Determinants of mortgage arrears in Europe: evidence from household microdata

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Abstract: This paper examines the drivers of mortgage arrears in Europe during 2004-2011. Mortgage arrears have social ramifications: they reduce aspects of households' wellbeing and health, and addressing such negative effects can lead to higher social spending by governments. Mortgage arrears can also pose a risk to the stability of banks and limit households' future access to credit. It is therefore important to identify the drivers of arrears and design policies to reduce them. Because important institutional features affecting mortgage markets such as financial regulation and bankruptcy rules are applied at national level, a comparative approach can be helpful. We apply regression analysis to a European household data set to analyse what drives arrears. Controlling for household characteristics such as age and education, we find that affordability problems such as unemployment, low income and high mortgage payments, matter. Longer-term arrears are more likely for households facing the "dual trigger" of affordability problems and negative equity. We also find that households in Cyprus and Greece are particularly prone to miss mortgage payments, while those in the United Kingdom and Belgium are very unlikely to do so. Generally, arrears tend to be higher in poor countries and where investors' interests receive less protection.

Keywords: Arrears, affordability, negative equity.

JEL codes: D14, E58, G28

[*] Email: Petra.gerlach@snb.ch and sean.lyons@esri.ie. The views in this paper are those of the authors and do not reflect those of the Swiss National Bank. This paper is based on data from Eurostat, Survey on Income and Living Conditions, 2004-2011, and the responsibility for all conclusions drawn from the data lies entirely with the authors. The same applies for the data analysis which uses the Eurosystem survey of the Household Finance and Consumption Network. We thank Brian O'Connell for his help with the data and the Editor, two referees, Michael Ehrmann, Stefan Gerlach, seminar participants at the Bank for International Settlements, the Economic and Social Research Institute, Dublin, the Nederlandsche Bank, the Swiss National Bank, conference participants at the 2014 Bank of Canada-Cleveland Fed-Atlanta Fed-SNB Conference in Ottawa and workshop participants at the 2014 Empirical Monetary Economics Workshop in Paris for useful comments and discussions.

Introduction

The aftermath of the global financial crisis that began in the summer of 2007 has brought an increased focus on the interplay between housing market volatility and fluctuations in households' economic circumstances. Housing markets played a central role in the onset, development and effects of the crisis. Policies that were long understood to have significant social and fiscal effects such as public support for home ownership, regulation of mortgage credit and securitisation arrangements are being scrutinised more closely for their possible influence on macroeconomic stability.

In particular, macroprudential policies are being employed more widely. These measures, such as limits on loan to value and loan to income ratios, aim to reduce the risk of individual households borrowing more than they can ultimately afford to pay, taking into account the future risk that ability to pay and the price of housing collateral may change in adverse ways. By reducing this risk, macroprudential policies also seek to improve systemic outcomes such as rates of arrears and bank solvency. However, these policies impose credit constraints on many households and behavioural restrictions on banks, with potential consequences for equity and efficiency.

As well as increasing the demand for analyses that can help inform the design of housing policy and macroeconomic management, the crisis generated rich new international comparative data on how borrower characteristics and macroeconomic conditions interact. Analysis of these data helps policymakers understand how adverse market and societal outcomes, and how particular sets of institutions and policies, may serve to mitigate or amplify these problems. Examining cross-country panel data from this time of economic stress can provide information on the potential benefits of macroprudential and income maintenance policies, but can also cast light on some implications of broader policies such as support for home ownership and recourse rules for mortgage debt.

This paper analyses the drivers of a key adverse market outcome: household mortgage arrears. In the US, 5% of mortgage households had missed their payments by over 90 days in 2010. In many European countries, arrears also rose to unprecedented heights. In 2014, they peaked in Ireland at 12%. Because important institutional features affecting mortgage markets such as financial regulation and bankruptcy rules are applied at national level, a comparative approach can be helpful. We study arrears by applying regression analysis methods to data from 15 European countries over the period 2004 to 2011. We relate arrears to both household-specific features and national institutional factors.

Mortgage arrears are both of social and economic relevance for at least four reasons. First, arrears reflect the extent of financial difficulties faced by households. Particularly during economic downturns, arrears capture the distributional effect of a recession that aggregate measures, such as GDP, do not cover. Arrears show how large a fraction of households is exposed to economic hardship, possible health effects and social stigma. Arrears also are an indicator for how many households may face the risk of homelessness, which in turn can affect government spending.

Second, mortgage arrears damage a household's future creditworthiness. The less creditworthy a household, the more difficulty it will have smoothing consumption when income declines. A rise in arrears can therefore cause greater volatility in future consumption and reduce the overall level of consumption, both on a household and an aggregate level. For example, Nkusu (2011) points to long-lived and potentially self-reinforcing negative effects on aggregate economic activity after sharp rises in the level of non-performing loans. Moreover, even once income recovers, households in arrears will only hesitantly adjust consumption and instead pay back their debt first. This mechanism can hold back economic recovery. They fear of entering arrears can have a similar impact if households engage in precautionary spending. Third, mortgage arrears may indicate that households are unable (or unwilling) to move to a cheaper dwelling. Arrears are thus associated with diminished labour mobility, which may reduce the speed with which an economy recovers from a recession. Fourth, they imply reduced income for commercial banks. Banks may also need to write down mortgages or see the value of mortgage-backed securities declines. All these factors weaken banks' balance sheets. Ultimately, arrears can threaten financial stability (Hellebrandt *et al.*, 2009).

For all these reasons, it is important to ask what drives arrears and what polices can be adopted to decrease their incidence. In this paper, we analyse the determinants of mortgage arrears in Europe by carrying out regression analysis on panel microdata from the European Survey on Income and Living Conditions (EU-SILC). Our EU-SILC data set contains information on over 50,000 households from 15 countries over the period 2004 to 2011. Comparative data on a sample of countries with different institutional settings helps us observe effects of policy, while having a time dimension spanning the Great Recession allows macroeconomic conditions to be taken into account.

The literature suggests two main economic drivers of mortgage arrears: affordability problems and negative equity. Households with affordability problems are unable to meet the payment obligations arising from the mortgage when income drops or the mortgage payment rises. If the household expects financial difficulties to ease soon, it may be optimal to go temporarily into arrears, in the hope of honouring the missed mortgage payment in the near future. If unemployment is expected to be permanent, it is generally optimal to sell the property and move to a more affordable place. However, selling the property may not be possible if the price is lower than the outstanding mortgage, i.e., if the household is in negative equity.

