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The Relationship between Second Liens, First Mortgage Outcomes, and
Borrower Credit: 1996-2010

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Abstract

To help inform the ongoing policy debate concerning the risks associated with second mortgages, the paper rigorously evaluates the effect of second liens on the performance of first mortgages.   Using a dataset that combines credit bureau information with mortgage performance data, the statistical analysis separately quantifies the extent to which piggyback and subsequent second liens impacted loan default and prepayment likelihoods for first liens. In a simple direct comparison of first-lien outcomes, piggyback second liens are shown to have substantially increased mortgage default rates, while decreasing mortgage prepayment likelihoods. The results differ significantly, however, when the relative comparison group is altered and the analysis looks for a "residual" relationship (i.e., the control variables are changed in the statistical analysis).   When first-lien outcomes are compared for borrowers with identical at-origination total equity and debt servicing obligations, the residual outcome differences tend to be minimal. Where material differences do exist, piggyback second liens tended to be associated with marginally worse outcomes for loans originated during the housing boom and slightly better outcomes for later years.   With respect to *subsequent* second liens, models that evaluate the direct relationship between second liens and first-lien outcomes find a pronounced time trend. In the late 1990s and early 2000s, the origination of a second lien generally signaled better subsequent performance for the associated first mortgage, most likely because only the most creditworthy borrowers were able to get such loans.   By the mid-2000s, the overall signal associated with subsequent second liens became negative—i.e., the underlying first mortgages performed materially worse than others. An abrupt switch at the inception of the housing bust is then evident, however, as second-lien-burdened first mortgages then performed better again. Models that control for total net equity and borrower debt obligations, i.e., seek the residual relationship between outcomes and second liens, show a consistent positive relationship between outcomes and subsequent second liens, but also reveal an interesting evolution over time. The paper concludes with a comparison of time trends for various nonmortgage credit statistics—including nonmortgage loan balances, revolving credit utilization rates, and credit scores—for borrowers with and without second liens.

1. Background

Although second mortgages have been available for decades, the housing boom of the early 2000s saw an increased prevalence of such loans. As home prices grew and underwriting standards loosened, second mortgages were used increasingly to help finance home purchases. So-called "piggyback" second mortgages—those taken out at the same time of the origination of first lien—enabled borrowers to fund home purchases (and refinances) with little down payment. In a commonly used "80/10/10" arrangement, borrowers financed 80 percent of a home purchase price with a conforming loan, 10 percent with a second lien, and then made a 10 percent down payment.[1]

Second liens were also used as a way of extracting home equity in the form of cash. Increases in home values meant that borrowers had more home equity, which was often extracted with a second lien. Millions of borrowers took out Home Equity Lines of Credit (HELOCs), which allowed flexible access to funds up to a certain dollar amount. Borrowers could take out HELOCs at the same time that they refinanced a first mortgages or they could take out a HELOC independently sometime after their first mortgage was originated.

Like HELOCs, "Closed-End" second liens (CES) were also used to avoid mortgage insurance and extract home equity. Like HELOCs, CES could be taken out at the time a first-lien was originated or sometime thereafter. CES provided less flexibility to borrowers relative to HELOCs, however. All loan proceeds were paid out at the time of origination (i.e., the borrower could not increase the loan amount after origination) and a fixed payment schedule amortized the loan balance over a set schedule.[2]

The large number of CES and HELOCs originated during the housing boom ultimately caused significant problems in mortgage markets. As home prices fell and macroeconomic conditions soured, the debt and the debt servicing associated with such loans strained household budgets and led to increased mortgage defaults. Also, as has been widely reported, the presence of second liens sometimes made it difficult for loan servicers to modify mortgages when borrowers were in financial distress.

Using a unique dataset containing millions of mortgage records from one of the two largest government sponsored enterprises, this paper attempts to quantify the impact of second liens on outcomes for first mortgages. The analysis focuses on measuring the increase in loan default rates and mortgage delinquencies that is associated with the presence of second liens. It also includes a broader analysis of the evolution of household financial outcomes for borrowers with second mortgages. Although a very

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[1] The term "piggyback mortgage" has frequently been reserved for these "80/10/10" situations, which usually involved borrowers who used the second lien to avoid paying mortgage insurance. In this paper, the "piggyback" term is used more generically to describe second liens of any size (and used for any purpose) taken out at the time of first-mortgage origination.

[2] For a discussion of the differences see, "What is a second mortgage loan or 'junior-lien'?" Consumer Financial Protection Bureau" available at http://www.consumerfinance.gov/askcfpb/105/what-is-a-second-mortgage-loan-or-junior-lien.html.

modest research literature has studied second lien impacts on first mortgage outcomes, no substantive literature has addressed the broader effects.

Recognizing that the effects of second liens may vary across different circumstances and for different loan types, the paper studies the impact of four different types of second lien on first-lien outcomes. The empirical work begins by analyzing piggyback second liens, including piggyback HELOCs and piggyback CES. It then then proceeds to study subsequent second liens—both HELOCs and CES.

Irrespective of the precise type of second lien being analyzed, a fundamental question that must be addressed is how to determine the impact of second liens on first mortgage performance. In general, it is clear that one should compare outcomes for first liens with associated seconds to outcomes for otherwise similar first-liens *with no seconds*. A significant decision needs to be made, however, when determining the meaning of "otherwise similar." When borrowers take on a second lien, they have greater debt and additional debt payments than they otherwise would have. The effects of these additional burdens on mortgage outcomes are the primary—or "direct"—impact of second liens. Alternatively, one could look at the "residual" impact of second liens by comparing first-lien outcomes for borrowers who have a second lien to borrowers with one lien, *but who have the same total debt and same total monthly payments.*

As a concrete example, suppose three types of households exist in a given geographic area. All households purchased $100,000 homes in the same year and have $2,500 in monthly income. None of the households has nonmortgage debt.

Now suppose the following:

> Household Type 1: Took out one mortgage for $80,000. The monthly mortgage payment on the first (and only lien) is $500.

> Household Type 2: Took out one mortgage for $80,000 and a second lien of $7,000. The monthly mortgage payment on the first lien is $500 and on the second lien is $100.

> Household Type 3: Took out one mortgage for $87,000. The total monthly mortgage payment is $600.

The "direct" approach to measuring the impact of second liens entails, in effect, comparing outcomes for Household Type 1 (no seconds) to outcomes for Household Type 2 (seconds). The households are similar and the first liens are similar, but households of Type 2 have additional debt and greater monthly debt obligations. The added debt and greater monthly debt obligations have an impact on first-lien outcomes. The alternative "residual" approach would effectively compare mortgages for households of Type 2 to those of Type 3. Both households have the same total equity at loan origination ($13,000) and the same total monthly debt burden ($600), but Type 3 has a second mortgage whereas Type 2 does not.

This paper will focus on measuring the direct effects of second liens—allowing the effects to include the impact of added debt and monthly debt payments. By changing certain inputs to the statistical model used for estimation, however, the paper will also present estimates of the residual impact. Such measurement is interesting because, in the context of buying homes, borrowers sometimes took out second liens not for taking on additional total debt, but rather because two loans were a more cost effective way of financing a home purchase than obtaining one larger loan. As indicated earlier, borrowers who did not have an 80 percent down payment sometimes found it less costly to take out two loans—one financing 80 percent of the home value and the second lien covering the rest of the needed funds—than obtaining one large loan and paying the necessary mortgage insurance premium.[3]

By providing empirical estimates of second lien impacts under various methodologies and for different types of loans, this paper provides valuable, policy-relevant information. In the context of mortgage markets, a proper assessment is important because some industry participants have proposed rules requiring that first-lien holders be notified in the event that a borrower applies for a loan secured by the same collateral property. Others have wondered whether certain types of second liens should even be allowed. A comprehensive analysis of the relationship between second liens and household financial outcomes is useful for understanding the value of such proposals.

Although the total current balance of outstanding second liens is far below peak levels, it is still substantial in absolute terms. As of the fourth quarter of 2013, the estimated outstanding balance of such loans in the U.S. was roughly $668 billion.[4] Given the total balance and the millions of households that still have such loans, evaluating their impact is also important from a macroeconomic perspective. Assuming that households continue to employ second mortgages to finance homes and cash-out home equity, understanding the linkages between those liens and household financial outcomes could provide valuable information for understanding the likely impact of the next housing market downturn on the larger economy.

2. Impact of Second Liens on First Mortgages: Fundamentals

As suggested above, second liens increase risks to first lien holders in two ways. First, second mortgages are debt, and by taking out a second lien, borrowers necessarily reduce the net equity position they have in their homes. A well-established research literature and strong empirical evidence from the last five years shows that borrowers with less equity (and more negative equity) tend to default more frequently on their loans. Second, supporting the debt—i.e., making payments on second liens—places an extra ongoing financial burden on households. Decades of loan underwriting have recognized that,

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[3] During the early part of the 2000s, taking out second liens was a relatively common strategy for avoiding the mortgage insurance premiums that would be required if the conforming loan had an above-80-LTV ratio. Second liens were relatively attractive because: (a) the interest rates on such loans were exceptionally low and (b) unlike mortgage insurance premiums, the mortgage interest paid on the second liens was tax deductible. For the period between 2007 and 2013, Congress made private insurance premiums tax deductible, thereby making private mortgage insurance somewhat more attractive than it previously had been.

[4] See Inside Mortgage Finance, Issue 2014: 12, March 28, 2014. In particular, see page 3.

all else equal, households with greater monthly debt-servicing payments have greater default probabilities. As with any other debt payments, required payments on second liens exacerbate financial strains and increase the default risk on first loans.

Aside from the effects on net home equity and the increases in household financial burden, a subsidiary but still-important impact of second liens was that they could act as roadblocks to the handling of distressed loans. Second liens were always junior to first lien holders when mortgages defaulted, but holders of second liens could "hold up" loan modifications and mortgage refinances that might be beneficial to first mortgage holders. Refinancing troubled loans required the re-subordination of second liens and loan servicers often were hesitant to modify first mortgages without the consent of second lien holders. Although the consent actually may not have been required in many cases, the mere perception that it was provided leverage to second lien holders and, in doing so, introduced new risks for first lien holders.[5]

A defining characteristic of the loosening mortgage credit standards of the early 2000s was that, despite risks associated with second liens, loan originators and owners of first mortgages frequently were unaware of the presence of second liens. Reporting requirements mandated that piggyback seconds be disclosed and to be taken into account in underwriting. Second liens originated after the time of first-lien-origination—hereafter "subsequent" seconds—generally did not require that the first-lien holder be notified and thus such loans were regularly invisible to the first-lien holder.

3. Prior Literature

Over the last several years, a great deal of economic literature has addressed second liens, but much of it has had a slightly different focus than the impact of second liens on first lien performance. In those cases where the literature has addressed this topic, the research generally often entailed a less involved set of statistical analyses than those in this paper.

While not a focus of their work, Elul, Souleles, *et al* (2010) produced estimates of the impact of second liens on first-lien performance in the context of a larger analysis of mortgage performance.   The authors used credit bureau and loan performance data to assess the effects of borrower liquidity and negative equity on loan default propensities for first mortgages.   Using a dynamic logit model to quantify marginal effects, the authors studied whether the effects of negative equity differed for mortgages with second liens vis-à-vis other loans. They found that the propensity of borrowers to go into default[6] in a given quarter was about one quarter of a percentage point greater for borrowers with a second lien vis-à-vis those without. The paper addressed how the risk increase varied across borrowers with different levels of equity, finding that borrowers with current loan-to-value ratios of about 100 percent saw the

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[5] For a comprehensive discussion of the relevant issues, see Been, Vicki, Howell Jackson and Mark Willis, "Essay: Sticky Seconds—The Problems Second Liens Pose to the Resolution of Distressed Mortgages," Furman Center Essay, August 2012 available at: http://furmancenter.org/files/publications/Essay_Sticky_Seconds_--_The_Problems_Second_Liens_Pose_to_the_Resolution_of_Distressed_Mortgages.pdf.

[6] In their analysis, "going into default" entailed becoming 60 days delinquent on their loan for the first time.

maximum risk premium associated with the presence of a second lien. The study did not evaluate whether the risk premium differed over time nor did it investigate whether the impact varied across different types of second liens. It did not, for instance, compare the impact of piggyback seconds against the impact of subsequent seconds. It also did not separately estimate the effects of CES and HELOCs.

Jagtiani and Lang (2010) and Lee, Mayer, and Tracy (2012) both focused attention on the relative performance of first and second liens.[7] Following up on prior literature, Jagtiani and Lang used credit bureau data and loan performance information to compare first and second mortgage default rates and determine the relative frequency with which borrowers chose to remain current on one type of loan, but not the other. They found that second liens generally had stronger performance (lower default rates) than might have been expected. Summary statistics computed on their relatively small dataset indicated that roughly thirty percent of borrowers who went delinquent on their first loans still remained current on their second mortgage.   Additional summary statistics and regression analysis produced findings consistent with a hypothesis that borrowers were remaining current on second mortgages for the purpose of maintaining liquidity. During financial distress, the performance of HELOC loans, in particular, remained quite strong relative to CES, suggesting that borrowers were making their HELOC payments to ensure access to the line of credit in the future.

After providing background on trends in second-lien originations during the housing boom and subsequent bust, Lee, Mayer, and Tracy presented empirical analyses that, in their opinion, did not unambiguously support this theory. Using a small random sample of data from the Federal Reserve Bank of New York's Consumer Credit Panel and deed data from DataQuick Information Systems, the authors computed loan default rates for first mortgages and compared those rates to default rates for second liens and for credit card and auto loans. For matched first and second liens (i.e., liens on the same property), the study found relatively similar performance across the two mortgage types. The study also found that, when a first lien defaulted, borrowers were more prone to remain current on auto loans and credit cards than they were on HELOCs. In the authors' view, this finding called into question the hypothesis that borrowers gave payment priority to HELOCs for the purpose of maintaining access to liquidity.

4. Evaluating the Impact of Second Liens: Basic Approach

The primary purpose of this paper is to quantify the extent to which second liens affect loan default probabilities for first mortgages. Although the analysis begins by comparing simple summary statistics of loan default frequencies, the bulk of the paper will be devoted to studying results from a more involved statistical analysis that produces more precise estimates in a multinomial logit model.

