and about 20-25% lower, in the groups between 45 and 64 years).

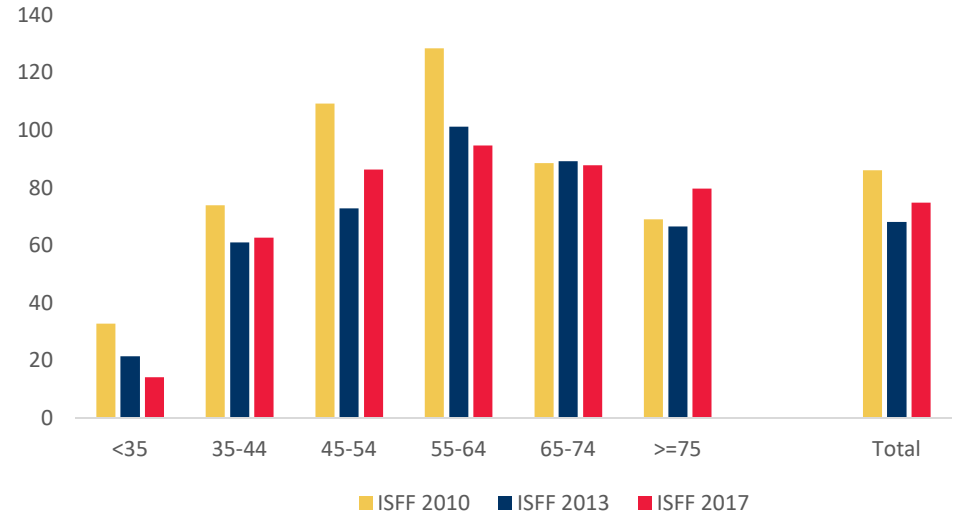

FIGURE 1: Net wealth of households in 2010, 2013 and 2017 (median values by age of the reference person, thousands of EUR)

Notes: The values of 2010 and 2013 were adjusted for inflation. The reference person broadly corresponds to the individual with the highest income in the household.

Net wealth increases with households' income. In most income groups the values of net wealth in 2010 and 2017 are not very different. The exception is the lowest income group, which in 2017 had a lower net wealth than the households of this group in 2010.

In 2017, about 75% of the households owned their main residence and about 30% owned other real estate properties. Although these percentages are very similar to those observed in 2010, real estate ownership declined for some specific groups. The percentage of households that own the main residence decreased in households whose reference person is under 35 years old and in households of the bottom income group.

In 2017, around 46% of households had debt. Main residence mortgages are the most frequent loans: about 32% of households had this type of loan. The second most common type of debt are non-mortgages loans which were held by about 18% of households. The percentage of indebted households did not change significantly between 2010 and 2017, but there was a recomposition of debt type. The percentage of households with mortgages decreased, with the reduction being particularly significant in the case of the youngest households, which may be related to the lower percentage of households that own their main residence. The value of debt per household decreased between

2010 and 2017. This reduction was common to all income groups and by age group it was more concentrated in young households.

The indebtedness ratios measure households' ability to pay their debts. Between 2010 and 2017, the median values of the debt-to-income ratio and the debt service-to-income ratio decreased significantly, reflecting the reduction in the outstanding amounts of debt and also the decrease in interest rates in the case of debt service ratio. The median value of the debt-asset ratio increased between 2010 and 2013 and decreased between 2013 and 2017, returning to a value close to the one of 2010. Changes in this ratio were due to fluctuations in opposite directions in the asset values, in particular in real estate.

Portuguese Household Finance and Consumption Survey: results for 2017 and comparison with the previous waves

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January 2020

Abstract
This article analyses the main results of the 2017 Portuguese Household Finance and Consumption Survey and compares them with the results of the 2010 and 2013 waves. In 2017, the median value of net wealth (i.e., the difference between total assets and total debts) of households living in Portugal was 74.8 thousand euros. In 2017, the median net wealth was higher in real terms than in 2013, but remained lower than in 2010. The analysis in this article suggests that in the period between 2010 and 2017 there were no major changes in the degree of inequality of net wealth in Portugal. However, by household groups, some differentiation in net wealth changes has taken place in this period.
(JEL: D10,D31)

Introduction

The Portuguese Household Finance and Consumption Survey (ISFF, the Portuguese acronym for *Inquérito à Situação Financeira das Famílias*), conducted by Banco de Portugal and Statistics Portugal, collects detailed information on wealth, debt and income of households living in Portugal. This survey also collects data on consumption and savings, demographic and social aspects, as well as attitudes and expectations. The data of the third wave of ISFF were collected in 2017 and released in November 2019. The first two waves were conducted in 2010 and 2013[1].

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1. The ISFF is part of the European project Household Finance and Consumption Survey (HFCS), an initiative of the Eurosystem, in order to collect household level data with harmonized definitions and methodologies among participating countries (HFCN, 2013a, 2016a). The results

The main results of the ISFF 2017 were co-released, first-hand, by Banco de Portugal and Statistics Portugal in a press release available in the ISFF page at the Banco de Portugal website[2]. This article presents a more detailed analysis of net wealth per household and its components (real assets, financial assets and debt) and compares the results of 2017 with those of previous waves.

The analysis of the distributions of the variables related to the financial situation of households in the period covered by the three waves of the survey is particularly interesting given that this is a period of significant adjustment of the Portuguese economy. Between 2010 and 2013 Portugal faced a severe recession, in the context of the euro area sovereign debt crisis and of the Financial Assistance Programme implemented in Portugal. Employment and household disposable income declined and consumer confidence deteriorated. Consumption decreased and household saving rate increased, partly reflecting the large increase in uncertainty (Banco de Portugal, 2016). These developments in savings, together with the reduction in housing investment, led to a recovery in households' financing capacity. Indebted households benefited from lower interest rates, but access to new credit became tighter and household debt declined. In this context, prices in the housing market fell. Between 2013 and 2017 economic activity recovered, with a significant increase in employment and consumer confidence. Consumption, especially durable goods consumption, recovered and the household's saving rate declined. New loans for house purchase and consumer credit started to increase, staying below the pre-crisis levels in the case of housing credit. The reduction in household debt continued over this period and the debt service continued to benefit from lower interest rates. Stronger demand and more favourable financing conditions contributed to a recovery in the housing market.

The next section characterizes the distribution of net wealth and shows how it has evolved between 2010 and 2017. It also presents a set of inequality indicators and the distribution of wealth by groups of households. The following section describes the composition of net wealth considering the households as a whole. Subsequent sections analyse the participation rates and values of real assets, financial assets and debt conditional on participation. The analysis is broken down by type of asset, type of debt and household group. In the case of debt, developments in the indebtedness ratios and in the indicators related to credit demand and credit constraints are also analysed. The last section presents the conclusions.

for the euro area as a whole are at first hand released by the ECB. The data for the 2017 wave have not yet been released (HFCN, 2013b, 2016b).

2. This page contains a broad set of information about ISFF, including a description of the methodological aspects.

Net wealth distribution

According to the ISFF data, the mean net wealth per household stood at 162.3 thousand euros in 2017 (Table 1)[3,4]. The median value, which is less affected by extreme values, was 74.8 thousand euros in the same year, i.e., less than half of the mean[5]. In real terms, mean net wealth increased between 2013 and 2017, reversing the reduction between 2010 and 2013. The median value also decreased between 2010 and 2013 and increased between 2013 and 2017, but remained in 2017 lower than 2010.

Indicators of inequality

The large difference between the median and the mean net wealth shows the high inequality of the distribution of this variable. This evidence, which is not specific to the Portuguese case, is driven by a highly skewed distribution of assets and by the fact that a large proportion of households do not have debt (Costa, 2016). Several factors contribute to the inequality of the distribution of net wealth, such as the fact that saving rates tend to increase with the level of wealth (Alves and Cardoso, 2010; Banco de Portugal, 2016) and that households with higher levels of wealth are able to have more diversified asset portfolios with different levels of risk and therefore higher expected returns (Fagereng *et al.*, 2016)[6].

Table 1 includes a set of other indicators often used to measure inequality of the net wealth distribution. The figures shown are broadly in line with those recorded for the euro area average (HFCN, 2016b). In 2017, the group of 10% of households with the highest net wealth in Portugal held about 54% of total net wealth, while the group of 50% of households with the

3. The ISFF includes data for 4004, 6207 and 5924 households with complete interviews in the first, second and third waves, respectively. The results presented in this article refer to extrapolated values for the population, i.e., they were obtained from the weighted answers of each sample household, using as weights the number of households in the population with similar characteristics. When analysing the results, the uncertainty underlying the production of the survey data was taken into account by testing the equality of the statistics presented in this article. These tests use standard errors that reflect the uncertainty underlying the imputation process of missing answers and also the sample selection. The formula for calculating these standard errors can be found in the note on how to use the ISFF database available in the "ISFF Database" tab of the ISFF page.

4. The main concepts used in this article can be found in the Appendix.

5. The median value corresponds to the 50th percentile of a distribution. The percentiles divide the population in ascending order of the data into 100 equal parts (e.g., a median net wealth of 74.8 thousand euros means that 50 per cent of the households living in Portugal have a net wealth below that value).

6. These factors also contribute to a greater inequality of net wealth in relation to income and of income in relation to consumption (Costa, 2016). In Portugal, in the most recent period, the smoothing mechanisms of consumption against temporary shocks in income may also have contributed to the lower inequality of consumption in relation to income (Alves *et al.*, 2020).

	ISFF 2010	ISFF 2013	ISFF 2017	Change 2010-13	Change 2013-17	Change 2010-17
Net wealth						
Mean (EUR, thousands)	172.8	143.3	162.3	-17**	13*	-6
Median (EUR, thousands)	86.1	68.0	74.8	-21***	10**	-13***
Gini coeficient of net wealth (%)	66.0	68.4	67.9	2,5	-0,5	2
Percentage of total net wealth held by:						
Top 10% net wealth group	51.6	53.0	53.9	1,5	0,8	2,3
Bottom 50% net wealth group	8.7	7.2	8.1	-1,5*	0,9	-0,6
40% of households between the percentiles 50 and 90	39.7	39.8	38.0	0,1	-1,8	-1,7
Percentile ratios						
P75/P25	7.7	9.8	7.7	2,1*	-2,1*	0
P90/P10	197.9	701.9	365.3	504*	-336.6	167.4*
P90/P50	3.9	4.2	4.3	0,3	0,1	0,4

TABLE 1. Net wealth and inequality indicators.

Notes: The values of 2010 and 2013 were adjusted for inflation. The Gini coefficient measures the concentration of the distribution of a given variable, variating between zero, in the case of minimal concentration (for instance, when all households have the same net wealth) and 100, in the case of maximal concentration (for instance, when a single household holds all the net wealth). ***, ** and * indicate that the test on the equality of the statistics obtained between the different waves of the survey is rejected at 1%, 5% and 10%, respectively.

lowest net wealth had about 8%. The net wealth of the household in the 90th percentile of this variable was 4.3 times higher than that of the household corresponding to the 50th percentile and 365.3 times higher than that of the household corresponding to the 10th percentile.

As mentioned, the mean net wealth returned in 2017 to a level close to that of 2010. The median, also increased in the period between 2013 and 2017, but remained below the level of 2010. These distinct developments suggest a slight increase in the inequality of net wealth distribution between 2010 and 2017. In fact, most inequality indicators increased between 2010 and 2013 and had a slight reduction between 2013 and 2017, remaining in 2017 higher than in 2010. Nevertheless, in most cases it is not possible to reject the equality of the values of the different periods. One exception is the ratio between the 90th and 10th percentiles, which increased between 2010 and 2013 and remained higher in 2017 than in 2010. By contrast, the ratio between the 75th and the 25th percentiles increased between 2010 and 2013, but reversed this movement between 2013 and 2017. These examples show that measuring changes in inequality is very sensitive to the type of indicator used. Overall, the various indicators suggest that over the period 2010-2017 there were no major changes in the degree of net wealth inequality in Portugal.

Net wealth by groups of households

The ISFF data allow to characterize the net wealth distribution of households with different demographic and socioeconomic attributes. In this article, the

analysis focuses mainly on household groups that differ in the following dimensions: level of net wealth, level of income and age of the reference person[7]. When analysing the results it is important to keep in mind that households can move from one group to another between different moments in time. In the case of age, this immediately reflects the ageing of individuals and, in the case of income and wealth, depends on the developments in the financial situation of households across time. These transitions may have been particularly relevant in the period under review given the significant adjustment in the Portuguese economy.