A negative-equity household can downsize if it has savings that make it possible to pay back the mortgage in full or if it has access to new credit. If neither is the case, staying put and going into arrears is optimal. The literature refers to this situation as "dual-trigger" arrears because it is caused by a combination of affordability problems and negative equity. Households facing the dual trigger should make up the bulk of longer-term arrears cases.

The rest of the paper is structured as follows. The next section provides a brief survey of the literature. We then present the data discuss how we model arrears. The next section presents the estimates and thereby establishes the role of the dual trigger in European arrears. Besides exploring

the role of household-specific characteristics, the section also relates arears to country-specific features. The final section concludes by exploring possible policy implications.

Related literature

Past research on the determinants of mortgage arrears arises from several disciplines (particularly economics, sociology and psychology) and uses a variety of data sources and empirical methods. It has long been understood that borrowers' socioeconomic circumstances and life events could play a role in predisposing households to have difficulty repaying debt or triggering arrears status. Ford *et al.* (2001) highlight marital breakdown, employment status, social class or income levels and exposure to high percentage mortgages as factors with enduring effects. These authors also identify a second set of factors with effects linked to the economic cycle. Spurred by macroeconomic fluctuations from the 1990s on and by debates about the potential benefits of macroprudential policies, research has increasingly focused on this second category of factors. For example, Borgersen (2016) shows how housing and mortgage markets can move from a stable 'debt-servicing' regime to an unstable 'collateral-dominated' regime due to a changing relationship between house price appreciation and the mortgage interest rate.

Most empirical studies in this area examine only one country. The disadvantage of a single country approach is that without comparative data it is difficult to identify effects of national policies and regulatory institutions or to disentangle the effects of policy changes from those caused by macroeconomic fluctuations. Elmer and Seelig (1999), Bhutta *et al.* (2010), Demyanyk *et al.* (2010) and Elul *et al.* (2010) study the US. They use microdata sets and find that the probability of a household going into arrears is higher if there are negative equity and affordability problems. Ghent and Kudlyak (2011) distinguish between US states with and without recourse legislation and find that negative equity on its own is a trigger of arrears in non-recourse states. Gerardi *et al.* (2013) and Guiso *et al.* (2013) also analyse such "strategic" arrears. Li *et al.* (2011) show that US bankruptcy reform in 2005, which reduced the amount of debt discharged in personal bankruptcy, caused mortgage arrears to rise.

Negative equity on its own should not cause arrears in Europe because there is no debt forgiveness. Certain US states have non-recourse mortgage legislation, which means that if a negative equity household sells its property, the shortfall between the mortgage and the property value is borne by the lender. In Europe, in contrast, recourse legislation, in which the household remains responsible for the negative equity, is the norm, and the only way to discharge a debt is to declare personal bankruptcy. In certain European countries, even bankruptcy does not lead to a discharge.

Whitley *et al.* (2004) find that for the UK, unemployment is a major driver of arrears. Whitley *et al.* use data up to 2002, a period with few incidences of negative equity. Böheim and Taylor (2002) model the incidence of housing problems and evictions in the UK using data from 1991 to 1997. May and Tudela (2005) also find a key role for unemployment and report that high loan-to-value (LTV)

ratios (for which negative equity emerges fastest if house prices decline) are associated with a higher probability of arrears. Using a dynamic model applied to aggregate time series data, Figueira *et al.* (2005) point to unemployment and low levels of 'unwithdrawn' equity as the main drivers of arrears, but also find longer term influences from the level of the loan/income ratio for first time buyers and the ratio of mortgage interest payments to real personal disposable income. Parkinson *et al.* (2009) discuss the role of equity withdrawal as a form of consumption insurance. Perhaps the most wide-ranging study undertaken in the UK is Aron and Muellbauer (2010). Developing a forecasting model for aggregate arrears, they conclude that "fundamental economic drivers of aggregate arrears and possessions" are the debt service ratio, a proxy for negative equity and the unemployment rate, with a secondary role for variables capturing loan quality and government policy towards possessions.

Psychological characteristics of borrowers, in addition to economic ones, are examined using a cross-sectional UK dataset by Livingstone and Lunt (1992). They find that disposable income and the amount of debt explain about 40% of variance in repayment amount, with a range of psychological attributes explaining an additional 9%. However, the analysis focuses on the value of regular repayments rather than whether borrowers were in arrears *per se*. Their results are likely driven by the higher borrowings and thus repayments among better-off people. Dawson and Henley (2012) use data from the British Household Panel Survey (BHPS) to show that individuals' over-optimism about their future financial circumstances before taking out a mortgage is associated with higher incidence of arrears afterwards. Understanding Society, a follow up survey to the BHPS, is used by Brown (2015) to ask whether neighborhood effects influence the probability of being in arrears. With data from after the financial crisis, she reports that mortgage holders in areas with strong neighbourhood ties, particularly where people felt able to ask a neighbour for support or advice, had a lower incidence of arrears.

For Ireland, Connor and Flavin (2013) find that negative equity and unemployment matter for arrears, while Lydon and McCarthy (2013) also show that the repayment burden, i.e., the mortgage payment-to-income ratio, matters. McCarthy (2014) adds that 'fragile' employment (temporary contracts, short job tenure or a history of unemployment) and higher loan to value ratios increase the risk of arrears. Aristei and Gallo (2016) find that for Italian households, the probability of going into arrears increases when income drops. Their paper does not test for the impact of negative equity, but they provide an excellent survey of the literature. Blanco and Gimeno (2012) consider arrears by Spanish province and year and test for the impact of macroeconomic variables. They find that a rise in regional unemployment and increasing interest-rate burdens drive up the incidence of arrears. A drop in credit growth has the same effect. The authors do not explore the role of negative equity. Finally, Ampudia *et al.* (2014) show that low wealth, rather than income, seems to be a major driver of arrears, both in Portugal and in Spain.

Two papers choose a country panel approach similar to ours. This type of comparative analysis has advantages for simultaneously examining macroeconomic, institutional and socio-demographic

effects, but it tends to limit the level of detail in the factors that may be modelled. Duygan-Bump and Grant (2009) use European data from the 1990s and find that affordability problems are a major driver of arrears. Magri and Pico (2009), who use European data from 2005 and 2006, find the same. They also show that mortgage arrears in 2005 and 2006 were particularly high in Italy and Spain. Because both of these papers cover a time period when house prices were rising in most of the countries considered, negative equity is not a common feature in their data. For a discussion of the available European microdata, see Gomez-Salvador *et al.* (2011). Doling *et al*. (2007) model arrears for seven European countries for the period 1995 to 2001 using country-level regressions and find that financial difficulties are the main driver.

