Portfolio Capital Flows and Household Portfolios*

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Abstract

In this paper, we show that cross-border portfolio flows around the peak of the European Crisis induced households to rebalance their portfolios toward housing. Estimating difference-in-differences regressions around Draghi's "Whatever It Takes" speech in July 2012 with household data from the ECB's Household Finance and Consumption Survey, we find that portfolio inflows induce households with larger ex-ante bond and equity shares to rebalance more strongly toward housing. The effect is not driven by higher pre-treatment access to credit or higher credit growth during the treatment period, and is stronger for wealthier and less risk-averse households.

Keywords: Capital Flows, Portfolio Flows, Household Portfolio Rebalancing, Real Estate, Credit Channel
JEL Classifications: F32, G11, G12, G51, R30

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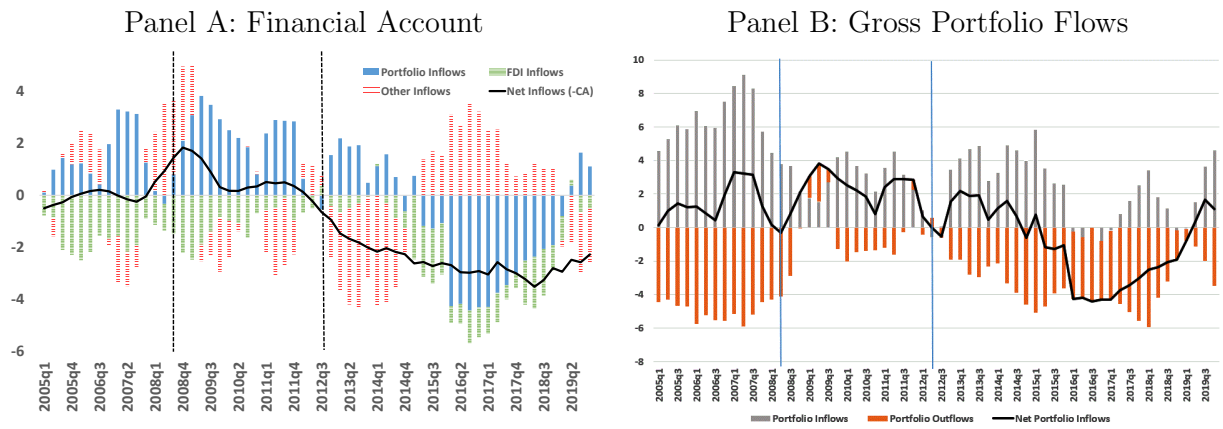
1 Introduction

In a standard household portfolio problem, foreign portfolio equity and debt inflow shocks can decrease the risk premium on these assets, inducing domestic households to rebalance their portfolios toward other assets, including particularly housing. Such a household rebalancing channel of transmission of portfolio flow shocks can take place alongside the traditional credit and housing collateral channels but is not necessarily reliant on higher credit supply.

In this paper, we investigate household portfolio rebalancing in response to portfolio inflows into the euro area using data from the European Central Bank's Household Finance and Consumption Survey. We find that a 10-percentage point increase in portfolio flows as a share of national nominal GDP raises the valuation-adjusted housing wealth share of households with larger initial bond and equity holdings (at the 75^{th} percentile of the distribution) relative to those with fewer holdings (at the 25^{th} percentile) by more than a third of a percentage point (0.38 percentage points). The rebalancing is stronger for wealthier and less risk-averse households. The portfolio rebalancing that we document is not driven by higher pre-treatment access to credit or higher mortgage borrowing during the treatment period. Using aggregate data, we also document that, unlike foreign direct investments and credit flows, portfolio flows predict aggregate house price increases one-to-two years ahead.

Portfolio flows are key drivers of total flows in the euro area. Panel A in Figure 1 shows that net portfolio flows quickly resume after Draghi's "Whatever-It-Takes" speech and largely drive the aggregate capital flow dynamics. In contrast, net FDI flows (which include foreign purchases of residential housing) are less volatile and generally negative over this period, while other investments are negatively correlated with the current account balance. Panel B of Figure 1 breaks down net portfolio flows into gross inflows and outflows. Changes in net portfolio flow are mostly driven by higher gross inflows, rather than lower gross outflows, which implies that foreign purchases are driving these dynamics more than domestic residents' adjustment of foreign asset holdings. As we document below, the inflow episode following Draghi's speech in July 2012 was driven by inflows into periphery countries, leaving

Figure 1 Capital Flows in Euro-Area



Note. Panel A plots the financial account of the euro area. The solid line is total net capital inflows, equal to the negative of the current account balance. The bars are the main components, including net portfolio inflows, net FDI inflows, and other net investment inflows as a share of euro area GDP (+ is an inflow). Panel B plots euro area net portfolio inflows (solid line, + depicts inflows), as well as gross portfolio inflows and outflows as a share of euro area GDP (+ and - are inflows and outflows, respectively). All variables are four-quarter moving averages to eliminate the seasonality. The vertical lines mark the Lehman Brothers' bankruptcy in 2008:Q3 and Draghi's "Whatever-It-Takes" speech in 2012:Q3. Sources: ECB, FRED. See the Data Appendix for more details.

flows into the core largely unaffected, thus providing useful cross-country heterogeneity.

The empirical analysis in the paper is based on the ECB's Household Finance and Consumption Survey (HFCS), combined with national capital flow data from the IMF's International Financial Statistics. The HFCS contains detailed information on household wealth, including the composition of wealth, the number of properties held, borrowing activities, income, and other household attributes in euro area countries, over three survey waves, which were conducted during 2009-11, 2013-14, and 2017-18.

To establish a causal link between foreign portfolio flows and households' portfolio rebalancing, we estimate two difference-in-differences (DiD) specifications around the peak of the European sovereign debt crisis, and in particular around Draghi's "Whatever-It-Takes" speech in July 2012. The first specification exploits the cross-country variations comparing households' behavior in "inflow-receiving" (treated) countries with "non-receiving" (control) countries. The second specification relies on a household-level measure of exposure to portfolio inflows, defined as the share of wealth invested in bonds and equities before the peak

of the crisis, which we call "ex-ante" exposure for brevity. The second specification thus exploits both cross-country and cross-household heterogeneity in the exposure to such flows. We also externally validate our main results by estimating a battery of regressions based on pooled cross-section data from a larger sample of euro area countries in the HFCS.

Our main result is that cross-border portfolio inflows drive more exposed households to rebalance their portfolios from bonds and equities to housing. More specifically, a 10-percentage point increase in portfolio flows as a share of national nominal GDP (about half a standard deviation in our sample) raises the valuation-adjusted share of wealth invested in housing for households with larger initial bond and equity holdings (at the 75^{th} percentile of the distribution) relative to those with fewer holdings (at the 25^{th} percentile) by an additional 0.38 percentage points. The more exposed households also increase the number of owned properties, which unambiguously controls for valuation effects. In addition, we document that equity, bond, and mutual fund shares decrease when portfolio flows increase, implying that households rebalance out of these assets into housing. We further show that our results are stronger for wealthier households—i.e., households in the upper decile of the country-wave-specific net wealth distribution—and for less risk-averse households. We also document that households rebalance toward second homes, suggesting that they might be motivated by a buy-to-let motive.

Importantly, we show that the rebalancing behavior that we uncover is not driven by credit access or mortgage borrowing. In particular, we show that (i) more exposed households do not raise their borrowing during the treatment period; (ii) households with better pre-treatment credit access or (iii) a stronger credit increase after portfolio inflows do not rebalance more significantly than other households; and (iv) our main results also survive when controlling for the country-level change in banks' credit standards to households, which can be interpreted as a measure of financial market liberalization (Favilukis et al., 2013).

Our results are robust to an extensive set of checks. First, they hold when we separate portfolio flows into equity and debt flows. In contrast, they disappear for FDI flows

that account for direct purchases of residential real estate and other investment flows, which consist mainly of cross-border interbank lending. Second, when we estimate our DiD specification during a placebo episode without significant cross-country heterogeneities in portfolio flows, our coefficients turn statistically insignificant, helping alleviate concerns that the parallel trend assumption underlying our analysis is not met. Third, our results are robust to controlling for interactions between country-level portfolio flows and other household characteristics, such as income, net worth, age, and tenure status. Fourth, our results are robust to controlling for potential macroeconomic confounders. Finally, our results are robust to using alternative measures of the housing wealth share (the outcome variable in our analysis) and of the ex-ante bond and equity wealth share (our household-level exposure variable).

Higher household housing portfolio demand, all else equal, should increase house prices and lower the housing risk premium. Unfortunately, we cannot match our household portfolio data to transaction-level data on house prices and rents to test this hypothesis directly in micro data. However, in the last part of the paper, we report aggregate evidence showing that portfolio flows predict real national house price indexes one-to-two years ahead.

Overall, the paper's findings add a new dimension to the policy discourse, echoing the existing literature that documents house price booms can occur without credit booms (Cerutti, Dagher and Dell'Ariccia, 2017). Our findings imply that macroprudential policy interventions targeting leverage and credit growth might not be enough to contain excessive house price growth and boom-bust cycles in housing markets and could be complemented by house transaction taxes that several countries have started to adopt.

Our paper relates to the literature along multiple dimensions. First, this paper contributes to the literature that focuses on households' portfolio choices conditional on their real estate exposure. For instance, Flavin and Yamashita (2002) relate housing consumption to optimal investments in other asset classes, particularly equity. Similarly, Yao and Zhang (2005) highlight the relevance of housing in shaping household portfolio structures in a model that allows households to choose between renting and owning. Cocco (2005) shows

that housing affects the cross-household variation in stock market participation. Chetty, Sándor and Szeidl (2017) show that the effect of housing on equity portfolio shares depends on the prevalence of home equity and mortgage financing, with only greater home equity wealth (given constant property wealth) increasing the participation in the stock market. As far as we are aware, this is the first paper documenting how the housing share of household portfolios responds to cross-border portfolio flows.

Second, we also contribute to the literature on capital flows in the euro area—see Lane (2013) for an overview of their dynamics pre- and post-crisis. Bergant, Fidora and Schmitz (2020) study the impact of monetary policy on household portfolio rebalancing across listed securities and find that it leads to capital outflows. Beck, Georgiadis and Gräb (2016) gauge that investors during the European debt crisis rebalanced their portfolios toward less affected countries, thus affecting within-euro area capital flows. Faia, Salomao and Veghazy (2022) highlight the importance of distinguishing among different types of investors, with insurance companies and pension funds having a stronger preference for local assets than mutual funds. Related to this body of work, Bednarek, Kaat, Ma and Rebucci (2021) show that during the European debt crisis, banks rebalanced their portfolio from Southern Europe to Germany, contributing to expanding the credit supply to firms with more tangible collateral and causing an increase in *commercial* real estate prices, without impacting the *residential* real estate market in Germany. Our contribution here is to focus on households rather than firms, and to document an alternative channel of transmission of exogenous capital flow shocks that does not depend on the credit and collateral channels, with a potential impact on house prices and different implications for financial stability.

