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The interest rate exposure of euro area households

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Non-technical summary

Research question

Interest rate fluctuations have a direct effect on the interest income flows received or paid by households. As interest-bearing assets and liabilities are distributed differently across households, these fluctuations have direct distributional consequences. Moreover, recent macro theory shows that the redistribution of income flows incurred is also important for determining the response of aggregate demand after a monetary policy shock. In this paper, I measure the changes in interest income flows in response to a monetary policy shock, as well as their distribution across countries and households.

Contribution

This paper quantifies the unhedged interest rate exposure (URE) for euro area households. The URE, defined in Auclert (2019), is a welfare metric that captures the extent to which households are exposed to changes in real interest rates, and reflects the direct gains and losses in income flows incurred by households after such a change. The paper further examines the distribution of UREs across countries, and across the net wealth, income, and age distributions and housing status groups within countries and for the euro area as a whole.

Results

The first important result is that there is substantial heterogeneity in the interest rate exposure across countries.

In some countries, such as Austria, Belgium, Germany, Italy and Malta, households have predominantly positive interest rate exposure, indicating that they would gain, in terms of interest income flows, after an increase in the interest rate, all other things remaining constant. By contrast, households in Cyprus, Ireland, the Netherlands, Portugal and Spain, for example, have, on average, negative interest rate exposure, indicating that households in these countries, would lose, in the first instance, from an increase in the interest rate, all other things remaining constant. The heterogeneity across countries can largely be attributed to the prevalence of adjustable rate mortgages (ARMs). In countries with a high prevalence of ARMs, households have, on average, negative interest rate exposure, as a large part of their liabilities is exposed to interest rate fluctuations. In countries with low ARMs, such as Germany, the interest rate exposure is, on average, positive.

A second important result is that in almost all countries, households at the lower end of the net wealth distribution, younger households and mortgagors have, on average, negative interest rate exposure. Assuming there is no response in expected inflation, these households would lose out, in terms of welfare, from an increase in the interest rate. Income effects could be substantial for mortgagors, who typically have a large negative interest rate exposure.

Nichttechnische Zusammenfassung

Fragestellung

Zinsschwankungen wirken sich unmittelbar auf die Zinserträge bzw. Zinslast der privaten Haushalte aus. Da verzinsliche Vermögenswerte und Verbindlichkeiten unter den privaten Haushalten ungleich verteilt sind, haben Zinsänderungen einen direkten Verteilungseffekt. Zudem zeigt die aktuelle makroökonomische Forschung, dass die Umverteilung von Einkommensströmen auch im Hinblick auf die Frage wichtig ist, wie die gesamtwirtschaftliche Nachfrage auf einen geldpolitischen Schock reagiert. Im vorliegenden Beitrag werden die Veränderungen der Zinseinkommensströme im Gefolge eines geldpolitischen Schocks sowie ihre Verteilung auf die verschiedenen Länder und privaten Haushalte bestimmt.

Forschungsbeitrag

In der vorliegenden Arbeit wird das nicht abgesicherte Zinsänderungsrisiko der privaten Haushalte, das von Auclert (2019) definiert wird, im Euroraum gemessen. Dabei handelt es sich um einen Wohlstandsindikator, der erfasst, wie stark die Haushalte auf Änderungen der realen Zinssätze reagieren, und Aufschluss über ihre direkten Zinsgewinne und -verluste nach solchen Zinsänderungen gibt. Des Weiteren wird die Verteilung des nicht abgesicherten Zinsänderungsrisikos in den verschiedenen Ländern und in den unterschiedlichen Nettovermögens-, Einkommens- und Altersgruppen sowie nach Wohneigentumsverhältnissen sowohl innerhalb der einzelnen Euro-Länder als auch im Euroraum als Ganzes betrachtet.

Ergebnisse

Das erste wichtige Ergebnis besteht darin, dass die privaten Haushalte in den einzelnen Ländern einem sehr unterschiedlichen Zinsänderungsrisiko ausgesetzt sind.

In einigen Ländern, beispielsweise in Österreich, Belgien, Deutschland, Italien und Malta, weisen die privaten Haushalte überwiegend ein positives Zinsänderungsrisiko auf. Somit würden sie (unter sonst gleichen Bedingungen) von einem Zinsanstieg profitieren. Im Gegensatz dazu ist das Zinsänderungsrisiko der privaten Haushalte in Zypern, Irland, den Niederlanden, Portugal und Spanien im Durchschnitt negativ – sie würden also im Fall einer Zinsanhebung (ebenfalls unter sonst gleichen Bedingungen) zunächst Verluste erleiden. Diese nationalen Unterschiede sind vor allem durch die unterschiedliche Verbreitung variabel verzinslicher Hypothekarkredite bedingt. In Ländern, in denen viele variabel verzinsliche Hypothekarkredite vergeben werden, ist das Zinsänderungsrisiko der privaten Haushalte im Schnitt negativ, da ein Großteil ihrer Verbindlichkeiten Zinsschwankungen ausgesetzt ist. In Deutschland sowie in anderen Ländern, in denen variabel verzinsliche Hypotheken weniger üblich sind, ist dieses Risiko im Schnitt positiv.

Eine weitere wichtige Erkenntnis besteht darin, dass die privaten Haushalte am unteren Rand der Vermögens- und Einkommensverteilung sowie Haushalte und Hypothekenschuldner jüngeren Alters in fast allen Ländern durchschnittlich ein negatives Zinsänderungsrisiko aufweisen. Unter der Annahme gleichbleibender Inflationserwartungen würden diese Haushalte bei einer Zinserhöhung einen Wohlstandverlust erleiden. Die Einkommenseffekte könnten für Hypothekenschuldner beträchtlich ausfallen, da diese in der Regel ein deutlich negatives Zinsänderungsrisiko aufweisen.

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The Interest Rate Exposure of Euro Area Households

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Abstract

We estimate the "unhedged interest rate exposure" (URE) of euro area households. The URE is a welfare metric that captures the extent to which households are exposed to changes in real interest rates, and reflects the direct gains and losses in interest income flows incurred by households after such a change. It is defined as the difference between maturing assets and maturing liabilities at a given point in time (Auclert 2019). We examine the distribution of the UREs along the net wealth, income, age and housing status distributions for the euro area as a whole and for individual countries, and document substantial heterogeneity across these dimensions. The median household in the euro area has a positive interest rate exposure, indicating that it would gain, in the first instance, from an increase in the interest rate, all other things remaining constant. Households in the lower end of the net wealth and income distribution, younger households and mortgagors, have negative interest rate exposure and would lose from an increase in interest rates. The heterogeneity across countries is largely attributed to the differences in the prevalence of adjustable rate mortgages (ARMs). Countries with a high prevalence of ARMs have interest rate exposure distributions skewed to the left, with negative mean interest rate exposure. Interest gains/losses after a monetary policy shock can be substantial for households with negative interest rate exposure, particularly for mortgagors, and of a similar (absolute) magnitude to capital gains/losses from associated changes in house prices. Besides the direct distributional consequences and the implications for monetary policy, the distribution of the interest rate exposures may help explain the general public's views with the respect to the prevailing monetary policy regime or the central bank.

Keywords: Interest rate exposure, URE, monetary policy, distributional effects, adjustable rate mortgage (ARM), Household Finance and Consumption Survey (HFCS).

JEL codes: D31, E21, E52, E58.

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1 Introduction

Interest rate fluctuations have a direct effect on the interest income flows received or paid by households. As interest-bearing assets and liabilities are distributed differently across the populations, interest rate fluctuations have distributional consequences. The persistently low interest rates in the major advanced economies following the onset of the financial crisis brought to light such effects, and together with the quantitative easing employed by the central banks in these economics, they have drawn the distributional consequences of monetary policy into the public debate; see Draghi (2015), Constâncio (2017).

In this paper we quantify the interest rate exposure of euro area households, and examine its distribution across euro area countries and groups of households. In particular, we compute the "unhedged interest rate exposure" (URE) as defined by Auclert (2019). The URE is a welfare metric that captures the extent to which households are exposed to changes in real interest rates, and reflects the direct gains and losses in income flows incurred by households after such a change. In anticipating a future change in the interest rate, the URE determines which countries and which households would benefit from such a change and which would loose. Identifying winners and losers is useful to form more informed policy opinions, communicate policy decisions better, and it also helps understand the general public's reaction to monetary policy announcements and its attitudes towards the policy of the central bank. This paper identifies which countries, income, wealth, age and housing status groups would benefit and which would loose after an interest rate increase. It thus provides a complete picture of the direct distributional effects following an interest rate increase, and is directly relevant to this debate.

The URE is defined as the difference between maturing assets and liabilities at a given point in time. Maturing assets include income, and maturing liabilities include the households' consumption. In effect, it is the resource flow available to be invested or the amount required to be financed, over an interval of time, and thus in effect, the amount that is exposed to interest rate changes. Considering the maturity of the assets and liabilities is crucial, since assets and liabilities with an interest rate fixed beyond the time interval considered, are "hedged" against a change in the interest rate (for the period considered). Assuming a complete pass-through of the policy rate into retail rates for deposits and loans, the interest rate exposure translates fully into the (direct) cash flow effect after a change in the policy rate. Households with positive UREs, with typically large investments in short-term instruments, such as deposits, are initially hurt by a drop in the interest rate, or by low interest rates in general (all other things being equal), while households with negative UREs, with typically adjustable-rate mortgages and smaller investments in deposits, gain from a drop in interest rates.

Auclert (2019) refers to the associated redistribution between households with positive and negative UREs as the "interest rate exposure channel". He shows that the interest rate

exposure channel affects how households will adjust their consumption after an interest rate change and, together with the households' marginal propensity to consume (MPC), it determines the effect of an interest rate change on aggregate demand.

In our paper, we focus on the distribution of the URE and the implied cash flow gains or losses across euro area countries and different groups of households within each country. We examine how the interest rate exposure[1] varies across the households' net wealth, income and age distributions. We also examine how the URE varies along housing status groups. To complete our analysis we compute the interest income gains and losses after a contractionary monetary policy shock together with the associated capital losses resulting from a drop in stock and house prices.

Our analysis is based on the Household Finance and Consumption Survey (HFCS), a large household survey covering euro area countries and providing detailed information on households' assets and liabilities, as well as information on their income and consumption. As consumption is not measured in a sufficiently detailed way, we combine information on consumption from other surveys. For the main part of our analysis we use the second and latest available wave of the survey, with 2014 as the reference year. Key stylized facts from this wave are reported in HFCN (2016).

We find that the median household in the euro area has a positive unhedged interest rate exposure. Assuming no response in expected inflation, the median household would gain from a rise in interest rates, in terms of welfare, from an increase in the interest rate.

There is considerable heterogeneity between countries, driven mainly by the heterogeneity in the liabilities of households across countries, and particularly by the differences in the prevalence of adjustable rate mortgages. The countries with large positive mean UREs have a low prevalence of ARMs, such as Austria, Germany, Malta or Italy, whereas the latter is high in the countries with large negative mean UREs, such as the Netherlands, Ireland, Portugal or Spain. The relative ratio of deposits to total wealth, as deposits are more exposed to changes in interest rates relative to other wealth components, also plays a role in shaping this heterogeneity. There is also considerable heterogeneity across wealth, age and housing status groups within countries, and the distribution of UREs across these dimensions differs among countries. On the whole, low net wealth households have negative UREs, as they have little financial assets and are more indebted. On average, URE increases with wealth, as households in higher wealth groups have accumulated more assets and have smaller debts (relative to their assets). In the countries with a high percentage of indebted households and a high percentage of ARMs, however, the mean URE is also negative for high net wealth groups. A less clear pattern emerges for the distribution of UREs across income. On the whole, it is negative or positive but close to zero for low income groups and positive, and large, for high income groups. But since the distribution of indebted households is more dispersed along income groups, the

[1] By interest rate exposure we always mean the "unhedged" interest rate exposure, as broadly defined above; that is, considering the maturing assets and liabilities, and not all interest-bearing assets and liabilities.

differences in the mean URE across income groups are less pronounced.

