Review of Economic Dynamics 18 (2015) 456–483

Contents lists available at ScienceDirect

Review of Economic Dynamics

www.elsevier.com/locate/red

Innovations in information technology and the mortgage market ☆

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ARTICLE INFO

Article history:
Received 30 May 2013
Received in revised form 16 September 2014
Available online 5 October 2014

JEL classification:
D82
D91
E21
R21

Keywords:
Housing
Mortgage contract
Asymmetric information
Default

ABSTRACT

In this paper I analyze the effects of innovations in information technology on the mortgage and housing markets using a life-cycle model with incomplete markets and idiosyncratic income, as well as moving and house price shocks. I explicitly model the housing tenure choices of households. Lenders offer individual-specific mortgage contracts to home buyers, and the terms of these contracts are endogenously determined. I find that, as lenders have better information about the households, the average mortgage premium, foreclosure rate, and homeownership rate all increase while average down payment decreases. Hence, improvements in information technology can rationalize the relaxation of mortgage credit terms, which has been suggested as one of the main reasons for the latest financial crisis.

1. Introduction

The U.S. housing market has witnessed some remarkable changes in the last two decades. Between 1995 and 2006, it went through an expansionary period during which homeownership rate, house price, and mortgage originations reached historically high levels. However, beginning in 2006, the housing market experienced the most severe downturn in U.S. history, which initiated the worst recession since the Great Depression. Many researchers point to the relaxation of mortgage lending terms for the boom and bust cycle of the housing market.[1] However, to the best of my knowledge, there is no study that models the reason behind the relaxation of the mortgage credit terms. Therefore, in this paper, I fill this gap by studying the effects of advances in the information technology used by mortgage originators on the relaxation of mortgage terms.

☆ I owe a debt of gratitude to Fatih Guvenen and P. Dean Corbae for their invaluable comments and suggestions. I greatly benefited from conversations with Yavuz Arslan, Satyajit Chatterjee, Burhanettin Kuruscu, Marcin Peski, Jose-Victor Rios-Rull, Juan M. Sanchez, Gianluca Violante, and Thomas Wiseman. I especially thank the three anonymous referees and the Editor for their valuable comments and suggestions. I also thank the seminar participants at the University of Texas at Austin, Indiana University, Georgetown University, Syracuse University, the Federal Reserve Bank of Cleveland, the Bank of Canada, CEMFI, EIEF, Koc University, Sabanci University, the Central Bank of the Republic of Turkey and Society for Economic Dynamics Montreal Meeting. All errors are mine.

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[1] For example, see Ortalo-Magne and Rady (2006), Mian and Sufi (2009), Corbae and Quintin (2013), Dell'Ariccia et al. (2012), Favilukis et al. (2011), Ferrero (2012), Landvoigt et al. (2012), and Demyanyk and Van Hemert (2011).

http://dx.doi.org/10.1016/j.red.2014.09.007
1094-2025/

Table 1
Summary statistics.

Statistic[a]	1992–1995	2002–2006
Homeownership	64.2%	68.6%
Foreclosure rate	0.7%	0.9%
Down payment fraction	25%	20%
Mortgage premium	1.3%	1.7%

[a] Homeownership data is from Census. Foreclosure data is from Mortgage Bankers Association with the correction suggested by Herkenoff and Ohanian (2013): Foreclosure completions are half of the foreclosure starts. Down payment data is from Chomsisengphet and Pennington-Cross (2006). They are calculated as the ratio of total mortgage loan at the time of origination and house price at the time of origination using Loan Performance data. Mortgage interest rate data is from Monthly Interest Rate Survey of Federal Housing Finance Agency and calculated for 30-year fixed rate mortgages. Mortgage premium is measured as the difference between the 30-year fixed rate mortgage and the 10-year treasury constant maturity rate.