A number of studies have used cross-country data sets to examine the impact of institutional, social and cultural factors on mortgage arrears. Jappelli *et al.* (2013) show in a data set comprising eleven European countries that information sharing arrangements and contract enforcement, proxied by population coverage of credit agencies and check collection times, affect the probability of households going into arrears. Duygan-Bump and Grant (2009) also identify a role for contract enforcement in a data set covering 14 countries and moreover show that credit information sharing reduces arrears. Gerhardt (2009) compares consumer bankruptcy laws and personal insolvencies in Germany, France, Ireland, Italy, Spain, the UK and the US. She argues that European legislation focuses on protecting the creditors' interests, whereas US law, and to a lesser extent UK law, is more "consumer-friendly". Claessens and Klapper (2005) examine what drives commercial bankruptcy laws in 35 countries from 1990 to 1999 and find that bankruptcies are more frequent in common-law countries and market-oriented financial systems. Georgarakos and Furth (2015) find that cultural factors, such as religiosity, confidence in institutions, and proxies for the amount of social capital (e.g. levels of trust and participation in voluntary groups) help explain geographical differences across ten countries. Diaz-Serrano (2005) reports for a data set of twelve countries that uncertain economic circumstances, as captured by income volatility, also increase the incidence of arrears. Finally, Frade and Abreu Lopes (2009) examine the macroeconomic drivers of the broader concept of household financial stress and find in a sample of 24 countries that low GDP, difficult access to credit and income inequality play a role.

A series of papers considers the policy responses to mortgage payment problems. Scanlon *et al.* (2011) describe the policy response to housing crises in 16 industrialised countries. They document a wide range of government programmes to support households in payment difficulties and tighter lending conditions by banks. Norris *et al.* (2007) review Irish policies supporting low-income buyers and argue that these households may end up in arrears and worse off than in rented housing. Turner and Yang (2006) and Hafner *et al.* (2015) discuss advantages of homeownership, especially in old age and as a source for equity withdrawals. We return to policy implications in the conclusions of this paper.

Data

The analysis uses data from seven data sources: EU-SILC, the Bank for International Settlements (BIS) and Eurostat for data on house prices, and data from the European Central Bank (ECB) and the European Mortgage Federation (EMF) on characteristics of typical mortgages by country. To analyse country fixed effects, we also use country-specific data from the OECD and the World Bank.

Using longitudinal microdata collected in a consistent way across a range of countries has advantages. In particular, observing the same households over time allows us to control for unobserved household-level heterogeneity. Inclusion of data from more than one country offers the possibility of taking institutional factors into account and brings greater variation in macroeconomic conditions into the sample. However, there are disadvantages as well. Multi-country surveys such as the ones we use tend to ask relatively few questions on any given topic due to competing demands from different topics of interest and limitations on the overall survey size. This means that the questions available on aspects of mortgage arrears and household characteristics were not specifically designed for the purpose to which we put them. We instead have to adopt a simplified view of arrears and their outcomes, focusing on economic processes for which we can find proxies in the data.

EU-SILC is conducted annually in the member countries of the European Union. For the period 2004 to 2011, it contains information on over 1.6m households from thirty countries. Given the availability of the other variables in our analysis, we concentrate on 15 countries, for which more than 900,000 households were interviewed.[1] Of those households, we analyse mortgage households only, which constitute about a seventh of the sample. The EU-SILC questions that we use focus on mortgage arrears, unemployment and income. We also make use of information on the length of residency, which we treat as an indicator of when the property was bought, and we use the age of the reference person in the household, the number of household members and the highest education level in the household as additional controls.

Figure 1: Arrears (% of all mortgage households) by country

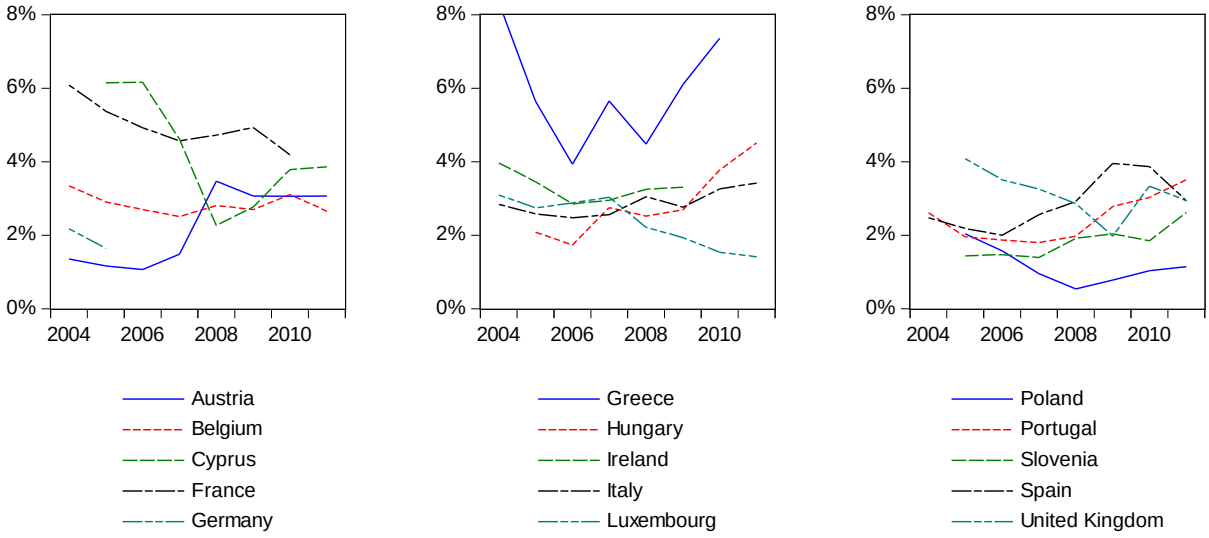


Figure 1 presents the percentage of mortgage households in arrears by year and country. The specific question in the questionnaire is: "*In the last 12 months, did it happen that the household was unable to pay rent or to make a mortgage repayment for the main dwelling on time, due to financial difficulties?*"[2] One striking feature is that there are large differences across countries as to what fraction of households is in arrears. Arrears are very common in Greece, with almost 10% of mortgage households being in arrears in 2004. Arrears are rarest in Poland. It should be noted that there has been no uniform increase in arrears after the onset of the global financial crisis. That said, some countries have seen clear rises, e.g. Hungary and Portugal, which may be due to affordability problems.

