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DISCUSSION PAPER SERIES

IZA DP No. 17739

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ABSTRACT

Macro-Economic Change and Household Financial Strain in Europe 2006-2022

This paper examines trends in household financial strain across Europe from 2006 to 2022, a period marked by three major economic shocks: the 2008 financial crisis, the COVID-19 pandemic, and the ongoing cost-of-living crisis. Using a subjective measure of welfare, financial strain, we analyse household responses to these shocks, which affected countries differently over time. Our theoretical framework centres on discretionary disposable income, accounting for non-discretionary expenses such as housing, commuting, and childcare costs, alongside household-specific inflation rates to assess purchasing power. Overall, we find many instances of increased financial strain during the financial and the cost-of-living crisis. While aggregate relationships between the drivers seem logical in many countries, there are many instances where the aggregate relationship is either unexpected in sign or strength, indicating that the relationship is due to distribution-specific changes than to aggregate changes. Our microanalysis corroborates this hypothesis, showing that most of the characteristics incorporated in our theoretical framework are significant and of the right sign, even if aggregate relationships were weak. Housing costs consistently emerged as a key determinant of financial strain; while commuting and childcare costs had a more complex, less predictable impact due to their endogeneity with employment, which is associated with lower financial strain.

JEL Classification: C63, I31, D31

Keywords: household financial strain, economic shocks, distributional effects, microsimulation

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1. Introduction

Since 2008, households in Europe have faced several major economic shocks, including the Great Recession (2007-2012), the COVID-19 pandemic (2020-2021), and the ongoing cost-of-living crisis (post-2021). These crises have led to significant financial challenges, affecting employment, income levels, housing costs, and overall living expenses. The impacts of these crises varied across countries, influenced by differing policy responses and economic conditions.

The combined effects of these economic shocks triggered a global recession that left many households struggling with *financial strain*. Housing wealth declined, credit tightened, and rising interest rates increased mortgage costs, reducing affordability and slowing the housing market (Liebersohn and Rothstein, 2023; Fonseca and Liu, 2023). Many workers faced job losses, wage stagnation, or precarious employment, while consumer debt reached record levels as the cost-of-living outpaced wage growth (Can et al., 2023). Nearly one-quarter of European households reported difficulties in making ends meet (EU-SILC, 2018).

Much of the existing research has focused on income and wealth distributions during these crises (Bargain et al., 2017; Jenkins et al., 2013; Dolls et al., 2012; Matsaganis & Leventi, 2017; Almeida et al., 2020; Amores et al., 2023). However, relatively few studies have considered subjective well-being measures like financial strain (Cracolici et al., 2012). This study aims to fill this gap by investigating how households across Europe coped with different economic shocks over time and how subjective well-being as measured by household financial strain evolved from 2006 to 2022 under the impact of various macroeconomic changes across a wide range of European countries. Financial strain provides a more comprehensive understanding of household coping mechanisms, especially when traditional income measures do not fully capture the complexity of economic hardship during crises (Angel et al., 2003; Leininger and Kalil, 2014; Whelan et al., 2017b).

There is an extensive literature on the distributional impact of economic changes in Europe has considered the impact on disposable income. For example, Jenkins et al. (2012), Dolls et al. (2012), Matsaganis & Leventi (2017), Whelan et al. (2017b), Bargain et al. (2017), and Černiauskas et al. (2022) analysed the effects of market and policy impacts on income distribution during the financial crisis. Similarly, Sologon et al. (2022a) and other studies (Almeida et al., 2020; Clark et al., 2021) examined the impact of the coronavirus pandemic on disposable income. More recent work by Sologon et al. (2022b) and Curci et al. (2022) investigated the effects of price inflation at the onset of the cost-of-living crisis on expenditures, while Amores et al. (2023) focused on disposable income, whereas Menyhert (2022) considered the impact of energy prices on household finances. Disposable income, however, is increasingly seen as a less reliable measure of welfare, particularly as the cost of non-discretionary expenditures such as housing, commuting, and childcare has risen faster than incomes during the cost-of-living crisis, with energy prices spiking significantly (O'Donoghue et al., 2020)[1].

Over the past three decades, the welfare literature has shifted from relying solely on objective measures, such as disposable income, to incorporating subjective measures like subjective

[1] Increases in the price of other items such as food, which are also essential, can also influence household well-being; nonetheless, these items can be substituted for other food items with reduced quality and quantity, or the use of coupons or discount stores (Nevo and Wong, 2019).

financial well-being (SFW). SFW assesses an individual's perception of whether their income is adequate to meet their needs. Angel et al. (2003) highlighted the need to distinguish between objective income levels and subjective perceptions of financial well-being, especially in relation to health outcomes. Other subjective measures, such as financial strain and employment uncertainty, also play a role in understanding how individuals perceive their economic situation.

This paper connects two strands of literature by examining how various macroeconomic changes affect financial strain, a subjective measure of welfare. Financial strain reflects both perceived financial inadequacy and uncertainty about employment prospects (Voydanoff, 1990). Leininger and Kalil (2014) found that during the Great Recession, financial strain was often driven more by uncertainty about the future than by actual economic conditions. Fallon and Lucas (2002) analyzed the broader impact of financial crises on labor markets, household income, poverty, and health and education outcomes, while Kakwani and Lambert (1998) explored the trade-off between inequality and economic growth.

Our study advances the understanding of household well-being by incorporating not only disposable income but also non-discretionary expenditures, including housing, commuting, and childcare costs, alongside household-specific inflation rates, which capture the impact of price changes in essential goods (O'Donoghue et al., 2020; Goodman & Oldfield, 2004).This study provides a detailed view of the factors influencing economic well-being through a composite financial strain measure during periods of macroeconomic change. On average increases in household inflation are positively associated with financial in Southern and Eastern Europe, but is less important in Northern and Western Europe. The study also concludes that non-discretionary expenditures, particularly housing costs, and real disposable income are stronger drivers of financial strain in Europe.

To construct this measure of financial strain, we draw on qualitative information from the European Survey of Income and Living Conditions (EU-SILC) between 2006 and 2022. By combining data from the Household Budget Survey, we impute a household-specific price index that reflects the changes in prices of basic basket of consumption goods. This approach captures the indirect effects of macroeconomic changes in Europe over a 15-year period while also accounting for labour market conditions, income, and non-discretionary expenditures (such as childcare, housing, and commuting costs). Our contribution to the literature lies in analysing the impact of different macroeconomic forces on subjective financial strain, providing a deeper understanding of household resilience and vulnerability.

Given the varying effects of different shocks across countries, we selected a diverse range of countries from various regions of Europe and across different welfare systems (Cyprus (CY), Germany (DE), Denmark (DK), Greece (EL), Spain (ES), Finland (FI), France (FR), Croatia (HR), Hungary (HU), Ireland (IE), Italy (IT), Lithuania (LT), Luxembourg (LU), Poland (PL), Portugal (PT), and Türkiye (TR)).

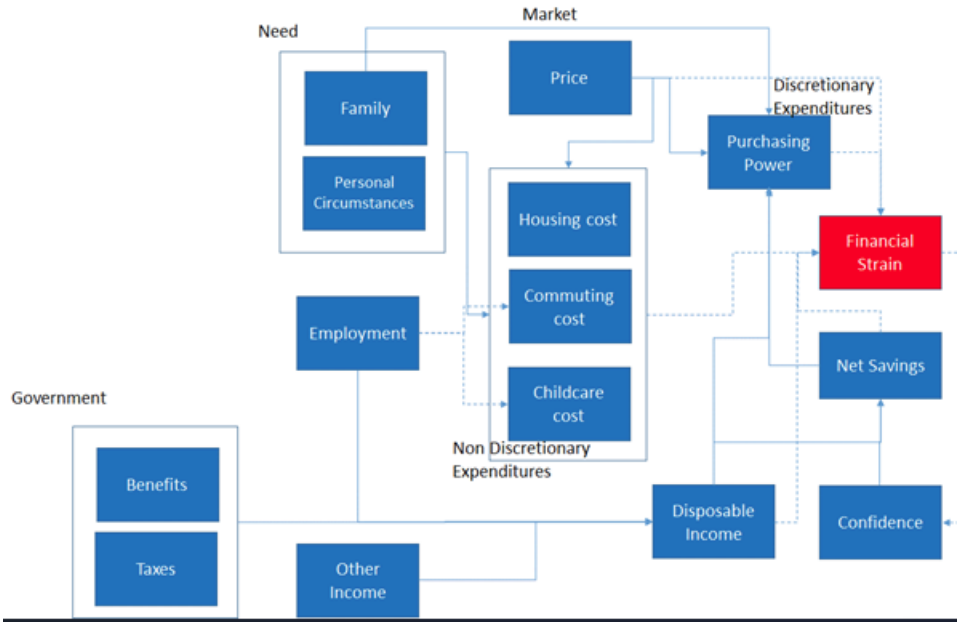
The remainder of this paper is organized as follows: Section 2 describes theoretical framework: drivers of financial strain. Section 3 outlines methodology and data. Section 4 presents results. Section 5 outlines the conclusions of the paper and provides several policy implications and recommendations.

2. Theoretical Framework: Drivers of Financial Strain

Understanding the impact of macroeconomic variables on well-being requires a multifaceted approach, as these changes significantly affect both individual and social welfare. This section outlines the theoretical basis for evaluating household financial strain, focusing on the role of key macroeconomic drivers and the mechanisms through which they impact welfare.

The relationship between macroeconomic factors and household welfare has been explored extensively in economic literature. Foundational work by Friedman (1957) linked macroeconomic fluctuations, such as changes in income levels, to household consumption and overall well-being. Subsequent studies have built upon this foundation, exploring various dimensions of macroeconomic effects. For example, Blanchard (2006) analysed the influence of GDP growth and unemployment rates on income and employment, and consequently on welfare. Fisher (1993) examined the detrimental effects of high inflation on purchasing power and economic stability, highlighting its impact on welfare. Bachmann (2012) examined the impact of inflation on consumer confidence and spending, key drivers of material well-being. Bernanke & Gertler (1995) investigated how changes in interest rates affect borrowing costs and credit availability, shaping household welfare. Mishkin (1996) detailed the role of monetary policy and interest rate changes in influencing economic activity and individual welfare.

Figure 1. Theoretical Framework.



Source: Authors' elaboration.

The Household Welfare Model

Household welfare is derived from four sources*: labour market, welfare state, private provision and voluntary welfare.* The labour market is a primary source of welfare, as it provides employment income that households rely on for their day-to-day needs. Earning capacity is linked to employment opportunities, wage rates, and the economic environment. The welfare state plays a critical role in enhancing household welfare through public provision and redistribution. As discussed by Titmuss (1974), and later elaborated by Barr (1992 & 2012),

the state ensures welfare by redistributing income via taxes and benefits, regulating markets, fostering social partnerships, and providing essential public goods and services like education, healthcare, and public housing. These public provisions help to reduce disparities and enhance social equity.

The theoretical framework, depicted in Figure 1, conceptualises household welfare $W_H(F_H)$ as a function of household disposable income $Y_{D,H}$ adjusted by equivalence scales $ES(F_H)$ to account for household size and composition[2]:

$$\boldsymbol{W_H(F_H) = y_{D,H} = \frac{Y_{D,H}}{ES(F_H)}} \quad (1)$$

Equivalence scale-adjusted income, $y_{D,H}$, is equivalent to household welfare, which facilitates making welfare comparisons across different types of households.

Disposable income $\boldsymbol{Y_{D,H}}$ is a function of employment income $\boldsymbol{Y_{E,H}}$, other income $\boldsymbol{Y_{O,H}}$, benefits $\boldsymbol{B_H}$ and taxes $\boldsymbol{T_H}$:

$$\boldsymbol{Y_{D,H} = Y_{E,H} + Y_{O,H} + B_H - T_H} \quad (2)$$

This depends on wages $\boldsymbol{w_t}$, benefit levels $\boldsymbol{b_t}$, and tax rates, $\boldsymbol{t_t}$.

Disposable income, however, is increasingly seen as a less reliable measure of welfare, particularly as the cost of non-discretionary expenditures such as housing, commuting, and childcare has risen faster than incomes during the cost-of-living crisis, with energy prices spiking significantly (O'Donoghue et al., 2020). As such, it is necessary to expand the definition of disposable income to account for *non-discretionary costs (e.g. childcare, commuting, and housing)* that working households must incur regardless of income levels. These costs play a substantial role in determining financial strain and provide a clearer picture of household welfare. Although there are other necessities such as food and non-commuting related energy costs, there is substantial variation in these costs with income both in volume and quality and as a result can be more appropriately be considered discretionary in the short run.

Childcare and commuting costs

Non-discretionary for working households, commuting costs TC_H and childcare costs CC_H impose additional financial burdens (Goodman & Oldfield, 2004; Blacklow & Ray, 2000). In low income situations, where both parents work or for single parents, childcare constitute a significant non-discretionary expense. In other scenarios, it can be seen as a "personal choice", where parents prioritize their professional careers. High childcare costs can significantly

[2] Equivalence scales adjust household income for differences in size and composition, offering a more precise measure of economic well-being. The choice of equivalence scale can greatly affect the assessment of inequality and poverty rates (Coulter et al., 1994).

disincentive female labour supply and reduce household's earnings capacity, thereby increasing the incidence of poverty and exacerbating income inequality (Garfinkel & Haveman, 2013). Policy interventions aimed at reducing barriers to employment, such as childcare subsidies (Gelbach, 2002), has enhanced household welfare by enabling more individuals—particularly women—to participate in the labour market, thereby mitigating poverty and reducing income inequality.

The impact of commuting on financial strain is complex but important. Blumenberg & Manville (2004) examines how transportation policies, including commuting costs, affect disposable income and economic opportunities for welfare recipients. They argue how commuting costs and transportation infrastructure influence disposable income and employment prospects for low-income individuals. Meanwhile, employing a spatial microsimulation approach, Vega et al. (2017) show how commuting patterns affect income distribution and economic outcomes across different geographic areas. The research utilizes detailed geographical data and statistical modelling techniques to simulate commuting behaviours, and their impact on disposable income (see, among other, Saunders, 2017; Wiesel et al., 2023; Dewilde & De Decker, 2016; Heylen & Haffner, 2012).