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[7] A summary of these articles, as well as others can be found in Been, Vicki, Howell Jackson and Mark Willis, "Essay: Sticky Seconds—The Problems Second Liens Pose to the Resolution of Distressed Mortgages," Furman Center Essay, August 2012 available at: http://furmancenter.org/files/publications/Essay_Sticky_Seconds_--_The_Problems_Second_Liens_Pose_to_the_Resolution_of_Distressed_Mortgages.pdf.

Following up on the loan default analysis, the paper then proceeds with a prepayment analysis and an evaluation of the overall relationship between second liens and household credit conditions. Because prepayments often represent mortgage refinances (as opposed to terminations resulting from the sale of properties), the prepayment analysis indicates whether second liens acted as significant hindrances to refinances. In cases where borrowers were financially distressed and were indirectly or directly unable to refinance because of the presence of a second lien, lower prepayment rates may be problematic from a public policy perspective. The analysis of household finances evaluates whether households with second liens saw significantly different trends in credit balances and delinquencies for nonmortgage trade lines.[8] Such an analysis is important because it can determine whether borrowers with second liens experienced financial strains that only manifested themselves in poorer nonmortgage outcomes.

More generally, the latter analysis may provide insights concerning the use of second liens during the housing boom. Anecdotal reports suggest that second mortgages (HELOCS especially) were often used for consumption–oriented expenditures in the mid-2000s. While it is not possible to know definitively how borrowers used second lien proceeds, if such consumption-oriented expenditures on balance outweighed the use of funds for more financially conservative uses (e.g., paying down credit card debt), the associated strains on borrower financial health should be evident in the results of the credit data analysis.

In evaluating the relationship between of seconds liens and outcomes for first mortgages, as discussed in the introduction of the paper, a fundamental question is whether the impact should be measured *holding other factors constant.* The very nature of second liens is that they reduce net home equity and increase debt servicing (i.e., greater monthly payments) for borrowers. While those two factors should have a significant impact on mortgage performance, one might wonder whether second liens have residual effects after holding constant those influences. An interesting finding would be if, for the same set of financial circumstances (net home equity, total monthly payments), second-lien-burdened first mortgages statistically had different outcomes. In the context of the hypothetical households presented in the introduction of this paper, the relevant question would be whether the households that had two mortgages and a combined loan-to-value ratio of 87 percent (Type 2 households) had similar outcomes vis-à-vis the otherwise identical households that only one loan (Type 3 households). Such might be the case, for instance, if the presence of a second lien acted as a signal of unobserved loan quality. While not the focus of the analysis, this paper does present evidence for whether such differences—"residual" effects—do exist.

Basic summary statistics are shown comparing characteristics and outcomes for mortgages burdened with second liens to those that were not, but the bulk of the impact analysis involves analyzing the estimates from multinomial logit models. Several different versions of the model are estimated to test various hypotheses, but the basic idea is to isolate the effect of piggyback and subsequent second liens—and different types of those second liens (CES and HELOCs)--on loan outcomes. The multinomial logit framework, which is frequently used in economic literature to assess mortgage outcomes, allows

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[8] Nonmortgage trade lines include various types of installment loans (e.g., auto and personal loans) and various forms of revolving credit (e.g., credit card debt).

for the concurrent estimation of the impact of seconds on prepayment probabilities and the likelihood of "negative" outcomes.   The default definition used for negative outcomes includes loans that had at least one episode where the loan was 90 days or more delinquent or terminated in one of the following ways:

- The property became real estate owned (REO) through the foreclosure process
- The property was taken over through a deed-in-lieu of foreclosure (DIL)
- The property was sold in a short sale
- The loan was written-off.

Outcomes for individual mortgages are classified as either "negative" (using the definition above), "prepaid", or still-performing. The dependent variable in the multinomial logit model takes on one of these three values and, as with all multinomial logit models involving categorical variables, estimated coefficients show the marginal effect of the different independent variables on the relative likelihood of specific outcomes. In this paper, the primary variables of interest are indicator variables signaling the presence of a piggyback second lien or a subsequent second. Separate indicators are included for CES and HELOCs, meaning that the models generally include a total of four indicators (piggyback CES, piggyback HELOCs, subsequent CES, subsequent HELOCs). Properly interpreted, the coefficients on those variables represent the difference in the relative likelihood of negative outcomes (and prepayments) attributable to the presence of a second lien.

Control variables—i.e., other independent variables—are included in the model to ensure that the effect of second liens on loan outcomes is measured absent confounding influences. Without such controls, systematic differences in other outcome-determining loan attributes (e.g., geographic areas, loan type, property types) might pollute measurements of the effect of second liens.

When measuring the primary, "direct" effects of second liens on outcomes, the control variables also include the first-lien's loan-to-value ratio (LTV) —the first-lien loan amount divided by the home value—and front-end debt-servicing ratio.   The front-end ratio is the ratio of the mortgage principal, interest, taxes and homeowners insurance expressed as a fraction of the borrowers' gross income.

To measure the residual impact of second liens on outcomes, the additional controls variables are slightly different. Instead of the LTV ratio and front-end debt-servicing ratios, the included controls are the cumulative loan-to-value (CLTV) ratio—the sum of the outstanding mortgage balances for all loans divided by the value of the home—and the "backend" ratio. The latter is the sum of all debt-related monthly payments divided by gross monthly income.   The CLTV ratio and the backend ratio are directly impacted by the presence of second liens and, when they are included as independent controls, the model coefficients on the second lien variables, be construction, will reflect only the residual effect of second liens on first-lien outcomes.

5. Data

The basis for the empirical analysis is a dataset of mortgage-level information from one of the two largest Enterprises regulated by FHFA (hereafter, the "Enterprise" data). The dataset contains mortgage characteristics, including outcomes information, for most loans bought or guaranteed by the particular Enterprise since the late 1970s. The empirical analysis focuses on loans originated between 1996[10] and 2010. Because the dataset is quite large and can be cumbersome to manage, the statistical analysis in the paper uses a one-in-five random sample extracted from the full database.

The loan-level dataset used here differs from prior research in that it focuses exclusively on Enterprise loans. Although non-Enterprise loans are not included, the dataset is still much larger and historically much "deeper" (i.e., includes more years of data) than the samples employed in other research.

Importantly, the core Enterprise data has been supplemented with credit bureau data from Equifax.[11] The Equifax data are critical because they are the source for the second liens information. The Equifax data are used to identify those Enterprise loans that had a second lien and, for those that did, when the second liens were originated. The Equifax information also is valuable because it provides annual data on borrower credit conditions. Contemporary balances are available for various types of trade lines (e.g., instalment credit, revolving credit, etc.) as are detailed data on loan delinquencies, credit scores, credit limits, and a host of other statistics.

While extremely valuable, the Equifax supplementary data have one significant drawback: they are annual snapshots as opposed to monthly indicators. For each Enterprise loan, the data received by FHFA include only a snapshot as of March of each year.[12] For example, for a loan originated in August 2000, the credit bureau snapshot data will first be available for March 2001 and then annually in March of each subsequent year until the loan terminates. For loans originated just after the snapshot data--in April, for instance--this means that there is a significant delay before the first information about a borrower's financial condition is available. Some of the analysis in this paper entails tracking the evolution of credit data from the time of loan origination through later years. The delay means that the "at-origination" statistics will actually represent borrower attributes several months (up to a year) after origination. This is not ideal, but unavoidable.

While "at-origination" trade line information has this drawback, for second liens, the lag problem is not quite as severe because the underlying dataset specifies how many months the loan has been open. Accordingly, one can impute the date on which the second mortgage was originated and, in doing so, can flag whether the second lien was a piggyback second. For an August 2000-originated first mortgage

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[10] Certain key data fields—for example credit scores—were not available for mortgage originated before 1996 and thus the analysis does not consider those loans.

[11] Mechanically, the specific Enterprise actually receives these data directly from Equifax and passes along the information to FHFA (which has a license agreement with Equifax permitting use).

[12] The Enterprise actually receives the credit snapshots with greater frequency, but the greater-frequency data are unavailable to FHFA under the terms of the licensing agreement.

with a piggyback second, for instance, the March 2001 Equifax snapshot should reflect data for a second lien that has been open for seven months.[13]

6. Loan Performance Model: Estimating the Effect of Second Liens on Mortgage Outcomes

The equation below shows the specification of the basic model used for estimating the second lien effects.

Equation 1:

$$
\begin{aligned}
Outcome\ &(Negative, Prepayment, or\ Still\ Alive)_i \\
&= \beta_0 + \beta_1 FIRST\_LTV_l + \beta_2 FIRST\_LTV\_80ABOVE_i \\
&\quad + \beta_2 FIRST\_LTV\_90ABOVE_i + \beta_3 FRONTEND\ RATIO_i \\
&\quad + \beta_4 STATE\ DUMMIES_i + \beta_4 FICO_i + \beta_5 BAL\_R\_AtOrig_i \\
&\quad + \beta_6 NONMTG\_DLQ\_ATOrig_i + \beta_7 MORT\_RATE_i + \beta_8 FRM_i + \beta_9 RT_i \\
&\quad + \beta_{10} CO_i + \beta_{11} ORIG\_UPB_i + \beta_{12} SFD_i + \beta_{13} PRIMARY_i \\
&\quad + \beta_{14} \textbf{SECOND\ LIEN\ DUMMIES}_i + \varepsilon_i
\end{aligned}
$$

The model attempts to explain outcomes for first liens using a large number of independent variables, with the primary variables of interest being second lien dummy variables that indicate when a second lien is present. In theory, the second lien effects could differ for at least four basic types of second mortgages: CES originated simultaneously with the first mortgage origination (piggyback CES), subsequent CES, piggyback HELOCs, and subsequent HELOCS. To accommodate the possibility that the impact of the various types of second liens differ, separate indicator variables are included to flag the presence of each of these second lien types.

The multinomial logit model is separately estimated for each annual cohort of first-mortgage originations, meaning that separate parameters are estimated for 1996 originations, 1997 originations, and so on. Outcome models are not estimated for origination years 2011 and later because of the limited period available for observing outcomes in the years since

Because separate logit models are estimated for each mortgage origination year, the effects of the second lien indicators (i.e., the relationship between second liens and the likelihood of a negative outcome for a first lien) are allowed to differ for the various mortgage cohorts. Importantly, year-specific estimation also ensures that many year-specific influences on the likelihood of default do not

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[13] Given the imprecision of the approach—and the sometimes-imprecise character of credit bureau data—a window of time is used for determining whether a second lien was a piggyback second. Specifically, second liens are identified as piggyback seconds if the imputed data of origination is within three months of origination date for the first lien.

pollute the estimate of the impact of second liens; the performance of mortgages with second liens is compared to the performance of solo mortgages for the same loan vintage.

The basic model attempts to measure the direct effects of second liens on outcomes and thus only includes controls for first-lien LTV ratio and the first lien's front-end ratio (FRONTEND RATIO).   To accommodate the known nonlinear relationship between the LTV ratio and loan default probabilities,[14] the equation includes three LTV variables. The first is simply the (first-lien) LTV ratio of the loan at origination (FIRST_LTV). The next variable, FIRST_LTV_80ABOVE, is the LTV ratio multiplied by a dummy variable that takes a value of one for LTV ratios of 80 percent or above. The final variable, FIRST_LTV_90ABOVE, is the LTV ratio multiplied by a dummy variable that is one for LTV ratios of 90 percent or above. The inclusion of all three variables permits the marginal impact of increases in the LTV ratio to change at kink points of 80 percent and 90 percent.

Besides LTV and the front-end ratio, the explanatory variables include a series of state-specific dummy variables. The inclusion of dummies for each state in the country (except Oregon, which is omitted for the purpose of avoiding perfect multicollinearity), ensures that the impact of second liens will be measured relative to other loans in the same state. Without the inclusion of these variables, the measured effect of second liens would incorporate state-specific effects; that is, the second lien effect would reflect the actual second lien effects as well as systematic differences in loan performance for those states where second liens were prevalent.

Three credit-related variables are included in the model. The first variable, sourced from the Enterprise Historical Loan Performance dataset, is the FICO® Score that was used in the loan underwriting.[15] The two other variables reflect payment delinquencies and revolving credit balances found in the Equifax data snapshot for the March immediately following loan origination.   BAL_R_AtOrig is the imputed magnitude of the borrowers' revolving credit balance at the time of loan origination and is expressed as a percentage of the borrower gross monthly income.   A value of 300 percent would mean that the revolving credit balance was three times the gross borrower monthly income. NONMTG_DLQ_AtOrig reports the imputed number of 30-day-or-more nonmortgage delinquencies at the time of loan origination.

Seven additional variables, five characterizing loan attributes and two describing collateral characteristics, are also included as independent variables. The loan attribute variables include the mortgage interest rate (MORT_RATE), a dummy variable flagging 30-year fixed rate mortgages (FRM), two dummy variables flagging rate-term and cash-out refinances (RT and CO), and the original loan amount (ORIG_UPB).   The two collateral-oriented variables are dummy variables that signal mortgages collateralized by single-family-detached properties (SFD) and properties that were the primary dwelling for the borrower (PRIMARY).

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[14] See Lam, Ken, "Impacts of Down Payment Underwriting Standards on Loan Performance," FHFA Working Paper 13-3, available at: http://www.fhfa.gov/webfiles/25877/FHFA_Working_Paper_13-3.pdf.
[15] FICO® Scores are also available in the Equifax data, but the earliest available FICO® Score in that dataset will frequently be from many months after loan origination.

In some cases, the model specification described in (1) is adjusted to include other ways of classifying second liens. For example, to accommodate the possibility that the impact of larger second liens could differ substantively from the impact of smaller second liens on first lien outcomes, a separate specification is included that flags first liens that were burdened by small, medium, and larger-sized second liens. In these cases, the magnitude of second mortgages is expressed as a function of home values. When analyzing prepayment rates, a reasonable hypothesis might be that borrowers who obtained second mortgages for the purposes of avoiding mortgage insurance might be more financially savvy or otherwise different than other borrowers. Accordingly, some model specifications allow for variations in second lien effects in cases where the first mortgage represented exactly 80 percent of the home value (a possible indication of MI avoidance).

The basic model described in (1) quantifies the direct impact of second liens on first lien outcomes. Those models that aim to quantify the residual relationship between second liens and outcomes include the same independent variables as are shown in Equation 1, except the LTV and FRONTEND RATIO variables are replaced.   As indicated earlier, the included control variables in those cases are the CLTV ratio and the backend ratio, which includes the second lien payments.