The interest rate exposure of households is generally negative for the youngest group and increases with age. In all countries, the group of households with household heads who are 65 years old and above have on average positive exposure, and the largest among all age groups, indicating that this is the age group that will benefit the most from rising interest rates. As regards housing status groups, it is predictably the owners with a mortgage who have, on average, negative interest rate exposure, whereas owners outright have a positive URE. Exceptions to this picture are Germany and France, where also households with a mortgage have on average positive UREs, due to the low percentage of ARMs among mortgagors in these countries.

Assuming a complete pass-through of the policy rate to bank rates on deposits and loans, the interest rate exposure translates into actual cash flow gains or losses incurred by households after a change in the policy rate. We compute gains and losses in interest income flows after a 1 percentage point increase in the policy rate. For the euro area households, such an increase in the policy rate would translate into an interest income gain of 139 euros on average. We also compare such gains/losses in interest income flows with capital gains/losses caused by an increase or drop in house and stock prices[2]. In general, the magnitude of the interest income gained or lost after an increase in the policy rate is smaller than the gains/losses caused by the associated changes in asset prices. Gains/losses in interest income flows are large for particular groups of households, such as mortgagors. For this group, losses after an increase in the policy interest rate are of the same order of magnitude as losses from the associated changes in house prices. For the upper middle part of the net wealth distribution, gains in interest income flows after an interest rate increase are also of the same order of magnitude as losses from the associated changes in house prices and can thus compensate for the latter. For the top 5%, gains are even larger, but only partly compensate for the capital losses in stock and house prices, though the latter may not be realized.

Aside from the magnitude of the interest income flows, it is important to note that almost all households experience a non-zero change in the interest income flow after an interest rate change, as almost all households hold deposits, and a good percentage have some kind of adjustable rate loan; hence they may be important in shaping the public's perception about the conduct of monetary policy. Examining the distribution of the interest rate exposures may help understand the public's opinions with respect to the prevailing monetary policy regime or the central bank.

In our analysis we focus on the interest rate exposure and the implied cash flow gains or losses, abstracting from any other indirect effects of monetary policy, such as those on inflation and employment. Also, as our analysis is based on survey data, our results are subject to measurement error, which we discuss extensively in the paper. The illustrated distributions of the interest rate exposures across countries and household groups remain

[2]Computations for the capital gains/losses are based on Adam and Tzamourani (2016).

similar across different specifications.

Our paper relates to the literature on the distributional consequences of monetary policy and to the broader literature quantifying the alternative channels of monetary policy transmission, in particular the role of interest rates, besides intertemporal substitution.[3]

The main reference of our paper is Auclert (2019), who defined the unhedged interest rate exposure (URE). Auclert (2019) lays out the theory behind UREs, but his main focus is on the effect of redistribution on aggregate demand, which requires him to measure UREs and MPCs jointly. However, the distribution of UREs is directly relevant when it comes to obtaining a precise assessment of the distributional effects of changes and interest rates, and this is what our paper provides.

Adam and Tzamourani (2016) quantified the distributional effects of asset price increases and of conventional and unconventional monetary policy actions in the euro area based on the portfolio structure of households' wealth. They showed that equity price increases largely benefit the top end of the net wealth (and income) distribution, whereas housing price increases display a hump-shaped pattern over the net wealth distribution, with the poorest and richest households benefitting least. Bond price increases do not correlate with net wealth or income. In our simulation experiment we use part of their methodology and report the associated capital gains/losses from changes in the asset prices along the gains/losses in interest income flows following a change in the policy interest rate.

A number of studies have also tried to quantify the gains and losses resulting from the low interest rates or the unconventional policy measures in the years since the financial crisis in the euro area, such as Demary and Niehues (2015), or Holzhausen and Sikova (2015), who measure interest rate gains and losses based on the difference between market interest rates in the years of the financial crisis and those in the years before the crisis for German and euro area households, respectively. We find similar qualitative results with respect to the higher foregone income losses because of the low interest rates in Germany and for older age households. Domanski, Scatigna, and Zabai (2016) measure the effect on wealth after simulating changes to returns on assets and the cost of debt liabilities. They find that the effect of fixed income assets, such as bonds and deposits, on inequality in the years before and after the crises is small, while in Germany, declining interest rates have added to inequality.

Casiraghi, Gaiotti, Rodano, and Secchi (2018) examine the effect of a conventional and unconventional monetary policy shock on the distribution of labour earnings, yields of savings and the prices of Italian households' asset holdings. They find that losses from low interest rates for savers are offset by asset price increases. The lower income and net wealth groups benefit from the increase in labor earnings. In a study for four European economies, Lenza and Slacalek (2018) find that after unconventional monetary policy

[3]Quantifying the effects of the interest rate exposure on consumption is, however, beyond the scope of this paper.

actions in the euro area, the wealthy benefit from asset price increases, but employment also increases and benefits mostly low income households.

Doepke and Schneider (2006), quantitatively examine the redistributional effects of inflation in the U.S. economy, measuring the balance sheet exposure of various sectors and groups of households to different inflation scenarios. Adam and Zhu (2016) quantify the redistributive effects of surprise deflation and inflation in the euro area; Meh and Terajima (2008) report such results for Canada.

Gornemann, Kuester, and Nakajima (2016) study the distributional effects associated with monetary policy shocks in the framework of a New Keynesian model with rich household heterogeneity. They find that shocks that tighten monetary policy increase inequality in the economy. Coibion, Kueng, Silvia, and Gorodnichenko (2017) analyze the effects of monetary policy shocks on income and consumption inequality. They show that contractionary monetary policy actions in the U.S. increase the inequality in labor earnings, total income, consumption and total expenditures. They further show that income sources are affected differently by a monetary policy shock and, whereas business income drops after a contractionary shock, financial income rises persistently and significantly over the entire sample period they consider. Our analysis relates to the latter results, as it quantifies the direct effect of a monetary policy shock on interest returns, a component of financial income.

In another strand of the literature, various papers highlight the significance of interest rate changes in the response of aggregate consumption to a monetary policy shock because of their direct effect on mortgage payments, and several note the importance of the type of mortgage, adjustable rate or fixed rate, in that effect. Auclert (2019), in illustrating the role of the interest rate exposure channel, notes the amplifying role of ARMs in the effect of interest rate changes on consumer spending, in line with Calza and Stracca (2013) who find that the monetary transmission to house prices, consumption and residential investment is stronger in economies with predominantly adjustable-rate, as opposed to fixed rate, mortgages. Similarly, Garriga, Kydland, and Sustek (2017) find that monetary policy shocks have larger real effects under ARMs than fixed rate mortgages (FRMs), particularly because price and wealth effects reinforce each other under ARMs, but tend to offset each other under FRMs.

Hofmann and Peeersman (2017) show that a monetary tightening leads to a significant and persistent increase in debt payments relative to income, as the higher effective lending rates on the stock of debt outweigh the decline in the debt-to-income ratio.

Di Maggio, Kermani, Keys, Piskorski, Ramcharan, Seru, and Yao (2017) explore the effect of lower interest rates on consumption via the reduction in monthly mortgage repayments and find a positive consumption response after the reset and further document a significant heterogeneity in borrowers' responses to rate reductions depending on their income and wealth. Hviid and Kuchler (2017) estimate the cash flow effect of changes in interest rates on the consumption choices of Danish households. They find that interest-

rate sensitivity is high for households with a large amount of debt and adjustable rate mortgages. Direct income effects of monetary policy on consumption are also discussed in Kaplan, Moll, and Violante (2018). The direct income effect following a reduction in interest rates is positive for borrowers, since lower interest payments on their debt translate into higher consumption, and negative for lenders with positive liquid wealth. The direct and indirect effects of a monetary policy shock is further examined in Cloyne, Ferreira, and Surico (2018), Jappelli and Scognamiglio (2018), and Ampudia, Georgarakos, Slacalek, Tristani, Vermeulen, and Violante (2018), which point to the importance of the heterogeneity in households' balance sheets in the transmission of monetary policy.

Although quantifying the effects of an interest rate change on aggregate demand is beyond the scope of the paper, our paper illustrates the determining role of the ARMs in the heterogeneity in the interest rate exposure across countries, which in turn affects monetary policy transmission.

This paper is structured as follows. After presenting the data set and the accounting methodology in the next section, section 3 presents the main results of our paper. Subsection 3.1 presents the unhedged interest rate exposure for the euro area and across euro area countries and discusses the sources of heterogeneity with respect to the URE. Sections 3.2 − 3.5 present the interest rate exposure across the net wealth, income, age and housing status distributions respectively. Section 3.6 quantifies the gains and losses in interest income flows based on the URE, and compares these with the associated capital gains following a monetary policy shock. The final section concludes.

2 Methodology and the Data Set

We use the Household Finance and Consumption Survey (HFCS) data to compute the unhedged interest rate exposures (UREs) for households in the euro area. Auclert (2019) defines the unhedged interest rate exposure of a household as the difference between all their maturing assets, including their income, and their liabilities, including their consumption over the next period of their consumption plan. In particular, using his simplified formula adapted for survey data, URE is defined for each household i as

$$URE_i = Y_i - C_i + A_i - L_i \tag{1}$$

where Y_i represents household income from all sources net of taxes and social contributions, C_i represents consumption, including interest payments, A_i represents the maturing assets, and L_i represents the maturing liabilities, including loan payments. Hence, URE_i measures the total resource flow that a household i needs to invest or borrow over the first period of its consumption plan. The maturity of the assets plays a key role, since assets with a longer maturity than the planned consumption period are "hedged", i.e. not affected by the change in the interest rate.

We will define these quantities using the data available in the HFCS. The HFCS collects information on all households' asset and liabilities, income and consumption, with varying degree of detail. The reference period for assets and liabilities is the time of the survey, or the end of the year preceding the survey. The reference period for income and consumption is the current year or the year preceding the year of the survey. Following the structure of the data, the reference period for the URE in our analysis is a year.

Households' assets are recorded in relatively great detail in the HFCS, which contains questions on the market value for each type of asset class owned, such as deposit accounts, self-employment business, shares, bonds, mutual funds, managed accounts, loans owed to households, other financial assets and real assets. For the purposes of our analysis we add to deposits the amount of mutual funds invested in money market funds[4], and to the value of directly held bonds the value of mutual funds invested predominantly in bonds. In the HFCS there is no specific information on the maturity of the assets held. In our baseline specification we will characterize all sight deposits as maturing, and a percentage, 80 %, of saving deposits as maturing.[5]

We further consider 90% of managed accounts as maturing, as this is approximately the ratio of our "maturing" deposits to total deposits held by households.[6]

We characterize a percentage of bonds as maturing, based on the information provided in the ECB Securities Holdings Statistics (SHS) database. We use the country-specific ratio of the securities (outstanding amounts), held by households, with a residual maturity of up to and including 1 year, to the total security holdings of households. These ratios are listed in Table 5 of the Appendix.

On the liabilities side, the HFCS records information on mortgages collaterized on the household's main residence and other real estate and on consumer debt. The initial and outstanding amounts and the monthly installment of all loans are recorded. For the mortgages there is also the indication of whether the loan has an adjustable or a fixed interest rate, the year the loan was initially taken out or last refinanced, and the duration of the loan at that time. From the latter two components, we compute the remaining maturity of fixed rate mortgages (FRMs), adding the duration of the loan to the year the

[4] According to the ECB Euro Area Money Market Fund Statistics Explanatory Notes, 4 May 2010: "MMFs are defined as collective investment undertakings of which the units are close substitutes for bank deposits in terms of liquidity. Furthermore, these funds primarily invest in money market instruments with a residual maturity up to one year, and/or in bank deposits".

[5] This is based on the ratio of the volumes of (euro area) new business deposits with a maturity of up to 1 year, relative to all new business deposits with an agreed maturity (which is approximately 80%), as recorded in the ECB Monetary Financial Institutions (MFI) Interest Rate Statistics. This percentage probably corresponds to a lower bound of the ratio of maturing deposits with respect to the date of the resetting of the interest rate, since the maturity recorded in the MFI Interest Rate Statistics does not necessarily correspond to the interest rate fixation period, and the latter could be shorter. Since the interest rate fixation period is not known and we need to use an approximation, we use the same percentage for maturing deposits for all euro area countries.

