Collateral constraints and macroeconomic asymmetries☆

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A B S T R A C T
Full information methods are used to estimate a nonlinear general equilibrium model where occasionally binding collateral constraints on housing wealth drive an asymmetry in the link between housing prices and economic activity. The estimated model shows 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 housing collapse that followed tightened the constraints and sharply exacerbated the recession of 2007–2009. The empirical relevance of this asymmetry is corroborated by evidence from state- and MSA-level data.

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1. Introduction

A growing number of theoretical and empirical papers has emphasized leverage, financial accelerator effects and housing prices as central elements to understand the boom and bust period that ended with the Great Recession.1 In many of these papers, the key mechanism linking housing prices and economic activity is the role of housing wealth as collateral for borrowing. As housing prices rise, household borrowing rises, fueling a debt–driven consumption boom. As housing prices decline, households are forced to borrow less, and the deleveraging pushes the economic contraction into overdrive.

We evaluate the aggregate implications of this mechanism using a DSGE model and a novel approach. The starting point is the idea that financial frictions matter disproportionately more in a recession than in a boom. Our novel approach is to use Bayesian methods to estimate a model which allows for, but does not impose, asymmetric effects of housing booms

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and busts, depending on whether housing collateral constraints are binding or not. Our estimates point to these asymmetric effects as a central mechanism to explain not just the depth of the Great Recession, but also the events that led to it. As the housing boom unfolded, collateral constraints turned slack, and expanding housing wealth made a small contribution to consumption growth. By contrast, the subsequent housing collapse tightened the constraints and, more than the zero lower bound (ZLB) on nominal interest rates, sharply exacerbated the Great Recession. Moreover, this asymmetry is not just a feature of the estimated model based on aggregate U.S. data. Evidence from both state- and MSA-level data shows that various measures of regional activity, including consumption, are more sensitive to housing prices when housing prices are low than when they are high.

To our knowledge, this paper is the first to combine key elements of the crisis, such as leverage, occasionally binding collateral constraints, house price fluctuations, and the ZLB, within a setting rich enough to tackle full information estimation. The amplification of the declines in house prices due to collateral constraints and deleveraging was very large in the 2007–2009 period, with collateral constraints accounting for about 70% of the observed decline in consumption. Without collateral constraints, for instance, the recession would have been curbed to such an extent that the Federal Funds rate would not have reached zero. Additionally, although the estimated model does not directly use data on household debt, the degree of cyclical variation in empirical and model-based measures of borrowing and leverage are remarkably similar, providing further support for the paper’s findings.

At the core of our analysis is a standard monetary DSGE model augmented to include a housing collateral constraint along the lines of Kiyotaki and Moore (1997), Iacoviello (2005), and Liu et al. (2013). As in these papers, housing serves the dual role of durable good and collateral for borrowers. To this framework, we add two empirically realistic elements that generate important nonlinearities. First, the housing collateral constraint binds only occasionally, rather than at all times. Second, in line with recent U.S. experience, monetary policy is constrained by the ZLB. We use Bayesian estimation methods to validate the nonlinear dynamics of the model against quarterly U.S. data. The estimation involves inferring when the collateral constraint is binding, and when it is not, through observations that do not include the Lagrange multiplier for the constraint. Our model has the property that house price movements matter little for economic aggregates when borrowing constraints are slack. By contrast, when the constraints are binding, the interaction of house prices with borrowing and spending decisions has a first-order effect on the macroeconomy, especially when monetary policy is unable to adjust the interest rate.

Most importantly, the model fits the data better than two competing alternatives, one without collateral constraints, and one where collateral constraints always bind. Without the collateral constraint, the model collapses to a standard monetary business cycle model, like in Christiano et al. (2005) and Smets and Wouters (2007). Such a model omits the housing collateral channel and needs to layer, on top of the shocks driving housing prices, a collective attack of patience – in the form of implausibly large negative consumption preference shocks – to fit aggregate consumption during the Great Recession. Nonetheless, this attack of patience, as well as other potential alternatives such as technology shocks, has little bearing on housing prices, which still require their independent source of variation, reducing the likelihood of that model.

A model with permanently binding collateral constraints faces unpleasant trade-offs, too. It misses the asymmetry in the relationship between house prices and consumption, so that by matching the expansion in consumption during the housing boom preceding the Great Recession, it ends up overstating the consumption collapse. Moreover, this model misses an important channel of propagation. At the peak of the housing cycle, the expansion in housing wealth relaxes collateral constraints, so that households can initially rely on borrowing to buffer any drop in consumption associated with falling house prices. Only after house prices continue falling, do borrowing constraint start to bind, and consumption and house prices comove more notably.

Support in favor of the asymmetries uncovered by the model also comes from our analysis using regional data. State- and MSA-level data confirm the asymmetric estimates based on national data. The sensitivity to house prices of expenditures – and other measures of economic activity – is about twice as large when house prices are low than whey they are high, confirming the relevance of the key mechanism at the center of our aggregate model.

A spate of recent papers has quantified the importance of financial shocks and frictions using a general equilibrium framework. Recent notable examples include Del Negro et al. (2017), Gertler and Karadi (2011), Jermann and Quadrini (2012), Christiano et al. (2014). The common thread among these papers is that financial shocks and frictions – including shocks and frictions in models with an explicit intermediation sector – are key elements of the Great Recession. The occasionally binding nature of the constraints and the estimation approach applied to a nonlinear DSGE model are the two elements that set our work apart. In our model, financial constraints endogenously become slack or binding, thus mimicking the role of time-varying financial shocks (or capital quality shocks) in models with 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 quantitative counterfactual exercises and to consider policy alternatives in an empirically validated model for the United States. 2 One application of the paper uses the estimated model to gauge the effects of policies aimed at the housing market in the context of a deep recession.

2 Gust et al. (2017) estimate a nonlinear DSGE model that takes into account the ZLB on nominal interest rates, but do not consider financial frictions. Bocola (2016) estimates a small-open economy model for Italy, including financial frictions and occasionally binding funding constraints for banks.
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