In 2017, the median value of net wealth ranged from less than a thousand euros in the lowest class of net wealth (i.e., in bottom 20% net wealth group) to more than 500 thousand euros in the highest class (i.e., in top 10% net wealth group) (Table 2). As mentioned above, median net wealth increased in real terms between 2013 and 2017, after falling over the previous three years. These developments were common to most classes of net wealth. In 2017, the median net wealth was in all classes below the 2010 level, but the difference in values is only significant in classes of net wealth below the 80th percentile.

Household wealth and income are positively related. Several factors contribute to this evidence. On the one hand, households with higher income are more likely to save, thus accumulating higher levels of wealth. On the other hand, households with a higher level of wealth tend to earn higher income from asset ownership. The ISFF data reflect this positive correlation. In fact, although in each class of income there are households belonging to all classes of wealth, the proportion of households with low wealth is higher in the lower income classes and the proportion of households with high wealth is higher in the higher income classes. (Figure 1). In 2017, the median value of net wealth was 33 thousand euros in the bottom 20% income group and almost 300 thousand euros in the top 10% income group (Table 2).

In contrast to wealth classes, when households are grouped by income classes, the reduction in net wealth between 2010 and 2013 and its increase between 2013 and 2017 is not common to all classes. Between 2010 and 2013, the reduction in net wealth was particularly marked in the lowest income class and in the 60th to 90th percentile classes. Between 2013 and 2017, the increase in net wealth is only statistically significant in the highest income class. In 2017, net wealth values do not appear to be very different from 2010 in most groups. The exception is the lowest income group, which had in 2017 a lower net wealth than the households in this group in 2010. By age

7. In Costa (2016) this analysis is also carried out in detail for households that differ by the number of household members and by the educational level or labour status of the reference person. The results of the three ISFF waves with all these breakdowns are available in the tables provided in the ISFF page. For some variables, the results of ISFF 2013 shown in Costa (2016) differ from those included in this article and those on the ISFF page, due to revisions in data resulting from methodological changes.

	Median (EUR, thousands)			Change (%)		
	ISFF 2010	ISFF 2013	ISFF 2017	2010-13	2013-17	2010-17
Total	86.1	68.0	74.8	-21***	10**	-13***
Net wealth percentile						
<=20	1.7	0.4	0.9	-76***	118**	-47*
20-40	38.3	25.0	33.0	-35***	32**	-14
40-60	86.2	68.0	74.8	-21***	10**	-13***
60-80	157.7	128.5	136.6	-19***	6	-13***
80-90	264.5	221.5	247.4	-16***	12**	-6
>90	553.6	446.0	516.1	-19**	16**	-7
Income percentile						
<=20	46.3	23.5	33.0	-49***	40	-29**
20-40	58.1	56.5	51.2	-3	-9	-12
40-60	77.4	68.1	64.8	-12	-5	-16
60-80	98.9	77.6	91.2	-22**	18	-8
80-90	151.4	114.6	135.2	-24**	18	-11
>90	260.8	217.7	291.6	-17	34***	12
Age of the reference person						
<35	32.7	21.5	14.1	-34	-34	-57**
35-44	73.8	60.9	62.6	-17	3	-15
45-54	109.2	72.8	86.3	-33***	19*	-21**
55-64	128.4	101.1	94.6	-21**	-6	-26***
65-74	88.4	89.2	87.8	1	-2	-1
>=75	68.9	66.6	79.7	-3	20	16

TABLE 2. Median net wealth, by household characteristics.

Notes: The values of 2010 and 2013 were adjusted for inflation. ***, ** and * indicate that the test on the equality of the statistics obtained between the different waves of the survey is rejected at 1%, 5% and 10%, respectively.

of the reference person, net wealth follows a pattern according to the life-cycle theory, increasing until retirement and falling thereafter (Table 2). The increase in early life is steeper than the decrease in older age groups, which renders a higher level of net wealth in households whose reference person is older than in those whose reference person is younger. This might be due to the fact that households with older individuals maintain wealth in order to leave inheritances and for precautionary reasons, due to uncertainty about the evolution of their financial situation and health.

In 2017, the median net wealth ranged between around 14 thousand euros for households whose reference person is younger, and around 95 thousand euros for households whose reference person is between 55 and 64 years old. Thus, net wealth shows a lower degree of heterogeneity by age groups than by income classes. In fact, the composition by net wealth classes is relatively similar in most age groups (Figure 2). The largest difference is observed in households whose reference person is under 35 years old. In this group the share of households with low net wealth is much higher than in the remaining groups.

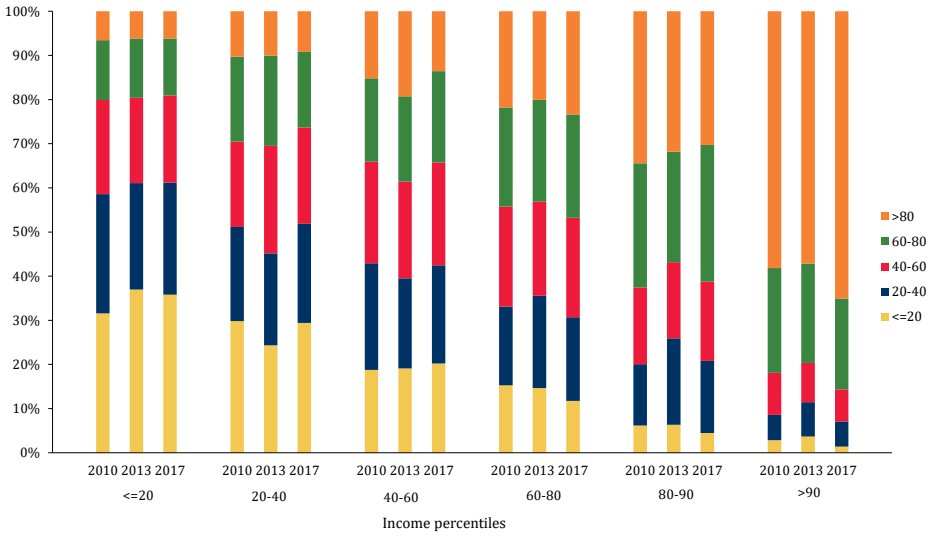

FIGURE 1: Percentage of households belonging to different net wealth classes, by income class.

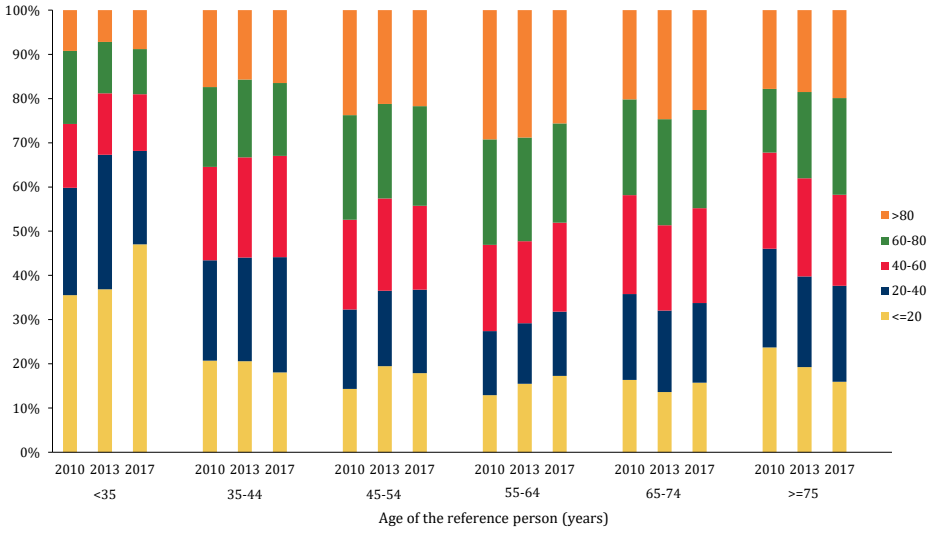

FIGURE 2: Percentage of households belonging to different net wealth classes, by age group.

As with income classes, the reduction in net wealth between 2010 and 2013 and its increase between 2013 and 2017 did not occur in all age groups. In 2017, households whose reference person is under 35 or between the ages of 45 and

64 had a lower net wealth than households in these groups in 2010. In the remaining groups, differences are not statistically significant.

Net wealth composition

In 2017, the mean net wealth of 162.3 thousand euros corresponds to 186.4 thousand euros in assets deducted by 24.1 thousand euros of debt (Table 3). Of the total assets, about 88% were real assets and about 12% corresponded to financial assets.

The reduction in mean net wealth between 2010 and 2013 was due to a reduction in the value of assets, mainly real assets, as debt also declined significantly. Between 2013 and 2017, debt fell again contributing to the increase in net wealth. During this period, the mean values of real and financial assets increased. However, the differences between the 2013 and 2017 values are not statistically significant.

The mean values of assets and debt of Table 3 were calculated considering all households living in Portugal, regardless of whether or not they had any assets or debt. One of the advantages of the ISFF data over macroeconomic data is that it enables to quantify the number of households that have certain assets and debts, as well as the value per household of these assets and debts by considering only those households that own them. The next sections analyse this information. In the analysis of the total value of each type of assets and debts, both the median and mean values are used, in order to illustrate the skewness of each variable. By household groups, given the smaller number of observations, the analysis focuses only on median values, so as to minimize the impact of extreme values that may not be representative of the groups in question.

	Mean (EUR, thousands)			Change (%)		
	ISFF 2010	ISFF 2013	ISFF 2017	2010-13	2013-17	2010-17
Net wealth	172.8	143.3	162.3	-17**	13*	-6
Total assets	205.9	172.5	186.4	-16***	8	-9*
Real assets	182.0	150.9	163.4	-17***	8	-10*
Financial assets	23.9	21.6	22.9	-9	6	-4
Debt	33.1	29.2	24.1	-12***	-17***	-27***

TABLE 3. Households net wealth, assets and debt, mean values considering all households.

Note: The values of 2010 and 2013 were adjusted for inflation. ***, ** and * indicate that the test on the equality of the statistics obtained between the different waves of the survey is rejected at 1%, 5% and 10%, respectively.

Assets: participation rates and values conditional on participation

Real assets

In 2017 about 91% of households had real assets (Table 4). The median and mean values of these assets for the households that held them were about 100 thousand euros and 180 thousand euros, respectively.

Among real assets, the main residence and motor vehicles are the most frequent assets. In 2017, both the main residence and motor vehicles are owned by about 75% of all the households. Other real estate properties, self-employment businesses and other valuables are owned by around 30%, 14% and 11% of households, respectively. These data confirm that Portugal is

	Real assets	Main residence	Other real estate properties	Self-employment business	Vehicles	Valuables
	Participation in assets (%)					
ISFF 2010	91.5	76.0	29.1	9.3	73.5	8.0
ISFF 2013	90.0	74.7	30.3	12.7	73.3	9.6
ISFF 2017	90.7	74.5	29.2	14.1	74.6	11.0
	Change (p.p.)					
2010-13	-2*	-1	1	3***	0	2
2013-17	1	0	-1	1	1	1
2010-17	-1	-1	0	5***	1	3***
	Median value of assets conditional on participation (EUR, thousands)					
ISFF 2010	113.6	109.4	71.5	54.7	6.1	2.7
ISFF 2013	101.1	92.5	50.7	15.8	5.1	5.1
ISFF 2017	100.2	99.7	50.0	23.7	5.0	1.5
	Change (%)					
2010-13	-11***	-15***	-29***	-71***	-16**	85**
2013-17	-1	8**	-1	50	-1	-70***
2010-17	-12***	-9***	-30***	-57***	-17**	-44
	Mean value of assets conditional on participation (EUR, thousands)					
ISFF 2010	198.9	133.1	159.3	265.5	10.9	22.8
ISFF 2013	167.7	109.9	115.9	201.0	8.4	21.5
ISFF 2017	180.1	119.2	121.4	219.9	9.6	8.7
	Change (%)					
2010-13	-16**	-17***	-27**	-24	-23***	-6
2013-17	7	8***	5	9	14***	-60***
2010-17	-9*	-10***	-24***	-17	-12***	-62***

TABLE 4. Real assets participation, median and mean values, by asset type.

Note: The values of 2010 and 2013 were adjusted for inflation. ***, ** and * indicate that the test on the equality of the statistics obtained between the different waves of the survey is rejected at 1%, 5% and 10%, respectively.

among the euro area countries where the percentage of homeowners is higher. (HFCN, 2016b)[8]

The real asset with the highest median value is the main residence (around 100 thousand euros in 2017), followed by other real estate properties and self-employment businesses (50 thousand euros and around 24 thousand euros, respectively, in 2017). Motor vehicles and other valuables naturally have significantly lower median values (5 thousand euros and 1.5 thousand euros, respectively, in 2017).