[6] Managed accounts are defined as accounts at a bank or an investment company for which a manager may make most of the day-to-day decisions or consult more closely with the account owner. Such accounts may also be trust accounts.

loan was taken and subtracting the survey year. In our baseline specification we define as maturing assets all the adjustable rate mortgages plus all the non-mortgage loans; to these we also add the percentage of FRMs with a remaining maturity of less than one year[7].

The HFCS further collects information on individual income components, allowing the computation of the households' annual gross income. However, net household income, which would be the right measure for computing the households' interest rate exposure, is generally not reported. For Italy the total social security contributions and taxes paid per household are reported, and we subtract these from gross income to obtain net income. For Austria net income is provided as an additional non-core variable. For Germany, net income has been made available by Zhu (2017), who has estimated household net income using a tax conversion model. For the rest of the countries we approximate net income using the net/gross income ratio per income decile provided by EUROMOD (2017)[8]. The information collected on consumption in the HFCS is less detailed. There are two questions on monthly consumption at home and outside the home, a question on utilities, a question on the amount of rent paid, and also a question on the household's estimate of total monthly consumption on non-durables (wave 2 only). For our baseline measure of URE we use this latter estimate, since this is the measure reported directly by participating households in the survey. To this we further add expenditures on vehicles, which are recorded in the second wave of the HFCS, as a measure for durables expenditures[9].

Since studies have shown that a one-off measure in general surveys tends to underestimate consumption, we compute the UREs using two alternative consumption measures. First, we employ an alternative measure for non-durables consumption, introduced by Lamarche (2017), in the Appendix. Second, we inflate our baseline consumption measure for all households by 30%. Furthermore, for Austria, Germany and Italy, country-specific information on household saving is available, and we also use this to construct an alternative URE measure (further details are provided in the Appendix). These alternative URE measures are also compared with the "stocks" component of the unhedged interest rate exposure as defined above, comprising maturing assets − maturing liabilities, which can be regarded as an "instantaneous" interest rate exposure.

In summary, in our baseline measure of URE, Y_i is net household income from all

[7]In the HFCS there is no information about the type of mortgage for Finland. According to Eurosystem (2009) however, 96% of mortgages held in Finland are of adjustable rate. Because of the small margin of the resulting error, we include Finland in our analysis considering all mortgages in Finland as ARMs.

[8] Data were downloaded on 20 June 2017.

[9]Auclert (2019) discusses the role of durable goods in deriving the URE and the overall net wealth change following a change in the real interest rate, and derives separate expressions for these based on the elasticity of the relative price of durables and the real interest rate. Where this elasticity is zero, indicating that their price does not change when the interest rate changes, overall expenditures, including durables expenditures, should be included in the URE. Auclert employs this assumption in his baseline scenario and we follow this approach. If one sees durable goods as serving as a hedge against interest rate movements then they should not count at all towards URE.

sources;

C_i is non-durables and durables expenditures plus rent;

A_i are all sight deposits, 80% of saving deposits, all mutual funds invested in money market instruments, the country-specific percentage bonds assumed to be maturing, plus 90% of managed accounts;

L_i are adjustable rate mortgages (ARMs), all non-mortgage credit, plus the fraction of FRMs with maturity less than one year at the time of the survey, plus all loan payments.

The URE is measured by construction in euros. To better compare the UREs across countries and to assess gains and losses across households, we standardize the households' UREs with the mean gross income of the group we refer to (for example, for the URE of a given country, we standardised with the mean gross income of all households in the sample of that country).

An alternative standardization, used by Auclert (2019), is by consumption. This has the advantage that the URE multiplied by the MPC (if known) gives the percentage change in household consumption after a change in the interest rate. We provide the URE estimates relative to household consumption in Table 8 in the Appendix.

From our analysis we exclude the (randomly selected) households of Ireland and France to which the consumption questions were not administered.

3 Results

3.1 Interest Rates Exposures Across Euro Area Countries

Figure 1 depicts the distribution of UREs across the euro area countries.[10] [11]

We note that the median URE is positive for the euro area and all individual euro area countries except the Netherlands.

For the median household in the euro area, the URE amounts to 27% of the euro area mean household gross income. Hence, for the median household in the euro area, an increase in the real interest rate by 100 basis points, would imply an increase in net income of 0.27% of the euro area mean gross income. Across all euro area households, the same increase in the real interest rate would imply an increase of 0.35% of the euro area mean gross income, on average, per household, or €139.[12] The largest positive median interest rate exposures (relative to each country's income) are observed in Malta (61%), Austria (43%) and Germany (40%). The country mean UREs are even larger. Furthermore, in these countries it is the vast majority of households, more than 80%, that have positive interest rate exposure.

[10] Results for Italy, using the SHIW, the Italian component of the HFCS, are also presented in Auclert (2019).

[11] Further and more detailed results on the distributions of the UREs across countries are presented in the Appendix. Figures 11, 12 and 13 depict the distributions of the UREs. The means and medians of the UREs across countries are given in Tables 6 and 7.

[12] Assuming a complete and equal pass-through for deposits and loans.

In contrast to these countries, Cyprus, Finland, Ireland, the Netherlands, Latvia, Portugal and Spain have negative mean UREs. In these countries the interest rate exposure distributions are skewed to the left, with negative URE households having large exposures and implying large gains/losses in interest income flows (interest returns or interest expenses) after a change in the policy interest rate. As negative interest rate exposure households typically have higher MPCs[13], the effect of these gains/losses on the consumption of these households can be large.[14]

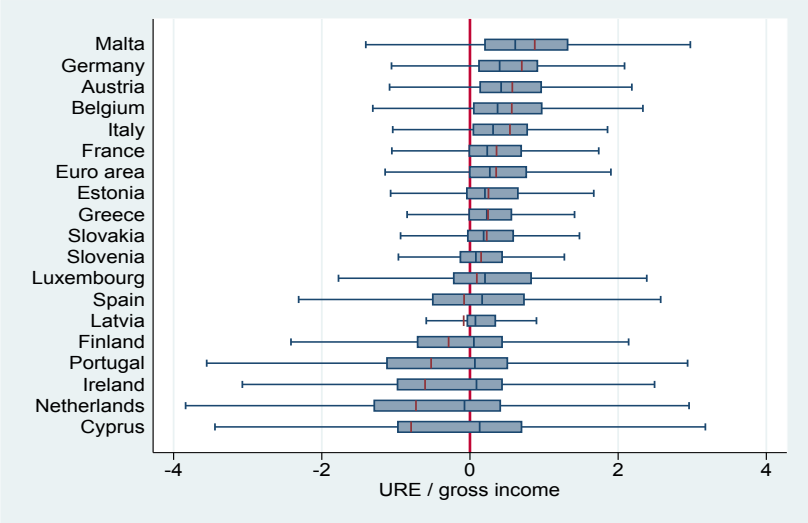
We explore what drives the heterogeneity in the distribution of UREs in more detail. Figure 2 shows the breakdown of the UREs across countries in their stocks and flows components, and Table 1 gives some country statistics that come into play. We find that the main source of variability is attributed to the liabilities component, and in particular the variability in the prevalence of adjustable rate mortgages across countries. The "negative URE" countries, such as Ireland, the Netherlands and Cyprus, have a high percentage of households with adjustable rate mortgages (ARMs), whereas the large "positive UREs" countries, predominantly have a low percentage of ARMs, such as Austria, Germany, Italy and Malta. Furthermore, in the "negative URE" countries, the percentage of households with debt is higher. Even if the distribution of ARMs and fixed rate mortgages is similar within a country, the large percentage of households with a mortgage results in a high prevalence of ARMs and a larger exposure to interest rate changes, as in Cyprus, for example. The maturing assets component is mainly determined by the ratio of deposits to total household wealth, as this is the main component subject to interest rate changes. This ratio is less dispersed across countries, since deposits form the main portfolio asset for households across all euro area countries. We note, however, the larger ratio of deposits to total household wealth in Germany and Austria. The lower such ratio in France compared to Germany, makes its URE smaller than that of Germany, although France has an even (slightly) lower prevalence of ARMs.

The saving component also differs across countries, although the saving component explains a smaller proportion of the variation of the URE. Germany has the highest saving rate, as measured by our net income minus consumption measure (over gross income). We note that since the consumption measure is underestimated, saving rates are overestimated. However, as shown in Tables 6 and 7 and Figure 1 of the Appendix, the relevant order of magnitude between countries is in general preserved, even if we use the alternative measure of consumption based on the Household Budget Survey or the URE based only on stocks (that is, considering only the maturing assets and liabilities and not the saving component).

[13] Auclert (2019).

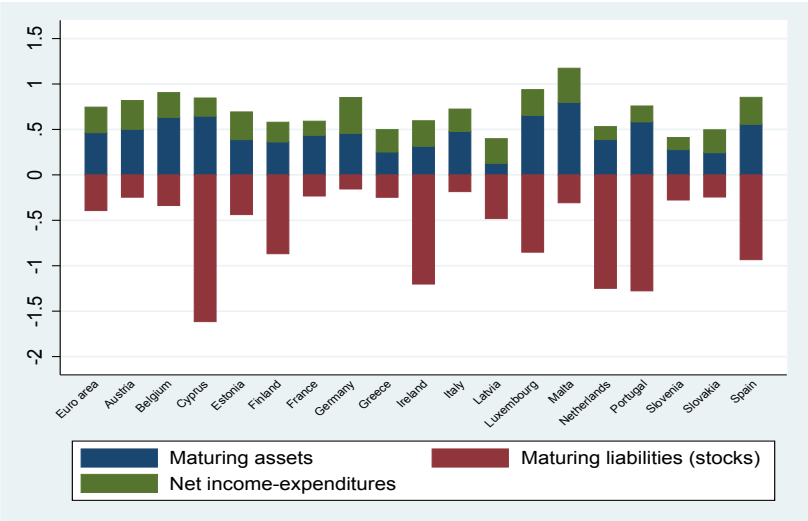
[14] Auclert (2019) provides the theory that links interest rate exposures to the response of consumption and aggregate demand after a monetary policy shock.

Figure 1: Unhedged Interest Rate Exposure (URE) across Euro Area Countries



Source: HFCS, 2014 (reference year). Boxplots of UREs standardized with countries' mean gross income. Countries ordered based on mean URE. The blue line in each box indicates the median and the red line the mean of the respective distribution.

Figure 2: URE components: maturing assets, maturing liabilities and savings (relative to gross income)



Source: HFCS, 2014 (reference year). URE components represent means within a country, standardized with countries' mean income.

[15]The HFCS does not report the type of mortgage (ARM/FMR) in Finland. However, Eurosystem (2009) reports that 96% of mortgages in Finland have adjustable rates. We use this number to impute the percentage of ARMs in all households and the euro area averages of the percentage of households with ARMs among mortgagors and among all households. In our analysis we assume that all households with a mortgage in Finland have an ARM.