Arguably, the most prominent technological change for the mortgage market in the last few decades is the emergence of automated underwriting systems (AUS), which have allowed for a better assessment of the credit risks of home buyers. In particular, advances in information technology (e.g., the rapid decline in the cost of storing and transmitting credit information) have enabled access to more comprehensive data on households, which, in turn, have increased the predictive power of credit scores, thereby allowing lenders to assess the credit risk of home buyers more precisely.[2] Accompanying these improvements in information technology, the housing market experienced important changes along several key dimensions. As reported in Table 1, a comparison of the periods between 1992 and 1995, and 2002 and 2006 reveals that (i) the foreclosure rate increased, (ii) the average mortgage premium went up, (iii) the average down payment decreased, and (iv) the homeownership rate rose.

In this paper, I explore the effect of innovations in information technology—specifically, the increased ability of lenders to assess the credit risk of home buyers—on the housing and mortgage markets. I develop a standard life-cycle model with incomplete markets and idiosyncratic labor income, as well as moving and house price shocks. I also model the housing tenure choice explicitly. Households are born as renters. Every period, renters decide whether to purchase a house. The purchase of the house can be done through long-term mortgages offered by a continuum of risk-neutral lenders. A mortgage contract consists of a mortgage interest rate, loan amount, mortgage repayment schedule, and maturity. Mortgages are fully amortizing (i.e., homeowners have to pay the mortgage back in full until the end of the mortgage contract, as specified by the maturity date).

Homeowners can transition to renting either exogenously or endogenously. They can receive a moving shock with a fixed probability in every period, and become a renter in the next period. In that case, during the transition from homeownership to renting, they have two options: they either sell their houses or default on the mortgage if they have one.[3] Selling a house is different from defaulting, because a seller has to pay back the outstanding mortgage balance to the lender, whereas a defaulter has no obligation. Therefore, default occurs in equilibrium as long as the sale price, net of transaction costs, is lower than the outstanding mortgage debt, which can happen due to the transaction costs of the housing sale or idiosyncratic house price shocks. However, default is not without cost. It involves periodic utility loss, and, upon default, the household becomes a renter again, and then is only eligible to purchase a house with a certain probability. There are two types of households: those with a high utility cost of default (i.e., the "low-risk" type) and those with a low utility cost of default (i.e., the "high-risk" type).[4]

There is free entry into the credit market, so in equilibrium lenders make zero profit on each contract. Since mortgages are long-term contracts, it is essential for the lenders to infer the default probability of each household throughout the life of the mortgage, which depends on the income and house price risks as well as on the type of the household. In this study, I explore two information structures. In one economy, lenders can observe all the characteristics of the household except its type, which creates asymmetric information between the lenders and households. I call this economy the asymmetric information (AI) economy. In the other economy, lenders can observe all of the characteristics of the household, and, therefore, the information is symmetric. Hence, I call it the symmetric information (SI) economy.[5]

I interpret the AI economy as representing the U.S. economy before the emergence of the AUS (before the mid-1990s), and the SI economy as representing the more recent period with AUS (mid-2000s). I calibrate the model to the mid-2000s in order to recover the underlying parameters of the model. Then, I solve the model with asymmetric information representing the mid-1990s. As these two time periods also differ with regard to average interest rates and house prices, I use the

[2] See Appendix A.3 for more empirical and anecdotal evidence on the effect of innovations in information technology on the mortgage market.

[3] I use the terms "default" and "foreclosure" interchangeably. They correspond to the same activity in the model.

[4] In the rest of the paper, "type" refers to this heterogeneity in the utility cost of default.

[5] The source of unobserved heterogeneity among households that creates informational asymmetry between lenders and households is somewhat arbitrary. Although this assumption has been used in the previous literature (e.g. Narajabad, 2012 and Athreya, 2002), it is a difficult task to identify the unobservable type in the data. However, I also experimented with other sources of unobserved heterogeneity, such as income, moving propensity and the discount factor. The qualitative results are similar.