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What drives mortgage default in Europe?
The role of liquidity, equity and debt enforcement

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Using harmonized household data from 18 European countries, this paper studies what triggers mortgage default. We distinguish between liquidity stress, negative equity, and the double trigger, where both occur simultaneously. We find that all three increase default risk, but the double trigger is by far the strongest predictor. The results also show that debt enforcement institutions shape how strongly equity-related incentives affect mortgage default.

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Keywords
Mortgage default, household finance, liquidity constraints, negative equity, macro-prudential policy

A theory-based approach

Rather than studying isolated shocks (e.g. unemployment), this paper tests competing mortgage default theories directly by classifying households into mutually exclusive trigger states. This allows a direct comparison of the relative importance of liquidity stress, negative equity, and the double trigger.

Trigger patterns vary across institutions

Trigger relevance differs across debt enforcement regimes. In weaker enforcement settings, negative equity accounts for a larger share of observed default risk. This pattern is consistent with lower expected default costs increasing equity-related default incentives.

Policy needs a joint risk view

Mortgage risk cannot be assessed from repayment capacity or collateral values alone. Default risk is highest when both coincide. Cross-country differences in trigger relevance further suggest that borrower-based measures should be activated and calibrated nationally

What drives mortgage default in Europe? The role of liquidity, equity and debt enforcement*

Peter Lindner and Aleksandra Riedl†

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Abstract

This paper provides the first systematic cross-country evidence on mortgage default triggers among households in Europe. Using harmonized microdata from the Household Finance and Consumption Survey (HFCS) covering 18 countries, we study three mutually exclusive drivers of default: liquidity stress, negative equity, and the double trigger—when households face both simultaneously. The double trigger is by far the strongest predictor of default, raising the probability of non-performing loans by about 16 percentage points (pp). Liquidity problems alone and negative equity alone also increase default risk, but more moderately (by around 4–6 pp each). Importantly, the role of negative equity varies across institutional contexts: it is weaker in countries with strong debt enforcement. This pattern is consistent with single-country evidence showing that lower effective default costs increase the relevance of equity-related incentives. By providing the first harmonized European evidence on how these trigger states translate into mortgage distress, the paper offers an empirical foundation for borrower-based macroprudential policies.

JEL Classifications: D10, D14, G21
Key Words: Default, NPL, HFCS, Household Finance

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Non-technical summary

Mortgage default is a central concern for financial stability. When households stop servicing their mortgages, banks face losses, credit supply may weaken, and housing market downturns can be amplified. For this reason, borrower-based macroprudential measures, such as loan-to-value (LTV) and debt-service-to-income (DSTI) limits, have become important policy tools in Europe. Yet the design of these instruments depends on a basic question: what actually triggers mortgage default?

This paper provides the first systematic cross-country evidence on mortgage default triggers among households in Europe. Using harmonized microdata from the Household Finance and Consumption Survey (HFCS) covering 18 countries, we distinguish between three default-relevant financial states: liquidity stress, negative equity, and the double trigger, where households face both conditions simultaneously. This approach allows us to compare the relative importance of different default mechanisms within one common European framework.

The main finding is that all three trigger states matter, but the double trigger is by far the strongest predictor of mortgage default. Households facing both liquidity stress and negative equity have a much higher probability of being in default than households facing only one of these conditions. Liquidity stress alone and negative equity alone also increase default risk, but their effects are considerably smaller. This suggests that mortgage distress in Europe is not well understood by looking only at repayment capacity or only at collateral values. Instead, default risk is especially concentrated where weak liquidity buffers and weak equity positions coincide.

The paper also shows that institutions matter. The role of negative equity is weaker in countries with strong debt enforcement, but more relevant in countries where enforcement is weaker. This pattern is consistent with single-country evidence showing that lower effective default costs can increase the importance of equity-related default incentives. At the same time, liquidity stress remains important across institutional settings, and the double trigger remains the dominant mechanism.

These findings have direct implications for macroprudential policy. First, monitoring mortgage risk requires more than tracking liquidity problems or negative equity separately. Because default risk is concentrated among households facing stress in both dimensions at the same time, early-warning systems should monitor their joint distribution. Second, our results suggest that both liquidity-based measures (such as DSTI limits) and equity-based measures (such as LTV caps) should be available within the macroprudential toolkit, as mortgage default can emerge through multiple pathways. This does not imply that these instruments should be calibrated uniformly across countries. Our evidence that the relevance of default triggers varies with debt enforcement supports a common European policy toolkit combined with national discretion in activation and calibration.

1 Introduction

Mortgage default represents a central risk channel for banks and a key transmission mechanism for macro-financial instability. Episodes of widespread mortgage distress have repeatedly amplified economic downturns by weakening bank balance sheets, constraining credit supply, and depressing housing markets. In response, borrower-based macroprudential measures (BBMs)—such as loan-to-value (LTV) and debt-service-to-income (DSTI) limits—have become core instruments of the European macroprudential framework and feature prominently in the policy toolkit of the European Systemic Risk Board (ESRB)[1]. At the same time, their implementation across Europe remains heterogeneous, prompting ongoing policy discussions about whether minimum borrower-based standards should be applied more uniformly across countries rather than relying solely on national discretion (European Commission, 2022).

BBMs are explicitly designed to prevent mortgage defaults. Yet their effectiveness depends critically on what actually triggers default. Conceptually, default may arise from liquidity stress, from negative equity, or from the interaction of both. These mechanisms correspond to competing strands in the theoretical literature on mortgage default, ranging from equity-based option models to liquidity-driven and double-trigger frameworks (Epperson et al., 1985; Riddiough, 1991; Goldberg and Capone, 1998). Each mechanism implies distinct policy implications: liquidity-driven default points to DSTI-type instruments, equity-driven default to LTV caps, while a dominant double-trigger mechanism suggests that focusing on only one dimension may be insufficient. Macroprudential policy therefore rests on implicit assumptions about default triggers—assumptions that require empirical validation.

Providing such validation has proven difficult for two related reasons. First, identifying default triggers requires observing households' liquidity positions and housing equity at the time default occurs—information that was largely unavailable in most mortgage datasets for a long time (Foote and Willen, 2018). Second, while the existing empirical evidence from Europe—largely based on single-country studies—has increasingly exploited richer household-level information, it has typically not been designed to assess the relative importance of competing default triggers. Instead, much of this literature focuses on selected components of the default process, for example by examining specific adverse events such as unemployment shocks or by relying on financial vulnerability indicators that proxy exposure to risk rather than realized financial states at default (O'Toole and Slaymaker, 2021; Mocetti and

[1] See https://www.esrb.europa.eu/about/html/index.en.html [accessed May 5^{th} 2026].

Viviano, 2017). As a result, the European empirical literature still provides limited evidence on which default triggers dominate, or on their relative importance in explaining mortgage distress.

By contrast, recent U.S. studies exploiting rich micro-level data have begun to quantify the relative contribution of competing default triggers. In doing so, they provide new evidence that challenges the earlier emphasis on negative equity, showing instead that liquidity stress and double-trigger mechanisms account for most observed defaults, while purely equity-driven default is relatively rare (Ganong and Noel, 2023; Low, 2023). Whether these insights carry over to European mortgage markets, with their distinct institutional and legal environments, remains an open question.

This paper fills that gap. Using data from the fourth wave of the Household Finance and Consumption Survey (HFCS), conducted between 2020 and 2021 (European Central Bank, 2023a,b), we provide the first systematic, cross-country analysis of mortgage default triggers across 18 European countries. Importantly, the fourth HFCS wave is the first to collect harmonized information on households' repayment difficulties on mortgage and other loans, making it possible to observe default outcomes alongside households' contemporaneous liquidity positions and housing equity. This unique feature allows us to test competing default theories directly within a unified European framework.

The paper makes three main contributions. First, we provide a conceptual contribution by testing theoretical default triggers directly, rather than individual shocks. We estimate the total effects of liquidity distress, negative equity, and their interaction on default risk, allowing for a direct comparison of competing default mechanisms and their relative importance—an approach that is genuinely new in the European context. Second, we introduce an empirical identification strategy grounded in causal inference. Using a directed acyclic graph (Hernán and Robins, 2020; Pearl, 2009; Greenland et al., 1999), we align the empirical specification with default theory, focus on mutually exclusive trigger states, and estimate total effects rather than over-controlled partial correlations. This strategy allows us to capture the main causal pathways leading to default in a transparent and theory-consistent way. Third, we contribute to the literature on European mortgage institutions by examining whether the relevance of default triggers varies with debt enforcement strength across Europe's predominantly full-recourse mortgage systems.

Our results show that all three default triggers are empirically relevant in Europe, with the double trigger emerging as the dominant mechanism. At the same time, the role of negative equity varies across institutional contexts: in countries with weaker

debt enforcement (i.e. lower expected default costs), equity-based default incentives appear more pronounced, a pattern consistent with evidence from settings such as Greece (Artavanis and Spyridopoulos, 2023). Liquidity stress, by contrast, remains central across enforcement regimes. These findings have direct policy implications, which we discuss in the concluding section.

The remainder of the paper is structured as follows. Section 2 develops the theoretical framework, identification strategy, and institutional context. Section 3 describes the data and the construction of default trigger states. Section 4 presents the empirical results on total trigger effects and cross-country heterogeneity by enforcement strength. Section 5 discusses robustness and extensions. Section 6 concludes by summarizing the main findings and discussing their implications for macroprudential policy.

2 Theoretical and institutional foundations

This section develops the conceptual and empirical framework used to study mortgage default in Europe. It proceeds in three steps. Section 2.1 reviews the main theoretical approaches to mortgage default and the corresponding empirical evidence, highlighting that—despite differing assumptions—these models characterize default in terms of households entering specific financial states rather than experiencing particular shocks. Section 2.2 builds on this insight and outlines an identification strategy that targets the total effects of these states on default, using a directed acyclic graph (DAG) to guide empirical specification and variable selection. Section 2.3 then situates these mechanisms in the European institutional context, discussing how cross-country differences in debt enforcement strength may shape the relevance of alternative default triggers. Together, these elements motivate the empirical approach and cross-country analysis that follow.

2.1 Mortgage default theories, triggers, and empirical evidence

Theoretical models of mortgage default differ in their assumptions about borrower behavior and market frictions, yet they share a common conceptual foundation: default arises when households enter particular financial states of distress. While these models are often formalized in terms of income shocks, house price dynamics, or other adverse events, such shocks matter only insofar as they move borrowers into states characterized by negative equity, binding liquidity constraints, or both.

Throughout the theoretical literature, these conditions are commonly referred to as default triggers. Although the term is sometimes used interchangeably with the underlying shocks, its conceptual role in the theory is to denote the financial state under which default becomes optimal or unavoidable. In this sense, the theoretical literature consistently frames default as a state-contingent decision rather than a direct response to specific shocks.

One of these states, emphasized in early option-based models, places home equity at the center of the default decision. In these frameworks, borrowers default strategically once the outstanding mortgage balance exceeds the market value of the property, rendering continued repayment economically irrational (Epperson et al., 1985; Kau et al., 1994). Default is modeled as the exercise of a put option, and borrowers are assumed to have frictionless access to credit markets, allowing them to smooth consumption and service mortgage payments in the absence of equity incentives to walk away. Thus, by construction, the current liquidity position of the household does not additionally enter the default decision. These models were developed in the context of U.S. mortgage markets, where non-recourse or weak-recourse loans are prevalent and lenders can typically claim only the collateral in the event of default, making strategic default economically feasible. Liquidity constraints play no role in these models, and negative equity is both a necessary and sufficient condition for default.

Double-trigger models extend this framework by moving beyond a purely option-based perspective toward a household-level decision framework that incorporates idiosyncratic liquidity shocks—such as income losses or unemployment—while continuing to treat negative equity as a necessary precondition for default. In these models, adverse life events impair repayment capacity, but borrowers with positive equity are assumed to sell or refinance their home rather than default. Default therefore occurs only when liquidity problems coincide with negative equity (Goldberg and Capone, 1998). More recent theoretical contributions relax this strict structure by allowing liquidity stress to affect default incentives more directly, while still recognizing that negative equity strengthens the incentives to walk away (Schelkle, 2018).

A smaller but conceptually important strand of the literature challenges the view that negative equity is required for default. These models emphasize binding liquidity constraints and show that severe repayment stress alone can trigger default, even when borrowers retain positive equity (Riddiough, 1991). In such settings, households may be unable to bridge short-term cash flow shortfalls, face borrowing constraints, or encounter transaction frictions that prevent timely property sales.

While these liquidity-driven models have historically received less attention than equity-focused theories, they establish that default can arise purely from repayment capacity constraints. From the lender's perspective, this type of default might be less problematic, as positive equity generally implies that liquidation of the collateral is sufficient to cover the outstanding mortgage balance.

Taken together, these theoretical approaches imply three distinct default-relevant states: households may default because they are liquidity constrained, because they have negative equity, or because both conditions apply simultaneously. Importantly, the theories make competing predictions regarding which of these states are sufficient to trigger default and how important each mechanism is in practice. Empirically distinguishing between these mechanisms therefore requires observing households' liquidity positions and equity status at the time default occurs—information that, for a long time, was largely unavailable due to data limitations.