As noted, the median is an indicator less affected by extreme values than the mean. Due to the positive skewness of the assets distribution, the mean is higher than the median for all types of assets. Among the main assets, the difference between the two values is much wider in self-employment businesses and, to a lesser extent, in other real estate properties, than in the main residence. The self-employment businesses even have a mean value much higher than the main residence. This is due to the fact that these assets are more heterogeneous and more concentrated in wealthier families than the main residence. The top 10% net wealth group owns about 30% of the total value of households' main residences, about 70% of the value of other real estate properties and about 90% of the value of self-employment businesses.

The only significant change in the participation rates of the main types of real assets was the increase in the percentage of households with businesses between 2010 and 2013. This may reflect the fact that some individuals who have lost their jobs have started self-employed activities. The percentage of households with businesses is still higher in 2017 than in 2010 both when all households are considered as well as in most wealth, income and age groups[9]. The participation rate in real estate assets did not have significant changes for households as a whole but is in 2017 lower than in 2010 for some specific groups. In the case of the main residence, the percentage of owners decreased in the lowest wealth and income classes and for households whose reference person is under 35 years old. These developments might have been caused by tighter borrowing conditions and, in the most recent period, also by the rise in real estate prices.

8. According to data from the 2013/14 HFCS wave, in the euro area 60% of households owned the main residence and 24% owned other real estate properties. The real estate ownership rates are very heterogeneous across countries and the aggregate euro area figure is pushed downwards by larger countries. For example, the homeownership rate was below 60% only in Germany, France, the Netherlands and Austria. Differences between countries largely reflect institutional factors (for example, in the Portuguese case, the absence for several decades of an effective housing rental market).

9. The data by net wealth classes, income classes and age groups analysed in this section can be found in the annex to this review - Additional tables for the article "Portuguese Household Finance and Consumption Survey: results for 2017 and comparison with the previous waves" – which is available here.

The median value of real assets decreased between 2010 and 2013. This reduction was seen in most classes of wealth, income and age and was common to the main types of real assets. The context of a severe recession, which resulted in a reduction in real estate prices, contributed to these developments. Between 2013 and 2017, changes in the value of assets were more heterogeneous. The median value of the main residence increased, in line with the recovery in real estate prices. The median value of most other real assets did not change significantly. By groups of households, the median value of total real assets increased in all net wealth classes and most income classes, but the increase is only statistically significant in groups with net wealth above the 40th percentile. By age group, it is worth noting a reduction in the median value of real assets in households whose reference person is younger, what partly reflects the aforementioned reduction in the percentage of households owning the main residence.

Financial assets

In 2017, around 97% of households had financial assets and their median and mean values were around 5 thousand euros and 24 thousand euros, respectively (Table 5). These values are significantly lower than those of real assets, which explains the fact that, although the participation in financial assets is higher, their weight in total household assets is much lower.

The high participation of households in financial assets is driven by the fact that almost all households have sight accounts. According to the ISFF 2017, savings accounts are held by almost half of households, voluntary pension schemes by about 13%, tradable assets (mutual funds, debt securities and quoted shares) by around 6% and other financial assets by 9% of households. The predominance of deposits in household financial assets is common to other euro area countries, although it is more noticeable in Portugal than in most other countries. (HFCN, 2016b).

Savings accounts are the financial asset with the highest median value (10 thousand euros) and sight accounts are the asset with the lowest value (around one thousand euros). However, the mean of tradable assets is close to the mean of savings accounts (almost 30 thousand euros), partly reflecting the fact that the former are more concentrated in wealthier households. The top 10% net wealth group holds about 50% of the total value of savings accounts and about 80% of the total value of tradable assets.

Participation in sight accounts increased between 2010 and 2013 and remained unchanged in subsequent years. Savings accounts participation rate also increased between 2010 and 2013, but this change was partly reversed between 2013 and 2017. This latter development may have been caused by the reduction in the remuneration of savings accounts, which had increased in the period of the crisis, partly due to the need of retail funding by banks. Participation in other financial assets also decreased between 2013

	Financial assets	Sight accounts	Savings accounts	Tradable assets	Voluntary pension schemes	Other
	Participation in assets (%)					
ISFF 2010	95.0	93.7	44.8	7.5	16.1	9.2
ISFF 2013	96.3	95.6	48.3	8.1	17.2	10.5
ISFF 2017	96.6	96.0	46.5	6.4	13.2	9.0
	Change (p.p.)					
2010-13	1**	2***	4**	1	1	1
2013-17	0	0	-2	-2**	-4***	-2*
2010-17	2***	2***	2	-1	-3***	0
	Median value of assets conditional on participation (EUR, thousands)					
ISFF 2010	5.4	1.1	10.9	7.9	5.5	5.5
ISFF 2013	5.1	1.0	11.3	5.0	3.8	5.1
ISFF 2017	4.6	1.1	10.0	5.7	4.0	5.0
	Change (%)					
2010-13	-6	-7	3	-37	-31*	-7
2013-17	-10	4	-11	15	5	-1
2010-17	-15*	-3	-9	-27	-28*	-9
	Mean value of assets conditional on participation (EUR, thousands)					
ISFF 2010	25.1	3.2	30.1	38.2	17.1	19.3
ISFF 2013	22.5	2.6	26.1	19.3	11.4	29.0
ISFF 2017	23.8	4.2	28.7	29.8	11.0	24.0
	Change (%)					
2010-13	-11	-20	-13	-50	-33	50
2013-17	6	67***	10	55**	-4	-17
2010-17	-5	33***	-5	-22	-36***	24

TABLE 5. Financial assets participation, median and mean values, by asset type.

Note: The values of 2010 and 2013 were adjusted for inflation. ***, ** and * indicate that the test on the equality of the statistics obtained between the different waves of the survey is rejected at 1%, 5% and 10%, respectively.

and 2017. These changes in participation in different types of financial assets were broadly common across household groups (although in most cases the changes are not statistically significant).

The median value of financial assets decreased between 2010 and 2017. By asset type, the only significant change in median values was a reduction in the amount invested in voluntary pension schemes between 2010 and 2013. The mean values of both sight accounts and tradable assets increased significantly between 2013 and 2017. This different evolution of the mean and median values is due to an increase in the higher amounts invested in these assets. As a matter of fact, by household groups, the increase in the median value of sight accounts took place in the top net wealth and income classes and that of tradable assets in the top net wealth class. In the lower classes of net wealth

and income, the median value of all financial assets fell between 2010 and 2013 and remained in 2017 at a lower level than in 2010.

Debt

Participation rates and values conditional on participation

In 2017, around 46% of households living in Portugal had debt. (Table 6). The share of mortgages of the main residence (i.e., loans using the main residence as collateral) on total debt were above 80%. This very high share is due to both a high participation rate (over 30% of households) and a high value (median and mean in 2017 of around 50 thousand euros and 62 thousand euros, respectively). Mortgages on other properties also have a high value (median and mean of around 50 thousand euros and 73 thousand euros, respectively) but are much less frequent (only 4% of households have this type of debt). The second most common type of debt is non-mortgage loans, which in 2017 were held by about 18% of households and had a median value of around 4 thousand euros. About 9% of households had credit lines, overdrafts or credit cards debts, with a median value of 500 euros. In Portugal, the percentage of households with non-mortgage debt is lower than in the euro area average, but the percentage of households with mortgages is higher, which implies a higher median value of total debt per household. (HFCN, 2016b).

The percentage of indebted households did not change significantly between 2010 and 2017. There was, however, a recomposition of debt, with a reduction in the percentage of households with mortgages and an increase in the percentage of households with non-mortgage debt. Participation in non-mortgage debt increased from 13.4% in 2010 to 17.9% in 2017. This increase took place mainly between 2010 and 2013 and was relatively widespread across household groups. In the case of mortgages, the reduction in participation was more gradual and less widespread. Between 2010 and 2017, the participation rate in main residence mortgages dropped from 34% to about 32% and, in mortgages of other properties, from 5.7% to 4%. The reduction in the participation in main residence mortgages is statistically significant for households with income between the 40^{th} and 60^{th} percentiles and for the youngest households. In mortgages on other properties, there are statistically significant reductions in the two lowest income classes and in the 55-64 age group.

Considering the households with debt, debt decreased between 2010 and 2013 and again between 2013 and 2017. The median value decreased from about 60 thousand euros in 2010 to 35 thousand euros in 2017 and the mean from about 72 thousand euros to about 53 thousand euros.

By net wealth classes, the decrease in the debt median value was more concentrated in the first period in higher wealth classes and in the second

	Total	Main residence mortgage	Other property mortgages	Non-mortgage loans	Credit lines, overdrafts and credit cards
	Participation in debt (%)				
ISFF 2010	46.2	34.0	5.7	13.4	8.9
ISFF 2013	45.9	32.7	3.7	17.3	8.8
ISFF 2017	45.7	31.8	4.0	17.9	8.6
	Change (p.p.)				
2010-13	0	-1	-2***	4***	0
2013-17	0	-1	0	1	0
2010-17	-1	-2*	-2***	4***	0
	Median value of debt conditional on participation (EUR, thousands)				
ISFF 2010	59.4	68.5	72.6	5.5	1.1
ISFF 2013	49.2	64.6	59.7	4.1	0.7
ISFF 2017	35.0	50.3	49.7	4.4	0.5
	Change (%)				
2010-13	-17***	-6	-18*	-26**	-38***
2013-17	-29***	-22***	-17	9	-19
2010-17	-41***	-27***	-32***	-19*	-50***
	Mean value of debt conditional on participation (EUR, thousands)				
ISFF 2010	71.6	78.2	87.3	9.4	3.7
ISFF 2013	63.7	73.7	84.6	10.4	2.6
ISFF 2017	52.8	61.8	72.6	8.0	1.2
	Change (%)				
2010-13	-11***	-6	-3	11	-30
2013-17	-17***	-16***	-14	-23***	-52***
2010-17	-26***	-21***	-17	-15	-66**

TABLE 6. Debt participation, median and mean values, by debt type.

Note: The values of 2010 and 2013 were adjusted for inflation. ***, ** and * indicate that the test on the equality of the statistics obtained between the different waves of the survey is rejected at 1%, 5% and 10%, respectively.

period in lower wealth classes. When analysing these changes it is important to keep in mind that the composition of household groups changes over time and that these changes may be especially relevant in the case of net wealth given the leverage effect. This effect means that when the value of assets declines, households with higher debt (more leveraged) have more significant reductions in net wealth than the others, and that the opposite happens when the value of assets increases. Therefore, given the reduction in the value of real assets between 2010 and 2013 and its increase in the subsequent period, there may have been a shift of the most indebted households to lower classes of net wealth in the first period and to higher classes in the second period.

The debt decline between 2010 and 2017 was widespread across income classes. Between 2010 and 2013, the reduction occurred mainly at the bottom of the distribution and between 2013 and 2017 at the top. In the first period,

these developments may have resulted, from a decline in demand for credit by households and tighter lending conditions by banks. In the second period, the decline in the debt values may partially reflect early repayments of mortgage loans by households in a context of the low level of deposit interest rates and an increase in the differential between loan and deposit interest rates (Banco de Portugal, 2018).

By age, debt had a significant reduction in the household groups whose reference person is under 55 years old, with the reduction in the two youngest classes occurring mainly between 2013 and 2017. The reduction in debt value of households whose reference person is under 35 years old, partly reflects the lower percentage of households with main residence mortgages.

Between 2010 and 2017, the reduction in median values was common to all types of debt. In non-mortgages loans, the reduction occurred between 2010 and 2013. In main residence mortgages, the reduction occurred mainly in the most recent period. In the case of mortgages on other properties, the reduction occurred gradually in both periods.

The median values of mortgages are lower in 2017 than in 2010, in nearly all household groups. Differences are, however, statistically significant in only a few subgroups: as regards main residence mortgages, in wealth and income classes below the 80th percentile and in age groups below 55 years old; in the case of other properties mortgages, in higher wealth and income classes, and in the 55-64 age group.

Indebtedness ratios

Compared with macroeconomic data, ISFF data has the advantage of enabling the computation of indebtedness ratios considering only the households that hold some form debt (Costa and Farinha, 2012). These indicators are important to evaluate the impact of debt on households' financial situation, as well as on the economy as a whole. When facing high indebtedness situations, households have a higher probability of default, as well as a higher probability of facing liquidity constraints, which may amplify the reaction of consumption to income fluctuations (Costa, 2012).