Housing Costs

Over the last eight years after the financial crisis, housing costs increases by 48% according to Eurostat House Price Index. Private actors such as construction companies, banks and other property owners can influence individual welfare, often by determining access to essential resources like housing. Housing costs, HC_H, includes all expenditures related to residing in a dwelling, plus the value of rents or any mortgages payments, taxes, among others. These costs are critical drivers of financial strain/well-being as they impact disposable income directly, and are a major determinant of economic inequality. Rising housing costs, as shown by Atkinson et al. (1994) and Wiesel, Ralston, and Stone (2023), reduce disposable income for many households, contributing to economic inequality. These findings underscore that the affordability of housing is crucial for ensuring equitable welfare, as rising costs can widen the gap between different socio-economic groups (see Oldman, 1991; Goodman & Webb, 1994; Atkinson, 1995; Iacoviello, 2008; Heylen & Haffner, 2012; Dewilde & De Decker, 2016).

Household-specific inflation and purchasing power

Price changes, relative to income growth, influence household's purchasing power, which in turn affect household well-being. Household-specific inflation ($\boldsymbol{cpi_{H,t}}$) is critical for understanding purchasing power, calculated as follows:

$$\boldsymbol{cpi_{H,t} = Y_{D,H} * (1 - s_H) \sum_{i=1}^{m} cpi_{i,t} * bs_i} \quad (3)$$

which depends on the good specific price growth, $cpi_{i,t}$, the budget share of good i, bs_i and the savings rate of the household, s_H.

Savings and Expenditure

The savings rate is lower for poorer households – across all countries. Lower-income households operate under tighter budget constraints, which significantly affects their ability to save. These households spend a larger proportion of their income on essential goods and

services, leaving less oom for discretionary spending or savings (Deaton, 1992). However, savings may also rise in economic challenging times as people have less confidence about the future. After the financial crisis of 2008-2012, the savings rate recovered significantly. This increase was driven by a heightened general risk aversion as people responded to the lasting impact of the crisis (Sologon et al., 2024). Hence, higher savings may result in more wealth and thus increased capacity to absorb changes in purchasing power.

During economic downturns, expenditure is often considered a more appropriate measure of welfare and inequality than income. This is because income can be volatile during economic crises, with sudden job losses or reduced wages affecting households. In contrast, expenditure reflects how households adjust their consumption to maintain their living standards despite income fluctuations. For instance, families may rely on savings, informal borrowing, or government transfers to smooth their consumption during tough times. Therefore, examining expenditure provides a more stable and comprehensive picture of actual living conditions and disparities between households during periods of economic distress (Glewwe and Hall, 1998).

Determinants of Financial Strain

The determinants of household welfare $W_H^*(F_H)$ can be summarised by the following equation:

$$W_H^*(F_H) = f\left(\frac{Y_{D,H}(E, w_t, b_t, t_t,)}{ES(F_H)}, TC_H, CC_H, HC_H, cpi_{H,t}, s_H\right) \quad (4)$$

Welfare is a function of employment (E), wage growth (w_t), social benefits (b_t), taxes (t_t), household's size and composition (equivalence scale $ES(F_H)$), commuting (TC_H), child-care (TC_H), and housing costs (HC_H); the price growth of each product consumed and its share in the budget in the household ($cpi_{H,t}$); and the households saving rates (s_H).

Overall, evaluating the welfare effect of policy responses during a financial strain situation requires a multifaceted approach, considering the variety of indicators that reflects the well-being of individuals or a society. Disposable income is a critical measure since it is the remaining income after taxes and transfers, and it directly affects purchasing power and net savings, and ultimately, overall welfare. By examining changes in income, consumption, savings, inflation, and employment, we can assess the overall impact on disposable income. However, it is not the only measure. Measures on the standards of living such as like access to housing, good environmental conditions, healthcare, education, or subjective well-being (SWB) can also holistically assess people's quality of life.

The aim of the article is to investigate the impact of various macroeconomic changes on a subjective measure of welfare measured by financial strain, based on our theoretical framework. Subjective well-being is defined by Diener et al. (1999) as "a broad category of phenomena that include people's emotional responses, domain satisfactions, and global judgements of their lives". Kahneman and Krueger (2006) suggest, "subjective well-being may have a useful role in the measurement of consumer preferences and social welfare, if they can be done in a credible way". In the field of income inequality, Ferrer-i-Carbonell (2005) and Clark and Oswald (1996) highlight that income relative to peers can be as important as their own income, however in a broader review of the literature, this effect is not always found (Ngamaba et al., 2018). While, there is a broad literature on subjective of well-being (Diener,

1984; Diener et al., 2018), this paper builds upon this literature by examining how macroeconomic factors influence subjective well-being through the lens of financial strain.

3. Methodology and Data

Our aim is to model the financial strain experienced by households in response to various macroeconomic changes across Europe. We utilise the cross-sectional dataset of the Survey of Income and Living Conditions (EU-SILC), covering data from the first wave in 2003 up to the most recent available wave in 2023. The EU-SILC dataset includes detailed information on household incomes, labour market characteristics, demographics, and living conditions, making it highly suitable for assessing the socio-economic factors underlying financial strain.

The EU-SILC is widely recognised and used for analysing poverty, inequality, and deprivation across European countries. Although data collection began in 2003, some countries joined the survey in subsequent years, making it an extensive source for longitudinal comparisons. To ensure that the sample is representative of the population, a weighting methodology is applied, adjusting for key demographic and regional attributes, including gender, age, region, and household composition.

Financial Strain

The EU-SILC does not collect an overall measure of subjective well-being for the period of study, unlike the British Household Pane Survey (Clark and Oswald, 1996) or the German Socio-Economic Panel (Ferrer-i-Carbonell, 2005). Only in waves 2013 and 2018, questions about life and job satisfaction variables were asked to the respondents. Nonetheless, the EU-SILC collect yearly information on satisfaction indicators related to the financial, housing and environmental situation. The questionnaire asks about the household ability to make ends meet; capacity to face unexpected financial expenses; financial burden of total housing costs: problems with the dwelling too dark, or not enough light; noise from neighbours or the street; pollution, grime or other environmental problems; and crime violence or vandalism in the area.

A growing body of literature have employed the EU-SILC to analyse financial strain (Cracolici et a., 2012), the impact of housing cost (Deidda, 2015), the mediating impact of financial strain on health status arising from job loss (Reeves et al., 2014; Huijts et al., 2015; Tøge, 2016; Mazeikaite et al., 2019). Following these studies, we develop a measure of financial strain as an indicator of financial well-being over time. To create this variable, we utilise a weighted average of the following variables:

- Problems with making ends meet;
- Problems with facing unexpected financial expenses;
- Housing Costs a Burden;
- Arrears on Utility Bills;
- Arrears in Mortgage or Rental Payments;
- Financial Burden of the Repayment of Debts or Loans

We weight these variables by employing the methodology suggested by Desai and Shah (1988), which involves assigning weights to variables based on their frequency within the population; in other words, factors that are more common receive lower weights. This methodology is grounded in the principle that a deprivation is more significant when it affects a minority of individuals rather than the majority. Additionally, this method accounts for choices regarding the deprivation threshold of ordinal variables, like the challenge of financial sufficiency. In

summary, the deprivation indicator (D_{FS}) adjusted for the number of component variables is characterised as:

$$D_{FS} = \frac{\sum_{j=1}^{n} D_{FS,j}}{n} = \frac{\sum_{j=1}^{n}(1 - p_j) \times k_j}{n} \quad (5)$$

Where p_j is the prevalence of each factor k_j in each particular year for the cross-section. Figure 2 describes the trend in these financial strain variables and its components over time. While we discuss the trends in more detail in next section, we note here both the general rise in financial strain during the latter part of the period, coinciding with the cost-of-living crisis, and the large variation in the share of high values for the component variables.[3] Given the difference in scale between components, there is a concern that the straight mean might be affected by this. To test the robustness of the indicator, we also construct an adjusted measure of the financial strain variable $\frac{D_{FS,adj}}{\overline{D_{FS,J}}}$, where we rescaled each component $D_{FS,j}$ by dividing by its inter-temporal mean $\overline{D_{FS,J}}$:

$$D_{FS,adj} = \frac{\sum_{j=1}^{n} {D_{FS,j}}/{\overline{D_{FS,J}}}}{n} \quad (6)$$

Although this adjustment gives each component the same weight in the average, a downside is that inter-country comparisons are not possible. The adjusted financial strain is only comparable across time within a country. We compare both indicators using a correlation coefficient displayed in Table 1. The results indicate that the correlation between the unadjusted and adjusted financial strain variable is reasonably high. The correlation coefficient is nearly 90% for the majority of the countries, and only less than 80% for Germany and Denmark.

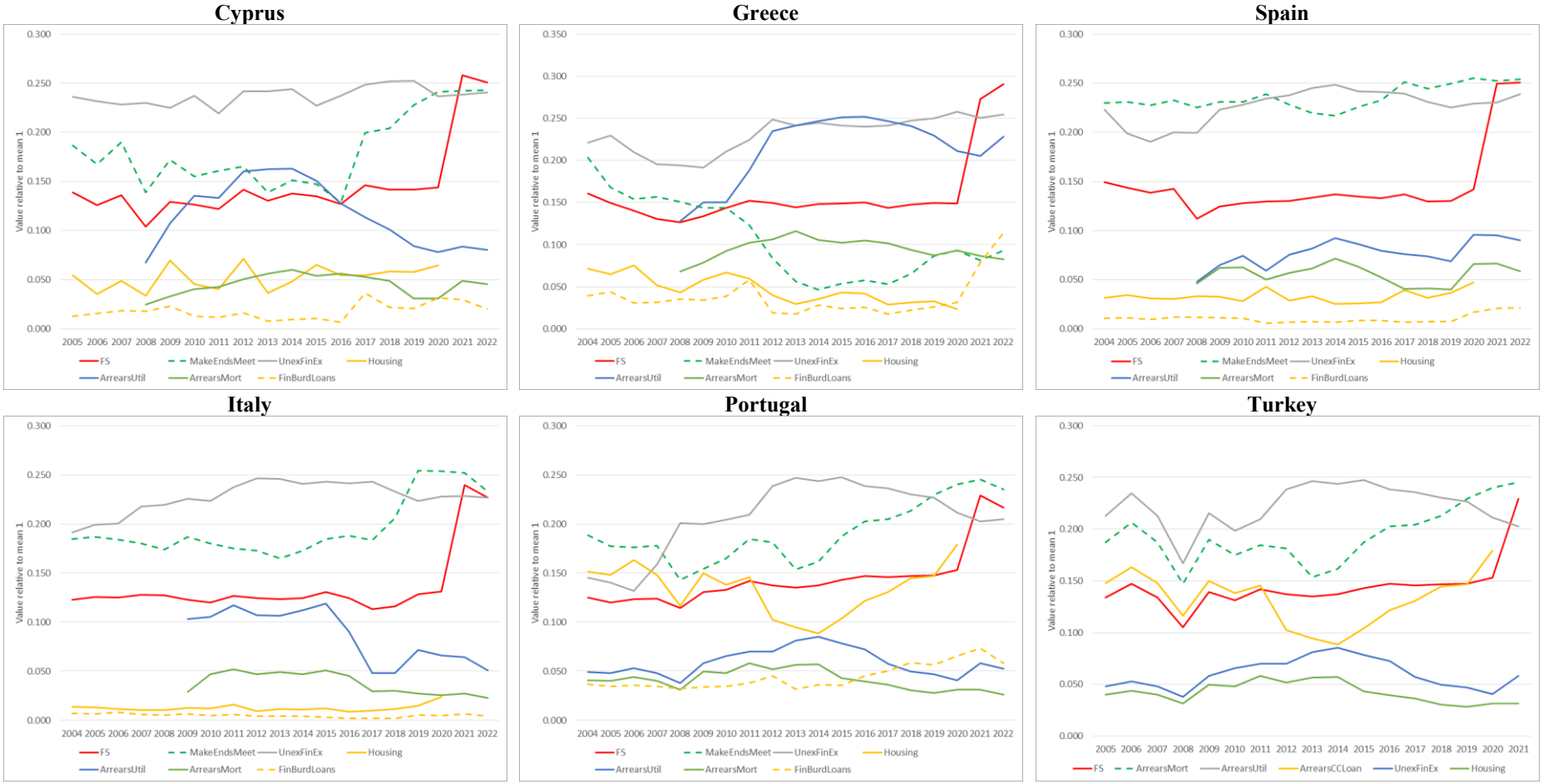
Table 1. Correlation between the Adjusted and Unadjusted Financial Strain Variable

Country	Correlation
CY	0.952
DE	0.771
DK	0.671
EL	0.972
ES	0.923
FI	0.908
FR	0.824
HR	0.969
HU	0.969
IE	0.927
IT	0.932
LT	0.872
LU	0.765
PL	0.911
PT	0.877
TK	0.930

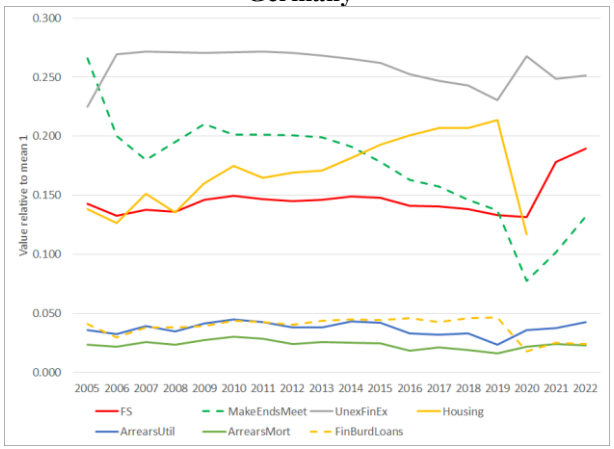
Note: The adjusted financial strain variable involves dividing each component index by its inter-temporal mean.

[3] Missing values were imputed keeping ratios with non-missing variables constant in some cases to avoid biases to the financial strain variable.