7. Basic Summary Statistics

As background for the logit analysis, Tables 1a, 1b, 2 and 3 present detailed summary statistics for loan size, FICO® Scores, loan outcomes, and other variables. With the exception of Table 1b—which shows the annual shares of mortgages originated in select states—the tables compare statistics for three types of first liens: those that were never burdened by second liens, those having a piggyback second mortgage, and those for which a second lien was originated after the first lien ("subsequent" seconds).

The first few columns of Table 1a report the relative frequency of second liens in the dataset.   Piggyback seconds, as has been widely discussed, became significantly more prevalent during the housing boom of the mid-2000s. Between 2000 and 2006, the percentage of first liens burdened by piggyback seconds grew more than ten-fold, from 2.1 percent to 21.4 percent. After 2006, the share dropped precipitously and, by 2012, the share was down to 3.5 percent.

Like piggyback second liens, the incidence of subsequent seconds grew during the housing boom. The first-lien cohorts most affected by subsequent seconds tended to be slightly earlier vintages, however. Roughly 22.5 percent of the 2003 first-lien cohort—the cohort with the greatest incidence of subsequent seconds—saw subsequent seconds. For the 2006 loan cohort, the share was about eight percent (i.e., subsequent seconds have been originated for about eight percent of the loans). The share

of loans with subsequent seconds fell further in later years; only about 4.9 percent of first liens in the 2010 cohort, for instance, have seen second lien originations.[17]

Table 1a provides a limited comparison of credit quality—in the form of FICO® Score averages—for different types and vintages of first liens. In general, the table reveals that the credit scores of mortgages burdened by second liens were similar to mortgages with no second liens. During the height of the housing boom, however, a very small gap did develop between loans that were never burdened (hereafter "solo" loans) and first-liens with piggyback seconds. For the 2004-2008 cohorts, the solo mortgages had FICO® Scores between 10 and 20 points below those of piggybacked mortgages. That gap quickly dissolved in the housing bust, however. During almost the entire 1996-2012 time frame, first mortgages burdened with *subsequent* seconds tended to look very similar to solo loans in terms of their FICO® Scores.[18]

Table 1b reports the proportion of first-lien originations in select states, particularly those representing relatively high and low proportions of the data sample. In general, the table reveals very limited geographic shifts over time, although notable variation in California's share is evident. In the early part of the housing boom, a gradual increase in California's relative volume can be seen, with its share increasing from about 13 percent in the late 1990s to 16 percent by 2003. The California share declines as the housing boom accelerated and borrowers sought alternative (non-Enterprise) forms of financing. By 2007, the California share declined to about 10 percent of the data sample. As non-Enterprise mortgage financing options dried up and conforming loan limits were increased in California,[19] Table 1b reveals a growing proportion of California loans. For 2013, roughly one-in-five loans in the sample were from California.

Table 2 shows some simple comparative statistics for the relative frequency of poor outcomes for the first mortgages with and without associated second liens. Using the previously-discussed definition of negative outcomes (i.e., including severe delinquencies of 90 days or more, short-sales, REO outcomes, etc.), Table 2 presents the expected result that mortgages with piggyback and subsequent second liens generally performed worse than solo mortgages. The finding, which is a mere comparison of averages (and thus does not account for the fact that solo loans, by construction, had greater home equity and smaller debt servicing payments), was particularly striking for the comparison of solo mortgages and those with subsequent seconds. For first-lien cohort years of 1996-2006, the relative frequency of negative outcomes was between 3 and 7 percentage points higher for loans with subsequent seconds than it was for solo mortgages. During that same time frame, the outcome gap between solo and piggybacked loans ranged between -2 percentage points (i.e., piggybacked mortgages performed better) and +4 percentage points.

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[17] Of course, the share of 2010-originated first liens being burdened by a second lien will grow somewhat as time passes. The trajectory of the burdening of that cohort is much shallower, however, vis-à-vis other cohorts.

[18] This result differs somewhat from Lee, Mayer, and Tracy, who found that "higher quality [*sic*] borrowers tended to take out second liens well after origination." That paper analyzed a different dataset than the one used here.

[19] Beginning in 2008, Congress passed a series of bills that increased the maximum size of loan the Enterprises could guarantee (the "conforming loan limit") in high-cost areas. The new legislation pushed up loan limits in most of California, where real estate prices are relatively high.

Interestingly, for first mortgages originated at the onset of the housing crisis in 2007 and 2008, Table 2 reveals that piggybacked and loans with subsequent seconds performed slightly better than solo loans. This outcome may be a function of increased underwriting scrutiny for such loans. Alternatively, it could be merely a reflection of other covariates that systematically differ across the loan types. The multinomial logit models presented in the following section attempts to control for those other factors.

Unlike Tables 1a and 2, which presented statistics for first-lien cohorts, Table 3 provides cohort-specific statistics for different vintages of second liens. It shows the time trend in the average size of second mortgages for each second lien origination year. It also shows the average relative size of such loans (relative to the contemporary home value) and the average FICO® Score of the primary borrower when the liens were originated. In general, the table suggests two basic findings: (a) as average home values grew in the mid-2000s, the average size of piggyback and subsequent second liens grew as well and (b) until the onset of the housing bust, FICO® Scores for borrowers taking out second liens were relatively stable. With respect to the latter, the average FICO® Score of borrowers taking out new second liens ranged from about 715 to around 730 between 1996 and 2007. Thereafter, average FICO® Scores grew sharply. The average FICO® Scores for borrowers with piggyback and subsequent second liens originated in 2013 was approximately 760.

The final two columns of Table 3 analyze the conditions under which subsequent second liens were originated. In analyzing the impact of subsequent second liens on the burdened first liens, a key question is whether the mortgages that were ultimately burdened by second liens were systematically different somehow than other mortgages. If, for example, subsequent second liens were only originated in situations in which the borrower had a particularly strong track record of payment, then sample selection bias would afflict the measurement of the impact of second liens. The origination of the second lien, in itself, would act as a signal of high borrower quality and would be associated with better subsequent outcomes. The opposite hypothesis—one in which the second lien acts as a "lifeline" to a struggling borrower—could introduce the opposite bias.

In an effort to determine whether the first liens burdened with seconds mortgages "look different" than others, the penultimate column in Table 3 analyzes FICO® Scores for borrowers taking out second liens. For each second lien originated in the denoted years, the average FICO® Score for the primary borrower is compared to the average contemporary FICO® Score for mortgages of the same first-lien cohort. For example, for a borrower taking out a first lien in 2001 and a second lien in 2005, the calculated difference would be the borrower's FICO® Score in 2005 minus the average FICO® Score for all 2001-originated loans in 2005. That gap would generally be positive if second liens act as a signal of high borrower quality and would tend to be negative if subsequent seconds act as lifelines.

In general, the average computed gap tends to be relatively close to zero, mitigating concerns that second liens were only taken out under ideal (or poor) financial circumstances. Two exceptional years do exist: 2008 and 2009, however. In those years, the average FICO® Score gap exceeded 20 points. Given the tumult in the housing market at the time, tightened underwriting standards meant that only relatively well qualified borrowers were able to take out second mortgages.

The final column in Table 3 presents a slightly different statistic, but one that also suggests that the origination of a second lien does merely signal the trajectory of borrower credit health. For subsequent second liens originated in the respective years, the column computes the difference between the borrower's current FICO® Score and his/her FICO® Score at the time of the origination of the first-lien. The final column reveals that the average change in the FICO® Score tends to be slightly positive during the relevant periods, but the magnitude of the increases tends to be very small. Between 2007 and 2009, years of sharply tightening underwriting, the average increase in FICO® Score was still only between six and eight points.

The results in the final two columns of Table 3 aside, unobserved quality differences between loans with and without second mortgages are, to be sure, unavoidable. Mortgages that ultimately were burdened with second liens likely had some positive (and perhaps some negative) unobserved attributes at the time of the origination of the first lien. The findings in Table 3, however, generally dispel concerns that subsequent seconds were only originated in situations in which the mortgage performance trajectory was particularly bad or particularly good. While any measurement of the impact of second liens on first lien outcomes will necessarily be affected by unobserved characteristics, these findings suggest that biases may be somewhat smaller than one might have anticipated.

8. Second Liens and Mortgage Defaults: Logit Model Results

Transitioning from summary statistics to the analysis of regression results, Figures 1-7 shows the results of the aforementioned multinomial logit models that attempt to quantify the impact of second liens on loan performance *holding constant other factors*. The figures show the coefficients on the second lien dummy variables in the model described in Equation 1. Figures 1-6 focus on the relationship between second liens and negative outcomes, while later figures will address the relationship of second liens with prepayments. The initial three figures, Figures 1-3, show the impact of *piggyback* second liens on the relative likelihood of a negative outcome. Figures 4-6 show the impact of *subsequent* second liens on the odds of a negative outcome. The impact of other modeling variables—for example the loan-to-value ratios or the state-specific dummy variables—are not shown in the figures.[20]

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[20] Appendix 1 reveals the estimate coefficient estimates on each of the state dummy variables in the most basic model (i.e., the model used to produce the second-lien effects shown in Figure 1 and Figure 4). The table shows the association between a mortgage's state (i.e., the state the collateral is in) and the relative likelihood of a negative outcome. As with the second-lien coefficients, the coefficients reflect the marginal effects *holding other factors constant.*
In general, the largest coefficients shown in Appendix 1 are for states that saw the biggest busts in home prices. For example, for mortgage origination years 2005-2007, particularly large coefficients are evident for California, Nevada, Arizona, and Florida mortgages. The large coefficients mean that, relative to other mortgages with similar attributes at the time of loan origination, mortgages in those states had particularly large likelihoods of negative outcomes. The large coefficients for these states are not surprising given the very substantial home price declines that took place in these areas.

To simplify the presentation of results in Figures 1-6, the second-lien coefficients that are statistically not significantly different from zero are shown as zero. As distinct indicator variables are included for CES and HELOCs, for each year, two coefficients can be shown corresponding to the impact of each type of second lien on the performance of the burdened first mortgage.

Figure 1 shows the relative second lien coefficients on the most basic model of negative outcomes. As logit model coefficients, the parameters are interpreted as the impact of second liens (in this case, the presence of a *piggyback* second) on the relative likelihood of a negative outcome. Higher coefficients correspond to a greater likelihood of negative outcomes. To derive the magnitude of the second lien's effect on the log-odds ratio, the coefficients can be exponentiated. A coefficient of +0.7, for example, corresponds to a multiplier of about 2.0.[21] This means that, controlling for other variables included in the model, the presence of a piggyback second lien roughly doubles the odds of a negative outcome.

Figure 1 reveals that, for mortgage origination cohorts between 1996 and 1999, there was generally no statistically significant impact of the presence of second liens. Given that second liens were associated with higher CLTV ratios and more debt servicing (factors not controlled for in the model), the absence of a significant effect is notable. Tighter underwriting standards at loan origination for loans with second liens evidently offset the impact of those other factors for those years.

A discernible and rather large effect appears in later years, however, and persists through about 2009. Statistically significant coefficients for both HELOCs and CES piggybacks are evident in almost all cases. The statistically significant coefficients range from about .115 (piggyback HELOCs in 2008) to .599 (piggyback CES in 2008). Such values mean that, in the respective years, the relative odds of a negative outcome was elevated by between 12 and 82 percent with the presence of piggyback second liens.

Two additional observations can be made from the graph. First, outcomes for CES-burdened first mortgages tended to be worse than for HELOC-burdened loans for most cohorts. This finding is consistent with prior research on the performance of second liens themselves: CES have tended to have greater mortgage delinquency rates than HELOCs.[22] The worse CES performance, perhaps a result of the more-limited payment flexibility that CES have relative to HELOCs, is particularly significant for loans originated in the early stages of the housing crisis. Second, the detrimental impact of second liens for both CES and HELOCs generally shrank with the 2009 and 2010 loan cohorts. For CES, after reaching a maximum of .599 in 2008, the coefficient fell to .392 in 2009 and became statistically indistinguishable from zero for 2010. For HELOCs, second liens were slightly detrimental to outcomes for 2009-originated mortgages, but had no discernible effect for 2008- and 2010-originated loans.

Figure 2 presents the relative effects of piggyback seconds under an alternative definition of "negative" outcomes. The alternative measure is less expansive, as it does not include as negative outcomes situations in which loans had 90-day delinquencies but did not terminate in an REO, short-sale, or a

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[21] Exp(0.7)=2.014
[22] See, Been, Jackson, and Willis, "Essay: Sticky Seconds—The Problems Second Liens Pose to the Resolution of Distressed Mortgages," New York University School of Law, Law and Economics Research Paper Series, Working Paper No. 12-21.

deed-in-lieu of foreclosure. Situations in which first liens were modified as a result of mortgage distress would generally not be counted under the definition used in Figure 2, whereas those cases would be included under the former definition (assuming a 90-day delinquency occurred while the borrower was in distress).

Under this alternative measure, Figure 2 reveals relatively similar results vis-à-vis Figure 1: piggyback second liens were still associated with worse outcomes. The only substantial difference, however, is that 2009 piggyback seconds under this alternative measure look relatively benign. That is, their impact on the likelihood of a negative outcome was not statistically different from zero. The absence of a material effect for these loans may be a function of the fact that only a small number of 2009-originated loans ultimately defaulted or were sold in short-sale situations. The small share makes it difficult to statistically discern any effects.

Unlike the models underlying Figures 1 and 2, the multinomial logit model associated with Figure 3 controls for the aggregate CLTV ratio (i.e., total mortgage-related debt divided by home value) and the total debt servicing payments *inclusive* of the second mortgage payment. In the terminology introduced earlier, it quantifies the extent to which a residual relationship exists between second liens and first-lien outcomes. The residual relationship, in other words, measures the relationship between second liens and outcomes *independent of the second mortgages' harmful effects of added debt and the added debt servicing.*

In general, the results in Figure 3 indicate little residual relationship between outcomes and the presence of piggyback seconds. Some outcome differences are present, however. During select years in the early part of the housing boom—2001-2002—the presence of piggyback seconds was associated with roughly a 16-35 percent increase in the relative odds of a negative outcome for first mortgages. In later years (2007-2010), by contrast, the opposite was true, at least for HELOCs; piggyback HELOCs were associated with decreases in the relative likelihood of a negative outcome.

While not shown in the figure, a variant of the model used in Figure 3 was estimated to test whether there were differences for piggyback seconds originated for the presumed purpose of avoiding mortgage insurance. In the variant model, the effect of piggyback seconds was allowed to differ in cases where the first lien's loan-to-value ratio was 80 percent.[23] The coefficients on the MI-avoiding piggyback seconds generally were quite similar to coefficients shown in Figure 3. Where there were differences, the coefficients tended to be slightly above those reflected in the figure (indicating that, relative to other second liens with otherwise-similar borrowers, such seconds may have been associated with slightly worse first-lien outcomes).