Figure 2: Fraction of mortgage households in arrears once (= temporary arrears) or several times (= longer-term arrears) over the previous year (in %)

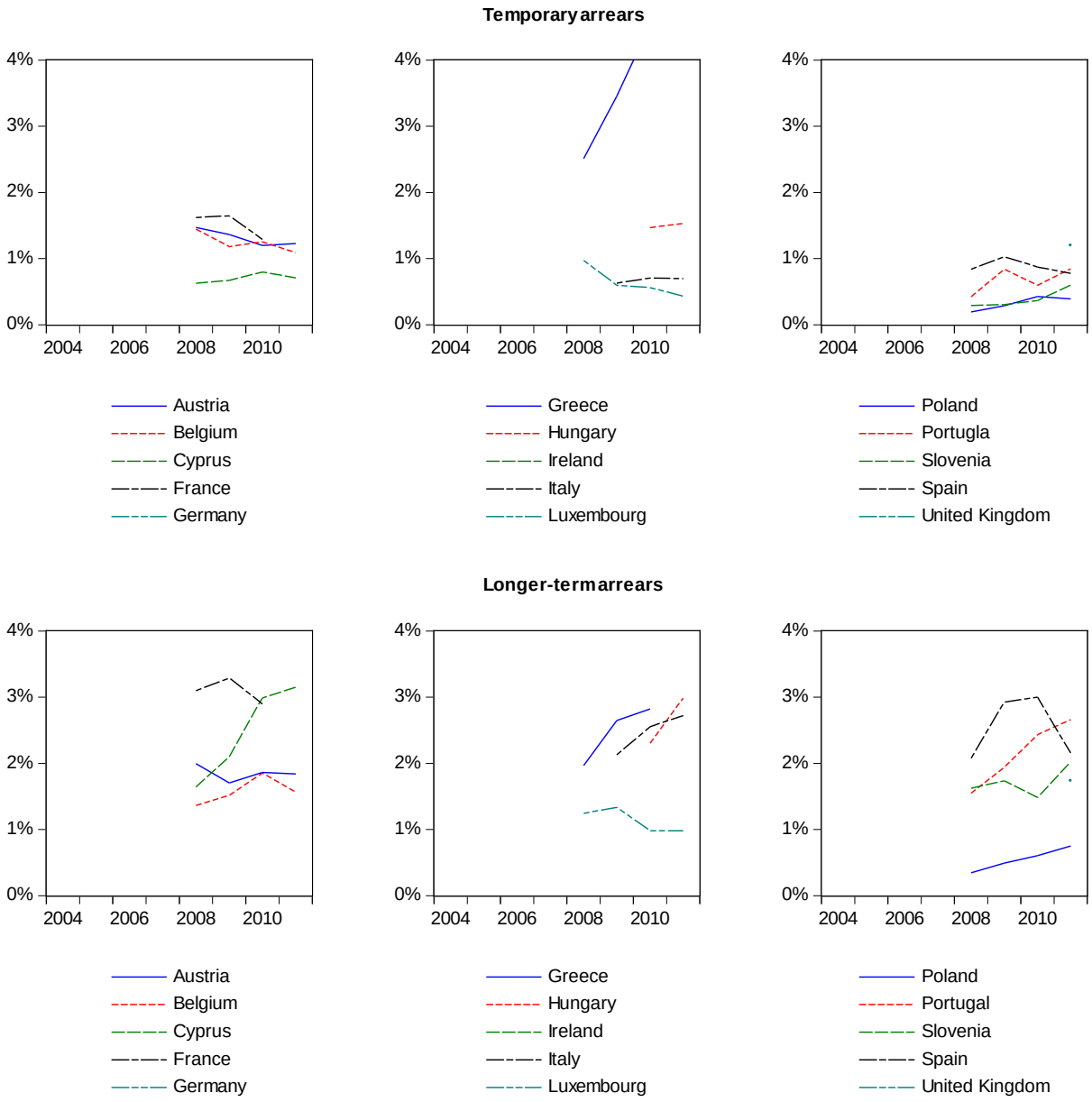
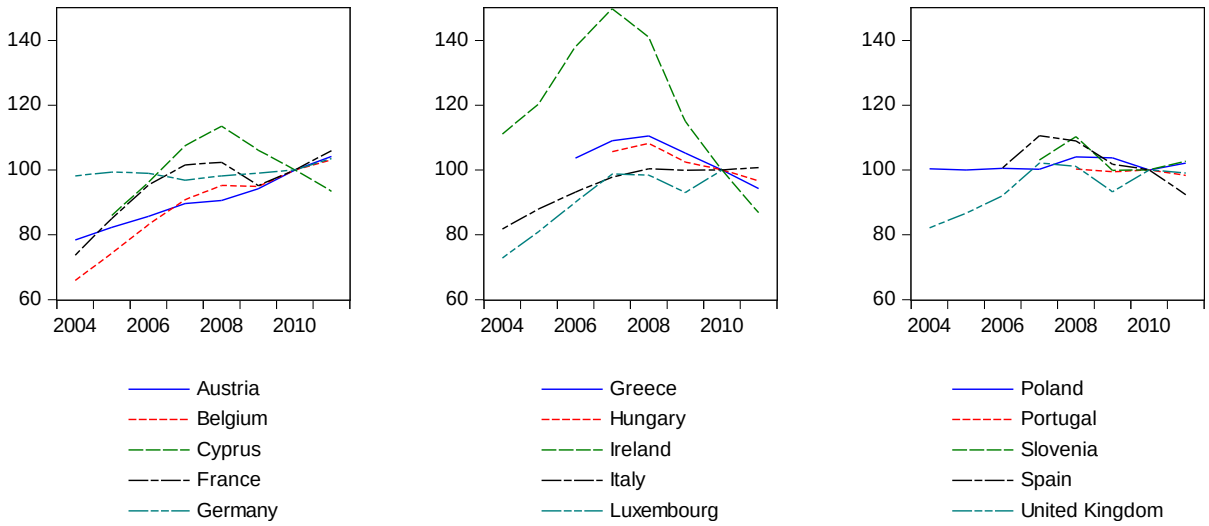


Figure 2 shows what fraction of mortgage households indicated to have been once or several times in arrears over the course of the previous year.[3] We refer to these as temporary and longer-term arrears, respectively. Generally, temporary and longer-term arrears tend to simultaneously increase, which makes sense given that they both depend on affordability. Longer-term arrears were more prevalent than temporary arrears in all countries but Greece.

House price data come from the BIS website. We use the broadest BIS measure available and address data gaps, where possible, using Eurostat data. Figure 3 presents these data. The house price level in 2010 is normalised for all countries to 100.

Figure 3: House price data



In the following, we concentrate on episodes when house prices decline, because negative equity arises only when the value of a property falls below the mortgage value. When a mortgage is freshly signed, it is by construction in positive equity, so that rising house prices should have no direct effect on mortgage arrears. They may have a second-order effect if equity withdrawal is used to avoid arrears that would otherwise be caused e.g. by unemployment. The variable we construct takes a value of zero if national house prices are increasing. If they are decreasing, it records the rate by which they have declined since their last peak. We also performed the estimations using the change in house prices rather than declines only; the main results are unaffected by this change.