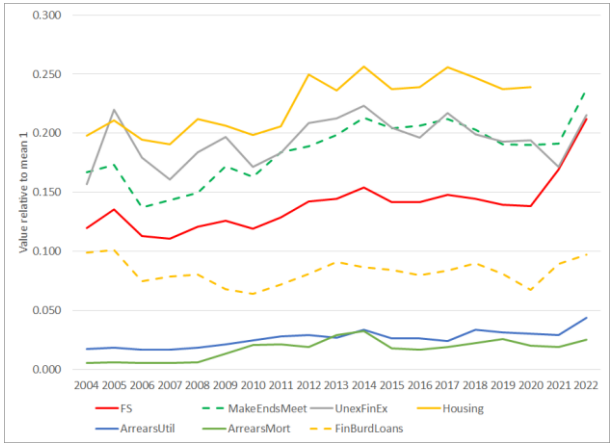
Figure 2. Components of Financial Strain



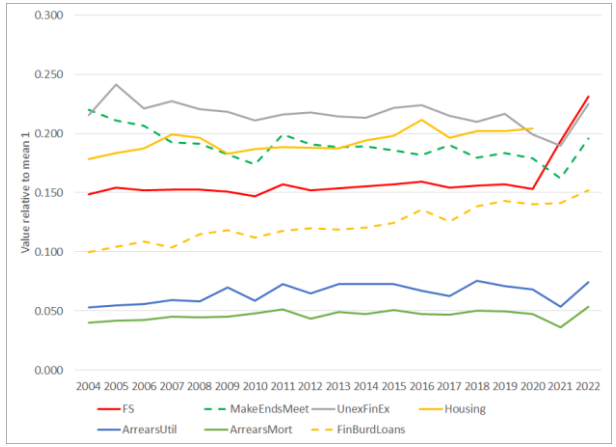
Germany



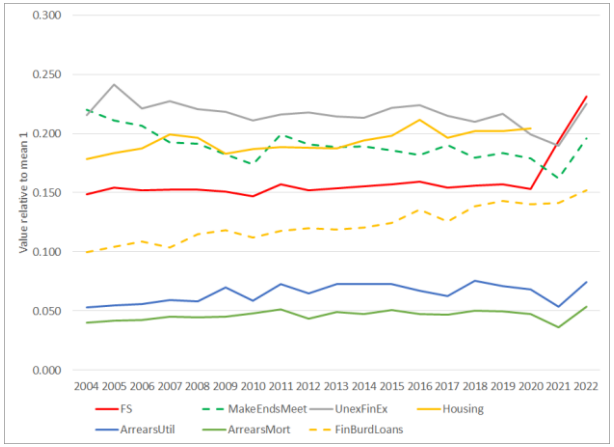
Denmark



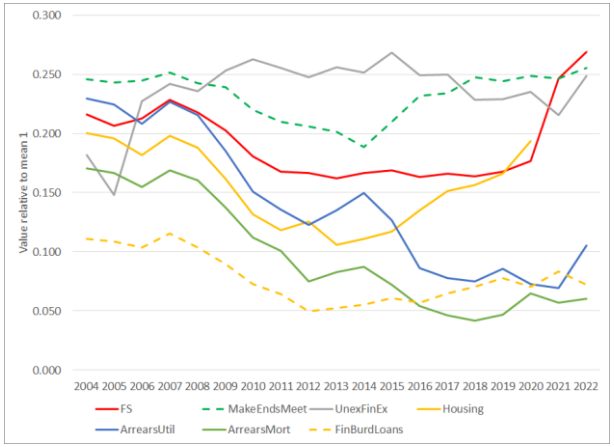
Finland



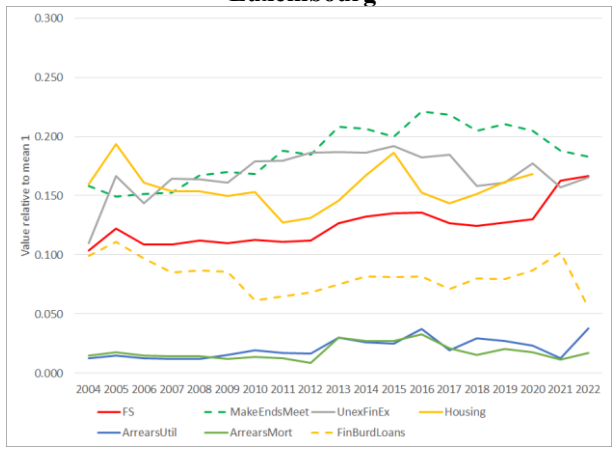
France

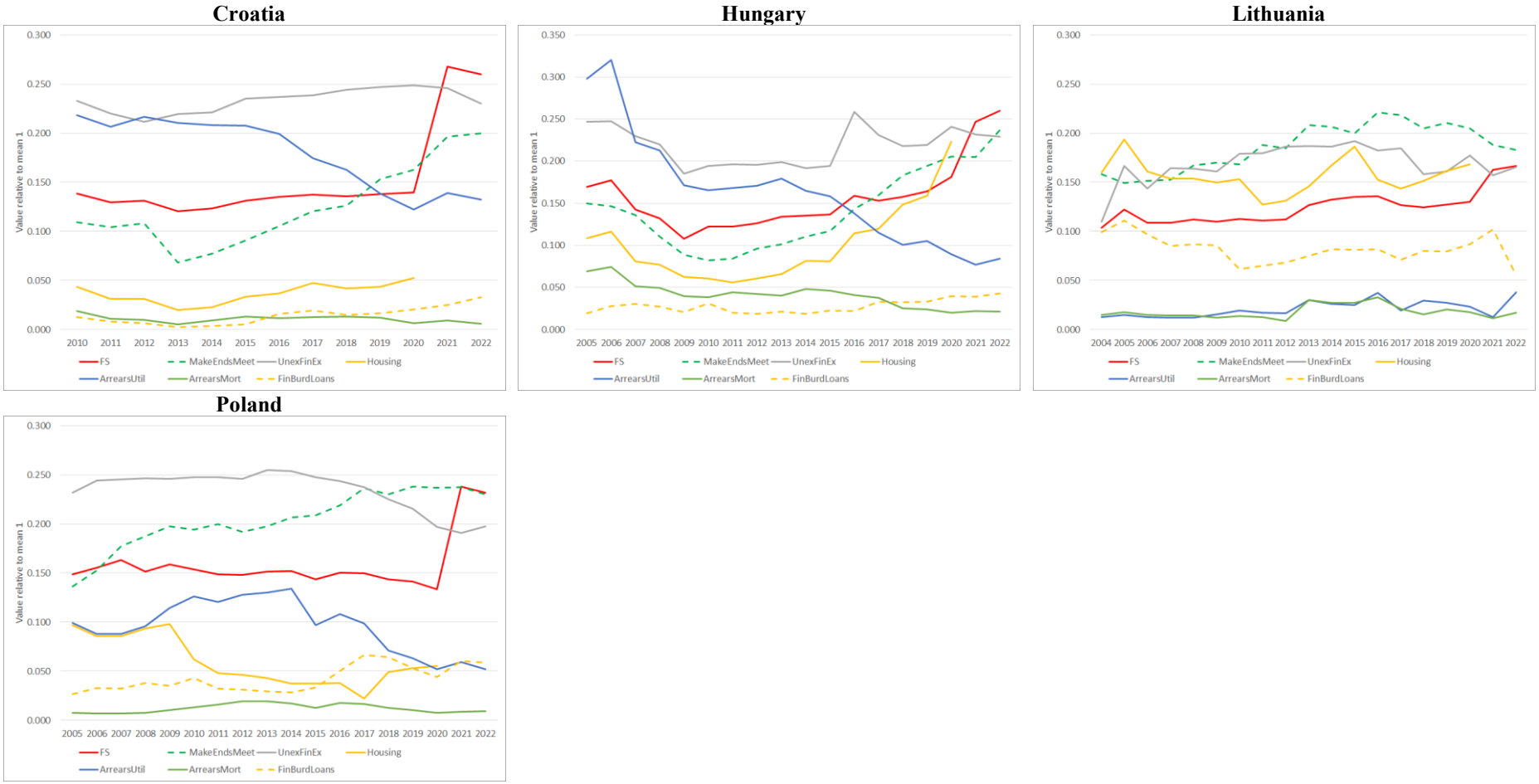


Ireland



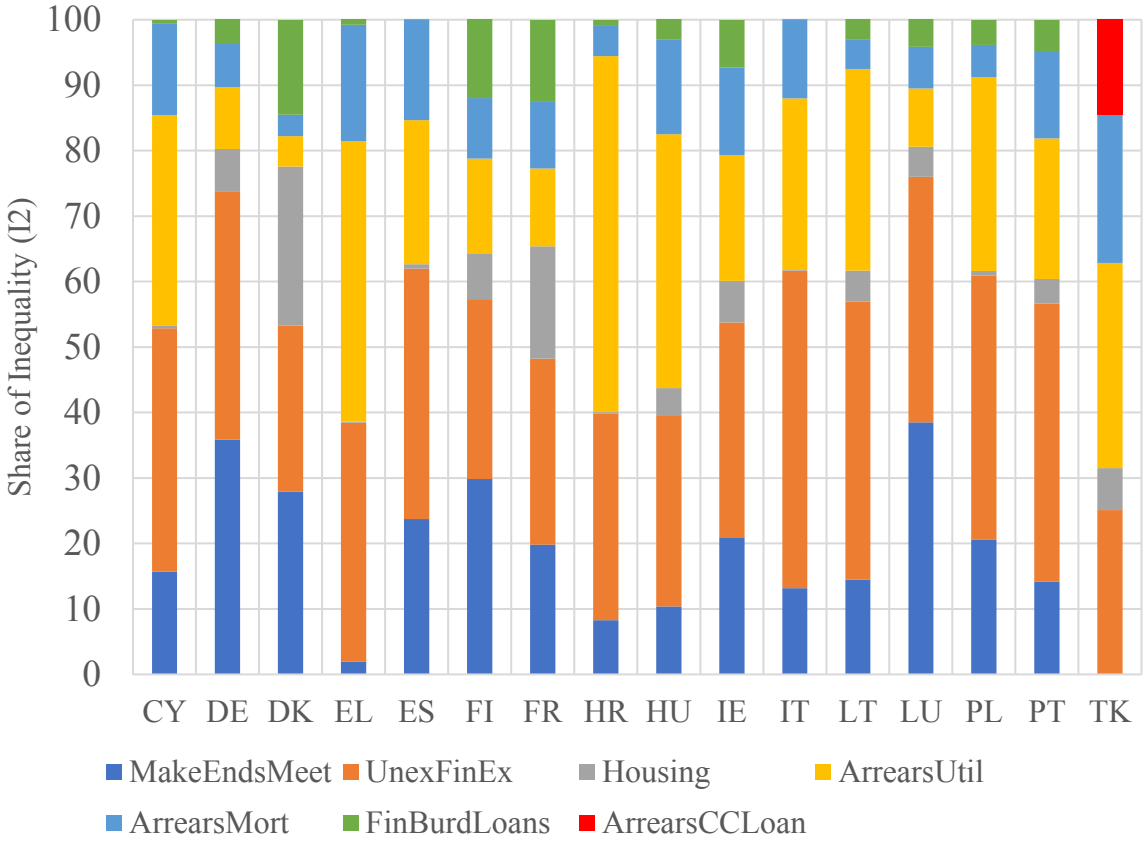
Luxembourg





Note: Variables in graphic. FS: Financial Strain; MakeEndsMeet: Problems with making ends meet; UnExFinEx: Problems with facing unexpected financial expenses; Housing: Housing Costs a Burden; ArrearsUtil: Arrears on Utility Bills; ArrearsMort: Arrears in Mortgage or Rental Payments; FinBurdLoans: Finanical Burden of the Repayment of Debts or Loans.

Figure 3. Share of Inequality (I2) of Financial Strain accounted for by different components



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In order to report the contribution of each component to the overall distribution of financial strain (as measured by I2, half the square root of the coefficient of variation), we use Shorrocks' (1982) factor decomposition statistic. Figures 3 shows the share of each component on the overall financial strain measure. The decomposition shows that the component "*Problems with facing unexpected financial expenses*" has the largest influence on the overall financial strain variable, having the highest rank in 9 countries. "*Problems with making ends meet*" and "*Arrears on Utility Bills*" have in general the next highest influence, with respectively 3 and 4 highest ranks.

Following the theoretical framework described in Figure 1, we employ a number of explanatory variables. The majority were drawn directly from the EU-SILC, including demographic variables such as age, marital status, education, number of children, rural residency, as well as disposable income[4], and housing costs. Other relevant variables are, however, not available in the EU-SILC dataset, such as childcare costs[5], commuting costs, savings rate, and purchasing power. To incorporate these additional explanatory variables, we require a survey with both incomes and expenditure data, such as the Household Budget Survey (HBS).

[4] In order to make disposable income comparable across years, we deflate it by the consumer price index.
[5] Albeit child care costs were collected in 2016.

Household Budget Survey

While housing costs are taken from the EU-SILC[6], other non-discretionary expenditures such as childcare or commuting costs are not asked in the survey. These costs are then drawn from the 2015 Eurostat harmonised Household Budget Survey.To introduce these variables into the EU-SILC, we apply a statistical matching technique that takes expenditure variables from the HBS and simulates them in the EU-SILC (Decoster et al., 2020). We employ a multi-stage parametric regression matching technique (Decoster et al., 2020) used in the statistical matching of expenditures for indirect tax analysis in EUROMOD (Akoğuz et al., 2020).

To make imputations from one dataset into another, it is important that both datasets cover the same population and that the common characteristics are defined in the same way. The matching processes are based on the "closeness" of the overlapping variables, which require that the variables used measure the same characteristics.

Another issue to consider in Engel curve estimations is the issue of zero expenditures, which can be due to infrequent purchases as well as abstention from consumption. This issue highlights that the reliability of the imputations relies upon a statistical model, which may be (slightly) miss-specified in the presence of zero-expenditures. The greater the level of disaggregation used, the greater the significance of zero expenditures. In addition, different definitions of the overlapping variables may also influence the quality of the imputation.

In practical terms, a model of total expenditure is firstly estimated utilising for each country the corresponding national household budget survey (B). The functional form of the model to be estimated is described below.

$$\boldsymbol{lnC_B = \alpha + \beta lnY_B + \gamma X_B + u} \quad (7)$$

Where C is the consumption, Y represents the income and X describes a vector of socio-demographic characteristics, detailed below. In order to avoid issues associated with transforming from logs, we limit the analysis to incomes plus or minus two standard deviations, assuming that the relationship is linear at the extremes. This is a variant of the same approach used by Akoğuz et al., (2020).