Figure 4 begins the analysis of the impact of *subsequent* second liens on loan outcomes. Just as in prior figures, Figure 4 shows the value of statistically significant coefficients on dummy variables signaling the presence of second liens, except in this case the second lien variables indicate the effects of *subsequent* seconds. The coefficients are shown separately for CES and HELOCs.

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[23] To account for rounding and other data nuances, first liens were flagged where the LTV ratio was between 79.5 percent and 80.5 percent.

The estimated coefficients reveal that, for most of the relevant period, second liens were associated with better first-lien performance. For subsequent HELOCs, for instance, statistically significant coefficients of between -0.08 and -0.79 were evident for first liens originated in the intervals of 1996-2002 and 2008-2010. These coefficients, which correspond to 8 to 55 percent reductions in the relative odds of a negative outcome, likely signal greater underwriting scrutiny when such loans were originated.

Interestingly, Figure 4 reveals a steady change in the effect of second liens as the housing boom accelerated in the late 1990s and early 2000s. By 2003, the presence of subsequent second liens was associated with worse outcomes holding other factors constant, an empirical phenomenon that existed through 2006. The coefficients are shown to be relatively large. The relative likelihood of a negative outcome for such loans was between 7 and 44 percent higher during those years.

As with the analysis of piggyback seconds, the robustness of the second lien-outcome relationship was checked against an alternative definition of "negative" outcomes. In particular, the multinomial logit was re-estimated with a dependent variable that did not classify 90-day-delinquencies episodes as negative outcomes. The coefficient estimates from the alternative model differed somewhat, but qualitatively the results were generally the same as in Figure 4.[24]

Figure 5 focuses attention on the relative magnitude of subsequent seconds. The effect of subsequent HELOCs and CES is allowed to differ for second liens of different sizes. The size of second liens is expressed as a fraction of the contemporary home value (i.e., the estimated home value at the time the second lien was originated). The coefficients are generally as expected: first liens burdened with larger CES and HELOCs were in most cases associated with worse outcomes than those burdened with smaller second lines. For years in which second-lien-burdened first mortgages tended to perform better than solo mortgages (1996-2001, 2008-2010), loans with smaller second liens performed particularly well. During the height of the housing boom—in the 2003-2006 period—second-lien-burdened mortgages performed poorly vis-à-vis solo loans, but those burdened by the largest second liens fared particularly poorly.

As with the modeling associated with Figure 3, the underlying model used in Figure 6 controls for the direct effects of second liens and presents their independent relationship with outcomes. In general, the figure indicates that the residual relationship between outcomes and subsequent seconds is positive; virtually all statistically significant coefficients are negative, meaning that the presence of subsequent seconds tended to be associated with relatively low likelihoods of defaults and other negative outcomes. Perhaps not surprisingly, extremely large negative coefficients are present for the 2008 and 2009 loan vintages. For loans originated in those years of the housing crisis, the data clearly

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[24] Under the assumption that borrowers having 90-day-delinquncies may not have been able to take out subsequent second liens, some endogeneity may exist between the original definition of negative outcomes and the presence of subsequent seconds. Such endogeneity generally would not exist where short-sale, REO, and deed-in-lieu outcomes comprise the entire set of negative outcomes.

suggest that only borrowers of extraordinary (unobservable) credit quality were able to obtain subsequent second liens.[25]

9. Second Liens and Prepayments

The impact of second liens on loan defaults is of primary importance in this paper, but an interesting by-product of estimating the multinomial logit model is that one can observe the association between second liens and prepayment likelihoods. Although little published research has been found on the topic, the extent to which the presence of second liens leads to reduced prepayment likelihoods has some policy relevance.[26] Second liens can act as a hurdle to borrower refinancing. Borrowers with second liens tend to have more debt and greater debt servicing payments, which may make it it difficult for them to qualify for new mortgages. Also, as discussed earlier, second lien holders can "hold up" refinances by virtue of the perceived requirement that their interests be resubordinated.

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[25] A number of additional analyses beyond those in this section can explore different dimensions of the relationship between second liens and mortgage outcomes. For brevity, the analyses are included only in the Appendix. Further research could be performed, however, that might evaluate nuances in the empirical results shown.

The first of two supplemental analyses—shown in Appendix 2a and 2b—explores the relationship between the outcomes and the time interval between the first and second liens. Thus far, empirical work has categorized second-lien-burdened mortgages into two groups: those burdened at the time of first-lien origination and those for which the second lien was originated sometime thereafter. A continuum of time exists, however, such that one can study the relationship between mortgage outcomes and the duration between first- and second-lien origination. Appendix 2a and 2b generally reveal that longer intervals between first- and second-lien origination are generally associated with lower odds of negative outcomes. This result is likely a function, in part, of survival bias: only those loans that have performed may be ultimately get burdened by subsequent second liens. Other factors may be at play, however.

Appendix 3 evaluates the extent to which house price trends prior to second-lien origination may be correlated with the impact of subsequent second liens. The effect of subsequent second liens is allowed to differ based on the degree of home price appreciation that occurred prior to the origination of the second lien. The second-lien effects are estimated separately for cases where the pre-second-lien appreciation was: less than 5 percent, 5-20 percent and more than 20 percent. To determine home price appreciation, the FHFA "all-transactions" house price index for the applicable metropolitan area—or state—has been used.

The estimates in Appendix 3 show that greater home price appreciation prior to the second lien was generally associated with better outcomes. This finding is generally consistent with the hypothesis that second liens originated in stronger markets may have had more benign effects. The interpretation of the results is not entirely straightforward, however. For example, for a given level of pre-origination appreciation, significant differences existed in the evolution of local home prices *after* the second-lien origination. That is--for loans with the same amount of pre-origination price increases, a variety of ultimate price outcomes occurred: some may have seen very large home price declines, while others may have experienced only modest declines or perhaps further price growth. The second-lien impact likely differs across the different types of post-origination price "paths." A deeper analysis would account for these differences as well as other factors.

[26] The extent to which second liens were associated with loan modifications is also an interesting topic, but is not addressed specifically in this paper. Given that the definition of "negative" outcomes in this paper has included loans that had a 90 day delinquency, many—if not most—of modified mortgages will have been flagged as having had negative outcomes. In the context of the multinomial logit, however, one could expand the number of model outcomes to include not just "negative" and "prepaid" possibilities, but also "modified" outcomes.

Figures 7-11 present estimates of prepayment-related coefficients in various multinomial logit models. As with the earlier analysis, the focal models allow the impact of second liens to be reflective of all direct effects (i.e., controls are not included for the overall CLTV ratio and the second-lien-inclusive debt payments). Results are also shown, however, for models that measure only the independent relationship between second liens and prepayment likelihood. Figures 7-9 report results for piggyback seconds, while Figures 10-11 show coefficients for subsequent seconds.

For the piggyback lien models (i.e., Figures 7-9), the prepayment effect of second liens is allowed to differ for HELOCs and CES that have a first-lien LTV ratio of 80 percent. As discussed earlier, because second liens were often viewed an inexpensive alternative to mortgage insurance during the relevant time frame, the borrowers who took out such loans may have been fundamentally different (perhaps more financially savvy) than others. It thus makes sense to allow the second-lien coefficient to differ for such borrowers.

For those models addressing the impact of subsequent seconds (Figures 10-11) the effects of subsequent seconds are allowed to be different for second liens of different sizes. As with the default-oriented models, "size" is categorized based on the relative amount of the lien vis-a-vis the underlying home value.

Six major observations can be derived from Figures 7-11. First, mortgages burdened by second liens were generally associated with lower prepayment propensities. The negative coefficients—corresponding to lower likelihoods of prepayment—were particularly large for mortgages originated between 1996 and 2002. Second, the lower likelihood of prepayment was robust to an alternative analysis window: if one looks at the relationship between second liens and prepayments in *the first four years after loan origination* (see Figure 8), the qualitative result is similar to the results when one looks at prepayments over the entire time frame. Third, the decreased likelihood of prepayment for second-lien burdened mortgages shrank during the housing boom. Indeed, some mortgage vintages (piggybacked first liens originated between 2003 and 2004) actually had a higher likelihood of prepayment than others. Fourth—the hypothesis of differing prepayment rates for second-lien borrowers seeking to avoid mortgage insurance is not borne out in the data; no consistent relationship exists between the coefficients for such borrowers and those of others. Fifth—it appears that there is a negative association between second liens and prepayments even if one controls for the direct effects of second liens. Figures 9 and 11 indicate that, irrespective of whether the burdening happened at the time of or after origination of after loan origination, lower likelihoods of prepayment are associated with such loans.

A sixth conclusion—that larger post-origination second liens tended to be associated with lower prepayment rates—can be drawn from Figure 10. The difference in prepayment likelihoods is particularly stark for HELOCs. Comparing the largest HELOCs to the smallest HELOC, for example, one finds that the coefficient difference often exceeded 0.3 (the "large HELOC" coefficient, was 0.3 points lower than for the "smallest HELOC" group). For CES, by contrast, the coefficient for the largest CES was frequently only 0.1-0.2 lower than for the smaller CES.

10. Second Liens and Household Credit: Outcomes

A more expansive view of the impact of second liens looks beyond just their relationship with mortgage outcomes. Credit bureau data can be used to study how second liens interacted with other types of credit and other household financial outcomes. Trends in credit scores, delinquency rates for non-mortgage credit, non-mortgage debt levels, and other variables can illuminate the impact of second mortgages on the overall household financial condition. With some limitations, available credit bureau data also can be used to understand the financial circumstances under which subsequent second liens were originated.

As discussed earlier, the underlying data source used in this paper incorporates annual snapshots of borrower credit statistics for a sample of mortgages guaranteed by the specific Enterprise.   For second liens, this means that credit bureau statistics are available for as long as the first lien was still active. For piggyback seconds, the evolution of credit statistics can generally be tracked from the time they and the first liens were originated through first-lien termination. For subsequent seconds, credit data are generally available for a period *before* they were originated.

While the focus of this section is to study how household credit outcomes evolved after second mortgages were originated, where available, some statistics are presented showing the pre-origination evolution of borrower outcomes. Following up on the brief analysis that was performed earlier in the paper, this analysis presents statistics pertinent to whether subsequent second liens acted as "lifelines" (i.e., were originated primarily in cases where the borrower was in financial difficulty). Because the data show little evidence that second liens acted as such, in general, the impact of second liens on financial outcomes can be assessed by analyzing the evolution in borrower credit outcomes after the second lien was originated.

Table 4 presents borrower credit statistics for five different types of first-lien mortgages: solo mortgages, those burdened by CES and HELOCs at the time of their origination, and those burdened by CES and HELOCs at some point after their origination. For each type of mortgage, the table shows how credit statistics differed three, six, and nine years after the second lien was originated. For subsequent seconds where data are available, household credit statistics are shown three years *before* the second mortgage origination.

The credit outcomes include usage-related statistics for nonmortgage debt and delinquencies-related data. With respect to the former—pre- and post-origination averages are shown for nonmortgage debt outstanding, the average nonmortgage credit limit, and the utilization rate for revolving credit. The time series of delinquencies-related outcomes includes the average FICO® Score and the average number of nonmortgage delinquencies.[29]

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[29] Some of the variables in the table are available both directly from the loan seller-servicer and from the Enterprises' credit bureau data. Because the table tracks the *evolution of credit statistics across time,* it is best to maintain consistency and to use the latter as a source for all data. Because the credit bureau data come from

Although they will be described as such, the underlying data used to construct Tables 4 and 5 are not, strictly speaking, "household" statistics.   Rather, the underlying data are aggregates for all borrowers associated with a given mortgage. For a loan with two co-borrowers, for instance, the nonmortgage debt outstanding is the total of the nonmortgage debt outstanding for the two. Likewise, the revolving debt utilization rate would be the total revolving debt for the two borrowers divided by their aggregate revolving credit limit.

Unlike the other statistics in Tables 4 and 5, the FICO® Score averages do not reference pooled data for all borrowers associated with a given loan. Rather, the FICO® Scores used are those of the *primary* borrower. Thus, for each mortgage type, Tables 4 and 5 show the evolution in the average FICO® Score for the primary borrowers.

To facilitate the tracking of the trends over time, the final five columns in the tables show the respective changes relative to period zero—i.e., the time the second lien was originated. For mortgages never burdened by second liens, the comparison period is the date upon which the first lien was originated. The differences are color-coded such that "worse" outcomes (e.g., increases in debt, utilization rates, and delinquency rates) are shown in darker shades of red. Benign or improving statistics are shown without any shading.

It should be noted that the final difference columns are not derived from the summary statistics in the first five columns. Rather, the difference columns show the average changes for borrowers for whom differences could be computed. This approach is much more appropriate given that data are not available in all periods for each household.[30]

In general, the results in Table 4 suggest very different post-origination trends for mortgages with piggyback second liens relative to those with subsequent second liens. Indeed, outcomes for households with piggyback seconds more closely resembled outcomes for solo mortgage households than for subsequent second lien households.

Household financial outcomes for borrowers with piggyback seconds were not generally as strong as outcomes for households with solo mortgages, but the results are somewhat mixed. FICO® Scores increased for the primary borrowers in both types of households, but the growth for solo mortgage households was greater. Six years after mortgage origination, primary borrowers with only one loan saw, on average, a 5.5 point increase in FICO® Scores. By contrast, those with piggyback seconds had average increases of between 1.0 and 1.1 points. After six years, revolving debt utilization rate had

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annual snapshots, this means that the "at-origination" data generally reflect values draw from March of the year following loan origination.

[30] To illustrate, one can look at nonmortgage debt outcomes for households with no second liens. The first column in Table 4 reveals that the average non-mortgage debt outstanding at mortgage origination was about $22,000, while the average nonmortgage debt three years later was close to $23,000. Rather than $1,000, the difference between those two averages, the "average change" shown in the sixth column is closer to $3,000.   This means that, for borrowers who did not prepay or default on their loans within the first three years (i.e., for whom a change could be calculated), the average growth was about $3,000. This figure is a more relevant to tracking borrower outcomes because it omits borrowers who dropped out of the data sample between the two time periods.

drifted upward for both solo and piggyback households, but the average increase was slightly smaller for solo mortgage households. The change in nonmortgage debt outstanding actually looks *better* for those with piggyback seconds. When measured six years after mortgage origination, the average change in total mortgage debt outstanding for households with piggyback seconds was between +$400 for households with CES and -$1,000 for households with HELOCs. By contrast, households with only one mortgage saw, on average, an increase of around $1,600 in nonmortgage debt outstanding.