Third, our paper also relates to a strand of the literature showing that lower returns on financial assets can induce households, in search for yield and income, to reallocate their portfolios toward real estate. Korevaar (2022) shows for historical Amsterdam that lower bond returns induce wealthy households to invest in housing. Gargano and Giacoletti (2022) employ Australian data to establish that the lower the interest rate the larger the fraction

of households becoming landlords. Our contribution is to identify a similar effect for cross-border portfolio investment inflows and to show that such portfolio reallocations do not happen only out of fixed-income securities, but also out of stocks and mutual funds.

Fourth and last, we contribute to the literature that investigates the impact of cross-border capital flows on house prices, mainly focusing on the US—e.g., Sá and Wieladek (2015), Hoffmann and Stewen (2020), and Evgenidis and Malliaris (2023), Favilukis, Kohn, Ludvigson and Van Nieuwerburgh (2013) and Favilukis, Ludvigson and Van Nieuwerburgh (2017), among others. We contribute to this literature by providing aggregate evidence that our household portfolio rebalancing channel might contribute to higher housing prices in countries more exposed to this mechanism. However, the evidence that we report is only suggestive and could in future research be further explored in matched portfolio and transaction-level housing data.

The rest of the paper is organized as follows. Section 2 presents the data. Section 3 discusses identification strategies. Section 4 reports our main results. Section 5 performs robustness checks. Section 6 establishes the aggregate association between portfolio flows and housing prices at the country level. Section 7 concludes. An appendix not for publication provides additional details on data sources, variable definitions, and supplementary results.

2 Data

For our empirical analysis, we combine European household-level data from the ECB's Household Finance and Consumption Survey (HFCS) with national capital flow data from the IMF's International Financial Statistics and house price data from Eurostat. This section describes the main data sources and the sample construction, and reports selected summary statistics, with additional details reported in the appendix.

2.1 Household Data

The HFCS data have detailed wealth, borrowing, and income information for households in 22 European countries, interviewed in three survey waves in 2009-2011 (wave 1), 2013-2014 (wave 2), and 2016-2018 (wave 3).[1]

To work with a sample of households in countries with the same exchange rate regime and monetary policy, we do not use data from Croatia, Hungary, and Poland. Additionally, we drop eight other countries that do not set up their surveys as panels and hence do not allow us to construct our main outcome variable, the *change* in housing portfolio shares, either between waves two and one or between waves three and two. This leaves us with 11 countries in total. In fact, panel data between waves one and two are only available for six of these countries, covering about 8,000 households in Belgium, Cyprus, Germany, Italy, Netherlands, and Spain—three core and three periphery countries of the euro area. Five additional euro area countries have panel data between waves two and three, namely Estonia, Finland, France, Latvia, and Slovakia, with altogether more than 7,000 additional panel households.

Our main results are based on two DiD specifications centered around Draghi's "Whatever-It-Takes" speech in July 2012 exploiting household and country heterogeneity in the panel of 8,000 households from the six countries for which we have panel data between wave two and wave one of the HFCS. As an external validity check, we also estimate pooled cross-section regressions in the larger sample of more than 15,000 households from the 11 countries for which we have panel data *either* between waves two and one or between waves three and two of the HFCS.

Our main outcome variable is the change between survey waves in a household's housing share. We measure this variable in four different ways. First, as the share of total housing

[1]See Finance and Network (2020) and the HFCN website https://www.ecb.europa.eu/pub/economic-research/research-networks/html/researcher_hfcn.en.html for further information on how the survey is set up and how to access it. The HFCS features different versions of the second and third survey waves. We use the following versions: DOI10.2866/177251 (Wave 2), and DOI10.2866/776370 (Wave 3).

wealth in total risky and liquid assets, i.e., the sum of housing wealth, bonds, equities and mutual funds. While this is a narrow definition of housing share, it is the closest and cleanest definition of what we are attempting to measure in the data, especially in relation to the macroeconomic evidence that we report in the Introduction, but also to the theoretical notion of household portfolio rebalancing we have in the background. Second, as total housing wealth over risky and non-risky liquid assets—i.e., houses, bonds, equity, mutual funds, and deposits. Third, we measure the housing share as total housing wealth divided by *total* wealth, which additionally includes other real assets, such as vehicles, jewelry, and the value of self-employment businesses and other financial assets, such as insurances, managed accounts, and money owed to households. Fourth and finally, for some specifications, to gauge whether our portfolio rebalancing channel is related to a buy-to-let motive, we also use the share of wealth invested in second homes as an outcome variable.[2]

As we document in detail in Appendix B, we correct all wealth variables for valuation effects, as we are interested in capturing portfolio rebalancing due to changing quantities. In one specification, we also use the change between survey waves in the number of properties that a household owns as an outcome variable, which cannot be affected by valuation changes.

To control for the potential credit channel, we estimate specifications that net out the housing share by the portion of housing wealth financed by mortgage credit, i.e., we focus on *net* housing wealth. We also construct outcome variables for credit dynamics at the household level, defined as the log difference in either the outstanding total credit or mortgage credit—see Table A1 for details.

As we discuss in Section 3, the household level exposure measure to cross-border portfolio flows that we use in our second DiD specification is the ex-ante share of wealth invested in equity and bonds, directly or indirectly via mutual funds (henceforth just bond and equity exposure or wealth for brevity). About 10% of the households in our final sample directly own bonds, 22% directly own stocks, and 19% indirectly hold both assets via mutual funds. The

[2]While this variable includes both housing owned for investment purposes and vacation homes, Boddin et al. (2022) show that most of its dynamics are driven by the former in Germany.

remaining 59% of the households in our sample, our control group, do not report holding any bond and equity exposure. This means that the mechanism that we investigate and document is driven by a subset of households that, as we show below, are those more exposed households with higher net worth and lower risk aversion.

Household-level control variables include the log of a household's net wealth, a dummy variable for the richest 10% households (in terms of net wealth) in the same country and wave, the log of income, the age of the household's head, a dummy measuring whether a household is risk-seeking[3], the number of household members, and a tenure status dummy variable indicating whether a household is a renter or owner of the main residence.[4] We also construct a dummy variable indicating whether a household is credit-constrained by exploiting information on whether the respondent has applied for a loan but was rejected or whether the respondent did not apply due to a high chance of being rejected—see again Table A1 for details.

The HFCS relies on imputing techniques to manage households' non-responses. We only use the first of the five imputed values available (henceforth "implicate"), because most variables that we use are populated, and all five implicates are highly correlated. We obtain virtually unchanged results, however, when using the other four implicates. Following Cameron and Trivedi (2005), we do not use survey weights (in principle available from the HFCS), but we check robustness by re-estimating our main specifications using households' sampling weights and obtaining consistent results. If households declare to rent their main residence, we assume that they do not own their main residence when this information is missing. Similarly, we replace missing values for other real estate property data with zeros if households declare not to own any other property apart from their main residence.

[3]Households self-report their risk attitude from 1 to 4, with the most risk-averse households being assigned a 4; we define a household risk-seeking if it has a self-reported risk attitude of 1-3).

[4]As we take the log of income and net wealth, we drop 127 households reporting zero or negative net wealth or income.

2.2 Country Data

The main country-level regressor in our regressions is net portfolio flows over national GDP, sourced from the IMF's balance-of-payments statistics. We also report results using *gross* portfolio inflows and outflows, and results breaking down portfolio flows into either equity or bond flows. As a "placebo test," we also use foreign direct investments (FDI) and other investment flows, which by and large comprise cross-border credit flows.[5] In the DiD analysis, all country-specific flow variables are averages of 2012 and 2013, so as to focus on the inflows occurring after Draghi's speech between the pre-inflow (2011) and post-inflow (2014) survey wave—see Section 3 for more details. In the cross-sectional regressions, we compute them as three-year moving averages.

We use the annual, country-level house price indexes from Eurostat (2015=100). The database does not cover Greece, for which we use the annual average dwellings price index from the Bank of Greece. The indexes are then deflated using national CPI indexes from the World Economic Outlook Database (April 2022).

Finally, in our robustness analysis, we use several country-specific variables, including real GDP growth, sovereign debt-to-GDP ratios, and changes in bank lending standards to households.[6] These variables are from the IMF's World Economic Outlook Database (April 2022), the ECB's Bank Lending Survey, and the Dutch Central Bank, respectively.

2.3 Summary Statistics

Table 1 reports summary statistics for all variables used in the DiD analysis based on the sample of 8,371 households from the six countries that report panel data for the first and second waves of the HFCS. Depending on the definition of housing share that we consider,

[5]Note that FDI flows also include cross-border purchases and sales of real estate, which might crowd domestic households out of the housing market. Such transactions, however, typically represent only a very small portion of total FDI.

[6]Bank lending standards to households measures the percentage of banks in a country tightening their lending standards to households (for housing purchases) less the percentage of banks easing them, a measure for financial market liberalization following Favilukis et al. (2013).

Table 1 Summary Statistics

Variable	Unit	Observations	Mean	SD	5^{th}	95^{th}
ΔHousing	%	8,371	0.7	15.1	-12.8	16.1
ΔSecond homes	%	4,468	1.9	31.9	-49.8	71.8
ΔHousing Alt. 1	%	8,371	0.2	16.9	-23.0	23.4
ΔHousing Alt. 2	%	8,371	1.2	19.3	-28.5	33.2
ΔUnits	%	8,371	0.1	2.0	-2.0	2.0
ΔStocks	%	8,371	-0.3	5.3	-4.0	2.7
ΔBonds	%	8,371	-0.3	6.2	-4.9	1.8
ΔMutual	%	8,371	0.1	6.5	-1.5	6.0
ΔDeposits	%	8,371	0.5	11.5	-15.7	17.5
ΔOther Fin.	%	8,371	-0.4	10.6	-15.1	12.7
ΔOther Real	%	8,371	-0.9	12.6	-18.2	12.9
Net wealth	ln(euro)	8,371	12.7	1.2	11.0	14.7
Rich	0/1	8,371	0.1	0.3	0	1
Income	ln(euro)	8,371	10.6	0.9	9.2	11.9
Renter	0/1	8,371	0.1	0.2	0	1
Household members	-	8,371	2.5	1.2	1	5
Age	-	8,371	61.3	13.7	38	83
Risk seeking	0/1	8,371	0.3	0.5	0	1
Bonds and equity shares (Exp)	%	8,371	4.2	10.7	0.0	24.6
ΔCredit	%	8,371	53.9	260.2	-100	829.4
ΔMortgage	%	8,371	39.0	236.8	-100	222.2
Constrained	0/1	8,371	0.04	0.2	0	0
Portfolio flows	%	8,371	4.8	14.3	-4.7	51.0
Gross portfolio inflows	%	8,371	0.8	1.8	-0.1	5.9
Gross portfolio outflows	%	8,371	-4.1	14.4	-51.1	5.8
Debt flows	%	8,371	-0.0	1.0	-0.7	3.2
Equity flows	%	8,371	0.0	1.0	-1.9	1.3
FDI flows	%	8,371	-2.1	5.4	-18.7	1.4
Other flows	%	8,371	-5.3	8.3	-31.8	0.1
Growth	%	8,371	-1.7	1.6	-5.1	0.6
Gov. debt	%	8,371	99.0	19.9	67.1	129.5
CS	-	8,371	16.9	11.3	6.6	49.4

Note. The table reports summary statistics for all variables used in the difference-in-differences analysis for the sample of 8,371 households from the six euro area countries that have panel data between waves one and two. See Table A1 for variable definitions and data sources.

the average change in housing share between wave one and two is 0.2-1.2%. The change in the second-home share is even more pronounced with an average of 1.9%. The table also shows that, in this sample, on average, household reduce their bond and stock positions, as well as the share of their other financial and other real assets. In contrast, the deposit share as a fraction of total assets increases. The average household size in our sample is 2.5 members. The average household also rents its main residence. It has a household head aged 61, with a bonds and equity share (our exposure measure) averaging 4.2% and ranging from 0 to 25%. The average growth rate in total and mortgage credit averages 54% and 39%, respectively,

in the sample. However, the standard deviation and the range are huge, likely reflecting new household entries into the credit market and some cases of exit. The average percentage of households declaring to be risk-seeking is 30%, while only 4% of the households self-assess as credit-constrained, possibly because the HFCS oversamples wealthier households.