Between 2010 and 2017, both the debt-service income ratio, which measures the households' capacity to serve their debt in the short-term, and the debt-income ratio, which assesses the debt burden in a longer perspective, had significant reductions (the median values of these ratios declined from 20.3% to 14.4% and from 224.4% to 132.6%, respectively) (Table 7). To this evolution has contributed, throughout the whole period, the reduction of the outstanding amount of debt per household referred previously and, between 2013 and 2017, also the increase in income, largely associated to the recovery in

	Debt-service income ratio	Debt-income ratio	Debt-asset ratio
	Median values for the indebted households (%)		
ISFF 2010	20.3	224.4	34.0
ISFF 2013	16.8	198.5	37.8
ISFF 2017	14.4	132.6	31.5
	Change (p.p.)		
2010-13	-3***	-26**	4*
2013-17	-2***	-66***	-6***
2010-17	-6***	-92***	-3

TABLE 7. Debt burden indicators.

Note: ***, ** and * indicate that the test on the equality of the statistics obtained between the different waves of the survey is rejected at 1%, 5% and 10%, respectively.

employment and wages[10]. The debt-service income ratio also benefited from the reduction of the EURIBOR interest rates, in a context in which the ECB has kept an accommodative monetary policy along the whole period. The median value of the debt-asset ratio, which measures the households' degree of solvency in a long term perspective (it measures the households' capability of paying their debt, based on the sale of their assets) was 31.5% in 2017, a value that is not significantly different from the one observed in 2010. The reduction of the value of assets between 2010 and 2013 contributed to the increase in debt-asset ratio in this period. This change was reverted between 2013 and 2017.

The favourable evolution of the debt-service and debt-income ratios, between 2010 and 2017, was common to the majority of both net wealth and income classes. By age group, these ratios also recorded a generalized reduction, but the values of 2017 are not statistically different from the ones of 2010 for most of the groups above 54 years old. The debt-asset ratio decreased in some of the upper classes of net wealth and income, while in the remaining classes the values of 2010 and 2017 are not significantly different.

Credit demand and credit constraints

The ISFF has a set of qualitative questions that aim to assess the households' credit demand and credit constraints, in the three years before the interview.

According to the ISFF 2017, 19.6% of the households applied for credit (Table 8). This percentage is lower in the two lowest income classes than in

10. According to the ISFF, the income per household decreased between the first two waves of the survey and increased in the third wave.

	Applications for credit (% of total households)	Refusals [(a)] (% of households that applied)	Perceived credit constraints (% of total households)	Credit constratins (% of total households)
ISFF 2010	23.4	14.2	4.1	6.0
ISFF 2013	14.4	13.3	5.7	7.1
ISFF 2017	19.6	8.2	5.6	6.9
	Change (p.p.)			
2010-13	-9***	-1	2**	1
2013-17	5***	-5**	0	0
2010-17	-4***	-6***	2**	1

TABLE 8. Applications for credit and credit constraints.

Notes: The values of 2010 and 2013 were adjusted for inflation. ***, ** and * indicate that the test on the equality of the statistics obtained between the different waves of the survey is rejected at 1%, 5% and 10%, respectively. (a) Includes households with refused loan applications or only partially satisfied.

the remaining classes, decreases with the age of the reference person and it is higher in the lower net wealth classes than in the higher net wealth classes. Among the households that applied for credit, 8.2% had loan applications refused or partially satisfied . Additionally, 5.6% of the households did not apply for credit, although they wanted to get a loan, because they considered that their loan applications would have been rejected.

A household is considered to face credit constraints whenever the household would like to have credit but is not able to get it (regardless of having applied for credit or not). The percentage of households with credit constraints was 6.9% in 2017, reaching values above 10% for the households in the lowest net wealth class and for the households whose reference person has less than 45 years old. In the period 2010-2017, the percentage of households with credit constraints does not have statistically significant changes when all households are considered, but increases in the lowest income class and in the age group 35-44 years old. The households' perceived credit constraints increased significantly between 2010 and 2013 (from 4.1% to 5.7%) and remained relatively stable between 2013 and 2017 (5.6%). Among the credit constrained households, the share of those who did not have refused loan applications but have perceived credit constraints has increased from approximately 50% in 2010, to approximately 75% in 2013 and 2017.

The percentage of households that applied for credit has decreased from 23.4% in 2010 to 14.4% in 2013, and recovered partially in 2017, to 19.6%. By household groups, the percentage of households that applied for credit in 2017 is lower than in 2010 in the highest net wealth classes, in the highest income class and in those whose reference person has less than 35 years old.

The decline in applications is partially due to changes in the perceived credit constraints mentioned earlier. As a whole, the percentage of households that applied for credit or wanted credit, but did not apply decreased from 25.5% in 2010, to 18.7% in 2013 and increased to 23.4% in 2017. This evolution suggests that the "unconstrained credit demand", i.e., not conditioned by perceptions about the banks' behaviour, decreased from 2010 to 2013 and recovered in 2017 to a value close to 2010. Therefore, the relative stability of the percentage of households with credit constraints, between 2010 and 2013, seems to be in part the result of a decrease in the percentage of households that wanted credit, in a context of the high uncertainty in the economy.

Conclusions

According to the ISFF, in 2017 each household in Portugal had on average 186.4 thousand euros in assets and 24.1 thousand euros in debt, which rendered a net wealth per household of 162.3 thousand euros. The median value of net wealth, which is least affected by extreme values, stood at 74.8 euros. The fact that the median value is almost half of the mean value reflects the high inequality that usually characterizes the distribution of wealth.

Real estate assets account for a large share of households wealth in Portugal. About 75% of households own their main residence and about 30% own other properties. The main residence is the asset with the highest median value. In the case of financial assets, sight accounts are the only asset held by nearly all households and savings accounts are the asset with the highest median value. In total, around 46% of the households have debt and about 32% of the households have mortgages on the main residence, which is the most common type of debt.

In real terms, mean net wealth increased between 2013 and 2017, reversing the reduction observed between 2010 and 2013. The median value also decreased between 2010 and 2013 and increased between 2013 and 2017, but remained in 2017 lower than in 2010. The opposite direction of the changes in the net wealth in the two sub-periods was determined by a distinct evolution of the value of assets, especially real assets, as debt decreased in both sub-periods. Between 2010 and 2013, the median value of the main types of real assets declined. Between 2013 and 2017, the median value of the main residence increased, in line with the recovery in real estate prices, but the values of the remaining assets did not change significantly.

The median value of debt for indebted households declined markedly between 2010 and 2017, and this reduction was common across types of debt. Mortgages declined in both sub-periods, while for the remaining liabilities the decline was concentrated in the period between 2010 and 2013. The decrease in total household debt also reflected a change in the composition by type of debt. Although the percentage of indebted households remained broadly

stable between 2010 and 2017, the percentage of households with mortgages declined and the percentage of households with other type of debt increased.

Between 2010 and 2017 there were no major changes in the degree of inequality of net wealth in Portugal. However, by household groups, some differentiation in net wealth changes has taken place in this period. Analysis by household groups shows that in 2017 the median net wealth was lower than in 2010, in most wealth classes below the 80th percentile, in the lowest income class and in households whose reference person is under 35 years old or between 45 and 64 years old. The decline of wealth in these groups essentially reflected the reduction in the values of real and financial assets. In households whose reference person is under 35 years old, as well as in those in the lowest wealth and income classes, the percentage of households owning the main residence has decreased, contributing to the lower value of real assets held by these household groups. In the youngest age group, participation in main residence mortgages also declined. These developments might have been caused by tighter borrowing conditions and, in the most recent period, also by the rise in real estate prices.

Overall, between 2010 and 2013, for indebted households, the debt reduction was more concentrated in households in the lower income classes. In contrast, between 2013 and 2017, the reduction in households' debt was observed in households with higher incomes. This pattern may have resulted, in the first period, from a lower demand for credit by households and tighter borrowing conditions by banks. The ISFF data suggest that between 2010 and 2013, the percentage of households demanding credit declined, both effectively and due to the increase of perceived credit constraints. Between 2013 and 2017, the debt reduction, in a context of the low level of deposit interest rates and an increase in the differential between loan and deposit interest rates, may partly reflect the existence of incentives for early repayments by households with financial the capacity to do so.

The reduction in the outstanding amounts of loans, together with the decrease in money market interest rates and, in the most recent period, the rise in income, have led to a substantial reduction in the median of the debt-income ratio and debt-service income ratio between 2010 and 2017. These developments were common across most classes of net wealth and income and to the age groups below 54 years. The median value of the debt-asset ratio increased between 2010 and 2013 and decreased between 2013 and 2017, returning to a value close to the one of 2010. Changes in this ratio were due to fluctuations in opposite directions in the asset values, in particular in real estate.

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Appendix: Definitions

Household: group of people who live together in the same private dwelling and share expenditures, including the joint provision of the essentials of living, regardless of family ties.

Reference person: selected amongst household members according to the Canberra definition (United Nations, 2011). In most cases it corresponds to the major income earner.

Net wealth: Difference between the value of all real and financial assets and the value of total debt at the time of the interview.

Real assets: value of the household main residence, other real estate properties, vehicles, self-employment businesses and other valuables owned by the household[11].

Self-employment businesses: value of the participation of the household in non-publicly traded businesses, in which any household member works as self-employed or has an active role in running the business.

Financial assets: value of the sight deposits, savings deposits (including savings certificates and treasury certificates), financial tradable assets (investment funds, debt securities and quoted shares), voluntary pension plans and other financial assets.

Other financial assets: all of the remaining financial assets, including, for instance, the value of participations in unquoted businesses, in which any household member participates only as an investor and money owed to the household as private loans.

Total debt: outstanding amount of all debts, which includes loans having real estate properties as collateral, non-mortgage loans, bank overdrafts, credit lines and credit card debts.

Household income: includes all types of income received by any household member. Corresponds to the gross income (i.e., income before the payment of taxes and mandatory retirement contributions by the workers) received in the civil year before the interview.

11. This definition of real assets in not in line with the European System of National Accounts, because it includes vehicles and participation in businesses.

Non-technical summary

January 2020

Non-performing loans and bank lending: Evidence for Portugal

Carla Marques, Ricardo Martinho, Rui Silva

One consequence of the international financial and sovereign debt crises was the pronounced and system-wide increase of non-performing loans (NPLs), which merited particular attention from competent authorities, especially given its potential impact in banks' credit supply and ultimately on economic growth. This is a relevant topic in many European Countries, including Portugal where, at its peak, in mid-2016, the NPLs accounted for almost 18% of banks' total loans.

We analyse the impact of Portuguese banks' NPLs on the loan supply to non-financial corporations (NFCs) in the 2009-2018 period, building on granular data at the level of individual bank-firm relationship. Our paper adds to the literature as we employ a methodology and identification strategy that allows to disentangle the roles of credit demand and credit supply, taking advantage of the high prevalence of Portuguese firms with multiple bank relationships. Moreover, our sample includes a period where a significant increase in banks' NPLs co-existed with a sharp reduction in credit but also a more recent period of pick-up in firms' investment and credit demand. The analysis focuses mainly in the existing credit relationships (intensive margin) but we also investigate the dynamics of new credit relationships (extensive margin) to achieve a more comprehensive view about the relation between banks' NPLs and firms' access to credit.

We find that, when controlling for loan demand and several bank characteristics, there is no evidence that NPL ratios per se constrained bank loan supply to corporates in this period. More specifically, on average, a firm borrowing from two banks that only differ in the level of the NPL ratio did not observe a significant difference in the respective loan growth. This result holds for both the crisis and the post crisis periods (2009-2015 and 2016-2018, respectively), regardless of the firm size and for firms with low and medium credit risk. Still, there is evidence of a positive, although statistically weak, relation between NPLs and credit granted to performing NFCs with high credit risk, which could reflect credit support to riskier firms, whose viability could have been difficult to assess, special in a period of challenging and less predictable macroeconomic circumstances. These conclusions are robust

to different definitions of both dependent and explanatory variables and to alternative/additional bank-level and credit demand controls.

In turn, we find that other bank variables impacted on credit supply, namely, we find: i) a positive relation with banks' voluntary capital buffer (i.e. difference between observed capital ratios and the respective minimum requirement) during the crisis / NPL buildup period; ii) a negative relation with the recourse to ECB funding; and iii) a negative relation with the share of household credit on banks' total credit, potentially reflecting differences in banks' business models and in risk appetite. Finally, we find that higher NPLs were associated with a lower propensity to initiate new credit relationships in the post crisis period (2016-2018).