As a result, early empirical studies were largely shaped by data constraints. Much of the U.S. evidence relied on loan origination characteristics or regional house price variation, variables that were readily observable in administrative datasets. Some studies linked default risk strongly to negative equity (Foster and Van Order, 1984; Deng et al., 2000), while others emphasized adverse life events such as income shocks (Cutts and Merrill, 2008). However, as noted by Foote and Willen (2018), the early empirical literature tended to place particular weight on equity-based explanations, in part because borrower-level liquidity conditions at the time of default were typically unobserved. As a consequence, negative equity often appeared as the most measurable and therefore most prominent predictor of default. With the emergence of richer micro-level data, subsequent studies were able to observe both liquidity and equity conditions directly. A key contribution in this regard is Gerardi et al. (2018), who show that both liquidity problems and negative equity raise default risk and that their interaction further amplifies default probabilities, consistent with a double-trigger mechanism.

More recent U.S. studies have gone further by explicitly assessing the relative importance of competing default mechanisms. Using high-frequency financial data or linked administrative records, these contributions find that liquidity-driven and double-trigger defaults account for the majority of observed mortgage defaults, while purely equity-driven default plays a comparatively limited role (Ganong and Noel, 2023; Low, 2023). These findings suggest that, even in institutional settings where strategic default would be feasible, negative equity alone does not appear to be a dominant driver of default in the absence of binding liquidity constraints.

In Europe, empirical evidence on mortgage default triggers remains much more

limited. The existing literature that comes closest to the theoretical notion of default triggers consists primarily of single-country studies that exploit household-level information on balance sheets, income, or repayment difficulties around the time of default. While these studies consistently document that both liquidity-related and equity-related factors are associated with mortgage distress, they do not systematically distinguish between liquidity-driven, equity-driven, and double-trigger defaults, nor do they assess the relative importance of these mechanisms within a unified framework. Instead, most contributions focus on selected components of the default process, either by examining specific adverse events—such as unemployment spells or house price declines—or by using financial vulnerability indicators that capture exposure to risk rather than realized financial states at the point of default (O'Toole and Slaymaker, 2021; Mocetti and Viviano, 2017; Kelly and O'Malley, 2016; Gerlach-Kristen and Lyons, 2018; Antoniou et al., 2022).

Despite these contributions, the European literature has not yet provided an assessment that directly compares the relative importance of competing default triggers within a unified and harmonized framework—neither at the country level nor across Europe. This gap reflects persistent data limitations and the fact that existing studies were not designed to evaluate default triggers as mutually exclusive financial states with comparable total effects. Addressing this gap requires an empirical framework that targets financial states, estimates their total effects on default, and allows for a systematic comparison of competing mechanisms. The next section develops such an identification strategy.

2.2 Identification strategy: total effects of default triggers

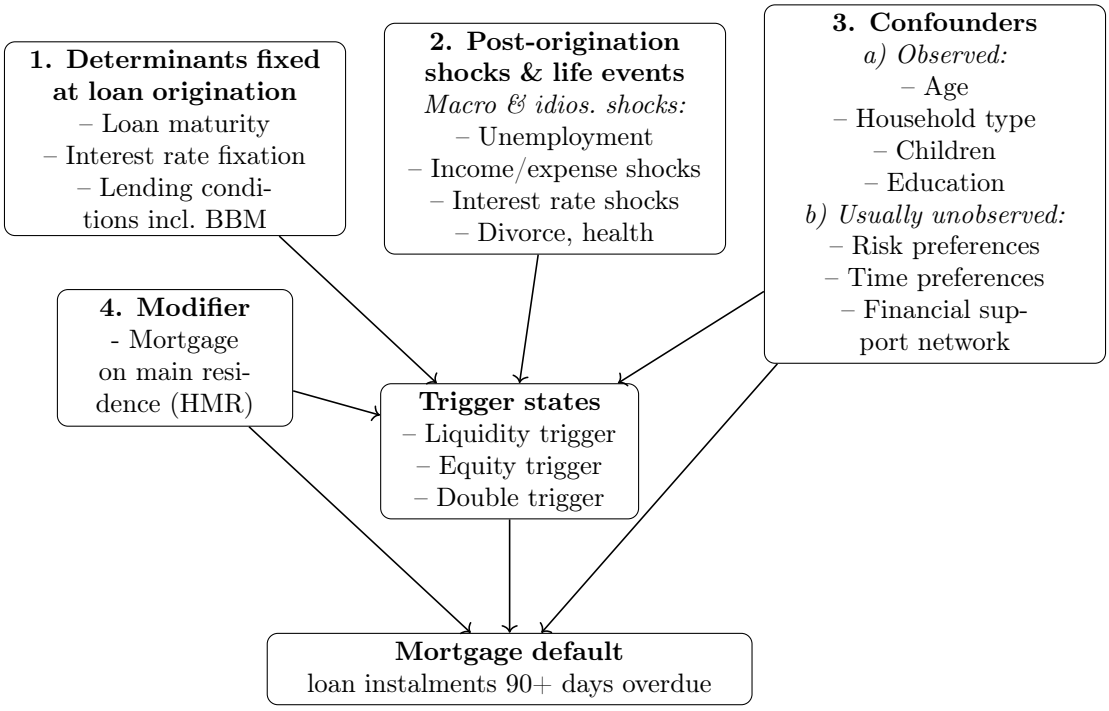
As emphasized in Section 2.1, prevailing theories of mortgage default are formulated in terms of financial vulnerability states—liquidity distress, negative equity, and their interaction—rather than in terms of individual adverse shocks. In these frameworks, default becomes optimal or unavoidable once households enter such states, regardless of the specific sequence of events that led there. Our empirical objective is therefore to estimate the effects of these default-relevant states on the probability of mortgage default.

Focusing on financial states rather than shocks is crucial for two reasons. First, the theoretical literature is concerned with the effect of entering a default-relevant state, not with the effect of any single adverse event. Individual shocks—such as unemployment, income losses, or house price declines—capture only partial pathways into liquidity distress or negative equity, and conditioning on them would therefore identify only partial effects, decomposing the mechanisms emphasized by theory. By

contrast, our approach estimates what we refer to as the total effects of liquidity distress, negative equity, and their interaction: effects that aggregate all observable and unobservable mechanisms through which households enter these states. This aggregation is essential for comparing the magnitude of competing default triggers, particularly given evidence that a wide range of shocks can lead to default through different channels (Low, 2023).

Second, shocks do not translate automatically into default-relevant states. Identical events can have very different consequences across households depending on pre-existing buffers, access to credit, and adjustment margins. An income loss or spell of unemployment, for example, may push some households into binding liquidity stress while leaving others able to continue servicing their mortgage. Moreover, the transmission of shocks into financial distress depends on institutional features such as unemployment benefit replacement rates, benefit duration, and social insurance systems, which vary widely across countries. By the time households enter a liquidity- or equity-based state of distress, these institutional transmission mechanisms have already operated. Estimating trigger-state effects therefore yields parameters that are more comparable across heterogeneous institutional environments and more directly informative about default mechanisms.

Figure 1: Directed acyclic graph (DAG) of the causal pathways to mortgage default



Notes: BBM = borrower-based measures.

To operationalize this state-based approach and clarify the corresponding identi-

fication choices, Figure 1 presents a directed acyclic graph (DAG) summarizing the assumed causal structure underlying mortgage default. The DAG formalizes the distinction between underlying (i.e., upstream) determinants that move households into default-relevant financial states, confounders that jointly affect trigger exposure and default behavior, and variables that shape how a given trigger translates into default. In doing so, it provides a transparent framework for determining which variables should be included or excluded when estimating the total effects of default triggers, in line with standard principles from the causal inference literature (Hernán and Robins, 2020; Pearl, 2009; Greenland et al., 1999).

Boxes 1 and 2 in Figure 1 collect underlying determinants that give rise to the trigger states. These include loan characteristics fixed at origination—such as loan maturity, interest rate fixation, and lending standards—as well as post-origination shocks, including unemployment, income and expense shocks, interest rate changes, and family or health events. These variables affect default primarily by pushing households into liquidity distress, negative equity, or both. In the DAG, they therefore point into the trigger states but not directly into default.

In line with our objective of estimating total trigger effects, these underlying determinants are deliberately excluded from the baseline regression. Conditioning on them would block part of the causal pathways operating through the trigger states and would change the estimand to a conditional effect of the trigger net of its underlying (i.e., upstream) causes, rather than the total effect implied by default theory (Hernán and Robins, 2020). Instead, the trigger variables are constructed to summarize the combined impact of these underlying forces.

Box 3 represents household characteristics that may influence both the likelihood of entering a trigger state and the propensity to default conditional on that state. Observed confounders (3.a)—such as age, household type, the presence of children, and education—can affect exposure to liquidity and equity distress as well as repayment behavior directly. Younger households, for example, typically have shorter credit histories, lower accumulated wealth, and higher leverage, making them more likely to enter liquidity stress or negative equity; conditional on distress, they may also face tighter access to refinancing or restructuring options, increasing the likelihood of arrears. Single households are more exposed to income volatility and lack intra-household risk sharing, which raises the probability of entering liquidity distress and weakens repayment resilience once financial stress occurs. Households with children face higher non-discretionary consumption needs, which can increase the likelihood of liquidity stress and constrain repayment capacity when resources become scarce. Education, as a proxy for financial literacy, can shape borrowing

and budgeting choices that affect trigger exposure and can also influence repayment outcomes through information frictions, repayment management, or the ability to engage effectively with lenders.

Usually unobserved characteristics (3.b), including risk preferences, time preferences, and access to informal support networks, may likewise affect both exposure to financial triggers and mortgage default behavior. A key advantage of the HFCS is that it provides direct information on these dimensions, which are typically not observed in administrative or loan-level datasets used in much of the existing literature. In particular, the survey elicits households' willingness to take financial risk, allowing us to identify risk-seeking households, and includes a hypothetical lottery question that provides a proxy for impatience, capturing households' preference for immediate consumption over saving or debt repayment. It also asks whether households could rely on financial assistance from friends or relatives if needed.[2] In particular, risk-seeking households are more likely to choose high leverage and maintain thinner liquidity buffers, increasing their exposure to both liquidity and equity triggers, and may also be more willing to stop repayment once incentives deteriorate. Impatience or short planning horizons can reduce precautionary saving and increase vulnerability to liquidity stress, while also lowering the perceived cost of default relative to continued repayment. Informal support networks can mitigate the likelihood of entering liquidity distress by cushioning adverse shocks and can help households remain current on mortgage payments even when formal liquidity constraints bind. These concerns are well established in the mortgage default literature. For instance, Gerardi et al. (2018) explicitly discuss unobserved traits such as impatience as potential confounders, noting that more impatient households may both choose higher leverage at origination and exhibit higher default propensities, and therefore employ instrumental-variable strategies to address this source of bias. In contrast, our setting allows us to directly control for several of these otherwise unobserved characteristics.

Because these characteristics are common causes of both trigger exposure and

[2]Risk tolerance is measured using the HFCS investment attitudes question and coded as one for households reporting above-average or substantial willingness to take financial risk. Impatience is proxied using the HFCS lottery module, which asks households how much of an unexpected one-month income windfall they would spend within the next 12 months rather than save or use for debt repayment. Households with a high immediate spending share (>80%) are classified as more present-oriented. Financial support networks are measured using a hypothetical question on whether the household could obtain financial assistance from friends or relatives if needed, rather than support actually received during a crisis. This distinction is critical: because the measure captures pre-existing access to informal support rather than a reaction to financial distress, it can be validly treated as a confounder. If it instead reflected realized help triggered by hardship, it would lie along the causal path from constraint to default and should not be controlled for in the baseline specification.

default, failing to account for them would bias the estimated trigger effects. We therefore control for observed confounders in all specifications and examine robustness to typically unobserved characteristics in a restricted sample. This adjustment strategy follows standard principles from the causal inference literature on identifying causal effects by conditioning on common causes of treatment and outcome, while avoiding adjustment for variables that lie downstream of the trigger states—that is, on the causal pathway from trigger exposure to mortgage default (Greenland et al., 1999; Pearl, 2009).

Finally, box 4 captures whether the mortgage is secured on the household's main residence (HMR). This characteristic can influence both the likelihood of entering liquidity or equity distress and how a given trigger state translates into default. Mortgages on the main residence typically differ in borrower attachment to the property and the legal or institutional treatment they receive in default. In particular, as discussed in more detail in Section 2.3, main residences are often subject to stronger borrower protections and slower or less certain enforcement, which may alter the incentives to default when households become liquidity constrained or fall into negative equity. As a result, the effect of a given trigger state on default may differ systematically between main-residence and non–main-residence mortgages. We therefore allow HMR to enter the regression model directly as a variable that modifies the relationship between trigger states and default, consistent with standard causal reasoning (Hernán and Robins, 2020).

Guided by the DAG, for household i in country c, we estimate the following logit model:

$$\Pr(\text{Default}_{ic} = 1 \mid z_{ic}) = \Lambda\big(\beta_1 \text{EquityTrigger}_{ic} + \beta_2 \text{LiquidityTrigger}_{ic} + \beta_3 \text{DoubleTrigger}_{ic} + \boldsymbol{\gamma}_2 \mathbf{C}_{ic}^{(a,b)} + \gamma_3 \text{HMR}_{ic} + \mu_c\big). \tag{1}$$

where $\Lambda(z) = \frac{e^z}{1+e^z}$ denotes the logistic cumulative distribution function, $\mathbf{C}_{ic}$ collects observed confounders as well as those that are typically unobserved, which will be considered in a restricted sample, and μ_c are country fixed effects. The coefficients β_1, β_2, and β_3 are the parameters of primary interest and measure the total effects of the equity, liquidity, and double-trigger states on mortgage default.