The natural logarithm of consumption and income are used since, typically, both follow approximately a lognormal distribution. The estimated coefficients (indicated with a hat) are then applied to the model dataset (Y) to obtain an imputation of total consumption:

$$\boldsymbol{lnC_Y = \hat{\alpha} + \hat{\beta} lnY_Y + \hat{\gamma} X_Y + u^*} \quad (8)$$

[6] Housing costs encompass the monthly expenses required to reside in a dwelling. These include utilities such as water, electricity, gas, and heating. Only expenses that are actually paid are considered, regardless of who pays them. Housing costs cover items such as structural insurance, mandatory services and charges (e.g., sewage and garbage disposal), routine maintenance and repairs, taxes, and utility costs. For homeowners, the calculation includes mortgage interest payments after accounting for any tax relief, without deducting housing benefits. For tenants, it includes rent payments, also without subtracting housing benefits from the total housing cost.

In order to reproduce the same variance of consumption in the Household Budget Survey (HBS), an error term (u^*) is generated that is normally distributed, with zero mean and a variance equal to the variance of the residual of the HBS regression. It is quite likely that the results are affected by heteroscedasticity; however, this problem only affects the standard errors of the coefficients, not their estimated value.

In order to introduce individual categories of expenditure, expenditure needs to be simulated for disaggregated sub-groups of expenditure, subject to the zero expenditure biases highlighted above. Consumption on particular goods is estimated as budget shares of total consumption bs_i, utilising Engel functions:

$$\boldsymbol{bs_i = \alpha + \beta lnC_B + \gamma(lnC_B) + \delta X_B} \quad (9)$$

Where bs_i is the i^{th} budget share, C is consumption as defined above and X is the same set of demographic characteristics used above.

In modelling aggregated expenditure groups, certain categories of goods and services are grouped together, typically based upon standard COICOP[7] groupings or for different indirect tax-rates to minimise the challenges associated with significant disaggregation. Grouping expenditures has the following advantages:

- It reduces the impact of the zero expenditures problem, which could substantially undermine the results of ordinary least squares (OLS) regressions.
- The estimates for smaller groups of goods could be unstable.

From these regressions carried out on the HBS, only the coefficients, not the residuals are used. In order to take into account the problem of zero expenditures due to infrequent purchases, the simple use of estimated coefficients without residuals, attributes to nearly all households a positive share for each good.

Using the OLS method guarantees that the sum of the imputed shares is one, but some of them may be negative (the sum in absolute value is greater than one), which is not acceptable. This problem can be solved by setting negative shares to zero, and correcting the other shares proportionally, so that the sum is still one for each household.

Equation (10) imputes a measure of total expenditure E_H within the EU-SILC, which when combined with Disposable income produces a measure for the savings rate s_H:

$$E_H = Y_{D,H}.(1 - s_H) \quad (10)$$

Applying simulated budget shares to total expenditures gives an estimate of sub-group expenditures $\boldsymbol{E_{H,i}}$ on childcare costs and commuting costs in the EU-SILC:

$$\boldsymbol{E_{H,i} = Y_{D,H}.(1 - s_H).bs_i} \quad (11)$$

[7] The Classification of individual consumption by purpose.

These together with the EU-SILC defined housing cost are transformed to being a share of disposable income to avoid multi-collinearity.

Household Inflation Rate

Combining with the sub-group specific CPI figures, a measure of household purchasing power or a household specific CPI is derived. In order to impute the household inflation rate, drawn upon the commodity group inflation rates produced by Eurostat, household specific budget shares and an imputation of the relationship between household disposable income and expenditure are required. The Eurostat Household Budget Survey for 2015 is used as a source of expenditure data. Although harmonised, there are some harmonisation issues in relation to the definition of disaggregated expenditures (De Agostini et al., 2017), and in relation to the quality of the disposable income variable, which is a key variable used to link the two files.

4. Results

We divide the results into three sections, a description of the pattern of financial strain over time, an exploration of the relationship between financial strain and adjusted disposable income (accounting for non-discretionary expenditures) and lastly regression results in relation to the relationship between financial strain and individual components.

Financial Strain

Figure 4 reports the trend in average financial strain over time, broken into three regional groupings, Southern Europe, North and Western Europe and Eastern Europe between 2005/6 and 2022[8]. Fundamentally, the dominant trend across all countries is the peak of financial strain during the pandemic and the cost-of-living crisis.

In Southern Europe, we see two broad periods, a period of small variations at the start of the period prior to the pandemic and the cost-of-living crisis then a large increase in financial strain associated with this crisis. Southern Europe has seen, from a regional perspective, the most consistent trend across countries within the region. The financial crisis saw short-term increases in financial strain in each country except for Italy with a steady indicator until 2011 during the period of the bailout. Italy in general had the lowest rate of financial strain, albeit following the same trend, with Greece in general having the highest rate. Except for Greece, most countries experienced a slightly lower level of financial strain during the cost-of-living crisis than during the pandemic.

In North and Western Europe, the pattern is less consistent and with a broader range than in the other regions. While most countries have relatively low financial strain followed by an increase at the time of either the pandemic or the cost-of-living crisis, Ireland had a relatively high level of financial strain around the time of the Celtic Tiger prior to the financial crash. However, after the financial crash, financial strain actually fell. This was likely in part to a large change in expenditure patterns and an increase in savings due to the scale of the shock, (O'Donoghue et al., 2024). In Figure 2, we see that all components of financial strain declined during the financial crisis, except "Problems with facing unexpected financial expenses". Irish financial strain grew the highest in the pandemic and the cost-of-living crisis. France's financial strain, although lower than in Ireland at the start of the period was amongst the highest in North and West Europe since the financial crisis. Luxembourg generally had the lowest level of financial

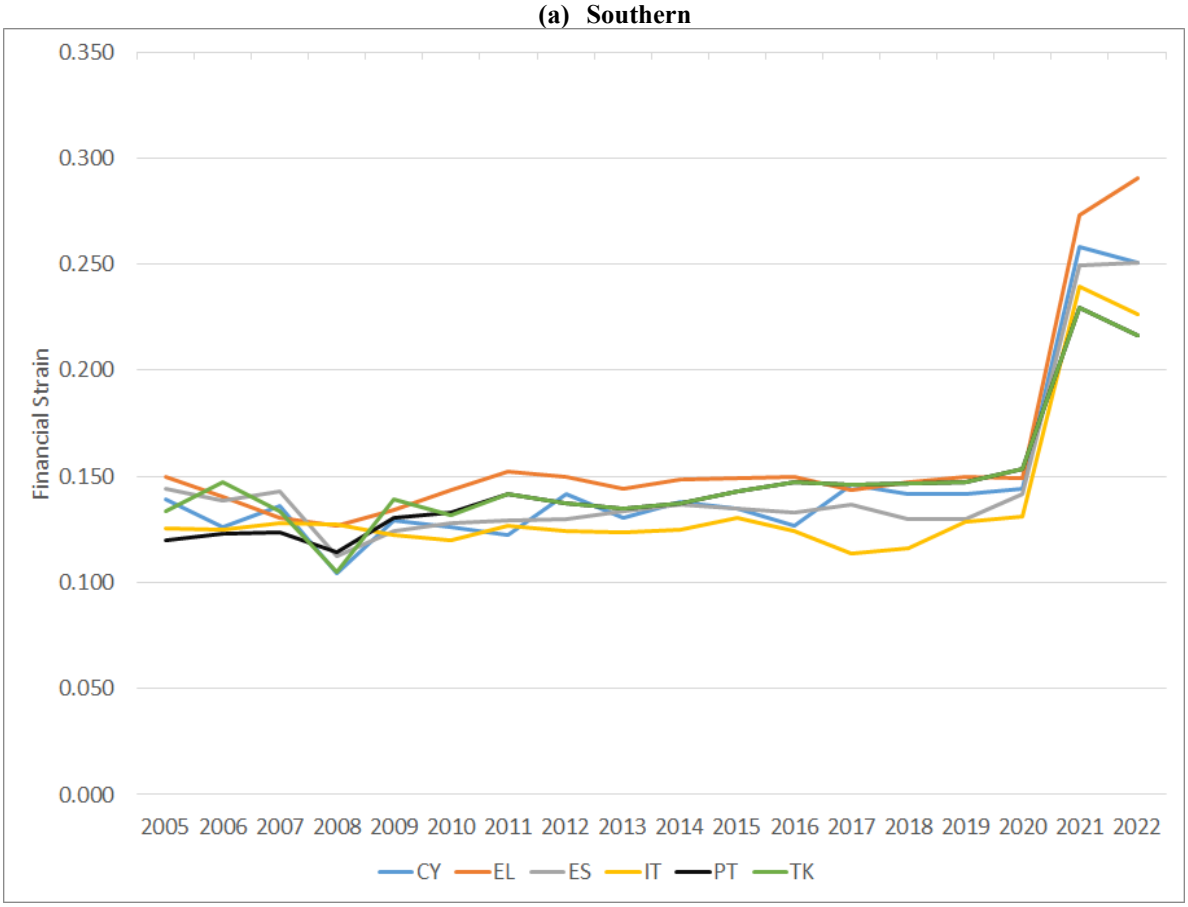
[8] 2023 for Turkey.

strain throughout. Denmark started relatively low but increased after the financial crisis to German levels, which had been the most stable over the whole period. Finland's level was mid ranked throughout. Unlike in Southern Europe, financial strain increased in 2022 relative to the Pandemic.

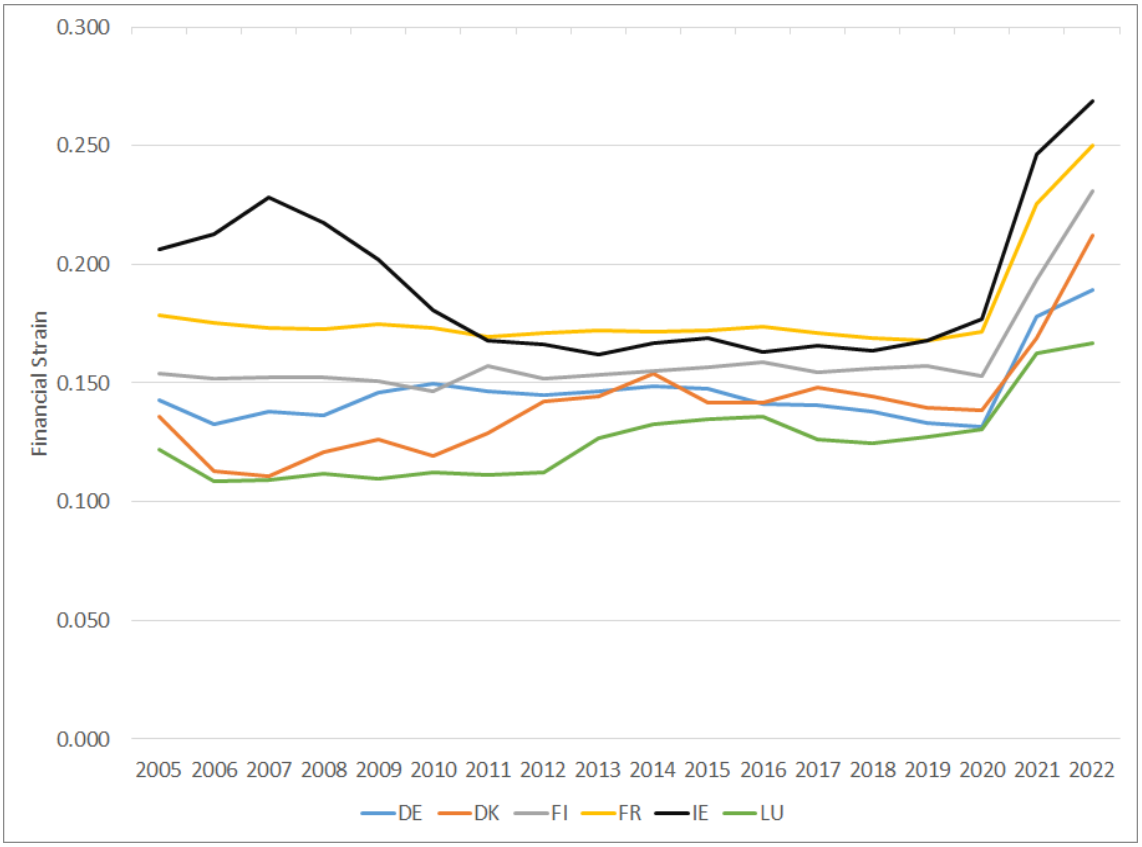
Southern Europe, Poland and Hungary saw reduced or falling financial strain after EU membership and around the financial crisis, followed by a stable period and an increase in financial strain in the later period. Poland and Croatia exhibited a similar pattern to Southern Europe during the pandemic and the cost-of-living crisis, with an increase in the pandemic and then a slight decline during the cost-of-living crisis. Hungary and Lithuania see a peak during the cost-of-living crisis.