	Full sample	Firm size		Firm credit risk profile			Crisis and post crisis periods	
		Retail	Non - retail	Low	Medium	High	2010 - 2015	2016 - 2018
	Existing credit relationships (intensive margin)							
Net NPL ratio	o	o	o	o	o	+	o	o
Voluntary capital buffer	o	o	+	o	o	o	+	o
ECB funding	-	-	o	-	-	o	-	-
Share of household credit	-	-	-	-	-	-	-	-
	New credit relationships (extensive margin)							
Net NPL ratio	o	o	o	o	o	o	o	-

(**o**) no significant relation; (**+**) positive relation; (-) negative relation; significance levels: 10% 5% 1%

TABLE 1. Estimated relations with credit supply to NFC

Non-performing loans and bank lending: Evidence for Portugal

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Abstract
This article analyses the impact of Portuguese banks' non-performing loans (NPLs) on the loan supply to non-financial corporations in the 2009-2018 period by exploring the granularity of the Portuguese Central Credit Register. We conclude that, when controlling for loan demand and several bank characteristics, there is no evidence that NPL ratios per se constrained bank loan supply to performing corporates in this period. This result is robust to different econometric specifications and holds both for the crisis and the post crisis periods, as well as regardless of the firm size. Nonetheless, we find that the relevance of banks' NPLs on credit supply differs according to debtors' credit risk profile, namely that banks with higher NPL ratios granted more credit to performing high credit risk NFCs, while no differentiation was found for low and medium credit risk firms. Finally, we also explore the extensive margin of credit and find that a higher level of NPLs in banks' balance sheet is associated, in the post crisis period, with a lower propensity to initiate new credit relationships. (JEL: E51, G21)

Introduction

The vulnerabilities associated with European banks' balance sheets have been brought to the fore by the international financial crisis and were subsequently exacerbated by the sovereign debt crisis. One consequence of these crises was the pronounced and system-wide increase of non-performing loans (NPLs), although with considerable heterogeneity

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across countries, both in terms of the magnitude and the timing of the increase (Figure 1)[1].

The high level of NPLs in banking systems merited particular attention from competent authorities due to its systemic nature, not only because it reflected an excessively leveraged non-financial private sector but also given its possible influence in terms of banks' ability and willingness to finance the economy, with the potential to constitute a drag on economic growth. The latter and, ultimately, the need for a swift reduction of NPLs has been a focal point much discussed among national and international policymakers in recent years, especially in countries where credit risk materialisation was more pronounced.

In Portugal, this topic has also been intensively debated. The significant accumulation of NPLs by the banking sector, which at its peak, in mid-2016, accounted for almost 18%[2] of banks' total loans, and the importance of bank lending for the financing of the Portuguese economy were at the core of the discussion.

This paper contributes to this discussion by exploring the relation between NPLs and credit granted to non-financial corporations (NFCs), in Portugal, during the 2009-2018 period. The focus of the analysis on bank lending to firms is justified not only by the relevance of this sector to economic activity but also given that, in Portugal, corporate NPLs account for the bulk of the stock of NPLs.

Estimating the impacts of any variable on bank lending decisions is a difficult task. The existence of shocks that affect both supply and demand of bank loans, especially in periods of severe economic recessions and financial stress, make it difficult to ascertain whether credit dynamics is driven by supply side decisions or weak loan demand related with firm fundamentals. Building on the Portuguese Central Credit Register (CCR) granular data at the level of individual bank-firm relationship we take advantage of the high prevalence of Portuguese firms with multiple bank relationships which, combined with firm-time fixed effects, allows disentangling demand and supply effects.

The remainder of the paper proceeds as follows. In the next section we describe the recent national and European developments concerning NPLs and discuss the link between NPLs and bank lending, including a brief literature review. In the following sections data and econometric specifications are described and estimation results are presented. The last section concludes.

1. The ESRB report on "Macroprudential approaches to non-performing loans" of January 2019 relies on the experience of Member States where system-wide increases in NPLs were observed in the aftermath of the recent crisis to identify the main triggers, vulnerabilities and amplifiers that can drive system-wide increases in NPLs.

2. NPLs according to the EBA definition.

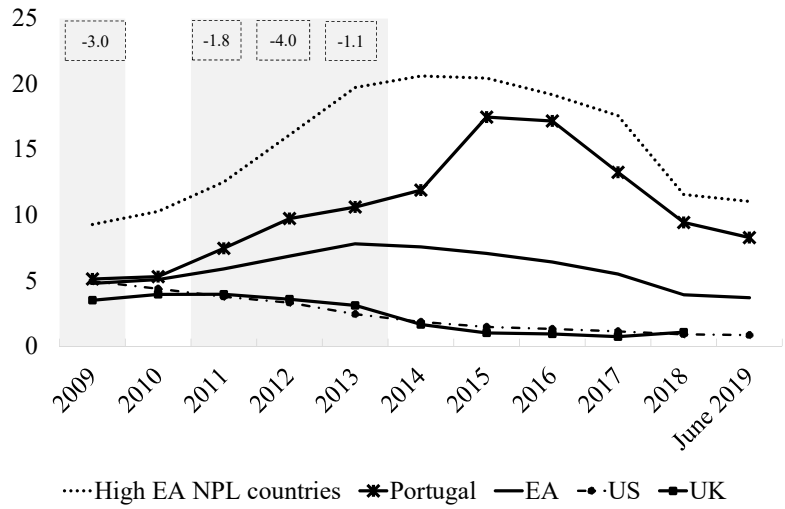

FIGURE 1: NPL ratio | in percentage

Notes: The light grey bars denote years of real negative GDP growth rates in Portugal. The NPL ratio is calculated by taking the value of NPLs as numerator and the total value of loan portfolio as the denominator. National definitions on NPLs may vary across countries and, for each country, over time. High EA NPL countries refers to the five Euro Area countries with highest average NPL ratio for the 2009-2019Q2 period: Cyprus, Greece, Ireland, Italy and Lithuania.
Source: IMF Financial Soundness Indicators (FSIs).

Background and motivation

In recent years the stock of NPLs in European banks' balance sheets decreased significantly, even though it is still high in some countries, including Portugal. The composition of NPL portfolios is not homogeneous within the Euro Area (EA). In particular, while corporate loans account for the bulk of the stock in Portugal as in most countries, there are a few cases where NPLs associated to households' credit prevail (e.g., Spain and Ireland). The levels of overall coverage by impairments have also increased, particularly in countries with higher gross NPL ratios, affecting banks' profitability and ultimately banks' capital, but also facilitating the further decline of NPL ratios.

Against this background, NPLs rank high in the agenda of both policymakers and supervisors. Several initiatives at national and European levels have been put in place in recent years targeting NPLs due to their negative impact of NPLs on banks' financial soundness which, ultimately, may affect banks' lending to the economy and the market perception of the

European banking sector, especially within the Banking Union. The various initiatives address the existing stocks of NPLs as well as the buildup of new NPLs on banks' balance sheets, covering areas such as prudential supervision, macroprudential policy, secondary market for NPLs and the underlying legal and judicial framework[3].

In Portugal, one can identify periods with different credit and NPL dynamics. Between end-2008 and mid-2016, in the midst and the aftermath of the global financial crisis and the subsequent sovereign debt crisis, the Portuguese banking system's NPLs more than tripled as a percentage of total bank credit, driven mostly by the increase in NPLs associated to NFCs. During this period, the annual growth rate of bank loans to NFCs dropped significantly to negative figures. As from mid-2016, NPLs exhibited a downward path, whilst bank loans gradually recovered, resuming slightly positive growth rates in 2018 (Figure 2).

These developments convey a negative correlation between NPL ratio and bank loans but do not necessarily endorse a causal relation. They occurred in a period of exceptionally challenging economic and financial conditions for Portugal and the observed correlation could be the reflection of cross-cutting macroeconomic factors that brought about both a decrease in loans, driven by demand and supply factors, and an increase in NPLs.

Furthermore, the correlation observed at aggregated level might conceal a significant heterogeneity between banks and borrowers, which is particularly relevant in the Portuguese case where the corporate sector largely consists of small NFCs. Namely, between 2008 and 2018 about 57% of bank loans to NFCs were granted to micro and small corporations. Micro and small NFCs also account for most of the NPLs. The risk profile of these corporations is quite heterogeneous and, consequently, analysis based on aggregate data may lead to misleading conclusions[4].

3. The 'Action plan to tackle non-performing loans in Europe', agreed by the Economic and Financial Affairs Council (ECOFIN) in July 2017, outlines a comprehensive set of measures to be adopted by various European authorities and by the Member States (http://www.consilium.europa.eu/en/press/press-releases/2017/07/11-conclusions-non-performing-loans/). In addition, the ECB has also implemented several measures from the supervisory perspective to tackle NPLs in the "SSM banks". For more details about the strategy to address NPLs implemented in Europe and in Portugal, see the Special Issue "Strategy to address the stock of non-performing loans (NPLs)", Financial Stability Report, Banco de Portugal, December 2017 and Box 3 "Action plan to tackle non-performing loans in Europe – main measures and state of play regarding its implementation", Financial Stability Report, Banco de Portugal, June 2018.

4. In effect, when considering micro data at individual bank-firm credit relationships, we find some evidence that during this period banks with higher NPL ratio presented less negative credit growth rates to NFC when compared to lower NPL banks (c..f. Summary statistics in Table 1, computed for the benchmark specification sample).

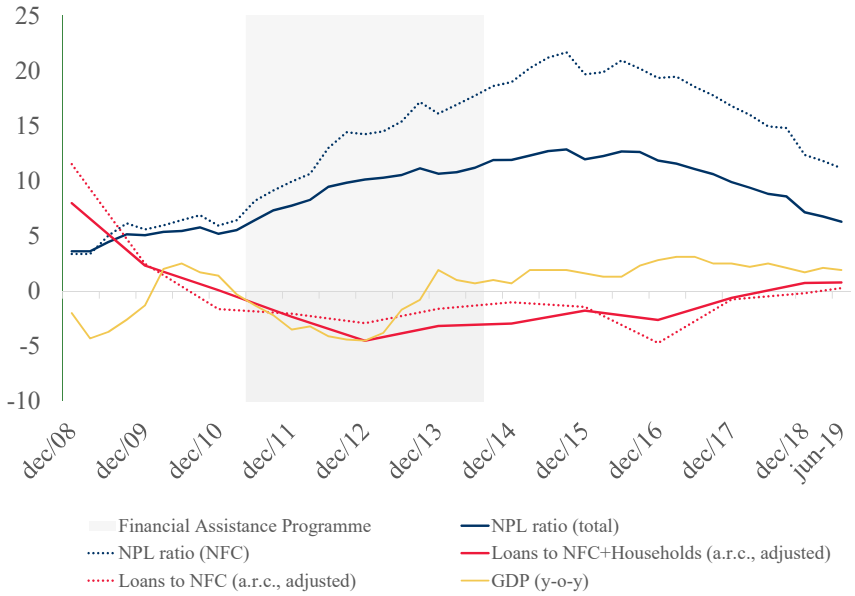

FIGURE 2: Bank loans and NPLs | in percentage

Notes:Up to December 2016 the NPL ratios refer to credit at risk reported by banks. From March 2017 onwards, the figures are estimated based on the changes in the NPL ratio according to the EBA. (2) Annual rate of change (a.r.c.) adjusted for securitizations and loan sales. (3) Vertical lines flag Banco de Portugal / SSM relevant measures, namely in terms of capital requirements (solid line) and asset quality review (dashed line)[a]. The light grey area denote the Financial Assistance Programme.

a. Full list of measures taken by Banco de Portugal and SSM, namely in terms of capital requirements and asset quality review, are available at https://www.bportugal.pt/en/list/medidas-do-banco-de-portugal-no-ambito-do-paef.

Despite the positive developments, Portuguese banks' aggregate NPL ratio still remains high in the European context, representing, therefore, a vulnerability of the banking system. In this context it is relevant to understand the potential impact of NPLs, especially as there is a degree of uncertainty regarding some of the underlying transmission mechanisms at play and how they have potentially evolved over time.

In particular, a relevant question relates to whether non-performing assets may impair the supply of bank credit. A high proportion of NPLs in a given banking system is typically associated with a poorer credit allocation and tends to be symptomatic of a highly indebted and, therefore, more vulnerable economy. During times of prolonged economic contraction, more indebted economic agents (non-financial corporations and/or households) have greater difficulties in servicing debt, thus eventually defaulting. In this context, banks

may have an incentive to maintaining a flow of financing towards these indebted agents in order to prevent the materialization of default[5] and allow them to recover. Still, this can reflect a credit support to firms that, ex-post, turn out to be non-viable at the expense of viable and/or new ones[6].

The problem of credit misallocation, combined with the cost of funding, the profitability and the capital consumption channels support the commonly-held view that high NPL ratios constrain banks' ability to lend to the economy (IMF (2015), Balgova et al (2016), ESRB (2017), Fell et al (2018)). This view is, however, partially challenged by the idea that high NPL may create incentives to increase credit supply to riskier customers, following a 'gamble for resurrection' type of logic (Acharya and Steffen, 2015, Altavilla et al, 2017). Moreover, Angelini (2018) argues that such channels may be dampened, or neutralized altogether, if the bank is sufficiently profitable and/or capitalized.