Across several of the measures in Table 4, households with *subsequent* seconds had substantively different trends 3, 6 and 9 years after second lien origination than other households. For example, for mortgages with subsequent seconds, FICO® Scores tended to be lower at +3 years (i.e., three years after origination) and at +6 years and only rebounded to slightly above at-origination levels by +9 years. On the other hand, as indicated earlier, FICO® Scores tended to *increase* for borrowers with piggyback seconds and solo mortgages.

The relative growth in credit limits over time was particularly notable for those with subsequent seconds. Nine years after loan origination, households with subsequent seconds had grown their credit limits by more than $7,900. Households with piggyback seconds and with only one mortgage, by contrast, saw much different growth rates. Such households saw much smaller increases in their credit domain. For piggyback HELOCs, in fact, borrowers tended to have substantial declines in the cumulative credit limits. The average decline in their nonmortgage credit limits was almost $11,000.

In the context of *pre*-origination outcomes, consistent with data shown earlier in the paper, Table 4 provides little evidence supporting a theory that subsequent second liens tended to be used as "lifelines." The pre-origination empirical results are quite interesting, however, as they tend to suggest that subsequent seconds were taken out by borrowers who had significantly expanded their nonmortgage debt outstanding and their credit availability. Measured from three years prior to the time of second lien origination (i.e., "-3 years"), the average increase in nonmortgage debt was between $5,200 and $7,100. The average growth in the household's credit limit (for nonmortgage debt) over the same interval was more than $17,000. Meanwhile, although debt and credit limits were generally rising prior to loan origination, there were no signs of distress.   For borrowers with subsequent HELOCs, for instances, the average utilization rate was virtually unchanged between -3 years and loan origination. Also, FICO® Scores and nonmortgage delinquencies tended to improve in the three years prior to second lien origination.

Given the materially different *post*-origination outcomes for borrowers with subsequent seconds and given the relatively large amount of debt that borrowers took out during the housing boom, it is worthwhile to investigate whether the evolution in financial outcomes differed across second lien size. Focusing on borrowers with subsequent second liens, Table 5 analyzes whether household finances deteriorated more for borrowers with the largest subsequent seconds liens. The size of second liens is shown relative to the gross household income; second lien sizes are expressed as the number of months of gross income equivalent. For example, a borrower with a gross monthly income of $2,000 who took out a $10,000 second lien would be categorized as a borrower with a five-month lien (i.e., would be in the "6 months or less" category in the table).

Although they are simple summary statistics that do not control for all differences in household and loan characteristics, the comparative statistics shown in Table 5 suggest that households with larger subsequent seconds tended to see poorer trajectories for credit quality measures (FICO® Scores, nonmortgage delinquencies) than households with smaller second liens.   Borrowers with second liens with the largest balances (i.e., representing 12 months or more worth of gross income) experienced FICO® Score declines that averaged 10 points or more six and nine years after loan origination. Borrowers with smaller second liens saw smaller declines and, in some cases, actual increases.

Perhaps related to the declining creditworthiness of households with larger subsequent seconds, changes in nonmortgage debt outstanding and aggregate credit limits are much more modest for such households. Measured six and nine years after loan origination, the total amount of nonmortgage debt outstanding fell on average for borrowers with the largest second liens, but grew substantially for households with the smallest liens. The same qualitative result holds for credit limits: borrowers with smaller second liens tended to see relatively large increases in credit limits.

Table 5 suggests that households with larger second liens took out those liens in the process of vastly expanding their debt levels and credit availability, but such households may have run into difficulties after doing so.[31]   Those households showed no signs of significant stress when the second liens were originated (FICO® Scores grew and delinquencies fell on average prior to origination), to be sure, but decreases in nonmortgage debt outstanding and poorer post-origination FICO® Score trajectories imply that the new debt may have brought some households beyond a tipping point. When combined with prior growth in nonmortgage debt, the new financial stresses accompanying second liens meant that further expansion of nonmortgage debt may not have been practical for many households.

The results in Table 5 are aggregations across many different second lien cohorts. For example, pre- and post-origination trajectories for 1999-originated second liens are aggregated with those for 2000-originated second liens, 2001-originated second liens, and others. Given the vast changes in housing markets and the macroeconomy that occurred across time, a cohort-specific analysis—one that separately reports outcomes for second liens originated in different years—is enlightening. Figures 12 and 13 provide such detail. For subsequent second liens originated in different years, Figure 12 shows average pre- and post-origination changes in nonmortgage balances. Figure 13 shows average FICO® Score changes.

As with Tables 4 and 5, all changes are shown at relative to year 0. For instance, the "-3 Year" change reports the average change from three years prior to origination to the origination date.   (A negative value would mean that the statistic tended to grow just before loan origination).   Similarly, the "Year 3" change represents the difference between year 3 and year 0, with positive values corresponding to average growth after origination.

With respect to nonmortgage debt balances, Figure 12 shows stark differences for the various vintages of subsequent seconds. Second liens originated between about 1999 and 2003 saw large pre-

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[31] Pre-origination growth in nonmortgage debt and credit limits, for example, was particularly large for households with the largest second liens.

origination growth in nonmortgage balances and higher amounts of non-mortgage debt after origination. With later vintages, however, the graph shows less significant pre-origination growth and actual post-origination *declines* in nonmortgage balances. Households taking out subsequent second liens in 2007, for instance, saw their nonmortgage debt shrink by an average of more than $2,700 in the first six years after origination. Households with subsequent seconds originated between 1996 and 2003, by comparison, had nonmortgage growth of between $3,300 and $22,000 in the first six years after origination.

With respect to the trajectory of FICO® Scores, Figure 13 shows relatively consistent results for most vintages. The general FICO® Score trajectory involved pre-origination growth and post-origination declines. In other words, FICO® Scores tended to grow just before the origination of the second lien and fall immediately thereafter. The post-origination declines vary in magnitude and the extent to which the declines "rebounded" (i.e., get closer to at-origination levels over time), but the same general evolution tends to be reflected in the graph.

For those few vintages that saw post-origination FICO® Score growth (1996, 2002-2004), the figure shows very modest increases. The largest increase was for the 1996 vintage, which saw a nearly 10 point average FICO® gain between the time of origination and six years later. The 2002-2004 vintages saw much smaller increases, however, with average six-year FICO® Score improvements of only two to five points.

11. Discussion and Conclusion

Although no performance differences were evident for some years, the empirical analysis presented here has generally found that, consistent with the limited prior literature, piggyback second liens have been associated with higher likelihoods of mortgage default for the burdened first mortgages. The effects on performance have been found to be large—frequently involving a 40 percent or more increase in the relative odds of a negative outcome. Once one controls for the effect of second liens on net home equity and debt servicing requirements, however, little residual relationship exists between piggyback seconds and loan outcomes. That is—the presence of a piggyback second *in and of itself* is not associated with poor outcomes. This means that second liens that were originated for the purpose of mortgage insurance avoidance (and that did not add to the total indebtedness of household) generally had no material influence on outcomes for the associated first liens.

The empirical results for *subsequent* second liens are much more nuanced and, in many ways, more interesting than the piggyback results.   A gradual, but very pronounced time trend is evident for subsequent seconds.   Subsequently burdened first liens originated in the late 1990s showed relatively strong performance relative to other first liens, presumably because the presence of a second lien acts a strong positive signal: only borrowers with the best unobservable characteristics[32] were able to obtain second liens. The strength of that signal was very significant. The quality signal is so strong, in fact, that

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[32] "Unobservable" characteristics would be those not available to the mortgage performance model.

such borrowers actually had substantially better outcomes despite the fact that, in taking out second liens, they had taken on less home equity and more debt servicing. Subsequently burdened first mortgages originated between 1996 and 1999, for example, had roughly half the relative odds of a negative outcome vis-à-vis contemporary loans.

The model estimates clearly indicate that, over time, second liens signaled increasingly poor outcomes and, by 2003 mortgages subsequently burdened with seconds actually performed notably worse than other mortgages. The negative signal remained strong for a few years, at which point the nature of the signal abruptly shifted back to being positive (i.e., associated with lower probabilities of default) by 2008.

The large negative impact of subsequent seconds on outcomes for first liens originated at the height of the housing boom (2003-2007) is notable in scale. The estimates reported in Figures 4 and 5 are extremely large in light of the fact that the baseline mortgage delinquency rates were very large for first-liens originated for those years. The second-lien-associated increase in the relative odds of a negative outcome is in essence *multiplicative*, meaning that the increases have larger absolute effects for years in which defaults were generally high, in effect, magnifying mortgage risks. For instance, a second-lien coefficient of .4 (generally consistent with the coefficients in those years), would mean that if the odds of a negative outcome was 20 percent, the origination of a subsequent second lien would increase the predicted odds of a negative outcome to 30 percent.[33] A subsequent second lien, in such cases, increases the odds of a negative outcome by a full 10 percentage points. By contrast, if the baseline odds of a negative outcome had been lower—say five percent—then the same .4 coefficient would have had a much lower absolute effect.[34]

Once the large direct effects of second liens are identified and removed, the empirical results in this paper indicate that residual second lien effects (controlling for LTV and debt servicing obligations) are modest. The empirical work suggests that, once the controls are included, burdened mortgages had similar or better outcomes than solo mortgages . During the housing bust, better performance for mortgages with second liens is clearly evident, undoubtedly signaling that only borrowers with the best creditworthiness were able to obtain second liens under tightened underwriting standards. This finding, which reflects changes in unobservable borrower characteristics (i.e., borrower characteristics not controlled for in the statistical model but relevant to performance), is particularly striking when one looks at the largest second liens. The 2008 vintage of mortgages burdened with the largest second liens, for example, had extraordinarily low likelihoods of default—about one-tenth the expected level given borrower net equity, debt servicing obligations, and other factors.

By controlling for net home equity and debt servicing obligations when measuring the second lien effects, these estimates are reasonable, though imperfect measures of the impact of unobserved differences in borrower credit quality associated with the presence of a second lien. By contrast, the estimates that do not include the controls incorporate both the impact of systematic differences in

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[33] 29.8 percent = .20 * Exp(.4)

[34] The predicted odds of a negative outcome for a second-lien-burdened loan in this case would be about six percent, meaning that the second lien increased the odds of a negative outcome by one percentage point.

unobserved borrower quality as well as a treatment effect (i.e., the actual effect of second liens on outcomes). As a general matter, further analysis can make significant improvements to what has been done in this paper to disentangle the various effects. The included analysis of pre-second-lien trends in borrower credit provides some relevant information, to be sure. It seems, for example, that borrowers who took out subsequent seconds had small pre-origination improvements in their credit scores. Although such borrowers also had large increases in their nonmortgage debt levels, the data presented generally do not support a hypothesis that second lien borrowers were systematically in relative distress at the time they took out second liens. How such borrowers would have fared without the origination of their second liens, of course, is the key question, but is not possible to know for certain. Further research that involves more sophisticated techniques may provide better (though still-imperfect) estimates.

One contribution of this paper is its concurrent analysis of prepayment rates alongside the evaluation of mortgage defaults. It is clear from the data presented that prepayment propensities were much lower for mortgages burdened by second liens. To some extent, those findings may reflect refinancing difficulties that some borrowers may have encountered because of the presence of second liens. In some cases—where the borrower was in financial distress—those difficulties may have had a negative impact on owners of first liens. It is conceivable that, in some cases, loan defaults may have been forestalled or precluded had second liens not hindered loan refinancing. On the other hand, it should be recognized that slower prepayment speeds associated with second liens –all else equal—would be a positive attribute for first-lien holders. To be sure, the benefits of having slower prepayment rates is likely dwarfed by the costs associated with the added default risk brought about by the presence of a second lien. The slower prepayment speeds represent an interesting offsetting factor, however.

The overall harm caused to first mortgage holders by second liens is likely to be a function of how borrowers used their second lien proceeds. The use of funds for certain purposes may mitigate the increases in loan default risks. As mentioned earlier, the use of funds for making home improvements, for example, would increase home values and, in doing so, might offset a portion of the increase in loan default probability that would otherwise be associated with a second lien origination.

FHFA has recently acquired a license to use a historical dataset of historical property attributes for individual homes. The analysis of the data permits the identification of situations where borrowers used second lien proceeds to make certain home improvements. Cases where borrowers added bedrooms, bathrooms, or square footage to their properties, for example, are identifiable. Although well beyond the scope of this paper, a relevant analysis would compare loan outcomes in these cases to outcomes for borrowers who took on second liens but did not make tangible changes to properties.[35]

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[35] The underlying dataset, licensed from DataQuick Information Systems (now CoreLogic), includes information recorded at county assessor offices. County assessors typically only collect a small number of attributes for each property (e.g., number of bedrooms, number of bathrooms, lot square footage, etc.). Accordingly, the analysis of the impact of "home improvements" will necessarily be constrained to analyzing situations where there was a change in one of the variables tracked at county assessor offices.

Although data constraints will hamper any analysis of how second lien proceeds have been used, to the extent that such assessments can measure the differences in relative mortgage default risks associated with different uses of second lien proceeds, those assessments will be useful for policy and regulatory purposes. Currently, the breadth of second-lien-related policy proposals under public debate is extensive. Nuanced, detailed statistics on second lien effects can inform regulatory and legislative initiatives and therefore produce better outcomes.

