

# Price Level Changes and the Redistribution of Nominal Wealth Across the Euro Area \*

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## Abstract

We document the presence of sizable redistribution effects from unexpected price level movements in the Euro Area (EA), using sectoral accounts and newly available data from the Household Finance and Consumption Survey. The EA as a whole is a net loser of unexpected price level decreases, with Italy, Greece, Portugal and Spain losing most in per capita terms, and Belgium and Malta being net winners. Governments are net losers of deflation, while the household (HH) sector is a net winner in the EA as a whole. HHs in Belgium, Ireland, Malta and Germany experience the biggest per capita gains, while HHs in Finland and Spain turn out to be net losers. Considerable heterogeneity exists also within the HH sector: relatively young middle class HHs are net losers of deflation, while older and richer HHs are winners. As a result, wealth inequality in the EA increases with unexpected deflation, although in some countries (Austria, Germany and Malta) inequality decreases due to the presence of relatively few young borrowing HHs. We document that HHs inflation exposure varies systematically across countries, with HHs in high inflation EA countries holding systematically lower nominal exposures.

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## 1 Introduction

Unanticipated price level movements redistribute nominal wealth between lenders and borrowers. The unexpectedly low inflation rates recently experienced within the Euro Area, for example, shift wealth from borrowers to lenders. The goal of the present paper is to provide a comprehensive and integrated view of the structure of financial claims held within the Euro Area. While of interest in its own right, this allows assessing which countries, which economic sectors and which households are winners and losers of price-level induced redistribution of nominal wealth. The present paper thus contributes to our understanding of the welfare implications associated with price level surprises and the welfare gains associated with price stability; furthermore, in a situation with elevated inflation or deflation risk, it allows identifying those parts of society that are most exposed to such risk; finally, within a monetary union such as the Euro

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Area, the size and the direction of the redistribution are likely to be helpful for understanding countries' incentives to shape union-wide monetary policy outcomes and for understanding their participation incentives.

The main goal of the paper is to systematically document the relationship of financial claims in the Euro Area (EA) and to quantify the distributional effects associated with unexpected price level movements.<sup>1</sup> The analysis shows that even moderately sized unexpected price level movements induce quantitatively important wealth redistribution. To quantify the effects we integrate the newly available Household Finance and Consumption Survey (HFCS), which is collected by the European System of Central Banks, with Euro Area Accounts (EAA) data, which provide detailed sectoral balance sheets for all EA countries. Creating an integrated system of nominal accounts allows us to document which EA countries are winners and losers of unexpected inflation or deflation, how much each of the countries is winning and losing, how different economic sectors within each country are affected by such price level movements, and how gains and losses are distributed at the individual household level.

We begin our analysis by computing the net nominal position (NNP) of each country, each sector and each household.<sup>2</sup> The NNP is a measure of the nominal claims minus nominal liabilities held by an economic agent or economic sector and measures how exposed it is to price level changes. It comprises the direct nominal positions, which consist of nominal claims and liabilities held outright, but also the indirect nominal positions, which arise from the ownership of firms (directly or indirectly via investment funds). Since firms are leveraged entities, the indirect nominal position can be an important component of overall inflation exposure. We fully account for this by attributing the net nominal position of the corporate sector to its ultimate owners (domestic households, domestic governments, foreigners).

The EA as a whole turns out to be a net loser of unexpected deflation, as it holds a substantially negative net nominal position (NNP) vis-a-vis the rest of the world. A 10% surprise decrease in the price level, for example, leads to a wealth loss equal to 4.2% of EA per capita GDP, according to our baseline findings. Gains and losses are proportional to the size of the considered price level movement, with a price level *increase* leading to a correspondingly sized wealth *gain*. Overall, the redistribution risks associated with price level uncertainty are sizable and suggest - to the extent that households are risk averse - that there exist strong incentives for avoiding unexpected inflationary or deflationary episodes in the EA.

The aggregate losses associated with price level decreases turn out to be fairly unevenly distributed within the EA. The so-called GIPS countries (Greece, Italy, Portugal, Spain) turn out to be the biggest losers of unexpected price level decreases, experiencing - according to our baseline results - losses between 6% and 14% of per capita GDP from a 10% drop in the

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<sup>1</sup>Section 2.6 describes in detail what we mean by unexpected price level movements. Throughout the paper we focus on unanticipated price level changes, due to lack of information about the maturity structure of bondholdings at the sectoral level (except for the government sector) and at the individual household level. This together with lack of information on whether nominal assets carry a fixed or variable coupon rate prevents a rigorous assessment of the distributional consequences of anticipated inflation.

<sup>2</sup>The country level analysis fully includes the government sector, i.e., next to government assets and liabilities also the asset positions of national central banks, e.g., via the TARGET2 payment system.

price level.<sup>3</sup> Malta and Belgium lie on the other end of the spectrum and are net *winners* of unexpected deflation, winning up to 9% of per capita GDP. The gains and losses thus display a large amount of variation across EA countries.<sup>4</sup>

Considerable differences across EA countries also exist at the household (HH) level. We document this fact by defining the HH's inflation exposure as its NNP per unit of net wealth owned. This measure captures how exposed a HH is to unexpected inflation or deflation per unit of net wealth and allows for a comparison across HHs with different wealth levels and across countries with different wealth distributions. An exposure value equal to one, for example, indicates that the HH has invested all its net wealth in nominal assets; a value of zero indicates that the HH faces in net terms no exposure to price level risk, while a negative value indicates that the HH is on net a debtor of nominal claims, thus a winner of unexpected inflation.<sup>5</sup>

We then document that the cross-sectional distribution of HH inflation exposures varies considerably across EA countries. For example, the GIPS countries and the former transition countries (Slovakia and Slovenia) have comparatively many HHs with a close to zero inflation exposure, i.e., HHs owning on net only real assets. In addition, these countries have comparatively few HHs who hold virtually all their net wealth in the form of nominal claims. The opposite is true for some of the EA 'core' countries (Austria, Belgium, Finland, Germany and the Netherlands), which - across all EA countries - have the highest share of HHs holding basically all net wealth in the form of nominal assets; these countries also have the lowest share of HHs with a close to zero inflation exposure.

Considering HHs' inflation exposure across age cohorts and broad social classes (rich, middle class and poor HHs), we document that the EA as a whole looks very similar to the U.S. and Canada, as previously analyzed by Doepke and Schneider (2006b) and Meh and Terajima (2008), respectively. In particular, young cohorts turn out to be net debtors of nominal claims while older cohorts are net holders of nominal claims. Quantitatively, the EA exposure numbers are very close to the U.S. numbers, when aggregating across all social classes of an age cohort.<sup>6</sup> As a result, unexpected deflation leads to a wealth transfer from younger HHs to older HHs. While in the U.S. the losses of unexpected deflation fall on young middle class and young poor HHs, the losses in the EA are concentrated entirely among young middle class HHs. Young poor HHs in the EA hold in net terms virtually no inflation exposure.

We also explore the effects of unexpected deflation for wealth inequality in the EA. We find that surprise deflation leads to an increase in the Gini coefficient for the EA net wealth distribution, as would be the case with a regressive net wealth tax. This occurs because young borrowing HHs, who are losers of deflation, are poorer than older HHs, who are winners of deflation. Yet, important differences exist with regard to this finding across EA countries: in

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<sup>3</sup>Correspondingly, these countries are the biggest winners of unexpected price level increases.

<sup>4</sup>Due to proportionality, the redistributive effects are equally dispersed when considering unexpected price level increases instead.

<sup>5</sup>These examples assume that net wealth is positive, which is the case for the large majority of HHs. We discuss the case with negative net wealth in the main text of the paper.

<sup>6</sup>The main difference is that in the U.S. inflation exposure of the oldest two age cohorts (65-63, >74 years) is about 50% higher than in the EA.

Austria, Germany and Malta the young middle class HHs borrow on average relatively little, so that wealth inequality actually decreases following surprise deflation, similar to what would be the case with a progressive wealth tax.

Overall, we find that in the EA the ‘inflation tax’ is relatively ineffective in generating government revenue in the sense that it requires relative high tax rates to achieve a given level of revenue. We document this by comparing the revenue generated by a 10% surprise increase in the price level to that of a more conventional proportional tax on net wealth. For most EA countries the same government revenue can be generated by a proportional wealth tax in the range of 1-2%. For some countries (Finland and Cyprus) the wealth tax can be lower, although for Greece it would have to amount to approximately 4%. This result is obtained even though the wealth tax, unlike the inflation tax, fails to tax foreigners.

We also document that the cross-sectional distribution of the inflation exposures across HHs correlates at the country level strongly with the country’s inflation experience: countries that have historically experienced higher inflation rates tend to be ones where HHs are borrowing more (relative to net worth) and where fewer HHs hold their net worth predominantly in nominal assets. Indeed, grouping countries according to their past inflation experience gives rise to a first order stochastic dominance ordering with respect to the inflation exposures in the HH sector. We also find that past inflation correlates with the marginal effects of net worth on inflation exposures in the cross section. This suggests that the inflation risk exposure of HHs is influenced by past inflation experience.

In previous work, Doepke and Schneider (2006b) study the distributional implications of the U.S. Great Inflation episode in the 1970’s. Meh and Terajima (2008) report results for Canada. Meh, Ríos-Rull and Terajima (2010), analyze the welfare implications of inflation targeting and price-level targeting strategies, calibrating their model to the nominal wealth positions documented for Canadian data. Brunnermeier and Sannikov (2013) discuss the redistributive effects of monetary policy in a setting with financial frictions and how policy can occasionally use these effects to avoid liquidity and deflationary spirals. Coibion, Gorodnichenko, Kueng and Silvia (2012) analyze the effects of monetary policy shocks for inequality. While not providing direct evidence for wealth inequality, they show that a contractionary monetary policy shock in the U.S. raises the inequality of income, labor earnings, expenditures and consumption across households. Gornemann, Kuester and Nakajima (2014) study the distributional effects associated with changes in the systematic conduct of monetary policy. Albanesi (2007) documents the positive cross-country relationship between inflation rates and inequality and rationalizes it using a political economy model in which low income households are more exposed to inflation than high income households. Doepke and Schneider (2006a, 2006c) show how inflation induced redistribution can have long-lasting negative real effects because winners and losers tend to have different age and employment status, but that average household welfare might nevertheless increase.

In early work, Bach and Stephenson (1974) and Cukierman, Lennan, and Papadia (1985)

study inflation induced redistribution of nominal wealth. These studies do not integrate sectoral accounts with household data, as the latter were unavailable at the time, and also do not include indirect nominal positions (INP) arising from firm ownership. Erosa and Ventura (2002) present a monetary growth model that is consistent with the evidence on heterogeneity in transaction patterns and portfolio holdings, focusing on the effects of anticipated inflation for transaction balances and their redistributive effects. The present paper studies the distributional implications of unanticipated price level changes, taking into account all nominal claims, i.e., liquid and illiquid ones.

The remainder of the paper is structured as follows. The next section presents the data sets, the procedures for integrating them into a coherent accounting framework, and the accounting methodology for computing net nominal exposures. Section 3 presents our baseline findings regarding the redistributive effects across EA countries and across different economic sectors in each EA country. It also discusses the robustness of these findings to alternative assumptions and integration approaches. Section 4 presents information about the cross-sectional distribution of inflation exposures at the HH level, documenting important differences across EA countries. It also offers a comparison with U.S. and Canadian data. Section 5 analyzes how wealth inequality is affected by unexpected inflation. Section 6 documents the relationship between past inflation experience and the cross-sectional distribution of inflation exposures at the HH level. A conclusion briefly summarizes and provides an outlook on future work. The appendices offer additional and more detailed information about individual EA countries and about the accounting methodologies.

## **2 Data Description and Accounting Methods**

We perform our analysis using data for the year 2010, which is the last year for which harmonized Euro Area household survey data is available.

### **2.1 HFCS - Household Finance and Consumption Survey**

The Household Finance and Consumption Survey (HFCS) is a coordinated HH survey covering all EA countries, except for Ireland. The core questionnaire is common among the countries and provides detailed household-level balance sheet information. Financial variables are all reported at market value. The survey covers about 62,000 households and the reference year for the latest available survey wave is 2010. Data is collected using a harmonized methodology to insure country-level representativeness. To maximize comparability across countries, the survey output is harmonized through usage of a common set of target variables. The survey also employs a common blueprint questionnaire to foster input harmonization. The survey is multiply imputed to account for missing data and oversamples wealthier households. Household weights are adjusted for unit non-response and calibrated to external information such as population distributions. Basic stylized facts of the survey are documented in HFCN (2013a, 2013b).

## 2.2 EAA - Euro Area Accounts

The Euro Area Accounts (EAA) provide detailed balance sheet information for a number of economic sectors (households, non-financial corporations, financial corporations, government and rest of the world) for each Euro Area country and for the EA as a whole. The sectoral balance sheets allow us to identify the nominal assets and liabilities held by each sector in each of the considered countries.

The EAA establish a quarterly integrated accounting system, which encompasses non-financial accounts and financial accounts. The accounts are integrated to balance the changes in transaction accounts and balance sheets. The EAA is compiled according to the European System of Accounts, ESA95(1995), which is the European application of the System of National Accounts 1993, SNA93(1993). The EAA combines national data with EA aggregate statistics, where the latter are produced in collaboration with the national central banks, Eurostat and the national statistical institutes. The sectoral balance sheet of the HH sector is generally only indirectly estimated because little direct evidence concerning households is available. For this reason, we replace in our baseline approach the EAA HH sector balance sheet with information obtained from the HFCS, as described in the next section.

## 2.3 HFCS Integration

This section explains how we integrate the HFCS data with the EAA, so as to obtain a coherent accounting framework for discussing the distributional effects of unexpected inflation across countries, economic sectors and households.

