The Benefits of Pre-Purchase Homeownership Counseling[1]

Gabriela Avila

Hoa Nguyen

Peter Zorn[2]

Abstract

Our paper provides an empirical assessment of the effectiveness of pre-purchase homeownership counseling in reducing 90-day delinquency rates. We use data on nearly 38,000 fixed-rate, purchase money mortgages originated under Freddie Mac's affordable lending programs between the years 2000 and 2008. We take efforts to control for the quasi-experimental nature of our data, as well as the heterogeneous experience of borrowers post-origination.

We find that counseling reduces the delinquency rate of first-time home buyers by 29 percent, that counseling's effectiveness is largely insensitive to its method of delivery, and that its effectiveness was greatest in the boom/crisis years of 2005 through 2008. We estimate the dollar benefit of counseling's reduction in delinquency rates to be about $1,000, easily sufficient to pay for its delivery.

[1] The views expressed in this paper are those of the authors and are not necessarily those of Freddie Mac, Freddie Mac's Board of Directors, or any of Freddie Mac's regulators.

[2] Gabriela Avila and Hoa Nguyen are Senior Economists, and Peter Zorn is a Vice President in Freddie Mac's Models, Mission and Research Division. Paper prepared for presentation at the 2013 Federal Reserve System Research Conference. Please direct all correspondence to Peter Zorn at Freddie Mac, 1551 Park Run Drive, MS D3F, McLean VA 22102, or at peter_zorn@freddiemac.com.

I. Introduction

The recent housing crisis has raised alarm over high foreclosure rates and the sustainability of homeownership. This concern is particularly relevant for low-income and first-time home buyers, who were especially hard hit in the crisis. Housing advocates have called for the development and establishment of policies that will mitigate default risk while allowing the extension of credit to these targeted populations. It is within this content that we direct our attention to the efficacy of homeownership counseling.

Pre-purchase homeownership counseling has frequently been integrated with efforts to responsibly extend credit to borrowers. Counseling's proponents have argued that it reduces the probability of borrowers becoming delinquent or going into default. However support for counseling has been tempered by the inconclusive empirical evidence of its efficacy. Our hope is to provide more decisive evidence in this paper.

The absence of definitive evidence of the benefits of pre-purchase homeownership counseling is not from lack of trying, there is a rich literature on the subject. Existing literature is generally found deficient on two dimensions; relying on a small sample, and/or relying on data derived from a quasi-experiment and failing to appropriately account for the associated potentials for bias and inconsistency.

In this paper we attempt to address both concerns. Our study uses an unusually rich sample of nearly 38,000 mortgages that were originated under Freddie Mac's affordable lending programs between the years 2000 and 2008. Our data contain information on whether borrowers received pre-purchase homeownership counseling and how the counseling was delivered. The data also contain information on borrowers, their mortgages and their mortgage payment histories over a period that encompassed widely varying house price experiences, labor markets, interest rates and underwriting standards.

Unfortunately, like most other empirical analyses of counseling, our data come from a quasi-experiment—some of the borrowers in our sample received counseling and some did not, but

borrowers were not randomly assigned into counseling. Moreover, the characteristics of the borrowers, the origination and servicing practices of their lenders, and the macroeconomic environments they experienced post-origination all varied considerably.

Our empirical strategy is to estimate a series of models explaining the delinquency performance of mortgages taken out by the affordable borrowers in our data, controlling as best we can for potential biases arising from the quasi-experimental nature of its creation. In these models we variously account for whether borrowers received counseling, whether borrowers were first- or repeat-time home buyers, the delivery mechanism of any counseling borrowers received, and the time period in which borrowers' mortgages were originated. Once estimated, we use our models to conduct conceptual experiments on our entire population of affordable borrowers. We measure pre-purchase homeownerships counseling's efficacy by assessing its overall impact in reducing 90-day or more delinquency rates.

Our analysis addresses the following questions:

1) Does pre-purchase homeownership counseling reduce delinquency rates?
2) Is pre-purchase homeownership counseling more effective for first-time home buyers?
3) Do the various types of counseling delivery differ in their effectiveness?
4) Does the efficacy of pre-purchase homeownership counseling depend on the macroeconomic environment in which it is delivered?

We find strong evidence that participating in pre-purchase homeownership counseling reduces delinquency rates. Our results suggest that the overall delinquency rates of borrowers receiving counseling are 15 percent lower than otherwise identical borrowers not receiving counseling. We find, however, that the efficacy of pre-purchase homeownership counseling is primarily limited to first-time home buyers. First-time buyers experience a 29 percent decline in delinquency rates from counseling, while we find little empirically significant effect for repeat buyers.

All types of counseling delivery are found to reduce delinquency rates. Considered individually, however, impacts for classroom, home study, and telephone counseling are statistically

significant and impact for individual counseling is not. Our analysis also finds that counseling is most effective in the boom/crisis years of 2005 through 2008; a period when underwriting guidelines were the most lenient and house prices the most volatile, and arguably a time when counseling's efficacy is most important.

We also calculate that receiving counseling reduces lender's default costs for first-time home buyers by up to $1,000. While this is likely an upper bound estimate of the dollar benefits from counseling, it clearly suggests that the savings lenders receive from requiring counseling are sufficient to pay for its targeted delivery.

There are, of course, important caveats to our analysis. Key among these are our ability to effectively address the quasi-experimental nature of our data, and our failure to consider other potential benefits or impacts from counseling. Nonetheless, we believe our analysis provides convincing evidence of the efficacy of pre-purchase homeownership counseling, and hope our study is a catalyst for appropriately expanding its use and funding.

II. Review of the Literature on Pre-Purchase Homeownership Counseling

There have been several literature reviews on homeownership education and counseling. Two seminal pieces are Quercia and Wachter (1996), who conducted a summary of homeownership counseling research up to the mid-1990s, and Collins and O'Rourke (2004), who surveyed much of the literature related to both pre-purchase and post-purchase homeownership education and counseling studies available through 2010.

We use these review articles to reduce our focus to six studies of quasi-experiments (i.e., studies that compare the outcomes of groups receiving counseling to groups not receiving counseling, when counseling is not randomly assigned) and examine their methods as well as main findings. Table 1 provides an overview of these six studies.