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Table 1a: Characteristics of First-Liens: By Origination Year and Number of Associated Second Liens

Origination Year for First Lien	% with Piggyback Seconds	% with Subs. Seconds	Average Original Balance of First Lien			Average Original FICO® Score			Average Original CLTV			% Originated in California		
			No Second	Piggyback Second	Subseq. Second	No Second	Piggyback Second	Subseq. Second	No Second	Piggyback Second	Subseq. Second	No Second	Piggyback Second	Subseq. Second
1996	1.2%	6.1%	$104,609	$98,269	$91,246	724	715	719	76%	72%	72%	13%	14%	10%
1997	1.3%	6.0%	$110,067	$102,988	$96,147	727	725	719	75%	74%	73%	13%	13%	10%
1998	1.5%	10.9%	$117,215	$115,901	$109,249	738	734	732	73%	71%	71%	13%	13%	11%
1999	2.0%	8.6%	$120,350	$122,825	$112,212	731	725	726	75%	75%	72%	13%	13%	11%
2000	2.1%	3.0%	$126,060	$123,849	$106,051	718	715	705	77%	79%	75%	13%	12%	10%
2001	3.9%	8.1%	$138,849	$151,410	$127,798	725	726	722	73%	76%	72%	14%	16%	13%
2002	6.3%	12.8%	$143,439	$154,410	$140,192	726	730	729	71%	75%	69%	16%	15%	13%
2003	8.8%	22.5%	$143,768	$164,492	$157,284	731	733	731	68%	77%	69%	16%	16%	17%
2004	14.1%	18.1%	$148,983	$173,332	$166,697	720	731	721	72%	80%	72%	13%	13%	16%
2005	17.3%	15.0%	$161,974	$192,278	$183,423	717	727	716	73%	81%	73%	10%	10%	12%
2006	21.4%	8.0%	$170,009	$203,909	$192,565	707	718	708	76%	85%	74%	8%	9%	10%
2007	18.4%	3.7%	$182,419	$222,265	$194,505	699	720	713	79%	84%	75%	8%	11%	8%
2008	9.3%	2.7%	$194,826	$259,395	$190,149	732	746	738	73%	74%	68%	13%	14%	7%
2009	5.7%	4.2%	$202,957	$263,182	$201,122	764	766	763	67%	69%	64%	15%	14%	9%
2010	4.9%	2.6%	$201,196	$256,307	$196,544	765	765	762	68%	70%	64%	16%	13%	9%
2011	3.8%	1.6%	$188,900	$247,346	$189,659	760	763	756	70%	70%	65%	16%	11%	8%
2012	3.5%	0.9%	$197,342	$257,173	$225,755	760	766	764	73%	71%	69%	16%	12%	13%
2013	1.7%	0.0%	$196,268	$245,100		756	764		72%	72%		19%	9%	

* Source: FHFA. As discussed in the text, the underlying dataset is a one-in-five random sample of Enterprise originations.

Table 1b: Geographic Distribution of Loans in Enterprise Random Sample

Representation of Select States in Data Sample (by Loan Count): 1996-2013

	Select High-Representation States						Select Low-Representation States					
Origination Year for First Lien	California	Florida	Texas	Michigan	Illinois	Five State (%)	South Dakota	Wyoming	West Virginia	D.C.	North Dakota	Five State (%)
1996	13%	7%	6%	5%	5%	35%	0.2%	0.2%	0.2%	0.1%	0.1%	0.9%
1997	13%	6%	6%	5%	5%	35%	0.2%	0.2%	0.2%	0.2%	0.1%	0.9%
1998	13%	6%	5%	6%	5%	34%	0.2%	0.2%	0.2%	0.1%	0.1%	0.9%
1999	12%	6%	5%	6%	5%	34%	0.2%	0.2%	0.2%	0.2%	0.1%	0.9%
2000	13%	8%	6%	5%	4%	36%	0.2%	0.2%	0.3%	0.2%	0.1%	0.9%
2001	14%	6%	4%	5%	5%	36%	0.2%	0.2%	0.2%	0.1%	0.1%	0.8%
2002	16%	7%	4%	5%	5%	37%	0.2%	0.2%	0.2%	0.2%	0.1%	0.8%
2003	16%	7%	4%	5%	5%	37%	0.2%	0.2%	0.2%	0.2%	0.1%	0.9%
2004	14%	8%	5%	4%	5%	36%	0.2%	0.2%	0.3%	0.2%	0.1%	1.0%
2005	12%	9%	5%	3%	4%	34%	0.2%	0.2%	0.3%	0.2%	0.1%	1.0%
2006	10%	9%	6%	3%	4%	33%	0.2%	0.2%	0.4%	0.2%	0.1%	1.1%
2007	10%	8%	7%	3%	5%	32%	0.2%	0.2%	0.3%	0.2%	0.1%	1.2%
2008	13%	6%	7%	2%	5%	33%	0.3%	0.3%	0.3%	0.3%	0.1%	1.3%
2009	15%	3%	6%	2%	5%	32%	0.3%	0.3%	0.3%	0.3%	0.2%	1.4%
2010	16%	4%	6%	3%	5%	33%	0.3%	0.2%	0.3%	0.3%	0.2%	1.3%
2011	16%	4%	7%	3%	5%	35%	0.3%	0.2%	0.2%	0.3%	0.2%	1.3%
2012	17%	4%	6%	3%	5%	36%	0.3%	0.2%	0.2%	0.3%	0.2%	1.3%
2013	19%	4%	5%	4%	5%	37%	0.4%	0.3%	0.3%	0.3%	0.2%	1.4%

* Source: FHFA. As discussed in the text, the underlying dataset is a one-in-five random sample of Enterprise originations.

Table 2: Outcomes for First-Liens--By Origination Year and Number of Associated Second Liens

Origination Year for First Lien	% with Piggyback Seconds	% with Subs. Seconds	Proportion of Negative Outcomes (Any D90, Short-Sale, Foreclosure)			Fraction Prepaid		
			One Loan	Piggyback Second	Subseq. Second	One Loan	Piggyback Second	Subseq. Second
1996	1.2%	6.1%	4%	6%	7%	94%	92%	87%
1997	1.3%	6.0%	3%	6%	6%	95%	92%	88%
1998	1.5%	10.9%	2%	4%	4%	95%	92%	88%
1999	2.0%	8.6%	3%	6%	6%	94%	89%	85%
2000	2.1%	3.0%	4%	8%	11%	94%	89%	80%
2001	3.9%	8.1%	4%	5%	7%	93%	91%	80%
2002	6.3%	12.8%	4%	5%	7%	89%	88%	75%
2003	8.8%	22.5%	5%	5%	8%	79%	82%	69%
2004	14.1%	18.1%	9%	7%	13%	72%	77%	62%
2005	17.3%	15.0%	15%	15%	22%	63%	65%	54%
2006	21.4%	8.0%	24%	27%	30%	58%	58%	52%
2007	18.4%	3.7%	30%	29%	25%	52%	56%	55%
2008	9.3%	2.7%	13%	10%	8%	66%	74%	66%
2009	5.7%	4.2%	2%	2%	1%	54%	65%	53%
2010	4.9%	2.6%	1%	1%	1%	37%	46%	35%
2011	3.8%	1.6%	1%	0%	1%	23%	28%	19%
2012	3.5%	0.9%	1%	0%	0%	4%	4%	5%
2013	1.7%	0.0%	0%	0%		1%	1%	

* Source: FHFA. As discussed in the text, the underlying dataset is a one-in-five random sample of Enterprise originations.

Table 3: Summary Statistics for Second Mortgages--By Type and Origination Year

Origination Year for **Second** Lien	Average Size of Second Lien		Average Size of Second Lien as % of Contemporary Home Value		Average FICO® Score at Second Lien Origination		Which Loans are Being Burdened with Subsequent Second Liens?	
	Piggyback Second	Subseq. Second	Piggyback Second	Subseq. Second	Piggyback Second	Subseq. Second	Average Difference between FICO at Second Origination and current FICO scores for other loans of the same first mortgage vintage (Negative values=borrowers taking seconds had below-average FICOs)	Average Change in Borrower FICO: Second Lien Origination vs. First Lien Origination (Negative values=borrowers taking seconds saw FICO declines prior to second lien origination)
1996	$23,798	$15,342	19%	11%	713	714	-13	0
1997	$17,279	$17,806	13%	14%	723	712	-14	1
1998	$18,364	$18,623	12%	14%	734	725	-9	0
1999	$20,613	$20,324	13%	13%	730	725	-9	2
2000	$20,480	$23,851	13%	15%	716	725	-8	6
2001	$23,555	$26,804	11%	15%	724	728	-2	5
2002	$23,330	$28,827	11%	15%	730	726	0	4
2003	$25,240	$30,287	11%	14%	736	729	1	1
2004	$27,668	$34,780	12%	14%	731	727	-4	2
2005	$29,400	$39,652	12%	14%	734	727	2	5
2006	$34,391	$40,781	13%	14%	727	722	1	6
2007	$38,450	$39,662	13%	14%	722	725	7	7
2008	$49,210	$36,969	12%	14%	740	738	20	8
2009	$39,094	$29,033	8%	12%	764	751	21	4
2010	$35,847	$28,522	8%	12%	761	754	12	6
2011	$33,653	$29,514	8%	12%	760	755	7	3
2012	$34,727	$31,454	8%	12%	766	758	5	4
2013	$38,927	$28,350	9%	11%	764	754	3	3

* Source: FHFA. As discussed in the text, the underlying dataset is a one-in-five random sample of Enterprise originations.

Table 4: Did Post-Origination Credit Patterns Look Different for Different Types of Borrowers
Evolution of Credit Characteristics

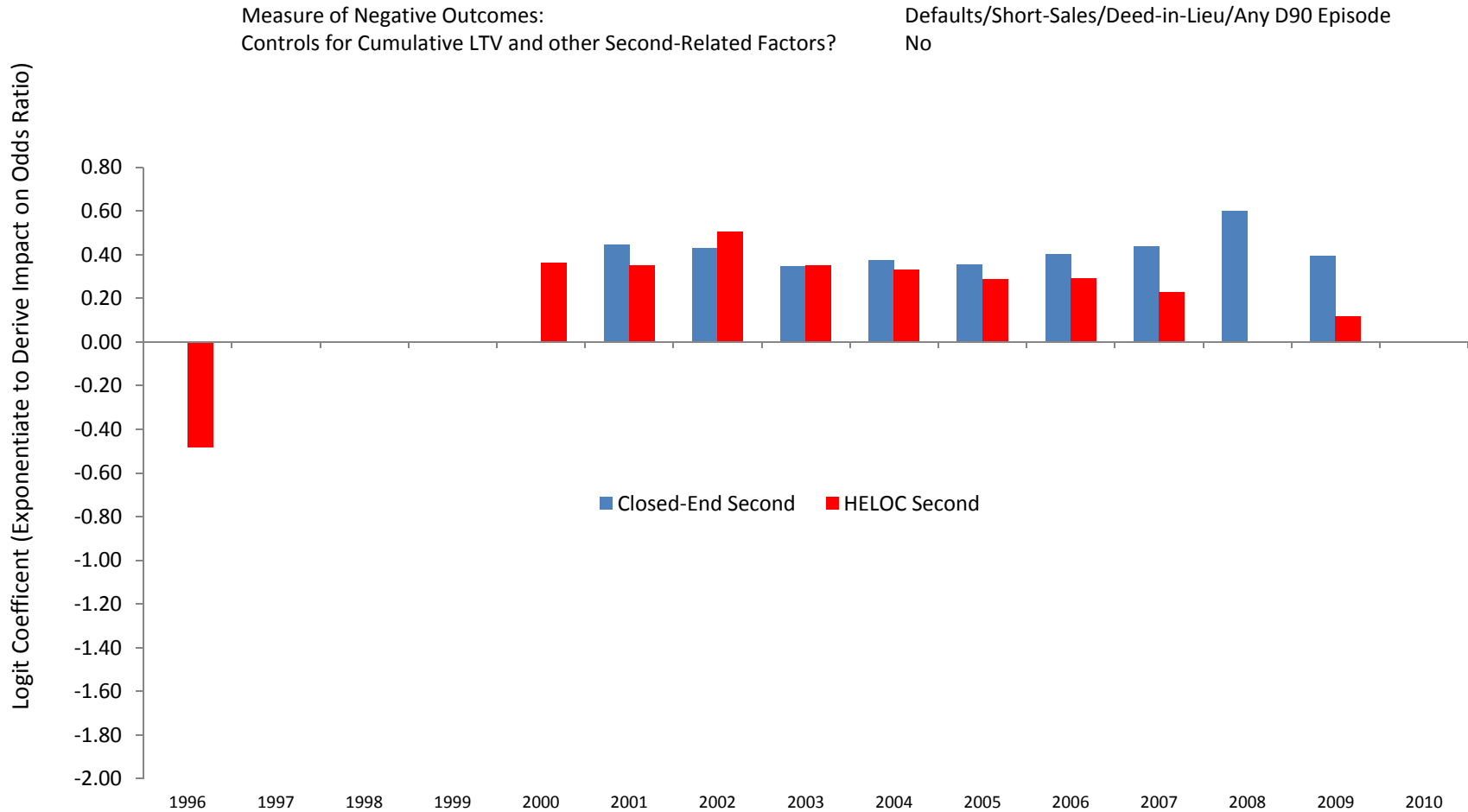|	Average for Active Loans					Avg. Change (vs. Year 0): Nonmissing Values				
	One Loan	Closed (Piggy.)	Closed (Subs.)	HELOC (Piggy.)	HELOC (Subs.)	One Loan	Closed (Piggy.)	Closed (Subs.)	HELOC (Piggy.)	HELOC (Subs.)
Average Non-Mortgage Debt										
3 Years Before			$27,256		$23,848			($7,148)		($5,207)
At Orig. of Second Lien	$23,986	$34,336	$32,097	$28,822	$27,211					
2nd Orig + 3yrs	$24,782	$35,400	$34,942	$28,593	$29,662	$2,266	$1,691	$2,663	$356	$2,124
2nd Orig + 6yrs	$22,842	$31,636	$33,355	$26,094	$28,776	$1,583	$385	$1,066	($959)	$836
2nd Orig + 9yrs	$20,648	$27,704	$31,043	$23,356	$27,002	$930	$348	$3,158	($1,832)	$3,172
Average Revolving Debt Utilization Rate										
3 Years Before			36%		20%			8%		0%
At Orig. of Second Lien	21%	27%	29%	21%	21%					
2nd Orig + 3yrs	21%	28%	31%	27%	22%	1%	3%	2%	7%	2%
2nd Orig + 6yrs	19%	27%	32%	23%	24%	1%	2%	2%	3%	3%
2nd Orig + 9yrs	18%	25%	30%	21%	23%	-1%	0%	0%	1%	3%
Average Credit Limit--NonMtg Debt										
3 Years Before			$69,021		$74,220			($17,508)		($15,472)
At Orig. of Second Lien	$67,218	$78,710	$73,859	$82,164	$77,197					
2nd Orig + 3yrs	$69,822	$80,381	$81,612	$80,314	$85,439	$4,472	$770	$6,128	($3,405)	$6,683
2nd Orig + 6yrs	$67,344	$74,421	$75,627	$73,712	$78,673	$2,828	($796)	$976	($9,043)	$69
2nd Orig + 9yrs	$63,814	$69,356	$71,758	$68,246	$75,112	$3,584	$1,504	$9,653	($10,775)	$7,917
Average Contemporaneous FICO® Score (First Borrower)										
3 Years Before			721.7		743.9			(2.8)		(6.5)
At Orig. of Second Lien	731.6	715.6	713.7	736.3	738.3					
2nd Orig + 3yrs	736.4	719.4	709.5	739.0	738.2	1.5	(2.0)	(6.4)	(1.1)	(0.3)
2nd Orig + 6yrs	741.1	722.0	708.2	741.6	734.0	5.5	1.0	(5.9)	1.1	(2.3)
2nd Orig + 9yrs	745.4	726.1	710.3	742.7	735.6	9.2	7.2	2.7	2.6	1.2
Average Number of 30+ DQs--Non-mortgage										
3 Years Before			0.13		0.07			(0.05)		(0.01)
At Orig. of Second Lien	0.10	0.12	0.17	0.07	0.10					
2nd Orig + 3yrs	0.17	0.24	0.28	0.16	0.14	0.08	0.15	0.12	0.10	0.05
2nd Orig + 6yrs	0.22	0.32	0.42	0.19	0.23	0.13	0.22	0.21	0.13	0.12
2nd Orig + 9yrs	0.22	0.35	0.44	0.21	0.22	0.15	0.26	0.02	0.15	(0.00)

