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**The Fundamental Principles of Financial Regulation**by Markus Brunnermeier, Andrew Crockett, Charles  
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# Quantifying the triggers of subprime mortgage defaults

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*This column presents empirical evidence identifying the factors triggering mortgage defaults in the US. Both deterioration of borrowers' net equity and liquidity constraints have been important. Policy remedies will have to address both concerns – the authors recommend write-downs on loan principal amounts as one such measure.*

*Editors' note: The following views are the personal views of the authors and do not necessarily reflect the positions of the Federal Reserve System.*

The recent financial turmoil was initially triggered by the rise in defaults by subprime mortgage borrowers, followed by the implosion of the market for securitised assets backed by such loans. Many proposals for setting the economy back on track try to address this root cause, yet the task of designing an appropriate policy response is limited by an incomplete understanding of the drivers behind mortgage default. What measures would most effectively avert future waves of default and increase market transparency without impeding borrowers' access to loans? Would the remedy involve modifying existing loan terms or instead targeting market failures at an institutional level? This column aims to put the policy debate into perspective by drawing on our empirical analysis of subprime borrowers' default decisions.

## **Is default the exercise of a financial option or a reflection of illiquidity?**

Much research has been done examining two aspects of mortgage borrowers' decision to default. First, default amounts to the exercise of a put option that limits the downside risk when the value of a house falls below the value of the mortgage. Thus, one strand of research has focused on how net equity or home prices affect default rates. Other studies have examined the importance of financial frictions; households may be liquidity-constrained and temporarily unable to pay, especially if they have low credit quality. The literature has consistently found empirical evidence for both stories (Archer,

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Ling, and McGill, 1996; Crawford and Rosenblatt, 1995; Demyanyk and van Hemert, 2008; Deng, Quigley, and van Order, 2000; Foote, Gerardi, and Willen, 2008a; Gerardi, Shapiro, and Willen, 2008; Quigley and van Order, 1995; Vandell, 1993), but has not completely disentangled the relative magnitudes of each effect.

## **Interaction between option value and illiquidity**

Our [work](#) builds on the previous literature, but also departs from it by nesting the various potential incentives for default within a unified model (Bajari, Chu, and Park 2008). The decision to default is captured by two equations in our model – borrowers default either if their net equity falls below a certain threshold or if they cannot make their monthly payments due to credit constraints. As researchers, we observe when a default occurs, but cannot distinguish whether a particular default is triggered by the first or second cause. This feature is explicitly incorporated in our two-equation model. By contrast, previous researchers have typically included in a single equation both the determinants of financial incentives as well as measures of liquidity. Such models do not take into account the fact that a mortgage's option value is only relevant to the default decisions of households that are not already liquidity-constrained, while liquidity constraints only matter to households that have an incentive to continue making payments. Ignoring this interdependence may bias results due to misspecification.

We must understand the empirical importance of illiquidity and net equity as drivers of default in order to assess alternative policy remedies. Many of the current proposals are directed primarily toward payment affordability. For example, an FDIC proposal aims to reduce monthly payments to no more than 31% of borrowers' pre-tax income, either by means of interest rate reductions or by extending loan lengths. Similarly, measures underway within the banking industry have mostly involved loan modifications to make payments more affordable. While such modifications would help to stanch default due to liquidity constraints, they would be much less effective in a regime of falling house prices if defaults are primarily driven by dwindling net equity.

## **Empirical analysis of key drivers behind subprime defaults**

We estimate our model using detailed loan-level data from the LoanPerformance company, which cover the universe of securitised subprime and Alt-A mortgages originated between 2000 and 2007. We observe characteristics of each loan and borrower at the time of origination and the borrower's subsequent payment behaviour over time. To impute changes in the value of each house based on the initial assessed value, adjusted using Case-Shiller's price indices for various price ranges of houses in different metropolitan areas.

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A decomposition using our estimation results indicates that the nationwide decrease in home prices accounts for roughly half the increase in default propensity of loans originated in 2006 compared to 2004-vintage loans. With home prices down by more than 20% from their peaks in many US cities, borrowers whose outstanding mortgage liabilities now exceed their home values can in effect increase their wealth by walking away from their loans. Our estimates indicate that, for a borrower who purchased a home one year earlier with a 30-year fixed-rate mortgage and no down payment, a 20% decline in home price makes the borrower 15.4% more likely to default than an otherwise identical borrower whose home price remained stable.

However, we also find that household illiquidity is an equally important factor behind the increasing propensity of borrowers to default. Our parameter estimates indicate that roughly half the increase in default probability for 2006-vintage loans relative to 2004-vintage loans can be attributed to deterioration over time in observed characteristics of the borrower pool. In particular, later borrowers tend to have lower credit scores and a higher probability of having undocumented loans or additional liens on their properties—indicators of a greater risk of illiquidity due to insufficient income or lack of access to other forms of credit. We also see an increase over time in the proportion of adjustable-rate mortgages among new originations. Adjustable-rate mortgages are generally chosen by more liquidity-constrained borrowers, and often come with large, periodic increases to monthly payments, forcing liquidity-constrained borrowers to default.

## Policy implications

Based on the importance of illiquidity as a driver of default, the observed deterioration in borrower pool quality is consistent with the notion that lenders loosened their underwriting standards over time, perhaps due to flaws in the securitisation process. Because lenders do not hold mortgages that they have securitised, they do not bear the consequences of risky mortgages at the point in time when they go bad, even as they continue to generate income by originating such loans. This agency problem, coupled with the general underestimation of default risks by financial markets at the height of housing boom, gave primary lenders an incentive to lower their lending standards. Thus, a key policy implication is that future waves of default can be made less likely by measures that reduce originator moral hazard.

Our results also have ramifications for the efficacy of various policy remedies under consideration. Because we find empirical importance for both illiquidity and net equity as drivers of default, this suggests that effectively mitigating foreclosures would require either some combination of policies targeting each cause, or a single instrument that

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targets both. For example, loan modifications that merely increase payment affordability by extending loan lengths would not be very effective as a standalone measure, as they would leave borrowers' equity positions unchanged. On the other hand, write-downs on loan principal amounts would address both causes simultaneously, with the reduction in loan size serving both to increase the borrower's net equity as well as reduce monthly payments.

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