Figure 4. Trends in Average Financial Strain over Time

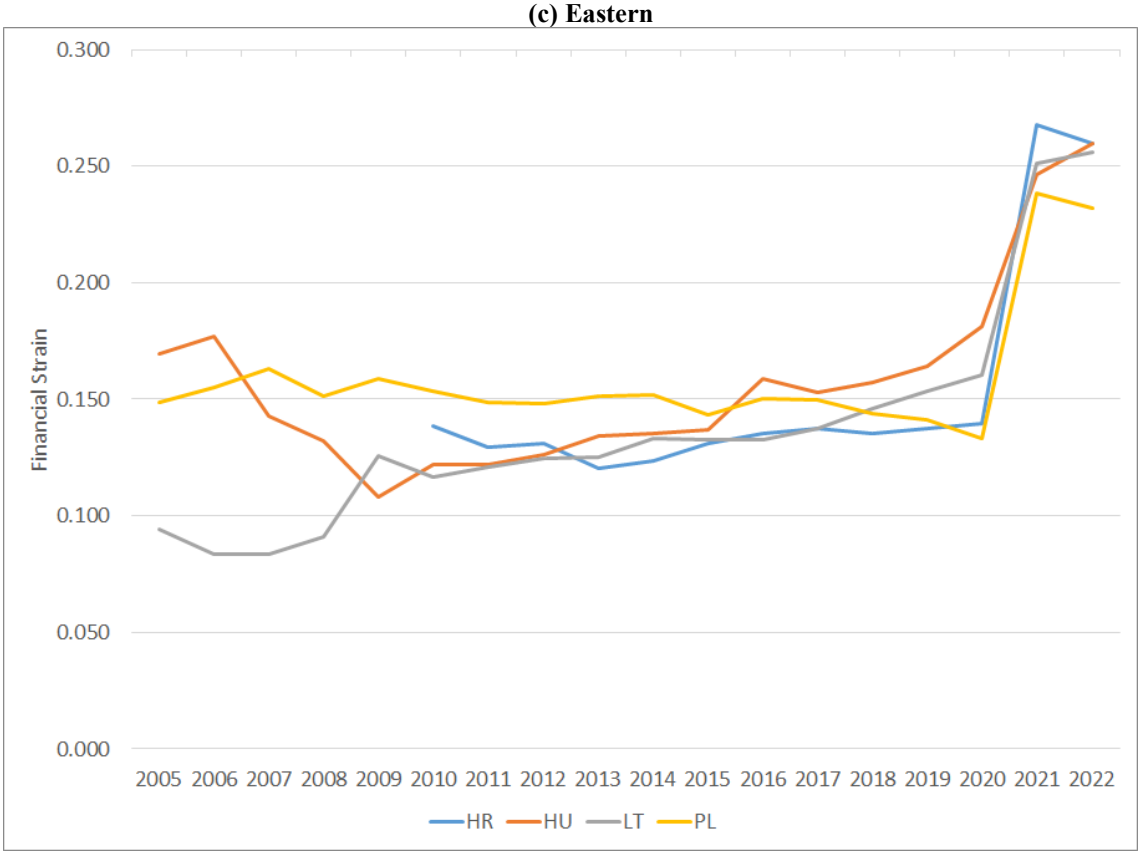
(a) Southern



(b) North and Western



(c) Eastern

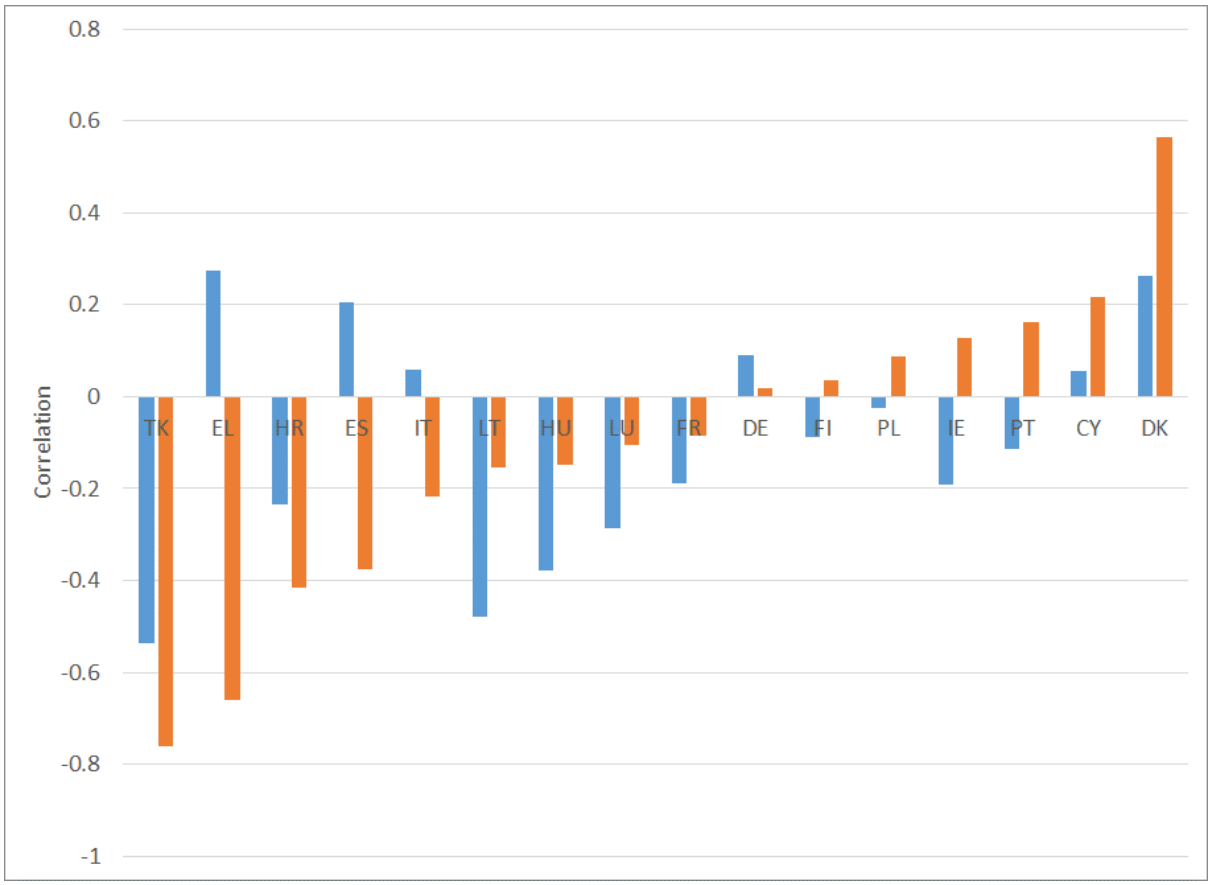


Source: Authors' calculations using EU-SILC

Figure 5 reports the correlation between the average household consumer price index (weighted for individual household consumer patterns and financial strain for two periods, the entire

period 2004/5-2022 and post financial crisis from 2012. Fundamentally, there is not a clear story. Although, there is clearly a spike in financial strain during the cost of living crisis, there is quite a large range of correlations between the two variables across countries. At either extreme Denmark has the highest positive correlation and Turkey has the lowest negative correlation. In general, more countries have a negative correlation than a positive correlation, so that in periods of low inflation, movements in inflation are not strongly related to financial strain, albeit this changes during a period of higher inflation. For most countries, the correlation remains the same for both periods, however for Portugal, Ireland, Italy, Greece and Spain, the so called PIIGS which had amongst the largest impact of the financial strain, changed sign before and after the financial crisis.[9]

Figure 5. Time trend of Components of Adjusted Disposable Income, CPI and Financial Strain 2006-2022



Source: Authors' calculations using EU-SILC

Financial Strain and Adjusted Disposable Income

Figure 6 reports the trend in components of average adjusted disposable income (Income, commuting, childcare and housing costs), together with the trend in financial strain variable reported in Figure 4. It should be noted that we report disposable incomes not for the survey year, but the income-reporting year, so that the 2019 EU-SILC reports incomes for 2018. Figure

[9] Finland also changes sign, however the correlation is relatively low.

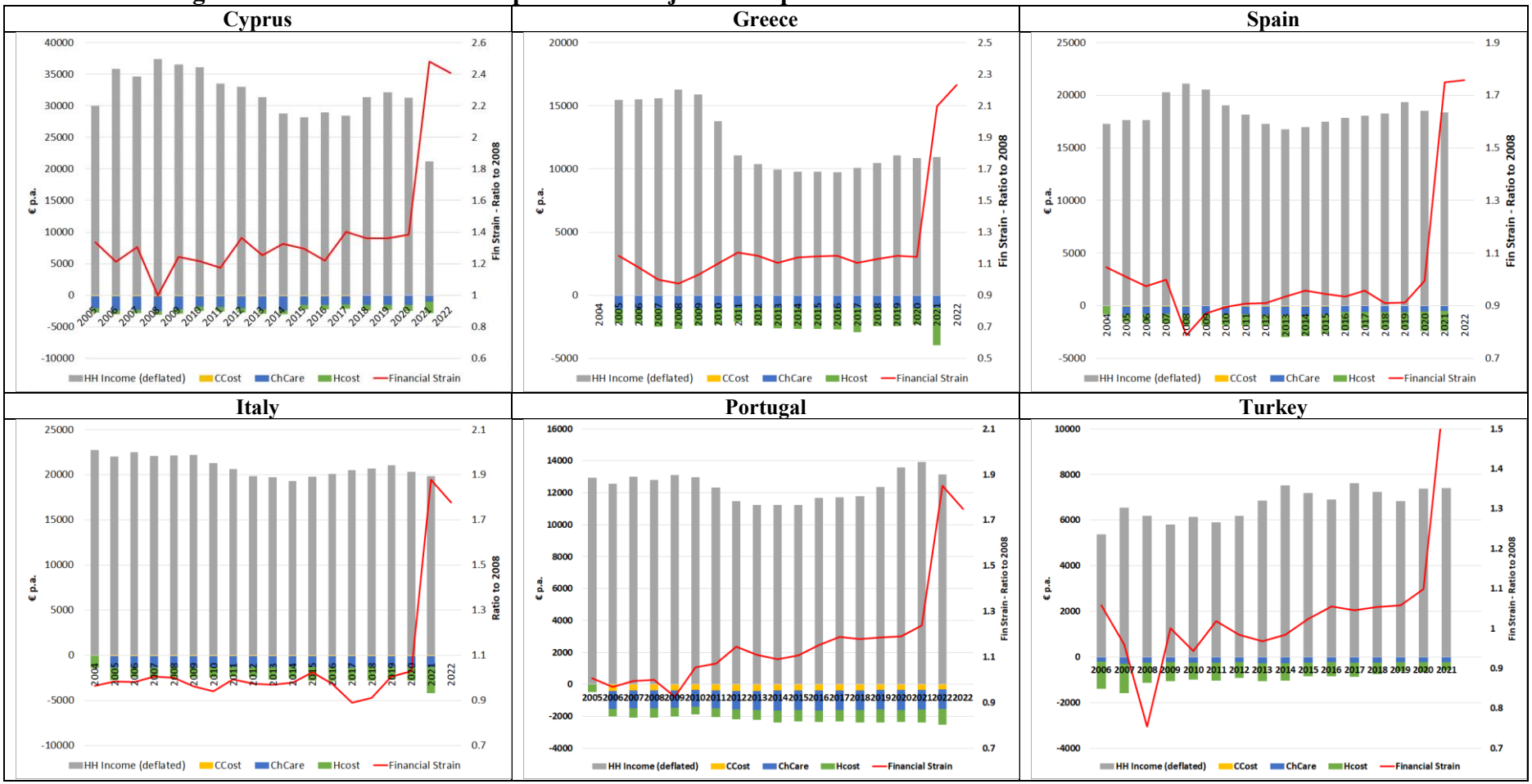
7 summaries the relationship between the trend in financial strain and non-discretionary expenditures.

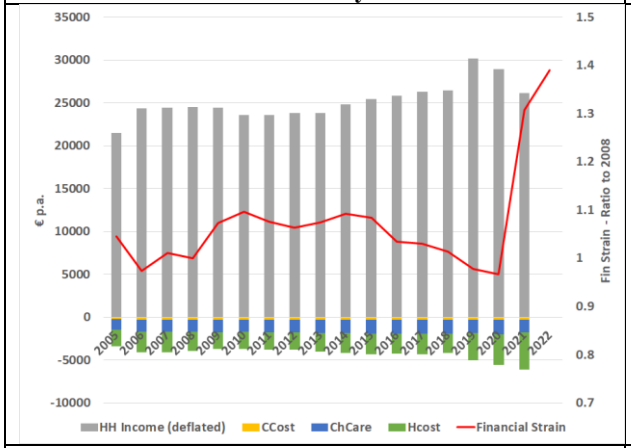
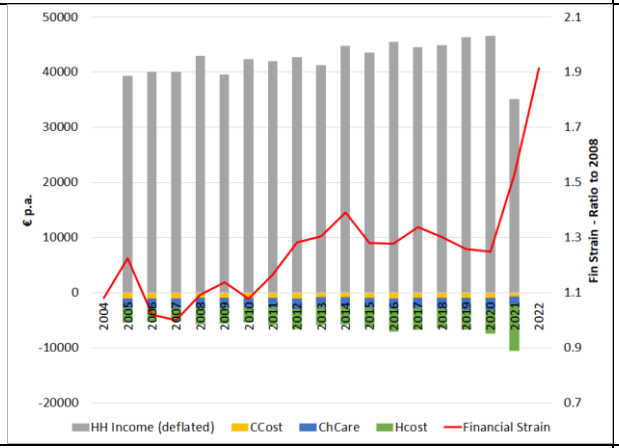
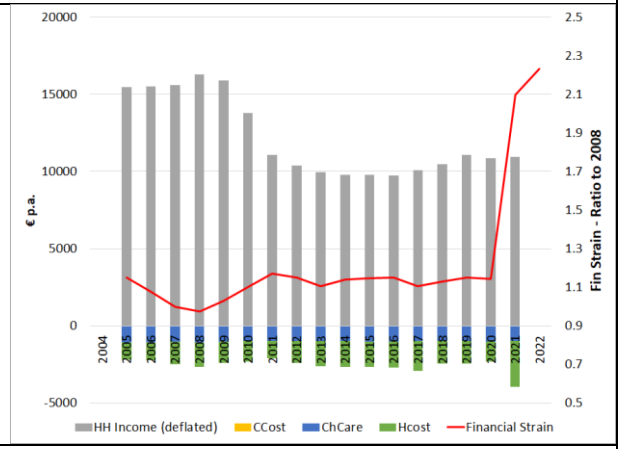
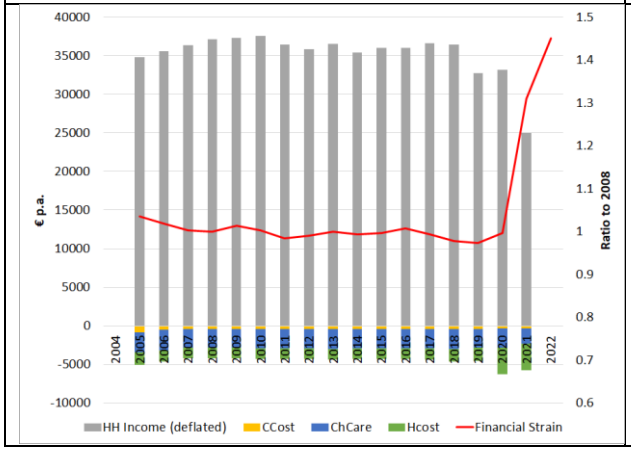
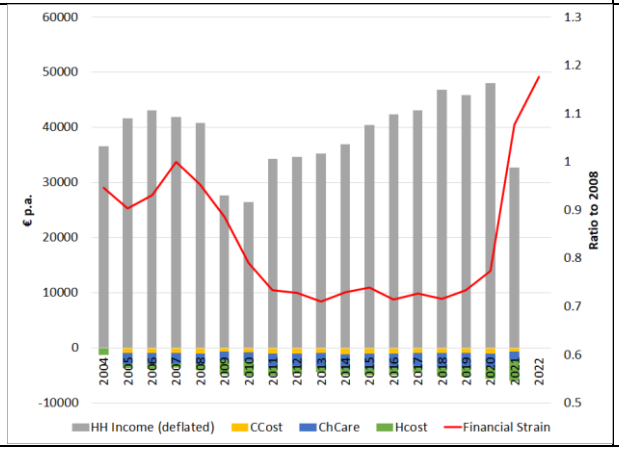
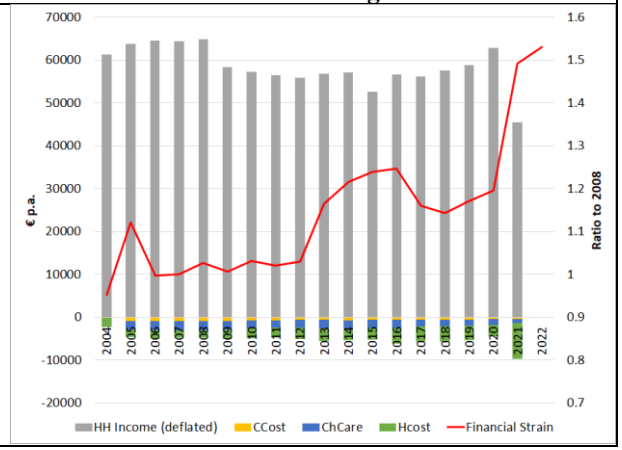
Considering first the Southern European countries, we observe the decline and recovery of real disposable income during the time of the financial crisis. Greece had the deepest and most prolonged impact on real living standards. Italy had the lowest dip in real disposable income, while Turkey prior to 2022 had the large increase in real disposable income. Greece say an increase in financial strain in the financial crisis but it levelled out as incomes flattened. Non-discretionary expenditures, particularly housing grew when incomes fell, but there was not an appreciative change in financial strain. However, as these costs grew in the cost-of-living crisis, financial strain rose as well. Overall, the correlation between financial strain and non-discretionary expenses is rather low. The correlation is also low for Turkey due to the falling share of non-discretionary expenses driven by housing costs over time. The correlation is higher for the other Southern European countries. After the crash, financial strain, remain fairly low despite relatively high price inflation. However, this turned after the pandemic with higher financial strain associated with extraordinarily high prices, growing faster than disposable income.