We first construct from HFCS data the variables showing up in the EAA HH sector balance sheet, following the suggestions in Honkkila and Kavonius (2012), and then aggregate these across HHs to compute HFCS aggregates corresponding to the EAA positions. Appendix A explains in detail how this is achieved. The HFCS aggregates thus obtained tend to differ from their EAA counterparts, with the former typically falling short of the latter. The shortfall is documented in appendix B, which reports the ratio of HFCS over EAA aggregates for all financial assets and liabilities, as well as for main sub-positions. The shortfall occurs for a number of reasons, discussed in Kavonius and Törmälehto (2010), Honkkila and Kavonius (2012) and HFCN (2013b), one of which is that the HH sector in the EAA comprises non-profit institutions, e.g., private foundations, while these institutions are not part of the HFCS data set; another one is that business wealth of the HH sector is (under certain conditions) classified as a financial asset in the EAA, while we classify it as a real asset when using the HFCS survey, see appendix A for further details.

In a second step, we integrate the HFCS data into the EAA, adopting as our baseline the integration strategy pursued also in Doepke and Schneider (2006b), which adjusts the counterpart positions in the other sectors of the EAA data set pro-rata in line with the HFCS aggregates.<sup>7</sup> As a robustness check, we also perform the opposite approach, which amounts to rescaling the

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<sup>7</sup>This is required to retain a zero net supply of nominal claims.

HFCS aggregates, so as to obtain the corresponding position in the HH sector balance sheet of the EAA. When considering sectoral aggregates only, the latter approach is identical to just using EAA data. We show in section 3 that these two approaches lead to very similar conclusions for the sectoral NNPs and thus for the sectoral redistribution effects associated with unexpected movements in the price level.

## 2.4 Computation of Net Nominal Positions (NNPs)

This section explains how we compute the net nominal positions (NNP) of the HH sector, the firm sector (FI), the government sector (GOV), the rest of the world sector (ROW) and of individual HHs. The NNP is a measure of the net inflation exposure of a sector or an economic actor arising from the ownership of nominal claims and liabilities. The NNP is expressed in Euros, with a positive (negative) NNP indicating that nominal assets exceed (fall short of) nominal liabilities. Economic actors with a positive NNP are losers (winners) from unexpected price level increases (decreases). The computation of the NNPs is based on the integrated HFCS-EAA data set, as described in the previous section.

We wish to mention up front that asset values in the EAA and in the HFCS are reported at market value and have been transformed into Euros. As a result, we do not know what share of financial assets or liabilities are denominated in foreign currency. While foreign currency is arguably not a big issue for the household sector, it may be more important for firms and in particular for financial institutions. Due to the lack of currency information, we treat all financial assets and liabilities as if they were denominated in Euros when computing NNPs. This is justified whenever foreign currency claims are matched by corresponding foreign currency liabilities, say due to currency hedging activities, or in the absence of such hedging, whenever the exchange rate does not move so as to restore the relative purchasing power prior to the considered price level movement. Given the weak performance of price level changes in predicting nominal exchange rate movements, see Engel and West (2005) and references cited therein, this approach appears justified.

As a first step, we compute the direct net nominal position (DNP), which comprises all nominal assets and liabilities, except those arising indirectly from the ownership of equity/firms. In a second step, we add to this the indirect net nominal positions (INP) resulting from equity/firm ownership. The NNPs of a sector or of an individual HH are then defined as the sum of the DNPs and INPs of the sector or HH.

We explain below how we compute the DNP of a sector or HH. The computation of the INPs is explained in section 2.5.

The DNP of each sector includes all financial assets net of financial liabilities, except for the equity parts on the asset and liability side.<sup>8</sup> We also exclude monetary gold and special drawing rights (SDRs) from the nominal positions. We do so because these (government) positions have

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<sup>8</sup>For the HH sector, we also include direct lending or borrowing by households. Yet, according to our survey, only about 0.1% of EA HHs are making direct loans and the median loan size is approximately equal to 3000 Euros. Online appendix E.2 provides detailed country information on direct HH lending.

no counterpart in the private sector accounts of the EAA, so that by excluding them the NNP of all sectors sum up to zero (except for rounding discrepancies).<sup>9</sup> Exclusion of these items has a quantitatively small effect on our results. Appendix A provides the list of variables used for computing the DNPs.

An important aspect for computing the HH sector NNPs regards the treatment of pension claims. In our analysis, we distinguish between pay-as-you-go social security schemes and other individual account based pension and life insurance claims. In particular, we exclude pay-as-you-go social security claims and payment obligations from our analysis, which amounts to assuming that the claims and benefits generated by these systems are fully indexed to the price level. This is partly motivated by the fact that neither the HFCS nor the EAA contain information on pay-as-you-go social security claims and benefits, but also by the fact that social security contributions tend to be a fixed share of nominal wage income, i.e., are effectively indexed.<sup>10</sup>

Regarding defined contribution and individual defined pension benefit and life insurance schemes, we treat these claims in the HH sector, as well as their counterparts in the financial sector of the EAA, as nominal claims. This is motivated by the fact that insurance companies in the Euro area are predominantly invested in nominal claims.<sup>11</sup> Moreover, pension owners often do not have a direct claim on the (relatively small) equity positions of the insurance sector, as they often own such positions only indirectly via life insurance type contracts. This represents an important institutional difference relative to the U.S. where individual investment accounts are much more widespread in retirement plans.

## 2.5 Accounting for Firm Ownership

To compute nominal exposures, we need to account for indirect nominal positions (INPs) arising from firm ownership by households (HH), the government (GOV) and the rest of the world (ROW). This is important because firms tend to be leveraged claims, i.e., entities that on net issue nominal debt, so that firm ownership tends to represent a hedge against inflation risk.

In the EAA and the HFCS we observe the equity owned by HHs,  $E^{HH}$ , equity owned by the government,  $E^{GOV}$ , as well as the equity positions on the asset and liability side of the firm sector,  $E^{FI-A}$  and  $E^{FI-L}$ , respectively.<sup>12,13</sup> We do not observe, however, whether ownership

<sup>9</sup>Furthermore, monetary gold is de-facto a real asset, while SDRs represent more an outstanding credit line than a financial claim.

<sup>10</sup>Some EA countries apply upper caps to social security contributions, which would cause contributions not to be fully indexed to the price level absent changes to social security law.

<sup>11</sup>Of the € 6.7 trn of financial assets held by insurance corporations and pension funds in the EA, only about € 0.85 trn are invested in equity. A further € 1.6 trn is invested in mutual funds, but these are to a large extent themselves invested in nominal claims: the other financial intermediaries sector, which consists mainly of mutual, private equity and hedge funds, holds only about 36% of its assets in quoted and unquoted shares. This suggests that of the € 6.6. trn of pension assets in the insurance sector only about € 1.4trn (=0.85 trn+36%·1.7trn), i.e., only about 21% are invested in equities. Given that the other financial intermediaries sector contains also private equity and hedge funds, which tend to have a higher equity share, the true equity share is likely to be even lower.

<sup>12</sup>Equity positions of the firm sector in the EAA are not reported in consolidated form: if a domestic firm owns the equity of another domestic firm, then this position appears on the asset and liability side of the firm sector balance sheet.

<sup>13</sup>Some countries (ES, FI, IE, SI, SK) report a (quantitatively small) equity position on the liability side of the

regards foreign or domestic equity, requiring us to impute the foreign ownership share. We explain below how this is achieved and how we assess the robustness of our results with respect to the imputation approach.

Throughout the paper, we assume that domestic governments own domestic firms only. Given that none of the considered countries runs a sovereign wealth fund, this appears justified. Next, we decompose household equity claims as follows

$$E^{HH} = E^{HH-D} + E^{HH-F}, \quad (1)$$

where  $E^{HH-D}$  and  $E^{HH-F}$  denote HH ownership of domestic and foreign equity, respectively. Likewise, we decompose the asset side of firms' equity as follows

$$E^{FI-A} = E^{FI-A-D} + E^{FI-A-F}, \quad (2)$$

where  $E^{FI-A-D}$  denotes ownership of other domestic firms and  $E^{FI-A-F}$  ownership of foreign firms. Letting  $E^{ROW-A}$  denote the equity positions on the asset side of the ROW balance sheet, we have

$$E^{FI-L} - E^{ROW-A} - E^{GOV} = E^{FI-A-D} + E^{HH-D}, \quad (3)$$

where the l.h.s. is the total equity issued by domestic firms ( $E^{FI-L}$ ), net of the equity owned by the ROW ( $E^{ROW-A}$ ) and the equity held by the GOV ( $E^{GOV}$ ). The remaining equity must be held either by domestic firms ( $E^{FI-A-D}$ ) or domestic households ( $E^{HH-D}$ ). Finally, we have

$$E^{ROW-L} = E^{HH-F} + E^{FI-A-F}, \quad (4)$$

which states that the equity liabilities of the ROW ( $E^{ROW-L}$ ) must either be held by domestic households ( $E^{HH-F}$ ) or domestic firms ( $E^{FI-A-F}$ ).<sup>14</sup>

Equations (1)-(4) represent four equations in the four unknown variables ( $E^{HH-D}$ ,  $E^{HH-F}$ ,  $E^{FI-A-D}$ ,  $E^{FI-A-F}$ ). The equations are nevertheless insufficient to determine the unknowns because the system suffers from a rank-deficiency that results from an accounting identity: summing equations (3) and (4) and using (1) and (2) to substitute the terms on the r.h.s. of the summed equation, one obtains the identity that the net equity claims of the domestic sectors (HH, GOV and firms) must equal the negative of the net equity claim of the ROW. Thus, to identify the domestic and foreign ownership variables, one has to impose one additional identifying assumption. We shall consider the following scenarios which span the range of plausible assumptions:

**Maximum HH Home Bias:** All foreign equity is held by the domestic firm sector ( $E^{FI-A-F} =$

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GOV balance sheet. If so, we let  $E^{GOV}$  denote the *net* equity claim of the government sector. The household sector never has an equity position on its liability side. The equity position of a HH sector in the HFCS data, is computed by adding the HFCS counterparts of the following EEA positions: quoted shares, unquoted shares and equity mutual fund shares.

<sup>14</sup>Recall that we assume that the domestic government does not own foreign equities.

$E^{ROW-L}$ ), which amounts to assuming a perfect equity home bias in households' equity portfolio ( $E^{HH-F} = 0$ ).<sup>15</sup>

**Identical Home Bias:** Households and firms are equally internationally diversified in their equity positions, i.e.,  $E^{FI-A-F}/E^{FI-A-D} = E^{HH-A-F}/E^{HH-A-D}$ .

**Maximum Firm Home Bias** All foreign equity is held by domestic households ( $E^{FI-A-F} = E^{ROW-L}$ ), which amounts to assuming perfect equity home bias by firms ( $E^{FI-A-F} = 0$ ).<sup>16</sup>

As our baseline, we shall use the 'Identical Home Bias' assumption. Section 3 shows, however, that results regarding the net nominal positions of the HH, GOV and ROW sectors are very similar when entertaining one of the other identifying assumptions instead.

We are now in a position to compute the net nominal exposure of domestic firms per unit of equity issued.<sup>17</sup> Let  $DNP^{FI}$  denote the direct net nominal position of the domestic firm sector, i.e., nominal assets minus nominal liabilities of the firm sector balance sheet.  $DNP^{FI}$  tends to be negative, as firms issue typically more nominal debt relative to the nominal claims they hold.  $DNP^{FI}$  does not include the nominal exposures generated in the domestic firm sector due to the ownership of foreign firms, which are themselves leveraged claims. We therefore add the latter positions.

Let  $R$  denote the net nominal claims per unit of equity issued by the domestic firm sector

$$R = \frac{DNP^{FI}}{E^{FI-L} - E^{FI-A-D}}, \quad (5)$$

where  $E^{FI-L} - E^{FI-A-D}$  denotes domestic firm equity issued that is not held by domestic firms themselves. In what follows we will assume that the same nominal exposure ratio  $R$  applies to foreign equity held by domestic firms. This appears justified if domestic firms' choice of  $R$  reflects the preferences of domestic investors and if domestic firms and households invest abroad on average in firms with the same nominal exposure characteristics.<sup>18</sup>

With this assumption we can compute the net nominal exposure of domestic firms arising from ownership of foreign firms, which equals  $R \cdot E^{FI-A-F}$ , so that total net nominal position of the domestic firm sector  $TNP^{FI}$  is given by

$$TNP^{FI} = DNP^{FI} + R \cdot E^{FI-A-F}$$

The  $INPs$  of the HH, GOV and ROW sectors then consist of  $TNP^{FI}$ , which we attribute to

<sup>15</sup>For countries in which  $E^{ROW-L} > E^{FI-A}$  we attribute the remaining foreign equity holdings to the household sector, i.e., then set  $E^{HH-A-F} = E^{ROW-L} - E^{FI-A}$ ,  $E^{FI-A-D} = 0$  and  $E^{FI-A-F} = E^{FI-A}$ .

<sup>16</sup>For countries in which  $E^{ROW-L} > E^{HH-A}$  we attribute the remaining foreign equity holdings to the firm sector, i.e., then set  $E^{FI-A-F} = E^{ROW-L} - E^{HH-A}$ ,  $E^{HH-A-D} = 0$  and  $E^{HH-A-F} = E^{HH-A}$ .

<sup>17</sup>Using  $E^{FI-A-F}/E^{FI-A-D} = E^{HH-A-F}/E^{HH-A-D}$  together with equations (1), (2) and (4) it is straightforward to determine  $(E^{HH-D}, E^{HH-F}, E^{FI-A-D}, E^{FI-A-F})$ .

