1 Introduction

The Subprime crisis of 2007 is one of those rare events in which a financial crisis triggered a worldwide recession. During the crisis, not only home prices fell by a large amount, but also plunged throughout the United States. The Composite S&P Case-Shiller Price index dropped 30% between 2006 and 2010. Out of the 20 cities included in this index, housing prices fell by more than 20% in 15 of them. This price movement was followed by a sharp increase in the mortgage delinquency rate. In the first quarter of 2010 the delinquency rate [1] reached its peak with a national average of 8.89%, significantly above the historical average of 1.0%.

The Subprime crisis motivated an extensive research agenda that, among other things, includes the determinants of households' decision to default on their mortgages. This issue gained importance due to the high number mortgage contracts with negative equity value, that is, a debt outstanding higher than the house value. According to CoreLogic, there were 10.9 million negative equity contracts in the first quarter of 2011 which accounted for 22.7% of all US residential mortgages.

In these negative equity contracts, it pays for the borrowers to default strategically on their mortgages. In other words, it may be on the borrowers' interest to exchange their homes for the write-off of the debt even if they can afford mortgage payments. And yet, when Foote et al. (2008) and Gerardi et al. (2009) analyze delinquency data using traditional models of optimal mortgage decision, they find a surprisingly low delinquency incidence given the large negative position on home equity from households.

To explain this puzzle, we propose a model in which households have concerns about failure to access the mortgage market after a default. In deciding whether to default strategically, households compare the short-term gain of walking away from a negative equity mortgage contract with the long-term cost of losing access to the housing credit market. We show that delinquent low-income households avoid defaulting strategically because they anticipate that banks are more likely to deny a new mortgage request for them.

[1] US mortgage delinquency data was taken from the Quarterly Report On Household Debt and Credit from the New York Fed.

In order to evaluate the importance of this trade-off on the mortgage default decision, we provide some evidence of the existence of this wealth effect by estimating a mortgage delinquency model with state fixed effects. We show that delinquency is more sensible to house price drops in states with higher per capita income.

To gain an understanding of the economic importance of this wealth effect, we calculate the impact of a 20% drop in house prices on mortgage delinquency in California and Arizona that had per capita personal income of 44 and 35 thousands of dollars respectively in the last quarter of 2010. The estimated increase on delinquency is between 0.3 p.p. and 0.65 p.p. larger in California due to its higher per capita income.

To make our point, we build a model with three main ingredients. First, the model has a dynamic setting in which families require a loan to buy a house at the initial period. In the following periods, borrowers cannot commit to pay their debt obligations whenever they can afford it. Households choose whether to walk away from their mortgage contract to maximize their expected utility. In doing so, households consider the probability of being eligible for a new mortgage to buy a home if they walk away from their current mortgages.

Our second ingredient is a cost for breaching debt contracts after the Subprime crisis. Banks take into account default probability and the collateral value when deciding whether to accept a mortgage request. Therefore, the availability of mortgage contracts to households are linked to the current and future house prices and to the borrower's income profile. Because of the high foreclosure risk of low-income mortgages, these families are more likely to be excluded from the credit market if house prices are not expected to increase continuously. The fear of losing access to the credit market is therefore a cost of walking away from the existing mortgage contract.

The third and last main ingredient of our model is income inequality. We assume that it is common knowledge that households either have High-income (type H) or Low-income (type L). High income households have both a higher income and a lower unemployment probability. Hence, loans to high-income families are less risky. The lower default chance of high-income families facilitates their return to the mortgage market if they default strategically.

Combining these three ingredients, we build a dynamic model that can be calibrated to replicate the U.S. mortgage market. Simulations of the model can be used to evaluate the impact of the housing prices fall on the strategic default incidence. We show that low-income households (Subprime borrowers) require a larger price drop to default strategically when compared to high-income households (Prime borrowers). Moreover, simulations show that the price drop

that triggers strategic default is increasing in the mortgage contract's age. Lastly, model simulations show that the expectation of continuously gains in home prices leads to a reduction of the minimum mortgage down payment. This effect is particularly important for low-income families.

Our paper is related to the literature that analyzes the determinants of mortgage delinquency, especially strategic default. Guiso et al. (2009) offer a different explanation for this puzzle. They use survey data to show that moral constraints are important to avoid default of households that can afford their mortgages. If moral constraints were indeed relevant and if moral values are not correlated with wealth, we would not expect strategic default behavior to be affected by borrower's wealth. If anything, wealthy families would be less likely to default strategically, because Guiso et al. (2009) document that wealthier families have stronger moral constraints.

Additional evidence of the wealth effect proposed in this paper are given by Elul et al (2010) and Ghent and Kudlyak (2010). Elul et al. (2010) analyze how the default probability responds to changes in the current loan to value ratio and in credit card utilization. They conclude that the impact of a decrease in net home equity is smaller for credit restricted households (with higher credit card utilization). Moreover, Ghent and Kudlyak (2010) show that strategic default is more diffuse among wealthy families. Exploring differences in legislation between states, Ghent and Kudlyak (2010) conclude that the effect of negative equity on the probability of mortgage delinquency is lower in states that allow recourse. This effect is only significant for expensive houses. Since house value and wealth are positively correlated, their results suggest the existence of strategic default only among high-income households.

Our paper is also related to the recent literature on the determinants of default after the Subprime Crisis. Bhutta et al. (2011) estimate the negative equity amount that triggers default with data from the US market during the housing bust of 2007-2009. They find that households default when the house value is on average 62% bellow the mortgage debt. Beyond these papers, Gerardi et al. (2009) also find that the housing price drop was the main factor responsible for the rise in mortgage delinquency in Massachusetts in 2006 and 2007. Finally, in a seminal paper Foote et al. (2008) show that the default behavior of mortgage holders is inconsistent with predictions of traditional models using loan-level data of Massachusetts homeowners during the 1991 recession. They argue that borrowers rationally choose to pay a negative equity mortgage if they expect prices to recover in the near future.

Moreover, our paper is related to the literature of mortgage valuation using an optimal borrower's financing decision setup as well. Kau et al.

(1995) survey the literature of mortgage pricing accounting for the default and refinance options. When households decide to pay their mortgages, they must take into account both the value of possibly refinancing if mortgage rates fall and the value of defaulting if house prices fall. Deng et al. (2000) test the capacity of the Option Approach to Mortgage Valuation to explain the default and refinance behavior. They conclude that the simultaneity of the default and refinance options is important to explain the behavior of homeowners.

The remainder of the paper is organized as follows: in section 2, we present a simple model in which we show the main trade-offs of the paper; in section 3, we propose a general model with an infinite-horizon; in section 4, we solve the general model; in section 5, we calibrate the general model to replicate US mortgage market; section 6, we present evidence of the wealth effect proposed in the paper; and section 7 concludes.