Taken together, this identification strategy captures the main causal pathways leading to default while remaining closely aligned with default theory. By focusing on total trigger effects and carefully distinguishing between underlying determinants, confounders, and effect modifiers, the analysis provides a coherent and policy-relevant assessment of the relative importance of liquidity and equity mechanisms in explaining mortgage default.

2.3 Debt enforcement strength and cross-country heterogeneity

As mentioned in section 2.1, prevailing theories of mortgage default are closely aligned with the legal environments in which they were developed. In particular, equity-based and strategic default models emerged in the United States, where a large share of mortgages are issued under non-recourse regimes. In such settings, lenders' claims are typically limited to the collateral, and borrowers are shielded from further liability once they walk away from the property. This institutional setup lowers the private cost of default and might amplify equity-driven default incentives. By contrast, most European mortgage systems are formally full recourse, meaning that creditors can pursue not only the collateral but also other assets and, in principle, future income streams of the borrower (Moore et al., 2013; Harris and Meir, 2015).

Empirical evidence confirms that legal recourse plays a central role in shaping equity-related default incentives. Using variation in recourse regimes across U.S. states, Ghent and Kudlyak (2011) show that recourse substantially dampens borrowers' responsiveness to negative equity: borrowers are significantly more likely to default in non-recourse states, and the sensitivity of default to equity is markedly higher where lenders cannot pursue deficiency judgments. Complementary evidence is provided by Andrieș et al. (2025), who exploit a legal reform that shifted mortgage contracts from full recourse to non-recourse and document a sharp increase in default rates following the reform. Taken together, these findings confirm that equity-based default incentives are considerably stronger in non-recourse environments. From this perspective, one would expect equity-driven or strategic default incentives to be of limited relevance in Europe, and the empirical effect of negative equity to be small relative to liquidity-related triggers, if present at all.

However, recent evidence suggests that variation in effective debt enforcement can shape default incentives even within formally full-recourse systems. O'Malley (2021) studies a legal change in Ireland that reduced lenders' ability to repossess collateral and document a significant increase in mortgage default following the reform, with effects concentrated among highly leveraged and less liquid households. This finding indicates that a reduction in effective enforcement —by lowering the expected cost of default—can increase the likelihood that financial distress translates into default. Related evidence is provided by Artavanis and Spyridopoulos (2023), who exploit legal protections of primary residences in Greece and show that these led to a rise in mortgage default consistent with strategic behavior.[3] In this environment,

[3] Artavanis et al. (2023) exploit variation in the legal protection of primary residences in Greece,

households could remain in their homes for extended periods despite non-payment, while banks faced slow, costly, and uncertain recovery prospects. As a result, lenders often opted to renegotiate loans or grant partial debt forgiveness, and default could become a rational choice for households even when they retained repayment capacity. The resulting behavior is consistent with strategic considerations, even within a formally full-recourse system.

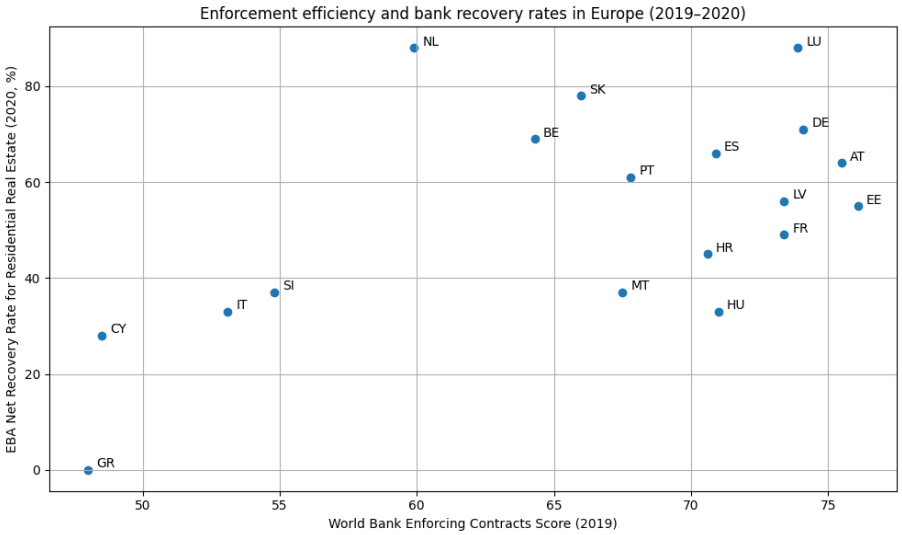
Taken together, this evidence suggests that effective debt enforcement—beyond the formal distinction between recourse and non-recourse regimes—plays a central role in shaping the cost of default in practice. This motivates the hypothesis that debt enforcement strength may influence how financial conditions translate into default outcomes, and that weaker enforcement may be associated with a greater role for equity-related default incentives.

To examine whether the relevance of cash-flow, equity, and double-trigger mechanisms varies with institutional context, we classify countries according to the strength of debt enforcement. Estimating country-specific effects is not feasible given the limited number of default events and the resulting small trigger–default cell counts in household survey data (see section 3.4). We therefore adopt a grouped-country approach that balances institutional relevance with statistical power, while remaining transparent about the criteria used. The grouping is based on the only two indicators that provide harmonized, cross-country information on debt enforcement strength across European countries. First, we rely on the Enforcing Contracts indicators from the World Bank (2020) Doing Business project. These indicators measure the time and cost required to resolve a commercial dispute through a local first-instance court, as well as the quality of judicial processes index, which captures the adoption of good practices that promote efficiency, transparency, and legal certainty in the court system. The most recent round of data collection was completed in 2019. Second, we use evidence from the European Banking Authority (2020) Report on the Benchmarking of National Loan Enforcement Frameworks, which documents net recovery rates for residential real estate, defined as the average share of loan amounts ultimately recovered by banks or external collectors through foreclosure or insolvency proceedings.[4] Taken together, these indicators

which limited lenders' ability to foreclose on certain households. Using eligibility thresholds and changes in the scope of these protections, they compare borrowers differentially exposed to the reform. They document a significant increase in mortgage default among eligible borrowers, including households with relatively strong repayment capacity. This pattern is interpreted as evidence of strategic behavior, as the legal framework reduced the expected cost of default by delaying or preventing foreclosure.

[4]The OECD also provides an indicator measuring the typical duration of foreclosure proceedings for the most common procedure in each country. However, this indicator is available only for a limited subset of countries in our sample (van Hoenselaar et al., 2021).

Figure 2: Country groups and debt enforcement regimes



Notes: The World Bank indicator measures time and cost to resolve a commercial dispute at a first-instance court as well as the quality of judicial processes. The EBA rate reflects the average share of loan amounts recovered by banks or external collectors under insolvency proceedings.
Source: World Bank Doing Business 2019 (Enforcing Contracts). European Banking Authority 2020 (Transparency Exercise).

reveal a clear empirical pattern, as illustrated in Figure 2: European countries can be broadly characterized as belonging to one of two groups, with a small subset of countries exhibiting markedly lower enforcement strength compared to a much larger group with relatively stronger and more effective enforcement frameworks. Importantly, this distinction reflects differences in procedural efficiency and recovery outcomes rather than normative assessments of legal systems. Based on this classification, Greece, Cyprus, Italy, and Slovenia stand out as countries with comparatively weaker or slower enforcement, while the remaining countries in the sample form a larger group characterized by stronger enforcement regimes.[5]

From an empirical perspective, the available data allow trigger effects to be estimated separately for the two enforcement regimes without running into the rare-event and sparse-cell constraints that would arise in country-specific estimations (see section 3.4). Grouping countries along this institutional dimension yields two sufficiently large samples, preserving statistical reliability while still capturing meaningful heterogeneity in enforcement strength. This setup makes it possible to assess

[5] As a robustness check, we additionally consider an alternative grouping in which Malta and Hungary are included in the weaker-enforcement category, as they exhibit recovery rates similar to Slovenia and Italy according to the EBA indicator. However, because our empirical results are not sensitive to this reclassification and because both countries align more closely with the stronger-enforcement group under the alternative indicator, we retain the baseline classification in the main analysis. Additional results are available upon request.

whether weaker enforcement is associated with a stronger role for equity-related default incentives.

Importantly, this approach does not aim to identify the causal effect of enforcement changes on default behavior, as in studies exploiting policy variation or regime shifts. Rather, it examines whether the broader patterns documented in such settings—namely that lower effective default costs influence borrower default behavior—also emerge systematically across countries with different levels of debt enforcement. As countries differ along multiple dimensions that may be correlated with enforcement strength, observed differences cannot be attributed uniquely to this channel.[6] At the same time, the evidence discussed above (e.g., Ghent and Kudlyak, 2011; Andrieș et al., 2025; Artavanis and Spyridopoulos, 2023) suggests that weaker enforcement may increase the relevance of equity-related incentives, a pattern we assess in a European setting. In this sense, our analysis provides cross-country evidence on whether the mechanisms identified in single-country studies are reflected more broadly.

3 Data and empirical implementation

3.1 Measuring mortgage default in the HFCS

The empirical analysis is based on data from the fourth wave of the European Central Bank's Household Finance and Consumption Survey (HFCS), conducted between 2020 and 2021 (European Central Bank, 2023a,b). The HFCS is the most comprehensive source of harmonized household-level financial information in Europe, covering detailed data on households' balance sheets, income, employment, preferences, and demographic characteristics. Its survey design ensures national representativeness within each participating country and enables consistent cross-country comparisons, making it particularly well suited for studying mortgage default behavior across heterogeneous institutional environments.

Throughout the analysis, household-level survey weights are applied to ensure representativeness within countries. To facilitate cross-country comparisons, we normalize weights to sum to one within each country, so that each country contributes equally to the reported average effects. This approach allows us to identify patterns that are common across countries rather than being driven by larger economies. For completeness, we also report population-weighted estimates in robustness exercises,

[6] For instance, enforcement regimes may be correlated with housing market conditions, borrower characteristics, or macroeconomic volatility, all of which may independently affect default behavior.

which reflect the average effect across the euro area as a whole and are relevant for aggregate policy assessments.

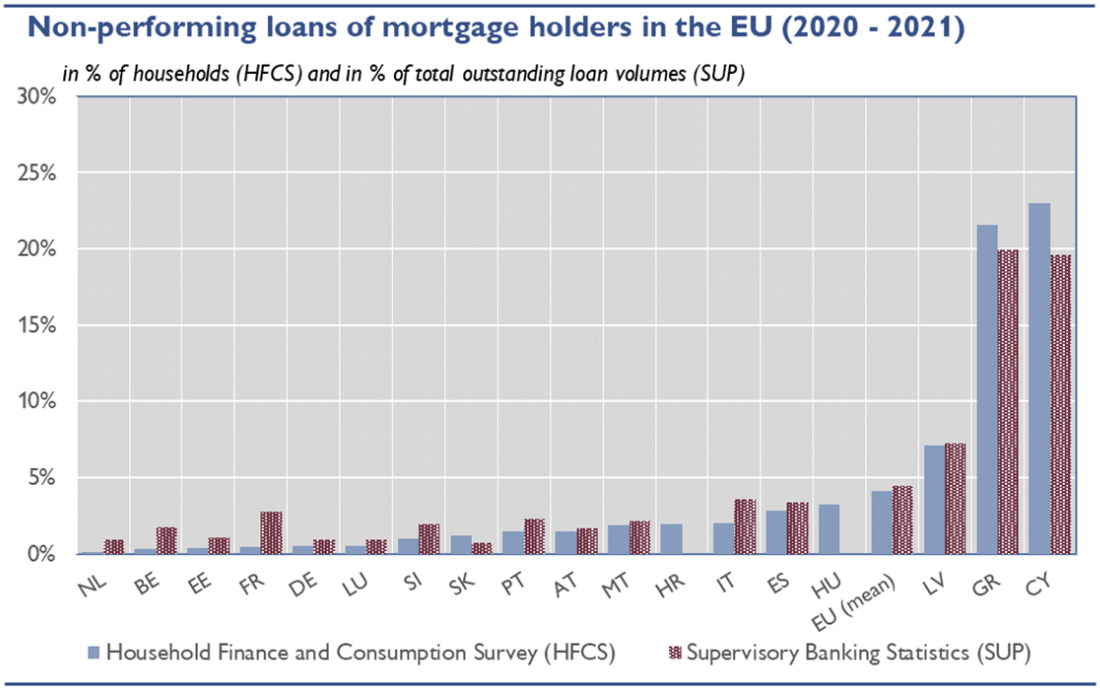
A key advantage of the fourth HFCS wave for the purposes of this study is that it collected information on severe loan repayment difficulties for the first time. Specifically, households were asked whether they had been in arrears for 90 days or more on mortgage or other loan payments during the preceding 12 months. Restricting the sample to households with outstanding mortgage debt, we use this information to identify serious mortgage delinquency. Formally, mortgage default is defined as

$$\text{NPL}_i = \begin{cases} 1 & \text{if 90+ days in arrears in past 12 months} \\ 0 & \text{otherwise} \end{cases} \tag{2}$$

This definition closely aligns with supervisory practice and regulatory guidelines from the European Banking Authority (EBA) for identifying defaulted exposures (European Banking Authority, 2016). While the HFCS does not observe foreclosure events or legal default outcomes directly, the 90-day arrears threshold captures economically meaningful mortgage distress and is widely used in both supervisory and academic contexts.

