

prevent a traditional bank from lending to a given borrower altogether (Buchak et al. 2018). We capture this type of regulatory burden through parameter  $1/\zeta_{tg}$ .

For banks, the probability of lending to a specific borrower of mortgage  $g$  in market  $ct$  is scaled by a factor  $\zeta_{tg}$ . A higher  $1/\zeta_{tg}$  (lower  $\zeta_{tg}$ ) captures a relatively constrained bank; a lower  $1/\zeta_{tg}$  (higher  $\zeta_{tg}$ ) captures a relatively unconstrained bank. These shocks are i.i.d. across lender-borrower pairs, which accounts for the uncertainty that a bank faces with respect to which loans may be subject to these issues ex post.

#### IV.B.3 Choosing Mortgage Rates and Financing

Taking other lenders' actions as given, an individual lender maximizes its profits by setting interest rates across all markets and chooses how many mortgages to retain on its balance sheet. Denote by  $\mathbf{r}_{jt}$  the set of prices of all products, conforming and jumbo, across all markets for lender  $j$  at time  $t$ ,  $\mathbf{r}_{jt} = \{r_{jctg} : \forall c, g\}$ . Lender  $j$  chooses each rate. Since all jumbo mortgages are securitized, the only decision in addition to setting interest rates is how many, if any, conforming mortgages to retain on the balance sheet  $m_{jctc}^b$ , and how many to securitize,  $m_{jt}^{GSE} = \sum_c (m_{jctc} - m_{jctc}^b)$ . Then the lenders choose interest rates and the amount of conforming mortgages to retain on the balance sheet by maximizing profits:

$$\max_{\mathbf{r}_{jt}, m_{jctc}^b} \underbrace{\sum_{ctg} r_{jctg} m_{jctg}}_{\text{rate income}} - \underbrace{\sum_{ctg} m_{jctg} w_{jg}}_{\text{origination cost}} - \underbrace{\left( m_{jt}^{GSE} \sigma_t^{GSE} + \sum_{ctg} (m_{jctg}^b) \sigma_{jt}^p \right)}_{\text{financing cost}} \quad (\text{S.4})$$

The first term, labeled *rate income*, is the yearly income that the lender earns from the loans that it has made, equal to the sum of interest rates times mortgage volumes across all loan types and markets. The second term, labeled *origination cost*, is the costs the lender occurs in originating the loans, such as the wages of mortgage brokers, advertising, and administrative expense. The third term, labeled *financing cost*, is the financing cost of the mortgage, reflecting the costs of either GSE or balance-sheet financing, depending on the lender's optimal financing cost.

Intermediaries' profits comprise interest rate income (either collected by themselves or through servicing rights), origination costs, and financing costs. Note that interest rates enter profits both directly and indirectly through market shares. Market shares are also affected by regulatory constraints. In other words, the amount of mortgages originated,  $m_{jctg}$ , is implicitly a function of both the interest rates of the lender  $\mathbf{r}_{jt}$ , other lenders  $\mathbf{r}_{-jt}$ , and the regulatory burden parameter  $\zeta_{tg}$ , which we omit for ease of notation.

#### IV.B.4 Equilibrium

We study symmetric equilibria. Demand is characterized by consumers' choice of mortgages and market share equations. Consumers maximize utility-taking prices and lender characteristics as given. Supply is characterized by intermediaries' maximization in S.4. Banks, non-fintech shadow banks, and fintech shadow banks set mortgage rates across all markets in which they participate. Moreover,