Table 1 presents data capturing institutional, social and cultural structures of the different countries. Data on the typical mortgage maturities and LTV ratios at origination are from the ECB (2009) and the EMF (2009 and 2012). Mortgages are typically shortest in Greece and Hungary (15 to 20 years; the table reports the mid-range used in the econometric analysis below) and longest in Portugal (30 to 40 years). LTV ratios vary between 65% (in Italy and Slovenia) and 91% (in France).

The ownership rate shown in the third column is constructed using EU-SILC data, concentrating on the survey year 2011. Ownership is highest in Hungary and lowest in Austria. As a measure of wealth, we consider income per capita at market prices constructed using OECD data, also for the year 2011. Income in highest in Luxembourg and lowest in Poland, and accumulated wealth should correspondingly be highest in the former and lowest in the latter. The last column lists information on investor protection from the 2009 World Bank Doing Business Report. We think of the variable as a measure for how easily banks can enforce their rights as creditors. Protection is strongest in Ireland and weakest in Greece.

Table 1: Country-specific data

	Mortgage maturity (in years)	Loan-to-value ratio (in %)	Ownership rate (in %)	Per capita income (in euro)	Investor protection index
Austria	30	84	52.4	35,729	5.0
Belgium	20	80	71.8	33,567	7.0
Cyprus	22.5	80	73.5	21,290	5.0
France	19	91	63.1	30,801	5.3
Germany	27.5	70	53.4	31,925	NA
Greece	17.5	73	75.9	18,747	3.3
Hungary*	17.5	75	89.8	9,906	4.3
Ireland	33	83	70.2	35,573	8.3
Italy	22	65	72.9	26,614	6.0
Luxembourg	25	87	68.2	81,529	4.3
Poland*	27.5	87.5	82.1	9,743	6.0
Portugal	35	71	75.0	16,186	6.0
Slovenia	25	65	77.5	17,633	6.7
Spain	30	72.5	79.7	22,421	5.0
United Kingdom*	27.5	70	67.9	28,100	8.0

Note: Maturity and LTV data for euro area countries from the ECB (2009). Information on countries marked with * are taken from EMF country fact sheets, which are from 2012 (Poland from 2009). Midpoints where the ECB/EMF report ranges for mortgage maturities; where the ECB reports "X years and above", another 5 years are added. Ownership rates were constructed using SILC 2011 data; per capita income at market prices is from OECD 2011 data; and the investor protection index is from the 2009 World Bank Doing Business Report.

To capture the incidence of negative equity we combine the house price data with data on the typical mortgage maturity at origination from ECB (2009) and EMF (2009 and 2012). These maturities differ considerably by country, ranging from less than twenty years in France, Greece and Hungary to more than thirty years in Ireland and Portugal.

When house price decline, new house owners fall into negative equity fastest because they have large amount of debt outstanding. This effect should be stronger in countries with a long typical mortgage maturity because amortisation takes longer. Amortisation rules differ between countries: for instance, the ECB (2009) reports that interest-only mortgages, where the principal is not amortised until the end of the mortgage contract, are common in Cyprus and Ireland. We disregard these differences for lack of exact data. We use as a proxy for the fraction of the remaining principal outstanding a variable that takes the value of 1 in the year in which a household buys its dwelling and the value of 0 once a household has owned its property for longer than the typical mortgage maturity. Between these two dates, we assume linear amortisation. This proxy neglects the possibilities of rolling over a mortgage at expiry into a new mortgage and of obtaining equity release, but we have no data on the use of such options.

To capture the probability that a particular household is in negative equity, we multiply the house price decline in a given country with the household's remaining principal outstanding. We concentrate on house price declines because a first-time buyer household starts out with positive equity. For the value of the mortgage to exceed the value of the house, house prices have to fall. We multiply the house price decline with the remaining principal outstanding to account for the fact that households pay back their mortgage over time, and we treat the resulting measure as our negative equity proxy. Given a house price decline, this proxy takes a large value for households that have a lot of principal outstanding – typically households that recently bought their residence. These households are the first to enter negative equity when house prices decline. For households that have little principal left outstanding, typically long-time owners, the negative equity proxy takes a small value because house prices can fall a lot before the value of the house is lower than that of the remaining mortgage. One important caveat is that the measure we use for negative equity is a proxy. Our analysis thus depends on the quality of this variable.[4]

Modelling arrears

This section provides a discussion of when it is optimal for households to go into arrears. It should be noted that this model concentrates on households with mortgages for their primary residence; we do not consider buy-to-let properties to keep the analysis focussed.

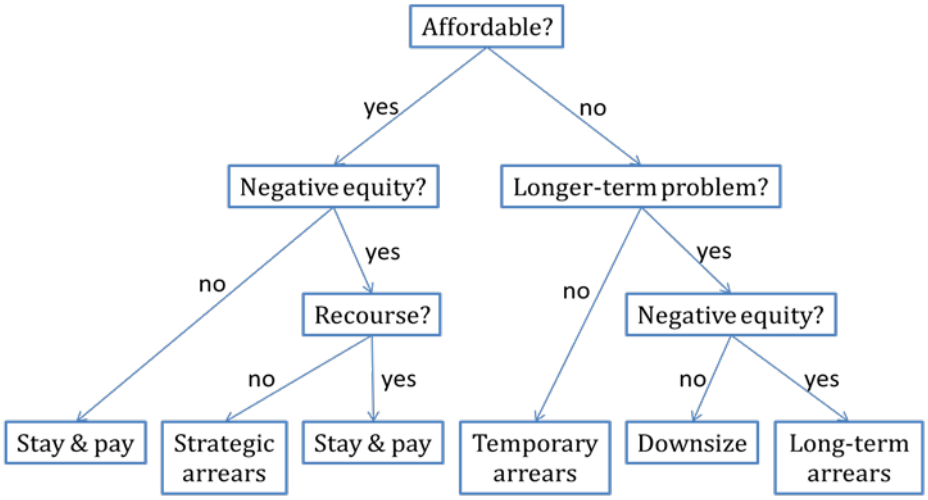
To analyse the decisions taken and strategies chosen by households, we follow Foote *et al.* (2008) in using a model in which households buy a property in period 0 that they have to sell in period 2. In period 1, households must decide whether to pay the mortgage, move to another place or go into arrears. In contrast with Foote *et al.,* we assume that households consume and receive income in both periods 1 and 2 (households do not consume or earn income in period 2 in the original model).