Figure 3 reports mortgage non-performing loan (NPL) ratios based on HFCS data for the 18 countries included in our sample. The figure reveals substantial cross-country heterogeneity, with survey-based default rates ranging from around 0.1 percent in the Netherlands to more than 20 percent in Cyprus. To assess the credibility of the survey measure, the figure also compares HFCS-based NPL ratios with official supervisory statistics reported to the ECB for loans collateralized by residential property and held by households. Despite differences in data sources and coverage, the two measures align closely across countries, providing reassurance that the HFCS captures mortgage distress in a manner consistent with administrative banking data.

Figure 3: NPL-ratios in EU countries: Household survey and banking statistics



Notes: The analysis includes 18 countries: Austria (AT), Belgium (BE), Cyprus (CY), Germany (DE), Estonia (EE), Spain (ES), France (FR), Greece (GR), Croatia (HR), Hungary (HU), Italy (IT), Latvia (LV), Luxembourg (LU), Malta (MT), the Netherlands (NL), Portugal (PT), Slovenia (SI), and Slovakia (SK). Four HFCS countries are excluded: the Czech Republic (CZ) and Finland (FI), which do not report mortgage NPL information, and Ireland (IE) and Lithuania (LT), due to data limitations in the NPL module. Countries are sorted in ascending order based on household mortgage NPL ratios from the HFCS (left bars). Right bars (SUP, ECB) report the share of non-performing loans (by volume) collateralized by immovable property and granted to households by significant institutions (SII), or by less significant institutions where SII data are not available (LV, SI, SK). For consistency, supervisory data from Q2 of the respective HFCS survey year are used. Comparable supervisory data are not available for HU and HR.
Source: HFCS 2021, ECB; SUP Q2-2020 and Q2-2021, ECB.

Beyond the measurement of default itself, the HFCS offers several features that are particularly valuable for analyzing mortgage default triggers. First, it provides contemporaneous information on household income, liquid assets, debt balances, and housing values, allowing financial conditions to be observed at the time households experience repayment difficulties. Second, the harmonized survey design ensures that key variables are measured consistently across countries, which is essential for comparative analysis. Third, the HFCS includes a rich set of additional variables—such as risk and time preferences, expectations, and access to informal financial support—that will be used to address concerns about unobserved heterogeneity.

At the same time, several limitations of the data should be acknowledged. First, the HFCS does not contain detailed loan-level performance histories, information on foreclosure proceedings, or direct measures of creditor enforcement actions. As a result, our analysis focuses on serious mortgage arrears rather than formal default outcomes. Second, the HFCS is a cross-sectional dataset and does not provide a

panel structure that would allow us to observe how households transition into mortgage distress over time. In particular, although our trigger variables are designed to capture default-relevant financial states, we cannot fully rule out that mortgage distress itself may feed back into these states.

Despite these limitations, the HFCS offers a uniquely suitable framework for our research question. Its harmonized design, broad cross-country coverage, and detailed information on household balance sheets allow us to directly observe key dimensions of financial stress—liquidity positions and housing equity—at the household level. To our knowledge, no alternative dataset provides comparable coverage and consistency across European countries while simultaneously capturing these dimensions. By explicitly structuring the analysis around theoretically motivated trigger states, and by examining alternative trigger definitions in the robustness analysis, we extract as much information as possible from the available data and provide the first systematic cross-country evidence on the relative importance of liquidity and equity conditions in mortgage distress.

3.2 Defining liquidity constraints and negative equity

To construct the default trigger groups introduced in the next subsection, we first identify whether mortgaged households are liquidity constrained and whether they hold negative housing equity. These two conditions constitute the empirical building blocks underlying the trigger classification.

We classify a household as liquidity constrained if it simultaneously experiences cash-flow pressure and lacks sufficient liquid buffers. Specifically, a household is defined as liquidity constrained if its regular expenses exceeded its income over the preceding 12 months and its holdings of liquid assets are smaller than one month of gross household income. Formally,

$$\text{liquidity constrained}_i = \begin{cases} 1 & \text{if expenses}_i > \text{income}_i \ \& \ \text{liquid assets}_i < \frac{\text{income}_i}{12} \\ 0 & \text{otherwise} \end{cases} \tag{3}$$

Information on income–expense balances is taken directly from the HFCS survey question on whether households' regular expenses exceeded, matched, or fell below income during the past year. Liquid assets comprise deposits, bonds, mutual funds, managed investment accounts, and private business equity, net of overdrafts and revolving consumer credit. This definition captures households facing binding short-term liquidity shortages without readily available financial buffers, consistent with

standard interpretations of liquidity constraints as impediments to consumption smoothing following adverse events.

Negative equity is identified by comparing households' outstanding mortgage liabilities with the current value of the residential property securing those loans. For households owning a single property, the loan-to-value (LTV) ratio is defined in the standard way as the ratio of the outstanding mortgage balance to the reported property value. For households owning multiple properties, we first compute property-level LTV ratios for each property. We then aggregate these into a household-level LTV by taking a weighted average of the property-specific LTVs, where the weights are given by the share of each property's outstanding mortgage in total outstanding mortgage debt. A household is classified as beeing in negative equity if its (aggregated) LTV exceeds 100 percent:

$$\text{negative equity}_i = \begin{cases} 1 & \text{if } \frac{\text{mortgage debt}_i}{\text{property value}_i} > 1 \\ 0 & \text{otherwise} \end{cases} \tag{4}$$

Mortgage debt includes all loans secured on residential real estate, including refinancing loans and credit lines backed by housing collateral. While property values are self-reported and may be measured with error, this approach follows established practice in the literature and provides the most comprehensive assessment of households' equity positions available in cross-country survey data.

Table 1 summarizes selected household characteristics and adverse events associated with liquidity constraints and negative equity. As discussed in Section 2, theoretical models of mortgage default are typically formulated in terms of financial states, but are often motivated by underlying shocks and adverse events—such as income losses, unemployment, expense shocks, or house price declines—that move households into these states. The table provides empirical evidence that precisely these underlying determinants are strongly correlated with the liquidity and equity conditions identified in our data.

Liquidity-constrained households exhibit substantially higher incidences of unemployment, income losses, and rising expenses than unconstrained households. For example, 21 percent of liquidity-constrained households report unemployment, compared with 9 percent among unconstrained mortgage holders, and more than half experienced a significant income drop over the preceding year. Major life events such as divorce and disability are also more prevalent among constrained households, consistent with idiosyncratic shocks impairing short-term repayment capacity.

Households with negative equity, by contrast, differ most strongly along the housing market dimension, consistent with the theoretical literature emphasizing falling

Table 1: Possible sources of (1) liquidity constraints and (2) negative equity

	Liquidity constrained		Negative equity	
Characteristics of mortgaged households	Yes	No	Yes	No
Unemployment (HH member)	0.21	0.09	0.14	0.09
Unemployment (RP)	0.08	0.02	0.05	0.02
Income drop	0.51	0.18	0.23	0.19
Expenses rise	0.48	0.18	0.24	0.19
Interest rate	3.00	2.20	2.43	2.24
Divorce (HH member)	0.20	0.14	0.14	0.14
Disability (HH member)	0.08	0.03	0.04	0.03
House price drop	0.21	0.08	0.33	0.07
Regional house price drop	0.10	0.06	0.12	0.06
Liquidity withdrawal	0.07	0.02	0.04	0.02

Notes: Values are population-weighted means (equal country weights), averaged across all five implicates. Country sample as defined in Figure 3. Binary variables (i.e., all except the interest rate) are reported as shares. Liquidity-constrained and negative-equity borrowers are defined in equations 3 and 4. Unemployment equals one if at least one household (HH) member or the reference person (RP) is unemployed. Income drop and expenses rise refer to changes over the past 12 months relative to a usual year. The interest rate is the current mortgage rate (volume-weighted across all loans, including unsecured loans). Divorce and disability indicate whether at least one HH member is divorced or permanently disabled. House price drop equals one if the current value of the main residence is below the purchase price; the regional measure captures the share of such cases within region × loan-cohort cells. Liquidity withdrawal indicates mortgage use for debt consolidation or living expenses.
Source: HFCS 2021, ECB.

collateral values as a key source of equity distress. As shown in Table 1, 33 percent of households with negative equity report that the value of their property has fallen below the purchase price, compared with only 7 percent among households with positive equity. A similar pattern emerges at the regional level, where households with negative equity are also more likely to be located in areas that experienced broader house price declines. These differences are also more pronounced than for liquidity-constrained households, consistent with falling house prices being a central channel through which households enter negative equity. At the same time, households with negative equity also show somewhat higher incidences of unemployment, income losses, and liquidity withdrawals than households with positive equity, although these differences are generally smaller than those observed for liquidity-constrained households. This suggests that negative equity is often linked to housing-market shocks, but may also coincide with broader episodes of financial strain that slow balance-sheet repair over time.

Taken together, the patterns in Table 1 illustrate that a wide range of underlying shocks and financial stressors—of the type emphasized in the theoretical literature—are empirically linked to the liquidity and equity conditions observed in the HFCS. This supports our empirical strategy of focusing on trigger states rather than

conditioning on individual shocks: the trigger variables aggregate the combined impact of multiple underlying determinants and capture the financial conditions under which default becomes likely. In section 4 we use these two dimensions to construct mutually exclusive default trigger groups and examine how mortgage default incidence varies across them.

3.3 Constructing default trigger groups and default incidence

Building on the definitions of liquidity constraints and negative equity introduced in the previous subsection, we classify each mortgaged household into one of four mutually exclusive groups. Three of these correspond to the default triggers emphasized in the theoretical literature, while the fourth serves as a residual group facing neither condition. This classification translates the conceptual trigger framework into an empirically transparent grouping of households.

Specifically, households are assigned to the following categories. An equity trigger group consists of households that are in negative equity but not liquidity constrained. A liquidity trigger group includes households that are liquidity constrained but retain positive housing equity. A double trigger group comprises households that are both liquidity constrained and in negative equity. Finally, the no-trigger group includes households that face neither liquidity stress nor negative equity. By construction, each household belongs to exactly one group.

Table 2 reports the number of households in each category and the corresponding mortgage default rates, defined as the share of households reporting mortgage arrears of 90 days or more over the past 12 months. The overall default rate among mortgaged households in the sample is approximately 3 percent, masking substantial heterogeneity across trigger groups. Households classified as facing both liquidity constraints and negative equity exhibit by far the highest incidence of default. Nearly half of the households in the double-trigger group report serious mortgage arrears (46%), far exceeding the average default rate in the population. In contrast, households facing only one form of financial stress show elevated but substantially lower default rates (13% and 9%). Finally, households in the no-trigger category rarely default (2%).

This pronounced gradient in default incidence across trigger groups provides first descriptive evidence that the interaction between liquidity stress and negative equity plays a central role in mortgage default behavior. The pattern closely mirrors findings from U.S. microdata. In particular, Gerardi et al. (2018) show that default probabilities increase sharply when borrowers simultaneously experience negative equity and tight residual income, whereas the presence of either condition alone is

Table 2: Default probability by financial state

		Liquidity constrained: Yes	Liquidity constrained: No	All
Negative equity	**Yes**	$P(\text{Default}) = \mathbf{0.46}$ ***Double trigger*** $N = 57$	$P(\text{Default}) = \mathbf{0.09}$ ***Equity trigger*** $N = 636$	$P(\text{Default}) = 0.13$ $N = 693$
	No	$P(\text{Default}) = \mathbf{0.13}$ ***Cash-flow trigger*** $N = 517$	$P(\text{Default}) = \mathbf{0.02}$ ***No trigger*** $N = 13{,}860$	$P(\text{Default}) = 0.03$ $N = 14{,}377$
	All	$P(\text{Default}) = 0.17$ $N = 574$	$P(\text{Default}) = 0.03$ $N = 14{,}496$	$P(\text{Default}) = 0.03$ $N = 15{,}070$

Notes: Country sample as defined in Figure 3. P(Default): the default probability is defined as the share of mortgaged households in arrears ($NPL = 1$, see also equation 2), within each trigger group. Values are population-weighted means (equal country weights), averaged across all five implicates. Liquidity constrained and negative equity borrowers are defined in equations 3 and 4. N stands for number of observations.
Source: HFCS 2021, ECB.

typically insufficient to generate comparably widespread arrears. The similarity of these patterns suggests that the basic structure of default risk documented in U.S. data also applies in the European context.

The descriptive differences in default incidence across trigger groups should not be interpreted causally. Trigger groups differ systematically in household characteristics—such as age, education, household composition, and behavioral traits—that may affect default risk independently of trigger status. In the next section, we therefore estimate the total effects of the trigger states while controlling for household-level confounders implied by the causal framework developed in Section 2.

3.4 The rarity of mortgage default and estimation implications

Mortgage default models are typically estimated in a rare-event setting. In nonlinear probability models such as logit, low outcome incidence can generate small-sample bias in coefficient estimates and predicted probabilities, especially when the fraction of observed events is very small (King and Zeng, 2001). In our baseline specification, the unweighted NPL rate is approximately 2 percent, corresponding to 324 default events in a sample of about 15,000 households. While this reflects the structural rarity of mortgage default, it is reassuring that it remains well above the extreme

low-incidence scenarios (e.g., below 1 percent) emphasized by King and Zeng (2001), where bias becomes quantitatively substantial even in large samples. Combined with our relatively large sample size, this suggests that rare-event bias is unlikely to materially affect our baseline estimates. As an additional check, we re-estimate all models using the broader arrears measure (30+ days past due), where the event rate is around 5 percent. The results are quantitatively and qualitatively similar, indicating that our main findings are not driven by the low incidence of NPL events (for the baseline see table 4).