Table 1 further shows that portfolio flows as a share of GDP take an average value of 4.8% in the specific difference-in-differences sample that we study, and there is a significant cross-country variation, as can be seen from the big standard deviation of 14.3%. The positive average value is driven by both positive gross portfolio inflows and negative outflows. FDI and other investment flows were both negative in 2012-13, with means of -2.1 and -5.3%, respectively. Finally, GDP growth is negative on average, government debt ratios take an average value of 99% and the positive mean for credit standards (CS) implies that banks on average tightened their loan supply to households during this period.

Table 2 Characteristics of House Buyers and Sellers

Variable	$+\Delta Units$	$-\Delta Units$
Observations	1710	1423
Logarithm of Net wealth	13.0 (12.9)	13.3 (13.2)
Logarithm of Income	10.7 (10.7)	10.7 (10.7)
Age	57.3 (58)	59.4 (60)
Risk seeking	0.43 (0)	0.39 (0)
Bond and Equity Share (Exposure)	5.5 (0)	4.5 (0)

Note. The table reports the number of households buying or selling real estate in our difference-in-differences sample, as well as the arithmetic average and median (in parentheses) values of a household's wave 1 log-net wealth, log-income, age, and our exposure measure for house buyers vs. sellers separately.

Table 2 shows selected pre-inflow (wave 1) characteristics of households buying vs. selling real estate during our sample period. Notice the number of buyers and sellers in our sample nearly balances each other. They are quite similar in net wealth and income, although buyers are about two years younger than sellers and have lower risk aversion. They also have larger pre-inflow exposure to the bond and equity markets, with around 5.5% of their wealth in bonds and equities. This difference is also statistically significant at the 1% level.

3 Research Design and Identification

In our benchmark specification, we focus on the six countries that construct their national survey as a panel of households between waves one and two. Based on this sample, we estimate two difference-in-differences specifications that exploit the country and household data variation around the time of Draghi's "Whatever-it-takes" speech. Specifically, as Figure 2 shows, after Draghi's speech, cross-border portfolio flows into the periphery increased substantially (treatment countries), while flows into the core remained largely unaffected (control countries). Exploiting this evidence, our first specification is:

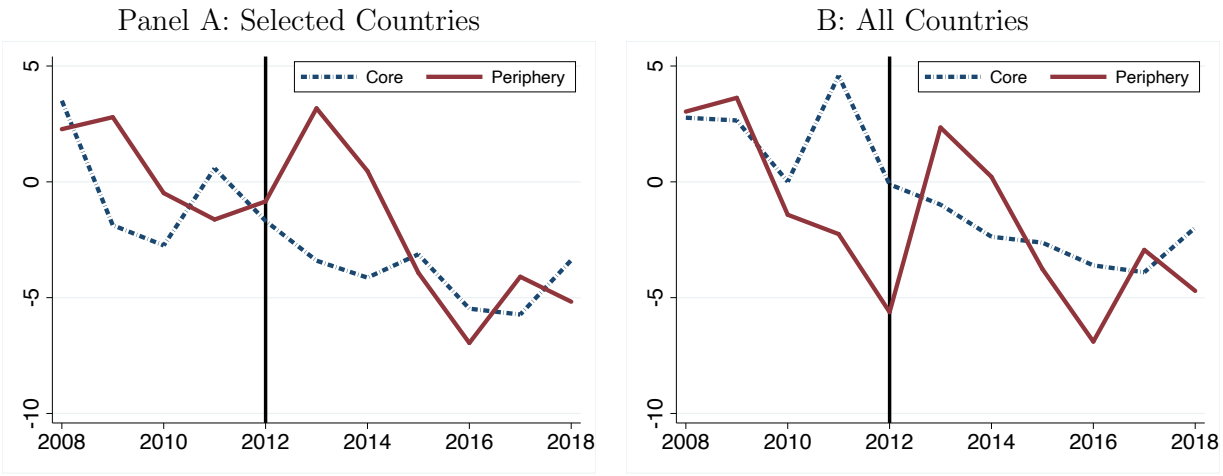
$$\Delta Y_{h,c}^{w2-w1} = \kappa \cdot \text{Flows}_{c,2012-13} + \lambda \cdot X_{h,c,w1} + \epsilon_{h,c}, \tag{1}$$

where $\Delta Y_{h,c}^{w2-w1}$ is the change in the housing portfolio share from the first wave of the HFCS (conducted in 2010-2011, shortly before the recovery of portfolio flows) to the second one (conducted in 2013-2014). $\text{Flows}_{c,2012-13}$ is the average country-level portfolio inflows as a share of GDP in 2012 and 2013, and $X_{h,c,w1}$ includes a set of household control variables, fixed at the pre-treatment period in wave 1, including the initial share of wealth invested in housing. Standard errors are heteroskedasticity-robust (HC1), but most results are similar when we cluster them by country (although we then have only six clusters).[7]

Equation (1) compares households located in more affected countries to those in less affected ones, using an aggregate continuous treatment variable (i.e., portfolio inflows). When we replace portfolio flows with a dummy variable that indicates whether a household lives in a country with positive cross-border portfolio inflows on average during 2012-2013, we obtain similar results that we do not report. As a placebo exercise, and to check that the parallel trend assumption underlying our analysis is valid, we also compare the change in housing shares between waves two and three. As cross-border portfolio flows did not display marked significant cross-country heterogeneities within the euro area during this placebo period (see

[7]The statistical significance is also similar for HC2 or HC3 heteroskedasticity-consistent standard errors.

Figure 2 EURO AREA PORTFOLIO FLOWS: CORE VS PERIPHERY



NOTE. This figure plots net cross-border portfolio inflows (in % of nominal GDP) separately for the periphery and core countries in the euro area (+ is an inflow). The series are aggregated from the national balance of payment data, using as weights 2007 nominal GDP. Panel A is based on the sample of six countries in the HFCS with panel household data—namely, Belgium, Germany, and Netherlands representing the core, and Cyprus, Italy, and Spain representing the periphery. Panel B is based on a sample that also includes other countries, i.e., Austria, Belgium, Germany, Finland, France in the core, and Cyprus, Greece, Spain, Italy, Portugal in the periphery. In both panels, the vertical lines mark Governor Draghi's "Whatever-it-takes" speech in 2012:Q3. See the Data Appendix for more details.

again Figure 2), we expect the coefficients to be statistically insignificant.

A second DiD specification exploits household-level exposure to portfolio flows. Specifically, it examines whether households more affected by portfolio flows rebalance more strongly toward housing. Thus, in this case, we estimate the following regression:

$$\Delta Y_{h,c}^{w2-w1} = \alpha_c + \theta \cdot \text{Exp}_{h,c,w1} + \rho \cdot X_{h,c,w1} + \xi \cdot (\text{Exp}_{h,c,w1} \times \text{Flows}_{c,2012-13}) + \epsilon_{h,c}, \qquad (2)$$

where $\text{Exp}_{h,c,w1}$ is the share of equity and bonds in total wealth for household h in country c, fixed at its pre-treatment value in wave 1 ($w1$). Note that $\text{Exp}_{h,c,w1}$ includes bonds and stocks held directly and indirectly via mutual funds. Equation (2) also includes country-fixed effects, α_c, to control for macroeconomic factors that affect household portfolios and might correlate with cross-border portfolio flows, such as cross-country differences in mortgage rates, population (density) or homeownership rates. Standard errors are heteroskedasticity-

robust, and clustering at the country level yields again similar results.

Equation (2) is a more demanding specification. Even if omitted macroeconomic variables were to correlate both with cross-border portfolio flows and housing portfolio shares, they would not threaten identification as long as they do not affect households' ex-ante exposure to such flows (the initial bond and equity shares). Here, one concern regarding Equation (2) is that initial bond and equity shares are not randomly distributed among households. Indeed, the shares correlate weakly but statistically significantly with standard household characteristics, such as demographics, income, wealth, household size, etc. We address this concern by adding interaction terms between those household characteristics and cross-border portfolio flows. By doing so, we run a horse race between our exposure measure and other household characteristics. As we shall see, our benchmark estimates hardly change, suggesting that the non-randomness of our household-level exposure variable is not a threat to identification, as argued in Roberts and Whited (2013).

Several papers show that with the OMT program spelled out after Draghi's speech, bank loan supply to firms and households increased moderately (e.g., Acharya et al., 2019; Nogueira et al., 2023). As a result, an important step in our empirical analysis is to control for the potential impact of increased credit access on our baseline estimation results. To this end, we control for the interaction between portfolio flows and (i) households' initial leverage, (ii) their mortgage credit growth rate between waves one and two, and (iii) a dummy for whether a household perceives him/herself as credit-constrained. Using a country-level measure of bank loan supply conditions (a measure of financial market liberalization as in Favilukis et al. 2013), based on the ECB's Bank Lending Survey, we also (iv) estimate robustness specifications in which we include the interaction between household-level bond and equity shares (exposure) and this aggregate credit variable as a control.

Equations (1)-(2) exploit the divergence of portfolio flows between the core and periphery countries after Draghi's "Whatever-it-takes" speech. These country patterns, clearly visible in Figure 2, can be reasonably assumed unanticipated and exogenous from the perspective

of individual households. However, one remaining concern is that the portfolio shocks that we focus on correlate with other macroeconomic shocks that may confound our analysis. To control for the possibility that portfolio flows are related to domestic fundamentals, we follow a two-pronged strategy. First, we estimate a specification in which portfolio flows are instrumented by countries' sovereign bond yield during the peak of the crisis in 2011 and 2012.[8] The intuition is that countries with higher sovereign bond yields during the peak of the crisis should be more affected by Draghi's speech, and consequently, their portfolio flows recovered disproportionately more. Second, we explicitly control for two other macroeconomic variables that changed substantially during our sample period—country-level GDP growth and government debt-to-GDP ratios. Either way, our results are essentially unaffected, implying that the potential correlation between portfolio flows and other macro variables is not a threat to identification in our empirical analysis. Importantly, note here also that significant euro area monetary policy changes, such as the adoption of quantitative easing or negative interest rate policies, only happened after our difference-in-differences sample period. Such shocks, therefore, cannot distort our estimations.