Figure 4 presents the considerations that a household faces when it decides whether or not to make its mortgage payments. If it decides to pay, we refer to this choice as the "stay & pay" strategy, which is optimal in two cases: first, if the household can afford to make the mortgage payments and is in positive equity, and, second, if it can afford to make the payments, is in negative equity and is in a recourse environment, i.e., in a legal framework where it remains responsible for the negative equity after default. In a non-recourse setting, which is the case analysed by Foote *et al.* (2008) and which implies debt forgiveness at default, going into arrears and finally into default is optimal. In our European data set, where recourse is standard, we should not observe such "strategic arrears".

In any event, during the period we study lenders in European countries tended to exhibit a 'relatively restrained' attitude to taking possession of properties in arrears (as characterised by Wallace and Ford, 2010, in a study of UK lenders). From the borrower's side, transaction costs associated with default and bankruptcy may be high and Kau *et al.* (1994) point out that even borrowers in negative equity possess more or less valuable real options associated with future prepayment or postponed default. We do not explicitly consider default or repossession as outcomes in this paper.

If the household is unable to pay its mortgage, the question arises about whether this problem is temporary or permanent. If income temporarily decreases or the mortgage payment increases and if the household is credit constrained, going into temporary arrears is optimal. If affordability problems are expected to last, it is optimal to downsize, i.e., to sell the property, pay back the mortgage and move to a new place.[5]

Figure 4: Arrears decision tree



However, selling the house is not possible if the household is in negative equity, i.e., if the mortgage exceeds the selling price. We assume that the household has no previous savings that could be used to cover the negative equity. Thus, a household that cannot afford the mortgage payment and is also in negative equity is best off staying in its original dwelling and going into long-term arrears and eventually into default, which is the situation that the literature refers to as the dual trigger for arrears.

Table 2: Expected impact on arrears

Variable	Expected sign	Explanation
Affordability problems		
Share of unemployed household members	+	Arrears are more likely if household members are unemployed.
Ln(Household disposable income)	-	Arrears are less likely if income is high.
Ln(Mortgage payment)	+	Arrears are more likely if mortgage payments are high.
Negative equity		
House price decline*principal outstanding	0	In non-recourse economies (e.g., some US states) arrears are more likely if there is negative equity, i.e., if there is considerable principal outstanding and the house price decline has been substantial. This should not matter in Europe.
Dual trigger		
House price decline*years of ownership*share of unemployed	+	Arrears are more likely if there is the dual trigger of unemployment and negative equity. The dual trigger should be particularly useful in explaining longer-term arrears.

Table 2 summarises the model predictions. The model shows that not only unemployment or a drop in income but also a rise in mortgage payments can make a household's situation unaffordable. On its own, negative equity, which we capture by the interaction of house price decline and principal outstanding, should not increase arrears in our European data set because of the non-recourse framework. However, negative equity should matter if it coincides with affordability problems.

Empirical results

Using the EU-SILC data, we analyse what drives arrears in Europe using random effects OLS. Appendix A3 discusses econometrics issues. The first column of Table 3 provides the full estimation output for a model of arrears that accounts for the impact of affordability problems, negative equity and the dual trigger; for other household characteristics; and for country-specific effects. The second and third columns show the results for temporary and longer-term arrears. As baseline household, we use a single 35- to 44-year old household with tertiary education in the United Kingdom.

Households in the EU-SILC database are interviewed for up to four years in a row. We analyse what drives arrears and what role policy can play by concentrating on this panel element of the EU-SILC data set. We estimate a household random-effects model, thus controlling for the fact that each household has special characteristics that are not captured by our right-hand side variables and that are constant over time. At the same time, we include country fixed effects to account for the fact that there may be institutional, social and cultural factors that affect a household's decision to go into arrears.

Table 3 presents random effects OLS estimates, even though the dependent variable is either zero (not in arrears) or one (in arrears), which normally calls for estimation using a logit or probit transformation. However, our main interest is in interactions between the explanatory variables, and in a non-linear model interaction effects depend upon the values of all the other explanatory variables in the model. Testing hypotheses and displaying the results for such terms is not straightforward (see e.g. Ai and Norton, 2003), and we felt that this would add needless complexity to the paper. We instead apply a linear probability model (which is estimated using random effects OLS) and rely on extensive robustness tests.

The table is structured in columns, listing first the results for the full sample, and then splitting the sample into households in temporary and longer-term arrears. Furthermore, the panel is split into panels relating to affordability problems, negative equity, the dual trigger, other household-specific characteristics and country fixed effects.

We first discuss affordability problems. For the full sample, we find a clear impact of affordability. The likelihood of a household being in arrears increases, the more unemployed household members there are. Low disposable income and high mortgage payments also increase the likelihood of missed payments. Low income and high mortgage payments increase the incidence of both temporary and longer-term arrears. Beyond low income, unemployment appears to have an effect only on longer-term arrears. Possibly this reflects that households that have recently become exposed to unemployment can use savings to make their mortgage payments. The longer unemployment lasts, the lower the savings and the higher the incidence of arrears, which then tend to be longer-term.

Negative equity is insignificant, as expected, for the full and the two subsamples. Negative equity matters for arrears only if the is no recourse. Since in Europe, recourse is standard, negative equity on its own has no impact. That said, negative equity matters for arrears if it coincides with affordability problems, in particular unemployment.[6] This is true for the full sample and longer-term arrears, but not for temporary arrears. This fits well with theory. A household that expects its affordability problems to be temporary should go into arrears for a brief time only (if the expectations prove correct); negative equity plays no role in this household's decision. A household that faces longer-term affordability problems should downsize, though downsizing is not possible if it is in negative equity. Thus, for households that are in longer-term arrears, we expect the dual trigger to matter.

For the other household characteristics, we find that older households are less likely to be both in temporary and longer-term arrears. This finding is not due to a small principal outstanding or low mortgage payments for older households; we control for these variables separately. One possible reason for this finding is an attrition effect: Households that have successfully served their mortgage over a long period are likely to continue doing so.