A related issue concerns the number of outcome events relative to the number of estimated parameters. Peduzzi et al. (1996) propose a rule of thumb of at least 10 events per variable (EPV) in logistic regression to avoid biased coefficients and unstable inference. In our baseline model (full sample), the ratio of default events to estimated coefficients[7] is 12, placing us slightly above this conventional benchmark. Subsequent simulation evidence by Vittinghoff and McCulloch (2007) shows that the 10-EPV rule is conservative and that acceptable performance is often achieved with as few as five events per parameter, depending on model structure and covariate distributions. Taken together, these thresholds suggest that our baseline specification lies within the range generally considered acceptable in the applied literature. In more demanding specifications—such as sample splits—the EPV ratio declines but remains within the 5–10 range typically viewed as tolerable. Re-estimating these specifications with the broader arrears outcome, which entails a larger number of events, further increases EPV ratios and leaves coefficient magnitudes and relative trigger shares largely unchanged.

A further concern is sparse-data bias arising from small cell counts in specific exposure–outcome combinations (Greenland et al., 2016). In our context, this issue is most relevant for the double-trigger state, which is itself rare. In the full sample, the smallest trigger–default cell (double trigger = 1 and NPL = 1) contains 18 observations. In split-sample analyses—most notably when dividing countries into weak and strong enforcement regimes—cell counts become smaller, with a minimum of five observations in the most restrictive cases.

While these cell counts are naturally limited, they do not generate signs of quasi-complete separation[8] or numerical instability in practice. Estimation converges reliably across all specifications, no trigger variables are dropped due to perfect prediction, and coefficient magnitudes remain stable across alternative model specifications. Moreover, when using the broader arrears definition, trigger–default

[7] 324 events relative to 27 parameters

[8] That is, for one value of a predictor, only one outcome category is observed (e.g. all double-trigger households default, but some non-double-trigger households also default).

cell counts increase mechanically, and the pattern of results remains qualitatively unchanged. In light of the EPV guidance discussed above and the absence of convergence or separation problems, the available event counts appear sufficient for the pooled analysis.

Importantly though, the combination of these three considerations—the structural rarity of default, the limited number of outcome events relative to model parameters, and small trigger–default cells in subsamples—implies that country-wise estimation is not feasible. In some countries, certain trigger states are observed only very rarely and, in a few cases, not at all in the data (in particular for the double-trigger state). Estimating the model separately at the country level would therefore not only sharply reduce the number of default observations, but in some instances render specific trigger coefficients unidentified or highly unstable due to empty or near-empty cells. This would push EPV ratios and trigger–default counts into ranges where sparse-data bias and separation problems become likely. Pooling countries within a unified framework, while allowing for institutional heterogeneity through country fixed effects and enforcement-based groupings, thus represents a methodologically more reliable and internally consistent strategy.

4 Results

This section presents the empirical results in two steps. First, we estimate the total effects of the three default triggers implied by the theoretical literature—liquidity distress, negative equity, and their interaction—and assess their relative importance in explaining mortgage default. Second, we examine whether these trigger effects differ systematically across countries with weaker versus stronger debt enforcement regimes.

4.1 The total effects of default triggers in Europe

Table 3 reports the results of estimating equation (1) introduced in Section 2.2. Throughout the paper, we present *average marginal effects* (AMEs), which translate the logit coefficients into changes in the predicted probability of default. This allows us to interpret β_1, β_2, and β_3 as the *average increase in the likelihood of being in arrears* for households experiencing a given trigger, compared to those experiencing *none* of the three. This interpretation is particularly transparent in our setting because the trigger variables are mutually exclusive by construction: if one trigger equals one, the other two are necessarily zero. The base category—households with no trigger—is therefore clearly defined, and the AMEs capture distinct, non-

overlapping trigger effects. Since each trigger is modeled as a binary variable and marginal effects are averaged over the observed sample, the resulting estimates are directly comparable in magnitude, enabling a ranking of the empirical relevance of competing default mechanisms.[9]

Table 3: Total effects of mortgage triggers (AMEs), Dep. var.: NPL

	Full sample			Restricted sample	
	FE only	+ HMR	+ Conf.1	+ Conf.1	+ Conf.1 & 2
	(1)	(2)	(3)	(4)	(5)
Cash-flow trigger (D)	0.070***	0.075***	0.056***	0.055***	0.047**
% of ∑ trigger AMEs†	22%	22%	21%	17%	19%
	(3.49)	(3.80)	(3.45)	(2.71)	(2.56)
Equity trigger (D)	0.036***	0.055***	0.050***	0.055***	0.040***
% of ∑ trigger AMEs†	11%	16%	19%	17%	16%
	(2.71)	(4.18)	(4.12)	(3.83)	(3.11)
Double trigger (D)	0.212***	0.208***	0.156***	0.207**	0.163**
% of ∑ trigger AMEs†	67%	62%	60%	65%	65%
	(2.89)	(2.89)	(2.94)	(2.17)	(2.18)
Owns main residence (D)		0.026***	0.026***	0.032***	0.032***
		(4.99)	(5.45)	(5.49)	(5.55)
Tertiary education (D)			-0.031***	-0.035***	-0.030***
			(-5.38)	(-4.83)	(-4.12)
Age			0.003*	0.003	0.004*
			(1.72)	(1.42)	(1.86)
Age, squared			-0.000	-0.000	-0.000*
			(-1.58)	(-1.35)	(-1.78)
Household type single (D)			0.021**	0.026**	0.026**
			(2.12)	(2.01)	(2.14)
Number of children			-0.002	-0.004	-0.002
			(-0.77)	(-1.12)	(-0.65)
Impatience (D)					0.024***
					(2.68)
Fin. support network (D)					-0.029***
					(-3.39)
Risk-seeking (D)					0.035**
					(2.03)
Share of defaulting hh	0.035	0.035	0.035	0.041	0.041
Model	logit	logit	logit	logit	logit
Country dummies	incl.	incl.	incl.	incl.	incl.
Weights	hh	hh	hh	hh	hh
N	15,069	15,069	15,069	10,732	10,732

Notes: Two-tailed significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. T-statistics in parentheses. AMEs are average marginal effects based on one implicate. Country sample as defined in Figure 3. † '% of ∑ trigger AMEs' reports each trigger's AME as a share of the sum of all three trigger AMEs. Column (1) includes country fixed effects only; (2) adds the main-residence indicator (HMR); (3) additionally includes confounder set a: tertiary education, age and age squared of the reference person (RP), single-household status (RP never married/single), and the number of dependent children. Columns (4)–(5) re-estimate this specification on a restricted sample; (5) additionally includes confounder set b: impatience (HH would consume >80% of a hypothetical lottery gain), access to financial support from family/friends, and risk-seeking preferences of the RP and partner (above-average or substantial financial risk tolerance).
Source: HFCS 2021, ECB.

Specification (1) of Table 3 reports the AMEs of the three triggers with country fixed effects only. All three trigger variables are strongly and statistically significantly associated with mortgage default. In economic terms, households in the

[9]Unless otherwise indicated, we base our estimates on the fifth implicate provided in the HFCS dataset. As shown in the robustness section, using all five implicates leads to qualitatively identical results but substantially increases computational burden. For this reason, most of our analysis focuses on a single implicate.

cash-flow trigger group exhibit an approximately 7 percentage point higher default probability relative to the no-trigger group, while households in the equity trigger group exhibit an increase of about 3.6 percentage points. The largest effect is associated with the double trigger: households simultaneously facing liquidity constraints and negative equity exhibit an increase in default probability of roughly 21 percentage points. These magnitudes are sizable given that the average default rate among mortgaged households is about 3.5 percent (see the "Share of defaulting hh" row at the bottom of the table). The dominant role of the double trigger is also reflected in its relative size compared to the other two trigger effects. To make relative importance transparent, Table 3 reports each trigger's AME as a share of the sum of all three trigger AMEs ("*% of* $\sum$ *trigger AMEs* "). Under specification (1), the double trigger accounts for about 67 percent of the total trigger-related increase in default risk.

Specification (2) adds the indicator for a mortgage on the household's main residence (HMR), the effect modifier highlighted in the DAG. The coefficient on HMR is positive and statistically significant, indicating that households whose mortgage is secured on their main residence are more likely to default, holding trigger status constant. While this may seem counterintuitive—one might expect households to prioritize repayment to avoid losing their home—it is consistent with the fact that primary residences can be more protected or more shielded from lenders in practice (e.g., through delayed enforcement), potentially lowering the perceived cost of default. Importantly, controlling for HMR also changes the estimated trigger effects: the equity-trigger effect becomes markedly larger once HMR is included. This pattern is consistent with HMR acting as an effect modifier of the trigger–default relationship: negative equity may translate into default differently for main-residence mortgages than for other housing collateral, precisely because strategic or quasi-strategic behavior is more plausible where legal protection or delayed enforcement differ.

Specification (3) adds the observed confounders discussed in Section 2.2. The estimates are broadly consistent with the expected patterns. Age enters nonlinearly, consistent with younger households being more exposed to financial stress and having thinner buffers. Household composition also matters. Default risk is higher among households whose reference person is single, consistent with lower scope for income pooling and risk sharing within the household. The estimated effect of the number of children, by contrast, is not statistically significant in this specification. Finally, higher education is associated with a lower probability of default, consistent with stronger financial planning and budgeting capacity and fewer payment mistakes or

frictions in dealing with lenders. As expected, adding confounders absorbs part of the variation previously captured by the trigger variables: the AMEs on the trigger indicators decline relative to specification (2), but they remain economically large and statistically significant, and the double trigger continues to be the most important mechanism. We view specification (3) as our preferred baseline, as it includes the modifier and the key observed confounders identified by the DAG.

A remaining concern is that some relevant confounders are typically unobserved in many datasets, particularly behavioral traits that may jointly influence trigger status and default behavior. To assess the sensitivity of trigger effects to such factors, specification (4) re-estimates the baseline model on the reduced sample for which the HFCS provides information on these traits; this specification serves as the appropriate baseline for evaluating the incremental role of additional confounders. Specification (5) then adds the additional confounders capturing risk tolerance, impatience/time preferences, and the availability of informal financial support. The estimates for these variables align with priors: higher risk tolerance is positively associated with default, consistent with both greater exposure to high leverage and a greater willingness to stop repayment when incentives deteriorate; impatience has a positive association, consistent with lower precautionary saving and faster abandonment of repayment; and access to informal support is negatively related to default, consistent with financial help preventing default even when households face stress.

The key result from specification (5) is that once the modifier and both sets of confounders are included, the estimated total trigger effects remain strongly present: all three triggers are economically meaningful, the double trigger remains the dominant mechanism, and the relative ranking across triggers is stable. While the trigger AMEs decline somewhat as confounders are added—as expected if part of the raw association reflects differences in household composition—the qualitative conclusion remains unchanged: liquidity distress, negative equity, and especially their interaction all matter for mortgage default in Europe. We interpret these effects as causal in nature. The stability of the trigger estimates across increasingly rich specifications—including controls for behavioral traits and support networks—suggests that the main causal pathways from financial vulnerability to default are adequately captured by the model rather than driven by omitted confounding.

Finally, the magnitudes provide guidance for interpreting the relevance of competing default theories. First, the dominant role of the double trigger is consistent with evidence emphasized by Schelkle (2018) for the United States, who argues that mortgage-crisis patterns align more closely with joint trigger mechanisms than with frictionless option-style models. Second, the equity trigger—often interpreted as

capturing strategic default in the absence of liquidity distress—accounts for a relatively small share of total trigger effects in our specifications, aligning with recent U.S. findings that purely strategic defaults are uncommon (Low, 2023; Ganong and Noel, 2023). At the same time, one may still find the estimated equity-trigger effect in Europe noteworthy, given that European systems are predominantly full-recourse. As the next subsection shows, this average effect masks substantial cross-country heterogeneity: equity-trigger effects are disproportionately driven by a subset of countries, consistent with the institutional discussion in Section 2.3.

4.2 Country heterogeneity - the role of debt enforcement strength

Table 4 examines whether the total effects of mortgage default triggers vary systematically with the strength of debt enforcement. Throughout, we again report average marginal effects (AMEs), which allow for a direct comparison of trigger magnitudes across samples and specifications. Column (1) reproduces our preferred baseline specification from the previous subsection (corresponding to column (3) in Table 3) for ease of comparison. Columns (2) and (3) split the sample according to the enforcement classification introduced in Section 2.3. Column (2) restricts the sample to the four countries with markedly weaker debt enforcement—Greece, Cyprus, Italy, and Slovenia—while column (3) reports results for the remaining countries with stronger enforcement regimes.

Importantly, this sample split permits separate estimation of trigger effects without running into a low-events problem (see also the discussion in section 3.4). Although mortgage default is a rare event in household survey data, pooling countries into two sufficiently large enforcement groups yields adequate numbers of defaults in both subsamples, allowing for stable estimation of marginal effects. This makes it possible to assess institutional heterogeneity in default mechanisms while preserving statistical power.