Finally, we only expect portfolio flows to affect households' portfolio rebalancing to the extent that the additional foreign demand for bonds and stocks is not countervailed by an additional supply of both assets. We note in this regard that both the supply of stocks and government bonds (which represent about 90% of the total bond volume in the euro area according to Novick et al., 2016), do not correlate with cross-border portfolio flows. For example, Raposo and Lehmann (2019) report no significant increase in the share of firms accessing external equity in the euro area countries that experienced the highest increase in portfolio inflows. This aligns with PWC (2018), which does not report heightened IPO activity in years when portfolio inflows increased the most in Europe as a whole. Also, based on data from the IMF's World Economic Outlook Database (October 2023), we do not see increases in government lending in the sovereign bond market between 2012 and 2014, the

[8] Using the spread vis-a-vis the German bund as an instrument yields similar results.

years in which cross-border portfolio inflows into the euro area surged. That the increases in foreign demand for bonds and equity exceed any domestic supply changes can also be seen in the reaction of bond and stock returns—sourced from the Macrohistory Database of Jordà et al. (2019)—which correlate negatively with (lagged) country-level net portfolio inflows in our sample period. This aligns with Adam and Tzamourani (2016), who show using the same HFCS data set that we employ that Draghi's OMT announcement increased stock and bond prices in the euro area, and hence lowered their returns.

4 Estimation Results

This section presents our benchmark results on the link between cross-border portfolio flows and households' portfolio rebalancing. We provide extensive robustness checks in Section 5.

4.1 Country Treatment Effects of Portfolio Flows

Table 3 reports a baseline set of estimation results for Equation (1) above. In column (1), the dependent variable is the change in the housing portfolio share, where total wealth is the sum of bonds, stocks, mutual funds, and housing. The coefficient on portfolio flows is positive and statistically significant at the 1% level. The effect is also economically significant: a ten-percentage point increase in net portfolio inflows as a share of GDP (less than half a standard deviation in this sample) increases households' housing share by an additional 0.45 percentage points.[9] In column (2), the outcome variable is the share of second homes in households' wealth, where wealth is defined as in column (1). Again, the estimate is positive and highly statistically significant, implying that some of the rebalancing is driven by buy-to-let motives. In column (3), the dependent variable is the housing share, where wealth is now defined as bonds, stocks, mutual funds, housing, and deposits. In column (4), we

[9] Appendix Section C.2 reports results where we break down total portfolio flows into debt and equity flows. Both components have a positive and statistically significant effect on household portfolio rebalancing, with a slightly larger point estimate for equity flows.

scale the housing wealth by the *total* household wealth. In both cases, the portfolio flow coefficients are positive and statistically significant. Interestingly, once we scale by deposits, the statistical significance of the coefficient estimate declines, suggesting that households are less likely to rebalance out deposits.[10] In column (5), we use the change in the number of owned housing units as the dependent variable, which cannot be affected by any imperfectly corrected valuation effect. The coefficient of interest is still positive and significant at the 1% level. This result is important because it shows that our estimated effects cannot be driven by valuation changes.

Taken together, these first five regressions provide compelling evidence that portfolio inflows can induce households to rebalance their portfolios toward real estate. This evidence is independent of how we compute the housing outcome variable. In the remainder of the paper, we use the change in the share of total housing wealth over bond and equity holdings, mutual funds, and total housing as the dependent variable, as it most directly captures household rebalancing from other risky assets (i.e., bonds and equity) toward real estate. In addition, it is a continuous variable that, in contrast to changes in the number of housing units, better captures the intensity of rebalancing.[11] Nevertheless, most results are unchanged when using different outcome variables.

Important assumptions underlying the results above are that the portfolio flows in the particular episode that we consider are driven by Draghi's "Whatever-It-Takes" speech, are exogenous to household characteristics and are unanticipated from the perspective of households. Yet, we cannot fully rule out the possibility that at least some of these flows are driven by some other observable or unobservable factors. To address this concern, we instrument the portfolio flows by countries' government bond yields during the peak of the sovereign debt crisis in 2011 and 2012. The intuition is that countries with higher yields on their government bonds should have been more affected by Draghi's speech. Consequently,

[10] This is possibly the case because high-income and high-wealth households, *not* poorer households that typically hold the largest fraction of their wealth as deposits, drive our household portfolio rebalancing result.

[11] When households sell a small house and instead purchase a large (more expensive) one, this would not be captured by the change in housing units.

Table 3 Difference-in-Differences: Standalone Effect of Portfolio Flows

	(1) ΔHousing	(2) ΔSecond Homes	(3) ΔHousing Alt. 1	(4) ΔHousing Alt. 2	(5) ΔUnits	(6) ΔHousing	(7) Portfolio Flows
Portfolio Flows	0.045***	0.103***	0.026*	0.079***	0.012***	0.150***	
	(0.01)	(0.03)	(0.01)	(0.02)	(0.00)	(0.03)	
Net wealth	-0.893***	0.686	-0.697***	-1.414***	0.242***	-1.172***	1.329***
	(0.19)	(0.42)	(0.20)	(0.24)	(0.04)	(0.20)	(0.17)
Income	-0.526***	-0.933*	-1.052***	-2.309***	-0.004	-0.254	0.008
	(0.20)	(0.56)	(0.24)	(0.29)	(0.03)	(0.21)	(0.21)
Renter	-7.179***	-3.675**	-5.714***	-8.576***	0.083	-7.649***	4.143***
	(1.40)	(1.56)	(1.38)	(1.43)	(0.06)	(1.41)	(0.77)
Age	-0.017	-0.043	-0.008	0.059***	0.002	0.005	-0.207***
	(0.01)	(0.04)	(0.02)	(0.02)	(0.00)	(0.02)	(0.01)
Household members	0.640***	1.116***	1.120***	1.079***	0.045**	0.487***	0.410***
	(0.13)	(0.43)	(0.15)	(0.18)	(0.02)	(0.14)	(0.15)
Initial housing shares	-0.434***	-0.313***	-0.418***	-0.455***	-0.373***	-0.439***	0.032***
	(0.02)	(0.01)	(0.02)	(0.01)	(0.05)	(0.02)	(0.01)
Sovereign bond yield							3.806***
							(0.10)
Obs	8,371	4,468	8,371	8,371	8,371	8,371	8,371
No. of Countries	6	6	6	6	6	6	6
R^2	0.234	0.163	0.211	0.225	0.099	0.225	0.234
First-Stage F-Stat.	-	-	-	-	-	1350.3	

Note. The regressions are based on the first two waves of the HFCS survey. The dependent variable in columns (1) and (6) is the change in the share of a household's total housing wealth over housing, equity, bonds, and mutual funds between the first and the second wave. In column (2), the dependent variable is the change in the share of housing wealth invested in second homes. In columns (3) to (5), we use the change in (i) total housing wealth over housing, equity, bonds, mutual funds, and deposits, (ii) total housing wealth over a household's total portfolio size, and (iii) the number of owned housing units, respectively, as dependent variables. The main regressor is country-level net cross-border portfolio inflows, averaged over 2012-2013. All regressions include the following household controls measured in the pre-treatment period: log of wealth and income, age of the household head, number of household members, a dummy indicating whether a household rents or owns the main residence, and the initial share of housing wealth. Columns (1)-(5) are estimated via OLS, and columns (6) and (7) are the second and first-stage results, respectively, of an IV estimation that uses the average country-level sovereign bond yield in 2011 and 2012 as an instrument for portfolio inflows. The heteroskedasticity-robust standard errors are shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

their portfolio flows should also have recovered disproportionately more. The first-stage regression reported in column (7) validates this intuition, with higher yields in 2011-12 increasing portfolio inflows in 2012-13. The attendant second-stage estimate is presented in column (6). It shows that our benchmark estimation is robust and the portfolio flow coefficient even increases in size relative to column (1).

4.2 Household Treatment Effect of Portfolio Flows

Table 4 reports a baseline set of estimation results for Equation (2). This regression exploits household heterogeneity by interacting portfolio flows with a pre-treatment share of wealth invested in bonds and equity. As portfolio inflows decrease the risk premium on bonds and equity, they affect households with a larger share invested in these risky assets more, possibly inducing them to rebalance toward housing, assuming that the latter is a substitute for bonds and equity in households' portfolios.

Column (1) of Table 4 shows that, measuring exposure by assuming zero exposure when a household does not report stock, bond, or mutual fund wealth, the coefficient is positive, as expected, and statistically significant at the 1% level. Economically, a 10-percentage point increase in portfolio flows increases the housing portfolio share of more relative to less exposed households (at the 75^{th} and the 25^{th} percentiles of the distribution, respectively) by 0.38 percentage points. This result is unchanged when we do not replace missing observations for bond and equity shares with zeros (column 2), or when we impute missing observations by replacing them with the average share in the respective net wealth decile (column 3).

Table A3 in Appendix C.1 shows that more exposed households, while raising more their housing portfolio shares, simultaneously reduce their stock, bond, and mutual fund holdings in a statistically significant manner. This is strong evidence that households increase their housing wealth by reducing the risky asset positions that are most affected by cross-border portfolio flows. Other portfolio components, such as deposits or other financial assets, are not affected by larger inflows.

Table 4 Difference-in-Differences: Household Exposure

	(1)	(2)	(3)	(4)	(5)
			ΔHousing		
Flows × Exp 1	0.016***			0.014***	0.010*
	(0.00)			(0.00)	(0.01)
Flows × Exp 2		0.016***			
		(0.01)			
Flows × Exp 3			0.015***		
			(0.00)		
Flows × Exp 1 × Rich				0.016*	
				(0.01)	
Flows × Exp 1 × Risk seeking					0.013*
					(0.01)
Household Controls	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Obs	8,371	3,416	8,371	8,371	8,371
No. of Countries	6	6	6	6	6
R^2	0.250	0.275	0.248	0.254	0.255

Note. All regressions are based on the first two waves of the HFCS survey. The dependent variable is the change in the share of a household's total housing wealth over housing, equity, bonds, and mutual funds from the first to the second wave. The main regressor is country-level net cross-border portfolio inflows, averaged during 2012-2013, interacted with the initial household share of wealth invested (directly and indirectly) in bonds and equity. Column (1) replaces missing observations for the latter variable with zeros. Column (2) does not do so. Column (3) imputes missing observations for this variable by replacing them with the median in the respective net wealth decile that a household belongs to. Columns (4) and (5) additionally interact the double interaction with a dummy equal to one if a household belongs to the top 10% of the country-wave-specific net wealth distribution in wave 1, or a household's self-reported as risk-seeking as measured by a dummy equal to one when the household declares to tolerate at least some risk. All linear terms and double interactions are included in the regressions, when they are not absorbed by the fixed effects, but not shown to conserve space. In addition, all regressions include the following household controls measured in the pre-treatment period in wave 1 and again are not reported to save space: log of wealth and income, age of the household head, number of household members, a dummy of whether household rents or owns the main residence, and the initial share of housing wealth. The heteroskedasticity-robust standard errors are shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

In Appendix C.3, we show that our results are robust when we distinguish between gross portfolio inflows and outflows. In theory, both inflows and outflows can induce greater household portfolio rebalancing toward real estate. In the case of *larger* inflows, foreign investors raise their investment in the domestic bond and equity market, reducing the expected return on both assets and thereby inducing rebalancing. In the case of *smaller* outflows, domestic agents invest less abroad or repatriate their foreign assets, focusing more on the domestic market, with the same theoretical effect on bond and stock returns and households' rebalanc-

ing. Empirically, in our setting, we find that both higher inflows and lower outflows induce more exposed households to reallocate their portfolio toward housing.