<sup>18</sup>Online appendix E.4 shows that results from section 3 are robust to assuming instead that foreign firms are as leveraged as the average firm sector across all EA countries.

these sectors according to their ownership shares  $E^{HH-D}$ ,  $E^{GOV}$  and  $E^{ROW-A}$ . In addition, we attribute the nominal exposure  $E^{HH-F} \cdot R$  to the HH sector, which is due to outright ownership of foreign firms by HHs. Within the HH sector we distribute the  $INP$  to individual households according to the relative ownership shares of equity reported in the HFCS survey.

To preserve symmetry of the nominal balance sheet positions between domestic agents and the ROW, we furthermore need to add the following nominal exposure to the ROW balance sheet, which arises from attributing the exposure from foreign ownership of firms to HH, GOV, and ROW, as described above:

$$-R \cdot (E^{FI-A-F} + E^{HH-F}).$$

Proceeding this way we have incorporated nominal exposures of the firm sector and of foreign equity holdings as  $INPs$  into the balance sheets of the households, government and the ROW.

## 2.6 Unexpected Inflation: The Thought Experiment

In the remainder of this paper, we will consider the effects of a one-time unexpected increase in the general price level by 10%. The distributional effects of smaller price increases can be computed by proportionately rescaling the presented results. The effects of price deflation are obtained by inverting the signs of the results.

A general increase in the price level is one where all nominal prices increase by the same relative amount, i.e., current prices but also all state-contingent future prices. As a result, all relative prices, including future inflation as well as current and future nominal interest rates remain unchanged. Provided the wealth redistributions generated by the price level surprise do not give rise to relative demand shifts, as would be the case, for example, when HHs have identical homothetic preferences, see Chipman (1974), the new state contingent price path remains consistent with equilibrium. Moreover, the present value of firm profits remains unchanged, so that the effects of unexpected price level changes on equity valuations can be captured by the changes in real value of firms' total net nominal position ( $TNP^F$ ), as determined in the previous section.<sup>19</sup>

In practice, movements in the general price level are likely going to be accompanied by temporary movements in relative prices, e.g., due to the presence of nominal rigidities. Such relative price changes may induce additional redistributive effects beyond the ones we compute in the present paper.<sup>20</sup> Quantifying these requires, however, specifying a fully fledged economic model and thus imposing additional assumptions about preferences, production technologies, etc.. While of interest, the present paper focuses on the redistributive effects associated purely with a movement in the general price level.

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<sup>19</sup>This holds true whenever equity valuations are frictionless, i.e., reflect the present value of future profits plus the value of firms' net financial claims.

<sup>20</sup>Likewise, deviations from the homothetic preference assumption, say due to different age or employment status of households, may also generate additional redistributive effects.

## 3 Winning and Losing Countries and Sectors

### 3.1 Baseline Findings

Using the baseline methodology described in the previous sections, table 1 reports the net nominal positions (NNPs) for the Euro Area (EA) as a whole and for all EA countries.<sup>21</sup> The table reports the nominal positions for the three sectors that are the ultimate holders of financial claims (GOV, HH, ROW), where the net position of the ROW is the mirror image of the joint positions reported for the GOV and the HH sectors.<sup>22</sup> The nominal positions are reported once in per capita terms and once scaled by GDP of the considered country or currency area.

A positive NNP in the ROW column in table 1 indicates that the ROW is losing from unexpected price level increases. For the EA, for example, an unexpected price level increase by 10% leads to a real gain of 1080 € per capita (p.c.) at the expense of the ROW.<sup>23</sup> This corresponds to gain of 4.2% of p.c. GDP, i.e., a sizable wealth redistribution. Table 1 reveals, however, that the EA gains are distributed unequally within the EA: while domestic governments gain 1860 € p.c., the domestic HH sector is losing 780 € p.c.

Table 1 shows that the governments of all EA countries are winners of unexpected price level increases, except for the government of Luxembourg. The sectoral evidence for Luxembourg must, however, be interpreted with care: due to the large size of the financial sector in Luxembourg, even small margins of errors in the computation of the business sector's total net nominal position ( $TNP^{FI}$ ) can have considerable effects on the reported outcomes, whenever these are scaled by domestic variables such as domestic population or GDP.<sup>24</sup> In the rest of this section, we therefore ignore the data reported for Luxembourg.<sup>25</sup> Considerable uncertainties also exist regarding the Dutch figures: as we show in the next section, the Dutch sectoral results turn out not to be robust to alternative ways of integrating the HFCS data with the EAA data.<sup>26</sup>

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<sup>21</sup>Since HFCS data is not available for Ireland, table 1 reports the EAA data for Ireland, i.e., skipping the EAA-HFCS integration step described in section 2.3. The EA aggregates reported in table 1 are obtained by summing the individual country data after integrating the HFCS into the EAA at the country level (again, for Ireland we use pure EAA data). Very similar results are obtained when instead integrating the HFCS data at the EA level. Note that by summing up individual EA countries, we do not include the ECB into the EA aggregate, as the ECB balance sheet is part of the ROW for each individual EA country (national central bank balance sheets are part of the domestic financial sector though). Online appendix E.5 shows that regrouping the ECB into the domestic EA sector has only negligible consequences for the results.

<sup>22</sup>Online appendix E.1 provides a detailed breakdown of the direct and indirect net positions by economic sector and country.

<sup>23</sup>This is 10% of the reported ROW EA NNP of 10.8 thousand Euros.

<sup>24</sup>For Luxembourg, the NNP of the ROW before accounting for firm ownership is -1.1 trn €. After incorporating firm ownership, this number shrinks to -17 bln €, which is large relative to population size, but small relative to the initial position and in absolute terms.

<sup>25</sup>These problems do not affect the distributional information obtained from HFCS data for Luxembourg, as reported later on.

<sup>26</sup>This is due to the fact that in the Netherlands there exists a large and asymmetric discrepancy between assets and liabilities in HFCS and EAA aggregates, see appendix B for details. This asymmetry could be due to a variety of reasons: the Netherlands is the only country that carried out the HFCS using computer assisted web interviews, i.e., without relying on personal contact with an interviewer, which may affect the quality of Dutch HFCS data; interest payments on mortgage debt are tax deductible in the Netherlands, thus have been declared to authorities before; tax deductibility may cause debt to be very stable over time and thus mentally easier to recall.

The same applies for the results reported for Cyprus in table 1.<sup>27</sup> We shall thus also ignore the outcome for the Dutch and Cypriot data in rest of this section.

	NNP per capita			NNP/GDP		
	<i>GOV</i>	<i>HH</i>	<i>ROW</i>	<i>GOV</i>	<i>HH</i>	<i>ROW</i>
	(thousands of Euros)					
<b>Euro Area</b>	<b>-18.6</b>	<b>7.8</b>	<b>10.8</b>	<b>-0.73</b>	<b>0.30</b>	<b>0.42</b>
Austria	-21.7	11.6	10.1	-0.70	0.37	0.32
Belgium	-27.6	40.8	-13.2	-0.93	1.37	-0.44
Cyprus*	-9.9	-7.2	17.0	-0.52	-0.38	0.89
Finland	-3.0	-8.4	11.3	-0.10	-0.27	0.37
France	-22.3	10.6	11.7	-0.81	0.39	0.43
Germany	-17.4	15.3	2.2	-0.60	0.53	0.08
Greece	-22.9	-1.2	24.1	-1.34	-0.07	1.41
Ireland	-19.2	21.8	-2.6	-0.54	0.61	-0.07
Italy	-23.2	8.1	15.1	-0.99	0.35	0.64
Luxembourg*	22.7	12.0	-34.7	0.35	0.18	-0.53
Malta	-8.3	20.1	-11.8	-0.63	1.52	-0.89
Netherlands*	-16.5	-9.5	25.9	-0.50	-0.29	0.78
Portugal	-13.1	-0.2	13.3	-0.88	-0.01	0.89
Slovakia	-4.8	2.2	2.6	-0.54	0.24	0.29
Slovenia	-8.6	2.9	5.7	-0.56	0.19	0.37
Spain	-12.4	-6.7	19.1	-0.60	-0.32	0.93

\* country result not robust to HFCS-EAA integration approach

Table 1: Net nominal position (NNP), baseline results

Table 1 reveals that most EA countries gain from the ROW following unexpected price level increases. The five largest winners are the so-called GIPS countries, with Greece winning 2410€ p.c. from a 10% price level increase, Spain winning 1910 €, Cyprus 1700 €, Italy 1510 € and Portugal 1330 € (all in p.c. terms). Two countries turn out to be net losers of inflation, with Belgium losing 1320 € p.c. and Malta losing 1180 € p.c.. In both countries this is due to the large amount of nominal claims accumulated in the HH sector. Some of the countries, e.g., Germany, Ireland, and Slovakia, remain in the aggregate largely unaffected by unexpected price level changes (although considerable wealth redistribution occurs within these countries); the remaining countries are moderate to medium-sized winners, with gains ranging from 560 € p.c. (Slovenia) to 1170 € p.c. (France).

For the HH sector there exists considerable heterogeneity across EA countries. In some

<sup>27</sup>As with Dutch data, see footnote 26, the Cypriot data displays a considerable asymmetry between HFCS and EAA aggregates, see appendix B for details.

countries, the HH sector is even a net winner of inflation. For the considered 10% unexpected price level increase, HHs gain 840 € p.c. in Finland, 670 € in Spain, 120 € in Greece and 20 € in Portugal (all in p.c. terms). The HH sector is a net loser in all other countries, with the three largest losers being HHs in Belgium (-4080 € p.c.), Ireland (-2180 € p.c.) and Malta (-2010 € p.c.). In the remaining countries, the HH sector loses approximately in line with the per capita losses experienced for the EA as whole (-780 € p.c.).

	Maximum HH			Maximum Firm		
	Home Bias			Home Bias		
	<i>GOV</i>	<i>HH</i>	<i>ROW</i>	<i>GOV</i>	<i>HH</i>	<i>ROW</i>
	(thousands of Euros)			(thousands of Euros)		
<b>Euro Area</b>	<b>-18.6</b>	<b>7.5</b>	<b>11.1</b>	<b>-18.7</b>	<b>8.4</b>	<b>10.3</b>
Austria	-21.8	12.2	9.5	-21.7	10.5	11.1
Belgium	-27.6	38.2	-10.6	-27.8	45.5	-17.7
Cyprus*	-9.9	-7.6	17.4	-9.9	-6.8	16.6
Finland	-3.0	-8.2	11.2	-2.9	-8.5	11.4
France	-22.3	10.3	11.9	-22.4	12.1	10.3
Germany	-17.4	14.4	3.0	-17.6	17.5	0.1
Greece	-22.9	-1.0	24.0	-22.9	-1.3	24.2
Ireland	-19.2	19.1	0.1	-19.2	22.5	-3.3
Italy	-23.2	7.9	15.3	-23.2	8.8	14.5
Luxembourg*	22.8	7.5	-30.2	22.7	13.0	-35.6
Malta	-8.3	19.5	-11.2	-8.4	21.0	-12.7
Netherlands*	-16.5	-10.0	26.5	-16.5	-9.3	25.7
Portugal	-13.1	-0.1	13.2	-13.0	-0.9	13.9
Slovakia	-4.8	2.2	2.6	-4.8	2.2	2.6
Slovenia	-8.7	3.0	5.6	-8.4	2.4	6.0
Spain	-12.5	-5.6	18.1	-12.2	-10.1	22.3

\* country result not robust to HFCS-EAA integration approach

Table 2: NNP per capita, alternative ownership assumptions

### 3.2 Robustness Analysis

This section documents that most of the findings reported in the previous section turn out to be robust to entertaining a range of alternative assumptions.

Table 2 evaluates the effects of alternative ownership assumptions regarding foreign equity. Our baseline approach assumes that firms and households hold equal portfolio shares of foreign equities, see section 2.5. The columns titled 'Maximum HH Home Bias' in table 2 assume

instead that foreign equity is held by domestic firms, while the columns titled 'Maximum Firm Home Bias' explore the implications of assuming that foreign equity is held by the HH sector. Table 2 reveals that the findings previously reported in table 1 turn out to be very stable with respect to making alternative foreign ownership assumptions. The Spearman rank correlation coefficient for the three sectors and the 16 countries between the baseline results in table 1 and those reported in table 2 is above 0.99, for each of the two considered alternative ownership assumptions.

	<i>GOV</i>	<i>HH</i>	<i>ROW</i>
	(thousands of Euros)		
<b>Euro Area</b>	<b>-22.2</b>	<b>14.2</b>	<b>8.0</b>
Austria	-23.5	14.9	8.6
Belgium	-28.7	53.1	-24.4
Cyprus	-13.1	7.1	5.8
Finland	-7.3	-3.4	10.7
France	-27.0	18.0	9.0
Germany	-20.2	19.3	0.9
Greece	-27.7	4.2	23.5
Ireland	-19.2	21.8	-2.6
Italy	-30.0	11.7	18.3
Luxembourg	22.5	62.2	-84.7
Malta	-8.8	22.4	-13.6
Netherlands	-21.7	34.8	-13.1
Portugal	-15.1	4.5	10.6
Slovakia	-5.3	3.7	1.6
Slovenia	-8.8	2.4	6.4
Spain	-13.1	-6.2	19.3

Table 3: NNP per capita, alternative HFCS-EAA integration approach

Next, we explore the effects of an alternative approach for integrating HFCS data into the EAA. The baseline approach, described in section 2.3, consists of reconciling differences in HFCS and EAA aggregates by adjusting the EAA counterparts of HFCS positions, in line with the approach in Doepke and Schneider (2006b). We now explore the effects of pursuing the opposite strategy, i.e., rescaling HFCS positions to match the EAA aggregates.<sup>28</sup> Table 3 below reports the outcomes of this approach. Along the dimensions emphasized in the previous section, results are fairly similar to those reported in table 1. In particular, Greece, Spain, and Italy continue to be the countries winning most from unexpected inflation, but Finland now just overtakes

<sup>28</sup>For the sectoral outcomes reported in table 3, this delivers the same results as when using EAA data only.