The results reveal a clear and economically meaningful pattern. As expected, the relative importance of the equity trigger increases markedly in countries with weaker enforcement and declines sharply in countries with stronger enforcement. In the weak-enforcement group (column 2), the equity trigger accounts for 35 percent of the combined trigger effect, compared with only 6 percent in the strong-enforcement group (column 3), where the estimate is small and even marginally insignificant. At the same time, the double trigger remains the dominant mechanism in both subsamples, accounting for roughly half or more of the total trigger effect regardless of enforcement strength. This pattern is in line with the institutional discussion in

Table 4: The role of debt enforcement strength: total effects of mortgage triggers (AMEs)

Dependent variable:	NPL (90+ days due)			Arrears (30+ days due)		
	All countries (1)	Weaker enforcement (2)	Stronger enforcement (3)	All countries (4)	Weaker enforcement (5)	Stronger enforcement (6)
Cash-flow trigger (D)	0.056***	0.103**	0.049***	0.119***	0.148***	0.115***
% of ∑ trigger AMEs†	21%	16%	23%	23%	16%	28%
	(3.45)	(2.12)	(2.89)	(4.82)	(2.66)	(4.13)
Equity trigger (D)	0.050***	0.226***	0.013	0.061***	0.241***	0.018
% of ∑ trigger AMEs†	19%	35%	6%	12%	26%	4%
	(4.12)	(4.41)	(1.54)	(3.45)	(4.94)	(1.14)
Double trigger (D)	0.156***	0.316**	0.154**	0.340***	0.546***	0.281**
% of ∑ trigger AMEs†	60%	49%	71%	65%	58%	68%
	(2.94)	(2.27)	(2.35)	(3.82)	(7.20)	(2.41)
Owns main residence (D)	0.026***	0.127***	0.006**	0.033***	0.143***	0.007
	(5.45)	(5.16)	(2.18)	(3.62)	(5.22)	(0.77)
Tertiary education (D)	-0.031***	-0.162***	-0.006*	-0.053***	-0.180***	-0.029***
	(-5.38)	(-5.41)	(-1.73)	(-6.93)	(-5.61)	(-4.44)
Age	0.003*	0.013	0.001	0.004**	0.014	0.003
	(1.72)	(1.11)	(1.38)	(2.06)	(1.18)	(1.49)
Age, squared	-0.000	-0.000	-0.000	-0.000*	-0.000	-0.000
	(-1.58)	(-1.07)	(-1.12)	(-1.93)	(-1.21)	(-1.33)
Household type single (D)	0.021**	0.088	0.007	0.024**	0.047	0.020**
	(2.12)	(1.36)	(1.54)	(2.03)	(0.72)	(2.14)
Number of children	-0.002	-0.011	0.000	0.000	-0.014	0.004
	(-0.77)	(-0.91)	(0.03)	(0.03)	(-1.00)	(1.23)
Share of defaulting hh	0.035	0.149	0.012	0.073	0.186	0.051
Model	logit	logit	logit	logit	logit	logit
Country dummies	incl.	incl.	incl.	incl.	incl.	incl.
Weights	hh	hh	hh	hh	hh	hh
N	15,069	1,755	13,314	15,069	1,755	13,314

Notes: Two-tailed significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. T-statistics in parentheses. AMEs are average marginal effects based on one implicate. Country sample as defined in Figure 3. † '% of ∑ trigger AMEs' reports each trigger's AME as a share of the sum of all three trigger AMEs. Column (1) includes all countries in the sample (i.e., baseline, corresponds to column (3) of table 3). Column (2) restricts the sample to countries with weaker debt enforcement—GR, CY, IT, and SI—as defined in Section 2.3, while column (3) reports results for the remaining country group with stronger enforcement. Columns (4)–(6) follow the same sample definitions but use a milder delinquency indicator based on arrears of 30 days or more.
Source: HFCS 2021, ECB.

Section 2.3: although all countries in the sample operate under formally full-recourse systems, weaker or slower enforcement is typically associated with lower effective default costs, which in turn can increase the empirical relevance of negative equity as a default trigger, consistent with evidence from settings such as Greece (Artavanis and Spyridopoulos, 2023). Nevertheless, liquidity distress—especially when combined with negative equity—remains central to explaining mortgage default across Europe.

Columns (4)–(6) repeat the analysis using a milder delinquency indicator based on arrears of 30 days or more. This exercise serves two purposes. First, it provides a robustness check for the enforcement channel by increasing the number of observed repayment problems, thereby mitigating concerns related to rare events. Second, it allows us to assess whether trigger effects differ when households with shorter-term or less severe repayment difficulties are included.

Comparing columns (1) and (4) shows that the relative importance of the equity trigger is smaller in magnitude when the outcome variable includes shorter arrears spells. This suggests that short-term repayment problems are more closely associated with liquidity stress, whereas negative equity becomes more relevant for prolonged or severe delinquency. One interpretation is that households experiencing temporary cash-flow problems may fall briefly into arrears but recover without defaulting, while sustained non-payment is more likely when negative equity weakens repayment incentives or expectations about future recovery.

More importantly for our institutional hypothesis, comparing columns (5) and (6) with the corresponding baseline in column (4) confirms that equity-related default incentives are much more pronounced in weak-enforcement countries even when using the broader arrears measure. The equity trigger accounts for 26 percent of the total trigger effect in weak-enforcement countries, compared to only 4 percent in strong-enforcement countries, where it turns insignificant. By contrast, the dominance of the double trigger persists across both enforcement regimes and delinquency definitions.

Finally, it is important to emphasize that we do not interpret the equity-trigger coefficient as reflecting purely strategic default behavior. Several mechanisms may link negative equity to default beyond the canonical strategic narrative. Households may temporarily suspend payments to renegotiate loan terms and share losses following house price declines. Households with deep negative equity may experience demoralization effects that weaken repayment discipline, as documented by Bajari et al. (2008), Guiso et al. (2013), and Foote et al. (2008). Others may be close to liquidity distress and ultimately default as their equity position turns negative, even if liquidity constraints are not yet fully binding. Default may also reflect misperceptions about legal liability or expectations regarding debt relief or bankruptcy procedures. In this light, it is not surprising that equity effects can still be observed even in strong-enforcement countries—albeit statistically insignificant at conventional levels and economically modest—since negative equity may affect repayment behavior through multiple channels beyond purely strategic default incentives.

Taken together, the results in Table 4 indicate that the relative importance of default triggers varies systematically with debt enforcement strength in economically meaningful ways. In countries with weaker enforcement, equity-related default incentives play a more prominent role, whereas in stronger-enforcement regimes default is more closely associated with liquidity-driven mechanisms. At the same time, across all institutional settings, the interaction of liquidity distress and negative equity remains the most powerful predictor of mortgage default in Europe.

5 Robustness

To assess the stability and interpretation of our main findings, we implement a series of robustness checks. We first address alternative trigger definitions, estimation choices, sample restrictions. We then examine the potential role of reverse causality in the cross-sectional data, before turning to potential post-treatment bias due to COVID-19 moratoria, and country-exclusion exercises.

5.1 Sensitivity to threshold choices in liquidity and equity measures

This subsection assesses the sensitivity of our results to alternative operationalizations of the liquidity and equity trigger states. While our baseline definitions are guided by the HFCS structure and the existing literature, any state-based classification necessarily relies on threshold choices. To evaluate whether our findings depend on these choices, Table 5 re-estimates the baseline specification using stricter and looser cutoffs for liquidity constraints and negative equity. Specifications (2) and (3) vary the definition of liquidity stress by tightening or relaxing the threshold for liquid asset buffers relative to monthly income ($2\times$ and $\frac{1}{2}\times$ monthly income), while specifications (4) and (5) adjust the loan-to-value cutoff used to define negative equity (LTV $> 90\%$ and $> 110\%$). Across all variants, the estimated average marginal effects of the three trigger states remain remarkably stable in magnitude and statistical significance. In particular, the double trigger consistently emerges as the dominant mechanism, followed by the cash-flow and the equity trigger. This confirms that our main results are not driven by a specific parametrization of the trigger variables.

5.2 Alternative specifications and estimation techniques

Table 6 presents a series of additional robustness checks that vary weighting schemes, estimation techniques, sample definitions, and the inclusion of additional fixed effects capturing regional heterogeneity and loan-origination cohorts. Across all specifications, the qualitative pattern of results remains unchanged: all three trigger states are statistically and economically relevant, and the double trigger consistently emerges as the dominant predictor of mortgage default when countries are pooled. The relative ranking of triggers is therefore robust to alternative modeling choices.

Specification (2) applies population weights that account not only for within-

Table 5: Robustness checks: Alternative measures of liquidity constraints and negative equity

	Baseline	Liquidity <2mth inc	Liquidity < $\frac{1}{2}$mth inc	LTV >90%	LTV >110%
	(1)	(2)	(3)	(4)	(5)
Cash-flow trigger (D)	0.056***	0.059***	0.067***	0.060***	0.058***
% of $\sum$ *trigger AMEs*†	21%	22%	25%	28%	22%
	(3.45)	(3.39)	(3.38)	(3.45)	(3.62)
Equity trigger (D)	0.050***	0.052***	0.051***	0.042***	0.062***
% of $\sum$ *trigger AMEs*†	19%	20%	19%	19%	24%
	(4.12)	(4.10)	(4.25)	(4.06)	(4.50)
Double trigger (D)	0.156***	0.152***	0.153***	0.115***	0.143***
% of $\sum$ *trigger AMEs*†	60%	58%	56%	53%	54%
	(2.94)	(3.03)	(2.81)	(2.74)	(2.60)
Share of defaulting hh	0.035	0.035	0.035	0.035	0.035
Model	logit	logit	logit	logit	logit
Controls	incl.	incl.	incl.	incl.	incl.
Country dummies	incl.	incl.	incl.	incl.	incl.
Weights	hh	hh	hh	hh	hh
N	15,069	15,069	15,069	15,069	15,069

Notes: Two-tailed significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Estimates are based on one implicate.
† "% of $\sum$ trigger AMEs" reports each trigger's average marginal effect (AME) as a share of the sum of the AMEs of all three trigger states. All specifications control for the modifier (mortgage on the main residence, HMR) and the full set of observed confounders (confounder set 1): age, age squared, tertiary education, single household status, and number of children.
Source: HFCS 2021, ECB.

country sampling probabilities but also for cross-country differences in household population size. This gives greater weight to larger economies and yields average marginal effects (AMEs) that better reflect the aggregate euro-area perspective. As expected, the overall default probability declines under this weighting scheme, reflecting lower default incidence in larger countries. While absolute AMEs become smaller, this change is proportional to the lower baseline probability of default. Importantly, the double trigger remains the most influential mechanism.

Specification (3) re-estimates the model using multiple imputation (five implicates) and combines estimates using Rubin's rules to account for additional uncertainty arising from the imputation procedure. Throughout the paper, results are based on a single implicate. Incorporating all five implicates allows us to account explicitly for between-imputation variance. The results are virtually identical to the baseline specification, indicating that our findings are not sensitive to imputation uncertainty.

Specification (4) reports OLS estimates for comparison. Although linear proba-

Table 6: Robustness checks: Alternative specifications and estimation techniques

	Baseline	Country weights	MI	OLS	Region FE	Year loan take-up FE	Mortgage only
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Cash-flow trigger (D)	0.056***	0.044***	0.056***	0.090***	0.064***	0.056***	0.077***
% of ∑ trigger AMEs†	21%	26%	22%	29%	20%	21%	25%
	(3.45)	(3.64)	(3.47)	(3.20)	(4.01)	(3.64)	(3.27)
Equity trigger (D)	0.050***	0.031***	0.050***	0.060***	0.063***	0.057***	0.077***
% of ∑ trigger AMEs†	19%	18%	20%	19%	20%	21%	25%
	(4.12)	(2.87)	(3.86)	(2.99)	(4.20)	(4.83)	(4.08)
Double trigger (D)	0.156***	0.094**	0.144***	0.159***	0.188***	0.157***	0.151**
% of ∑ trigger AMEs†	60%	56%	58%	51%	60%	58%	50%
	(2.94)	(1.98)	(2.75)	(3.61)	(3.17)	(2.92)	(2.36)
Share of defaulting hh	0.035	0.015	0.035	0.035	0.041	0.035	0.045
Model	logit	logit	logit, mi	OLS	logit	logit	logit
Controls	incl.	incl.	incl.	incl.	incl.	incl.	incl.
Country dummies	incl.	incl.	incl.	incl.	incl.	incl.	incl.
Region dummies	excl.	excl.	excl.	excl.	excl.	incl.	excl.
Weights	hh	hh+c	hh	hh	hh	hh	hh
N	15,069	15,069	15,068	15,069	13,468	14,802	8,991

Notes: Two-tailed significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Estimates are based on one implicate.
† "% of ∑ trigger AMEs" reports each trigger's average marginal effect (AME) as a share of the sum of the AMEs of all three trigger states. All specifications control for the modifier (mortgage on the main residence, HMR) and the full set of observed confounders (confounder set 1): age, age squared, tertiary education, single household status, and number of children. Specification (1), included for comparison, replicates model (3) in Table 3. (2) shows population-weighted estimates, accounting for both within-country sampling and cross-country differences in household population size, (3) uses multiple implicates (m=5) in an MI setting. (4) estimates OLS with standardized coefficients. (5) includes regional dummies (or country dummies where unavailable). (6) adds dummies for the year the loan was taken (main loan if multiple). (7) restricts the sample to households that have mortgages only, i.e. no unsecured loans.
Source: HFCS 2021, ECB.

bility models can be sensitive when key regressors—such as the double trigger—are relatively rare, the standardized coefficients[10] confirm the same ranking of effects. This suggests that the nonlinear functional form of the logit model is not responsible for the main results.