In Appendix C.3, we also split the sample into core and periphery countries of the euro area. This specification is important because one could argue that our findings are driven by improvements in economic prospects (and hence by a more positive outlook in those housing markets), which were more marked in the periphery countries after the peak of the European crisis. Our estimation results point to an even stronger rebalancing effect of more exposed households in the sub-sample of core countries, with an estimated coefficient that is larger in economic terms than in the case of the periphery countries. This evidence suggests that our benchmark results are unlikely to be driven by brighter economic prospects in the periphery. While we are ultimately agnostic on why the effects are stronger in the core than in the periphery of the euro area, we note here that tax incentives favoring rented-out properties are stronger in the countries of the core, such as Germany (Boddin et al., 2022). Related to this, countries in the periphery have higher home ownership rates and much smaller rental markets, with a more limited scope for additional rebalancing toward second homes owned for investment purposes. The stronger effect in the sub-sample of core countries could also be driven by their higher average exposure to stock and bond markets.

In Section C.4, we break down the overall exposure variable into its components, i.e., bond, equity, and mutual fund, respectively. Here, we find the largest effects for direct equity exposure, followed by mutual fund exposure and direct debt exposure, for which the coefficient estimate is slightly below conventional significance levels. This suggests that households most strongly rebalance out of stocks into housing. In other words, stocks and real estate seem to be the most substitutable in European household portfolios. Finally, Section C.4 shows that our results are unchanged when we control for other macroeconomic variables that significantly changed after Draghi's speech and correlate (slightly) with cross-border portfolio flows.

In columns (4)-(5), we further show that the effects of portfolio flows on the portfolio re-

balancing of more exposed households are even stronger for wealthier and more risk-tolerating households. Specifically, once we introduce a triple interaction of portfolio flows with the bond and equity shares and these other household characteristics, we estimate positive and statistically significant coefficients. All these specifications include the linear terms and all the double interaction terms (not reported to conserve space). This evidence is consistent with the notion that richer and less risk-averse households are driving the portfolio rebalancing toward real estate that we document.

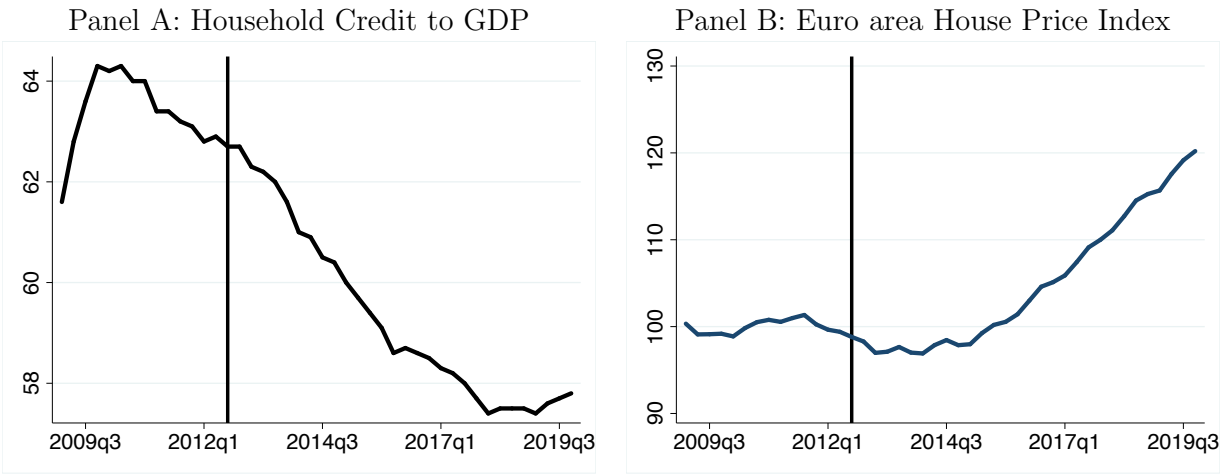
5 Robustness

In this section, we report evidence on several robustness checks. We first rule out that our results are driven by the concomitant announcement of the ECB's Outright Monetary Transactions (OMT) program aimed at expanding credit supply. Second, we report results on a placebo test in which we re-estimate our baseline specifications during a period in which we do not expect the effects to be there, which is important to strengthen the parallel trend assumption. Third, we control for the non-random assignment associated with the use of our exposure measure. Finally, we discuss external validity by exploiting data variation in a pooled analysis of housing share changes between waves one and two and two and three.

5.1 Portfolio Flows and Household Credit

Figure 3 plots household credit-to-GDP and house prices in the euro area. It shows that, at the aggregate level, credit was on a steep downward trend that stabilized and reverted only in 2016-2017. House prices were also declining around the time of Draghi's speech, but they stabilized toward the end of 2012 and started a modest recovery thereafter, accelerating sharply after the introduction of QE in 2015. Nonetheless, controlling for portfolio rebalancing driven by a higher supply of credit, or higher collateral values driven by a recovery of house prices, is particularly important in our difference-in-differences setting, as on July

Figure 3 Household Credit as a share of GDP (In Percent)



Note. The figure plots the aggregate credit-to-GDP ratio of the household sector in the euro area between 2009:Q1 and 2019:Q4. (Panel A), and the aggregate real house price index in the euro area (2010=100) over the same period (Panel B). Credit to the private, non-financial sector only includes loans from banks; Household credit includes loans from all lenders. The vertical line marks Draghi's "Whatever-it-takes" speech in 2012:Q3. Sources: BIS, FRED.

12, 2012, the OMT program was announced, at the same time as ECB President Draghi delivered his "Whatever It Takes" speech.[12] To this end, we run numerous robustness checks that exploit the richness of our household-level data. Table 5 reports the results.

First, we show that cross-border portfolio flows did not raise households' total or mortgage borrowing, at least during the inflow episode we consider. To this end, we estimate the difference-in-differences equation (2) using the change in the logarithm of household total or mortgage borrowing between the first and second wave of the HFCS as dependent variables.[13] Columns (1) and (2) of Table 5 show that portfolio flows do not induce more exposed households to increase their borrowing.

Second, all of our regressions include the wealth variables in gross terms, without subtracting outstanding liabilities, consistent with Chetty et al. (2017). In column (3), we subtract household-level outstanding mortgages from the value of total housing wealth and

[12] In the context of the OMT program, the ECB announced to purchase bonds under certain conditions. The program intended to strengthen monetary policy transmission and hence to boost bank lending to firms and households.

[13] We calculate both outcomes as the difference in the logarithm of (1+credit) to keep zero-valued observations. We also replace growth rates below -100% with -100%.

Table 5 Cross-Border Portfolio Flows and the Role of Household Credit

	(1) ΔMortgage	(2) ΔCredit	(3) ΔNet Housing	(4) ΔHousing	(5) ΔHousing	(6) ΔHousing	(7) ΔHousing
Flows × Exp	-0.006	-0.009	0.020***	0.016***	0.016***	0.016***	0.016**
	(0.01)	(0.02)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
Flows × ΔMortgage				-0.000**			
				(0.00)			
Flows × Leverage					-0.000		
					(0.00)		
Flows × Constrained						0.033	
						(0.036)	
CS × Exp							0.001
							(0.01)
Household Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	10,017	10,017	8,371	8,371	8,371	8,371	8,371
No. of Countries	6	6	6	6	6	6	6
R^2	0.091	0.137	0.960	0.257	0.251	0.251	0.250

Note. These regressions are based on the first two waves of the HFCS survey. The dependent variable is the change in the logarithm of a household's mortgage or total borrowing from the first to the second wave in columns (1) and (2); net housing wealth (housing wealth less outstanding mortgages) over total housing, plus bonds, equity, and mutual funds in column (3); and our benchmark housing wealth change (total housing wealth over housing, bonds, equity, and mutual funds) in columns (4)-(7). The main regressor is country-level net cross-border portfolio inflows, averaged during 2012-2013, interacted with households' initial wealth share invested (directly and indirectly) in bonds and equity. In columns (4)-(6), we add the corresponding interactions between portfolio flows and the change in mortgage borrowing from wave 1 to wave 2, households' initial leverage (outstanding loans over income), or a dummy equal to one if households are credit-constrained. The regressions also include country-fixed effects. In column (7), we add the interaction between country-level change in lending standards during 2012-13 and household-level initial wealth shares invested in bonds and equity. All individual variables included in the interactions, when they are not absorbed by the fixed effects, are also included in the regressions but not shown to conserve space. All regressions include the following household controls measured in the pre-treatment period that are also not shown to save spaces: log of wealth and income, age of the household head, number of household members, a dummy of whether a household rents or owns the main residence, and the initial logarithm of households' credit or mortgage borrowing, the initial net housing share or the initial total housing share, respectively. The heteroskedasticity-robust standard errors are shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

our results don't change. More exposed households increase their net housing shares when portfolio inflows are larger. We conclude from this evidence that mortgage and credit do not drive (or even accompany) the portfolio rebalancing identified in this paper.

Third, in columns (4), (5), and (6), we horserace our exposure measure with (i) a household's change in mortgage borrowing from wave one to wave two, (ii) households' initial leverage (outstanding debt over income), and (iii) a dummy indicating whether a household is credit-constrained (either due to a credit application being rejected or because no

application was submitted due to a high perceived chance of being rejected). In these three regressions, our benchmark results are robust.

Fourth and finally, in column (7), we control for the interaction between the household exposure variable and the change in the country-level bank lending standards (for housing purchases), a measure of financial market liberalization similar to the one used in Favilukis et al. (2013). While this additional control is not statistically significant, our main interaction of interest remains positive and statistically significant at the 5% level.

5.2 Placebo Tests

In this sub-section, we conduct two placebo tests, which are important as our data do not allow us to provide direct evidence for parallel pre-trends of our baseline difference-in-differences results. We first look at how cross-border FDIs and other investment flows affect the portfolios of more exposed households. Second, we run the analysis on the same dependent variable, the change in housing shares, computed from the second to the third wave of the HFCS, rather than from the first to the second.

Unlike portfolio flows, FDI and other investment flows should not have a direct impact on bond and equity returns, and hence they should also not increase households' housing shares. Columns (1)-(2) of Table 6 show that both of these two capital flow components reduce the housing portfolio shares of more exposed households. Although the FDI flow interaction coefficient is estimated quite imprecisely, the other flow interaction coefficient is negative and statistically significant at the 1% level. Note that other flows predominantly encompass cross-border interbank flows, which should have a direct effect on banks' credit supply (Baskaya et al., 2017; te Kaat, 2021). In sum, both negative interaction coefficients imply that other (placebo) capital flow components do not induce portfolio rebalancing toward real estate, as we documented for portfolio flows during the episode that we consider.