Portugal in terms of per capita gains. The results for Cyprus, Luxembourg and the Netherlands change significantly relative to table 1, justifying our caution in interpreting the findings for these countries reported in table 1. Abstracting from these countries, it continues to be true that Malta and Belgium are the biggest losers of unexpected inflation. For the remaining countries, the most important effect of the alternative integration approach consists of an increase in the HH sector NNP and - correspondingly - a decrease in the ROW NNP. Despite these differences, the Spearman rank correlation coefficient for the three sectors and the 16 considered countries between the baseline results in table 1 and those displayed in table 3 remains high and equal to 0.86, indicating that results in terms of countries' relative ranking reported in table 1 are rather robust to the considered alternative integration approach.

## 4 Winning and Losing Households

This section analyzes the redistributive effects of unexpected inflation at the level of individual HHs. It documents the distribution of inflation exposures in the EA and in individual EA countries, analyzes the HH characteristics associated with different inflation exposures and compares inflation exposures across different age cohorts and social classes. Section 4.1 compares the EA results to those documented for the United States and Canada. Section 4.2 presents detailed results across age cohorts and social classes for individual EA countries.

Using the HFCS data and the methods described in section 2.5, we can compute the net nominal position (NNP) of each HH in the survey. Using the same data allows computing each HH's net wealth (NW) position. Provided net wealth is positive, the ratio of the net nominal position over net wealth (NNP/NW) captures the household's exposure to unexpected movements in inflation per unit of wealth owned: a NNP to NW ratio of 0.5, for example, indicates that the HH suffers a 5% net wealth loss from an unexpected 10% increase in the price level. Conversely, a ratio of -0.5 indicates a 5% net wealth gain due to this price level adjustment. Since households cannot effectively short real assets, we have  $NNP \leq NW$  and thus  $NNP/NW \leq 1$ , whenever the HH has positive NW.

Figure 1 depicts the distribution of inflation exposures (NNP/NW) for all HHs with a positive NW position (shaded bars).<sup>29</sup> We superimpose on each distribution the so-called concentration curve for NW (solid line). The concentration curve depicts the share of net wealth in total HH net wealth owned by HHs with an NNP/NW below the value indicated on the x-axis. The slope of the concentration curve thus indicates where net wealth is located along the NNP/NW axis, with a steeper slope indicating areas with higher NW concentration. Figure 1 presents results for the Euro Area as a whole (top left panel), as well as for individual EA countries.<sup>30</sup> The figure abstracts from all EA household with a negative NW position (approximately 6% of all HHs), which will be discussed further below and is robust towards also excluding HHs with

<sup>29</sup>The distributions are computed using populations weights from the HFCS.

<sup>30</sup>The EA distribution in figure 1 is obtained by aggregating the individual distributions shown in the figure. Since HFCS data is not available for Ireland, the EA aggregate does not include Irish HHs, which should have a quantitatively small effect on the aggregate EA distribution.

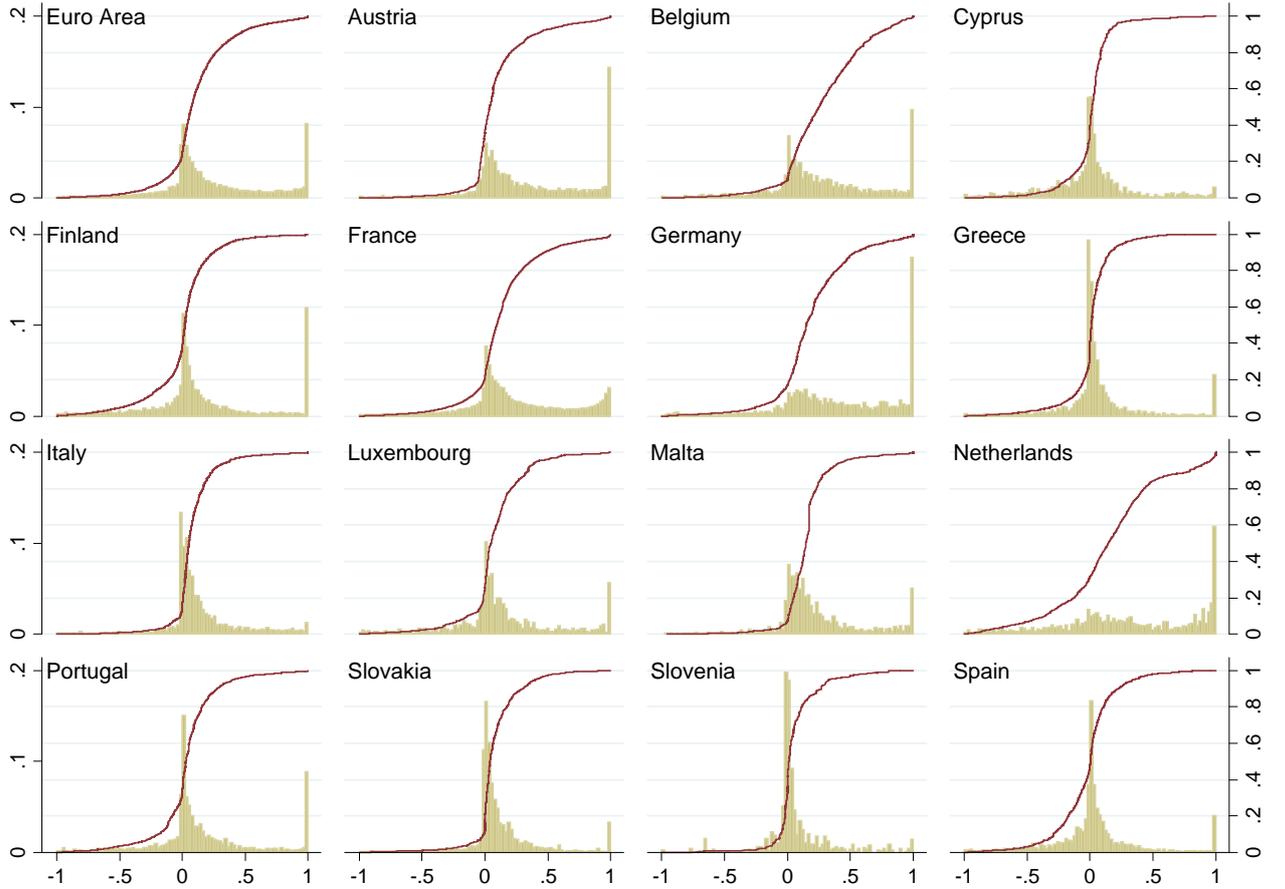


Figure 1: Distribution of inflation exposures ( $NNP/NW$ ) in the HH sector (shaded bars) and net wealth concentration curve (solid line)

a low NW position, say HHs with wealth below 2500 or 5000 Euros.<sup>31</sup>

We begin by discussing the  $NNP/NW$  distributions and turn the to information provided by the concentration curves in a second step. The  $NNP/NW$  distribution for the EA displays a peak around the zero exposure point: about 21% of all EA HHs have virtually no inflation exposure, when defined as  $NNP/NW \in [-0.05, 0.05[$ . There is a thin tail to the left of this peak, consisting of about 15% of all EA HHs, which are net borrowers ( $NNP/NW < -0.05$ ). To the right of the zero exposure position, the density first decays but later on increases as inflation exposure rises: approximately 35% of all EA HHs are holding predominately real assets ( $NNP/NW \in [0.05, 0.5[$ ), with a further 14% holding predominately nominal assets ( $NNP/NW \in [0.5, 0.95[$ ). A substantial 9% of HHs are bunched at the right end of the distribution and hold almost only nominal assets ( $NW/NNP \in [0.95, 1]$ ).

The panels for the individual countries depicted in figure 1 show that the pattern documented for the EA as a whole exists in similar form in all EA member countries, albeit important

<sup>31</sup>The figure also truncates the distribution below -1, thereby eliminating large negative  $NNP/NW$  positions resulting from NW position close to zero. The excluded share of HHs is negligible.

differences exist. The share of HHs holding almost only nominal assets ( $NNP/NW \in [0.95, 1]$ ) is particularly pronounced in some of the EA ‘core’ countries, reaching 17% in Germany, 15% in Austria, 13% in the Netherlands, and 11% in Finland. It is lowest in some of the current crisis countries, i.e., Cyprus (2%), Italy (2%), Greece (4%) and Spain(4%), as well as in the former transition countries Slovenia (2%) and Slovakia (3%). Furthermore, the latter two countries display a high peak around the zero exposure point, with many HHs holding virtually no inflation exposure (53% in Slovenia, 43% in Slovakia). The next highest values in this category are achieved by the crisis countries, with Greece reaching 45%, Spain and Italy both 36% and Portugal 30%. The lowest HH shares with virtually no inflation exposure are found in Germany and the Netherlands (both 7%), followed with a distance by Belgium (15%) and Austria (16%).

The EA concentration curve in the top left panel of figure 1 shows that net wealth is concentrated among HHs with close to zero or moderately positive levels of inflation exposure. The same holds true for individual EA countries, except for Belgium, the Netherlands and to a minor extent Germany, where the concentration curves are flatter, indicating that in those countries there are more wealthy households that have comparatively high inflation exposure. In some countries, very little net wealth is located in the upper parts of the  $NNP/NW$  distribution, e.g., in Cyprus, Greece, Italy, Portugal and Spain.

Table 4 below presents further more detailed summary statistics for EA HHs with different inflation exposures. For each HH group, table 4 reports the medium age of the HH head, the average education attained by the HH head, where education levels are discretely coded between zero (no formal education) and seven (second stage tertiary education) using the definitions of the International Standard Classification of Education (ISCED 1997)<sup>32</sup>, the share of HHs owning real estate, the median income, the medium net wealth level and the number of HHs in the respective group.<sup>33</sup> For benchmark purposes, the first row in table 4 reports the characteristics when considering all EA HHs.

Table 4 reveals that HHs with negative net worth tend to be comparatively young, tend to have relatively low education levels and low income, and rarely own a house. The median net wealth position, however, is only moderately negative.<sup>34</sup> Nevertheless, the group of HHs with negative NW is sizable and consists of 7.7m HHs in the EA.

As table 4 shows, borrowing HHs, HHs with no inflation exposure and HHs predominantly holding real assets are all relatively rich and are to a vast majority real estate owners. Together, these three HH groups account for 71% of all EA HHs. Borrowing HHs thereby have lower wealth levels than the other two groups, but the highest median income and mean education level of all HH groups. Borrowing HHs are also considerably younger. Households holding predominantly or almost exclusively nominal assets are considerably poorer: their median wealth level remains

<sup>32</sup>The coding used is as follows: 0 - no formal education or below 1; 1 - primary education; 2 - lower secondary or second stage of basic education; 3 - upper secondary; 4 - post-secondary; 5 - first stage tertiary; 6 - second stage tertiary education.

<sup>33</sup>The latter is computed using the population weights from the HFCS.

<sup>34</sup>Further investigation shows that most of these HHs tend to have a  $NNP/NW$  of close to one, indicating that their negative net wealth is approximately equal to their net nominal position (with both being negative).

below 20% of the median net wealth levels reported for the other HH groups holding positive wealth. Their income is also lower, although some of these HHs are well-educated. HHs with predominantly nominal assets also rarely own a house.

The patterns documented for the EA in table 4 are similarly present at the country level, albeit some important differences exist. The share of HHs with negative NW, for example, varies considerably across EA countries, reaching 12% in Finland and being as low as 1% in Slovakia. Appendix C reports for each individual EA country the numbers displayed in table 4 for the EA as a whole.

<b>Euro Area</b>	Median	Mean	Share of	Median	Median	# of	HH
	Age	Edu	Home	Income	Net Wealth	HHs	share
			Owners	(thou €)	(thou €)	(mln)	
All households	53	2.9	59%	28.1	125.0	130.9	100%
Negative net worth	41	2.9	13%	20.6	-3.4	7.7	6%
Borrower	45	3.3	87%	37.9	173.2	19.1	15%
Almost no exposure	58	2.5	86%	23.0	201.2	28.1	21%
Pred. real assets	58	3.0	74%	32.4	217.6	45.7	35%
Pred. nominal assets	48	3.1	10%	28.7	30.3	18.7	14%
Almost only nom. assets	50	2.9	0%	17.9	7.3	11.6	9%

Table 4: Inflation exposure and HH characteristics

#### 4.1 Comparison with US and Canadian Data

We now document HHs' nominal exposures across age cohorts and broad social classes, comparing results to those documented for the U.S. by Doepke and Schneider (2006b) and for Canada by Meh and Terajima (2008).

Following this earlier work, we define - for any considered age cohort - 'Rich HHs' as those within the top 10% of the cohort NW distribution. The remaining HHs of the cohort are then sorted by income into two additional groups, labeled 'Middle Class' (70% of the total population) and 'Poor HHs' (20% of all HHs, at the bottom of the income distribution of all non-rich HHs). For every cohort, we compute the average NNP and normalize it by average cohort NW. The resulting measure can be interpreted as the inflation exposure of the representative or average household within the considered cohort.

Table 5a documents results for the EA. It expresses the average NNP over average NW in percentage points and shows that young middle class HHs in the EA are on average considerably indebted, while rich and poor HHs of the youngest two cohorts have a close to zero exposure. As HHs become older, their inflation exposure increases stronger than NW, with the highest age

cohorts reaching the highest exposure. The results for the U.S. and Canada are quantitatively very similar, when considering the cohort results for all social classes together (listed in the row labeled ‘Total’ in Table 5a). The main quantitative difference to the EA is that older HHs in the U.S. and Canada hold in relative terms a 50% higher inflation exposure.