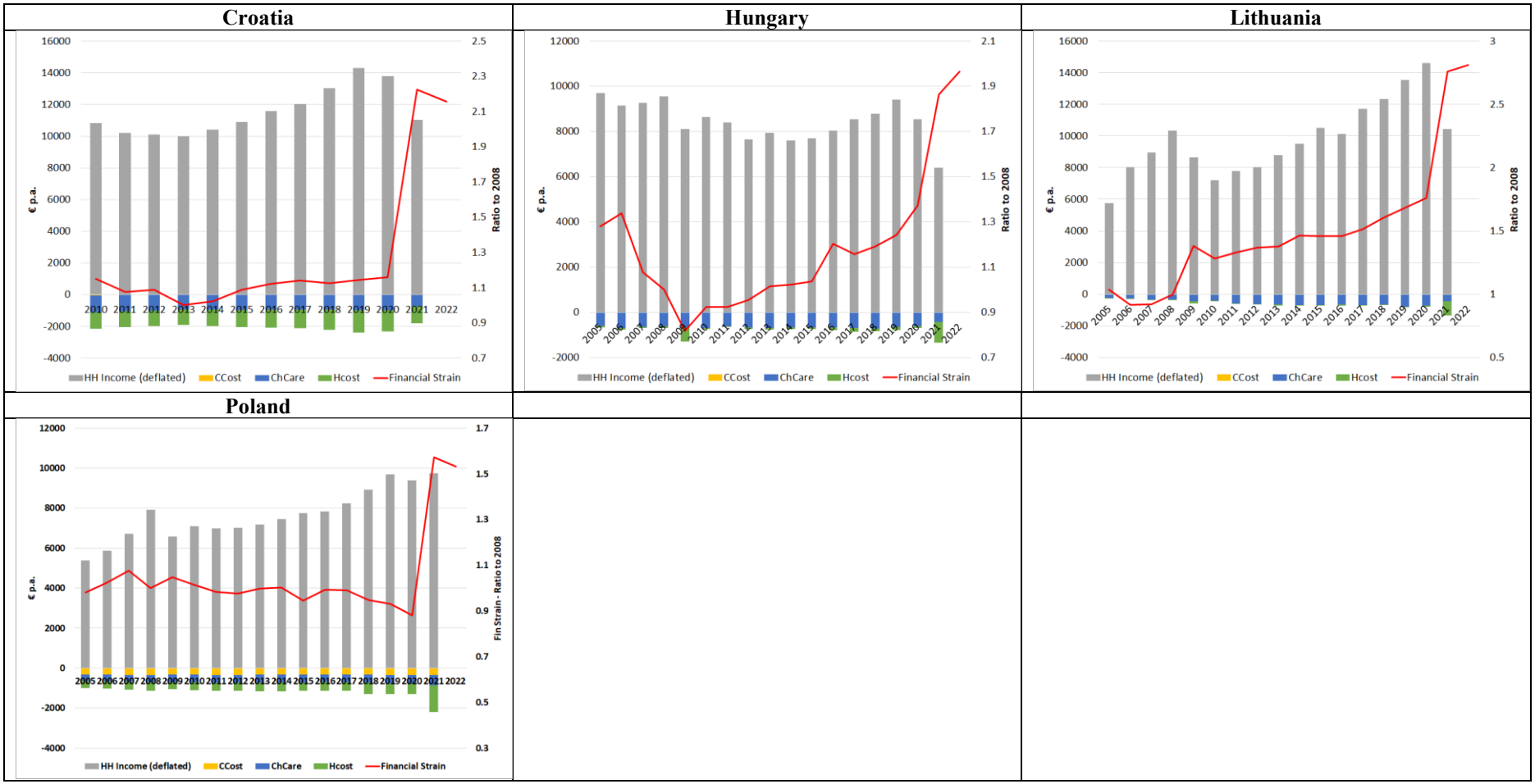
In Spain, financial strain fell during a period of rising real disposable incomes before the financial crash and rose over time as real incomes fell during the crisis. Financial strain rose again substantially as non-discretionary expenditures grew during the pandemic and cost-of-living crisis. In Italy financial strain varied only slightly prior to the recovery from the financial crisis, where financial strain fell as real incomes rose, but increased rapidly during the cost-of-living crisis when real disposable income fell. Portugal saw an increase in financial strain during the financial crisis, as real disposable income fell. It continued to fall as incomes stabilised, and then rose again as non-discretionary expenditures rose as a share of disposable income and as real disposable income increased. In Turkey, which experienced an increase in financial strain during the financial crisis following a decline prior to the crash, followed by a long period of increase in real disposable income until 2014.

In North and West Europe, the patterns are different, with different their macro-economic environment. Germany saw an increase in financial strain in the financial crisis, followed by a period of flat financial strain for a number of years as real incomes were steady. After mid-2010's financial strain saw a decline with the increases in real incomes until the end of the decade. Financial strain fell before and during the pandemic as real incomes rose, while financial strain rose rapidly as real incomes fell in the cost-of-living crisis. In Denmark, it is hard to explain the trend of rising financial strain with real incomes in the middle period, however there was a significant average increase in non-discretionary expenditures. Like Germany, real disposable income rose during the pandemic, while real disposable incomes only fell slightly during the cost-of-living crisis, albeit non-discretionary expenditures rose a good deal, seeing financial strain rise. Finland, perhaps reflecting the strong welfare state has had a very modest movement in both real disposable incomes and financial strain over the whole period, except in the pandemic and cost-of-living crisis. France too experienced a period of reasonably static financial strain and real disposable incomes, however with an increase in financial strain during and after the pandemic as real disposable incomes fell. After a period of rising financial strain before and during the start of the financial crisis, Ireland saw a period of falling financial strain, despite a decline in real incomes. It was accompanied by a period of low and declining costs and falling declines in non-discretionary expenditures. This was followed by a strong recovery with growing real disposable incomes associated with low financial strain, with financial strain rising in the pandemic and cost-of-living crisis.

Figure 6. Time trend of Components of Adjusted Disposable Income and Financial Strain 2006-2022

