Journal of Housing Economics 26 (2014) 139–150

Contents lists available at ScienceDirect

Journal of Housing Economics

journal homepage: www.elsevier.com/locate/jhec

Mortgage choice, house price externalities, and the default rate

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ARTICLE INFO

Article history:
Received 8 November 2013
Revised 11 April 2014
Accepted 6 June 2014
Available online 19 June 2014

JEL classification:
D62
D82
D53
D14
G21

Keywords:
House prices
Externalities
Mortgage type
Default rate

ABSTRACT

We study the pathways by which borrowers and lenders influence house prices and default rates via their choices and offerings of fixed-rate and adjustable-rate mortgage products (FRMs and ARMs) in a two-period setting. We extend previous literature on mortgage choice as a tool for borrower risk screening under asymmetric information by incorporating house price externalities. The novelty in our setup is that house prices in the second period are negatively affected by the first-period default rate. We show that when these negative externalities are large, lenders may benefit by offering a lower ARM rate. This outcome, in turn, influences the likelihood of a separating equilibrium in which high-risk (low-risk) borrowers choose ARMs (FRMs) relative to a pooling equilibrium in which both high-risk and low-risk borrowers receive the same contract. When the impact of the negative house price externalities is small, it is more likely that lenders will offer pooling contracts; however, when the impact of the house price externalities is large, it is more likely that lenders will offer separating contracts. We also compare the equilibrium default rates across different contract offerings and find that when the negative house price externalities are large, the pooling FRM contract or the separating contract tends to offer the lowest default rate; however, when the negative house price externalities are small, the pooling ARM contract may result in the lowest default rate.

1. Introduction

Since the U.S. housing market began to decline in the second quarter of 2006, the default rate for adjustable-rate mortgage products (ARMs) has consistently exceeded that for fixed-rate mortgages (FRMs),[1] and this difference can be attributed to at least two factors. First, some theory suggests that ARMs may be preferred among high-risk borrowers (Posey and Yavas, 2001). The fact that ARMs tend to be more popular among subprime borrowers is consistent with this suggestion (Pennington-Cross and Ho, 2010). Second, ARMs may also increase default risk via a payment shock if interest rates increase sufficiently to leave the borrower liquidity constrained, given his income. For these reasons, the popularity of ARMs prior to 2005 has been implicated as a factor contributing to the recent subprime mortgage crisis (Scanlon et al., 2008; Pennington-Cross and Ho, 2010).

Beyond the direct contribution of ARMs to the default rate, some researchers have also suggested that geographic proximity to alternative mortgage products, such as hybrid ARMs, may create spillovers that lead to higher default among nearby property owners (Agarwal et al., 2012), and thus potentially among borrowers with other types of mortgage products. Although general economic conditions,

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[1] For default rates by mortgage type, see the Mortgage Banker's Association's National Mortgage Delinquency Survey.

http://dx.doi.org/10.1016/j.jhe.2014.06.001
1051-1377/

such as high unemployment rates, have likely also contributed to recent increases in default rates across mortgage products,[2] the fact that the default rate on FRMs has also increased in recent years appears consistent with the idea that house price externalities may exist. Moreover, a variety of empirical evidence suggests that house price declines and equity-driven defaults are contagious, for reasons of both house prices and social norms/networks (Immergluck and Smith, 2006; Schuetz et al., 2008; Harding et al., 2009; Lin et al., 2009; Goodstein et al., 2011; Guiso et al., 2011; Campbell et al., 2011), and that negative equity plays a larger role than unemployment rates in driving defaults (Goodman et al., 2010). Thus, there is an implicit conduit running from the distribution of loan products to the house price level, and from house prices to default rates.[3]

However, the contribution of loan product to default risk has also been found to vary with the economic environment. An FRM can protect a borrower from inflation but can raise equity-driven default risk. ARMs may exhibit a lower or higher default rate than FRMs, depending both on the movement of interest rates and on whether principal payments are deferred, as in the case of interest-only or option ARMs (Vandell, 1978; LaCour-Little and Yang, 2010; Campbell and Cocco, 2011). Thus, the menu of mortgage contracts that minimizes the equilibrium default rate under house price externalities is not obvious *a priori*.