Table 3: The determinants of arrears

	Full sample	Temporary arrears	Longer-term arrears
Affordability problems			
Share of unemployed household members	0.0743***	-0.00304	0.0471***
Ln(Household disposable income)	-0.0365***	-0.00673***	-0.0190***
Ln(Mortgage payment)	0.0125***	0.00308***	0.00784***
Negative equity			
House price decline*principal outstanding	-0.320	-0.186	-0.261
Dual trigger			
House price decline*principal outstanding*share of unemployed	0.459**	0.107	0.672***
Other household-specific characteristics			
Aged 16-34	0.00437**	0.00110	0.000767
Aged 45-54	-0.000383	-0.000435	0.000265**
Aged 55-64	-0.0135***	-0.00262**	-0.00301
Aged 65+	-0.0249***	-0.00636**	-0.0107***
Household size	0.00945***	0.00143***	0.00632***
Primary education	0.0450***	0.00828**	0.0243***
Secondary education	0.0188***	0.00431***	0.00834***
House price decline	0.323	0.236	0.318
Principal outstanding	-0.0225***	-0.00501*	-0.0110**
Principal outstanding*share of unemployed	-0.0288	0.0278*	0.00837
Country fixed effects			
Austria	0.0177***	0.0136***	0.0209***
Belgium	0.00170	0.00598***	0.00770***
Cyprus	0.162***	0.0176***	0.0997***
France	0.0142***	0.00809***	0.0150***
Germany	0.0308***	0.00893***	0.0210***
Greece	0.150***	0.108***	0.0318***
Hungary	0.0536***	0.0156**	0.0211**
Ireland	0.0203***	-0.00101	0.00165
Italy	0.0323***	0.00651***	0.0233***
Luxembourg	0.00854***	0.00709***	0.0156***
Poland	0.00377	0.0114***	0.0153***
Portugal	0.00611	0.00887***	0.0283***
Slovenia	0.0521***	0.0109*	0.0583***
Spain	0.0267***	0.00602	0.0268
United Kingdom	0	0	0
Constant	0.287***	0.0434***	0.124***
Number of observations	107,764	105,842	105,842
Number of groups	52,185	51,545	51,545

Note: *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. OLS random effects with standard errors clustered at the country level (15 countries). *Temporary arrears* households missed only one mortgage payment over the last year, while *longer-term arrears* households missed several payments.

Arrears are more frequent for larger households. This may reflect the greater level of resources required to maintain a larger household. Because we have controlled separately for income, the household size effect estimates the effect of household size on arrears for households at the same level of income. Households with little education are more likely to be in arrears, both temporary and longer-term. One possible explanation is that households with little education find financial planning more difficult and take on too large financial burdens.

The larger the amount of principal remaining outstanding, finally, the higher the tendency to miss due mortgage payments, especially repeatedly. This may reflect a moral hazard effect: If there still is a lot of time and effort needed to repay the mortgage, the motivation to keep doing so may be low.

We include two household-specific variables for econometric reasons: the house price decline and the interaction of the principal outstanding and the share of unemployed. Since our proxy of the dual trigger is the interaction of all three terms, we need to include all possible interactions in the estimation to avoid biases in the estimation. These variables are insignificant.

Before turning to the country fixed effects, it should be pointed out that the results presented here are robust to a range of tests (see Gerlach-Kristen and Lyons, 2015). If as additional variables the house price change (rather than only house price declines) or the mortgage payment to income ratio (rather than both variables separately) are used, nothing changes regarding the significance of affordability problems and the dual trigger. Changing the estimation method to fixed effects makes the dual trigger become insignificant, while affordability problems remain significant. Estimating a Heckman model in which the first-stage equation captures which households have a mortgage, again yields significant affordability problems and a significant dual trigger.

We next turn to the question what might explain cross-country differences in arrears. The literature suggests that institutional, social and cultural factors affect mortgage arrears. An important caveat is that the fixed effects estimated here capture only the average effects of national characteristics that are stable throughout the sample period. Institutional and legal complexities of different countries are hard to capture and this method will not pick up time-varying changes in laws, implementation practices or cultural norms. Table 4 ranks the country effects from smallest to largest. Assuming we observe 15 identical households, one in each country, the ranking suggests that households in the UK are least likely to go into arrears, and those on Cyprus most likely.

Table 4: Country with the smallest (1) to largest (15) probability of mortgage arrears, after controlling for household characteristics

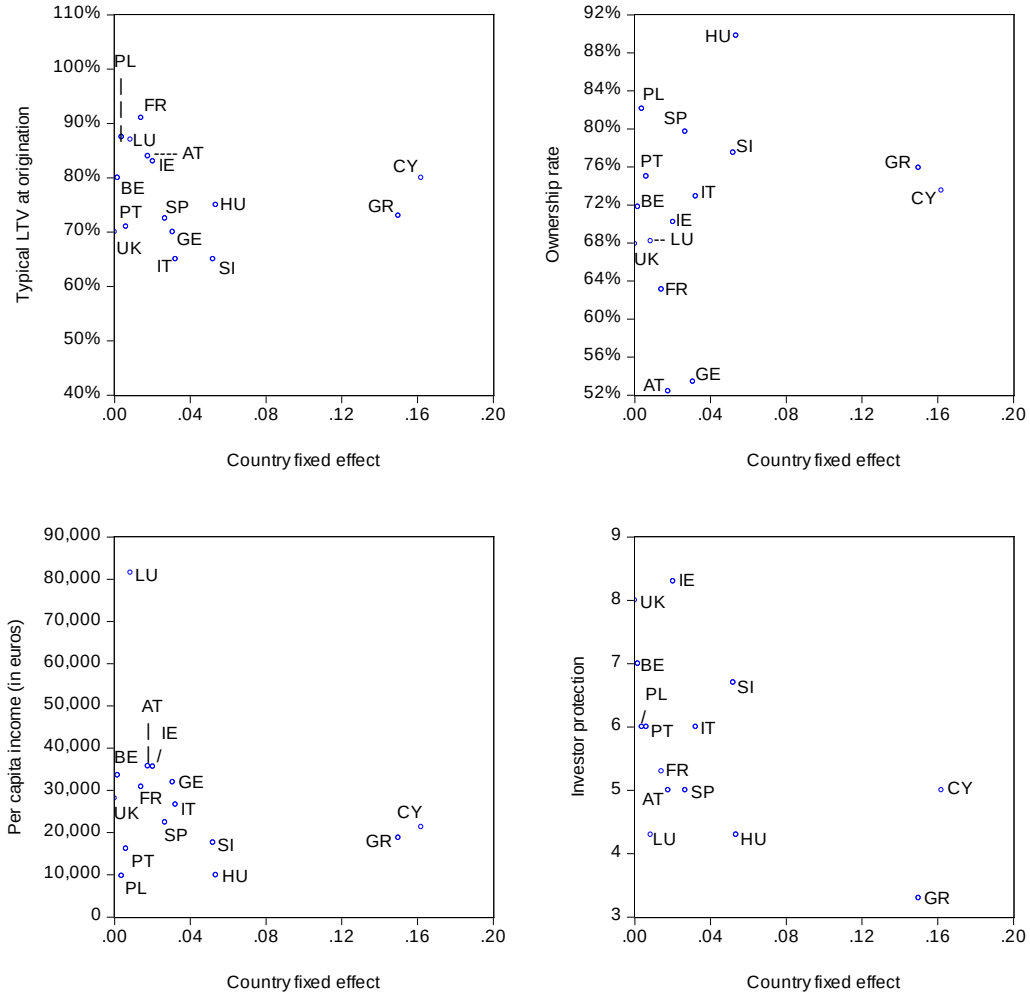
United Kingdom	1	Spain	9
Belgium	2	Germany	10
Poland	3	Italy	11
Portugal	4	Slovenia	12
Luxembourg	5	Hungary	13
France	6	Greece	14
Austria	7	Cyprus	15
Ireland	8		