Hirad and Zorn (2002) analyzed ever 90-day delinquency rates on 39,318 loans originated under Freddie Mac's Affordable Gold program in the period 1993 through 1998, an era of strong

house prices and labor markets. They find that face-to-face counseling is associated with a 34 percent reduction in delinquency rate, classroom and home study counseling reduce delinquency rates by 26 and 21 percent, respectively, and telephone counseling does not have a statistically significant effect. Hirad and Zorn also find a strong selection effect into different types of counseling.

This is one of the most widely cited studies to first highlight the importance of understanding selection bias. Once they control for this potential selection problem, they find that only classroom counseling is associated with a statistically significant decline in delinquency rates. However their estimated reduction in delinquency rates from classroom counseling is exceptionally large at 94 percent. Moreover, this result is difficult to generalize to the contemporary post-crisis mortgage market.

Two papers by Hartarska and Gonzalez-Vega (2005, 2006) further examine pre-purchase counseling. The programs in Hartarska and Gonzalez-Vega (2005, 2006) offered mortgages to low-income borrowers, requiring them to meet with a financial counselor prior to origination. Participants were eligible to receive a loan when they could generate a zero or positive cash flow. Both studies by Hartarska and Gonzalez-Vega find that counseled borrowers have lower delinquency rates than their non-counseled counterparts.

Unfortunately both studies are based on a relatively small number of loans, and neither study uses robust methods for estimating the causal effect from counseling. Nor did the studies' authors mention or control for selection effects into counseling. As a consequence, the studies' findings in support of counseling could be due to differences in loan or borrower characteristics between the treatment or control groups. In addition, their counseling estimates may be biased by unaccounted for selection effects.

Quercia and Spader (2008) analyzed a unique and relatively large secondary market loan purchase program of mortgages originated in the 1999 through 2003 period, with loan performance measured from 21 months to 79 months. They find no reduction in default probability associated with counseling. The relevance of these results to the current market is

impaired by a study period associated with low interest rates and a booming housing market. Moreover, their analysis did not explicitly model or account for selection issues.

It is important to note, however, that both Hartarska and Gonzalez-Vega (2005, 2006) and Quercia and Spader (2008) use a competing risk model for their estimations. All the authors find that counseled borrowers are somewhat more likely to exercise their prepayment options, a result that could be a potential additional benefit to borrowers who receive pre-purchase homeownership counseling.

Agarwal et al. (2009) studied an Illinois pilot program mandating that high-risk or low-credit-score borrowers attend pre-purchase counseling within 10 days of filing a mortgage application if they are located in one of 10 targeted zip codes. The authors used similar borrowers from these targeted zip codes as a matched comparison group to estimate the causal effect of counseling on borrowers' loan default rates one year after origination. They estimated a 30 percent reduction in default rates for counseled borrowers. This result is primarily attributable to lenders' screening actions or counseled borrowers' well-negotiated term. The authors study is noteworthy because they exploit a unique policy change implemented in several specific geographic areas over a short time period. Moreover, their analysis supports the view that the most motivated potential borrowers attend counseling sessions voluntarily.

A separate study by Agarwal et al. (2010) considers a voluntary pre-purchase counseling program for 359 counseled borrowers. Individuals who enrolled in the program completed an introductory class on money management, attended one-on-one counseling sessions and completed an eight-hour capstone class. Clients were also offered post-purchase counseling when and if they fell 15 days behind in their mortgage payments. The authors used a non-random comparison group of 16,667 loans from the same community originated over the same time period, pulled from a mortgage loan performance database.

The counseling results from this analysis must be attributed to both pre-purchase and post-purchase counseling. The authors applied robust methodology by using a propensity score-matching model to compare counseled borrowers and matched non-counseled borrowers.

They find that counseling significantly decreases delinquency rates for low-to-moderate income households as well as high-risk borrowers. This reduction in delinquency rate is attributable to several factors. First, individuals whose new skills have not yet been reflected in credit scores benefit from the counseling program to extend their credit and acquire budgeting and credit-management skills. Second, graduates of the program have a lower risk of significant early delinquency because of the program's proactive post-purchase counseling. Third, lenders' tight screening into the program beneficially affects delinquency outcomes.

Our paper is different from previous studies in several ways. First, our data give a comprehensive and up-to-date picture of loans originated over a long period of time, 2000 to 2008, and across the entire United States. Prior research primarily focused on particular geographical areas, or on subprime loans that are not representative of the contemporary mortgage market. Second, our models explicitly account for potential selection into counseling on both observables and unobservables. Earlier studies largely ignored or did not fully resolve the problem of self-selection or assignment into counseling programs. Third, we are the first study to recognize the importance of seller heterogeneity in explaining borrowers' loan performance, and use an instrumental variable approach to take this effect into account.

III. Data

A. Overview of Freddie Mac's Affordable Lending Outreach Programs

Our sample is composed of loans originated through Freddie Mac's affordable lending outreach programs during the period 2000 to 2008. Throughout this time Freddie Mac offered two home affordable, low downpayment mortgage products—Affordable Gold and Home Possible. The Affordable Gold and Home Possible programs were both designed to create homeownership opportunities for first-time and low-to-moderate income home buyers. Affordable Gold was the first of the two programs. Midway through the 2000 to 2008 time period Home Possible was also introduced. Affordable Gold and Home Possible operated in tandem for a while, but in 2007 Home Possible entirely replaced Affordable Gold.

Both Affordable Gold and Home Possible were targeted but not restricted to purchase money mortgages for first-time borrowers earning 100 percent or less of area median income.[3] Key features of these programs included reduced mortgage insurance coverage levels, flexible closing cost funding options, and no cash-out refinancing. The vast majority of Affordable Gold and Home Possible loans were fixed-rate, purchase money mortgage, owner-occupied and one-unit property, and our sample data are restricted to this group.