Specifications (5) and (6) add regional and loan-cohort fixed effects. In line with our identification strategy, we do not include underlying determinants of the trigger states in the baseline model, as these operate primarily through the trigger states and conditioning on them would move us away from estimating total trigger effects. However, to the extent that such factors may also act as potential confounders, we examine whether their inclusion affects our results. Regional fixed effects can proxy for persistent subnational characteristics such as local housing market dynamics or structural labor market conditions. These factors may function as underlying drivers of trigger exposure by influencing the likelihood of entering liquidity distress or negative equity. At the same time, they may also act as confounders. For example, regions with structurally volatile or declining labor markets may expose households more frequently to income shocks, increasing the probability of entering liquidity

[10]Standardized coefficients are estimated after rescaling the outcome and regressors to unit standard deviations. They indicate how strongly the outcome responds to a one-standard-deviation change in each regressor, facilitating comparisons across variables with different scales or frequencies, such as the three trigger indicators in our setting.

distress. Conditional on distress, weak local job prospects may also force households to relocate for employment reasons, which can increase the likelihood of default.

Similarly, year-of-loan-take-up fixed effects capture origination-period conditions. Credit standards at origination illustrate the dual role such factors may play. If looser underwriting primarily raises initial leverage (e.g., higher LTV ratios), they act as underlying determinants of trigger exposure that affect whether an equity trigger becomes binding later on. If they also select systematically riskier borrowers into the mortgage market, they may operate as confounders by influencing both trigger exposure and default propensity. Including cohort fixed effects therefore absorbs systematic borrower-composition differences across origination periods. In both cases however, the estimated trigger effects remain stable, indicating that our baseline results are not driven by omitted regional or cohort-level heterogeneity.

Finally, specification (7) restricts the sample to households holding mortgages only, excluding those that simultaneously hold unsecured debt. In the HFCS, repayment difficulties are reported at the household level and are not loan-specific. Households with both secured and unsecured loans could therefore report arrears driven exclusively by unsecured borrowing, potentially attenuating the estimated association between mortgage-related trigger states and mortgage default. Restricting the sample addresses this potential measurement issue. The results remain qualitatively unchanged, and the double trigger continues to account for the largest share of the combined trigger effect.

Taken together, these robustness exercises confirm that the central findings—namely the relevance of all three triggers and the dominant role of the double trigger—are not driven by weighting choices, estimation method, cohort effects, regional heterogeneity, or sample composition.

5.3 Assessing reverse causality in cross-sectional data

A potential concern in our empirical setting arises from the cross-sectional nature of the data, which does not allow for a clear temporal ordering between mortgage default and the explanatory variables. In contrast to panel or quasi-experimental designs, default and financial conditions are observed over the same reference period and may therefore be jointly determined (Ganong and Noel, 2023; Byrne et al., 2022; O'Malley, 2021). This raises the possibility of simultaneity bias, as the financial states used to explain default may themselves be affected by the occurrence of arrears.

Two distinct channels are relevant in this context. First, arrears may trigger behavioral responses that feed back into household financial conditions—for exam-

ple through labor supply, credit access, or precautionary saving—so that observed financial states may partly reflect responses to default rather than purely preceding conditions. Second, reverse causality may arise more directly from the measurement. In particular, arrears can directly affect expenditures—for example through fees, penalty charges, or catch-up payments—or reduce them if households suspend payments. This is especially relevant in our setting, as default is measured over the past 12 months, while the liquidity trigger includes a flow component based on expenditures relative to income over the same period, creating a direct overlap. By contrast, the equity trigger is based on the loan-to-value ratio at the time of the interview and is therefore less directly exposed to this concern.

While the first channel reflects an inherent limitation of cross-sectional data and cannot be addressed within our framework, the second can be examined more directly. The robustness checks in Table 7 therefore focus on assessing whether the baseline results are driven by such measurement-induced feedback effects. Column (1) reproduces the baseline results. Columns (2) and (3) focus on the stock dimension of liquidity, defining constraints solely in terms of low liquid asset holdings. By construction, these measures are less directly exposed to measurement-induced reverse causality, as they are observed at the time of the interview and not directly linked to arrears over the preceding period. In both cases, liquidity constraints remain positively and significantly associated with default, albeit with smaller magnitudes. This is consistent with the fact that these specifications capture only one dimension of liquidity stress—namely the absence of buffers—while abstracting from contemporaneous cash-flow imbalances.[11] Tightening the threshold increases the estimated effect monotonically, in line with the notion that more severe liquidity shortages raise default risk.

Column (4) isolates the flow component, defined as expenditures exceeding income over the last 12 months. The estimated effect is similar in magnitude to the baseline. This is informative in the context of measurement-induced reverse causality: if the relationship were primarily driven by a direct feedback from arrears to reported expenditures, one would expect substantially larger effects in this specification. The absence of such amplification suggests that this channel is unlikely to be the main driver of the results. Finally, Column (5) replaces the expenditure-based measure with an income shock indicator combined with low liquid asset holdings. This specification removes the most direct, measurement-induced, link between arrears and the liquidity measure. The results remain strong, and the effect of the

[11] The loss of significance of the equity-only effect in column (2) reflects reclassification: negative-equity households with low buffers are reassigned to the double-trigger group, leaving a smaller and compositionally different equity-only category.

Table 7: Robustness checks: reverse causality and timing of liquidity measures

	Baseline	Stock only	Stock only (tight)	Flow only	Inc. shock & stock
	(1)	(2)	(3)	(4)	(5)
Cash-flow trigger (D)	0.056***	0.029***	0.038***	0.055***	0.042***
% of ∑ trigger AMEs†	21%	15%	17%	21%	15%
	(3.45)	(4.75)	(5.19)	(3.72)	(3.50)
Equity trigger (D)	0.050***	0.027	0.057***	0.052***	0.047***
% of ∑ trigger AMEs†	19%	14%	25%	20%	17%
	(4.12)	(1.55)	(2.83)	(3.86)	(3.55)
Double trigger (D)	0.156***	0.137***	0.129***	0.154***	0.188***
% of ∑ trigger AMEs†	60%	71%	58%	59%	68%
	(2.94)	(5.23)	(4.83)	(3.46)	(4.40)
Share of defaulting hh	0.035	0.035	0.035	0.035	0.035
Model	logit	logit	logit	logit	logit
Controls	incl.	incl.	incl.	incl.	incl.
Country dummies	incl.	incl.	incl.	incl.	incl.
Weights	hh	hh	hh	hh	hh
N	15,069	15,069	15,069	15,069	15,031

Notes: Two-tailed significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Estimates are based on one implicate.
† "% of ∑ trigger AMEs" reports each trigger's average marginal effect (AME) as a share of the sum of the AMEs of all three trigger states. All specifications control for the modifier (mortgage on the main residence, HMR) and the full set of observed confounders (confounder set 1): age, age squared, tertiary education, single household status, and number of children. Columns vary the definition of liquidity constraints to isolate components with different exposure to potential reverse causality: "Stock only" uses liquid assets at interview, "Flow only" uses expenditures relative to income over the past 12 months, and the final specification replaces expenditures with an income shock indicator.
Source: HFCS 2021, ECB.

double-trigger state increases further, reflecting a more restrictive identification of financially distressed households. At the same time, this confirms that the baseline findings are not driven by the expenditure-based component.

Taken together, these results indicate that the relationship between liquidity constraints and mortgage default is robust to alternative definitions and is unlikely to be driven primarily by measurement-induced feedback effects. While simultaneity arising from behavioral responses cannot be ruled out in a cross-sectional setting, the consistency of the findings across specifications suggests that the baseline results capture a meaningful relationship between financial distress and default.

Importantly, the contribution of this paper does not lie in identifying the effect of specific shocks, but in testing the relative importance of competing default mechanisms derived from theory. In standard models, households do not default in response to shocks per se, but when such shocks translate into binding financial conditions—namely liquidity constraints, negative equity, or their interaction. By

directly mapping these states into the data and evaluating their relative importance for observed default outcomes, our approach provides evidence on the mechanisms underlying mortgage distress that is complementary to shock-based identification strategies. The harmonized European setting further allows us to examine whether patterns documented in single-country policy evaluations—such as a stronger role for equity-related incentives under weaker enforcement—are also reflected more broadly across countries with different institutional environments.

5.4 Accounting for COVID-19 Moratoria

A potential concern for our identification strategy is the COVID-19 policy response, most notably the widespread mortgage payment moratoria implemented across EU countries in 2020. These measures temporarily suspended mortgage installments, allowing borrowers facing short-term liquidity shortages to postpone payments without being classified as in arrears or default (European Banking Authority, 2020). Because the HFCS interviews were conducted between 2020 and 2021 (and in Greece and Austria partly also in early 2022), observed arrears during this period may not fully reflect underlying repayment difficulties.

Moratoria may affect our estimates in two opposite directions. First, some households that made use of a moratorium may have self-reported arrears in the HFCS, even though they would have remained contractually current under the policy. Such misreporting could mechanically inflate the estimated association between liquidity-related triggers and arrears. We consider this channel to be of limited empirical relevance. The HFCS arrears question explicitly asks whether payments were missed "in a way other than agreed," implying that households benefiting from formally granted payment deferrals should report having made payments as scheduled.[12] Moreover, moratoria were primarily taken up by households already experiencing repayment difficulties, so any remaining misclassification would mainly pool borrowers with varying degrees of liquidity strain rather than introduce spurious arrears.

The more important concern is the opposite one: moratoria may have suppressed observed arrears by keeping liquidity-constrained households contractually current. Households that would have missed payments in the absence of moratoria may therefore be observed as "not in arrears" in the HFCS. This mechanism would bias downward the estimated effects of the liquidity and double-trigger states, as part of the underlying repayment stress would remain unobserved in the outcome variable.

[12] This interpretation is consistent with the fact that HFCS-based default rates do not systematically exceed non-performing loan (NPL) ratios based on supervisory data (see Figure 1). Still, individual reporting behaviour cannot be verified and we therefore acknowledge this as a potential, though likely limited, source of noise.

The robustness exercise below is designed to quantify the magnitude of this latter bias by adjusting the arrears indicator for potential moratorium use. We exploit information from the HFCS COVID-19 non-core finance module, which is available for 12 countries. Importantly, this set includes nearly all European countries in which mortgage moratoria were most widely used during the pandemic, making the module particularly well suited to assess potential moratorium-related bias in our estimates.[13] In the COVID-19 module, households that experienced an income loss during the pandemic were asked how they compensated for that loss, including whether they relied on deferments of loan or rent payments. For owner-occupiers, we interpret a reported loan deferment as evidence of a mortgage moratorium, provided the household did not otherwise classify itself as being in arrears or default. Because the survey does not capture the duration of these deferments, we do not modify the NPL indicator (90+ days past due) but instead focus on the broader arrears measure (30+ days past due), which is more informative about temporary payment difficulties.

To implement the adjustment, we reclassify owner-occupier households reporting a loan deferment as being in arrears under increasingly restrictive assumptions. Specifically, the HFCS asks households with income losses to indicate the magnitude of the decline using categorical thresholds (at least 5%, 25%, or 50%). We therefore construct three alternative arrears definitions, classifying deferment households as in arrears if their reported income loss exceeded 5%, 25%, or 50%, respectively. These scenarios reflect increasing likelihoods that such households would have fallen behind on payments in the absence of moratoria.

Table 8 reports the results. Across all adjustment scenarios, the qualitative ranking of default triggers remains unchanged, with the double trigger continuing to account for the largest share of the combined trigger effect. As the adjustment becomes more restrictive—reclassifying households with loan deferments and increasingly severe income losses as being in arrears—the relative importance of the liquidity-only trigger rises modestly, while the contribution of the double trigger declines correspondingly. In particular, when households reporting income losses of 50% or more are reclassified as being in arrears, the liquidity trigger accounts for a larger share of the summed trigger effects than in the baseline specification (32% vs 26%).

[13]The following countries are included in the module: AT, CY, GR, EE, ES, FR, IT, MT, NL, PT, SI, SK. According to the European Banking Authority, around 7% of EU residential mortgages were under moratoria at the peak, with substantially higher take-up in Cyprus (around 40%), Hungary (25%), and Portugal (18%), and above-average levels in Spain, Italy, and Greece (approximately 10–15%) (European Banking Authority, 2020). Except for Hungary, all countries with high moratorium take-up are covered by the HFCS COVID-19 module.

Table 8: Robustness checks: COVID-19 Moratoria

	Baseline	Arrears adjusted for moratoria if income ↓ ≥5%	↓ ≥25%	↓ ≥50%
	(1)	(2)	(3)	(4)
Cash-flow trigger (D)	0.122***	0.206***	0.191***	0.182***
% of ∑ trigger AMEs†	26%	29%	29%	32%
	(5.02)	(6.39)	(6.22)	(5.73)
Equity trigger (D)	0.090***	0.117***	0.105***	0.098***
% of ∑ trigger AMEs†	19%	16%	16%	17%
	(4.60)	(4.83)	(4.80)	(4.72)
Double trigger (D)	0.262***	0.400***	0.368***	0.282***
% of ∑ trigger AMEs†	55%	55%	55%	50%
	(4.37)	(5.15)	(5.24)	(4.35)
Share of defaulting hh	0.077	0.107	0.093	0.084
Model	logit	logit	logit	logit
Controls	incl.	incl.	incl.	incl.
Country dummies	incl.	incl.	incl.	incl.
Weights	hh	hh	hh	hh
N	11,481	11,481	11,481	11,481

Notes: Two-tailed significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Estimates are based on one implicate.
† "% of ∑ trigger AMEs" reports each trigger's average marginal effect (AME) as a share of the sum of the AMEs of all three trigger states. All specifications control for the modifier (mortgage on the main residence, HMR) and the full set of observed confounders (confounder set 1): age, age squared, tertiary education, single household status, and number of children. The sample includes all countries covered by the HFCS COVID-19 non-core finance module (hv0200): AT, CY, GR, EE, ES, FR, IT, MT, NL, PT, SI, and SK.
Source: HFCS 2021, ECB.