Table 1: Indebtedness and portfolio composition indicators across euro area countries

Country	Has debt %	Has mortgage %	Has ARM Hhs with mortgage %	Has ARM All Hhs %	Deposits to total wealth %
Euro Area	42.4	23.3	46.8	10.6	19.6
Austria	34.4	16.7	53.0	8.9	34.4
Belgium	48.4	34.5	38.4	13.2	20.9
Cyprus	59.1	42.0	54.7	23.0	12.9
Estonia	36.8	20.7	81.1	16.8	18.8
Finland	57.4	35.2	96.0	33.8	23.0
France	47.2	24.3	12.0	2.6	16.9
Germany	45.1	20.4	14.5	3.0	29.4
Greece	27.1	13.3	56.3	7.5	10.3
Ireland	56.8	37.0	86.1	31.9	13.2
Italy	21.2	10.1	53.9	5.4	13.0
Latvia	33.5	17.0	87.5	14.9	10.9
Luxembourg	54.6	35.2	75.1	26.4	16.2
Malta	37.1	19.1	29.7	5.7	16.9
Netherlands	63.1	42.0	78.1	32.5	23.4
Portugal	45.9	34.7	94.3	32.7	18.8
Slovakia	36.7	16.2	59.2	9.6	10.3
Slovenia	38.6	9.1	69.0	6.3	12.2
Spain	49.3	35.0	80.3	28.1	11.0

Source: HFCS, 2014 (reference year). Own calculations. The percentage of ARMs in Finland refers to the percentage of ARMs to total new housing loans (Eurosystem 2009).[15]

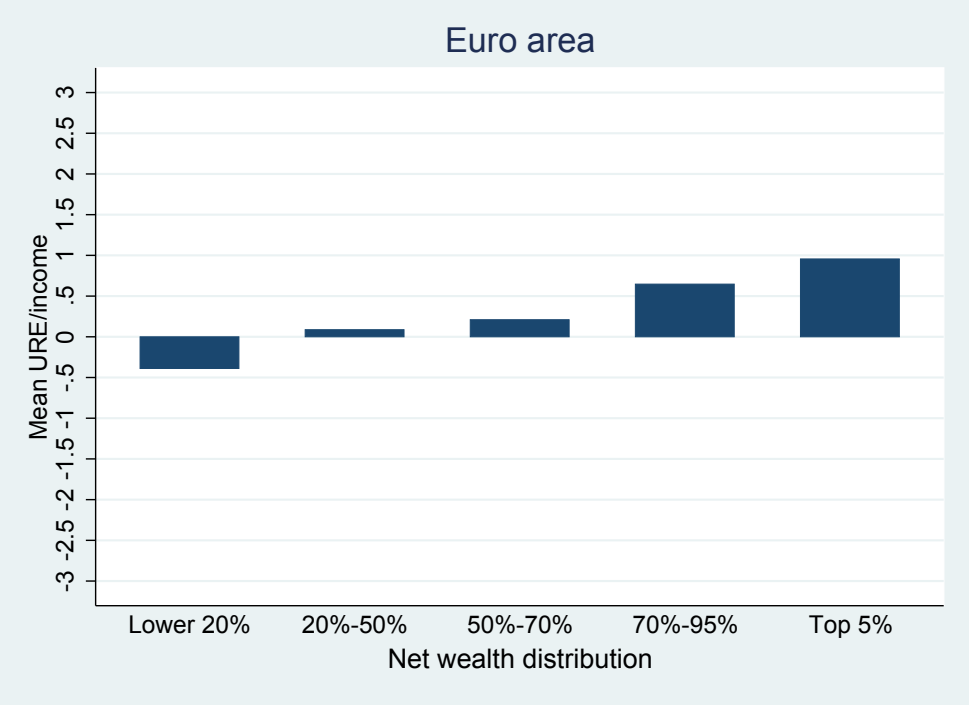
3.2 Interest Rate Exposures Across the Net Wealth Distribution

Figures 3 and 4 depict the interest rate exposure for euro area households across the net wealth distribution in the euro area and in selected euro area countries.

We consider five groups along the net wealth distribution: the lower 20%, the lower middle group, between the 20th and 50th percentile, the middle wealth group between the 50th and 70th percentiles, the upper middle group between the 70th and 95th percentiles, and the top 5%. For all groups, the depicted interest rate exposure is relative to the mean gross income of the respective group.

In general, lower net wealth households have negative UREs, as these have little financial assets and have larger debts (relative to their assets). For the euro area as a whole, it is the lowest 20% net wealth group that has a negative mean URE. URE increases with wealth, as higher wealth implies a smaller liabilities component and a larger assets component, the latter also typically including deposit accounts. Although the pattern of URE increasing with net wealth is consistent across countries, as seen in Figure 4, the point in the net wealth distribution where the mean URE turns positive across net wealth groups varies a lot between countries. Whereas, for example, in Austria and in France, similar to the euro area as a whole, it is only the lower 20% group that has, on average, a negative URE, in Spain, it is the lowest 70% that has a negative mean URE, and in the

Figure 3: The Unhedged Interest Rate Exposure (URE) across the net wealth distribution



Netherlands it is only the top 5% that has a positive mean URE.

3.3 Interest Rate Exposures Across the Income Distribution

As in the analysis above, we consider five groups across the income distribution of households: the lower 20%, the lower middle group, between the 20th and 50th percentiles, the middle income group between 50th and 70th percentiles, the upper middle group between the 70th and 95th percentiles, and the top 5%. Figures 5 and 6 depict the average URE across income groups in the euro area as a whole and in selected euro area countries. For all groups, the depicted interest rate exposure is relative to the total gross income of the respective group.

Taking the euro area as a whole, all income groups have positives UREs on average. Although the URE for the lowest income group is close to zero, and for the top 5% larger than the lower income groups, the URE does not increase monotonically with income. Looking at the distributions across individual countries, we also see an absence of a strong pattern in most countries, indicating that the households with negative interest rate exposure, are more dispersed across the income distribution. For example, in Austria and Germany, the mean URE is positive and of a similar magnitude across all income groups. In Ireland and the Netherlands the mean URE is negative across all income groups. The URE does increase with income in Italy and Cyprus.

Figure 4: The Unhedged Interest Rate Exposure (URE) across the net wealth distribution

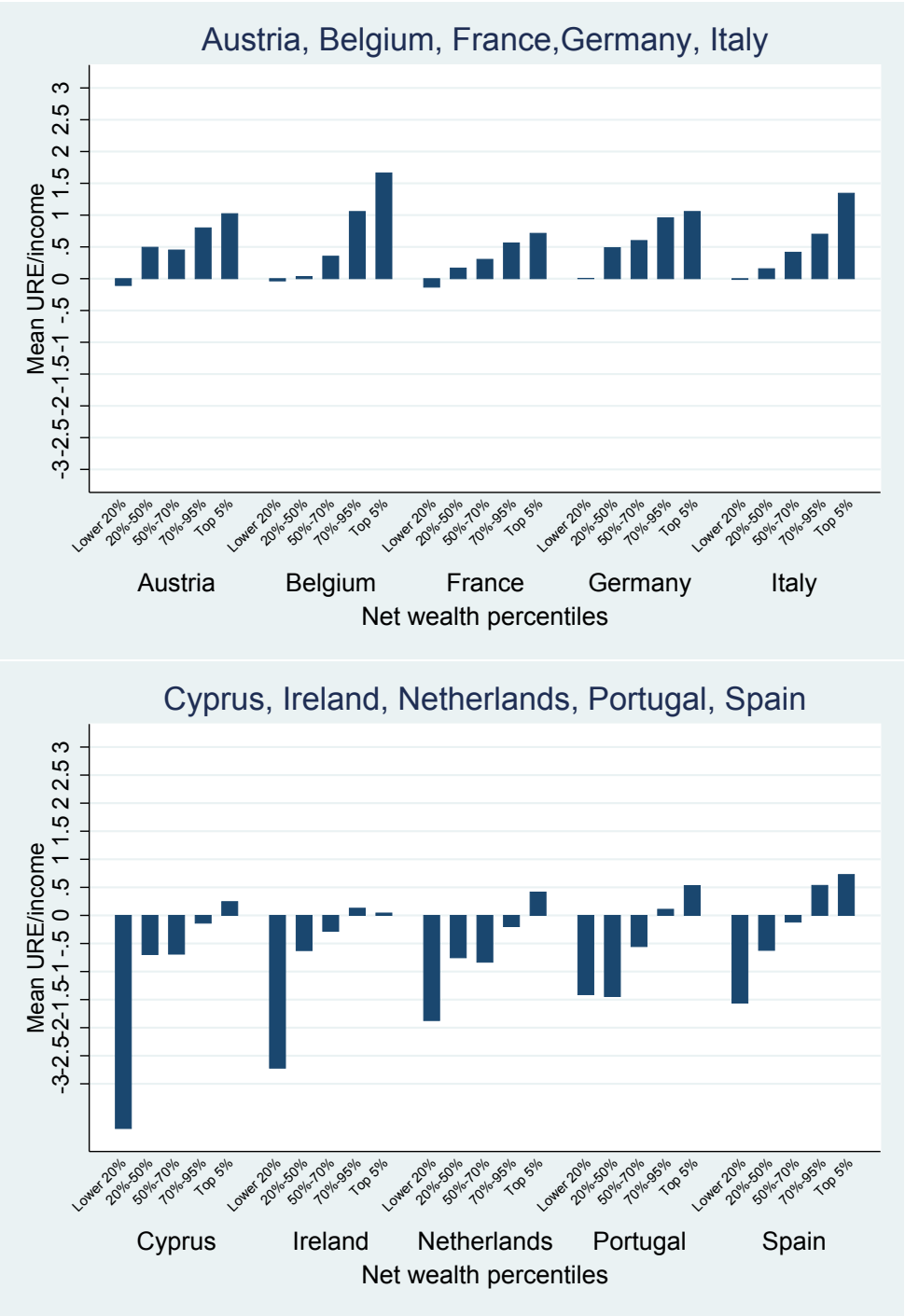
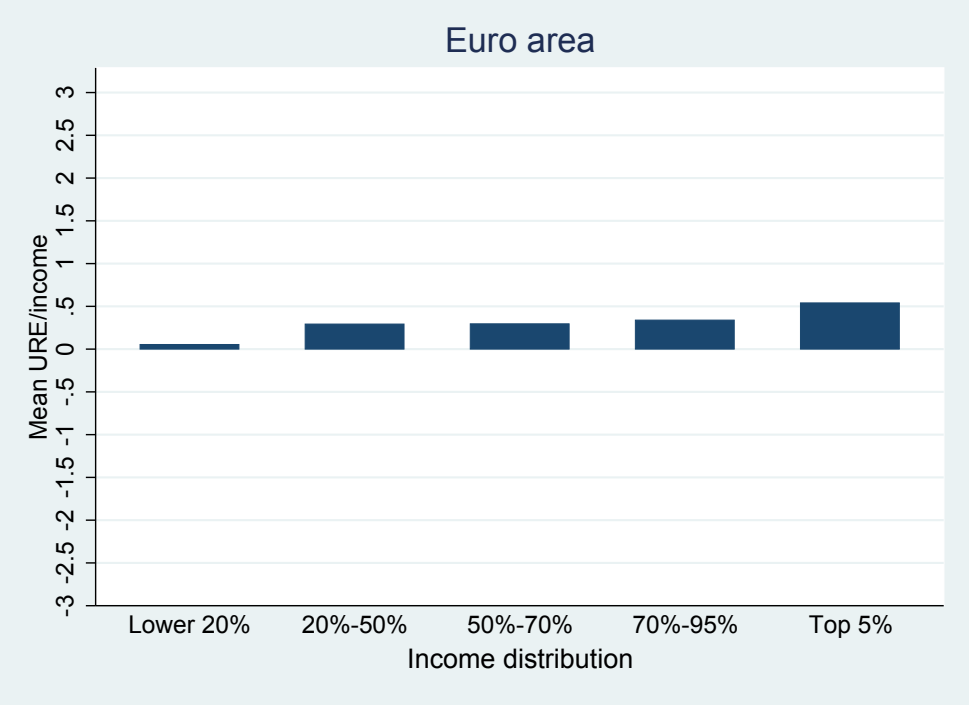


Figure 5: The unhedged interest rate exposure (URE) across the income distribution



3.4 The Interest Rate Exposure Across the Age Distribution

As in the analysis above, we examine the URE across age groups. Figure 7 depicts the URE across different household age groups for the euro area,[16] and Figure 8 depicts the same distribution for different euro area countries.[17] Overall, URE is negative for the younger age groups and increases for older age groups. The very youngest group is the group with little accumulated assets and higher interest exposure through debt. The 35−49 age group has higher debt exposure,[18] but has also higher assets and savings that partly offset the debt exposure. Households progressively accumulate assets and decumulate debt, hence the progressively positive exposure in older age groups. Despite the heterogeneity across euro area countries along this pattern, the 65+ age group has positive interest rate exposure in all countries, except the Netherlands.

3.5 Interest Rate Exposures Across Housing Status Groups

We examine the variability in the interest rate exposure across housing status groups. Figure 9 depicts the UREs across housing status groups for the euro area, and Figure 10 depicts the same for the "positive" and "negative" URE countries. As expected, in all countries, except Germany and France, homeowners with a mortgage have negative

[16] Age groups are based on the age of the household reference person.

[17] As before, for each household group considered the figures display the average URE divided by the average gross income of the group.

[18] Bover, Casado, Costa, Caju, McCarthy, Sierminska, Tzamourani, Villanueva, and Zavadil (2016) assess the distribution of debt across euro area countries and also across age groups and income groups within countries. The 35−44 age group has the highest probability of owning secured debt, i.e. mortgages.