Table 5: Did Post-Origination Credit Patterns Look Different for Borrowers with Subsequent Seconds of Different Sizes (Size Measured in Months of Income)

Evolution of Credit Characteristics

	Average for Active Loans					Avg. Change (vs. Year 0): Nonmissing Values				
	No Post-Orig 2nds	6 mos. or less	6.01 mos.- 12 mos.	12.01 mos.- 18 mos.	>18 mos.	No Post-Orig 2nds	6 mos. or less	6.01 mos.- 12 mos.	12.01 mos.- 18 mos.	>18 mos.
Average Non-Mortgage Debt										
3 Years Before	$18,684	$23,959	$26,958	$28,101	$27,476		($3,614)	($8,301)	($10,311)	($12,215)
At Orig. of Second Lien	$24,416	$26,616	$32,199	$35,152	$37,014					
2nd Orig + 3yrs	$25,234	$30,200	$34,531	$35,733	$35,537	$2,116	$3,548	$1,621	($754)	($2,662)
2nd Orig + 6yrs	$23,240	$29,558	$33,281	$33,483	$32,447	$1,311	$2,914	($183)	($3,852)	($5,757)
2nd Orig + 9yrs	$20,873	$28,092	$30,727	$30,042	$29,137	$782	$4,501	$2,033	($480)	($1,112)
Average Revolving Debt Utilization Rate										
3 Years Before	13%	20%	26%	51%	23%		0%	-1%	24%	-2%
At Orig. of Second Lien	21%	22%	28%	28%	25%					
2nd Orig + 3yrs	21%	23%	30%	30%	27%	1%	2%	2%	2%	3%
2nd Orig + 6yrs	20%	24%	32%	32%	29%	1%	3%	3%	4%	5%
2nd Orig + 9yrs	18%	24%	30%	29%	26%	-1%	2%	2%	3%	4%
Average Credit Limit--NonMtg Debt										
3 Years Before	$72,942	$72,742	$72,388	$74,607	$75,786		($13,807)	($19,029)	($21,070)	($22,859)
At Orig. of Second Lien	$68,359	$73,939	$77,975	$83,700	$89,949					
2nd Orig + 3yrs	$71,033	$84,592	$84,495	$86,681	$88,865	$3,946	$9,540	$4,133	($435)	($3,923)
2nd Orig + 6yrs	$68,215	$79,666	$77,056	$76,680	$77,093	$1,766	$5,317	($3,461)	($11,351)	($15,737)
2nd Orig + 9yrs	$64,351	$76,067	$72,008	$71,938	$72,808	$2,853	$11,680	$3,348	($2,558)	($3,914)
Average Contemporaneous FICO® Score (First Borrower)										
3 Years Before	760.9	741.3	728.5	728.4	731.6		(6.9)	(3.4)	(2.9)	(4.6)
At Orig. of Second Lien	731.9	734.4	720.9	722.6	730.8					
2nd Orig + 3yrs	736.7	735.9	716.3	714.9	720.2	1.2	1.2	(5.5)	(9.3)	(11.5)
2nd Orig + 6yrs	741.1	734.0	711.5	708.5	712.8	5.0	1.6	(8.6)	(14.4)	(17.3)
2nd Orig + 9yrs	745.3	734.5	711.9	711.8	718.7	8.8	4.7	(4.5)	(10.0)	(10.0)
Average Number of 30+ DQs--Non-mortgage										
3 Years Before	0.04	0.09	0.09	0.08	0.07		(0.01)	(0.03)	(0.03)	(0.03)
At Orig. of Second Lien	0.10	0.12	0.14	0.13	0.11					
2nd Orig + 3yrs	0.17	0.15	0.22	0.23	0.22	0.08	0.04	0.10	0.13	0.13
2nd Orig + 6yrs	0.22	0.23	0.35	0.38	0.34	0.13	0.10	0.19	0.24	0.22
2nd Orig + 9yrs	0.22	0.24	0.37	0.38	0.32	0.15	0.00	0.00	(0.00)	(0.00)

Figure 1: Did Mortgages with Second Liens have Worse Outcomes than Other Mortgages?

Impact of Having a <u>Piggyback</u> Second Lien on the Likelihood of Having a Negative Outcome

Measure of Negative Outcomes:	Defaults/Short-Sales/Deed-in-Lieu/Any D90 Episode
Controls for Cumulative LTV and other Second-Related Factors?	No

Figures are coefficient estimates for simultaneous second Indicator variables in multinomial logit models specified in the text. The model is estimated separately for each loan origination year. Statistically insignificant coefficients are not shown.

Figure 2: Did Mortgages with Second Liens have Worse Outcomes than Other Mortgages?

Impact of Having a <u>Piggyback</u> Second Lien on the Likelihood of Having a Negative Outcome

Measure of Negative Outcomes:	Defaults/Short-Sales/Deed-in-Lieu
Controls for Cumulative LTV and other Second-Related Factors?	No
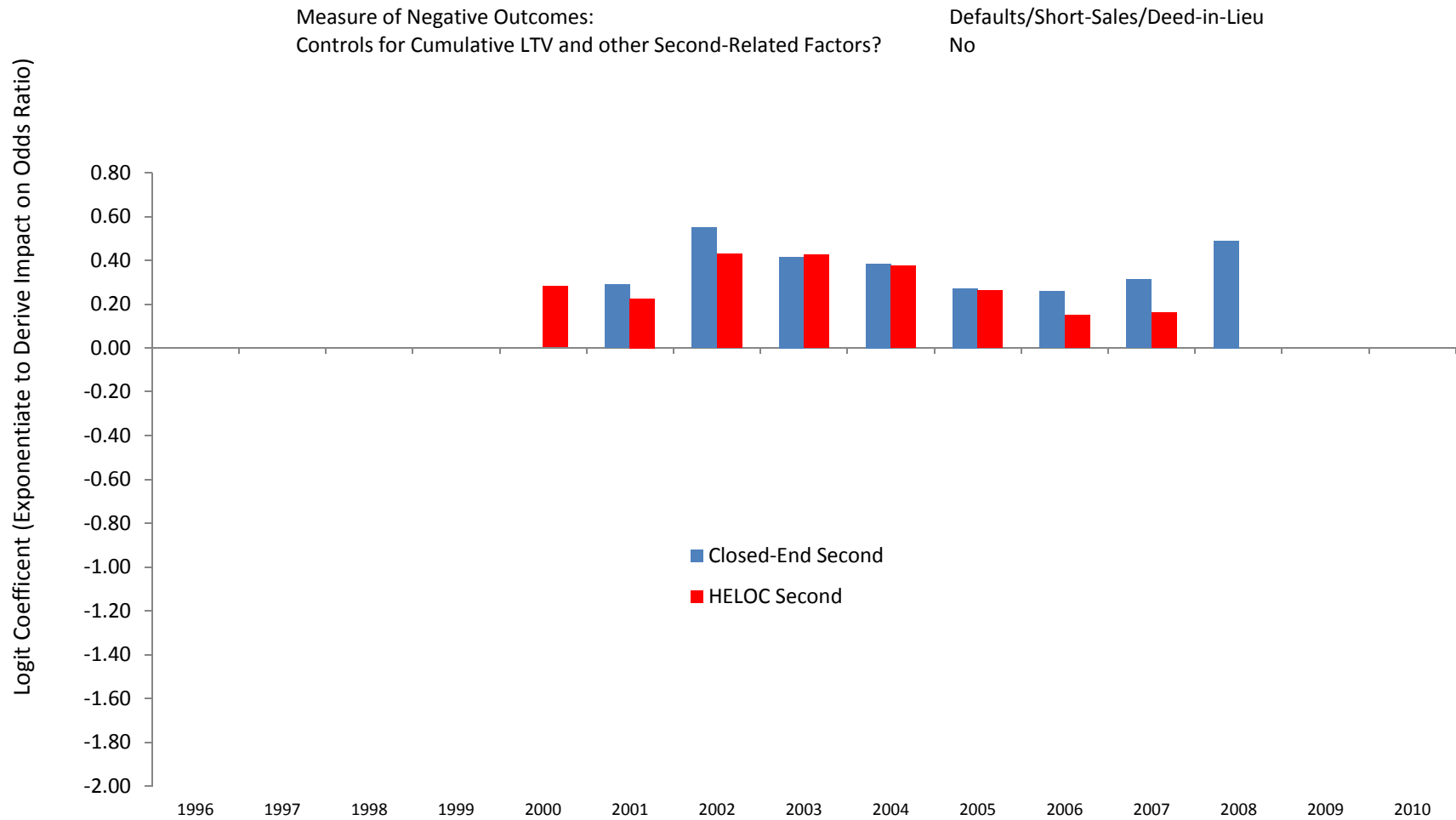
Figures are coefficient estimates for simultaneous second Indicator variables in multinomial logit models specified in the text. The model is estimated separately for each loan origination year. Statistically insignificant coefficients are not shown.

Figure 3: Did Mortgages with Second Liens have Worse Outcomes than Other Mortgages?

Impact of Having <u>Piggyback</u> Second Lien on the Likelihood of Having a Negative Outcome

Measure of Negative Outcomes:	Defaults/Short-Sales/Deed-in-Lieu/Any D90 Episode
Controls for Cumulative LTV and other Second-Related Factors?	**YES**

Figures are coefficient estimates for simultaneous second Indicator variables in multinomial logit models specified in the text. The model is estimated separately for each loan origination year. Statistically insignificant coefficients are not shown.

Figure 4: Did Mortgages with Second Liens have Worse Outcomes than Other Mortgages?

Impact of Having a <u>Subsequent</u> Second Lien on the Likelihood of Having a Negative Outcome

Measure of Negative Outcomes: Defaults/Short-Sales/Deed-in-Lieu/Any D90 Episode
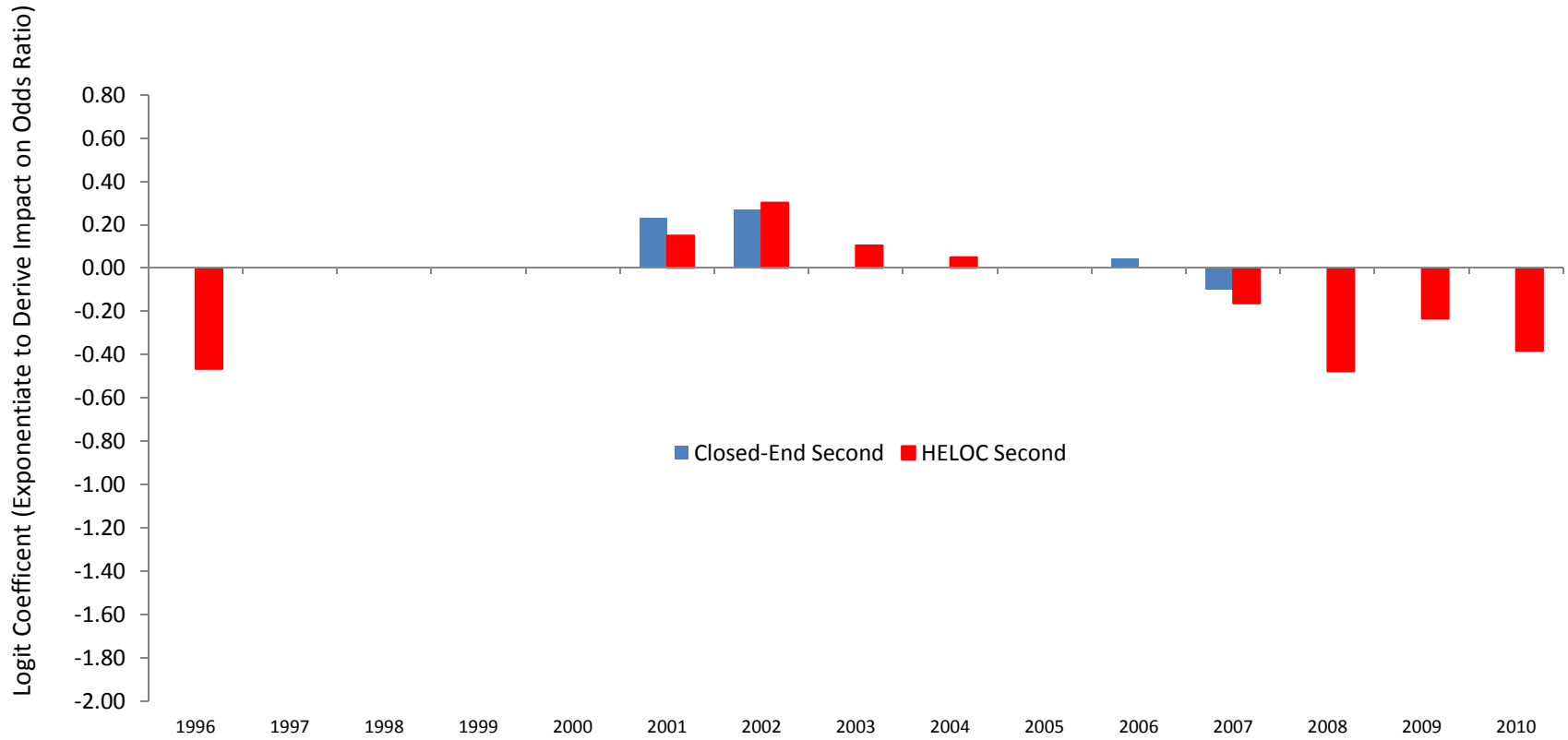Controls for Cumulative LTV and other Second-Related Factors?   No

Figures are coefficient estimates for simultaneous second Indicator variables in multinomial logit models specified in the text. The model is estimated separately for each loan origination year. Statistically insignificant coefficients are not shown.