With some exceptions, Freddie Mac required that each Affordable Gold or Home Possible loan have at least one qualifying borrower who received pre-purchase homeownership counseling. Homeownership counseling could be received through one of four delivery mechanisms: classroom, home study, individual and telephone (or internet). Freddie Mac did not mandate specific homeownership education courses or formats in its requirements, so originating lenders chose, at their discretion, the homeownership education resources that best met their organization's and borrower's needs.

Nearly 17 percent of mortgages in our sample did not receive counseling. Repeat home buyers were not required to take homeownership counseling. Some mortgages were also exempt from pre-purchase counseling if one of the co-borrowers was a previous homeowner, at least 5 percent of the down payment came from borrowers' funds, and the borrowers had two months of cash reserves after closing. The most significant exemption to counseling started in June 2006 when Freddie Mac waved the homeownership education requirement for one-unit purchase mortgages. Homeownership education requirements were reinstated in June 2008.

B. Data Summary and Statistics

We appended performance records through October 2012 to our sample of affordable loans. We used these data to identify mortgages becoming 90 or more days delinquent within the first three years of origination. We also incorporated a variety of variables from Freddie Mac's Corporate Data Warehouse to account for loan and borrower credit-related characteristics.

[3] The programs also provided additional flexibilities for teachers, firefighters, law enforcement officers, healthcare workers, and members of the United States Armed Forces.

These variables included FICO score, loan-to-value ("LTV") ratio, debt-to-income ("DTI") ratio, number of borrowers, loan amount, whether the loan was originated by a third party originator, and other constructed variables such as housing equity and more expensive home indicator. Also included were property type and geographic characteristics, as well as demographic variables such as family income, area median income, and whether the borrower is a first time homebuyer. Finally, we added variables to capture the different economic environments experienced by borrowers post-origination, such as the state in which the property is located, ZipCode-level house price appreciation rate, and the year the loan was originated.

Exhibit 2 illustrates the distribution of loans used in this paper. The sample includes a total of 37,577 Affordable Gold and Home Possible loans, 31,334 of which received counseling and 6,243 of which did not. The nearly 17 percent of our sample not receiving counseling makes up the control group in our quasi-experiment.

Among the 31,334 loans receiving counseling, 31.2 percent received home study, 32.7 percent were telephone (or internet) counseled, 17 percent received classroom counseling, and only 2.5 percent participated in face-to-face counseling or individual counseling. The skewed distribution of counseling's delivery is not ideal in terms of experimental design. In particular, the low number of observations for individual counseling reduces our ability to identify a significant counseling benefit from this delivery mechanism.

Exhibit 2 also shows the rate that loans went 90-day delinquent within the first three years across different types of counseled and non-counseled loans. In general, loans not receiving counseling had a higher delinquency rate (20.95 percent) than loans receiving counseling (11.80 percent). This at least partially reflects the fact that the majority of non-counseled loans were originated during the boom/crisis years of 2005 through 2008, a period of unusually high delinquency rates. Telephone counseling has the lowest rate of delinquency at 8.05 percent, next is individual counseling at 9.34 percent, followed by classroom at 13.30 percent and home study at 15.08 percent.

Exhibit 3 provides summary statistics of the variables we use in our estimation. As can be seen, counseled and non-counseled loans have similar characteristics, but there are some important differences. The average FICO score for borrowers in our sample is 684, and non-counseled borrowers have higher average FICO scores than the counseled borrowers, 691 versus 682. This is not surprising as borrowers were often exempted from counseling on the belief that they were less risky.

Borrowers in our sample have a DTI ratio of 40 percent, and an LTV ratio of 98 percent. Both counseled and non-counseled loans have similar LTVs, but counseled borrowers' DTIs are somewhat lower than those of non-counseled borrowers. The especially high LTV ratios arise because we restrict our sample to loans with LTVs of at least 90 percent.

The majority of loans in our sample were originated through a third party (56 percent), with a higher proportion of third party originations for non-counseling loans than for counseling loans (61 percent versus 55 percent). Most of the loans in our sample have positive equity at origination (99 percent), although counseled loans have slightly higher equity than non-counseled loans.

First-time home buyers account for 58 percent of our sample. Borrowers receiving counseling are disproportionately first-time buyers (63 percent), while borrowers not receiving counseling are mostly from repeat home buyers (64 percent). Most of our sample loans have only one borrower (72 percent) and are neither a condo property nor a manufactured home. Only 8 percent of borrowers in our sample took out loans that were more than 3 times the amount of area median income. However non-counseled borrowers did this at a rate of 17 percent relative to 6 percent for counseled borrowers.

We captured the percentage change in LTV that occurred due to house price changes over the first three years after origination (changes in the denominator of the LTV ratio). House prices generally increased for counseled borrowers and decreased for non-counseled borrowers. As a result, LTV after the first three years 2 percent lower for counseled loans and 4 percent higher for non-counseled loans.

IV. Basic Methodology

There are three key challenges arising from the fact that our data come from a quasi-experiment. The first is appropriately accounting for the widely varying credit risk characteristics of borrowers and their mortgages, as well as accounting for the dramatically changing local economic environments borrowers experienced after loan origination. We address this concern by including as explanatory variables in our estimations an assortment of borrower and mortgage credit risk attributes available at origination, as well as measures of the post-origination changes in the value of the property serving as collateral for the mortgage.

The second challenge is that the non-random assignment of borrowers into counseling may be based on factors unobservable in our data. Leaving this issue unaddressed could result in biased or inconsistent estimates of counseling's impact. To account for this potential bias we simultaneously estimate the likelihoods of mortgage delinquency and getting selected into pre-purchase homeownership counseling.

The third challenge for our testing is clearly distinguishing between the impacts of counseling and the behavior of lenders. Lenders have widely varying underwriting and servicing standards and practices, and this can lead to significant differences in loan performance. Lenders can also vary in their adoption of counseling and their choices for how it is delivered. As a consequence, what may initially appear to be an effect from counseling may actually arise from lenders' actions. We address this concern by using lender controls in our estimations.

We start our analysis by estimating four separate models. Our data are restricted to fixed rate loans made to affordable borrowers in owner-occupied, one-unit properties. Our dependent variable of interest is the probability that borrowers become 90 days or more delinquency on their mortgage payments within the first three years of origination.