In Figure 5, we show how the country fixed effects from the baseline regression using all arrears correlate with a number of indicators. The two plots on top indicate that there is no clear link between arrears and national housing market leverage and ownership rates. The plot on the left shows that arrears are not particularly high in countries where LTV ratios at origination tend to be high, even though a high debt burden should in principle make arrears more likely. It could be argued that this is an instance of reverse causality: In countries with high payment morale, banks are willing to approve mortgages with relatively high LTV ratios. The plot on the right shows that in countries with a high ownership rate, many financially vulnerable households own their dwellings. However, there seems to be no correlation between the ownership rates and arrears.

The first graph in the second row considers the association between arrears and per capita income. There is some evidence that arrears are more common in poorer countries, above and beyond the impact of household income, which we have included in the regression analysis. The graph on the right shows the correlation of the country fixed effects with an index of investor protection. There is some evidence of a negative association: In countries where creditors can enforce their rights more easily, fewer households go into arrears. [7]

Overall, the country-specific variables considered here suggest that, once we control for household characteristics, households in poor countries and where investor rights are poorly enforced are somewhat more likely to go into arrears than those in rich countries with strong investor protection. That said, our sample only contains 15 countries, so that these findings should be treated with some caution.

Figure 5: Correlation of country fixed effects from a model of household arrears with institutional, social and cultural characteristics



Note: Correlation between the country fixed effects reported in Table 2 and country indicators.

Conclusions

The economic crisis has led to a renewed focus on housing policy, financial regulation, macroeconomic management and the linkages between them. The experience of the crisis differed across countries, institutional settings and household circumstances in ways that offer a chance to learn more about how borrower and market characteristics may lead to more or less adverse market and societal outcomes during times of crisis. This paper applies regression analysis to national-level panel data for 2004 to 2011 to examine mortgage arrears in Europe. Mortgage arrears imply additional stress for households in financial difficulties. This makes them a social issue. They may cause health problems and homelessness and thus have indirect effects on government finances. Moreover, arrears have economic effects in terms of lower and more volatile aggregate consumption, lower labour mobility and weaker bank balance sheets.

As predicted by theory, arrears are driven by affordability problems, in the form of unemployment, low disposable income and high mortgage payments. We find no clear evidence that negative equity *per se* is associated with higher arrears, which is in line with expectations because of European recourse legislation. However, the combination of affordability problems and negative equity, which makes it impossible for financially strained households to move to cheaper places and which the literature refers to as a dual trigger situation, seems to matter for longer-term arrears. The dual trigger does not explain temporary arrears, as predicted by our model.

Since the social and economic impact of long-term arrears is likely to be larger than that of temporary arrears, an important policy issue is how the dual trigger can be avoided. Clearly, households that are both likely to enter negative equity – i.e. households with high indebtedness – and that are at the same time exposed to income volatility should be the main focus here. To the extent that young low-income households are most at risk of unemployment, policies should aim to limit the indebtedness of these households. Maximum loan-to-income and loan-to-value limits seem the right instrument here.

Moreover, policies limiting income volatility seem at least at first glance attractive. However, there exists a trade-off between job security and firms' willingness to hire that must not be neglected in this analysis. More generally, the finding that the dual trigger also matters in Europe raises the question whether policies promoting homeownership are desirable. It is clear that older households who have paid back their mortgage can more easily handle the decline in income at retirement because their housing cost is essentially zero. This advantage of homeownership has to be contrasted with the risk of arrears faced by highly indebted young households.

Since our model includes country fixed effects, we are also able to explore whether there are country-specific institutional, social and cultural factors that tend to raise households' likelihood of going into arrears, independent of the situation of the household itself. There is some evidence that strong investor protection is associated with lower arrears, and that the incidence of arrears generally tends to be lower in richer countries.

There are two main caveats to our analysis. First, we rely on a proxy for negative equity. It would be desirable to have an actual household measure for this variable, but we are not aware of a large European data set that would include these and the other relevant data. Second, the analysis of the country-specific effects relies with our data set of only 15 countries on a small sample.

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[1] Data made available to us by Eurostat cover Bulgaria, Estonia, the Czech Republic, Denmark, Finland, Iceland, Latvia, Lithuania, Malta, the Netherlands, Norway, Romania, Slovakia, Sweden and Switzerland. We do not include these country because of too few observations or missing explanatory variables..

[2] This is the question from the 2004 Irish questionnaire. Formulations vary slightly over time and between countries and languages.

[3] It should be noted that the EU-SILC questionnaire included the general question on arrears already in 2004; the distinction between one-time and repeated arrears yielded positive answers only from 2008 onwards, when the question was added "*Thinking about mortgage payments, how many times have you been in arrears in the last 12 months?*"

[4] The EU-SILC data can be compared with data from the Eurosystem survey by the Household Finance and Consumption Network (HFCN). Of this survey, only the first wave was available at the time of writing, whereas we can use 8 waves of EU-SILC. The HFCN survey contains data on mortgage maturity at origination, mortgage value at origination and negative equity. If we calculate country averages for these variables and compare them with the country averages from the EU-SILC data, we obtain correlations of 0.62, 0.97 and 0.02, respectively. The low correlation of the HFCN and the EU-SILC measures of negative equity does not necessarily imply that the EU-SILC measure is inferior. Our proxy assumes that households are likely to be in negative equity if they have outstanding debt and if property prices have fallen a lot. The HFCN survey gives information on the current value of a household's property and the outstanding mortgage. However, it is not clear how households evaluate the current value of their property. Presumably, there is considerable measurement error in both measures.

[5] For a mathematical representation of this model, see Gerlach-Kristen and Lyons (2015).

[6] Because of collinearity, we concentrated on one interaction between negative equity and affordability. The significance was strongest when we used unemployment.

[7] We also considered the correlations of the country fixed effects with national Gini coefficients and the fraction of Catholic population, but found no link.