In this paper, we study the pathways by which borrowers and lenders influence house prices and default rates via their choices and offerings of FRM and ARM products.[4] We extend the model of Posey and Yavas (2001), who demonstrate that mortgage product can be used as a risk screening tool, to incorporate house price externalities. In the model of Posey and Yavas (2001), borrowers are either high risk or low risk according to their likelihood of having a negative income shock. As long as the disutility of default is sufficiently high, high-risk borrowers tend to prefer ARM contracts, while low-risk borrowers tend to prefer FRM contracts. Intuitively, for an ARM contract, the potential costs associated with a rise in interest rates are outweighed by the potential benefits of a decline in interest rates for high risks but not low risks. Thus, high risks will experience a lower expected default rate under an ARM than under an FRM. Posey and Yavas (2001) find that two separating equilibria and two pooling equilibria exist in under asymmetric information. One of the separating equilibria provides positive profits to the lender, while the other does not. In both cases, high risks receive the ARM and low risks receive the FRM. These separating equilibria become increasingly likely relative to pooling contracts as the proportion of high risks in the population increases, and as the difference in the likelihoods of an income shock becomes greater.

In our model, borrowers similarly self-select into either FRMs or ARMs according to risk type. However, after defaults from income shocks are observed, house prices are determined, and an additional wave of defaults can occur based on the change in house prices. We find that house price externalities likewise have an impact on the likelihood of separating versus pooling equilibria, and on the equilibrium ARM interest rate, because they mediate the equilibrium default rate under different mortgage product menus via their interplay with the ARM interest rate.

A variety of related papers have considered mortgage choice under asymmetric information; beyond the work of Posey and Yavas (2001), those most similar to ours include papers by Brueckner (2000), Ben-Sharar (2006), and LaCour-Little and Yang (2010). To the best our knowledge, however, our paper is the first to explicitly consider the linkages among mortgage product choices, house price contagion, and equilibrium default rates under asymmetric information. Our paper complements existing borrower screening models by incorporating feedback from house prices to default rates via an additional period in which the price level is permitted to adjust and new defaults to occur. We also derive implications for the aggregate default rate, which may now depend on house price externalities, and provide insight into how to control the default rate in different situations.

In the following section, we present the model. In subsequent sections, we derive and interpret the results under both full information, in which the borrower type is public information, and under asymmetric information, in which the borrower's type is unknown to the lenders. In the final section, we provide conclusions.

2. Model

The model closely follows that of Posey and Yavas (2001). Consider a competitive lending market where lenders offer fixed-rate mortgages (FRMs) and/or adjustable-rate mortgages (ARMs). We consider interest-only loans with the loan amount as a balloon payment at the end of the term. The loan amount is normalized to \$1. There are two periods. The lenders borrow short-term (one year) at the spot market rate. At time $t = 0$, each borrower has a current income of Y, at which he qualifies for either an ARM or an FRM loan. However, the borrower's income may change in future periods, $t = 1,\ 2$. There are two types of borrowers: type H (high risk) borrowers have a higher probability than type L (low risk) borrowers of facing a reduction in income, which may fall to $y < Y$ at $t = 1$. Income remains constant from period 1 to period 2. The probability that a type j borrower experiences a decline in income is given by $p_j, j = L, H, p_H > p_L$. Let λ_j be the

[2] For example, Makarov and Plantin (2009) show that correlated income shocks can cause systemic defaults.

[3] More generous loan terms may also inflate house purchase prices by relaxing credit constraints and thus influence default rates. In this paper, we focus on the way in which mortgage choice relates to post-purchase house price movements and default rates, given an exogenous purchase price; however, we hope to consider the role of endogenous purchase prices in future work.

[4] While our analysis is partly motivated by recent housing market events and the empirical research mentioned above, please note that our goal here is not to model recent events in realistic detail or to provide concrete policy recommendations about how to avoid similar events in the future. Rather, we aim (more generally) to investigate and illustrate the dynamics of borrower and lender interaction in the context of both borrower income shocks and negative house price externalities, and to derive intuition about how the menu of mortgage contracts is related to the overall default rate in this context.