Our basic estimation model is a simple probit of the probability of delinquency. As noted above, it is possible that unobserved factors affecting selection into counseling also affect delinquency probabilities. To account for this possibility we also use a bivariate probit to

simultaneously estimate the probability of delinquency and the probability of receiving counseling. We also estimate versions of both the probit and bivariate probit models that include lender controls. These are designed to purge the effect of lenders' actions on our estimates of counseling's impact.

A. Probit Model

We employ a simple probit model for our base estimation. For each loan i originated by lender j there is an associated outcome variable D_{ij}. Let

$D_{ij} = 1$ if loan i was 90-day or more delinquent within the first three years,
$D_{ij} = 0$ otherwise.

Borrowers in our data may receive counseling. Let

$C_{ij} = 1$ if borrowers with loan i from lender j received counseling,
$C_{ij} = 0$ otherwise.

Our basic probit model can then be specified as follows:

$$(1)\ D_{ij}^{*} = \alpha C_{ij} + X_{ij}'\beta + \varepsilon_{ij} \qquad \text{where } D_{ij} = 1 \text{ if } D_{ij}^{*} > 0 \text{ and } D_{ij} = 0 \text{ if } D_{ij}^{*} \leq 0.$$

X_{ij}' is a k length row vector of observables that capture characteristics influencing the delinquency risk of loan i from lender j. β is a column vector of k estimated coefficients on X_{ij}'. α is the estimated coefficient on counseling, and ε_{ij} is an error that is assumed to come from a standard normal distribution $\varepsilon_{ij} \sim N(0,1)$.

We are particularly interested in the sign, size, and statistical significance of the estimated coefficient α. A large, negative, and statistically significant α is evidence that receiving pre-purchase homeownership counseling meaningfully reduces borrowers' delinquency rates.

B. Bivariate Probit Model

Our estimate of α from the probit model in equation (1) above will be unbiased if borrowers are randomly assigned to counseling programs. However borrowers were not randomly assigned to counseling in our data, raising concerns over the possibility of selection bias. In this section we briefly describe the model we use to address these potential concerns.

The current framework for addressing selection bias was built on the pioneering work by Heckman (1979). In this tradition researchers typically use two-step estimation procedures to account for potential selection issues when their outcome variable is continuous. We cannot follow this path because our outcome variable of interest, D_{ij}, is a binary outcome. Instead we use a bivariate probit model to simultaneously estimate delinquency and assignment into counseling, following Maddala (1983) and Wooldridge (2002).

Our bivariate probit model is specified as:

$$(2)\quad D_{ij}^{*} = \alpha C_{ij} + X_{ij}'\beta + \varepsilon_{ji1} \qquad \text{where } D_{ij} = 1 \text{ if } D_{ij}^{*} > 0 \text{ and } D_{ij} = 0 \text{ if } D_{ij}^{*} \leq 0,$$

$$C_{ij}^{*} = X_{ij}'\gamma + S_{ij}'\delta_j + \varepsilon_{ij2} \qquad \text{where } C_{ij} = 1 \text{ if } C_{ij}^{*} > 0 \text{ and } C_{ij} = 0 \text{ if } C_{ij}^{*} \leq 0.$$

The counseling equation includes lender fixed-effects to purge any persistent lender-specific impacts on the probability of receiving counseling. Define s_{ij} as follows:

$s_{ij} = 1$ if loan i was originated by lender j,
$s_{ij} = 0$ otherwise.

S_{ij}' is a j length row vector of the s_{ij}. δ_j is a j length column vector of estimated coefficients on S_{ij}'. γ is a k length column vector of estimated coefficients on X_{ij}'. The error terms $(\varepsilon_{ij1}, \varepsilon_{ij2})$ are assumed to be identically independently distributed as standard bivariate normal with correlation defined as ρ. Specifically:

$$\varepsilon_{ij1} \sim N(0,1),$$
$$\varepsilon_{ij2} \sim N(0,1),$$
$$\text{and } Corr(\varepsilon_{ij1}, \varepsilon_{ij2}) = \rho.$$

Again we are particularly interested in the sign, size, and statistical significance of the estimated coefficient α. A large, negative, and statistically significant α is evidence that receiving pre-purchase homeownership counseling meaningfully reduces borrowers' delinquency rates.

Equation (2) explicitly controls for selection into counseling and we use it to test for selection effects, which can alternatively be viewed as testing for borrowers' unobserved heterogeneity. Unobserved variables, or variables omitted from our model, can directly affect the probabilities of delinquency and receiving counseling. Examples of such variables might be borrowers' motivation, borrowers' ability at networking, unobserved neighborhood characteristics, and distance to counseling providers. The error terms in equation (2), ε_{ij1} and ε_{ij2}, can be thought of as denoting these omitted variables. If there is a statistically significant correlation between these omitted variables, i.e., if $\rho \neq 0$, ignoring selection effects will result in inconsistent parameter estimate of α in equation (1). Moreover, significant correlation is evidence that borrowers' unobserved characteristics play an important role in explaining their delinquency status and selection into counseling programs.

C. Incorporating Lender Effects in the Delinquency Equations

Lender effects also could, and likely do, have an important role in explaining borrower delinquency rates, however it is inappropriate to include lender fixed effects directly in our delinquency equations. This is because the majority of loans to counseled borrowers come from a small number of lenders, and the majority of these lenders originate few, if any, loans to uncounseled borrowers. So if lender fixed effects were directly included in our delinquency estimations, they would capture counseling's impact for these lenders as well as persistent overall lender-specific effects. This would severely inhibit the power of α to test counseling's efficacy in reducing delinquency rates.

We therefore use an indirect approach to control for lender specific impacts on delinquency rates—we first estimate lender fixed effects on auxiliary data, and then include these estimated effects as explanatory variables in our delinquency estimations. Specifically, we estimate the model:

$$D_{ij}^{*} = \alpha + X_{ij}'\beta + S_{ij}'\delta_j + \varepsilon_{ji1} \qquad \text{where } D_{ij} = 1 \text{ if } D_{ij}^{*} > 0,$$
$$\text{and } D_{ij} = 0 \text{ if } D_{ij}^{*} \leq 0$$

on a data set of about 800,000 loans that have the same basic characteristics as the affordable loans in our sample. The loans in this auxiliary estimation are all fixed-rate, purchase money mortgages on owner-occupied, one-unit properties. We additionally limit observations to borrowers who earn less than area median income and who have LTVs greater than 90 percent.