Even though several studies have recently explored the link between NPLs and credit growth, most of them use aggregated credit data[7]. Bending et al (2014) analyse the effects of NPL evolution on corporate sector credit growth, focusing on the Euro Area largest banks. Using a dynamic panel model, they find that a 1 percentage point increase in the NPL ratio decreases net lending by around 0.8 percentage points. In the same vein, Cucinelli (2015) estimates a fixed effect model where the dependent variable is measured by the growth rate of gross loans and the regressors include both macroeconomic and banks' specific variables. According to estimated results, credit risk of previous years is an important determinant of banks' lending behaviour, exhibiting a statistically significant negative coefficient.

More recently, Chiesa et al (2018) develop a theoretical model to analyse the transmission channels of NPL in the Euro area and test it by estimating an autoregressive distributed lags model. The empirical results confirm the model's predictions and suggest that holding NPLs increases the cost of capital for banks which, in turn, reduces credit and liquidity creation. The authors claim to control for possible endogeneity issues, stemming from macroeconomic conditions, through the use of variables such as GDP growth and unemployment rate. In addition, Fell et al (2018) explore differences between banks' NPL ratios and the respective volumes of credit provision over a period characterized by strong and improving loan demand. The

5. This should be mitigated with the implementation of the Addendum to the ECB guidance, the prudential backstop for NPEs and the adoption of IFRS 9, which create incentives for recognizing more promptly impairment losses in credit agreements, allowing a swifter exit of non-performing assets from institutions' balance sheets.

6. Azevedo et al (2018) find evidence of misallocation of credit by Portuguese resident banks towards unproductive non-financial corporations in the 2008-2013 period. In the same vein, Shivardi et al (2017) find that during the Euro Area financial crisis undercapitalised Italian banks were more reluctant to cut credit to non-viable firms.

7. By aggregated data we mean credit data at the country level or at the bank level, i.e. micro data (typically coming from Credit Register Databases) are not used in these studies.

authors conclude that the presence of high NPL stock may hinder individual bank's lending and contend that using such approach controls for credit demand effects.

The NPL-credit relation has also been explored in VAR frameworks. Espinoza and Prasad (2010), for instance, focus on the relation between macroeconomic variables and NPL in banks' books. They find that a one-standard deviation increase in the NPL ratio reduces credit growth by 1.5 and 2.2 p.p. after two and three years, respectively. Similarly, Klein (2013) suggests that high and rising levels of NPL exert strong pressure on banks' balance sheet, with possible adverse effect on banks' lending operations. In particular, using a panel VAR analysis the author concludes that a one percentage point increase in NPL ratio results in a cumulative decline of 1.7 p.p. in credit-to-GDP ratio.

In order to estimate the impact of any relevant variable on bank lending decisions, it is necessary to employ a proper identification strategy that allows disentangling the roles of credit demand and credit supply. These strategies are particularly relevant during prolonged periods of economic recession, as the balance sheet of both banks and corporates are significantly affected. The use of loan-level data is a key source of identification, as it allows to control for changes in loan demand. In particular, in a setting where solely firms with multiple bank relationships are considered and firm-time fixed effects are used, one can effectively control for unobserved firm-specific loan demand effects (Khwaja and Mian, 2008).

This approach has been used by several authors in various empirical applications related to financial stability[8]. Accornero et al (2017), for example, use an extensive borrower-level dataset to study the influence of NPLs on the supply of bank credit to non-financial corporates in Italy between 2009 and 2015. The authors conclude that NPL ratios per se have no impact on banks' lending behaviour. In addition, the authors also exploit the results of the 2014 asset quality review carried out by ECB together with national supervisors and conclude that unanticipated increases in the reported level of NPLs can temporarily reduce the supply of credit. The authors argue, however, that such effect was quantitatively small and compensated by the positive impact arising from higher confidence and transparency in banks' balance sheets.

Our paper adds to the literature as we employ a similar methodology and identification strategy for Portugal, building on micro data at the bank and firm levels. Moreover, our sample spans over a ten year period, which includes a period where a significant increase in banks' NPLs co-existed with a sharp reduction in credit but also covers other phases of the economic and credit cycles. This is particularly relevant as in a crisis/NPL buildup period the lack of credit demand and heightened uncertainty may dominate credit

8. See, e.g., Alves et al (2016), De Jonghe et al (2016), Beck et al (2017), Sivec et al (2018).

dynamics, rendering supply side credit restrictions, namely those associated to NPLs, less relevant. In turn, such restrictions may become more relevant in a post-crisis period marked by a pick-up in firm investment and credit demand. Finally, even though the analysis relates mainly to the intensive margin of credit, we also explore the extensive margin to achieve a more comprehensive view about the relation between banks' NPLs and firms' access to credit.

Data and model specification

Data

Different indicators can be used to assess credit quality. One of them is the so called credit at risk, which was developed by Banco de Portugal in 2011, and, during most of the period under analysis in this study, was regularly reported by banks to the supervisory authorities and disclosed to the market. At a later stage (2013), a harmonized NPL definition, at EU level, was developed by the European Banking Authority (EBA) and started to be published by Banco de Portugal, for the whole Portuguese banking sector, by end-2015[9]. Although the credit at risk is a concept narrower than the NPL as defined by the EBA, both indicators presented a similar dynamic from 2016 onwards -when both were available-, while credit at risk is available for a longer period. Thus, in our model and for the remainder of this paper, the credit quality indicator used is credit at risk, although, for simplification, the term NPL is used.

Loan-level data used in the model estimation is largely drawn from the Portuguese Central Credit Register (CCR)[10] that provides information on credit by resident credit institutions and borrowers, allowing to keep track of individual bank-firm credit relationships over time. The CCR covers information on both outstanding and undrawn credit liabilities[11]. It also allows for the identification of the amount and vintage of overdue credit. Furthermore, the identification of individual NFCs allows to match the data with other micro-databases, supplementing the analysis with firm specific variables (e.g. size and activity sector).

9. The EBA NPL concept is more complex and comprises a higher degree of subjectivity than most of the previously used credit quality indicators, such as credit at risk. Subsequently, the application of the harmonized NPL concept was challenging, thus constraining, especially in the first years, the comparison across countries and across banks. For more details, see the Special Issue on "Concepts used in the analysis of credit quality", Financial Stability Report, Banco de Portugal, November 2016.

10. Central Credit Register (CCR) is a micro-database managed by Banco de Portugal, with detailed monthly information regarding credit granted by resident institutions. Debt securities (including commercial paper) are excluded. The report to CCR is on a debtor-by-debtor basis, classifying the credit responsibilities according to an extensive list of dimensions.

11. Undrawn credit liabilities take the form of irrevocable commitments (e.g. undrawn credit lines or unused amounts on credit cards).

Only banks subject to own funds regulatory requirements in Portugal are considered, i.e. Portuguese branches of non-resident banks are excluded. This choice mitigates situations where the decision to grant credit is influenced or decided by institutions outside the Portuguese financial system in which the relevant NPL indicator would be that of the non-resident head office and not of its branch located in Portugal.

Where applicable, each bank is considered on a group basis, i.e. including all the resident credit-granting financial institutions in its supervisory perimeter. Additionally, only banks with at least 100 credit relationships with NFCs, in each period, are considered. This results in a sample of 20 banks (considering banking groups and individual banks which do not belong to any group), which accounts for, on average, 87% of the stock of bank loans to NFCs between 2009 and 2018.

Our sample includes NFCs with no material overdue credit for more than 90 days and with no written-off loans in the entire period. The exclusion of firms with overdue loans is justified by two main arguments. Firstly, credit dynamics would be unduly influenced by the rolling over of loans associated with banks' intention to prevent the materialization of default and by the accumulation of unpaid interest, causing a bias in the credit growth distribution, especially in a period dominated by credit contraction. Secondly, the funds lent to some of these firms may be, in many aspects, similar to sunk resources with low contribution to economic growth[12].

Due to methodological requirements, only NFCs with credit relationships with at least two banks are considered. The sample thus comprises an average of 74 thousand observations per year, where each observation corresponds to a credit relationship between a bank and a firm, covering about 33% of the stock of bank loans to NFCs (Figure 3).

12. The sensitivity of the results to the exclusion of these NFCs is addressed in the robustness analysis section.

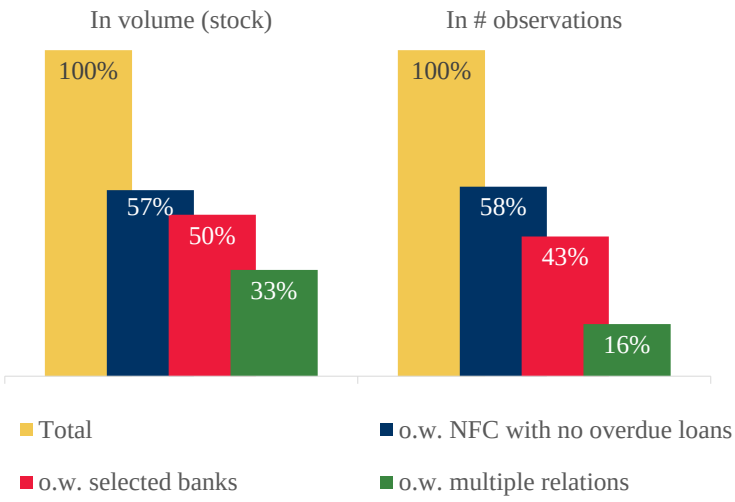

FIGURE 3: Sample representativeness | 2009 – 2017 average

Model specification

The econometric analysis is based on panel data, with annual frequency, from 2009 to 2018[13], focusing on bank loans to resident NFCs (at the micro level of each bank and individual firm). Our benchmark econometric specification is the following:

$$\Delta Loans_{i,j,t} = \theta_j NPL_{j,t-1} + \beta_j X_{j,t-1} + \alpha_{i,t} + \varepsilon_{i,j,t} \quad (1)$$

where $\Delta Loans_{i,j,t}$ corresponds to the year on year rate of change (in logs) of credit granted to firm i by bank j in period t, $NPL_{j,t-1}$ is the net NPL ratio and $X_{j,t-1}$ represents a vector of bank-level controls of bank j. $\alpha_{i,t}$ is a vector of firm-time fixed-effects, capturing time-varying firm characteristics, including shifts in credit demand. The estimation of $\alpha_{i,t}$ is the basis of our identification strategy to disentangle credit supply side effects from credit demand shocks, which requires a setting where only firms with multiple bank relationships are included. Assuming that a credit demand shock affecting a given firm impacts

13. 2018 credit data refers only to the January – August period due to data constraints.

all its lending relationships in the same degree[14], the coefficients on the bank-level variables would capture supply side effects, while the firm-time fixed-effects would absorb the demand dynamics (Khwaja and Mian, 2008).

Explanatory variables are lagged one period. Banks' overall position in the beginning of the year[15] is expected to influence the loans granted during that year as it is reasonable to assume that the analysis and decisions underlying banks' lending policy are carried out in advance and with a certain lag.

The dependent variable considers bank loans granted to NFCs at the individual bank-firm level and is defined as the end of period stock change, with no adjustment for write-offs or sales. This should not be a relevant limitation given that our sample is limited to NFCs with no overdue credit and no relevant sales of such loans were observed in this period.

In most of the estimated specifications only credit drawn is considered. Arguably, the inclusion of undrawn credit liabilities would better capture supply side decisions, as it would rule out changes in credit associated with the use of credit lines and other irrevocable commitments that depend on current firms' decisions. However, the evaluation of what actually constitutes an irrevocable commitment is not straightforward and may result in data comparability issues. As a robustness check, a specification with the broader loan concept (drawn and undrawn) was also estimated.

The explanatory variable of interest is the bank total NPL ratio, net of impairments[16]. Within the robustness analysis, some alternative specifications were considered, namely, the NPL ratio was taken gross of impairments and the impairment coverage ratio was added as an independent variable. Additionally, the net NFC NPL ratio was also considered. Both of these alternatives can help to evaluate the transmission mechanisms through which NPLs may affect credit supply in the period under analysis. Notwithstanding, the net NPL ratio is a better indicator of the overall risk on banks' balance sheet as it excludes the part covered by impairments, i.e. losses already recognized in the banks' profit and loss account.

The benchmark specification includes three bank-level controls which are commonly used in the related literature: the voluntary capital buffer, the share of ECB funding on total assets and the share of household credit in total assets.

