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A quantitative analysis of the U.S. housing and mortgage markets and the foreclosure crisis [☆]



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ABSTRACT

We present a model of long-duration collateralized debt with risk of default. Applied to the housing market, it can match the homeownership rate, the average foreclosure rate, and the lower tail of the distribution of home-equity ratios across homeowners prior to the recent crisis. We stress the role of favorable tax treatment of housing in matching these facts. We then use the model to account for the foreclosure crisis in terms of three shocks: overbuilding, financial frictions and foreclosure delays. The financial friction shock accounts for much of the house price decline while the foreclosure delays account for bulk of the rise in foreclosures. The scale of the foreclosure crisis might have been smaller if mortgage interest payments were not tax deductible. Temporarily higher inflation might have lowered the foreclosure rate as well.

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1. Introduction

This study is motivated by the collapse in house prices and rising defaults on mortgages in the United States during the recent financial crisis. It has two goals: first, to present a new model of long-duration collateralized debt obligations with default that can match key long-run features of the U.S. housing and mortgage markets and, second, to use the model to gain a quantitative understanding of the recent foreclosure crisis.

The main elements of the model are as follows. The economy is endowed with an exogenously given stocks of rental and owner-occupied housing space. There is a continuum of infinitely lived individuals subject to uninsurable idiosyncratic shocks to earnings. People buy consumption goods and save in the form of a risk-free savings account. An individual who is currently a renter can choose to purchase his housing space, offering the space as collateral in the mortgage market. The mortgage contract has long duration and borrowers freely choose their down-payment. An individual who is currently a homeowner can choose to sell his house, default on the mortgage (if he has one), or simply keep his house. A renter can choose to continue to rent or purchase a house; a renter with a record of default does not have access to the mortgage

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market. There is a competitive intermediation sector that accepts savings from individuals and makes loans to borrowers at an interest rate that exactly reflects the borrower's probability of default. It also owns and operates the rental properties. Each period, the rents and the price of owner-occupied housing space are determined by equality of demand and supply in the two markets. All individuals pay income taxes as per U.S. tax code and homeowners pay property taxes as well. The model also features developers who play a role in the crisis.

We show that the model can be calibrated to match the average homeownership and foreclosure rates and the lower tail of the home equity distribution. The tax treatment of housing plays a key role in bringing the model close to reality. The exemption of implicit rental income from income taxes gives an important tax-saving motive for homeownership. The mortgage interest deduction makes it desirable to take on leverage to purchase homes and helps account for the average level of foreclosures. Steady state inflation, as well as the fact that homeowners steadily pay down their debt, helps account for the dispersed distribution of home equity seen in the data. The model makes reasonable predictions regarding relevant data moments not targeted in the calibration.

To understand the foreclosure crisis, we chose three factors that seemed relevant *a priori*. These factors are: an overbuilding of housing, a disruption in the flow of credit to the mortgage market, and delays in completing foreclosures. The first two are obvious choices.¹ Delays in completing foreclosures – which means that a defaulter does not have to vacate the house right after default – raises the value of default since the defaulter gets to live “rent free” for the duration the delay (Ambrose et al., 1997). Zhu and Pace (2011) show that anticipated foreclosure delays positively influenced the foreclosure rate during the crisis.

Incorporating these three factors into the model, we find that it can account for all of the 19 percent cumulative decline in prices over the crisis years and the bulk (86 percent) of the 16 percent cumulative rise in foreclosures. We then use our model to assess the marginal contribution of each of the factors.

We find that the disruption to the flow of mortgage credit is key for accounting for the observed decline in house prices. In its absence, house prices decline little less than 6 percent. But, surprisingly, there is no corresponding large reduction in the rise of the foreclosure rate: the foreclosure rate still rises a hefty 10.51 percent. Thus, the financial disruption accounts for about 69 percent of the observed decline in house prices but only 20 percent of the observed jump in foreclosures.

In contrast, the foreclosure processing delay, which allows a defaulter to live rent free for a year with some probability, is an important inducement to default. In its absence, the house price drop would still be about 19 percent, but the foreclosure rate would rise to only about 8 percent. Thus, foreclosure delays play no role in accounting for the drop in house prices but account for 37 percent of the observed rise in foreclosures.

The supply shock is important as well. In its absence, house prices would decline 12.33 percent and foreclosures would rise to 7.38 percent. The overbuilding shock accounts for 35 percent of the observed drop in price and 40 percent of the rise in foreclosures, confirming the common intuition that excessive home building was an important element in the crisis.²

In addition to these findings, our model permits us to explore the implications of certain types of policy actions. We find that in face of the crisis, (temporarily) higher inflation leads to a lower foreclosure rate but almost the same drop in prices. We find that the shocks would have had a considerably smaller effect on foreclosures, if the tax code did not encourage leverage.

There are two aspects of our study of the foreclosure crisis that are worth pointing out. First, the marginal contributions we report are contributions in the *accounting*, not causal, sense. This is because we treat the three shocks as independent when, in reality, they are most likely not so.³ Nevertheless, our accounting is valuable (we think) for giving us a sense of the importance of different channels that a more comprehensive theory of the crisis may draw upon.

Second, our study does not address why house prices rose prior to the crash. There are (at least) two distinct possibilities. One possibility is that house prices had a “rational bubble” component which burst in 2006 (Barlevy and Fisher, 2011). Another possibility is a relaxation of household borrowing constraints that lenders thought was permanent (which led to the boom) but turned out not to be so (which led to the crash). This possibility has been explored in Boz and Mendoza (2014) and Favilukis et al. (2013). Our paper relates to both possibilities. If the crash in house prices was due to the bursting of a rational bubble, that would explain the post-crash oversupply of housing (see, for instance, the discussion of house price bubbles in Blanchard and Watson (1982)). If the boom resulted from a relaxation of borrowing constraints erroneously perceived to be permanent, the financial shock in our model can then be interpreted as the unanticipated *reversal* of this relaxation. What we add relative to Boz and Mendoza and Favilukis, Ludvigson and Nieuwerburgh is an understanding of the factors underlying default on mortgages during the crisis.

There are two quantitative-theoretic studies that account for certain long-run features of the U.S. housing and mortgage markets with the goal of gaining a better understanding of the foreclosure crisis. Garriga and Schlagenhauf (2009) account

¹ The construction boom that preceded the housing crash most likely involved some level of overbuilding and the financial crisis adversely affected the functioning of the U.S. mortgage market.

² The sum of the marginal contributions of the three shocks exceed the overall decline in prices and the overall rise in the foreclosure rate because of (nonlinear) interactions between the three shocks.

³ For instance, the initial jump in foreclosures may have been triggered by the fall in house price resulting from overbuilding. Because of the concentration of risky mortgage lending among large banks and the subsequent run on these banks, the initial jump reduced the flow of credit to the mortgage market as whole. The “credit crunch” forced steep drops in house prices and more foreclosures. The increased volume of foreclosures caused foreclosure delays that induced even more default. In this causal chain, the overbuilding shock causes the other two shocks.

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