More noticeable differences emerge when comparing different social classes. In the U.S. and Canada young poor HHs have a considerably negative inflation exposure, indicating their ability to borrow against future income, while the young poor cohorts in the EA have a close to zero exposure on average. As we shall see in the next section, there exists considerable heterogeneity across young poor cohorts across EA countries.

		Age cohort					
		$\leq 34$	35 – 44	45 – 54	55 – 64	65 – 74	$> 74$
EA	Rich HHs	-1.5	5.5	10.3	13.9	12.3	20.7
	Middle Class	-80.4	-15.3	1.0	9.6	13.7	22.8
	Poor HHs	1.0	-4.2	9.4	14.5	12.4	15.5
	Total	-48.3	-11.6	3.1	11.0	13.2	19.3
US	Rich HHs	-14.0	3.8	6.6	16.3	16.7	27.5
	Middle Class	-114.0	-31.6	-4.8	14.0	25.2	38.1
	Poor HHs	-36.6	-33.8	-5.5	7.5	17.5	26.4
	Total	-42.6	-10.1	2.3	15.2	19.4	30.6
CA	Rich HHs	-2.7	2.2	16.4	17.5	27.5	29.8
	Middle Class	-89.4	-26.5	11.4	26.0	29.4	33.9
	Poor HHs	-52.1	-27.1	-3.3	20.7	14.2	23.8
	Total	-35.8	-11.2	13.1	22.1	27.9	31.9

Table 5a: Inflation exposure (NNP/NW, % points) across age cohorts

## 4.2 Results for Individual EA Countries

Table 5b provides detailed information about inflation exposures across age cohorts and social classes for individual EA countries. It shows that the EA figures reported in table 5a mask a considerable amount of cross-country heterogeneity.

While the overall inflation exposure of young poor HHs in the EA is approximately zero, young poor HHs in the Netherlands, Finland, Belgium, Luxembourg, Spain and Portugal hold considerably negative exposures. Yet, these HH categories typically hold sizable positive exposures in Germany, Malta, Slovenia and France. Borrowing of young low-income HHs thus displays considerable variation across EA countries, which overall gives rise to the zero exposure documented in the previous section.

There exists also a considerable degree of heterogeneity with respect to the inflation exposure of old rich HHs. Their exposure is highest in Belgium, France, the Netherlands and Slovenia,

sometimes reaching values close to 50%. It is lowest in Spain, Cyprus and Greece where even old rich HHs often have a close to zero exposure to price level risk.

Table 5b: Inflation exposure (NNP/NW, % points) across age cohorts

	Age cohort					
	<= 34	35-44	45-54	55-64	65-74	> 74
<b>Austria</b>						
Rich HHs	-1.42	0.61	6.16	6.93	13.71	13.09
Middle Class	-17.87	-4.44	13.90	17.54	15.57	21.89
Poor HHs	-4.95	-1.78	13.75	14.85	15.08	15.00
Total	-12.42	-3.55	13.11	15.82	15.24	18.38
<b>Belgium</b>						
Rich HHs	3.59	30.55	42.42	47.61	40.90	49.02
Middle Class	-37.75	-1.56	14.49	26.33	26.00	27.99
Poor HHs	-55.74	4.86	18.83	18.21	11.73	22.02
Total	-39.37	2.67	17.81	26.50	23.06	27.79
<b>Cyprus</b>						
Rich HHs	-1.20	3.02	2.23	5.08	6.45	3.76
Middle Class	-27.56	-18.60	-7.98	-0.49	5.53	14.46
Poor HHs	-21.74	-3.30	-21.24	2.74	5.40	7.90
Total	-24.43	-13.91	-8.48	0.51	5.56	8.67
<b>Finland</b>						
Rich HHs	-27.01	-6.78	-1.79	4.50	9.04	4.90
Middle Class	-341.34	-57.18	-25.21	0.77	6.52	9.70
Poor HHs	-90.07	-36.40	-8.31	3.90	12.77	12.66
Total	-243.32	-50.04	-20.49	1.77	8.90	10.79
<b>France</b>						
Rich HHs	-0.62	4.51	9.05	18.15	21.89	38.01
Middle Class	-67.98	-21.00	-0.20	11.70	16.43	23.54
Poor HHs	10.32	-5.71	3.29	6.71	13.14	15.89
Total	-37.11	-16.37	1.26	11.27	16.09	21.75
<b>Germany</b>						
Rich HHs	5.69	14.67	17.98	15.68	13.53	17.34
Middle Class	8.48	-4.91	8.13	14.48	18.95	31.58
Poor HHs	30.83	11.74	30.36	37.49	23.31	31.33
Total	17.00	-0.63	12.04	19.36	19.56	30.09
<b>Greece</b>						

continued on next page

Table 5b – continued from previous page

	Age cohort					
	<= 34	35-44	45-54	55-64	65-74	> 74
Rich HHs	-1.11	0.01	2.81	4.38	3.24	5.54
Middle Class	-23.94	-10.56	-6.47	-3.52	1.96	8.59
Poor HHs	-4.72	-15.60	-4.77	-2.13	4.83	2.45
Total	-15.55	-10.08	-5.41	-2.49	3.13	5.02
<b>Italy</b>						
Rich HHs	1.98	2.81	7.51	10.80	8.17	13.66
Middle Class	-10.77	0.03	3.39	9.31	9.86	14.82
Poor HHs	-7.55	1.05	-0.51	5.83	7.13	6.80
Total	-8.68	0.48	3.29	8.96	8.82	10.58
<b>Luxembourg</b>						
Rich HHs	-2.28	7.37	9.35	12.52	8.19	18.07
Middle Class	-81.95	-22.68	-0.30	8.75	9.12	15.97
Poor HHs	-51.30	-9.91	-3.83	4.32	6.97	7.24
Total	-66.68	-16.96	-0.19	8.32	8.40	12.63
<b>Malta</b>						
Rich HHs	5.68	10.38	15.67	19.18	15.29	16.30
Middle Class	3.28	4.13	16.29	20.07	13.81	24.06
Poor HHs	16.28	3.37	25.20	14.62	19.22	16.07
Total	5.02	4.62	17.29	18.84	16.24	18.46
<b>Netherlands</b>						
Rich HHs	-45.67	12.60	14.18	23.82	14.29	48.00
Middle Class	-774.80	-77.02	-26.34	0.94	6.49	22.81
Poor HHs	-242.55	-35.12	-3.11	3.36	7.86	37.01
Total	-598.89	-60.13	-17.77	3.72	7.74	29.96
<b>Portugal</b>						
Rich HHs	-15.18	-4.44	2.27	5.60	4.71	13.67
Middle Class	-50.43	-31.10	-6.47	4.82	13.61	15.29
Poor HHs	-37.00	-21.70	-1.32	5.47	11.64	14.29
Total	-44.49	-27.22	-4.76	5.05	12.07	14.62
<b>Slovakia</b>						
Rich HHs	7.86	4.66	7.96	10.96	14.24	7.52
Middle Class	-7.15	5.55	9.92	10.86	6.17	4.43
Poor HHs	-4.85	3.70	6.54	8.37	5.82	5.35
Total	-5.22	5.20	9.31	10.27	6.76	5.18
<b>Slovenia</b>						

continued on next page

Table 5b – continued from previous page

	Age cohort					
	<= 34	35-44	45-54	55-64	65-74	> 74
Rich HHs	-0.27	3.42	6.41	22.21	1.56	30.26
Middle Class	2.05	3.95	1.57	5.48	3.20	5.83
Poor HHs	10.17	-7.70	-3.57	0.60	1.09	2.83
Total	2.84	2.02	0.73	5.91	2.29	6.73
<b>Spain</b>						
Rich HHs	-4.08	-10.27	-5.23	-1.04	-0.64	2.15
Middle Class	-62.69	-23.34	-6.44	0.82	3.23	9.34
Poor HHs	-25.82	-19.07	-0.05	2.94	4.88	6.33
Total	-51.60	-21.50	-5.46	1.03	3.54	6.71

## 5 Inflation Tax, Wealth Tax and Inequality

This section explores the effects of an unexpected price level increase for wealth inequality, using the Gini coefficient for the HH net wealth distribution as inequality measure. It considers the EA as a whole, as well as individual EA countries and also compares the effects of the inflation tax to that of a revenue-equivalent proportional wealth tax.

Table 6 below reports the Gini coefficient of the observed net wealth (NW) distribution (second column), the Gini coefficient after an unexpected 10% price level increase (third column), as well as the associated percentage change in the Gini coefficient (fourth column).

Table 6 reveals that net wealth inequality is highest in Austria and Germany and lowest in Slovakia and Slovenia. The results for the EA furthermore show that surprise inflation decreases net wealth inequality for the EA as a whole. The same is true for all individual EA countries, except for Austria, Germany and Malta, where unexpected inflation increases wealth inequality. In the latter countries, the young middle class cohorts are on net no or only very moderate borrowers, see table 5a. As a result, the young cohorts, which tend to be poorer in terms of accumulated net wealth (although not necessarily in terms of their expected present value of income), gain considerably less from surprise increases in the price level. Inequality therefore slightly increases following surprise inflation. Indeed, the Spearman rank correlation across countries between the changes in the Gini coefficient reported in table 6 and the average of the inflation exposures (NNP/NW) of the youngest two middle class age cohorts reported in table 5a is equal to 0.817 and is statistically significantly at the 1% significance level.

The fact that the inflation tax affects the Gini coefficient of the EA net wealth distribution in the same direction as a progressive net wealth tax may appear surprising. The existing theoretical literature, e.g., Erosa and Ventura (2002), typically emphasizes the regressive nature of the inflation tax when restricting consideration to nominal balances held for transaction purposes. Our results show that this fails to be the case when considering the effects of unexpected

inflation for the real value of nominal claims and liabilities more generally.

The last column in table 6 reports the proportional net wealth tax (in percentage points) that raises the same amount of government revenue as implied by the 10% surprise increase in the price level.<sup>35</sup> It shows that the revenue equivalent wealth tax is much smaller than the inflation tax.<sup>36</sup> This is obtained, even though the wealth tax applies to domestic HHs, i.e., unlike the inflation tax, falls short of taxing foreign wealth and emerges because HH net wealth comprises a comparatively large amount of real assets, which remains untaxed with an inflation tax.

	Gini pre inflation	Gini post inflation	$\Delta$ Gini (%)	Rev.-equivalent wealth tax (%)
<b>Euro Area</b>	0.652	0.650	-0.30	1.64
Austria	0.732	0.733	+0.21	1.70
Belgium	0.598	0.591	-1.21	1.80
Cyprus	0.685	0.682	-0.40	0.41
Finland	0.602	0.596	-1.02	0.37
France	0.664	0.661	-0.47	2.10
Germany	0.719	0.720	+0.04	1.73
Greece	0.546	0.544	-0.46	4.08
Italy	0.601	0.600	-0.13	2.09
Luxembourg	0.641	0.636	-0.70	-0.78
Malta	0.593	0.593	+0.02	0.64
Netherlands	0.545	0.537	-1.44	2.02
Portugal	0.658	0.654	-0.46	2.29
Slovakia	0.439	0.438	-0.28	1.64
Slovenia	0.525	0.523	-0.29	1.42
Spain	0.561	0.558	-0.52	1.11

Table 6: Effects on NW inequality (10% price level increase)

## 6 Inflation Exposure and Inflation Experience

This section documents that the cross-sectional distribution of HH inflation exposures, reported previously in figure 1, covaries in interesting ways with past inflation experience. To document this relationship, we rank all EA countries according to the average HICP inflation rate experienced since inception of the EA and then form three equally sized country groups: a high

<sup>35</sup>We assume that HHs with a positive NW position are taxed, but that HHs with a negative NW position are not subsidized when levying the wealth tax.

<sup>36</sup>It is even negative for the case of Luxembourg, where the government holds a positive net nominal position, see table 1. The caveats expressed in section 3 apply to this result.

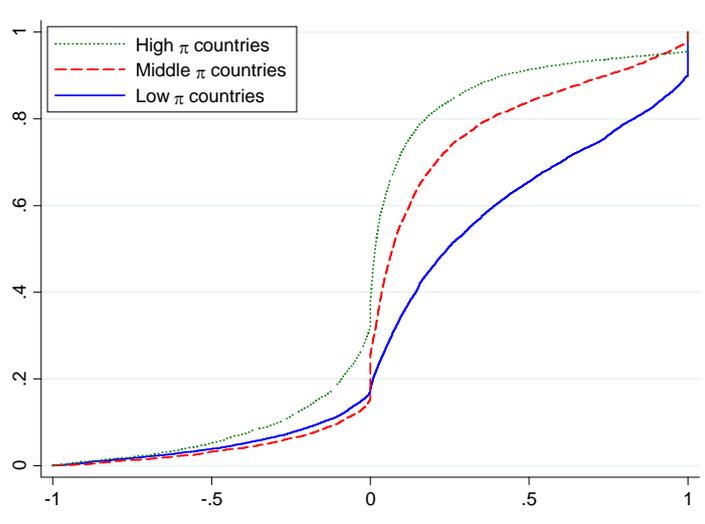


Figure 2: Inflation Exposures of all HHs (CDF over NNP/NW)

inflation group, a middle inflation group, and a low inflation group.<sup>37,38</sup>

Figure 2 depicts the cumulative density functions (CDFs) for HH inflation exposures (NNP/NW, on the x-axis) for all three country groups.<sup>39</sup> The figure shows that the CDF in high inflation countries first order stochastically dominates the CDFs of the other groups, illustrating that HHs in high inflation countries have lower inflation exposure. A similar, albeit less clear picture emerges when comparing the middle inflation group to the low inflation group. The CDFs are similar for negative NNP positions, but HHs in the low inflation group hold a slightly more negative inflation exposure, despite inflation being lower than in the middle inflation group. As we shall argue below, this may have to do with differential access to credit in the low and middle inflation groups, as a negative NNP position can only be achieved by borrowing. Despite this fact, the CDF for the middle inflation group dominates that for the low inflation group when inflation exposure is positive. Indeed, for the middle inflation group inflation exposures are much more heavily concentrated at zero. This shows that in low inflation countries, HHs are less concerned about holding large part of net wealth in nominal assets, when compared to middle or high inflation EA countries.