Second, as the dependent variable, we use the change in the housing share from the second to the third wave of the HFCS rather than from the first to the second. During

Table 6 Difference-in-Differences: Placebo Regressions

	(1) ΔHousing	(2) ΔHousing	(3) ΔHousing
FDI flows × Exp	-0.019*		
	(0.01)		
Other flows × Exp		-0.026***	
		(0.01)	
Portfolio flows × Exp			-0.002
			(0.00)
Country FE	Yes	Yes	Yes
Household Controls	Yes	Yes	Yes
Obs	8,371	8,371	5,184
No. of Countries	6	6	5
R^2	0.241	0.248	0.206

Note: The regressions in columns (1)-(2) are based on the first two waves of the HFCS survey, and column (3) is based on the second and third wave. The dependent variable in columns (1)-(2) is the change in the share of a household's total housing wealth over housing, equity, bonds, and mutual funds from the first to the second wave; in column (3) it is calculated over the placebo episode spanning the second and third wave. The main regressor is country-level net portfolio inflows, net FDI inflows, and net other investment inflows, averaged during 2012-2013, and interacted with household-level bond and equity shares measured in wave 1 (Exp). The linear term for the Exp variable is also included in the regression, but the estimated coefficients are not shown to conserve space. All regressions include the following household controls measured in the pre-treatment period that are also not reported for reasons of space: log of wealth and income, age of the household head, number of household members, a dummy whether a household rents or owns the main residence, and the initial share of housing wealth. The heteroskedasticity-robust standard errors are shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

the 2014-2018 placebo period over which the wave 3/wave 2 housing share changes are computed, as we show in Panel A of Figure 2, there is only household heterogeneity and no cross-country heterogeneity in portfolio flows. We exploit this fact in a placebo regression to explore the parallel trend assumption of more vs. less exposed households, in the absence of treatment. Note here that, in these regressions, all right-hand side variables are fixed at their wave 1 value because we are interested to see whether the trends for households that are more exposed in our benchmark analysis, relative to the less exposed ones, are the same in the absence of portfolio flow heterogeneity. According to the estimates reported in column (3), more exposed households in countries with larger portfolio inflows in 2012-2013 did not rebalance their portfolios more toward real estate between the second and third wave of the HFCS. This suggests that the household portfolio changes are the same across countries during this placebo period in which significant differences in cross-border portfolio

flows were absent. So while we cannot check for parallel pre-trends, this is strong evidence for parallel post-trends, which implies that the parallel trend assumption underlying our difference-in-differences analysis is likely satisfied.

5.3 Controlling for the Non-Random Allocation

Our benchmark regressions include a rich set of household controls, fixed at the initial wave 1 level. In this section, we control for their interactions with cross-border portfolio flows. We thus horse race our exposure measure with those household characteristics that likely affect the "optimal" household portfolio allocation. This exercise is important because the exposure measure (the bond and equity share) is unlikely to be distributed randomly. Indeed, there are small but statistically significant correlations between the exposure measure and other household characteristics. By explicitly controlling for these interaction terms, we make sure that our benchmark estimates are not biased by such correlations.

Table 7 shows that this important concern is not a threat to our results. In all regressions, the interaction term between portfolio flows and the exposure measure is positive and statistically significant at the 1% level. The economic magnitude only decreases slightly once controlling for the tenure status. This last result is intuitive because initial renters are more likely to rebalance. These results suggest that the non-randomness of our exposure measure does not threaten our identification, consistent with Roberts and Whited (2013).

5.4 External Validity

Our benchmark specification is a difference-in-differences model that includes about 8,000-panel households from six countries. To show that our results are externally valid, we estimate cross-section regressions including about 25,000 households, from eleven euro area countries including Belgium, Cyprus, Germany, Estonia, Spain, Finland, France, Italy, Latvia, Netherlands, and Slovakia. As noted earlier, this sample includes housing share changes between the first and the second wave and between the second and the third one.

Table 7 Difference-in-Differences: Other Household Characteristics

	(1)	(2)	(3)	(4)	(5)
			ΔHousing		
Flows × Exp	0.016***	0.016***	0.014***	0.016***	0.016***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Flows × Net worth	-0.031**				
	(0.01)				
Flows × Income		-0.006			
		(0.01)			
Flows × Renter			0.413***		
			(0.08)		
Flows × Age				0.002**	
				(0.00)	
Flows × Household members					-0.012
					(0.01)
Household Controls	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Obs	8,371	8,371	8,371	8,371	8,371
No. of Countries	6	6	6	6	6
R^2	0.252	0.250	0.260	0.251	0.251

Note. These regressions are based on the first two waves of the HFCS survey. The dependent variable is the change in the share of a household's housing wealth over housing, equity, mutual funds, and bonds from the first to the second wave. The main regressor is country-level net cross-border portfolio inflows, averaged during 2012-2013, interacted with the initial household share of wealth (directly and indirectly) invested in bonds and equity (our exposure measure). In each specification, we additionally control for the interactions between portfolio flows and households' initial logarithm of net wealth, their initial log income, a dummy equal to one if the household initially rents the main residence, the initial age of the household head, and the initial household size, respectively. The regressions include the individual variables included in these interactions when they are not absorbed by the fixed effects, but the attendant coefficients are not shown to conserve space. The regressions further include the initial share of housing wealth, whose coefficients are also not shown to save space. The heteroskedasticity-robust standard errors are shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

The HFCS reports the year when a household is interviewed. Using this information, we construct a household-country-year sample and estimate the following specification:

$$\Delta Y_{h,c,t} = \alpha_c + \alpha_t + \beta \cdot \text{Flows}_{c,t-1} + \gamma \cdot X_{h,c,t-1} + \epsilon_{h,c,t}, \tag{3}$$

where the dependent variable is the change in the housing share for household h, in country c, in year t. The main regressor is country-specific cross-border portfolio flows over GDP ($\text{Flows}_{c,t-1}$), averaged over three years preceding year t. The main hypothesis is that the coefficient β should be positive, as higher foreign flows into equity and bond markets induce households to rebalance more toward housing. Control variables are the same as in Section 3 and are lagged by one wave. α_t is a year-fixed effect that controls for macroeconomic factors

affecting all euro area households, such as the ECB's monetary policy. α_c are country-fixed effects to control for time-invariant, country-specific heterogeneity. Standard errors are heteroskedasticity-robust (HC1).[14]

Next, we estimate a version of Equation (3) where the main regressor is the interaction between cross-border portfolio inflows and our household exposure measure:

$$\Delta Y_{h,c,t} = \alpha_{c,t} + \sigma \cdot \text{Exp}_{h,c,t-1} + \nu \cdot X_{h,c,t-1} + \mu \cdot (\text{Exp}_{h,c,t-1} \times \text{Flows}_{c,t-1}) + \epsilon_{h,c,t}, \tag{4}$$

where $\text{Exp}_{h,c,t-1}$ is the one-wave lagged share of wealth (directly and indirectly) invested in equity and bonds. As before, the idea is that households with a larger ex-ante share should be more affected by the inflow-induced reduction in expected bond and equity returns, and thus rebalance more significantly toward real estate. This specification permits adding country-year fixed effects that can control for any country-year-specific variables that might affect household behavior, such as the differing positions of individual countries in the business cycle. They also absorb the country-level portfolio flows variable, which, therefore, cannot enter the regression individually.[15]

Table 8 reports the fixed effects regression results. In column (1), we do not add any fixed effects and the coefficient estimate suggests that portfolio flows have a positive and statistically significant impact on household portfolio rebalancing. In economic terms, the estimated coefficient implies that a one-standard-deviation increase in cross-border flows raises the housing portfolio share by an additional 0.52 percentage points on average, which is similar to the estimated magnitude in our baseline difference-in-differences specification reported in Section 3.

Columns (2)-(4) control for year, country, as well as year and country fixed effects. When

[14] Given the large sample size in most specifications, using HC2 or HC3 heteroskedasticity-robust standard errors does not change the statistical significance of the results. The results are similar when we cluster by country even though we have only 11 of them (not reported).

[15] The critical difference between this regression and the placebo specification reported in Section 5.2 is that here we do not fix all regressors at their wave 1 level. Instead, the regression here uses portfolio flows of the three years preceding the respective wave and one-wave lagged household characteristics.

Table 8 External Validity: Pooled-cross Section Results

	(1)	(2)	(3)	(4)	(5)	(6)
			ΔHousing			
Flows	0.052***	0.043**	0.054***	0.015	0.020*	-
	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	
$Exp_{h,t-1}$					-0.120***	-0.112***
					(0.04)	(0.04)
Flows × $Exp_{h,t-1}$					0.020***	0.021***
					(0.01)	(0.01)
Year FE	No	No	Yes	Yes	No	No
Country FE	No	Yes	No	Yes	No	No
Country-Year FE	No	No	No	No	No	Yes
Obs	25,366	25,366	25,366	25,366	25,366	25,366
No. of Countries	11	11	11	11	11	11
R^2	0.212	0.215	0.212	0.215	0.222	0.225

Note. These regressions are based on all three waves of the HFCS survey. The dependent variable is the change in total housing wealth over housing, equity, bonds, and mutual funds. The main regressor is the country-level portfolio flow averaged over three years preceding the respective survey wave. The household-level controls are lagged by one wave and include net wealth (in logs), income (in logs), the age of the household head, the number of household members, and a dummy variable of whether the household rents or owns the main residence. The coefficients are not reported to conserve space. In columns (5)-(6), we interact portfolio flows with the one-wave lagged value of the share of wealth invested (directly and indirectly) in bonds and equity. The heteroskedasticity-robust standard errors are shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

we only use year or country fixed effects, as in columns (2)-(3), the portfolio flow estimate remains positive and significant at least at the 5% level. Once we include both types of fixed effects, however, the estimate turns statistically insignificant. However, when we saturate the regressions with household exposure to cross-border portfolio flows, as summarized in Equation (4) and reported in columns (5)-(6), our results significantly strengthen. In column (5), in particular, the double interaction is highly statistically significant suggesting that more exposed households rebalance more toward housing. This result is unchanged (in coefficient magnitude and statistical significance) when we control for country-year fixed effects in column (6).

6 Portfolio Flows and House Prices

Higher household housing portfolio demand, all else equal, should increase house prices and lower the housing risk premium. Unfortunately, HFCS data cannot be matched to housing

Table 9 Capital Flows and Housing Prices

	Unweighted			GDP Weighted		
	(1)	(2)	(3)	(4)	(5)	(6)
	Real Housing Prices					
Portfolio Flows$_t$	0.017			0.026		
	(0.020)			(0.029)		
Portfolio Flows$_{t-1}$	0.011*			0.021		
	(0.006)			(0.011)		
Portfolio Flows$_{t-2}$	0.017**			0.034**		
	(0.006)			(0.014)		
Other Flows$_t$		0.003			0.016	
		(0.013)			(0.015)	
Other Flows$_{t-1}$		-0.000			0.007	
		(0.006)			(0.011)	
Other Flows$_{t-2}$		-0.011			0.011	
		(0.007)			(0.013)	
FDI Flows$_t$			-0.023			-0.038*
			(0.013)			(0.021)
FDI Flows$_{t-1}$			-0.006			-0.028*
			(0.017)			(0.013)
FDI Flows$_{t-2}$			0.017			0.012
			(0.010)			(0.023)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Joint Coeff.	0.045*	-0.008	-0.012	0.080**	0.034	-0.054*
Obs	188	188	188	188	188	188
No. of Countries	19	19	19	19	19	19
R^2	0.500	0.495	0.498	0.376	0.374	0.375

Note. The table reports regressions of country-level real house price indexes (in levels) for all 19 euro area countries at an annual frequency on the contemporaneous, one-year lag, and two-year lag of net portfolio flows, other net flows, and net FDI flows. All regressions include country and year-fixed effects. Columns (1)-(3) are unweighted regressions, while columns (4)-(6) weigh the data by average nominal USD GDP over 2009-2018 for each country in the sample. Newey-West standard errors with two lags are shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

transaction data, so we cannot directly link the household portfolio rebalancing that we documented in the previous sections with house prices at the transaction level. In this section, we provide aggregate evidence of an association between aggregate portfolio flows and national house prices in the euro area.