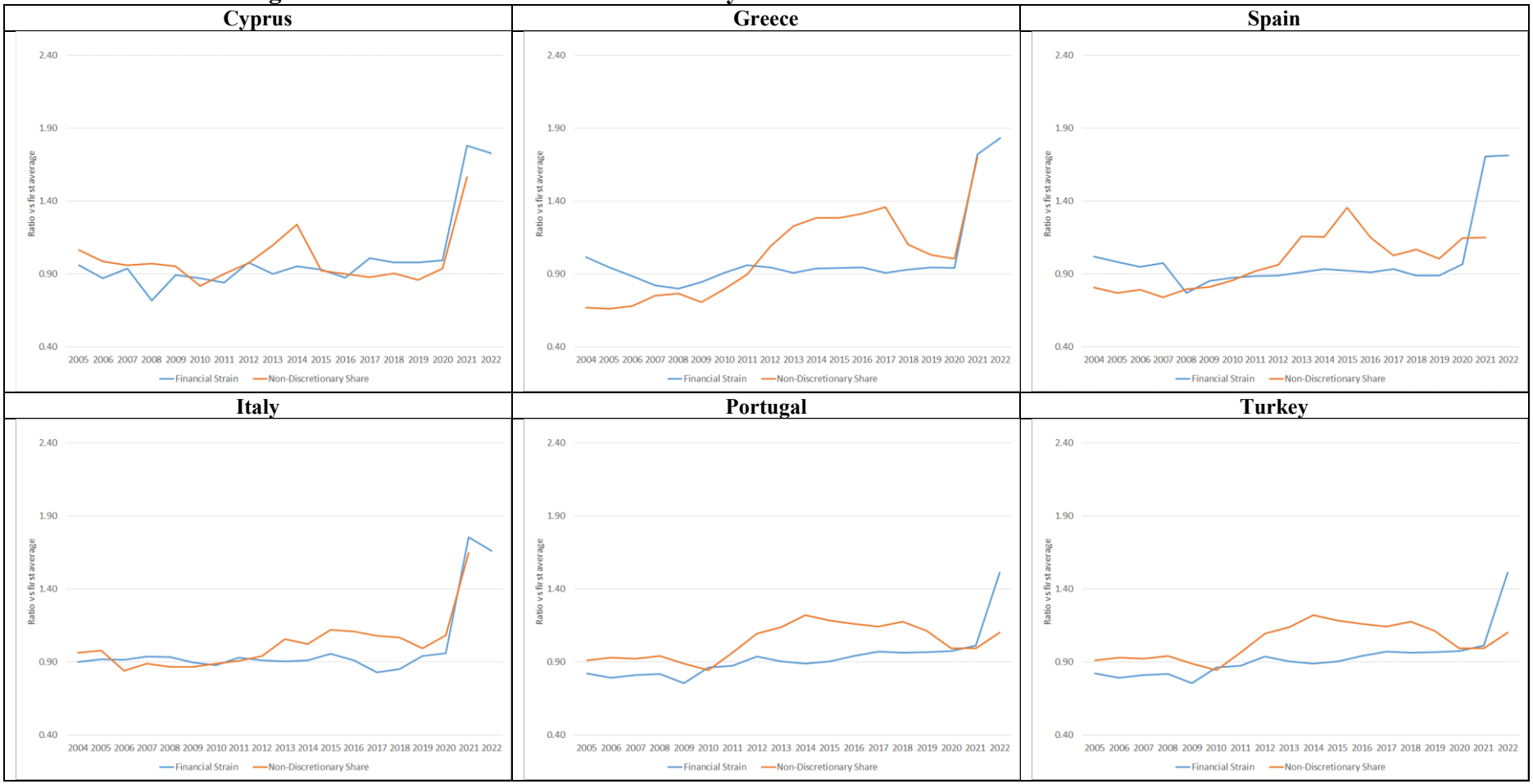


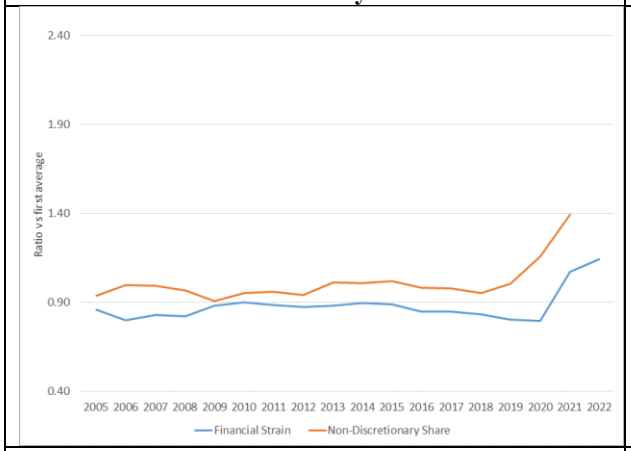
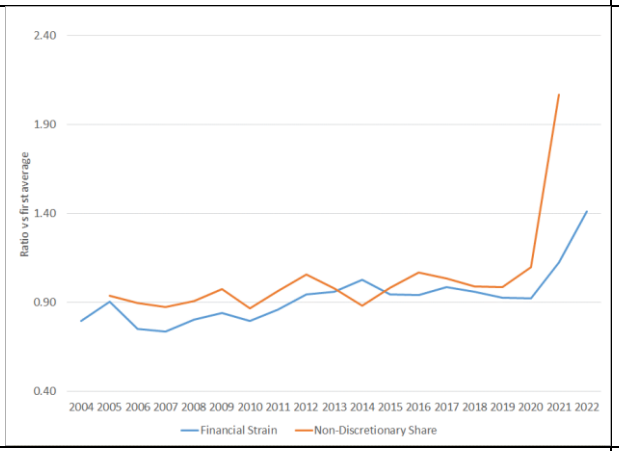
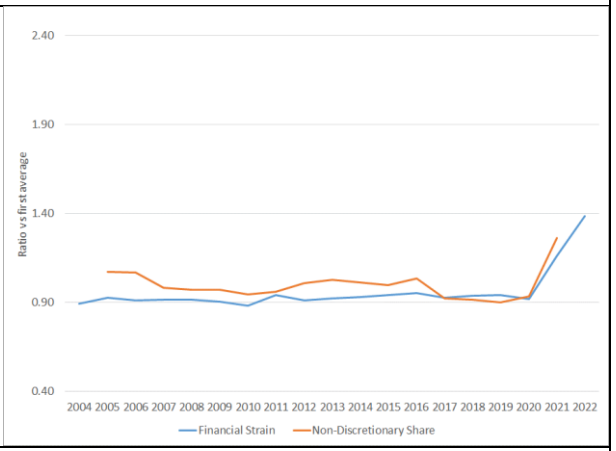
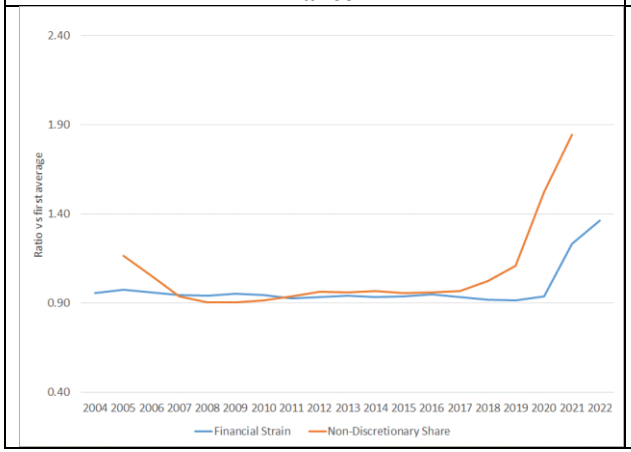
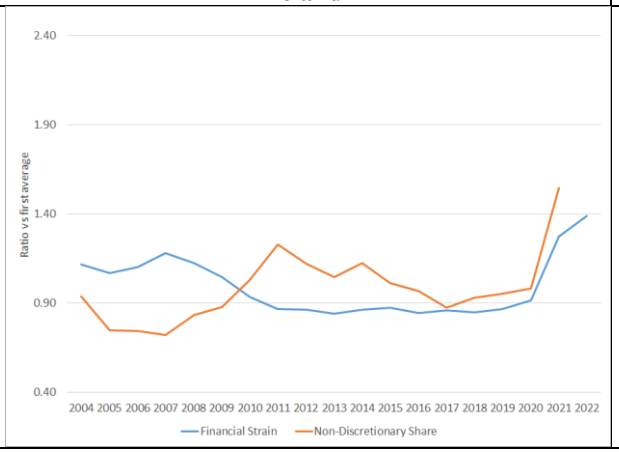
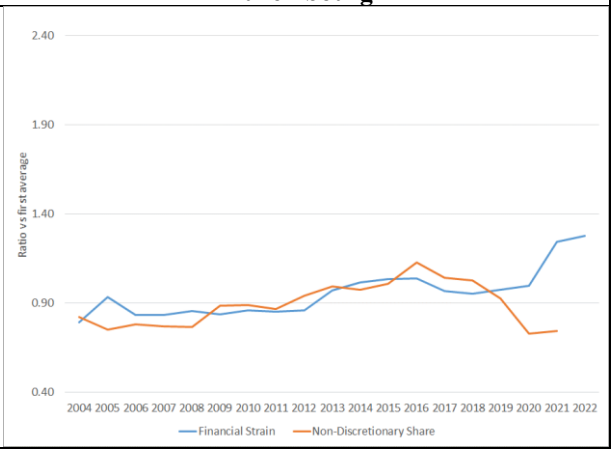
Germany	Denmark	Finland
		
France	**Ireland**	**Luxembourg**
		

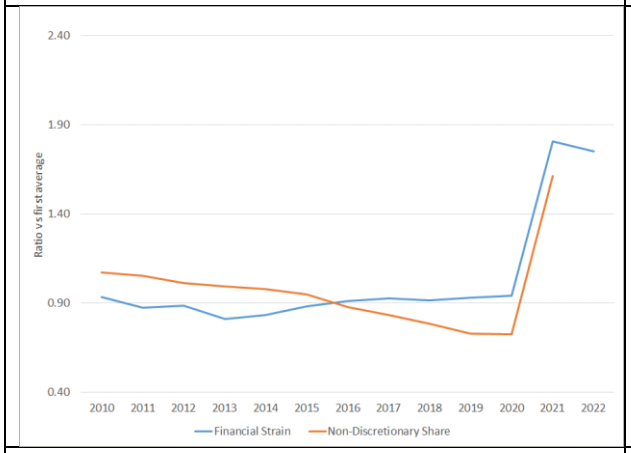
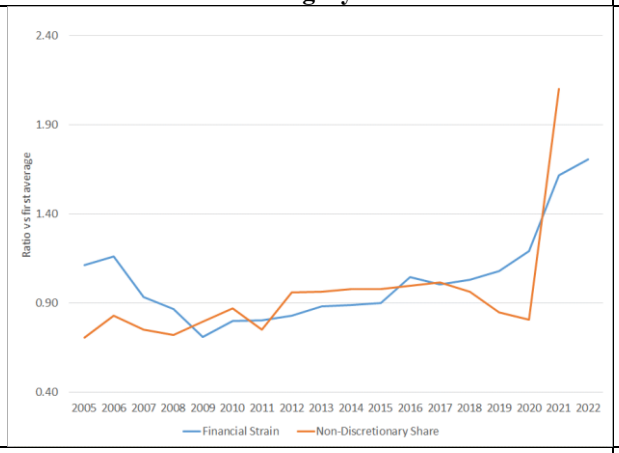
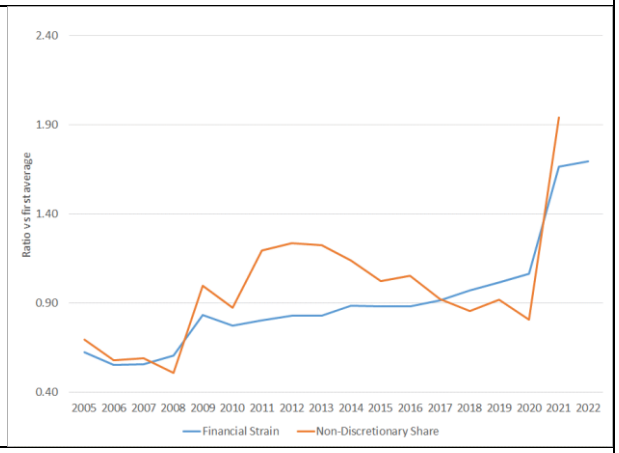
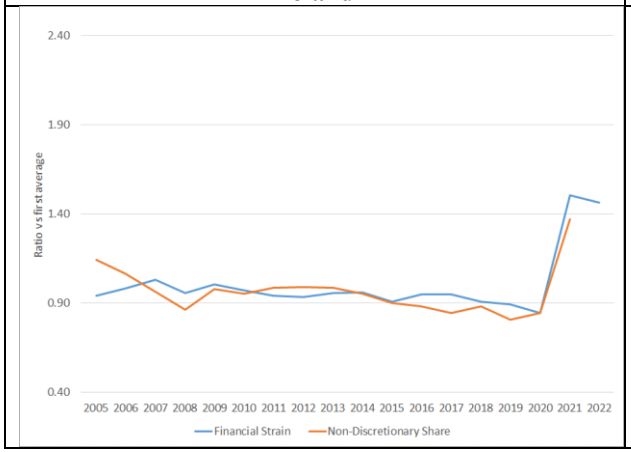


Note: Adjusted Disposable Income components (Income, Commuting (CCost), Child Care Cost (ChCare) and Housing Cost) and are deflated by CPI. HH CPI – Household specific consumer price index.

Figure 7. Time trend of non-Discretionary Costs Share and Financial Strain 2006-2022



Germany	Denmark	Finland
		
France	**Ireland**	**Luxembourg**
		

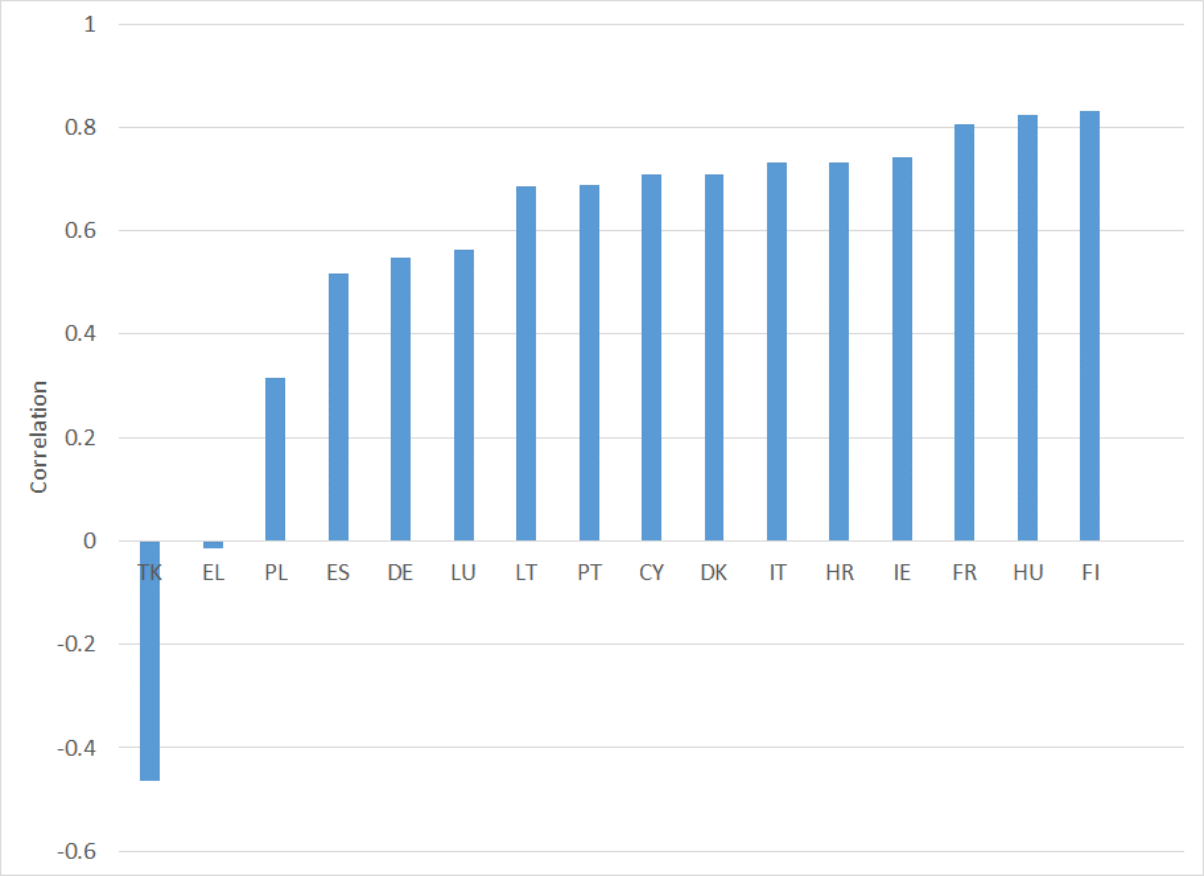
Croatia	Hungary	Lithuania
		
Poland		
		

Note: Non-Discretionary Costs: Commuting (CCost), Child Care Cost (ChCare) and Housing Cost) as a share of disposable income

Luxembourg experienced a period of falling real disposable income after the financial crisis, associated with flat financial strain. However afterwards financial strain rose as non-discretionary expenditures increased, before falling back again as real disposable incomes rose, rising again during the pandemic and rose again real disposable income fell. Overall, there is a high correlation between non-discretionary costs and financial strain in these countries.

In Eastern Europe, there is a consistent story with real disposable income falling in each country after the financial crisis and growing again as economies recovered, particularly in Lithuania. The correlation between financial strain and real disposable income is not clear cut before the cost-of-living crisis and the pandemic. Lithuania saw financial strain rise during the financial crisis. In Hungary, there was a step decline in financial strain prior to the crash and then a long period of increases as firstly real disposable incomes fell, before rising as non-discretionary expenditures rose. Except for Poland, each country had a strong correlation between non-discretionary expenditures and financial strain.

Figure 8. Correlation between Financial Strain and Non-Discretionary Expenditures



Regression Results

Table 2 reports regression coefficients using individual micro data for financial strain against the variables considered in the theoretical framework in section 2 described above. In an initial examination of the results, we find that in general the demographic variables are consistent with the theory, with financial strain increasing with age, but at a declining rate. Males in general experienced lower financial strain, with the gender differential strongest in Southern Europe and weakest in Eastern Europe. Except for households with young children in Eastern

Europe, the presence of children is associated with higher financial strain, while higher education is associated with lower financial strain across Europe.

The relationship at a micro level with real disposable income is consistently negative in general with a strong association at micro level between the cost of living and financial strain, with individual baskets being important. Housing costs are consistently strongly related to financial strain; however, amongst other non-discretionary expenditures the effect is less strong, as it is difficult to unpick the fact that those who work, and have higher incomes also have higher childcare and commuting costs. In Eastern and Southern Europe, where necessities form a higher budget share (Sologon et al., 2022) than in Western Europe, the household CPI is strongly related to financial strain, being positive and significant in nearly every case. In Western Europe, the household CPI is either not significant as in the case of France and Germany or taking the opposite sign in Luxembourg¸ Finland and Denmark as real incomes are more important. The sign is positive and significant in Ireland.