Figure 3 depicts the CDF for the subpopulation of house owners that hold a mortgage. This group has - by definition - access to credit. The figure shows that the CDF of high inflation countries stochastically dominates that of middle inflation countries, which in turn stochastically

<sup>37</sup>Each group comprises 5 countries; the high inflation group consists of Greece, Portugal, Slovakia, Slovenia and Spain; the middle inflation group comprises Cyprus, Italy, Luxembourg, Malta and the Netherlands; the low inflation group is composed of Austria, Belgium, Germany, Finland and France.

<sup>38</sup>Forming instead five groups that comprise three countries each, delivers very similar results. Similarly, using average inflation rates that extend further back, leads to very similar outcomes: online appendix E.3 reports the outcome when using the average inflation rate for the 30 years preceding the establishment of the EA to group countries.

<sup>39</sup>In line with the results reported in figure 1, we exclude HHs with a negative NW from the analysis, due to the discontinuity that negative NW creates for the inflation exposure measure (NNP/NW). We also cut-off the distribution below -1 to exclude HHs with NW very close to zero.

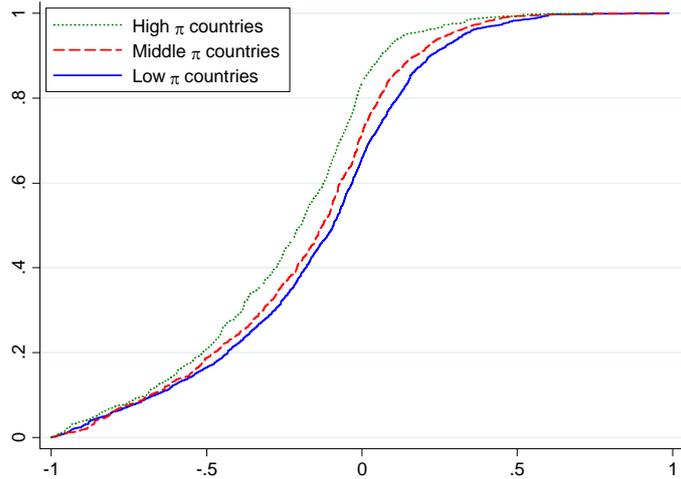


Figure 3: Inflation Exposure, Homeowners with Mortgage (CDF over NNP/NW)

dominates that of low inflation countries. Past inflation rates thus strongly correlate with inflation exposures, with higher inflation rates being associated with more borrowing and less accumulation of nominal claims.<sup>40</sup>

Table 7 provides further evidence for individual countries and various HH subpopulations. The table reports the outcome of regressing HHs' inflation exposure (NNP/NW) on log net worth (NW), thus illustrates the marginal effects of NW on inflation exposure in the cross-section.<sup>41</sup> The estimates are provided for outright homeowners (second column), homeowners with a mortgage (third column), renting HHs (forth column) and for all HHs jointly (last column). The table shows that for outright owners there exists a weak positive cross-sectional tendency to increase inflation exposure as NW increases. This tendency is very strong for owners holding a mortgage, presumably because repayment of mortgages is a key channel of NW accumulation for these HHs. For renters, however, there is a tendency to reduce inflation exposure as NW increases.

The second to last row in table 7 reports the Spearman rank correlation between the reported estimates and the country's HICP inflation experience since inception of the EA. It shows that the rank correlation is negative and statistically significant, except for the case of homeowners with a mortgage, where the correlation turns out to be insignificant at conventional significant levels. These results highlight that there again exists a systematic relationship between past inflation experience and the cross sectional distribution of NNPs: HHs in high inflation countries are in the cross-section less likely to increase inflation exposures as NW increases (renting HHs

<sup>40</sup>Appendix D reports the CDFs for the remaining subgroups (outright homeowners without a mortgage and renters). Similar findings regarding the relative ordering across inflation groups can be observed for these subpopulations.

<sup>41</sup>As with figure 1, we only consider HHs with positive NW and  $NNP/NW > -1$ . Each column of the table reports the outcome of a pooled regression of NNP/NW on a constant, the interaction between a country dummy and log NW, and a number of HH control variables (log HH income, education dummies and age group dummies). The coefficient reported in table 7 is the one pertaining to the interaction between the country dummy and log NW.

tend to decrease inflation exposures faster as NW increases in high inflation EA countries).

Understanding further the economic forces creating the systematic relationship between HHs' inflation exposures and inflation experience appears to be of considerable interest, but is beyond the scope of the present paper

	Outright homeowners	Homeowners with mortgage	Renters	All HHs
Austria	0.012***	0.182***	-0.020***	-0.091***
Belgium	0.018***	0.187***	-0.016***	-0.091***
Cyprus	0.005	0.168***	-0.054***	-0.106***
Finland	0.010***	0.176***	-0.030***	-0.098***
France	0.006	0.175***	-0.046***	-0.108***
Germany	0.017***	0.182***	-0.013***	-0.087***
Greece	0.006	0.174***	-0.058***	-0.112***
Italy	0.009**	0.173***	-0.042***	-0.100***
Luxembourg	0.009**	0.168***	-0.030***	-0.096***
Malta	0.015***	0.185***	-0.015***	-0.09***
Netherlands	0.017***	0.175***	-0.004	-0.091***
Portugal	0.011***	0.178***	-0.033***	-0.107***
Slovakia	0.013***	0.191***	-0.024***	-0.109***
Slovenia	0.007*	0.192***	-0.046***	-0.109***
Spain	0.009**	0.174***	-0.031***	-0.109***

\*/\*\*/\*\*\* indicates significance at 10%/5%/1% level

Spearman rank correlation with HICP inflation				
correlation	-0.45	0.13	-0.55	-0.60
p-value	0.09	0.66	0.04	0.02

Table 7: NNP elasticity w.r.t. NW and inflation experience

## 7 Conclusions and Outlook

We provide integrated accounts for nominal claims and liabilities in the Euro Area (EA) and document that quantitatively important redistributive effects are associated with unexpected price level movements. While the EA as whole is a sizable net winner of unexpected inflation, these gains are unevenly distributed across countries, with some countries winning well above average and others even losing in net terms. The gains are also unevenly distributed across the household (HH) and government sectors, with the former typically being a loser and the latter being a winner of price level increases. Within the HH sector, gains and losses are also fairly

unevenly distributed: rich older HHs turn out to be the largest losers of unexpected inflation and young middle class HHs the largest winners.

Since risk averse households dislike wealth redistribution risk, the present findings highlight that achieving price stability in the EA can contribute in important ways to HH welfare. Overall, the heterogeneity of HHs' inflation exposure across EA countries highlights the need to understand further what economic considerations motivate HHs to choose their net nominal positions. Why are HHs in some countries, say rich older HHs in Belgium, so much more exposed to inflation than their counterparts in Spain, which hold virtually no inflation exposure? Understanding these and related questions appears important and requires additional structural modeling efforts.

## A Integrating Survey Data and Financial Accounts

We compute NNPs in the EAA using the following financial variables (variable names and variable codes are as defined in ESA95(1995)): Currency and deposits (F2), Short-term debt securities (F331) Long-term debt securities (F332), Short-term loans (F41), Long-term loans (F42), Quoted shares (F511), Unquoted shares and other equity (F51M), Mutual funds shares (F52), Net equity of households in life insurance reserves and in pension funds reserves (F61), Prepayments of insurance premiums and reserves for outstanding claims (F62), Other accounts receivable and financial derivatives (F7+F34). We derive the DNP of a sector using all of these variable, except for F511, F51M and F52. The INP of a sector is computed using the DNP of the firm sector and as described in section 2.5 and the ownership information contained in F511, F51M and F52. The sector NNP is then simply the sum of the sector’s INP and DNP.

When integrating HFCS data into EAA data, we construct from the HFCS data the positions that correspond to those appearing in the EAA, essentially following the suggestions made in Honkkila and Kavonius (2012). On the asset side we proceeded as follows:

**Currency and deposits (F2):** corresponds to ‘Deposits’ (DA2101) in the HFCS plus imputed currency. Currency has to be imputed in the HFCS, as information on it is not available. For this purpose we distribute the aggregate stock of currency (F21) recorded in the HH sector of the EAA to HHs in the HFCS proportionally to their deposit holdings.

**Short-term debt securities (F331) and Long-term debt securities (F332):** correspond to ‘Bonds’ (DA2103). Since no maturity information is available in the HFCS and since according to the EAA F331 amounts to only 0.1% of F332 in the HH sector of the EA, we attribute all of DA2103 to F332 and the set the HFCS counterpart of F331 to zero.

**Short-term loans (F41) and Long-term loans (F42):** corresponds to ‘Amount owned to households’ (DA2107) in the HFCS.

**Quoted Shares (F511):** corresponds to ‘Shares, publicly traded’ (DA2105) in the HFCS.

**Unquoted Shares and other equity (F51M):** corresponds in the HFCS to ‘Net wealth in businesses, non-self-employment and not publicly traded’ (DA2104) plus ‘Self-employed business wealth’ (DA1140), unless it is a sole proprietorship. Sole proprietorships are not included because the national account statistics record these assets as real assets of the HH sector instead of recording them in the firm sector.

**Mutual Fund Shares (F52):** corresponds to ‘Mutual funds, total’ (DA2102).

**Net equity of households in life insurance reserves and in pension funds reserves (F61):** corresponds in the HFCS to the sum of ‘Public or social security account with account balance’ (PF0510), ‘Occupational pension plans with account balance’ (PF0710), and ‘Voluntary Pension/whole life insurance schemes’ (DA2109).<sup>42</sup>

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<sup>42</sup>Honkkila and Kavonius (2012) and Kavonius and Törmälehto (2010) explain that in the national accounts F61 contains defined contribution pension plans and individual defined benefit plans because the EAA covers only the funded system. As stated in HFCN (2008) the HFCS pension wealth variables PF0510, PF0710, and DA2109 also only includes funded plans, i.e., the value of individual pension plans and the value of all defined contribution occupational plans.

**Prepayments of insurance premiums and reserves for outstanding claims (F62):** since there exists no HFCS counterpart to this variable, we assign a zero value to it in the HFCS. Quantitatively, F62 amounts to 6% of F61 in the EAA for the EA as a whole.

**Other accounts receivable and financial derivatives (F7+F34):** corresponds to ‘Other financial assets’ (DA2108) in the HFCS.

The HFCS variable ‘Managed accounts’ (DA2106) has no single conceptual counterpart in the EAA, as the EAA does not distinguish whether or not an investment account is self-managed or not. We deal with this by distributing DA2106 to the HFCS variables DA2101, DA2102, DA2105 (the counterparts of F51M) and DA2108 proportionally before applying the matching scheme described above. We do so to capture the fact that managed accounts typically comprise assets from these asset categories.

On the liability side we apply the following scheme:

**Loans, short-term (F41) and Loans, long-term (F42):** corresponds in the HFCS to the sum of ‘Mortgages or loans using household main residence as collateral’ (HB170\$x and HB2100), ‘Mortgages or loans using other properties as collateral’ (HB370\$x and HB4100), ‘Non-collateralised loans’ (HC080\$x and HC1100), ‘Outstanding credit line/overdraft balance’ (HC0220), ‘Outstanding credit cards balance’ (HC0320).

**Derivatives (F34):** we assign a zero here, as the HFCS value is included on the asset side (HFCS counterpart to F7+F34). The national accounts, assign - by convention - derivative values to the liability side, recording a negative value, if required. The latter does not affect results as we are interested in net values only.

**Net equity of households in life insurance reserves and in pension fund reserves (F61):** in the EAA this covers the pension commitment of small enterprises in Italy, which are classified into the HH sector in Italian EAA. The HFCS does not provide information on this item and we set it to zero. In Italy F61 amounts to about 3.5% of total HH sector liabilities.

**Other accounts receivable/payable (F7):** there exists no counterpart to this in the HFCS so that we set it to zero.

A further issue with integrating HFCS data into EAA data arises because the HH sector in the EAA includes all households and non-profit institutions serving households (NPISH), e.g., churches, political parties, and non-profit universities, while the HFCS only covers households in the narrow sense and also excludes some households, e.g., elderly living in institutionalized households. When aggregating HFCS data to obtain HH sector aggregates we adjust the aggregates by the NPISH item-specific shares provided by Honkkila and Kavonius (2012) to obtain EAA counterparts. We also adjust for population coverage using the numbers provided by the same authors.