Figure 6: The unhedged interest rate exposure (URE) across the income distribution

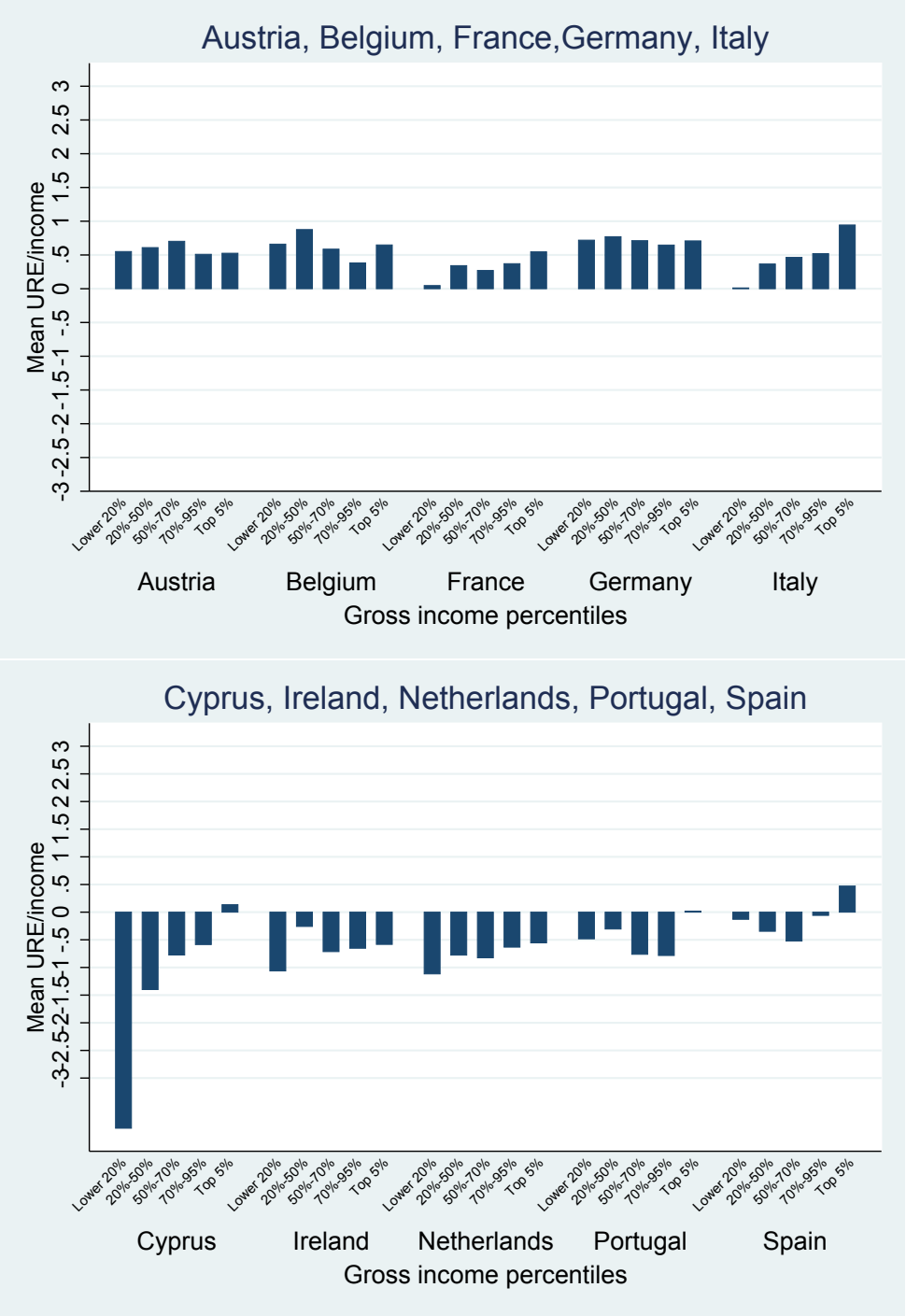
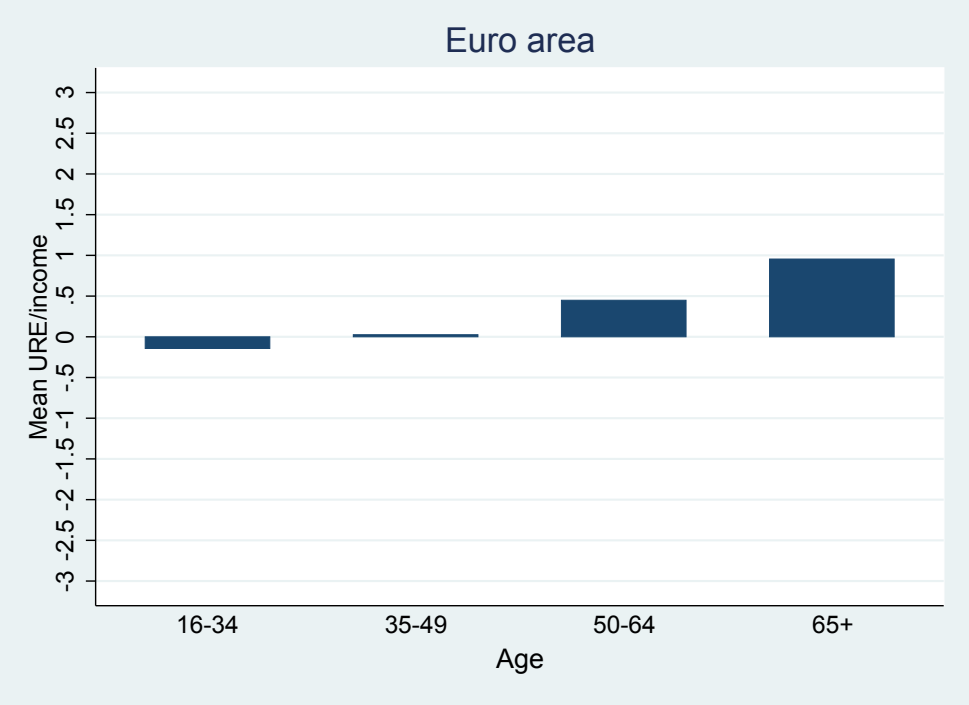


Figure 7: The unhedged interest rate exposure (URE) across age groups



interest rate exposure. The low percentage of ARMs in these countries makes the mean URE positive for this group, too.

3.6 Interest Income and Capital Gains after a Euro Area Monetary Policy Shock

This section quantifies the direct distributional implications for euro area households after a monetary policy shock. Such shocks simultaneously affect the interest income flows received and paid by households, from their maturing assets and liabilities, and the prices of their longer duration assets, namely bonds, equities and housing, resulting in capital gains or losses. In particular, we compute the gains and losses following an increase of 100 basis points in the policy rate. (An accommodative monetary policy shock will result in average effects in the opposite direction but of the same magnitude).

The direct changes in interest income flows are derived from the interest rate exposure, multiplying the latter with the change in the interest rate. The computation of capital gains/losses is based on Adam and Tzamourani (2016), who illustrated the distribution of capital gains following a monetary policy shock, using the asset responses derived in the study of Peersman and Smets (2003), which is one of the few studies simultaneously determining the response of all three asset classes to a euro area monetary policy shock.

Rescaling the point estimates of Peersman and Smets (2003) accordingly, a 1 percentage point interest rate increase would result in a 7.2% drop in stock prices[19], no movement

[19] Bernanke and Kuttner (2005) report elasticities for stocks in the U.S. in the 3%-4% range.

Figure 8: The unhedged interest rate exposure (URE) across age groups

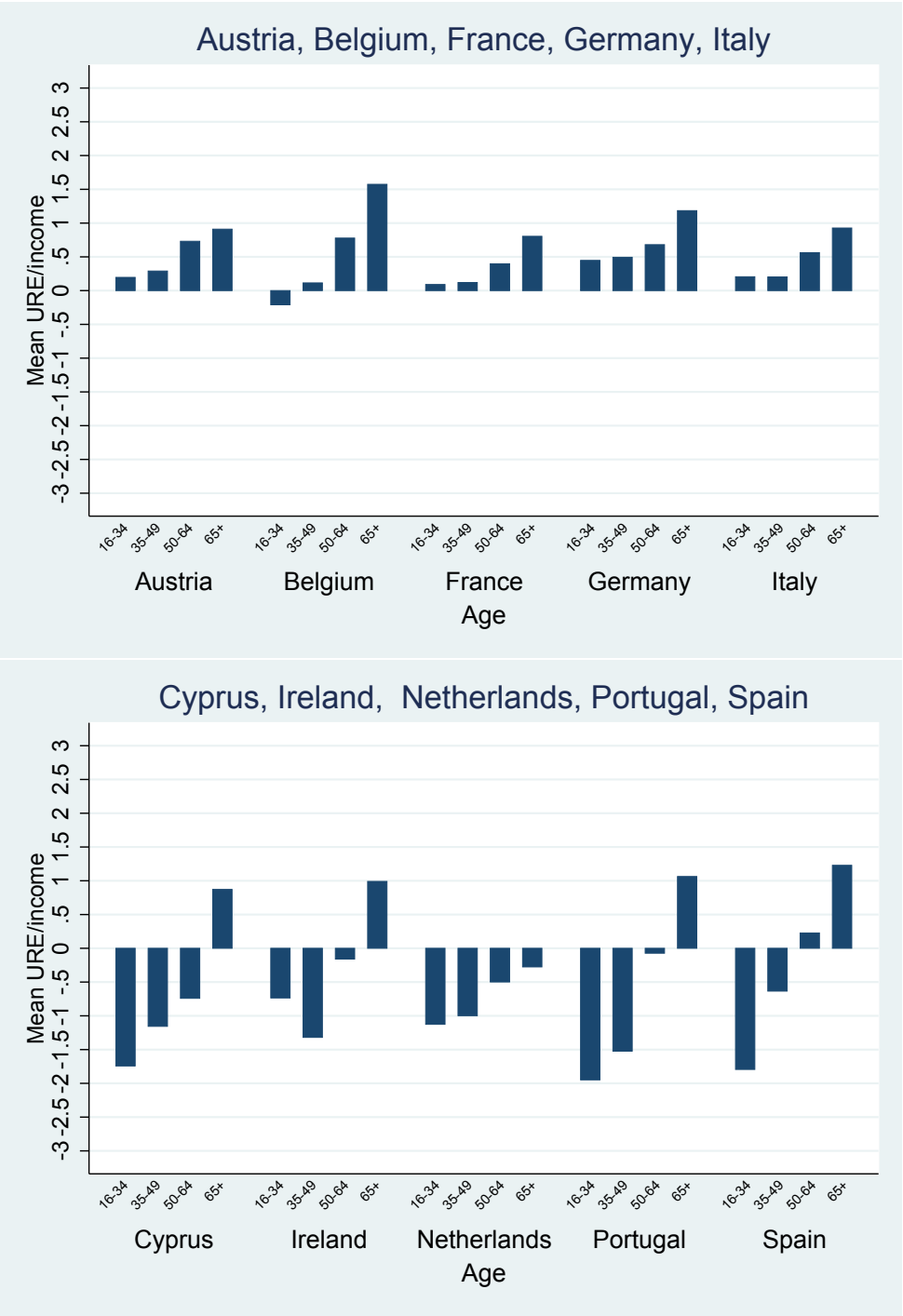
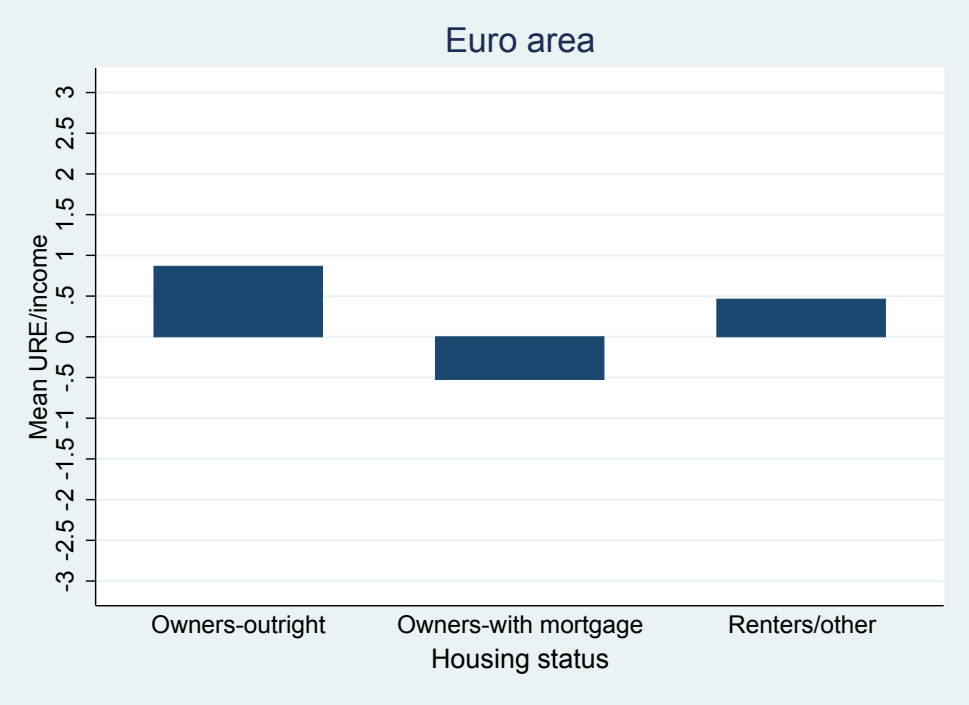


Figure 9: The unhedged interest rate exposure (URE) across housing status groups



in bond prices, and a 0.1% drop in housing prices.