Table 2. Regression Results of Financial Strain OLS Model

	CY	DE	DK	ES	FI	FR	HR
Age	0.0022***	0.0082***	0.0069***	0.0032***	0.0066***	0.0047***	0.0026***
Age Squared	-0.000032***	-0.000095***	-0.000092***	-0.00004***	-0.000082***	-0.0001***	-0.000032***
Male	-0.0033***	0.0059***	-0.0087***	-0.0019***	-0.0103***	-0.011***	0.0023***
Married	-0.0144***	-0.0391***	-0.027***	-0.0255***	-0.0164***	-0.0244***	-0.0142**
Number of CH 0-4	0.011***	0.0134***	0.0239***	0.0107***	0.0186***	0.0328***	-0.0025***
Number of Ch 15-20	0.0038***	0.0066***	0.0068***	0.0098***	0.014***	0.0169***	-0.0025***
University Educated	-0.0745***	-0.0783***	-0.0336***	-0.0676***	-0.0457***	-0.0998***	-0.0475***
Upper Secondary Educated	-0.0326***	-0.0456***	-0.0133***	-0.0393***	-0.0172***	-0.0408***	-0.0179***
Equivalised Disposable Income (Deflated to 2015)	-0.0000012***	-0.00000175	-0.00000028***	-0.00000346***	-0.00000102***	0.00000002**	-0.00000519***
Household Inflation Rate	0.8409***	0.0068***	-0.1408***	0.4334***	-0.8382***	0.0398	0.4733***
Child Care Costs (deflated to 2015) relative to Household Income	-13.506***	15.9917***	-1.9058**	88.7131***	-3.8834***	-1.2116***	-104.9861***
Commuting Costs (deflated to 2015) relative to Household Income	0.9489***	-4.5369***	0.8173***	-5.77***	3.0405***	4.3872***	0.7481***
Housing Costs (deflated to 2015) relative to Household Income	0.1452***	0.2331***	0.3645***	0.1428***	0.3943***	0.4139***	0.1182***
In-work	-0.0045***	-0.0338***	-0.0465***	-0.0116***	-0.039***	-0.0222***	-0.01***
Rural	0.0031***	0.0093***	0.0061**	-0.0191***	0.0119***	0.0025***	0.0031***
Year	0.0067	-0.0011***	-0.0006	0.0034***	0.0007	-0.0026	-0.0035
Public Income relative to Household Income Ratio	0.00000015***	0.0002612***	-0.00000032***	0.0018084	-0.0000012***	0.00000827***	-0.00000279**
Savings Rate	-0.000096***	0.000016***	0.000028***	0.000001***	0.000043	-0.0005***	-0.000168***
Constant	-14.2299***	2.3876***	1.4249***	-7.0698***	-0.4512***	4.9837***	6.9013***

	HU	IE	IT	LT	LU	PL	PT	TK
Age	0.0044***	0.0063***	0.0017***	0.0039***	0.0046***	0.0038***	0.003***	0.0069***
Age Squared	-0.000052	-0.000083***	-0.000024***	-0.000041	-0.000061	-0.000039***	-0.000038***	-0.000158***
Male	0.0009***	-0.0073***	-0.0016***	-0.001***	-0.001***	-0.0021***	-0.0037***	0.0181***
Married	-0.0223***	-0.0355***	-0.0133***	-0.0234	-0.0143***	-0.0344***	-0.0327***	-0.0029
Number of CH 0-4	0.0144***	0.0081***	0.0067***	0.0008	0.013***	0.0038***	0.0163***	0.0951***
Number of Ch 15-20	0.0101***	0.0097***	0.0034***	0.0013***	0.0084***	0.0097***	0.0174***	0.0897***
University Educated	-0.0756***	-0.0605***	-0.0653***	-0.0313***	-0.0733***	-0.0345***	-0.0531***	-0.3945***
Upper Secondary Educated	-0.0364***	-0.0375***	-0.0407***	-0.0089***	-0.0387***	-0.0043***	-0.0283***	-0.1187***
Equivalised Disposable Income (Deflated to 2015)	-0.0000039***	-0.0000011***	-0.0000021***	-0.0000038***	-0.0000006***	-0.000009***	-0.0000034***	-0.000042***
Household Inflation Rate	0.0625***	0.0941***	0.9111***	0.1348***	-0.3132***	0.5425***	0.284***	0.0265
Child Care Costs (deflated to 2015) relative to Household Income	51.1997***	-1.3851***	76.8926***	-9.8368***	-7.6303	4.793***	3.8259***	
Commuting Costs (deflated to 2015) relative to Household Income	-3.1652***	-2.2785***	-9.1184***	-1.5646***	-0.0917***	-2.2872***	-3.2271***	6.0214***
Housing Costs (deflated to 2015) relative to Household Income	0.126***	0.194***	0.1196***	0.1707***	0.3107***	0.0745***	0.2362***	1.0869***
In-work	-0.0172***	-0.0546***	-0.0105***	-0.0324***	-0.0155***	-0.0153***	-0.0022***	-0.0378***
Rural	0.0019***	0.0039	-0.0075***	0.0027***	-0.0067***	-0.0028***	-0.0072***	
Year	0.0056	0.0002***	0.0074***	0.0073	-0.0025	0.0078***	0.0089***	-0.0019***
Public Income relative to Household Income Ratio	0.00000294*	0.000176***	0.0003973***	0.0000163**	0.0000146***	0.0003558***	0.0306041***	
Savings Rate	0.000042***	0.000443	-0.000015***	-0.000008***	0.000006***	-0.000031***	0.001861***	
Constant	-11.1144***	-0.1472***	-15.2887***	-14.5297***	5.5758***	-16.1231***	-17.8409***	5.6558***

Figure 9 reports the ratio of drivers of financial strain, comparing the highest third with the lowest third. Except for Germany, non-discretionary costs are higher for the former group. For about half the countries this gap is more than 40%, while for a number of Southern and Eastern European countries, the gap is less than 20%. For the majority of countries, real disposable income is about 40% lower for the high financial strain tercile compared with the lowest. The gap is not the big for tertiary education or for CPI. There is a particularly high gap for poor health, with all countries having at least 100% higher rate for the highest financial strain compared with the lowest and with most countries having a rate of at least 200% higher (Figure 10).

Figure 9. Proportional Change in Drivers comparing High Financial Strain Group to Low Financial Strain Group

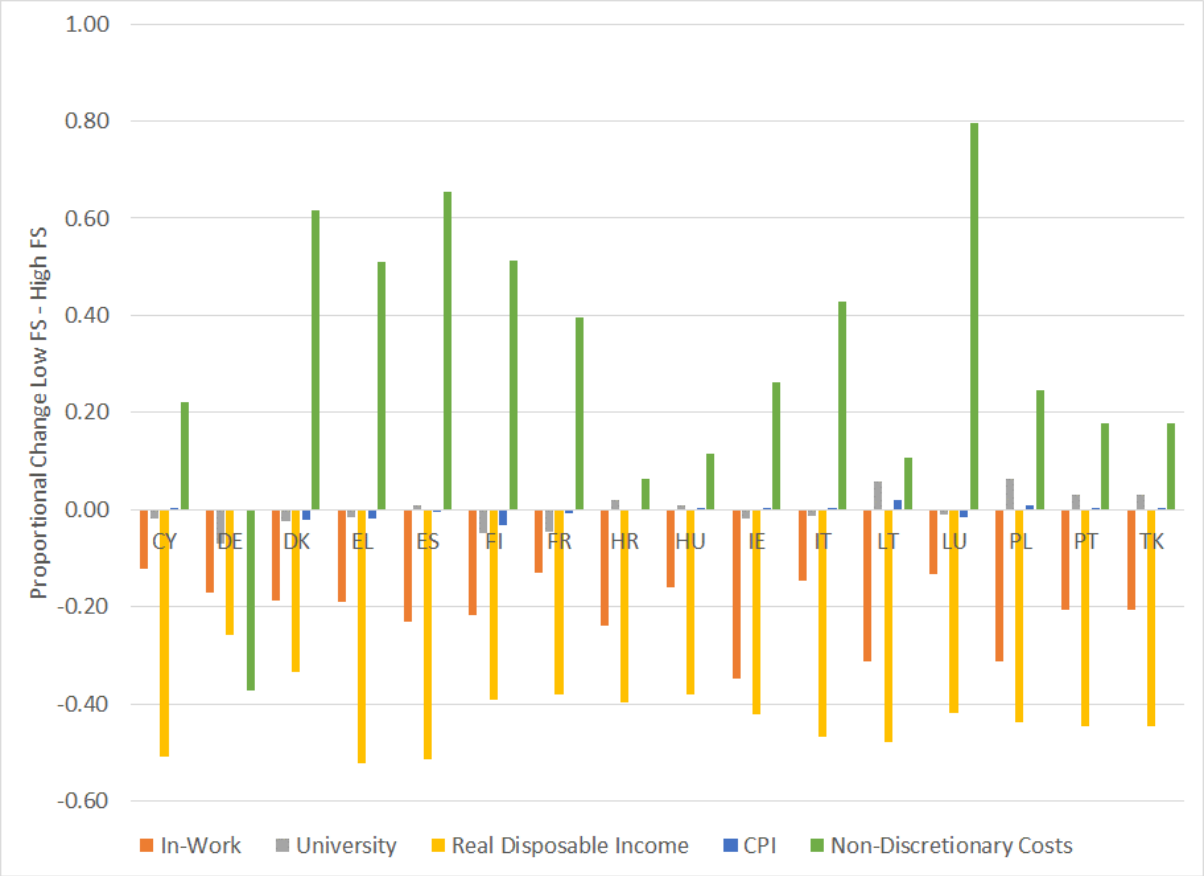
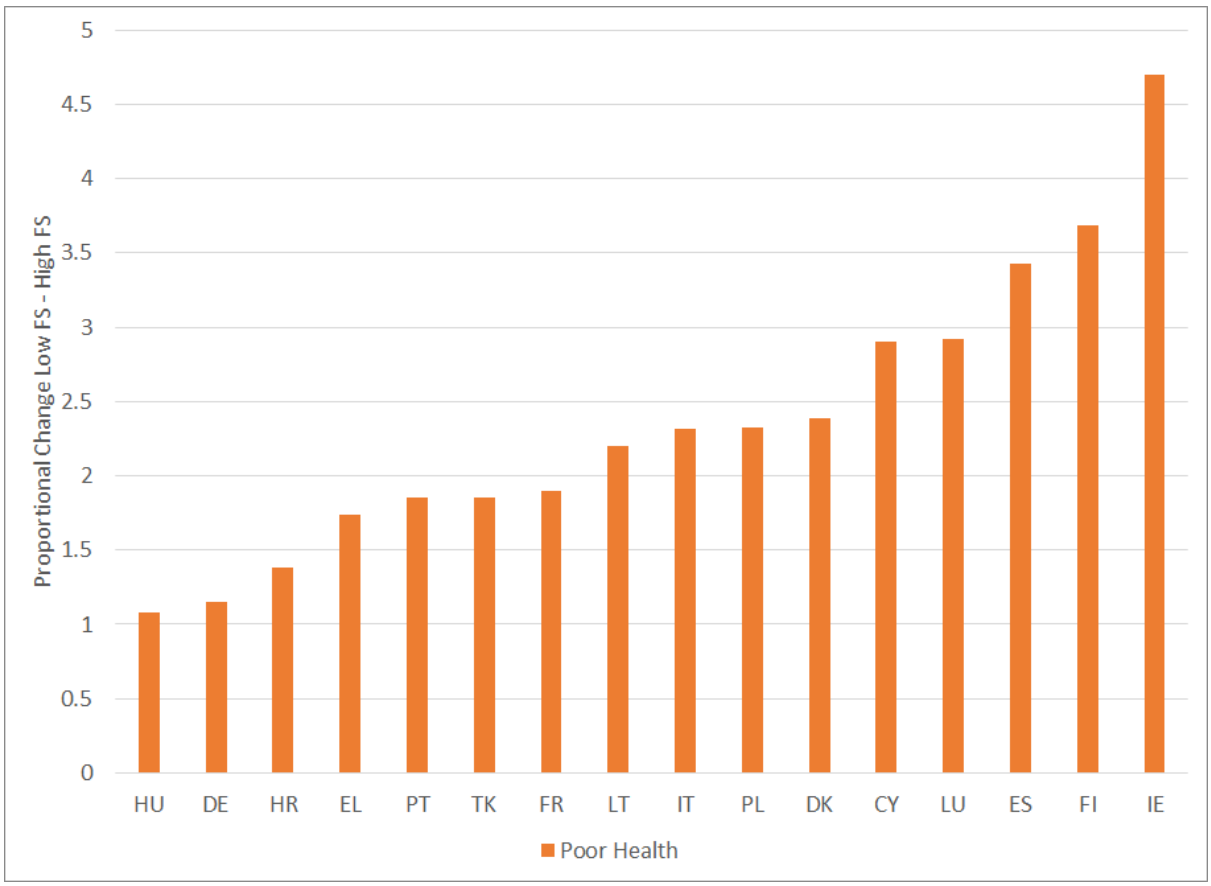


Figure 10. Ratio of Poor Health for the highest third of financial strain relative to the lowest third



5. Conclusions

This paper considers trends in financial strain in Europe over a period of about 15 years, where the continent experienced three major economic shocks, the financial crisis of 2008-2012 or so, the coronavirus pandemic in 2020-2021 and followed by a cost-of-living crisis. We utilise a subjective measure of welfare relating to financial strain to represent household responses to the multidimensional shocks that different countries faced in different ways at different points of this cycle. Despite shorthand references to the structure of these shocks, it is clear that different shocks affected countries in various ways, through different channels, in varying magnitudes and over different periods.

We develop a theoretical framework of the drivers of these shocks based on the concept of discretionary disposable income, once we account for non-discretionary or unavoidable expenditures due to housing, and work-related expenses such as commuting costs and childcare costs. In addition, we incorporate a measure of household specific inflation rates to translate this adjusted disposable income welfare concept into household specific purchasing power.

Overall, we find many instances of increased financial strain during the financial crisis and the cost-of-living crisis. While aggregate relationships between the drivers seem logical in many countries, there are many instances where the aggregate relationship is either unexpected in sign or strength, indicating that the relationship is due more to distribution specific changes

than to aggregate changes. Corroborating this hypothesis, where we undertook a micro analysis, most of the characteristics incorporated in our theoretical framework were significant and of the right sign, even if aggregate relationships were weak. Of non-discretionary expenditures, housing costs had the strongest and clearest influence on financial strain, whilst commuting and childcare costs were less clear due in part to the endogeneity with employment, which is itself associated with lower financial strain.

Considering households with the highest financial strain, we find that in almost all countries the average real disposable income is lower. Non-discretionary expenditures are lower in households with the highest financial strain compared to those with the lower levels. The difference in household CPI is less exaggerated. However, there is a very large gap in average poor health between the top and the lowest tercile.

This paper contributes to the scientific literature on the effects various economic crises. While some of the literature considers changes in household inflation negative from the perspective of household welfare, it is not mainly the case, albeit there is a strong spike during the cost of living crisis and the coronavirus Pandemicc. On average the sign is positive in Southern and Eastern Europe, but is less important in Northern and Western Europe, where non-discretionary expenditures, particularly housing costs and real disposable income are more important drivers of financial strain. This research finds that financial strain and disposable income are strongly related. However, non-discretionary expenditures are quite important, likely in particular for sub-sets of the population associated with the squeezed middle.

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