We ranked lenders by the number of loans they have in our affordable lending sample, and estimate lender fixed-effects for the top ten lenders. This accounts for about 82 percent of the total loans in our affordable lending sample. We create an additional dummy variable (fixed effect) for the remainder of the affordable lenders.

The j length vector of estimated lender effects, $\widehat{\delta_j}$, is then added to equations (1) and (2). This results in the following probit model:

$$(3)\quad D_{ij}^{*} = \alpha C_{ij} + X_{ij}'\beta + \widehat{\delta_j}\theta + \varepsilon_{ij} \qquad \text{where } D_{ij} = 1 \text{ if } D_{ij}^{*} > 0$$
$$\text{and } D_{ij} = 0 \text{ if } D_{ij}^{*} \leq 0.$$

The equivalent bivariate probit model is:

$$(4)\quad D_{ij}^{*} = \alpha C_{ij} + X_{ij}'\beta + \widehat{\delta_j}\theta + \varepsilon_{ji1} \qquad \text{where } D_{ij} = 1 \text{ if } D_{ij}^{*} > 0$$
$$\text{and } D_{ij} = 0 \text{ if } D_{ij}^{*} \leq 0,$$

$$C_{ij}^{*} = X_{ij}'\gamma + S_{ij}'\delta_j + \varepsilon_{ij2} \qquad \text{where } C_{ij} = 1 \text{ if } C_{ij}^{*} > 0$$
$$\text{and } C_{ij} = 0 \text{ if } C_{ij}^{*} \leq 0.$$

As was the case previously, a large, negative, and statistically significant estimate of α in equations (3) and (4) is evidence that receiving pre-purchase homeownership counseling meaningfully reduces borrowers' delinquency rates.

V. Basic Estimation Results

To estimate the models described by equations (1) through (4) we need to specify the independent variables we use to explain mortgage delinquency (the X'_{ij}). Mortgage underwriting typically considers credit risk to be a function of the "three C's"—credit, collateral, and capacity. We capture borrower's credit record via their FICO score, their collateral via their LTV ratio, and their capacity via their DTI ratio. The range of LTV ratios is quite limited in our data, so we bucket LTV ratios into four categories—90% $\leq$ LTV < 95%, 95% $\leq$ LTV < 97%, 97% $\leq$ LTV < 100%, and 100% $\leq$ LTV. To roughly account for potential interaction between FICO score and LTV ratio we also include a class variable. Our reference group is FICO < 780. We divide the 780 $\leq$ FICO population into two groups by LTV ratio—90% $\leq$ LTV < 95% and 95% $\leq$ LTV. This class variable captures the statistically significant difference in behavior of higher LTV ratio borrowers with high FICO scores.

We also add several other indicators of credit risk. These include a first-time home buyer flag, a third party originator flag, and indicators of whether the property is a condo or a manufactured home. We add housing equity as a dollar value to better capture the mitigation of credit risk associated with increasing downpayment amounts. In addition we capture the increased risk of taking out a relatively large loan by including an indicator for when borrower loan amount is greater than three times area median income.

Finally, we include three sets of variables to control for factors affecting credit risk post-origination. To account for the impact of house price changes on credit risk we include a variable that measures the percent change in LTV ratio three years after origination. This is calculated by discounting origination LTV ratio by an estimate of the percentage change in house prices in the area. We also include dummy variables for years of origination and state

where the property is located. These are designed to capture risks associated with origination cohorts and geography that are not picked up by other variables.

Exhibit 4 provides the estimated coefficients for equations (1) through (4). Our primary interest is the coefficient on the counseling variable and an assessment of the alternative model structures. However it is worth paying some attention to the coefficients on our control variables. Note first that the estimated coefficients for each control variable are very similar across models. This suggests that the alternative model structures do not lead to substantially different views of credit risk.

The signs of the coefficient estimates are also generally as expected. In particular, higher FICO scores reduce the probability of delinquency, while higher LTV and DTI ratios increase it. Moreover, even holding constant for LTV, increased borrower dollar equity in the home reduces delinquency rates. Third party originations, manufactured homes, relatively large loans, and having only one borrower on the mortgage note all lead to greater risk of delinquency. Declining LTVs after origination increases the risk of delinquency. Somewhat surprisingly first-time home buyers are not associated with any significant increase in delinquency rates, and condominiums are associated with lower delinquency. These results may reflect the high incidence of counseling for first-time home buyers in our data and the geographic heterogeneity of condominium structures.

Of more interest to us is the fact that the coefficient on counseling, α in equations (1) through (4), is negative and significant in all models. This is a clear indication that, independent of model structure, receiving pre-purchase homeownership counseling meaningfully reduces 90 day or more delinquency rates.

However the choice of model structure does substantially affect the size of our estimated impact. All things equal, including seller effects in our delinquency equations reduces counseling's impact. Moreover, the estimated coefficients on the seller effects terms are statistically significant in both the probit and the bivariate probit models. This suggests that models with seller effects should be the preferred specification.

In our view this conclusion is not entirely definitive because, as noted earlier, seller effects are correlated with selection into counseling. Nonetheless, because of their statistical significance in our models, and our desire to error on the side of being conservative in our estimation of counseling's impacts, we consider models with included seller effect the preferred specification.

It is also true that, all things equal, simultaneously estimating delinquency and counseling probabilities with a bivariate probit model increases counseling's estimated impact. The statistical significance of the correlation between ε_{i1} and ε_{i2} is a test of the empirical support for selection on unobservables, and thus the importance of the bivariate probit specification. This correlation is insignificant when seller effects are included. Combined with our desire to conservatively estimate counseling's impact, this causes us to pick the probit model with seller effects, i.e., equation (3), as our specification for further analysis.