This pattern is consistent with the nature of COVID-19 moratoria, which primarily postponed repayments for households facing acute cash-flow disruptions rather than addressing underlying balance-sheet problems. As a result, some liquidity-constrained households may have remained contractually current during the pandemic despite experiencing repayment stress that would likely have translated into arrears in the absence of policy intervention. Adjusting the arrears measure to account for this mechanism therefore reveals a slightly stronger role for pure liquidity distress relative to the baseline. Taken together, these results indicate that COVID-19 moratoria may have introduced a slight downward bias in the estimated effect of the cash-flow trigger, but the magnitude of this bias remains limited and well within a range that leaves the main conclusions unaffected.

5.5 Country exclusion

Table 9 reports a leave-one-country-out robustness exercise that assesses whether the main results are driven by any single national context. As country-wise estimation is not feasible for reasons discussed in section 3.4, we sequentially exclude each country from the sample and re-estimate the baseline specification. This approach allows us to assess whether any individual country disproportionately shapes the estimated trigger effects. The results show a high degree of stability. Across all specifications,

Table 9: Robustness analysis based on full sample: NPL as dep. variable; AMEs of triggers by country exclusion

Trigger	AT	BE	CY	DE	EE	ES	FR
Cash-flow	0.055 ***	0.061 ***	0.044 ***	0.057 ***	0.057 ***	0.051 ***	0.058 ***
% of ∑ trigger AMEs†	21 %	22 %	18 %	21 %	21 %	19 %	21 %
Equity	0.051 ***	0.055 ***	0.027 ***	0.052 ***	0.053 ***	0.050 ***	0.053 ***
% of ∑ trigger AMEs†	20 %	19 %	11 %	19 %	19 %	18 %	19 %
Double	0.153 ***	0.166 ***	0.179 ***	0.159 ***	0.161 ***	0.173 **	0.162 ***
% of ∑ trigger AMEs†	59 %	59 %	71 %	59 %	59 %	63 %	59 %
	GR	HR	HU	IT	LU	LV	MT
Cash-flow	0.061 ***	0.056 ***	0.058 ***	0.056 ***	0.056 ***	0.044 ***	0.059 ***
% of ∑ trigger AMEs†	27 %	21 %	21 %	21 %	20 %	21 %	22 %
Equity	0.042 ***	0.051 ***	0.050 ***	0.049 ***	0.053 ***	0.055 ***	0.052 ***
% of ∑ trigger AMEs†	19 %	19 %	18 %	19 %	20 %	26 %	20 %
Double	0.125 **	0.157 ***	0.168 ***	0.155 ***	0.164 ***	0.111 ***	0.152 ***
% of ∑ trigger AMEs†	55 %	59 %	61 %	60 %	60 %	53 %	58 %
	NL	PT	SI	SK		Baseline	
Cash-flow	0.062 ***	0.055 ***	0.057 ***	0.059 ***		0.056 ***	
% of ∑ trigger AMEs†	22 %	21 %	21 %	21 %		21 %	
Equity	0.056 ***	0.052 ***	0.052 ***	0.053 ***		0.050 ***	
% of ∑ trigger AMEs†	20 %	19 %	19 %	19 %		19 %	
Double	0.162 ***	0.158 ***	0.157 ***	0.165 ***		0.156 ***	
% of ∑ trigger AMEs†	58 %	60 %	59 %	60 %		60 %	

Notes: Two-tailed significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Estimates based on one implicate. AMEs: average marginal effects. Model specification based on model (3) in Table 3. † '% of ∑ trigger AMEs' reports each trigger's AME as a share of the sum of all three trigger AMEs.
Source: HFCS 2021, ECB.

the estimated effects of the cash-flow, equity, and double triggers remain statistically significant, and the double trigger consistently exerts the largest effect on default risk. This confirms that the core finding—that default risk is dominated by the joint occurrence of liquidity distress and negative equity—does not hinge on any single country. Some variation in the relative importance of the triggers is nevertheless visible. When countries with weaker debt enforcement, such as Greece or Cyprus, are excluded, the equity trigger becomes less important relative to the cash-flow trigger. These shifts mirror the enforcement-based heterogeneity documented in the main analysis. Overall though, the leave-one-out exercise reinforces the robustness and internal consistency of our results: while institutional differences across countries shape the relative importance of triggers to some extend, the dominance of the

double trigger and the qualitative structure of the findings remain remarkably stable across all country exclusions.

6 Summary remarks and policy conclusions

This paper provides the first systematic cross-country evidence on mortgage default triggers in Europe. Using harmonized microdata from the fourth wave of the Household Finance and Consumption Survey (HFCS), we analyze mortgage default behavior across 18 European countries, covering around 98% of the euro area and 87% of Europe's population. Our contribution lies in estimating—within a unified empirical framework—the relative importance of the three default triggers emphasized in the theoretical literature: liquidity distress, negative equity, and their interaction (the "double trigger").

Three main findings emerge. First, all three trigger states are economically and statistically relevant predictors of mortgage default. In the pooled sample, households experiencing liquidity stress only or negative equity only face significantly elevated default risks, with average marginal effects of around 4–5 percentage points each. However, the interaction of both states—the double trigger—has by far the strongest effect, increasing the probability of non-performing loans by roughly 16 percentage points in the baseline specification. In relative terms, the double trigger accounts for about 60% of the combined trigger effect, while liquidity-only and equity-only states each account for roughly 20%.

Second, the relative importance of triggers varies systematically with institutional context. When splitting the sample by debt enforcement strength, we find that negative equity alone does not significantly increase default risk in countries with strong enforcement regimes. By contrast, in countries with weaker enforcement, the equity trigger is more relevant—consistent with evidence from single-country studies exploiting variation in borrowers' default costs. This literature shows that when legal or institutional conditions reduce the effective cost of default—whether through limits on creditor claims or weaker enforcement—borrowers become more responsive to negative equity, and equity-related default incentives gain importance (Ghent and Kudlyak, 2011; Andrieș et al., 2025; Artavanis and Spyridopoulos, 2023). Our findings suggest that these mechanisms also extend more broadly across European mortgage markets, even within predominantly full-recourse systems. Nevertheless, across both institutional regimes, the double trigger remains the dominant mechanism.

Third, while we do find evidence that negative equity matters in the pooled

European sample, it is clearly not the primary driver of default. This result complements recent U.S. evidence by Ganong and Noel (2023) and Low (2023), who show that purely equity-driven default is rare in practice and that liquidity constraints play a central role. Our findings are also consistent with Gerardi et al. (2018) and O'Toole and Slaymaker (2021), who document significant interaction effects between liquidity and equity stress in the U.S. and in Ireland, respectively. In this sense, the European evidence supports a double-trigger view of mortgage default: negative equity alone is not the dominant driver of default, but it substantially amplifies default risk when combined with binding liquidity constraints.

The results have several implications for macroprudential surveillance and policy design. A first implication concerns early-warning systems. Monitoring default risk requires more than tracking the share of households with negative equity or liquidity constraints separately. Our results show that default risk is concentrated among households experiencing both trigger states simultaneously. Surveillance frameworks should therefore monitor the joint distribution of liquidity and equity stress, including the mortgage exposure of households facing stress in both dimensions.

A second implication concerns the design of the macroprudential policy toolkit. Since all three trigger states are associated with elevated default risk—and default risk is highest when liquidity stress and negative equity occur jointly—our findings suggest that both liquidity-based and equity-based borrower measures should be available within the macroprudential framework. In particular, instruments targeting repayment capacity (e.g. DSTI limits), and instruments targeting borrower leverage (e.g. LTV caps), address distinct dimensions of mortgage risk. Focusing on only one of these dimensions may therefore leave relevant vulnerabilities unaddressed. At the same time, this does not imply that both types of instruments must always be active. Rather, our results suggest that both should be part of the available policy toolkit, as mortgage default can emerge through multiple pathways.

At the same time, our results caution against a uniform calibration of borrower-based measures across countries. A first reason is institutional heterogeneity. Our findings show that the role of negative equity varies systematically with debt enforcement strength, suggesting that identical borrower states do not generate the same default incentives across institutional settings. A second reason is that countries may differ in how likely households are to enter financially vulnerable states in the first place. Differences in labor market institutions, social safety nets, mortgage market structures, and housing market volatility may all affect how strongly adverse shocks translate into liquidity stress, negative equity, or both. Third, borrowers themselves may differ across countries in their exposure to such shocks, for example due to dif-

ferences in leverage, liquidity buffers, interest-rate exposure, or mortgage contract design. These differences are economically relevant because borrower-based measures are not costless. While they may strengthen financial resilience and reduce default risk, they can also restrain mortgage credit growth and potentially broader economic activity (Richter et al., 2019; Araujo et al., 2024; Alam et al., 2024). The activation and calibration of such measures should therefore remain primarily national and reflect country-specific cost-benefit considerations, rather than follow a uniform European approach. This aligns with the ESRB's position that a common minimum toolkit of borrower-based measures should be available across Member States, while leaving implementation to national authorities (European Systemic Risk Board, 2022).

A key remaining policy question concerns how households transition into the double-trigger state, where default risk is highest. In some mortgage markets, households may enter this state gradually—for example when liquidity stress leads to arrears and, over time, contributes to equity erosion. In others, severe recessions combined with housing market corrections may push households directly into both trigger states simultaneously. Understanding these transition pathways is important because they may determine which borrower-based measures are most effective in practice. In settings where households enter the double-trigger state gradually—for example when liquidity stress precedes more severe financial distress—liquidity-focused instruments such as DSTI limits may already provide substantial protection. By contrast, in mortgage markets more exposed to simultaneous income and house-price shocks, both liquidity- and equity-based tools may be needed. Our arrears results are consistent with the possibility that liquidity stress may often emerge earlier in the distress process, although identifying such transition dynamics more precisely remains an important avenue for future research.

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Appendix

Table A.1: Descriptive statistics by default status

Variables	**All mortgaged households**	**In arrears** (30+ days due)	**In default (NPL=1)** (90+ days due)
Demographics and household characteristics			
Age of RP, median	45	45	50
Gender (male) of RP, share	0.66	0.61	0.62
Tertiary education of RP, share	0.46	0.22	0.15
Household type single, share	0.22	0.19	0.18
Number of children, median	1	1	1
Fin. support network, share	0.71	0.49	0.37
Risk-seeking RP, share	0.09	0.16	0.15
Impatience (>80%), share	0.17	0.28	0.35
Financial position of the household			
Gross yearly income (€), median	44,550	26,500	22,926
Liquid assets (€), median	10,000	300	51
Net wealth (€), median	186,500	111,365	107,370
Housing and mortgage characteristics			
Owns main residence, share	0.96	0.95	0.95
Floating rate mortgage, share	0.56	0.60	0.62
Age of the loan (years), median	8	13	14
Initial maturity (years), median	25	25	25
Interest rate, median	2.00	2.70	3.00
Mortgage debt (€), median	73,200	60,000	76,000
Loan-to-Value ratio, median	0.39	0.43	0.41
Default triggers and underlying determinants			
Equity trigger, share	0.05	0.08	0.12
Cash-flow trigger, share	0.04	0.15	0.16
Double trigger, share	0.01	0.05	0.08
Expenses exceed income, share	0.10	0.27	0.32
Liquidity constrained, share	0.05	0.20	0.23
Negative equity, share	0.05	0.14	0.20
Unemployed (HH member), share	0.09	0.24	0.28
Unemployed RP, share	0.02	0.09	0.11
Income drop, share	0.19	0.44	0.47
Expenses rise, share	0.19	0.20	0.19
Divorce (HH member), share	0.14	0.25	0.29
Disability (HH member), share	0.03	0.06	0.08
House price drop, share	0.08	0.15	0.22
Regional house price drop, share	0.07	0.09	0.12
Liquidity withdrawal, share	0.02	0.07	0.10

Notes: Values are population-weighted shares or medians (equal country weights). The sample includes 18 countries as defined in Figure 3 and corresponds to the baseline estimation sample reported in Table 3 (full sample); for risk-seeking, impatience, and financial support variables, the sample corresponds to the restricted specification in the same table. Arrears refer to mortgage payments overdue by 30+ days. NPL denotes non-performing mortgage loans, defined as mortgage arrears of 90+ days (see equation 2); RP denotes the reference person (Canberra definition), and HH denotes household. Fin. support network indicates whether the household reports access to financial assistance from relatives or friends if needed. Risk-seeking equals one if the RP (or partner) reports above-average or substantial willingness to take financial risk in saving and investment decisions. Impatience equals one if the household would spend more than 80% of a hypothetical lottery gain on current consumption rather than saving or debt repayment. Triggers, liquidity constraints and negative equity are defined in equations 3 and 4 and in table 2. House price drop equals one if the current value of the main residence is below its purchase price; the regional measure reports the corresponding share within region × loan-cohort cells. Liquidity withdrawal indicates mortgage use for debt consolidation or current living expenses. Dummy variables are reported as shares; all other variables are reported as medians.
Source: HFCS 2021, ECB.

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