## B Data Coverage: HFCS versus EAA

	Financial Assets	Financial Liabilities	Asset sub-positions		Liability sub-position
			Currency and deposits (F2)	Life insurance & pension funds (F61)	Long-term loans (F42)
Austria	0.52	0.41	0.64	0.26	0.45
Belgium	0.70	0.76	0.79	0.61	0.80
Cyprus	1.38	0.87	0.28	0.50	1.05
Finland	0.40	0.78	0.55	0.20	0.89
France	0.52	0.58	0.49	0.45	0.70
Germany	0.67	0.73	0.58	0.56	0.75
Greece	0.19	0.35	0.19	0.43	0.42
Italy	0.25	0.32	0.43	0.12	0.44
Luxembourg	0.45	0.81	0.37	0.62	0.83
Malta	0.83	0.38	0.57	1.03	0.49
Netherlands	0.33	0.92	0.55	0.24	0.94
Portugal	0.40	0.39	0.44	0.12	0.45
Slovakia	0.54	0.39	0.53	0.42	0.45
Slovenia	0.34	0.33	0.42	0.81	0.38
Spain	0.52	0.60	0.47	0.44	0.66

Table A1: HFCS/EAA coverage ratios

## C Household Characteristics Across the NNP/NW Distribution: Country Level Information

Table A2: Inflation Exposure and HH Characteristics

	Median Age	Mean Edu	Share of Homeowners	Median Income (thou €)	Median Wealth (thou €)	# of HHs (mill)	HH share
<b>Austria</b>							
All households	51	3.1	48%	32.2	86.9	3.7	100%
Negative net worth	42	2.9	11%	24.0	-6.6	0.2	6%
Borrower	42	3.2	73%	43.5	144.2	0.3	9%
Almost no exposure	56	3.0	86%	33.8	252.4	0.6	16%
Pred. real assets	55	3.2	67%	37.2	186.6	1.3	36%
Pred. nominal assets	49	3.2	7%	31.7	33.7	0.6	17%

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Table A2 – continued from previous page

	Median Age	Mean Edu	Share of Homeowners	Median Income (thou €)	Median Wealth (thou €)	# of HHs (mill)	HH share
Almost only nom. assets	50	3.0	0%	18.8	5.0	0.5	15%
<b>Belgium</b>							
All households	52	3.4	69%	33.5	226.3	4.4	100%
Negative net worth	40	3.2	4%	17.7	-1.4	0.2	4%
Borrower	41	3.7	91%	47.6	173.5	0.6	14%
Almost no exposure	58	2.9	88%	25.6	232.9	0.7	15%
Pred. real assets	57	3.5	89%	41.0	361.6	1.9	42%
Pred. nominal assets	50	3.5	38%	33.5	67.6	0.7	15%
Almost only nom. assets	39	3.0	0%	15.0	3.4	0.4	10%
<b>Cyprus</b>							
All households	51	3.2	76%	32.2	289.2	0.3	100%
Negative net worth	52	2.2	12%	10.8	-0.3	0.0	6%
Borrower	43	3.8	87%	38.1	297.7	0.1	31%
Almost no exposure	56	2.9	87%	27.3	367.7	0.1	32%
Pred. real assets	53	3.3	83%	33.0	386.5	0.1	24%
Pred. nominal assets	55	3.4	16%	32.2	57.2	0.0	6%
Almost only nom. assets	80	1.5	0%	10.5	15.5	0.0	2%
<b>Finland</b>							
All households	53	3.3	67%	34.6	105.5	2.3	100%
Negative net worth	31	3.5	36%	34.0	-7.4	0.3	12%
Borrower	46	3.7	90%	54.1	151.0	0.5	21%
Almost no exposure	61	3.3	88%	35.0	188.0	0.5	23%
Pred. real assets	61	3.3	79%	34.0	163.1	0.6	28%
Pred. nominal assets	49	3.2	17%	29.2	14.7	0.1	5%
Almost only nom. assets	50	2.9	2%	16.3	1.3	0.2	11%
<b>France</b>							
All households	53	2.7	54%	28.7	132.3	26.3	100%
Negative net worth	39	2.7	5%	26.1	-4.5	1.0	4%
Borrower	42	3.3	82%	39.3	172.5	4.1	16%
Almost no exposure	59	2.4	82%	28.0	228.6	4.9	19%
Pred. real assets	58	2.7	64%	29.8	207.7	9.9	38%
Pred. nominal assets	47	2.6	8%	22.6	10.6	4.7	18%
Almost only nom. assets	48	2.7	0%	21.4	19.5	1.6	6%
<b>Germany</b>							

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Table A2 – continued from previous page

	Median Age	Mean Edu	Share of Homeowners	Median Income (thou €)	Median Wealth (thou €)	# of HHs (mill)	HH share
All households	52	3.5	43%	32.0	61.5	37.7	100%
Negative net worth	43	3.0	8%	17.2	-2.3	3.4	9%
Borrower	47	3.7	87%	48.8	145.2	4.1	11%
Almost no exposure	56	3.4	81%	34.4	207.3	2.7	7%
Pred. real assets	58	3.6	73%	40.0	213.7	13.0	35%
Pred. nominal assets	46	3.6	10%	34.2	41.5	8.1	21%
Almost only nom. assets	52	3.1	0%	17.2	6.2	6.4	17%
<b>Greece</b>							
All households	54	2.6	72%	21.9	105.2	3.9	100%
Negative net worth	40	2.5	4%	13.3	0.0	0.2	6%
Borrower	47	2.9	83%	29.0	130.0	0.7	18%
Almost no exposure	57	2.3	87%	19.5	120.8	1.8	45%
Pred. real assets	55	2.9	73%	25.5	122.0	1.0	24%
Pred. nominal assets	43	3.1	16%	27.9	16.9	0.1	3%
Almost only nom. assets	30	2.9	0%	10.1	1.0	0.2	4%
<b>Italy</b>							
All households	55	2.4	69%	26.2	182.2	23.3	100%
Negative net worth	48	2.0	1%	11.8	-0.3	0.6	3%
Borrower	45	2.9	86%	37.7	180.0	2.0	8%
Almost no exposure	58	2.3	81%	21.7	209.9	8.3	36%
Pred. real assets	57	2.6	76%	32.0	223.9	9.8	42%
Pred. nominal assets	52	2.4	5%	22.2	20.1	2.2	9%
Almost only nom. assets	63	2.1	0%	15.5	6.7	0.4	2%
<b>Luxembourg</b>							
All households	50	2.9	66%	65.0	447.9	0.2	100%
Negative net worth	41	2.1	10%	38.5	-11.9	0.0	4%
Borrower	44	3.1	85%	74.1	380.5	0.0	19%
Almost no exposure	58	2.6	86%	62.0	567.3	0.0	24%
Pred. real assets	56	3.1	76%	79.0	644.7	0.1	36%
Pred. nominal assets	40	3.3	11%	51.5	64.9	0.0	11%
Almost only nom. assets	45	2.5	0%	23.0	4.8	0.0	5%
<b>Malta</b>							
All households	-	2.4	78%	21.5	222.0	0.1	100%
Negative net worth	-	1.6	0%	9.1	0.0	0.0	2%

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Table A2 – continued from previous page

	Median Age	Mean Edu	Share of Homeowners	Median Income (thou €)	Median Wealth (thou €)	# of HHs (mill)	HH share
Borrower	-	2.9	95%	30.0	162.1	0.0	7%
Almost no exposure	-	2.4	94%	17.4	233.4	0.0	19%
Pred. real assets	-	2.5	92%	24.6	292.9	0.1	56%
Pred. nominal assets	-	2.3	20%	20.8	35.3	0.0	10%
Almost only nom. assets	-	2.0	0%	10.2	37.0	0.0	6%
<b>Netherlands</b>							
All households	52	3.3	52%	39.5	128.3	6.5	100%
Negative net worth	36	3.8	38%	42.9	-24.5	0.9	13%
Borrower	50	3.4	95%	46.4	196.5	1.4	21%
Almost no exposure	57	3.1	85%	37.5	262.8	0.5	7%
Pred. real assets	57	3.3	79%	44.1	329.0	1.6	25%
Pred. nominal assets	58	3.1	6%	34.7	46.9	1.3	20%
Almost only nom. assets	51	2.9	0%	30.5	51.6	0.8	13%
<b>Portugal</b>							
All households	55	1.8	70%	14.4	81.6	3.7	100%
Negative net worth	46	1.4	14%	9.4	-0.5	0.2	5%
Borrower	44	2.4	92%	20.0	114.6	0.6	17%
Almost no exposure	60	1.5	91%	12.2	100.3	1.1	30%
Pred. real assets	58	1.9	76%	16.1	106.3	1.2	33%
Pred. nominal assets	53	1.8	25%	14.0	23.5	0.2	7%
Almost only nom. assets	60	1.4	0%	9.0	1.1	0.3	9%
<b>Slovakia</b>							
All households	50	3.2	90%	11.2	64.3	1.9	100%
Negative net worth	45	2.9	14%	5.5	-0.5	0.0	1%
Borrower	42	3.4	96%	12.8	56.0	0.1	8%
Almost no exposure	55	3.1	99%	10.2	68.7	0.8	43%
Pred. real assets	51	3.4	94%	13.0	71.2	0.8	40%
Pred. nominal assets	41	3.5	46%	15.5	30.2	0.1	4%
Almost only nom. assets	40	3.1	0%	7.0	1.1	0.1	3%
<b>Slovenia</b>							
All households	53	3.2	82%	17.7	104.1	0.8	100%
Negative net worth	47	2.2	0%	8.5	0.0	0.0	4%
Borrower	50	3.3	91%	22.9	78.9	0.1	13%
Almost no exposure	55	3.0	93%	13.8	134.5	0.4	53%

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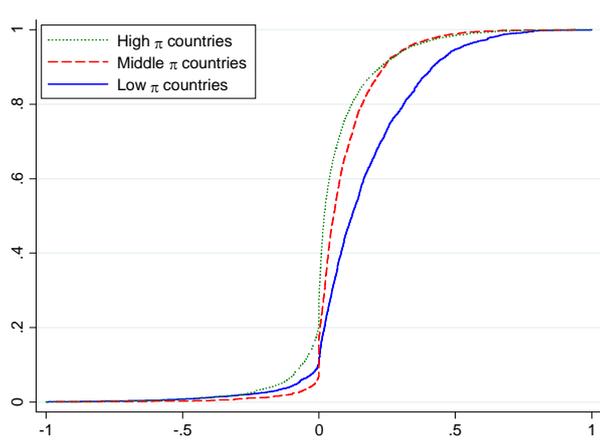


Figure 4: Inflation Exposure, Outright Homeowners (CDF over NNP/NW)

Table A2 – continued from previous page

	Median Age	Mean Edu	Share of Homeowners	Median Income (thou €)	Median Wealth (thou €)	# of HHs (mill)	HH share
Pred. real assets	53	3.6	86%	24.2	142.9	0.2	24%
Pred. nominal assets	39	3.6	16%	29.5	10.7	0.0	6%
Almost only nom. assets	58	2.3	0%	9.5	5.9	0.0	2%
<b>Spain</b>							
All households	52	2.6	83%	24.2	194.4	16.0	100%
Negative net worth	38	2.4	23%	23.0	-6.2	0.7	4%
Borrower	44	3.1	90%	29.3	201.9	4.3	27%
Almost no exposure	58	2.2	95%	19.7	206.7	5.7	36%
Pred. real assets	58	2.7	85%	27.5	256.0	4.1	26%
Pred. nominal assets	47	3.1	30%	23.7	39.4	0.5	3%
Almost only nom. assets	47	2.3	0%	12.2	1.3	0.6	4%

Median age is unavailable for Malta where age information is coded using age bracket information only.

## D Inflation Experience and Inflation Exposure: Further Details

Figure 4 redraws figure 2 for the subpopulation of outright homeowners that do not hold a mortgage; it confirms the findings reported in figure 2 for the overall population. Figure 5 depicts the outcomes for the subpopulation of renters (who do not own a house). It shows that for the middle inflation country group there is a relatively large jump around zero, which may again be due to credit restrictions.

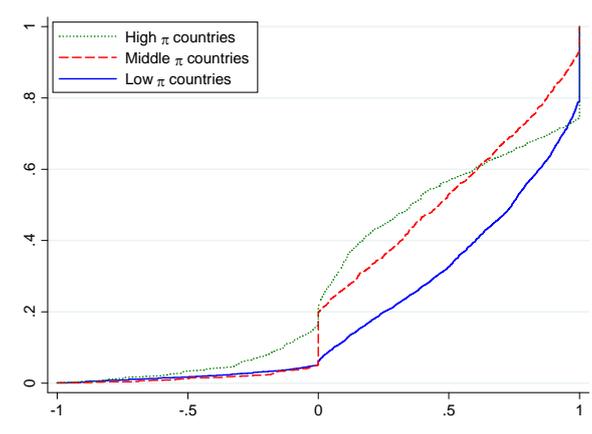


Figure 5: Inflation Exposure, Renters (CDF over NNP/NW)

## E Online Appendix

### E.1 Detailed Breakdown of INP and DNP Positions

Tables A3 and A4 report the DNP and INP positions for different sectors and for different HFCS-EAA integration approaches. Not surprisingly, given the coverage ratios reported in appendix B, the tables show that the DNP positions of the firm sector (FI) and HHs differ considerably across integration approaches. Likewise, the INP positions of the GOV and HHs are equally affected by the integration approach. In particular, for the baseline integration approach INP positions tend to be more often positive than for the alternative integration approach. This has to do with the fact that we rescale the counterparty positions when HFCS aggregates fall short of EAA aggregates, see the description in section 2.3 and appendix B. Such rescaling can lead  $TNP^{FI}$  to become positive, so that INP positions also become positive. Despite the sensitivity of DNP and INP positions across integration approaches, the total NNP positions reported in tables 1 and 3 of the paper prove, for most countries, reasonably robust across integration approaches, see the discussion in section 3.2.