14. This assumption commonly used in these settings, including in the papers described in the section 'Backgound and motivation', is not free from criticism as the matching between banks and firms is not necessarily random. Firms can have stronger relationships with one bank than with others and, therefore, when facing a borrowing need do not necessarily interact with all banks in the same manner.

15. Which, in this case, is equal to the one observed at the end of the previous year.

16. Taken as the NPL stock, less associated impairments, over total credit.

The voluntary capital buffer relates to banks' excess / shortage of capital with reference to the regulatory requirements[17]. This can be seen as an indicator of banks' capacity to withstand adverse shocks while maintaining the flow of credit to the economy. A positive relation with credit growth is thus expected. However, there are several other factors that may challenge this view. For example, considering the relatively higher cost of capital compared to other sources of financing, banks may choose to operate with thinner capital ratios if they are able to generate capital organically.

The share of ECB funding on total assets is associated with bank's liquidity position. Banks with a higher share of ECB financing are arguably more liquidity constrained thus negatively impacting credit supply. The increase in ECB funding or, at least, the maintenance of a high recourse to the ECB might, however, be driven by the opportunity to access cheaper funding compared to alternative sources and carry-trade strategies. The impact in banks' credit supply depends on how such funds are applied, and the possibility of crowding-out effects cannot be discarded.

The share of household credit in total assets aims to capture differences in banks' business models, even if most banks considered in the sample could be broadly classified as retail banks[18]. Housing credit is perceived as having lower credit risk. Consequently, in times of stress, banks more engaged on household credit, that are typically more risk averse, tend to flee from NFC loans, favoring their traditional areas of investment where they have more information and skills.

Table 1 presents summary statistics for the variables explored in the econometric setup[19].

Model estimation

We estimate a set of linear regression models linking credit growth with NPLs, progressively controlling for other bank characteristics and firm heterogeneity. In addition, we evaluate the robustness of the main results considering a different credit metric, other bank-level variables, alternative loan demand controls and other relevant specifications.The benchmark

17. Regulatory capital requirements are time and bank-specific, including the temporary capital buffer against sovereign debt exposures set in the context of the 2011/2012 EU capital exercise and, from 2015 onwards, Pillar 2 measures. In the analysed period, three capital requirements were in place: common equity/core tier 1, tier 1 and total capital. The difference is computed vis-à-vis each of these three metrics and the voluntary buffer considers the lowest figure. This variable has a more direct link with banks' decision than banks' capital ratio, given that the latter is inherently linked with the regulatory minimum requirements.

18. Even with cooperative and savings banks included.

19. Table A.1 in Appendix describes all the variables used.

VARIABLES	Units	Mean	Standard deviation	P10	Median	P90	High NPL banks P50	Low NPL banks P50
Loans to NFC growth	log change	-13,5	82,6	-84,4	-15,0	62,4	-14,2	-15,6
NPL ratio	%	9,5	5,4	3,5	9,4	16,3	12,0	5,9
Net NPL ratio	%	3,7	2,9	0,8	3,2	8,8	6,0	1,4
Impairment coverage ratio	%	64,7	17,1	46,1	66,5	83,4	50,8	72,9
NPL ratio: NFC	%	20,4	149,5	3,7	12,9	22,1	19,7	7,8
Net NPL ratio: NFC	%	3,9	8,1	0,1	2,5	10,7	8,5	1,2
Impairment coverage ratio: NFC	%	73,1	22,0	42,3	71,8	99,6	58,6	82,1
Voluntary capital buffer	pp	0,4	5,4	-1,6	0,8	2,8	1,1	0,5
ECB funding	%	8,8	5,3	2,8	8,3	14,9	10,8	6,7
Share of HH credit	%	55,6	14,5	34,4	58,1	71,1	51,8	64,6
Loan to deposits ratio	%	113,1	34,3	78,7	107,4	153,0	117,3	98,4
Return on assets (ROA)	%	-0,1	1,0	-1,3	0,1	0,8	0,0	0,3
Tier 1 ratio	%	10,7	5,6	8,4	10,9	13,5	11,0	10,9
# Observations				612 458			263 888	348 570

TABLE 1. Summary descriptive statistics (2009 – 2017, for the benchmark specification sample)

Notes: (1) High (Low) NPL banks present an average NPL ratio above (below) the median; (2) Two institutions were excluded from the computation of the loan-to-deposits ratio as they presented abnormal values (as these institutions presented virtually no deposits).

regression, most of its decompositions and robustness specifications are estimated for existing credit relationships (intensive margin). We also estimate related specifications to look into the impact of NPLs on new credit relationships (extensive margin).

Main results

The first set of results is presented in Table 2. Starting with a simple linear regression (column 1), we estimate the relation of NPLs with credit changes without taking into account bank and loan demand controls. In this setting, the net NPL ratio coefficient is positive and statistically significant at a 10% significance level, consistent with the descriptive statistics based on individual bank-firm data presented above (table 1) where banks with higher NPL ratios granted more (or restricted less)[20] credit to NFCs.

We then proceed with the inclusion of the bank-level controls (column 2): voluntary capital buffer, ECB funding over total assets and loans to households over total credit. In this case, the net NPL ratio coefficient, albeit still being positive, is not statistically different from zero at the conventional significance levels, thus highlighting the importance of controlling for other bank-level features.

20. In fact, in 2010-2018 period, the pooled distribution of loan's rate of change has more density around negative figures.

Results do not change qualitatively when we move to a setting where exclusively NFCs with multiple bank loan relationships are considered (column 3), despite the significant reduction in the number of observations.

Finally, we take one additional step and include time–varying fixed-effects at the firm level (column 4). As previously mentioned, this specification, which we will refer to as the benchmark, allows us to disentangle supply side effects from credit demand shocks and can only be estimated for firms with multiple bank relationships. Although this reduces the statistical significance of most bank-level variables, we continue to observe no relevant impact in terms of the net NPL ratio, i.e. no systematic difference is found between banks with high and low NPL ratios in terms of credit granted. Put differently, on average, and ceteris paribus, a firm borrowing from two different banks, a low-NPL bank and a high-NPL bank, does not observe any significant difference in the respective loan growth.

Regarding the remainder bank-level variables we find two statistically significant relations for the sample the period as a whole. Namely, a negative relation between the recourse to ECB funding and the NFC loan growth, which could be brought about by liquidity constraints and/or the crowding out effects mentioned earlier, and a negative relation between the share of household credit and the NFC loan growth, potentially reflecting the impact of differences in banks' risk appetite, especially given that our sample is dominated by a period of stress.

EXPLANATORY VARIABLES	(1) Simple univariate regression	(2) (1) + additional bank-level controls	(3) (2) restricted to firms with multiple loans	(4) (3) + Firm TVFE "Benchmark regression"
Net NPL ratio	0,458*	0,355	0,449	0,204
Voluntary capital buffer		0,182**	0,222***	0,102
ECB funding		-0,563***	-0,550***	-0,381**
Share of HH credit		-0,216***	-0,268***	-0,262***
# Observations	1 267 024	1 256 528	612 458	612 458
R-squared	0,000	0,002	0,004	0,402
Multiple bank loan relations			✓	✓
Firm TVFE				✓

*** p<0,01, ** p<0,05, * p<0,1

TABLE 2. Main estimation results: full sample period (2009 - 2018)

Table 3 presents the results of the benchmark specification estimated in different subsamples according to firm size and credit risk and in the periods of buildup and reduction of NPLs. Overall the non-significance of the NPL ratio is robust across virtually every subsample while, for the voluntary capital buffer and the share of ECB funding, the significance differs. The significance of the share of housing loans remains virtually unchanged across the subsamples considered.

Columns 2 and 3 explore a potential heterogeneity related to firm size, proxied by the size of firms' total loans (in each year, retail firms are identified as NFCs with total loans below 1 million euros). The NPL ratio is not statistically significant for both subsamples. The estimated relation between the voluntary capital buffer and credit growth is positive and statistically significant for non-retail (larger) firms at a 10% significance level, suggesting that bank loans' supply to these firms was influenced by banks' capital position. In turn, the negative coefficient associated with ECB funding is only statistically significant for retail (smaller) firms, suggesting that these firms experienced a change in the supply of credit from banks more liquidity constrained or due to crowding out effects, whereas for larger firms this impact was not significant.

Columns 4 to 6 explore differences in debtors' credit risk profile[21]. The main conclusion that can be drawn from these regressions is that there is no evidence that NPL ratio constrained credit supply to low and medium risk firms (which account for about 80 per cent of the sample). In turn, we find a positive link to credit granted to high credit risk firms, though only statistically significant at a 10% significance level. In different words, a given high credit risk firm borrowing from two banks that only differ in the level of the NPL ratio was granted slightly more, or restricted slightly less, credit from the bank with the higher NPL ratio. More specifically, a bank with a NPL ratio 1 percentage point higher is estimated to present, on average, a 0,47 pp higher loan growth to high credit risk NFCs. Still, this result could reflect the credit support to riskier firms which could turn out to be viable or non-viable. The distinction between these outcomes is usually difficult to make ex-ante, especially with riskier firms and during a period of challenging and less predictable macroeconomic circumstances, although it should be noted that our sample excludes firms that defaulted during the period under analysis. The identification of the relative importance of these two situations is beyond the scope of our analysis.

The regressions underlying columns 7 and 8 aim at distinguishing between the crisis / NPL buildup period – characterized by a strong deleveraging, a reduction of demand for credit and heightened uncertainty –, and a period of economic activity recovery, pick-up in investment, decrease in NPLs and slowdown in NFC deleveraging. As regards the net NPL ratio, despite the change in the sign of the estimated coefficients, they are both not statistically different from zero up to a 10% significance level. Interestingly, however, we observe that the relation between the growth rate of loans granted to NFCs with the voluntary capital buffer is only statistically relevant during

21. Credit risk profile is based on each NFC credit notation assigned by Banco de Portugal in-house Credit Assessment System (ICAS). The low-risk bucket consists of firms with a 12-month probability of default (PD) below 1%, the medium-risk bucket refers to firms with a PD above 1% and below 5% and the high-risk bucket comprises firms with a PD above 5%.

the crisis period. The absence of significance in the post-crisis period could be associated with the lower variability in the voluntary capital buffer across banks in this period[22].

EXPLANATORY VARIABLES	(1) Benchmark (full sample)	(2) Retail firms	(3) Non-retail firms	(4) Low-risk firms	(5) Medium-risk firms	(6) High-risk firms	(7) 2010 - 2015	(8) 2016 - 2018
Net NPL ratio	0,204	0,104	0,45	-0,34	0,296	0,469*	0,432	-0,128
Voluntary capital buffer	0,102	0,092	0,128*	0,033	0,128	0,103	0,156**	-0,372
ECB funding	-0,381**	-0,415**	-0,286	-0,563***	-0,393**	-0,171	-0,382*	-0,505**
Share of HH credit	-0,262***	-0,283***	-0,210***	-0,319***	-0,284***	-0,178***	-0,266***	-0,272***
# Observations	612 458	464 547	147 911	152 550	316 975	136 616	424 685	187 773
R-squared	0,402	0,436	0,310	0,391	0,399	0,418	0,402	0,399

*** p<0,01, ** p<0,05, * p<0,1

TABLE 3. Main estimation results (subsamples)

Robustness analysis

In this section, we assess the sensitivity of results underlying the benchmark regression when using: (i) a different credit definition, (ii) alternative firm selection criteria, (iii) additional bank-level and relationship controls and (iv) alternative demand controls. Table 4 summarizes the most relevant results.
Firstly, as previously mentioned, we consider a broader loan concept, including both drawn and undrawn credit granted to NFCs, which arguably allows to capture supply side decisions more effectively[23]. The results do not qualitatively change as the sign and magnitude of coefficients remain virtually unchanged (column 2).

Secondly, it is also important to assess the sensitivity of results to alternative firm selection criteria. In column 3 we assume less restrictive criteria in the exclusion of firms with overdue credit by eliminating firms only in periods for which overdue credit is observed[24]. In column 4 we further relax the criteria and include all firms, regardless of having overdue credit or not. Interestingly, the NPL coefficient turns positive and is statistically significant in these two regressions (even more so in the second case). To some extent, these results are in line with the results presented in the previous section, namely the positive NPL coefficient obtained for the 'high-risk' firms specification, and the same rational applies since we now consider a greater proportion of seemingly riskier firms. Finally, even though we work in a multiple relationship setting for identification purposes, it may be difficult

22. The recent period is associated with the implementation of the CRD IV, which include some bank-specific requirements (e.g. Pillar 2).

23. Moreover, a slight increase in the number of observations occurs as additional multiple relationships are now identified.