Exhibit 5 provides a scatter plot of the probit model with seller effects to illustrate its fit with the data. The scatter is produced by first ordering mortgages by predicted delinquency rates from the model. Loans are then divided into equally sized buckets, each composed of loans with similar predicted probabilities of delinquency. The average predicted delinquency rate and the observed delinquency rate are calculated for each bucket, and then plotted as a scatter in Exhibit 5.

If the model perfectly predicts delinquency, the average predicted delinquency will equal the observed delinquency in each bucket. As a result, the scatter plot for a perfectly predicting model will fall entirely on the 45 degree reference line. All the points in the scatter plot in Exhibit 5 are very close to this reference line, indicating that our model is a reasonably good fit.

VI. Extensions

We extend our basic model of equation (3) in several dimensions. Our data include information on how counseling is delivered—through classroom, home study, individual or telephone/Internet. We can therefore separately include counseling in our estimation by its

method of delivery. This enables us to assess whether the mechanism of counseling's delivery affects its efficacy. Recall from Exhibit 2, however, the small number of loans receiving individual counseling, which will make it difficult to find a significant impact.

We also consider how counseling's efficacy varies over the time period in which it is delivered. The period of our study is quite long (2000 through 2008), and encompasses what we roughly consider to be three different eras—the growth era of 2000 and 2001; the refinance era of 2002, 2003, and 2004; and the boom/crisis era of 2005, 2006, 2007, and 2008. Borrowers taking out mortgages in each of these eras experienced radically different macroeconomic environments after origination. In particular, borrowers originating mortgages during the boom/crisis era lived through declining house prices, rising unemployment, and an overall economic recession. All of these factors likely created significant stresses for the borrowers enrolled in affordable lending programs. And, as a consequence, this offers a particularly interesting period to assess counseling's efficacy in reducing delinquency rates. Toward this end, we separately estimate counseling's impact in each of the three eras.

Finally, affordable lending programs are primarily targeted at first-time home buyers, and they are likely to be the ones who most benefit from pre-purchase homeownership counseling. We therefore independently assess counseling's impact for first-time and repeat buyers by interacting counseling with the first-time home buyer variable.[4]

VII. Measuring the Impacts

Exhibit 6 provides estimates of counseling's impact on reducing 90-day delinquency rates. These impacts are calculated through conceptual experiments where a control group (borrowers not receiving counseling) is compared to an otherwise identical treatment group (borrowers receiving counseling). In each instance, our estimated models are first used to predict delinquency rates for all borrowers in our sample as if they did not receive counseling (the control group), and then again as if they did receive counseling (the treatment group).

[4] The coefficient estimates for each of these extensions of equation (3) are available from the authors on request.

Each borrower in the sample thus has control and treatment predictions of delinquency, and the percentage reduction in delinquency rates for each borrower is calculated as the difference in the control and treatment predictions, divided by the control prediction.

To conduct the conceptual experiment for first-time home buyers, we first "turn on" the first-time home buyer indicator for everyone in the sample, and conduct the calculations above. To conduct the conceptual experiment for repeat home buyers, we first "turn off" the first-time home buyer indicator for everyone in the sample, and conduct the calculations above. The values in Exhibit 6 are sample averages of the percentage reductions arising from these calculations. The statistical significance of these impacts is based on significance tests in our probit estimations.

Exhibit 6 clearly shows a more significant benefit from counseling for first-time buyers than for repeat buyers—not only are more of the impacts for first-time buyers statistically significant, they are also generally larger in magnitude. Counseling in general reduces the delinquency rate of first-time buyers by 29%. This effect is relatively constant across delivery through classroom, home study and telephone/Internet. The small number of individual counseling observations likely explains its insignificance.

Counseling is found to reduce delinquency rates for first-time buyer in the boom/crisis years of 2005 through 2008. Counseling is found to increase delinquency in 2000 and 2001, although we view this as an anomaly reflecting the very small sample of first-time home buyers who did not receive counseling in these years.

Repeat buyers receive a statistically significant benefit from counseling delivered through only home study and telephone/Internet, although roughly half of those benefits for first-time home buyers. They also receive a statistically significant benefit from counseling in the years 2000-2001.

VIII. Conclusion and Policy Implications

Our results provide strong empirical support for the benefits of pre-purchase homeownership counseling. We find that counseling reduces 90-day delinquency rates by 15 percent for a population of borrowers taking out fixed rate loans in owner-occupied, one-unit properties under Freddie Mac's affordable lending programs. First-time home buyers account for the bulk of this benefit, experiencing a 29 percent reduction in delinquency rates from receiving counseling. This sizeable reduction in delinquency rates clearly indicates the benefits of "doing homeownership right the first time."

We also find that counseling provides the most benefit in periods of macroeconomic stress, precisely when it is most needed. We do not find any sizeable difference in the effectiveness of counseling when delivered through classroom, home study, or telephone/Internet. We do not find that individual counseling is effective in reducing delinquency, but this likely reflects the small number of individual counseling observations in our data.

Our estimated reductions in delinquency rates are substantial. We use Freddie Mac's internal default costing model to estimate the dollar value of the reduction in default costs associated with providing counseling to first-time home buyers. Our analysis estimates that the benefits from counseling are in the range of $1,000. This is substantially more than the costs of providing counseling, suggesting that the cost savings from counseling are sufficient to pay for its delivery.

Finally, we close with a few caveats. Although we are confident in our analysis, the data used in our study do not come from a true experiment. We control as best we can for differences in the risk characteristics of borrowers, the different macroeconomic conditions borrowers experience post-origination, lender-specific differences in origination and servicing that may affect loan performance, and the impact of selection into counseling. However there remain factors we are unable capture in our data or our modeling, and it is possible these factors may result in bias or inconsistency in our estimates of counseling's impact.

We also note that several studies find that counseling affects borrowers' prepayment propensities. Our analysis does not account for the competing risks of prepayment and delinquency behavior, and doing so might change our estimate of counseling's net impact on delinquency. It might also affect our estimate of the dollar benefit from counseling. This is a line of research we plan to pursue in future work.

