

# Collateral Constraints and Macroeconomic Asymmetries

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## Research Summary

Collateral constraints drive an asymmetry in the relationship between house prices and economic activity, and are a central mechanism to explain the collapse of the Great Recession. When housing wealth is high, collateral constraints are slack, and the sensitivity of borrowing and spending to changes in house prices is positive but not large. Conversely, when housing wealth is low, collateral constraints are tight, and borrowing and expenditures move with house prices in a more pronounced fashion. We develop and corroborate this argument in two steps. First, we construct a nonlinear general equilibrium model and estimate it with Bayesian likelihood methods. The estimated model implies that, as collateral constraints became slack during the housing boom of 2001-2006, expanding housing wealth made a small contribution to consumption growth. By contrast, the subsequent housing collapse tightened the constraints and sharply exacerbated the recession of 2008-2009. Second, we present evidence from panel regressions on state- and MSA-level data that corroborates the asymmetry inferred from the estimated model.

### **A General Equilibrium Model with Collateral Constraints**

The starting point for our analysis is a workhorse macro model along the lines of [Christiano, Eichenbaum, and Evans \(2005\)](#) and [Smets and Wouters \(2007\)](#). The model features nominal price and wage rigidities, a monetary authority that uses an interest rate rule, habit formation in consumption, and investment adjustment costs. To this framework we add three main elements. First, we allow for the dual role of housing, as a durable good, and as collateral for “impatient” households. The total supply of housing is fixed, but housing reallocation takes place across “patient” and “impatient” households in response to an array of shocks which also influence the price of housing. Second, the housing collateral constraint binds only occasionally. The estimation of the model involves inferring when the collateral constraint is binding and when it is slack through observations that do not include the Lagrange multiplier for the constraint. Third, monetary policy is constrained by the zero lower bound. Our assumption that housing is in fixed supply and plays no role in production has the important advantage that the model behaves essentially like a typical model for monetary policy analysis when

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the borrowing constraint is slack. During these periods, housing prices passively respond to movements in the macroeconomy and only exert a negligible feedback effect on other macro variables. By contrast, when the constraint is found to be binding, the interaction of house prices with borrowing and spending decisions has a first-order effect on the macroeconomy.

We use Bayesian likelihood methods to validate the model against U.S. data. The nonlinear solution of the model allows us to capture the state-dependent effects of shocks based on whether housing wealth is high or low, and whether the zero lower bound on nominal interest rates binds or not. We quantify the contribution of collateral constraints to business cycles by simulating a version of the model in which parameters are set so that the collateral constraints are slack for all of the agents. The analysis shows that during the 1990-1991 and the 2008-2009 recessions, as collateral constraints became binding, they exacerbated the contraction in consumption substantially. The amplification due to collateral constraints is so large in the 2008-2009 period that, in their absence, the zero lower bound would not have been reached.

## **A Policy Experiment**

Our estimation results show that movements in house prices can produce asymmetries that are economically and statistically significant. These findings have bearing on the design of policies aimed at shoring up the housing market in the context of a deep recession. To illustrate our ideas, we choose a simple example of one such policy, a lump-sum transfer from patient (saver) households to impatient (borrower) households. This policy could mimic voluntary debt relief from the creditors, or a scheme where interest income is taxed and interest payments are subsidized in lump-sum fashion, so that the end result is a transfer of resources from the savers to the borrowers.

We consider this experiment against two different baselines. In one case, house prices are assumed to be declining; in the other case, housing prices are assumed to be increasing. The consumption response of borrower households is dramatically different depending on the baseline variation in house prices. When house prices decline, the borrowing constraint is tight and the marginal propensity to consume of borrower households is elevated. When house prices increase, the borrowing constraint becomes slack and the marginal propensity to consume of borrower households drops down closer to that for saver households. In reaction to the transfer, consumption of the savers declines less, and less persistently, against a baseline of housing price declines. In that case, there are expansionary spillover effects from the increased consumption of borrowers to aggregate hours worked and output. Taking together the responses of savers and borrowers, the partial effects of the transfer on aggregate consumption are sizable when house prices are low, and small when house prices are elevated. As a consequence, actions

such as mortgage relief can almost pay for themselves through their expansionary effects on economic activity in a scenario of binding borrowing constraints.

## **Regional Analysis**

The task of isolating the asymmetric effect of changes in house prices using only national data is fraught with difficulty. Barring the Great Recession, house price declines have been rare at the national level. Regional data exhibit greater variation in housing prices. Accordingly, we corroborate the results of the estimated general equilibrium model using a panel and cross-sectional regressions at the regional level. We verify that the asymmetries uncovered using the estimated model and the national data are just as pronounced when using regional data.

For the regional analysis, we choose measures of activity to match our model counterparts for consumption, employment and credit. Part of our empirical analysis looks for instruments for house price changes as a way to isolate housing preference shocks from other shocks that are more likely to jointly move both housing and other endogenous variables, as done by [Mian and Sufi \(2011\)](#). In all cases, we find statistically significant differences in the reaction of the activity measure of interest to changes in housing prices depending on whether housing prices are high or low.

## **Related Work**

Our analysis is related to two distinct bodies of work. Numerous recent papers develop general equilibrium models to study the nexus between financial frictions and macroeconomic outcomes at the national level. Our analysis of regional data builds on an expanding literature that has linked changes in measures of economic activity, such as consumption and employment, to changes in house prices.

A spate of recent papers has quantified the importance of financial shocks in exacerbating the Great Recession using a general equilibrium framework. For instance, see [Del Negro, Eggertsson, Ferrero, and Kiyotaki \(2011\)](#), [Jermann and Quadrini \(2012\)](#), [Christiano, Motto, and Rostagno \(2013\)](#). The common thread among these papers is that financial shocks are key drivers of the Great Recession. The occasionally binding nature of the constraints we consider sets our work apart. In our model, financial constraints endogenously become slack or binding, so that financial shocks are not required to effectively counteract or enhance an otherwise constant set of financial constraints. In this respect, our work extends the basic mechanisms in [Mendoza \(2010\)](#) who also considers occasionally binding financial constraints in a calibrated small open economy setting with an exogenous interest rate. Our extensions make it possible to construct quantitatively meaningful counterfactual exercises and to consider policy alternatives in an empirically validated model for the United States.

Regarding the regional analysis, other papers also point towards an prominent role for housing as collateral in influencing both consumption and employment. Recent contributions include [Case, Quigley, and Shiller \(2005\)](#), [Campbell and Cocco \(2007\)](#), [Mian and Sufi \(2011\)](#), [Mian, Rao, and Sufi \(2012\)](#), and [Abdallah and Lastrapes \(2012\)](#). Despite the emphasis on collateral constraints, this literature has failed to recognize that such a channel implies asymmetric relationships for house price increases and declines with other measures of aggregate activity and has not embedded this channel in a model for policy analysis.

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