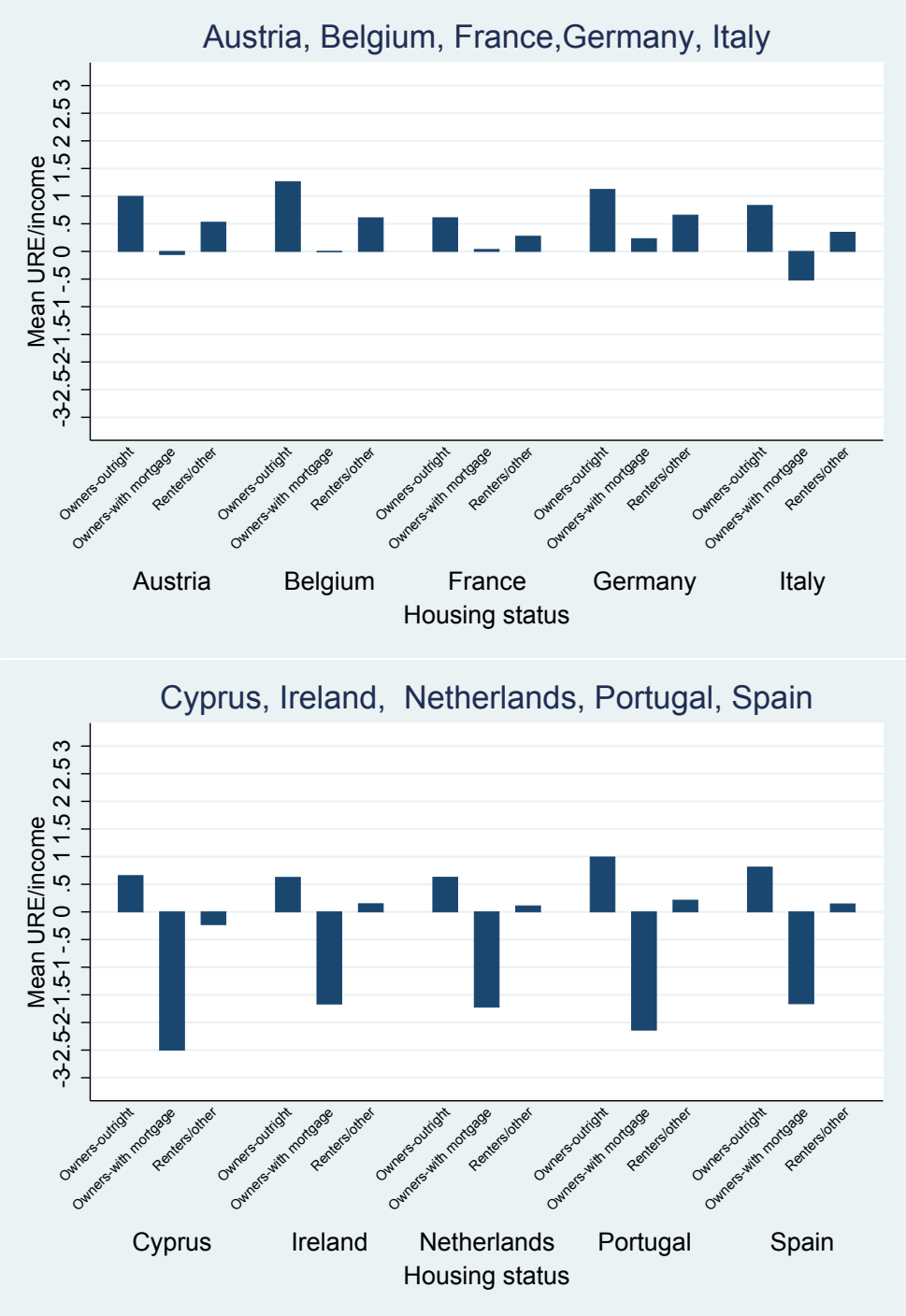
Table 2 reports the results of this analysis for the euro area as a whole and for the euro area countries. In particular, it shows the gains or losses in interest income flows, stocks and housing, and the percentages of households participating in the respective gains or losses.

For the euro area, the mean change in the interest income flow is positive and amounts to €139 over all households. In fact, this is averaged over 75% of households that will have a positive interest income flow change, i.e. an overall gain in interest income, and 25% of households that will have a negative change in their interest income flows, and therefore an increase in their interest payments, after netting out any interest income received. Interest gains/losses affect virtually all households, as all households have some interest rate exposure through deposits and/or some kind (adjustable rate) loan. Ownership of assets subject to capital gains is more concentrated, particularly ownership of stocks. The losses in stocks averaged over stock owners amount to €11,222. The percentage of households owning stocks is relatively low, 18%, and it is only this percentage that will suffer these losses. Averaged over all households these losses amount to €2,126, which are a lot larger than the gains in interest income flows.

The losses in the value of housing, averaged over real estate owners amount to €260.[20] These are suffered by the 66% of households owning real estate. Averaged over all households, mean losses amount to €171. Gains in interest income flows are smaller but of similar magnitude.

[20]Based on the elasticities of the reported study.

Figure 10: The unhedged interest rate exposure (URE) across housing status groups



Tables 3 and 4 show the gains/losses in interest income flows and the associated gains/losses across the net wealth distribution and for housing status groups, namely outright homeowners, homeowners with a mortgage and renters (or with some other housing arrangement). As also indicated from the graphs depicting the interest rate exposure across the net wealth distribution, taking the euro area as a whole, it is the lowest net wealth group that will be experiencing increased interest expenses, on average, after an increase in the interest rate. For this group, the "losses" in interest income flows are even larger than the losses from stock price or house price decreases. On the other hand, households in the upper middle net wealth group, between the 70th and 90th percentiles of the net wealth distribution, will experience gains in terms of interest income flows of a similar size (in absolute amounts) to the losses from house price decreases, compensating them in full. The top 5% of the net wealth distribution will experience, on average, even larger positive gains in interest income, though these compensate only some of the losses caused by asset price decreases, as the latter are even larger (in absolute amounts) for this group, particularly on account of the ownership of stocks, which is high for the very wealthy.

Looking across housing-status groups, it is the owners with a mortgage that will experience increased interest rate expenses (net of any gains in interest income), after such a contractionary monetary policy shock. This group will be also hurt by the decreases in the real estate value. Losses are substantial, and similar in size to the losses from house price decreases. On the other hand, outright owners will see increased interest returns which compensate for the losses in the value of their real estate.

Changes in interest income and capital gains/losses are of a different nature and offer a complementary picture. Interest income gains or losses are flows that, insofar as banks adjust their deposit and lending rates after a change in the policy rate, will be realized. However, as also discussed in Adam and Tzamourani (2016), capital gains or losses are changes in the value of the respective assets and, although they can be large and it is important to understand how these are distributed across households, some of the implied wealth changes may not be relevant in terms of welfare, as, for example, whenever households do not intend (do not need) to realize the capital gains (losses), or whenever the capital gains/losses are ultimately temporary in nature.

Insofar as bank deposit and lending rates are adjusted after a change in the policy rate, virtually all households will experience some gain or loss in terms of interest income, as almost all households have some interest rate exposure through deposits, and a good percentage of households also have such an exposure through some kind of (adjustable rate) debt. Hence, the interest rate exposure and the associated interest income gains or losses can be important in shaping the public's perceptions and opinions about the conduct and the effects of monetary policy.

Table 2: Interest income and capital gains from stock and house prices changes across euro area countries after a 100bp increase in the interest rate

	Hhs with interest gain	**Hhs with interest loss**	**Interest gains/ losses**	**Hhs with losses in stocks**	**Losses in stocks**	**Losses in stocks**	**Hhs with losses in h.p.**	**Losses h.p.**	**Losses h.p.**
			Mean		**Mean Stocks' owners**	**Mean All hhs**		**Mean Home owners**	**Mean All hhs**
	%	%	EUR	%	EUR	EUR	%	EUR	EUR
Euro area	75	25	139	18	11222	2126	66	260	171
Austria	87	13	248	12	30597	3630	53	338	178
Belgium	78	22	295	18	14316	2598	74	331	245
Cyprus	58	42	-234	31	20529	7088	83	381	314
Estonia	71	29	44	15	8835	1435	81	88	71
Finland	55	45	-144	32	4952	1650	74	239	178
France	74	26	135	20	14358	2890	63	269	169
Germany	86	14	337	16	13765	2407	51	291	149
Greece	74	26	53	16	3295	537	78	118	92
Ireland	58	42	-349	25	4640	1449	74	314	234
Italy	80	19	180	16	6667	1262	71	257	183
Latvia	68	32	-12	11	4427	522	82	43	35
Luxembourg	65	35	76	13	28729	3892	75	897	671
Malta	86	14	251	29	19171	5787	83	278	231
Netherlands	45	55	-361	10	3035	310	59	276	162
Portugal	57	43	-112	16	10959	1891	79	164	130
Slovakia	70	30	39	16	1958	309	87	66	57
Slovenia	60	40	27	18	11784	2283	79	124	98
Spain	62	38	-26	23	10588	2594	88	261	229

Table 3: Interest income and capital gains from stock and house prices changes across euro area countries after a 100bp increase in the interest rate

	Hhs with interest gain	**Hhs with interest loss**	**Interest gains/ losses**	**Hhs with losses in stocks**	**Losses in stocks**	**Losses in stocks**	**Hhs with losses in h.p.**	**Losses h.p.**	**Losses h.p.**
			Mean		**Mean Stocks' owners**	**Mean All hhs**		**Mean Home owners**	**Mean All hhs**
	%	%	EUR	%	EUR	EUR	%	EUR	EUR
Lower 20%	60	40	-87	2	940	28	10	125	12
20%-50%	75	25	27	11	1011	123	52	87	45
50%-70%	77	23	77	15	1781	288	94	156	147
70%-95%	83	17	340	31	4503	1483	98	309	302
Top 5+	83	17	951	62	51273	32777	99	1013	1002

Table 4: Interest income and capital gains from stock and house prices changes across euro area countries after a 100bp increase in the interest rate

	Hhs with interest gain	**Hhs with interest loss**	**Interest gains/ losses**	**Hhs with losses in stocks**	**Losses in stocks**	**Losses in stocks**	**Hhs with losses in h.p.**	**Losses h.p.**	**Losses h.p.**
			Mean		**Mean Stocks' owners**	**Mean All hhs**		**Mean Home owners**	**Mean All hhs**
	%	%	EUR	%	EUR	EUR	%	EUR	EUR
Owners-outright	88	12	347	21	13854	3125	100	268	268
Owners-with mortgage	48	52	-294	25	11219	2949	100	272	272
Renters/other	75	25	139	10	5689	646	12	137	17

4 Conclusions

The paper quantifies the unhedged interest rate exposure (URE) of euro area households, defined by Auclert (2019). The URE captures the extent to which households are exposed to changes in interest rates. Thus, its distribution across countries and household groups gives a picture of the distribution of gains and losses in interest income flows after such a change.