IX. References

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X. Exhibits

Exhibit 1

Methodological Classification and Overview of Previous Studies of Pre-Purchase Homeownership Counseling

	Authors	Dataset	Time Period of Loan Origination	Self-Selection Controls	Method to Control for Selection	Main Findings
1.	Hirad and Zorn (2002)	39,318 loans under Freddie Mac Affordable Gold Program	1993-1998	Yes	Two-stage with both logit estimation	Only classroom results in a statistically significant decline in ever 90-day delinquency rates.
2.	Hartarska and Gonzales-Vega (2005)	919 loans in several states of Midwest for low-income borrowers.	1992-2000	No		Counseling leads to a small increase in prepayment and an optimal decline in default behavior.
3.	Hartarska and Gonzales-Vega (2006)	233 loans from a counseling program developed by a large Midwest bank, community churches and a local community development company	1992-1996	No		Counseled borrowers defaulted less often than non-counseled borrowers. In addition, counseling affects optimal exercise of the default option.
4.	Quercia and Spader (2008)	2,688 secondary market loan across 42 states. Among them 1,155 received pre-purchase counseling. Loan performance is from 21 to 79 months.	1999-2003	No		Classroom and individual counseling improve a borrower's exercise of the mortgage prepayment option, but home study or telephone counseling did not affect borrower behavior. Counseling shows no effect on default propensities.
5.	Agarwal et al. (2009)	Illinois pilot program that required high-risk mortgage borrowers in 10 targeted zip codes to attend pre-purchase counseling within 10 days of filing a mortgage application. Counseling is required for low credit-score borrowers.	2005-2007	Yes	Use borrowers at the same zip code and similar demographics as a matched comparison group.	Counseling was associated with about a 30 percent decrease in default.
6.	Agarwal et al. (2010)	12,300 loans, among them, 359 loans received counseling from a pilot program, Indianapolis Neighborhood Housing Partnership.	2005-2007	Yes	Use borrower's distance and commuting time to the closest counseling center as instruments for selection into treatment, and propensity score matching as well	Long-term voluntary counseling program substantially decreases default rates among targeting low-to-moderate income households.

Exhibit 2
Performance Differences across Counseled and Non-Counseled Loans

Type of Counseling	All Borrowers			First-Time Buyers		Repeat Buyers	
	Number of Loans	Percent	Percent Delinquent	Percent	Percent Delinquent	Percent	Percent Delinquent
Classroom	6,383	17%	13.30%	3.7%	8.48%	13.3%	14.66%
Home study	11,740	31.2%	15.08%	22.5%	18.35%	8.7%	6.60%
Individual	931	2.5%	9.34%	1.3%	11.51%	1.2%	7.14%
Telephone	12,280	32.7%	8.05%	25%	8.36%	7.7%	7.07%
All loans with counseling	31,334	83.4%	11.80%	52.5%	12.73%	30.9%	10.20%
2000-2001	14,156	37.67%	7.47%	25.11%	8.13%	12.56%	6.16%
2002-2004	4,164	11.08%	5.14%	5.76%	5.36%	5.32%	4.90%
2005-2008	13,014	34.6%	18.62%	21.61%	20.04%	13.02%	16.25%
All loans without counseling	6,243	16.6%	20.95%	5.9%	22.85%	10.7%	19.90%
2000-2001	351	0.93%	6.27%	0.21%	1.27%	0.72%	7.72%
2002-2004	327	0.87%	6.12%	0.27%	10.00%	0.60%	4.41%
2005-2008	5,565	14.81%	22.75%	5.46%	24.31%	9.35%	21.84%
All loans in the sample	37,577	100%	13.30%	58.4%	13.76%	41.6%	12.69%

Note: Delinquency is measured as 90-day or more delinquent within the first three years of origination.

Exhibit 3
Summary Statistics for Variables Used in the Estimation

	Full Sample				Counseling	Non-Counseling
	(N=37,577)				(N=31,334)	(N=6,243)
	Mean	S.D.	Min	Max	Mean	Mean
A. Loan Characteristics						
FICO score	684.03	56.34	435	823	682.53	691.55
Debt-to-income ratio (DTI)	0.40	0.10	0.03	1.00	0.39	0.44
Loan-to-value ratio (LTV)	0.98	0.02	0.90	1.06	0.98	0.99
FICO≥780 (1=yes, 0=no)	0.04	0.19	0	1	0.03	0.06
LTV≥95% (1=yes, 0=no)	0.96	0.20	0	1	0.96	0.96
Equity (in $1,000)	2.42	3.05	-4.81	64.11	2.59	1.60
Third party originator (1=yes, 0= no)	0.56	0.50	0	1	0.55	0.61
B. Borrower and Property Characteristics						
First-time home buyer (1=yes, 0=no)	0.58	0.49	0	1	0.63	0.36
One borrower indicator (1=yes, 0=no)	0.72	0.45	0	1	0.71	0.75
Condo (1=yes, 0=no)	0.12	0.32	0	1	0.12	0.10
Manufactured home (1=yes, 0=no)	0.003	0.06	0	1	0.003	0.004
C. Macroeconomic conditions and other characteristics						
Origination UBP divided by area median income≥3 (1=yes, 0=no)	0.08	0.27	0	1	0.06	0.17
Percent LTV change in the first 3 years	-1.06	8.98	-23.92	46.36	-2.10	4.17