To this end, we regress country-level real house price indexes for all 19 euro area countries on contemporaneous, first- and second-year lagged values of three main components of total net cross-border flows—portfolio, FDI, and other investment flows in Table 9. The results show that house prices in the euro area, during the 2009-2018 post-GFC sample period, are

associated with *lagged portfolio* flows but not with net other flows or FDIs. Specifically, column (1) shows that higher portfolio flows are associated with higher housing prices. This tight link, however, does not materialize contemporaneously, but with a one-to-two-year lag. This contrasts with other investments and FDI flows that are not statistically significantly associated with housing prices. The results are stronger once we weigh the regressions by the average nominal USD GDP of the respective country (columns 4-6).

In Table 10, we leave the outcome variable unchanged, but use the interaction between country-level cross-border flows and the average wave 1 share of bond and stock wealth of households in the respective country (Exp) as the main regressor.[16] This interaction should capture a country's sensitivity to our mechanism. In other words, in countries with a greater initial bond and equity share, households are, on average, more susceptible to rebalancing their portfolio from stocks and bonds toward housing when cross-border portfolio inflows rise. This implies that in these countries, the link between portfolio flows and housing prices should be more distinct, as captured by a positive interaction coefficient. Column (1) of Table 10 shows that the previous results on portfolio flows are driven by countries where our survey households initially invest a larger fraction of their wealth in bonds, stocks, and mutual funds. The interaction coefficient is positive and statistically significant at the 5% level. In contrast, for FDI and other flows, the double interaction coefficients in columns (2) and (3) are even negative but estimated imprecisely.

Taken together, the reported evidence suggests that (i) portfolio inflows can predict higher real housing prices with a one-to-two years lag and (ii) this link is tighter in countries where households are more susceptible to rebalancing their portfolio from bonds, stocks, and mutual funds toward real estate.

[16] As some countries did not participate in the HFCS survey during wave 1, we have to exclude those from the sample and are hence left with only 15 countries.

Table 10 Portfolio Flows, House Prices, and Portfolio Investment Shares

	(1)	(2)	(3)
		Real Housing Prices	
Portfolio Flows	-0.097**		
	(0.040)		
Portfolio Flows × Exp	0.018**		
	(0.008)		
Other Flows		0.189*	
		(0.098)	
Other Flows × Exp		-0.023*	
		(0.011)	
FDI Flows			0.125
			(0.132)
FDI Flows × Exp			-0.016
			(0.012)
Exp	-0.416	-0.772	-0.872
	(0.245)	(0.545)	(0.549)
Year FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Obs	148	148	148
No. of Countries	15	15	15
R^2	0.521	0.512	0.513

Note. This table shows regressions of country-level real house price indexes for all 19 euro area countries at an annual frequency on the contemporaneous, one-year lag and two-year lag of net cross-border portfolio inflows, FDI flows, and other investment flows, respectively, and their interactions with the initial country-level average of households' portfolio shares of (directly and indirectly held) equity and bonds during the first wave of the HFCS (Exp). To conserve space, the table only shows the joint coefficient estimates and standard errors. All regressions include country and year-fixed effects. Newey-West standard errors with two lags are shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

7 Conclusions

This paper studies the impact of cross-border portfolio flows around the peak of the European crisis on the rebalancing of household portfolios. By exploiting data variation at both the household and country level, we find that portfolio flows induce households to rebalance their portfolios toward housing. In aggregate country data, we also find that portfolio flows predict house prices one-to-two years ahead.

Households with larger initial bond and equity holdings tend to reallocate more of their wealth away from these assets toward real estate. In economic terms, a one-standard-deviation increase in portfolio flows results in a 0.38 percentage point bigger increase in the valuation-adjusted housing portfolio share for households at the 75^{th} percentile of the

exposure distribution compared to those at the 25^{th} percentile. Furthermore, wealthier and more risk-seeking households are more inclined to engage in portfolio rebalancing toward real estate. Access to credit before the treatment period, or credit growth during it, does not significantly affect our estimation results.

While previous research has primarily focused on the transmission of cross-border capital flows to the housing market through credit and collateral channels, our results underscore the importance of household portfolio rebalancing and have novel policy implications. Policymakers have increasingly employed macroprudential tools, such as loan-to-value and debt-to-income ratio caps, to mitigate excessive leverage and potential boom-bust cycles in housing markets, and to safeguard the stability of the financial system. Our research suggests that these measures may not be enough to curb housing market boom-bust cycles if these are driven by wealthy households rebalancing large portfolios toward real estate.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this work the author(s) used LLM and other web tools in order to proofread selected portions of earlier drafts of the paper. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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Appendix

'Portfolio Capital Flows and Household Portfolios'

by D. te Kaat, C. Ma and A. Rebucci

February 27, 2024

A Data Appendix

Table A1 Variable Definitions and Sources

Variable	Definition	Unit	Source
ΔHousing	A household's change in the housing wealth over housing, bonds, equity, and mutual funds	%	HFCS
ΔSecond Homes	A household's change in the wealth in second homes over second homes, bonds, equity, and mutual funds	%	HFCS
ΔHousing Alt.1	A household's change in the housing wealth over housing, bonds, equity, mutual funds, and deposits	%	HFCS
ΔHousing Alt.2	A household's change in the housing wealth over the total portfolio	%	HFCS
ΔUnits	The change in the number of apartments that a household owns	-	HFCS
ΔStocks	A household's change in equity wealth over the total portfolio	%	HFCS
ΔBonds	A household's change in bond wealth over the total portfolio	%	HFCS
ΔMutual	A household's change in mutual fund wealth over the total portfolio	%	HFCS
ΔDeposits	A household's change in deposit wealth over the total portfolio	%	HFCS
ΔOther Fin.	A household's change in other financial wealth over the total portfolio	%	HFCS
ΔOther Real	A household's change in other real wealth over the total portfolio	%	HFCS
Net wealth	The logarithm of a household's assets less liabilities	ln(euro)	HFCS
Rich	=1 if a household is in the upper 10% of the country-wave specific net wealth distribution	0/1	HFCS
Income	The logarithm of a household's total gross income	ln(euro)	HFCS
Renter	=1 if a household is a renter in the main residence	0/1	HFCS
Household members	The number of household members	-	HFCS
Age	Age of the household head	-	HFCS
Risk seeking	=1 if a household self-reports to tolerate at least some risk	0/1	HFCS
Bonds and equity shares (Exp)	A household's share of bond and equity (directly and indirectly held via mutual funds) over the total portfolio value	%	HFCS
ΔCredit	The log-difference in households' outstanding credit volumes	%	HFCS
ΔMortgage	The log-difference in households' outstanding mortgage credit volumes	%	HFCS
Constrained	=1 when a credit application was rejected or when a household did not apply due to a high chance of being rejected	0/1	HFCS
Portfolio flows	Net portfolio investment inflows over nominal GDP	%	International Financial Statistics
Gross portfolio inflows	Gross portfolio investment inflows over nominal GDP	%	International Financial Statistics
Gross portfolio outflows	Gross portfolio investment outflows over nominal GDP	%	International Financial Statistics
Debt flows	Net debt investment inflows over nominal GDP	%	International Financial Statistics
Equity flows	Net equity investment inflows over nominal GDP	%	International Financial Statistics
FDI flows	Net foreign direct investment inflows over nominal GDP	%	International Financial Statistics
Other flows	Net other investment inflows over nominal GDP	%	International Financial Statistics
Growth	Real GDP growth during 2012-13	%	WEO
Gov. debt	Gross government debt over nominal GDP during 2012-13	%	WEO
CS	Net share of banks tightening their credit standards to households for housing purchases	-	ECB, Dutch Central Bank
HP index	National nominal house price index (2015=100), deflated by the CPI	-	Eurostat, Bank of Greece

Table A2 The Number of Households per Country (Panel Countries)

BE	CY	DE	EE	ES	FI	FR	IT	LV	NL	SK
853	691	1,364	1,407	2,718	1,745	3,256	2,155	526	521	626

B Valuation Adjustment

In this section, we provide details on how we correct households' self-reported bond, equity, and housing wealth for valuation changes. In the main body of the paper, we also report estimation results where we use the change in the number of housing units that a household owns as a dependent variable—an outcome that is not affected by valuation changes—and our results survive.

The main source of the house price data is Eurostat's House Price Statistics. For Greece, not covered by this database, we use the annual average dwellings price index from the Bank of Greece.[A1]

For equity wealth, we use country-level share price data at the annual frequency from the OECD. In three cases where a country's stock prices are not part of this data set (Cyprus, Lithuania, and Malta), we use the euro area average.

Bond wealth is valuation-corrected by using the country-specific, end-of-the-year Bank of America bond price index with a maturity of 7-10 years.[A2] Since Latvia, Lithuania, Luxembourg, Slovakia, and Slovenia are not covered by Bank of America's bond indices, we use the iboxx bond index for these five countries. Note as well that two countries (Latvia and Slovenia) only reported their bond prices after 2013, so we express households' bond wealth in these two cases in 2014 prices.

To adjust the self-reported housing, equity, and bond wealth, we use the aggregate asset price series described above as follows. For the difference-in-differences regressions, since all households were interviewed in wave 1 and we know the exact year when this interview took place, we use the national bond, equity, and house price indexes to express these three wealth categories in prices of the year in which a household was first interviewed (for most households 2010, only for a few 2011).

For the fixed effects estimation, as most households are not interviewed during the first

[A1] Using end-of-the-year housing prices does not affect the results.

[A2] For Cyprus and Lithuania, the Bank of America only reports a bond index without any maturity indication.

wave, we use the national price series to express the three asset categories in *average, country-level* prices prevalent during the first wave. For instance, if in the first wave of the HFCS 50% of households in country A were interviewed in 2010 and 50% in 2011, we express all asset values for households living in country A in average prices of 2010 and 2011.[A3]

Finally, as mutual funds mostly consist of bonds and equity, we correct their values for valuation effects, assuming a 50% of investment in bonds and equities, respectively.

[A3] Two of our sample countries (Estland and Latvia) did not participate in the first wave of the HFCS. We hence expressed their wealth variables in prices of 2010.

C Additional Results

In this appendix, we report selected additional results referred to in the main text.