	DNP				INP		
	<i>FI</i>	<i>GOV</i>	<i>HH</i>	<i>ROW</i>	<i>GOV</i>	<i>HH</i>	<i>ROW</i>
	(thousands of Euros p.c.)				(thousands of Euros p.c.)		
<b>Euro Area</b>	<b>7.6</b>	<b>-19.1</b>	<b>6.4</b>	<b>5.1</b>	<b>0.5</b>	<b>1.4</b>	<b>5.7</b>
Austria	-6.4	-20.2	14.7	11.9	-1.5	-3.1	-1.8
Belgium	35.2	-29.6	28.8	-34.5	1.9	11.9	21.3
Cyprus	3.0	-10.0	-10.5	17.4	0.1	3.3	-0.4
Finland	-2.0	-1.7	-7.8	11.5	-1.2	-0.6	-0.1
France	3.8	-23.3	8.2	11.4	1.1	2.4	0.3
Germany	5.2	-18.6	10.9	2.5	1.1	4.3	-0.3
Greece	-2.8	-20.7	-0.6	24.2	-2.2	-0.6	-0.1
Ireland	98.6	-21.5	13.9	-91.0	2.3	7.9	88.5
Italy	1.9	-23.8	6.9	15.0	0.6	1.2	0.1
Luxembourg	2,216.9	1.5	-1.5	-2,216.9	21.2	13.5	2,182.2
Malta	20.3	-9.3	12.7	-23.7	1.0	7.4	11.9
Netherlands	19.8	-18.4	-11.5	10.2	2.0	2.1	15.7
Portugal	-2.6	-12.6	1.0	14.2	-0.5	-1.2	-0.9
Slovakia	-0.1	-4.8	2.2	2.7	0.0	0.0	0.0
Slovenia	-6.3	-4.7	3.6	7.2	-4.0	-0.8	-1.5
Spain	-9.2	-11.1	-0.4	20.7	-1.3	-6.3	-1.6

Table A3: DNP and INP, baseline reconciliation approach

	DNP				INP		
	<i>FI</i>	<i>GOV</i>	<i>HH</i>	<i>ROW</i>	<i>GOV</i>	<i>HH</i>	<i>ROW</i>
	(thousands of Euros p.c.)				(thousands of Euros p.c.)		
<b>Euro Area</b>	<b>-6.4</b>	<b>-20.2</b>	<b>22.9</b>	<b>3.7</b>	<b>-2.0</b>	<b>-8.7</b>	<b>4.3</b>
Austria	-15.2	-20.6	25.3	10.4	-2.9	-10.5	-1.8
Belgium	26.4	-30.0	41.0	-37.4	1.3	12.1	13.0
Cyprus	-19.6	-10.8	15.7	14.6	-2.2	-8.6	-8.7
Finland	-11.0	-1.8	3.1	9.8	-5.5	-6.5	1.0
France	-12.9	-23.6	27.0	9.5	-3.3	-9.0	-0.5
Germany	-5.9	-18.9	24.1	0.7	-1.3	-4.8	0.3
Greece	-10.0	-22.0	9.3	22.6	-5.7	-5.1	0.9
Ireland	98.6	-21.5	13.9	-91.0	2.3	7.9	88.5
Italy	-14.4	-28.5	29.0	13.9	-1.5	-17.3	4.4
Luxembourg	2,194.3	1.5	43.3	-2,239.2	21.0	18.9	2,154.5
Malta	16.9	-9.7	18.2	-25.4	1.0	4.2	11.8
Netherlands	-36.0	-18.5	46.5	8.0	-3.2	-11.7	-21.1
Portugal	-9.7	-13.6	10.1	13.3	-1.5	-5.6	-2.6
Slovakia	-1.9	-4.8	3.9	2.9	-0.5	-0.2	-1.3
Slovenia	-9.5	-5.0	7.3	7.2	-3.8	-4.9	-0.8
Spain	-15.6	-11.2	6.1	20.7	-1.8	-12.3	-1.4

Table A4: DNP and INP, alternative reconciliation approach

## E.2 Direct Lending by Households

Table A5 below shows that very few HHs are directly lending money. Furthermore, the median loan size tends to be rather small. Yet, with the average loan size strongly exceeding the median loan size, some HHs appear to be engaged in significant private lending activities. Our NNP calculations fully takes these lending (and borrowing) activities into account.

	Share of HHs lending money	Average loan	Median loan size
Austria	0.024%	15,482	2,700
Belgium	0.014%	22,839	2,316
Cyprus	0.144%	22,453	7,000
France	0.012%	9,754	3,000
Germany	0.004%	9,445	2,800
Greece	0.012%	7,122	2,000
Italy	0.002%	10,271	4,000
Luxembourg	0.154%	30,396	4,500
Malta	0.115%	19,900	5,000
Netherlands	0.007%	14,075	2,000
Portugal	0.037%	16,103	4,500
Slovakia	0.044%	3,195	1,161
Slovenia	0.013%	12,236	7,000
Spain	0.012%	37,779	6,010

Table A5: Direct Lending by Households

### E.3 Inflation Experience: Longer Historical Samples

This section considers the sensitivity of figures 2 and 3 from section 6 when using the average inflation rate experienced in the 30 years prior to the establishment of the EA (1970-1999) to group countries into high/middle/low inflation countries.<sup>43</sup> The high inflation group is then unchanged relative to the baseline, i.e., consists of Spain, Greece, Portugal, Slovenia and Slovakia, the middle inflation group then consists of Finland, France and Italy, and the low inflation group of Austria, Belgium, Germany, Luxembourg and the Netherlands.<sup>44</sup> Figures 6 and 7 present the outcome from this exercise. Comparing these to figures 2 and 3, respectively, highlights the robustness of the baseline findings from section 6.

### E.4 Alternative Leverage Assumption for Foreign Firms

This section shows that the outcomes reported in tables 1 and 2 in the main text are robust to entertaining the alternative assumption that foreign firm leverage equals the average leverage of firms across all EA countries (the baseline assumption is that foreign firm leverage is equal

<sup>43</sup>We use CPI inflation rates provided by the OECD. For Slovenia and Slovakia data is available only from 1981 and 1982 onwards. For Cyprus and Malta no inflation data is available for those years, so that they have to be dropped from the sample. Since these are small countries, this should not affect the outcome.

<sup>44</sup>Since we have 13 countries, we cannot build three equally sized groups, thus use a 5-3-5 grouping.

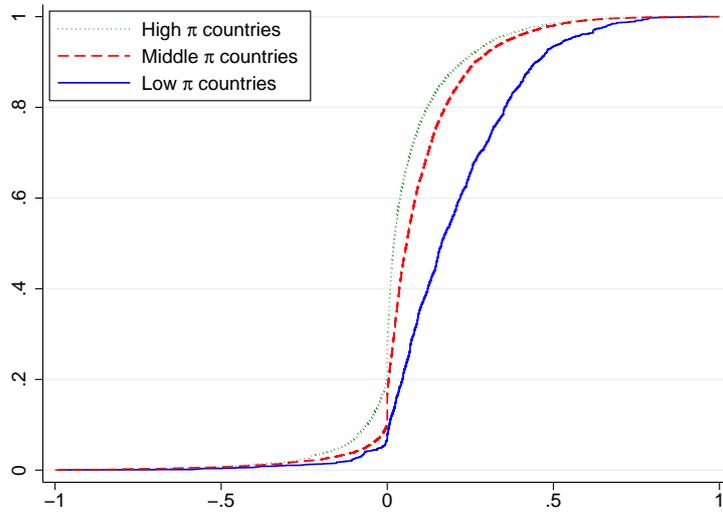


Figure 6: Inflation Exposures of all HHs (CDF over NNP/NW), 30 year inflation grouping

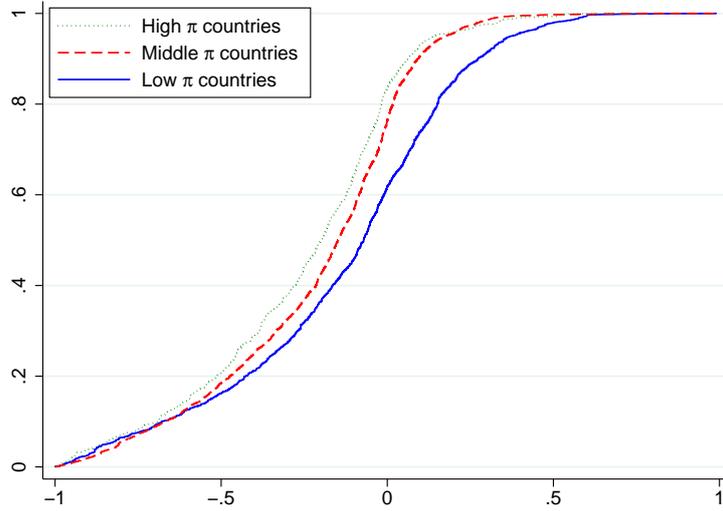


Figure 7: Inflation Exposure, Homeowners with Mortgage (CDF over NNP/NW), 30 year inflation grouping

to the leverage of domestic firms in the considered country). Table A6 below shows that (1) outcomes are once more very robust to making different foreign ownership assumptions, and (2) are quite similar to those reported in tables 1 and 2. Regarding the last statement, the most notable differences emerge for the ROW NNP positions of Luxembourg and Belgium, which are both countries in which the firm sector holds considerable financial claims against the ROW.

	Identical Home Bias			Max. HH Home bias			Max. Firm Home Bias		
	<i>GOV</i>	<i>HH</i>	<i>ROW</i>	<i>GOV</i>	<i>HH</i>	<i>ROW</i>	<i>GOV</i>	<i>HH</i>	<i>ROW</i>
	(thousands of Euros)			(thousands of Euros)			(thousands of Euros)		
<b>Euro Area</b>	<b>-18.8</b>	<b>7.2</b>	<b>11.6</b>	<b>-18.8</b>	<b>7.1</b>	<b>11.6</b>	<b>-18.8</b>	<b>7.2</b>	<b>11.6</b>
Austria	-21.0	13.4	7.6	-21.0	13.4	7.7	-21.1	13.5	7.6
Belgium	-28.1	35.7	-7.6	-28.1	35.6	-7.5	-28.1	35.8	-7.7
Cyprus	-9.9	-8.0	17.8	-9.9	-8.1	17.9	-9.9	-8.0	17.8
Finland	-2.4	-7.9	10.3	-2.3	-8.0	10.3	-2.4	-7.9	10.3
France	-22.6	9.7	12.9	-22.6	9.6	13.0	-22.6	9.7	12.9
Germany	-17.9	13.2	4.7	-17.8	13.1	4.7	-17.9	13.2	4.7
Greece	-22.2	-0.9	23.1	-22.2	-0.9	23.1	-22.2	-0.9	23.1
Ireland	-19.9	17.6	2.4	-19.9	17.4	2.5	-19.9	17.5	2.4
Italy	-23.4	7.6	15.8	-23.4	7.6	15.8	-23.4	7.6	15.8
Luxembourg	14.9	4.4	-19.2	14.9	4.2	-19.0	14.9	4.4	-19.2
Malta	-8.4	19.0	-10.6	-8.4	18.9	-10.6	-8.4	19.0	-10.6
Netherlands	-17.4	-10.7	28.1	-17.4	-10.7	28.2	-17.4	-10.7	28.1
Portugal	-13.0	0.2	12.8	-13.0	0.2	12.8	-13.0	0.3	12.7
Slovakia	-4.8	2.2	2.6	-4.8	2.2	2.6	-4.8	2.2	2.6
Slovenia	-7.8	3.1	4.6	-7.8	3.1	4.6	-7.8	3.1	4.6
Spain	-12.0	-3.7	15.6	-12.0	-3.7	15.7	-12.0	-3.7	15.6

Tables A6: Sensitivity to ownership assumptions with alternative imputation of foreign firm leverage

## E.5 Quantitative (Un-)Importance of the ECB Balance Sheet for EA Aggregates

In the financial accounts of individual Euro Area countries, the ECB is part of the ROW sector. In the Euro Area Aggregate Accounts (EAAA) the ECB is included in the domestic financial sector when Eurostat performs the aggregation from the individual country numbers. We perform aggregation in tables 1-3 of the paper by summing up the individual Euro Area country numbers (EASum), thus do not perform a regrouping of the ECB from the ROW into the domestic sector. As it turns out, regrouping of the ECB generates only a minor effect on the numbers that we report for the EA aggregates. We reach this conclusion via the following considerations:

1. We compared the DNP of the ROW in the EAAA to the DNP in our EASum aggregation. The difference in the DNP, which is due to the regrouping of the ECB position and due to a number of ‘adjustments’ by Eurostat to account for country ‘asymmetries’ in the individual country numbers when performing the aggregation, causes the DNP of the ROW in the EAAA to be higher by 158bln Euros, i.e., by about 1.9% of GDP.
2. Using the balance sheet of the ECB as of December 31, 2010, as available from the ECB Annual Report, we computed the effects that a regrouping of the ECB would have on the EA ROW DNP. The nominal claims of the ECB vis-a-vis non-Euro-Area residents amount to 41.5 bln. Liabilities vis-a-vis non-EA-Residents amount to 1.7 bln, so that the direct net claims of the ECB against non-EA-Residents are 39.8 bln Euros. The total DNP of the ECB is equal to its capital, provisions, revaluation accounts and current year profits minus its gold reserves and approximately equal to 13.3 bln Euros. That means that the ECB has a negative DNP of  $13.3\text{bln} - 39.8\text{bln} = -26.5\text{ bln}$  vis-a-vis EA residents. Incorporating this amount into the domestic financial sector would thus decrease the DNP of the EA versus the ROW by 26.5 bln, i.e., by about 0.3% of GDP, with the difference to the number computed in the previous point being likely due to the effects of ‘asymmetries’.

From these computations, it becomes clear that a regrouping of the ECB would amount to an adjustment between -0.003 and +0.019 in the EA number reported for the ROW in the last column of Table 1, which is 0.42. The effects of regrouping the ECB and of the ‘asymmetries’ are thus overall negligible for our findings.

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