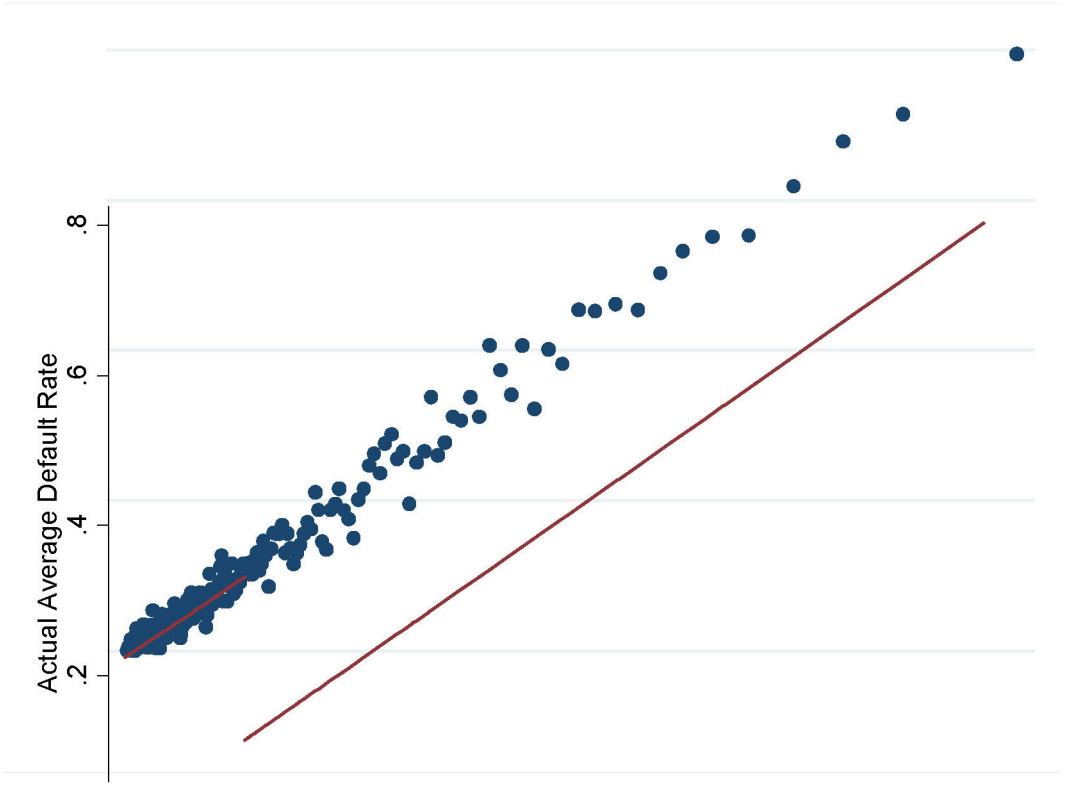
Exhibit 4
Estimation of Counseling Impact on Loans Becoming 90-Day Delinquent within Three Years

	Without Seller Effects		With Seller Effects	
	Probit Model	*Bivariate Probit Model*	*Probit Model*	*Bivariate Probit Model*
	Eq. (1)	**Eq. (2)**	**Eq. (3)**	**Eq. (4)**
Counseling (0/1)	-0.130***	-0.240***	-0.090***	-0.132**
	(0.028)	(0.049)	(0.029)	(0.054)
FICO score	-0.009***	-0.009***	-0.009***	-0.009***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
95% ≤ LTV < 97% (0/1)	0.092	0.095	0.090	0.090
	(0.065)	(0.064)	(0.065)	(0.065)
97% ≤ LTV < 100% (0/1)	0.168**	0.168**	0.167**	0.167**
	(0.069)	(0.069)	(0.069)	(0.069)
100% ≤ LTV (0/1)	0.146*	0.142*	0.142*	0.141*
	(0.084)	(0.084)	(0.084)	(0.084)
(780 ≤ FICO)*(95% ≤ LTV)	0.118***	0.115***	0.120***	0.119***
	(0.037)	(0.037)	(0.037)	(0.038)
DTI	0.971***	0.959***	0.955***	0.952***
	(0.102)	(0.102)	(0.102)	(0.102)
Equity	-0.010*	-0.010*	-0.011*	-0.011*
	(0.006)	(0.006)	(0.006)	(0.006)
First-time home buyer (0/1)	-0.013	0.005	-0.006	0.0004
	(0.022)	(0.023)	(0.022)	(0.023)
Third party originator (0/1)	0.168***	0.174***	0.180***	0.181***
	(0.023)	(0.023)	(0.023)	(0.023)
Condo (0/1)	-0.118***	-0.114***	-0.117***	-0.116***
	(0.031)	(0.031)	(0.031)	(0.032)
Manufactured home (0/1)	0.390***	0.385***	0.335**	0.336**
	(0.145)	(0.146)	(0.146)	(0.146)
Relatively large loan (0/1)	0.271***	0.262***	0.272***	0.270***
	(0.034)	(0.034)	(0.034)	(0.034)
Change in LTV after 3 years	0.038***	0.038***	0.039***	0.039***
	(0.002)	(0.002)	(0.002)	(0.002)
One borrower (0/1)	0.200***	0.199***	0.199***	0.199***
	(0.023)	(0.023)	(0.023)	(0.023)
Seller fixed effects			0.691***	0.650***
			(0.122)	(0.130)
Constant	3.863***	3.920***	3.846***	3.867***
	(0.163)	(0.164)	(0.163)	(0.164)
Corr $(\varepsilon_{i1}, \varepsilon_{i2}) = \rho$		0.093***		0.033
		(0.034)		(0.036)
Log pseudo likelihood	-11,632	-19,767	-11,617	-19,755
Number of Observations	37,554	37,577	37,554	37,577

Note: All the above models include state and year of origination dummies. *, **, *** indicate significant at 10%, 5% and 1% respectively. The log pseudo likelihoods are comparable among probit models or among bivariate probit models, but not across models.

Exhibit 5

Goodness of Fit Assessment of Probit Model with Sellers' Effects



Note: Each dot in the picture illustrates the degree of correlation between actual mean default rate and predicted mean default rate for each quantile of the full estimation sample. The sample is divided into 190 quantiles.

Exhibit 6
Estimated Reduction in 90-Day Delinquency Rates from Pre-Purchase Counseling

	First-Time Home Buyers	Repeat Home Buyers
Counseling (0/1)	29%***	5.5%
Classroom Counseling (0/1)	28%***	-2.4%
Home study Counseling (0/1)	33%**	15.7%*
Individual Counseling (0/1)	7%	11%
Telephone Counseling (0/1)	32%**	15.6%*
Counseling during 2000-2001 (0/1)	-66%*	35.9%**
Counseling during 2002-2004 (0/1)	49%	27.6%
Counseling during 2005-2008 (0/1)	33%***	-6.4%

Note: *, **, *** indicate significant at 10%, 5% and 1% respectively.