C.1 Decomposing Total Wealth into its Components

Table A3 reports results on the impact of portfolio flows on the total household portfolio and its components, distinguishing between housing, bonds, stocks, mutual funds, deposits, other financial assets (incl. insurances or loans to friends), and other real assets (incl. jewelry). Column (1) shows that more exposed households raise their housing shares, consistent with the results in Section 4.2 in which we used a different denominator to scale housing wealth. Columns (2)-(4) show that households reallocate toward housing by reducing their stock, bond, and mutual fund positions. The double interaction coefficient between country-level portfolio flows and household-level exposure for all three portfolio components is negative and statistically significant at the 1% level. In contrast, most other outcomes are not affected by portfolio inflows, i.e., households do not change their deposit or other financial wealth shares. Only the other real asset share tends to increase slightly for more exposed households subject to greater portfolio inflows.

C.2 Portfolio Debt and Equity Flows

Here we report results from the estimation of our regression equation (1) for portfolio debt and equity flows separately. We standardize both flow variables by subtracting the mean and dividing by the standard deviation to compare estimated coefficients.

Table A4 reports that both debt and equity flows have a positive and statistically highly significant impact on households' housing shares. However, the point estimate on equity flows is larger than on debt flows. One potential explanation is that euro area households, on average, invest a larger fraction of their wealth in equity and are thus more affected by equity inflows. As Adam and Tzamourani (2016) note, expected future equity returns fell

much more than bond returns in the month immediately after Draghi's Speech.

C.3 Gross Portfolio Inflows vs. Outflows and Core vs. Periphery

We first distinguish between gross portfolio inflows and outflows, and then distinguish between core and periphery countries. Distinguishing between gross outflows and inflows is important because Figure 1 indicates that the dynamics of net portfolio flows during the episode we consider in our difference-in-differences analysis looks driven by changes in gross inflows—i.e., driven by foreign investors increasing their exposure in the euro area, rather than domestic residents adjusting their foreign investment position. So here we also assess to which extent the difference between foreign vs. domestic investors adjusting their stock and bond portfolios matters. We expect that the coefficient on the gross inflow interaction is positive (as before) and the one on the gross outflow interaction is negative, as in the construction of our baseline net flow variable, outflows are *subtracted* from inflows.

Columns (1)-(2) of Table A5 show that both interaction coefficients are statistically significant and have the expected sign. That is both higher gross inflows and lower gross outflows induce more exposed domestic households to rebalance toward real estate. This result justifies our focus on a net flow measure in the benchmark regressions. Interestingly, however, the inflow interaction coefficient is larger in absolute terms than the outflow coefficient. This finding suggests that gross inflows may be more important than gross outflows in affecting households' portfolio rebalancing.

Noting that during the portfolio inflow episode on which we are focusing in our difference-in-differences analysis mostly occurred in periphery countries of the euro area, we now estimate our benchmark regression separately for core and periphery countries. Columns (3) and (4) show that the attendant coefficients are statistically significant in both country groups, but larger and estimated more precisely in the core countries. We provide potential explanations for this stronger effect in Section 4.2.

C.4 Other Robustness Checks

Finally, in this section, we report the results of several additional specifications and robustness checks. In columns (1)-(2) of Table A6, we control for two important macroeconomic variables that, at least during this specific period shortly after the European sovereign debt crisis, correlate with cross-border portfolio flows and might have an effect on household portfolios—real GDP growth and government debt as a percentage of GDP, both fixed at their 2012-13 average values. The results show that their inclusion reduces the size of our main coefficient of interest only marginally relative to the benchmark estimate in column (1) of Table 4. Of the two macroeconomic controls, only the government debt interaction turns out to be statistically significant. In particular, households having a higher bond and equity share rebalance more significantly toward housing in countries with higher government debt ratios, which are those with bigger sovereign debt spread reductions.

In the HFCS, countries can interview households in slightly different years as it takes time to complete these surveys. This implies that our dependent variable—the change in housing shares between the first and second wave can end up being measured over periods of different lengths across countries, or even within countries across households. The larger the gap between the two waves, the more likely households are to rebalance for reasons unrelated to portfolio flow shocks. To make sure that this data limitation does not drive our main results, in column (3), we control for the household-specific number of years between the first and second wave of the HFCS. As expected, the distance term has a positive coefficient, but it is not statistically significant. Moreover, the coefficient on the interaction between portfolio flows and household exposure is unaffected, equal to 0.016 as in Section 4.2.

Finally, we break down our household-level exposure variable into three components, the share of household wealth invested in stocks, bonds, and mutual funds, respectively. Table A7 shows that the coefficient on the interaction between portfolio inflows and direct equity exposure is the largest and statistically most significant, followed by the mutual fund interaction and the debt exposure interaction. Debt exposure has a statistical significance

just below the 10% level (p=0.12), consistent with evidence previously discussed. These results imply that households shift their portfolios from stocks (and mutual funds) to housing, and less so out of bonds, consistent with the observation by Jordà et al. (2017) that the two asset classes have returns with similar properties. Put differently, for households in our sample, stocks and real estate are closer substitutes than debt securities and real estate.

Table A3 Portfolio Flows and Household Portfolio Components

	(1) ΔHousing	(2) ΔBonds	(3) ΔStocks	(4) ΔMutual	(5) ΔDeposits	(6) ΔOther Fin.	(7) ΔOther Real
Flows × Exp	0.009***	-0.005***	-0.003***	-0.003***	0.002	-0.000	0.002*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Household Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	8,371	8,371	8,371	8,371	8,371	8,371	8,371
No. of Countries	6	6	6	6	6	6	6
R^2	0.248	0.483	0.283	0.242	0.248	0.375	0.310

Note. These regressions are based on the first two waves of the HFCS survey. The dependent variables are the changes in the share of housing, bonds, stocks, mutual funds, deposits, other financial assets, and other real assets over the total portfolio size. The main regressor is country-level net cross-border portfolio inflows, averaged during 2012-2013, interacted with households' initial wealth share invested (directly and indirectly) in bonds and equity. The regressions also include country-fixed effects. All individual variables included in the interactions, when they are not absorbed by the fixed effects, are also included in the regressions but not shown to conserve space. All regressions include the following household controls measured in the pre-treatment period that are also not shown to save spaces: log of wealth and income, age of the household head, number of household members, a dummy of whether a household rents or owns the main residence, and, depending on the specification, the initial logarithm of households' respective wealth component. The heteroskedasticity-robust standard errors are shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A4 Difference-in-Differences: Debt vs. Equity Inflows

	(1) ΔHousing	(2) ΔHousing
Debt Flows	0.595***	-
	(0.17)	
Equity Flows	-	0.795***
		(0.17)
Household Controls	Yes	Yes
Obs	8,371	8,371
No. of Countries	6	6
R^2	0.234	0.235

Note. These regressions are based on the first two waves of the HFCS survey. The dependent variable is the change in the share of a household's housing wealth over housing, mutual funds, equity, and bonds from the first to the second wave. The main regressor is country-level net cross-border debt inflows and equity inflows, averaged during 2012-2013 and standardized by subtracting the mean and dividing by the standard deviation. All regressions include the following household controls measured in the pre-treatment period that are not reported to save space: log of wealth and income, age of the household head, number of household members, a dummy of whether a household rents or owns the main residence, and the initial share of housing wealth. The heteroskedasticity-robust standard errors are shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A5 Difference-in-Differences: Gross Flows and Core vs. Periphery

	All countries		Core	Periphery
	(1) ΔHousing	(2) ΔHousing	(3) ΔHousing	(4) ΔHousing
Gross portfolio inflows × Exp	0.029**			
	(0.01)			
Gross portfolio outflows× Exp		-0.016***		
		(0.01)		
Net portfolio flows × Exp			0.030***	0.009*
			(0.01)	(0.01)
Household Controls	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Obs	8,371	8,371	2,808	5,563
No. of Countries	6	6	3	3
R^2	0.241	0.249	0.223	0.307

Note. The regressions are based on the first two waves of the HFCS survey. The dependent variable is the change in the share of a household's housing wealth over housing, equity, bonds, and mutual funds from the first to the second wave. The main regressor is country-level net portfolio flows in columns 3 and 4, gross cross-border portfolio inflows in column 1, and gross outflows in column 2 averaged during 2012-2013 and interacted with the initial household share of wealth invested (directly and indirectly) in bonds and equity. All regressions include country-fixed effects and the following household controls measured in the pre-treatment period that are not reported to save space: log of wealth and income, age of the household head, number of household members, a dummy for whether household rents or owns the main residence, and the initial share of housing wealth. The heteroskedasticity-robust standard errors are shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A6 Difference-in-Differences: Robustness Checks

	(1) ΔHousing	(2) ΔHousing	(3) ΔHousing
Flows × Exp	0.014***	0.014***	0.016***
	(0.00)	(0.01)	(0.00)
Gov. Debt × Exp	0.006***		
	(0.002)		
Growth × Exp		-0.035	
		(0.02)	
Distance between waves			0.116
			(0.93)
Household Controls	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Obs	8,371	8,371	8,371
No. of Countries	6	6	6
R^2	0.256	0.252	0.250

Note. The regressions are based on the first two waves of the HFCS survey. The dependent variable is the change in the share of a household's housing wealth over housing, equity, bonds, and mutual funds from the first to the second wave. The main regressor is country-level net portfolio investment inflows, averaged during 2012-2013, interacted with the initial household share of wealth invested (directly and indirectly) in bonds and equity. All regressions include country-fixed effects and the following household controls measured in the pre-treatment period that are not reported to save space: log of wealth and income, age of the household head, number of household members, a dummy of whether household rents or owns the main residence, and the initial share of housing wealth. Columns (1) and (2) add the interactions between household-level initial bond and equity shares and the country-level share of government debt over GDP and country-level real GDP growth, both averaged during 2012-2013, to the regressions. All individual variables included in the interactions, when they are not absorbed by the fixed effects, also enter the regressions, but their coefficients are not shown to conserve space. Column (3) controls for the number of years between the first and second wave of the HFCS. The heteroskedasticity-robust standard errors are shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A7 Difference-in-Differences: Debt vs. Equity Inflows Exposure

	(1) ΔHousing	(2) ΔHousing	(3) ΔHousing
Flows × Stock Exp	0.032***		
	(0.00)		
Flows × Bond Exp		0.010	
		(0.00)	
Flows × Mutual Fund Exp			0.026***
			(0.01)
Household Controls	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Obs	8,371	8,371	8,371
No. of Countries	6	6	6
R^2	0.248	0.246	0.246

Note. The regressions are based on the first two waves of the HFCS survey. The dependent variable is the change in the share of a household's housing wealth over housing, equity, bonds, and mutual funds from the first to the second wave. The main regressor is country-level net cross-border portfolio investment inflows, averaged during 2012-2013, interacted with the initial household share of wealth invested in stocks (column 1), bonds (column 2), and mutual funds (column 3), respectively. All regressions include country-fixed effects and the following household controls measured in the pre-treatment period that are not reported to save space: log of wealth and income, age of the household head, number of household members, a dummy of whether household rents or owns the main residence, and the initial share of housing wealth. All individual variables included in the interactions, when they are not absorbed by the fixed effects, also enter the regressions, but their coefficients are not shown to conserve space. The heteroskedasticity-robust standard errors are shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.