Our main findings are summarized as follows. The median household in the euro area has a positive URE, indicating that the median household would benefit from an increase in the interest rate in terms of interest income flows, all other parameters being constant. The median URE is positive in all countries except the Netherlands, whereas for several countries the mean URE is negative. The negative exposures can be large, indicating that households with such exposures will experience large income effects after a monetary policy shock. There is substantial heterogeneity across countries, which is driven mainly by the prevalence of adjustable rate mortgages. The interest rate exposure of households also varies substantially across the net wealth and age distributions and across housing status groups, though it is more equally dispersed across the income distribution. Households in the bottom part of the net wealth distribution have, in general, negative or close-to-zero UREs, as they have little financial assets and large debts (relative to their assets). The interest rate exposure is generally negative for households with a mortgage, driven mainly by the mortgagors with an adjustable rate mortgage. Overall, mean interest rate exposures are substantial for mortgagors, indicating that this group is particularly affected by changes in the policy interest rate. In contrast to all other euro area countries, in Germany and France the mean URE for households with a mortgage is positive, which is due mainly to the low prevalence of adjustable interest rate mortgages among mortgagors in these two countries. In addition, German households have a higher deposits-to-total assets ratio and a higher savings ratio than other countries.

Assuming a complete pass-through of the policy rate to deposits and loans, and that there is no response in expected inflation, the interest rate exposure translates fully into the direct gains and losses in interest income flows after a change in the interest rate. Compared to the gains or losses due to associated changes in stock or house prices after a monetary policy shock, gains in interest income flows are generally smaller than the capital gains made or losses suffered by the owners of the respective assets, although they are of a similar magnitude to the (absolute) changes in house prices, if the latter are averaged across all households.

Insofar as banks adjust their deposit and interest rates after a change in the policy rate, gains or losses in interest income flows will most likely be realized. And since most households have some non-zero interest rate exposure through their deposits or (adjustable rate) loans, interest income gains and losses, besides their importance in the transmission of monetary policy because of the direct effect on income, may be more important than

other effects of monetary policy in shaping the public's perceptions and opinions about the conduct of monetary policy and the central bank.

In discussing the effects of a monetary policy shock, our analysis is confined to the direct effects on interest rate flows resulting from the interest rate exposure of households. We have not taken account of inflation, which may also affect different households in differing ways. Nor do we take into account other effects of monetary policy, particularly on employment, which should also have redistributive effects. These subjects are beyond the scope of this paper and merit further research.

A Data Definitions

In our analysis, in computing the amount of maturing assets that contribute to the URE, we consider a percentage of bonds held by households as maturing (see Section 2). Since the maturity of the bonds held is not reported in the HFCS, we approximate this percentage, for each euro area country, for the reference year of the survey, by the percentage of maturing securities, i.e. with a maturity of up to one year, in the total securities held by households and non-profit institutions serving households (NPISHs). These percentages, across euro area countries, are reported in Table 5. For Malta, for which data are not available in the SHS database, we use the euro area average.

B Robustness Checks: the Unhedged Interest Rate Exposure Using Alternative Estimates for Consumption and Saving

Using imputed consumption based on the HBS. The HFCS collects only a few questions on consumption. There are two questions on food inside and outside the home, one question on utilities, one on rent and a question asking for the total amount spent in a typical month on total non-durables consumption ("on all consumer goods and services").

Lamarche (2017) provided alternative estimates of non-durables consumption for the HFCS data for wave 1, using the methodology provided by Browning, Crossley, and Weber (2003). In essence, a model relating non-durables consumption and variables that are also available in the HFCS, such as food consumption, sociodemographic characteristics of the household reference person, housing status and household size, is estimated from the Household Budget Survey (HBS) data. The estimated coefficients are then applied to the HFCS variables to estimate non-durables consumption for each HFCS household, also adding a random residual term. For the latter, Lamarche (2017) provides three alternatives. In our analysis the residual term used is drawn from a truncated normal distribution. This seems to provide similar results to those obtained using the hot-deck method, which he considers the best alternative.

Table 5: Securities with residual maturity of up to 1 year as a percentage of all the securities held by households and NPISHs (Q4 2014 data)

	Share (%)
Euro area	19.0
Austria	15.3
Belgium	18.3
Cyprus	23.7
Estonia	24.5
Finland	17.2
France	8.9
Germany	23.4
Greece	14.0
Ireland	12.2
Italy	18.6
Latvia	13.0
Luxembourg	23.5
Malta	-
Netherlands	11.1
Portugal	25.0
Slovakia	23.3
Slovenia	9.9
Spain	22.8

Source: ECB Securities Holding Statistics database. Own calculations.

We use the models of Lamarche (2017) to compute alternative estimates for non-durables consumption for wave 2, for the countries where such models are available, namely for Belgium, Cyprus, France, Italy, Luxembourg, Malta, Portugal, Slovakia and Spain, and indicate the effects of measurement error.[21] For all countries, the estimated consumption is much higher than the (non-durables) consumption measure given by the HFCS, leading to much smaller estimates of the URE.

Inflating the consumption measure. Since the imputed consumption data are not available for all countries, and since these are also subject to measurement error, as an alternative measure of consumption which may adjust for some of its underreporting, we inflate the consumption measure derived from the HFCS by 30%. This gives smaller URE estimates, but estimates that are closer to our baseline UREs than the estimates from the imputed consumption measure.

Using reported saving flows. The HFCS in Austria and Germany include country-specific variables to measure the saving of households.[22] In Austria there is one question asking for the total saving over the reference period of the survey (year prior to the survey). In Germany there are questions asking separately for regular saving flows in current and saving accounts; in private pensions and whole-life insurance contracts; in mutual funds, stocks, bonds and certificates; and, finally, a question on irregular saving flows. These are added together to compute the total amount saved over the reference period of the survey. The Italian survey also includes a saving variable, which is the residual of income − consumption. We adjust this variable for the differences in the definition of income. Based on these variables, an alternative measure of URE is computed for Austria, Germany, and Italy where the total amount saved for the reference year of the survey is added to the stocks component of the URE (maturing assets − maturing liabilities).

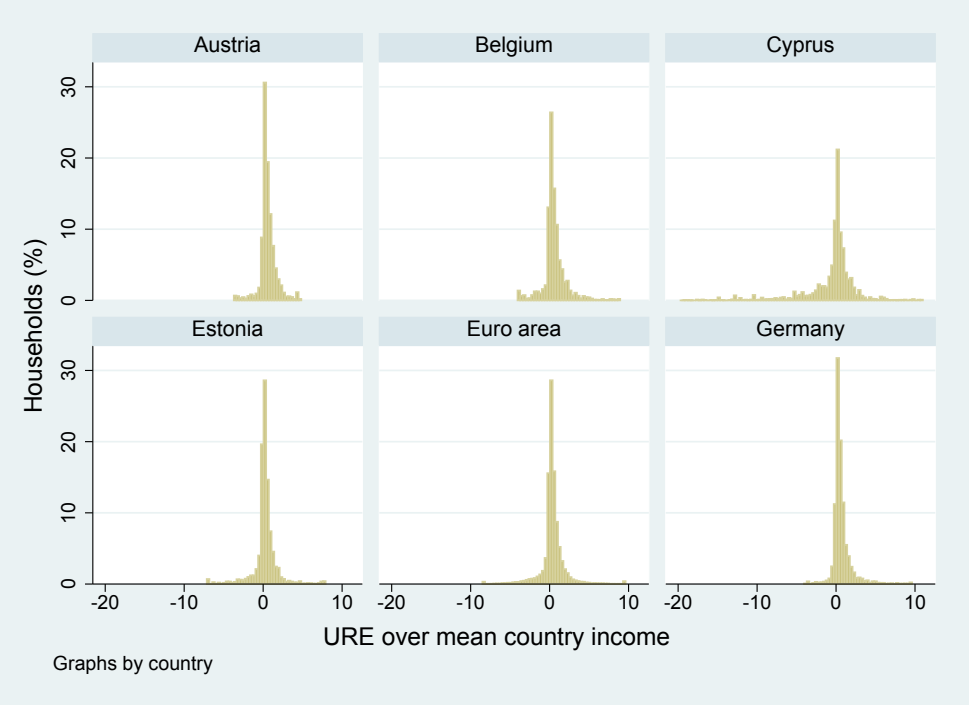
URE based on "stocks". As an alternative specification we compute the URE using only the "stocks" of the households' balance sheets; that is, based on maturing assets − maturing liabilities, without the savings component. The maturing assets and maturing liabilities are defined as in our baseline specification.

The means and medians of the UREs across countries using the above specifications are displayed in Tables 6 and 7. Figure 14 depicts the means of our baseline and the alternative URE measures for the euro area countries, namely using the imputed consumption data from the HBS, using the saving component for the countries this is available

[21] As noted above, Lamarche (2017) provides models for linking food consumption to non-durables consumption based on the estimated model in the Household Budget Survey for wave 1. We assume that the underlying relationship between non-durables consumption and food consumption, demographic variables and income has not fundamentally changed between the two waves.

[22] As with other country-specific variables, these can be obtained by applying for them directly from the respective national central banks.

Figure 11: The unhedged interest rate exposure (URE) across countries, histograms



for, and based only on stocks (excluding the savings component), ordered by the size of the mean URE. As saving is on average positive for all euro area countries (estimated from the consumption measure available in the HFCS), excluding the savings component shifts the mean UREs to the left. Also, since the consumption measure imputed from the Household Budget Survey makes saving smaller, the URE based on this measure is also shifted to the left, relative to our baseline measure.

The relative order of the mean UREs across countries is on the whole preserved, indicating that the measurement error in consumption is of the same direction and, on the whole, of a similar relative magnitude across all countries (though it seems the imputed consumption may be "overcorrecting" in some cases, as might, for example, be the case for France). The URE from the saving variable for the Italian survey is similar to the one computed from the HFCS, since the non-durables consumption measure is the same as that in the HFCS and it is only durables consumption that differs. durables consumption measure we estimate (see Section 2). The URE computed using the saving variables in Austria and in Germany is smaller than the URE using the consumption measures. The saving variables, however, may also be subject to measurement error, and they may be underestimating the actual savings over the reference period. Furthermore, to the extent that the underreporting error in deposits is higher than that for mortgages (HFCN 2013), the URE across euro area countries may be higher than that estimated using the HFCS survey baseline specification.