24. As opposed to excluding firms with overdue credit from the entire sample, including in periods when they had no overdue credit.

to identify statistically significant relationships if a significant share of firms borrow from banks with similar NPL ratios. In order to ensure that we have sufficient variability in the NPL variable, we estimate a regression exclusively for firms which have credit relationships, in each year, with at least a high and a low-NPL bank (column 5). Despite the decrease in the number of observations, both the magnitude and sign of the NPL ratio does not change vis-à-vis the benchmark specification.

Thirdly, we test the relevance of using alternative NPL metrics and including additional explanatory variables. We begin by replacing the total net NPL ratio with the net NPL ratio for NFCs (column 6). The former is a broader indicator of banks' overall asset quality and, in light of the transmission channels mentioned before (e.g. cost of funding), more adequate to capture its potential effects over credit supply. However, since our paper focus on credit to NFCs and the NPL ratio increased more significantly for firms in Portugal, during the period under analysis, one could argue that this alternative metric would be more relevant for identification purposes. A positive coefficient is also estimated for firm NPL ratio (albeit statistically significant at 10% only) and the results do not qualitatively change for the other variables. Column 7 presents the results of a less parsimonious regression which disentangles the effects between the gross NPL ratio and the coverage ratio. The results are similar to those of the benchmark regression and the conclusions seem to hold as no statistical significance is found for these two variables. In column 8 we augment the benchmark equation with two controls which capture the depth of firm-bank relationships, namely the weight of the loan exposure in total loans obtained by the firm in banking sector and the number of credit products a firm has in a given bank. Although statistically significant, the introduction of such controls does not change the findings of the benchmark regression. Similarly, adding other bank-level controls used in previous empirical studies such as the loan-to-deposits ratio, return-on-assets (ROA) or replacing the voluntary buffer with a more commonly used solvency variable, such as the Tier 1 ratio, does not meaningfully impact results (columns 9-11). The key finding is that, despite the relevance of these variables, the main result does not change, in particular NPL coefficient remains as statistically non-significant.

EXPLANATORY VARIABLES	(1) Benchmark (full sample)	(2) Commited credit (drawn and undrawn) as dependent variable	(3) Less restrictive firm sample selection	(4) All firms - with and without overdue	(5) Only firms with credit relations both with a high- and a low-NPL bank	(6) Alternative NPL variable (NFC)	(7) Alternative NPL variable (Gross + coverage)	(8) Relationship controls	(9) Alternative explanatory variables (1)	(10) Alternative explanatory variables (2)	(11) Alternative explanatory variables (3)	(12) Alternative demand control (Industry * Size * Time FE + Firm-level variables)
Net NPL ratio	0,204	0,056	0,402*	0,549***	0,212			0,195	0,207	-0,219	0,212	0,034
Voluntary capital buffer	0,102	0,063	0,109	0,243***	0,107	0,094	0,086	0,131	0,103	0,243***		0,003
ECB funding	-0,381**	-0,386**	-0,332**	-0,131	-0,395**	-0,379**	-0,350**	-0,416**	-0,357***	-0,503***	-0,391**	-0,367**
Share of HH credit	-0,262***	-0,277***	-0,230***	-0,176***	-0,247***	-0,267***	-0,254***	-0,275***	-0,143***	-0,241***	-0,265***	-0,237***
Gross NPL ratio							0,002					
Impairment coverage ratio							-0,046					
Net NPL ratio: NFC						0,085*						
Loan to deposits ratio									-0,001***			
ROA										-3,289***		
Tier 1 ratio											-3,289***	
Weight of credit relationship								-0,195***				
Number of credit products								-0,019***				
# Observations	612 458	701 591	773 456	1 112 570	443 504	612 458	612 458	612 458	606 404	612 458	612 458	1 160 794
R-squared	0,402	0,390	0,401	0,400	0,372	0,402	0,402	0,405	0,404	0,402	0,402	0,011

*** p<0,01, ** p<0,05, * p<0,1

TABLE 4. Robustness analysis

Lastly, it is important to evaluate the validity of our conclusions with respect to firms with a single bank relationship, particularly considering the relevance of such firms operating in Portugal (as documented in Figure 3). Working in a multiple relationship setting has a clear methodological advantage – as it allows us to effectively control demand through firm-time fixed effects – but also a high cost, as it implies a significant reduction in the sample size, arguably limiting the extrapolation of results for the whole sample of firms. Relaxing this assumption requires the use of an alternative demand control, such as industry-size-time fixed effects and firm level controls[25] (column 12). While the number of observations significantly increase, as expected, the estimates remain similar to those of the benchmark regression.

Overall, the main conclusions presented in the previous section are robust to different definitions of both dependent and explanatory variables and to alternative/additional bank-level and credit demand controls. Despite slight differences in the magnitude and statistical significance of some coefficients, we find no evidence in support of a relation between the NPL ratio and credit growth during the period under analysis as whole[26].

Extensive Margin

In this section we investigate the potential impact of NPL ratios on the extensive margin of credit, in particular, on the banks' propensity to initiate new credit relationships. This analysis complements the main results for the intensive margin, with the aim to obtain a more comprehensive view about the relation between banks' NPLs and firms' access to credit. In this setting some concerns previously mentioned are less pronounced, namely those associated with the role of relationship lending that may influence the matching between banks and firms.

In these regressions the dependent variable is a dummy that takes the value of 1 if a bank-firm relation exists in period t but not in t-1 and takes the value of 0 otherwise. The inclusion of firm-time fixed effects to control for credit demand is only possible in a setting where NFCs with new credit relationships maintain at least one previous credit relationship with a different bank. As such the regressions only consider new relationships with firms that were already in the credit market.

25. Firm-level controls include: Sales over Assets, EBITDA over assets, Financial debt over assets and the Leverage ratio which, for simplification purposes, are not reported in Table 4.

26. Additional specifications were explored, namely using bank fixed-effects to control for time-invariant heterogeneity at the bank-level, such as associated with business models, risk propensity and risk management practices. The results are not presented in the paper as the inclusion of bank-fixed effects change the interpretation of the coefficients associated with the variable of interest and all other bank-specific variables, setting the focus on an analysis within-bank, thereby impairing a comparison between banks.

Table 5 presents the extensive margin results for the main sample decompositions (presented in Table 3). A lack of statistical significance is observed across most specifications and coefficients. Interestingly, in firm size and firm risk decompositions no relation between the banks' propensity to initiate a new credit relation and NPL ratio is found. In particular, for higher-risk firms, this differs from the intensive margin results, where a positive although weak relation was documented.

For the 2016-2018 period (column 8), a negative relation between the NPL ratio and propensity to initiate new credit relationships is estimated. On the one hand, it could be that high-NPL banks were not competitive enough in terms of pricing and other loan conditions, compared to low-NPL banks, when faced with new loan requests, and this disadvantage may be particularly evident in a period of economic recovery and pick-up in credit demand. On the other hand, it could be that banks with higher NPLs adopted tighter credit standards in the recent period. Arguably, these changes would be more relevant for borrowers that are new to the bank, as credit history information and other information relevant for credit risk profiles would be more limited or inexistent.

The analysis of banks' propensity to initiate new credit relationships with firms new to the credit market would complement the extensive margin results but in this settings it would not be possible to use firm-time fixed effects to control for credit demand.

Extending the analysis beyond the intensive margin provides useful insights and a broader perspective on the impact of NPLs on credit supply. Notwithstanding, the credit demand control used in the extensive margin has some shortcomings. A more effective credit demand control would, for example, require taking into consideration data on loan applications and their outcome, which would allow to distinguish between loan acceptances and refusals. This vein is not explored due to data constraints.

EXPLANATORY VARIABLES	(1) Benchmark (full sample)	(2) Retail firms	(3) Non-retail firms	(4) Low-risk firms	(5) Medium-risk firms	(6) High-risk firms	(7) 2010 - 2015	(8) 2016 - 2018
Net NPL ratio	0,064	0,075	0,016	0,138	0,083	-0,096	0,185	-0,152**
Voluntary capital buffer	-0,023	-0,03	-0,013	-0,014	-0,033	-0,039	-0,018	0,055
ECB funding	-0,014	0,013	-0,119	-0,098	-0,097	-0,003	-0,082	0,081
Share of HH credit	-0,013	-0,006	-0,044	-0,079**	-0,031	0,004	-0,002	-0,048***
# Observations	1 612 282	1 266 545	315 094	257 848	559 542	442 644	1 200 427	411 855
R-squared	0,396	0,415	0,294	0,367	0,380	0,399	0,389	0,417

*** p<0,01, ** p<0,05, * p<0,1

TABLE 5. Extensive margin results

Conclusion

The implications for financial stability of a significant increase in NPLs on banks' balance sheets has become a topic of great interest following the international financial crisis. In particular, the discussion has focused on the consequences over credit supply with the potential to constitute a drag on economic growth, which justified several initiatives at the national and European levels to promote a swift reduction of NPLs.

Conceptually there are several channels through which NPLs may influence credit supply, not necessarily in the same direction. For example, to the extent that banks with significant NPLs are difficult to value, they influence risk perceptions by market participants, thus potentially increasing banks' funding costs, which ultimately might be passed on to credit supply. On the contrary, high NPLs may create incentives to increase banks' credit supply to riskier customers in order to prevent the materialization of default. This paper contributes to this debate as in Portugal the significant increase in banks' NPLs co-existed with a sharp reduction in credit.

We investigate the effects of banks' NPLs on credit growth to NFC in the 2009-2018 period using data at the individual bank-firm relationship from the Portuguese Central Credit Register. Our sample is limited to NFCs with no overdue loans and the analysis focuses on the existing credit relationship (intensive margin of credit).

Against this background, we find that, when controlling for loan demand and several bank characteristics, there is no evidence that NPL ratios per se constrained bank loan supply to corporates in this period. Put differently, on average, a firm borrowing from two banks that only differ in the level of the NPL ratio did not observe a significant difference in the respective loan growth. This result holds for the crisis and the post crisis periods (2009-2015 and 2016-2018, respectively). It also holds independently of the size of the NFC, and for low and medium credit risk firms which account for about 80 percent of the sample. These findings support the main conclusion whereby the supply of credit to NFCs was not significantly affected by the high NPL ratios prevailing on the Portuguese banks' balance sheet over the sample period. Still we find a positive relation between NPLs and credit granted to performing NFCs with high credit risk, though with a weak statistical significance, which could reflect credit support to riskier firms, whose viability could have been difficult to assess, special in a period of challenging and less predictable macroeconomic circumstances.

Additionally, we find some evidence that other bank characteristics influenced the credit supply to NFC during this period. Namely, i) banks' voluntary capital buffer (i.e. difference between observed capital ratios and the respective minimum requirement) seem to be positively associated with credit supply during the crisis / NPL buildup period; ii) a negative relation between the recourse to the ECB funding and the NFC loan growth

is estimated,; and iii) we find a negative relation between the share of household credit and the NFC loan growth, potentially reflecting the impact of differences in banks' business models and risk appetite, especially given that our sample is dominated by a period of stress.

These conclusions are robust to different definitions of both dependent and explanatory variables and to alternative/additional bank-level and credit demand controls.

Finally, with the aim to obtain a more comprehensive view we look into the extensive margin and find that higher NPLs were associated with a lower propensity to initiate new credit relationships in the post crisis period (2016-2018).

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Appendix: Variables description

Type of variable	Variable	Notes	Source
Dependent variable	Bank loans granted to NFCs	Drawn and undrawn amount; end-of-period stock change; bank and firm specific	Central Credit Register data
Variable of interest	NPL ratio	Credit at risk over total credit; value observed in the beginning of the period; bank specific	Supervisory data (Credit at Risk Instruction)
	Coverage ratio	Impairments over credit at risk; value observed in the beginning of the period; bank specific	
Control variables at bank-level	Voluntary capital buffer	Considering the difference between observed capital ratios and the respective minimum requirement. The variable is the smallest of these differences, for each bank, at each point in time.	Supervisory data (FinRep and CoRep)
	ECB funding	ECB funding over total assets	
	Share of household credit	Loans to Households over total credit (proxy for the bank business model)	
	Return on assets (ROA)		
	Loan to deposits ratio		
	Tier 1 ratio		
Control variables at firm-level	Sales/Assets		Central Balance Sheet data
	EBITDA/Assets		
	Leverage ratio		
	Financial debt/Assets		
	Economic sector		
Other explored variables	Firm total loan exposure	Used to differentiate between retail and non-retail segments.	
	Weight of credit relationship	Weight of the loan exposure in total loans obtained by the firm in banking sector	
	Number of credit products	The number of credit products a firm has in a given bank	
	NFC Rating	Probability of default based on Banco de Portugal in-house Credit Assessment System (ICAS). Used to differentiate firms according to credit risk buckets.	

TABLE A.1. Variables