Table 6: URE baseline and alternative specifications, relative to mean country income (means)

	1	2	3	4	5
	URE	URE_cons	URE_hbs	URE_fromsave	URE_stocks
Euro area	0.35	0.24	.	.	0.07
Austria	0.57	0.47	.	0.29	0.26
Belgium	0.57	0.47	0.35	.	0.29
Cyprus	-0.77	-0.90	-1.14	.	-0.97
Estonia	0.26	0.12	.	.	-0.05
Finland	-0.29	-0.42	-0.52	.	-0.51
France	0.36	0.21	0.09	.	0.20
Germany	0.70	0.62	.	0.32	0.30
Greece	0.25	0.11	.	.	0.00
Ireland	-0.61	-0.71	.	.	-0.89
Italy	0.54	0.40	0.36	0.52	0.29
Latvia	-0.08	-0.21	.	.	-0.35
Luxembourg	0.09	-0.02	-0.08	.	-0.20
Malta	0.87	0.75	0.58	.	0.49
Netherlands	-0.72	-0.85	.	.	-0.86
Portugal	-0.52	-0.67	-0.73	.	-0.69
Slovakia	0.25	0.10	0.08	.	-0.00
Slovenia	0.13	-0.03	.	.	0.00
Spain	-0.08	-0.21	-0.28	.	-0.38

1 URE baseline specification
2 URE_cons as in the baseline specification, with the survey consumption measure inflated by 30%
3 URE_hbs using the baseline specification for maturing assets and liabilities and the imputed measure from the Household Budget Survey for consumption
4 URE_fromsave: using the country-specific saving measure for the savings component
5 URE_stocks: based on maturing assets − maturing liabilities, as specified in the baseline (savings component not included)

Table 7: URE baseline and alternative specifications, relative to mean country income (medians)

	1 URE	2 URE_cons	3 URE_hbs	4 URE_fromsave	5 URE_stocks
Euro area	0.27	0.17	.	.	0.06
Austria	0.43	0.33	.	0.21	0.17
Belgium	0.37	0.27	0.20	.	0.11
Cyprus	0.17	0.07	-0.08	.	0.00
Estonia	0.20	0.09	.	.	0.02
Finland	0.05	-0.05	-0.05	.	0.00
France	0.23	0.12	0.05	.	0.09
Germany	0.40	0.33	.	0.08	0.08
Greece	0.22	0.10	.	.	0.01
Ireland	0.09	0.00	.	.	0.00
Italy	0.31	0.19	0.18	0.30	0.12
Latvia	0.08	0.00	.	.	0.00
Luxembourg	0.21	0.12	0.08	.	0.03
Malta	0.61	0.50	0.35	.	0.31
Netherlands	-0.11	-0.24	.	.	-0.00
Portugal	0.07	-0.04	-0.06	.	0.01
Slovakia	0.20	0.08	0.07	.	0.04
Slovenia	0.08	-0.04	.	.	0.01
Spain	0.16	0.07	0.03	.	0.03

1 URE baseline specification
2 URE_cons as in the baseline specification, with the survey consumption measure inflated by 30%
3 URE_hbs using the baseline specification for maturing assets and liabilities and the imputed measure from the Household Budget Survey for consumption
4 URE_fromsave: using the country-specific saving measure for the savings component
5 URE_stocks: based on maturing assets − maturing liabilities, as specified in the baseline (savings component not included)

Figure 12: The unhedged interest rate exposure (URE) across countries, histograms

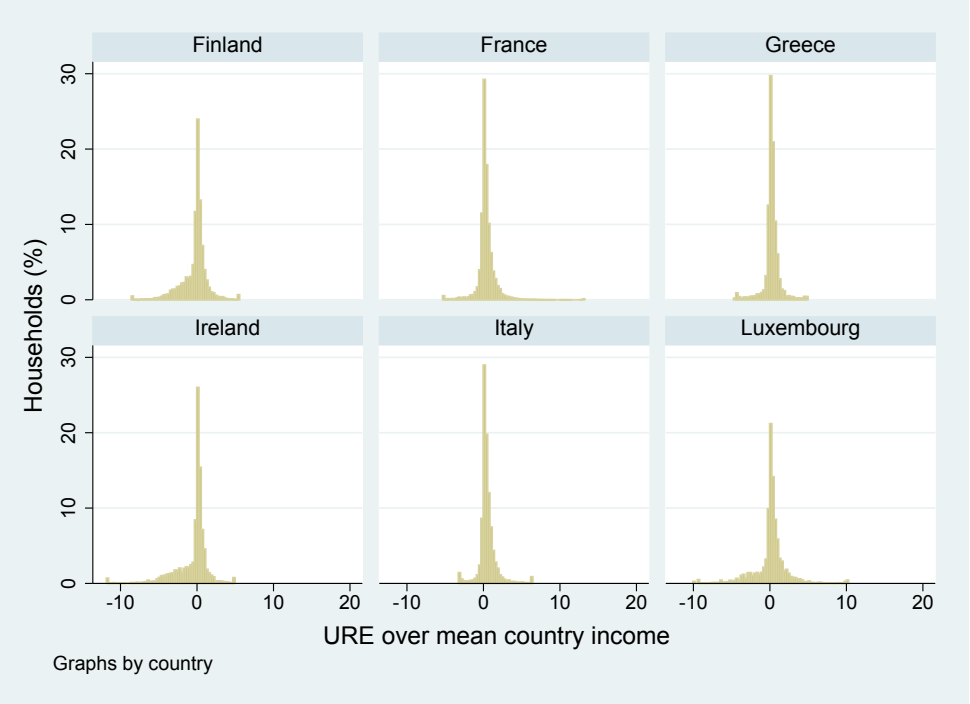


Figure 13: The unhedged interest rate exposure (URE) across countries, histograms

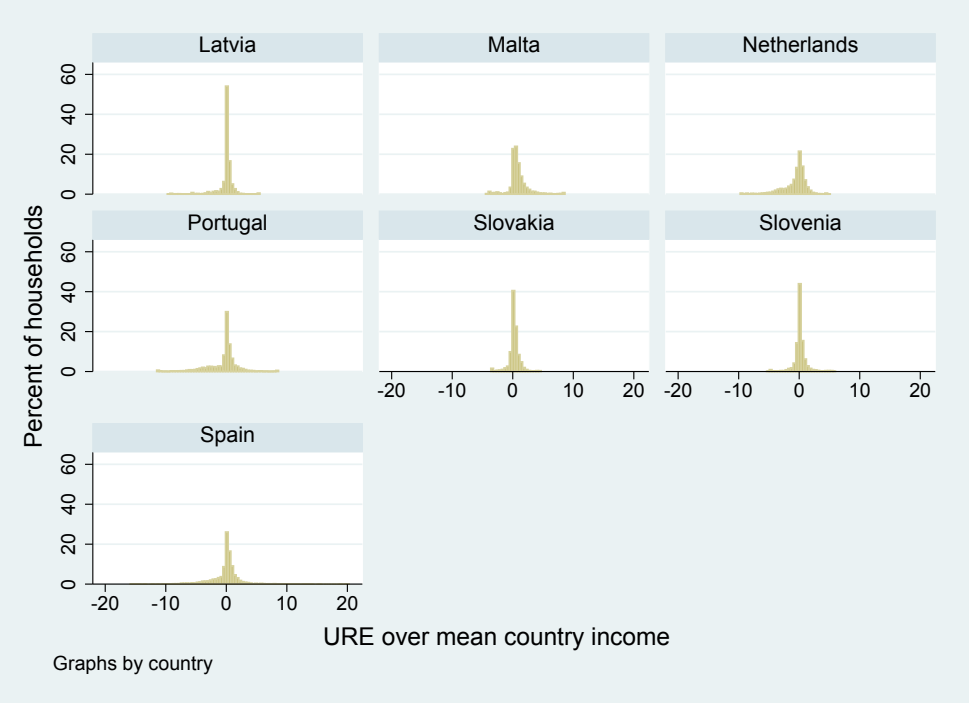
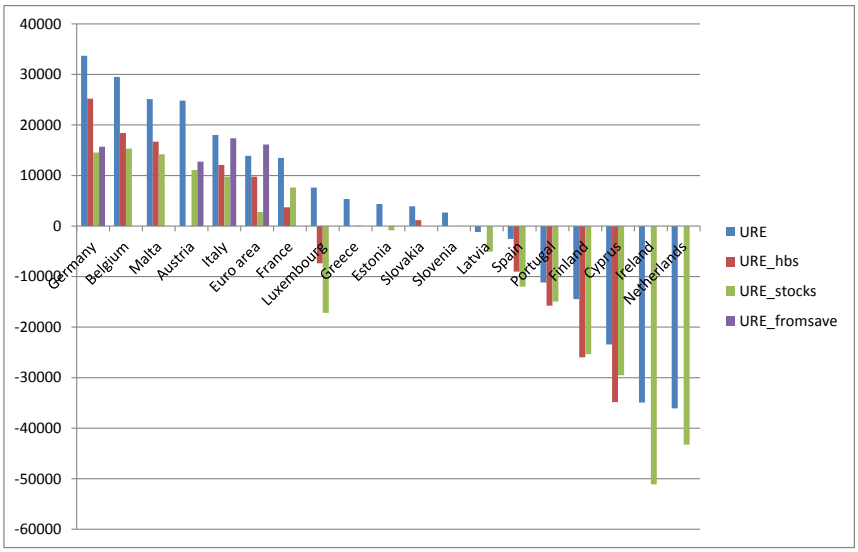


Table 8: URE baseline and alternative specifications, relative to mean country consumption (means)

	1	2	3	4	5
	URE	URE_cons	URE_hbs	URE_fromsave	URE_stocks
Euro area	0.91	0.47	.	.	0.18
Austria	1.70	1.08	.	0.48	0.76
Belgium	1.68	1.06	0.64	.	0.87
Cyprus	-1.81	-1.62	-1.43	.	-2.28
Estonia	0.55	0.19	.	.	-0.11
Finland	-0.64	-0.73		.	-1.13
France	0.75	0.34	0.14	.	0.42
Germany	2.58	1.76	.	0.51	1.12
Greece	0.53	0.18	.	.	0.01
Ireland	-1.76	-1.58	.	.	-2.58
Italy	1.13	0.64	0.55	1.04	0.61
Latvia	-0.20	-0.38	.	.	-0.84
Luxembourg	0.25	-0.04	-0.16	.	-0.56
Malta	2.15	1.42	0.83	.	1.22
Netherlands	-1.62	-1.47	.	.	-1.94
Portugal	-1.02	-1.02	-1.02	.	-1.37
Slovakia	0.50	0.16	0.11	.	-0.00
Slovenia	0.24	-0.04	.	.	0.00
Spain	-0.19	-0.37	-0.45	.	-0.87

1 URE baseline specification
2 URE_cons as in the baseline specification, with the survey consumption measure inflated by 30%, standardized with inflated consumption
3 URE_hbs using the baseline specification for maturing assets and liabilities and the imputed measure from the Household Budget Survey for consumption, standardized with the imputed consumption
4 URE_fromsave: using the country-specific saving measure for the savings component, standardized with the respective derived consumption (net income - saving)
5 URE_stocks: based on maturing assets − maturing liabilities, as specified in the baseline (savings component not included, standardized with the baseline consumption measure)

Figure 14: The unhedged interest rate exposure (URE) across countries: different specifications (means in EUR)



C Unhedged Interest Rate Exposures in 2010/2011 and 2014

Comparisons between the two waves of the survey can only be based on the stocks component of the unhedged interest rate exposure, maturing assets − maturing liabilities, as the question capturing the overall consumption of durables was not included in the questionnaire of wave 1. Figure 15 depicts the URE based on stocks for the euro area countries participating in the survey in each wave of the survey, standardized with the mean income of each country in the respective year. The differences in the interest rate exposure are small overall between the two waves of the survey. The most notable differences are in Belgium, Cyprus, Luxembourg, and the Netherlands. Looking at the individual countries, these changes seem to be due to the increase in liabilities relative to income in Belgium and Cyprus, a decrease in liabilities and in maturing assets in the Netherlands, and an increase in maturing assets, relative to income, in Luxembourg.

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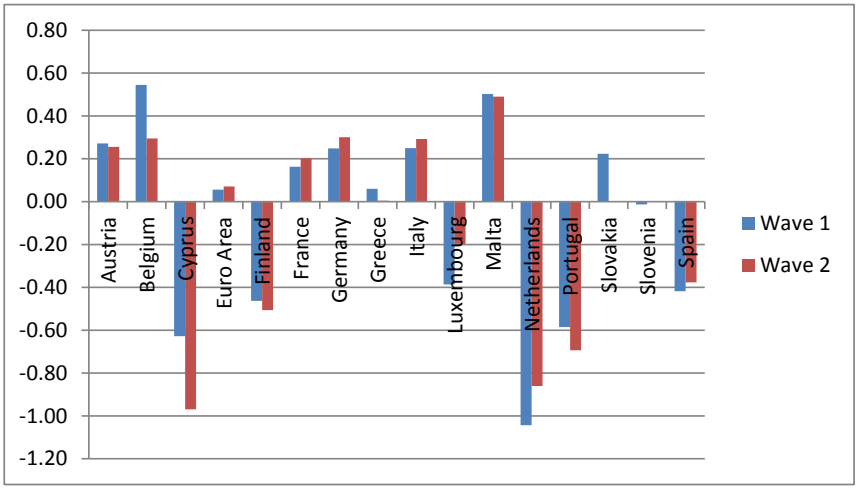
Figure 15: The unhedged interest rate exposure (URE) across the two waves of the HFCS
URE based on stocks (means in EUR)



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