Figure 5: Did Mortgages with Second Liens have Worse Outcomes than Other Mortgages?

Impact of Having a <u>Subsequent</u> Second Lien on the Likelihood of Having a Negative Outcome

Measure of Bad Outcomes:	Defaults/Short-Sales/Deed-in-Lieu/Any D90 Episode
Controls for Cumulative LTV and other Second-Related Factors?	No

■ Subsequent CES (Second Amount<=10% of PropVal)
■ Subsequent CES (10%<Second Amount<=20% of PropVal)
■ Subsequent CES (Second Amount>20% of PropVal)
■ Subsequent HELOC (Second Amount<=10% of PropVal)
■ Subsequent HELOC (10%<Second Amount<=20% of PropVal)
■ Subsequent HELOC (Second Amount>20% of PropVal)

Figures are coefficient estimates for second lien indicator variables in multinomial logit models specified in the text. The model is estimated separately for each loan origination year. Statistically insignificant coefficients are not shown.

Figure 6: Did Mortgages with Second Liens have Worse Outcomes than Other Mortgages?

Impact of Having a <u>Subsequent</u> Second Lien on the Likelihood of Having a Negative Outcome

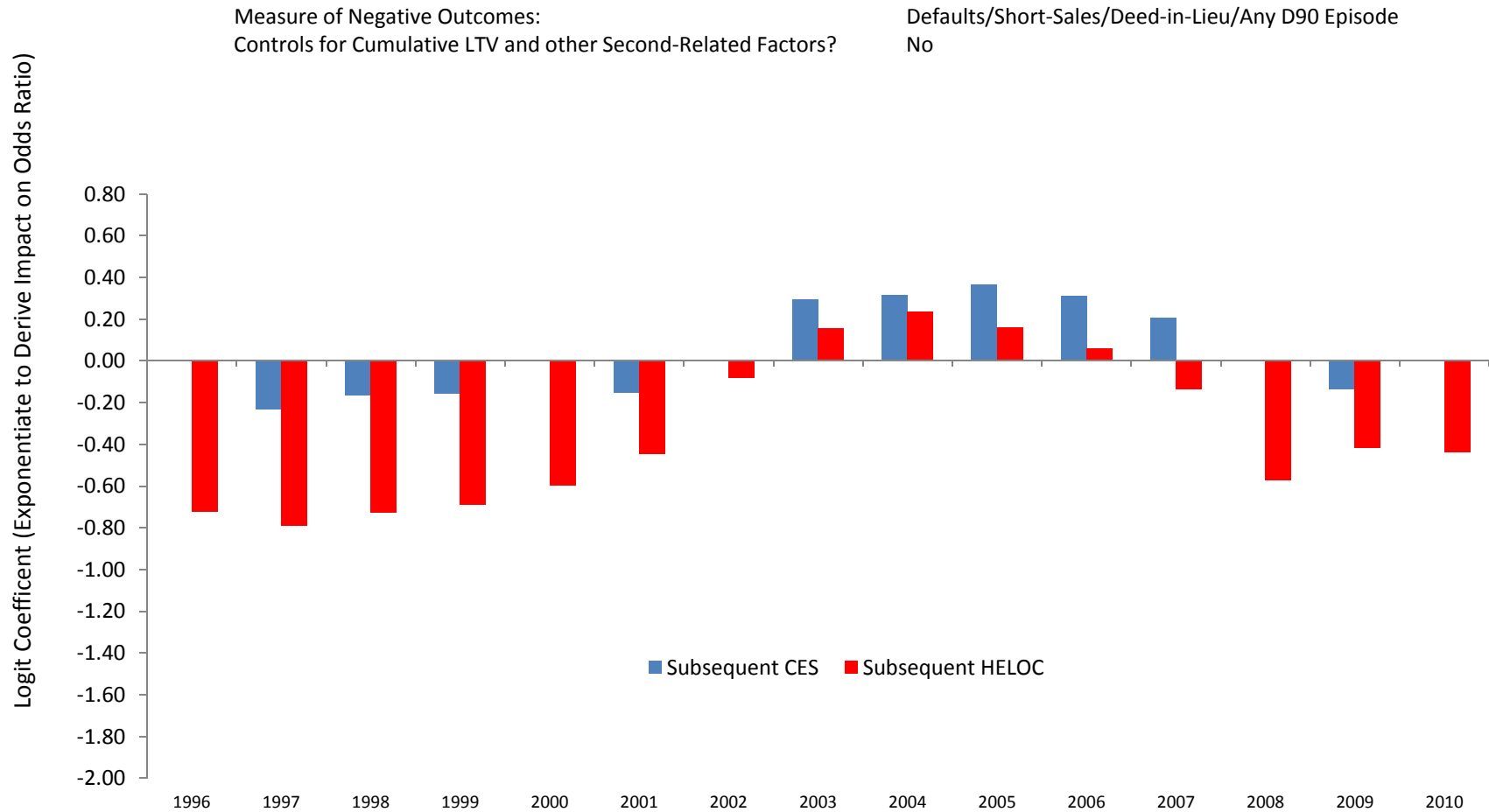Measure of Bad Outcomes: Defaults/Short-Sales/Deed-in-Lieu/Any D90 Episode
Controls for Cumulative LTV and other Second-Related Factors?   **Yes**

■ Subsequent CES (Second Amount<=10% of PropVal)
■ Subsequent CES (10%<Second Amount<=20% of PropVal)
■ Subsequent CES (Second Amount>20% of PropVal)
■ Subsequent HELOC (Second Amount<=10% of PropVal)
■ Subsequent HELOC (10%<Second Amount<=20% of PropVal)
■ Subsequent HELOC (Second Amount>20% of PropVal)

Figures are coefficient estimates for second lien indicator variables in multinomial logit models specified in text. The model is estimated separately for each loan origination year. Statistically insignificant coefficients are not shown.
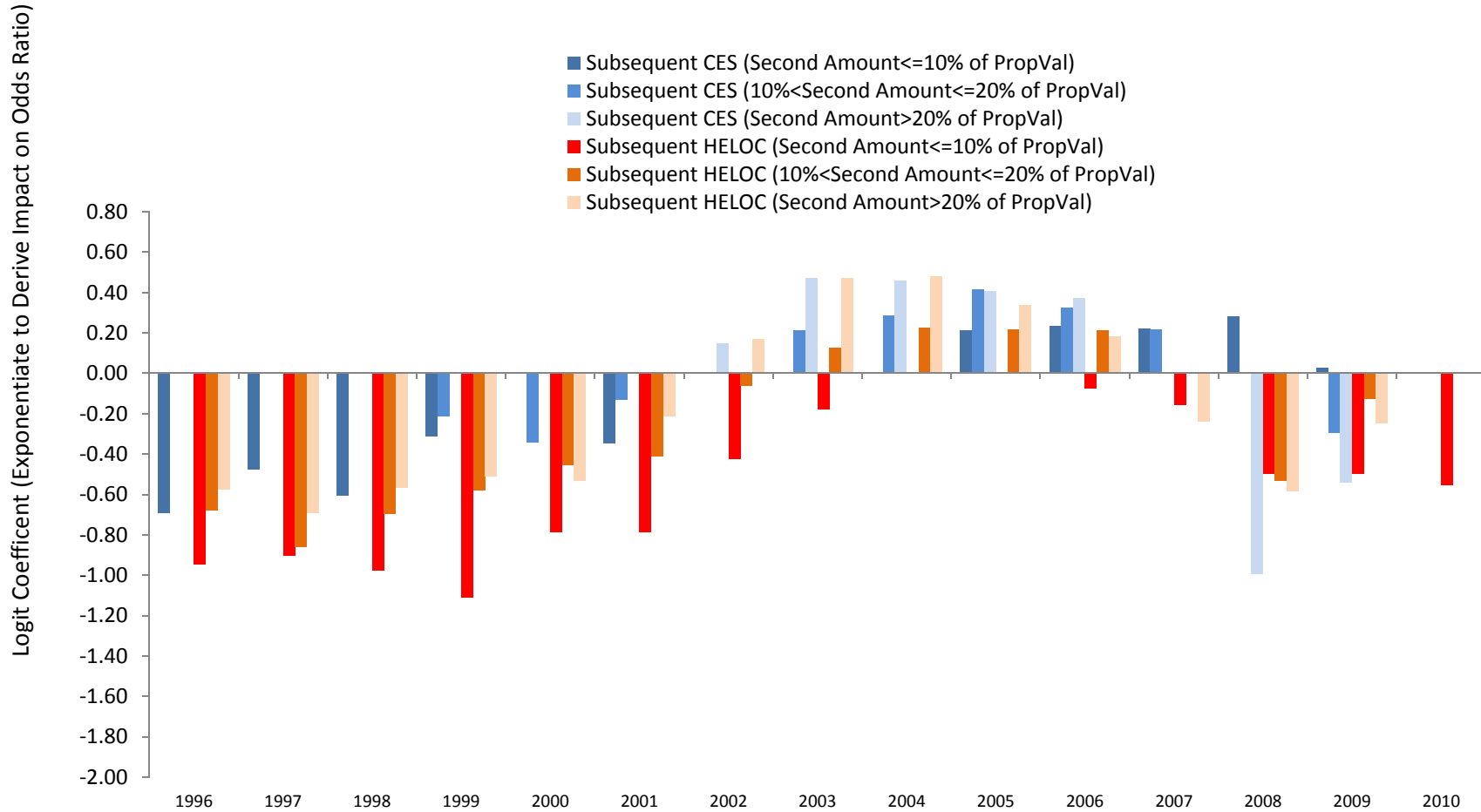
Figure 7: Did Mortgages with Simultaneous Seconds <u>Prepay</u> More/Less Readily than Other Mortgages?

Impact of Having <u>Simultaneous</u> Second on Likelihood of Having "Prepay" Outcome

Prepayment Window: Ever
Controls for Cumulative LTV and other Second-Related Factors?   No

Legend:
- ■ Closed-End Second (LTV of First ^=80)
- ▨ Closed-End Second (LTV of First=80)
- ■ HELOC Second (LTV First ^=80)
- ▨ HELOC Second (LTV First =80)

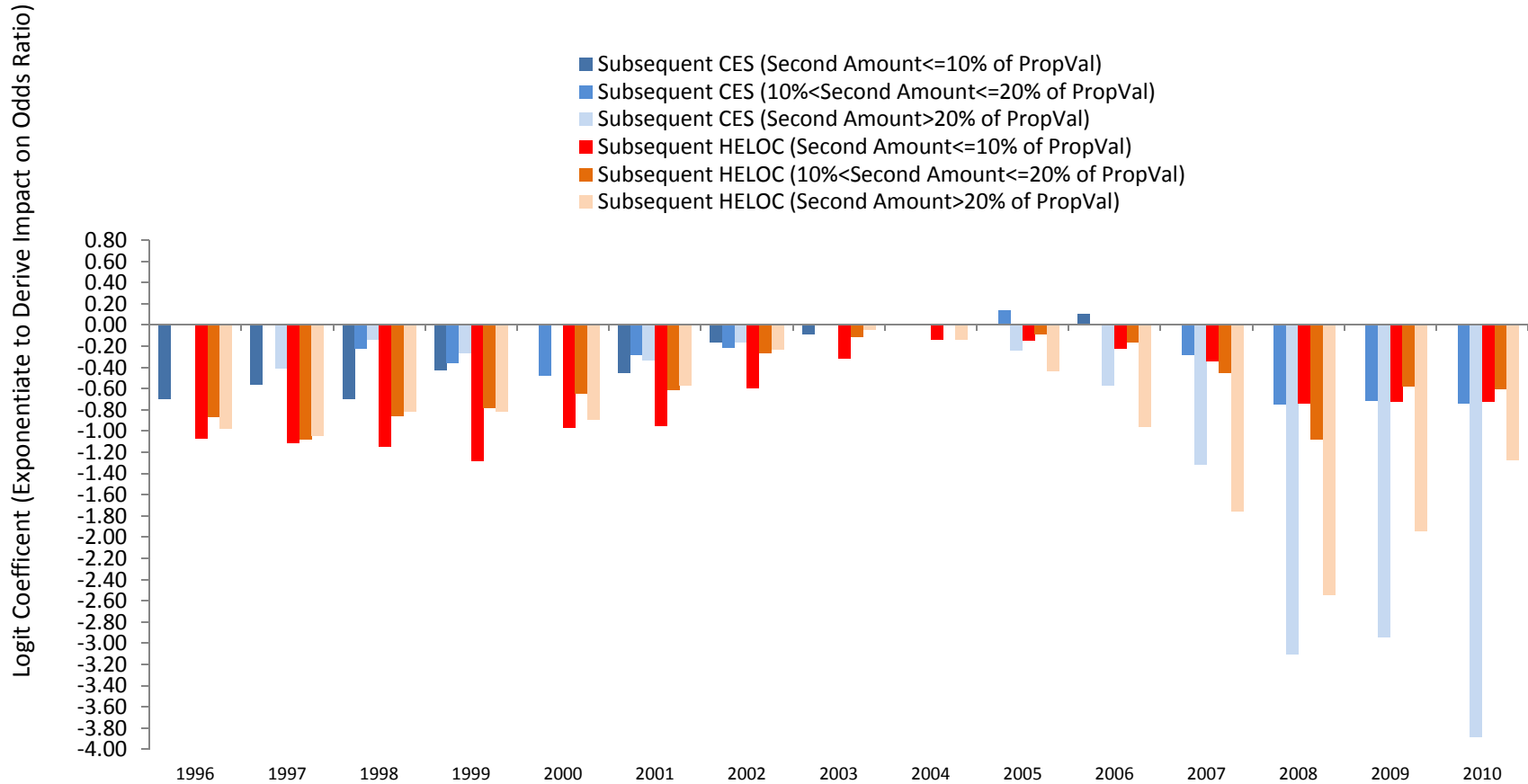Y-axis: Logit Coefficent (Exponentiate to Derive Odds Ratio)
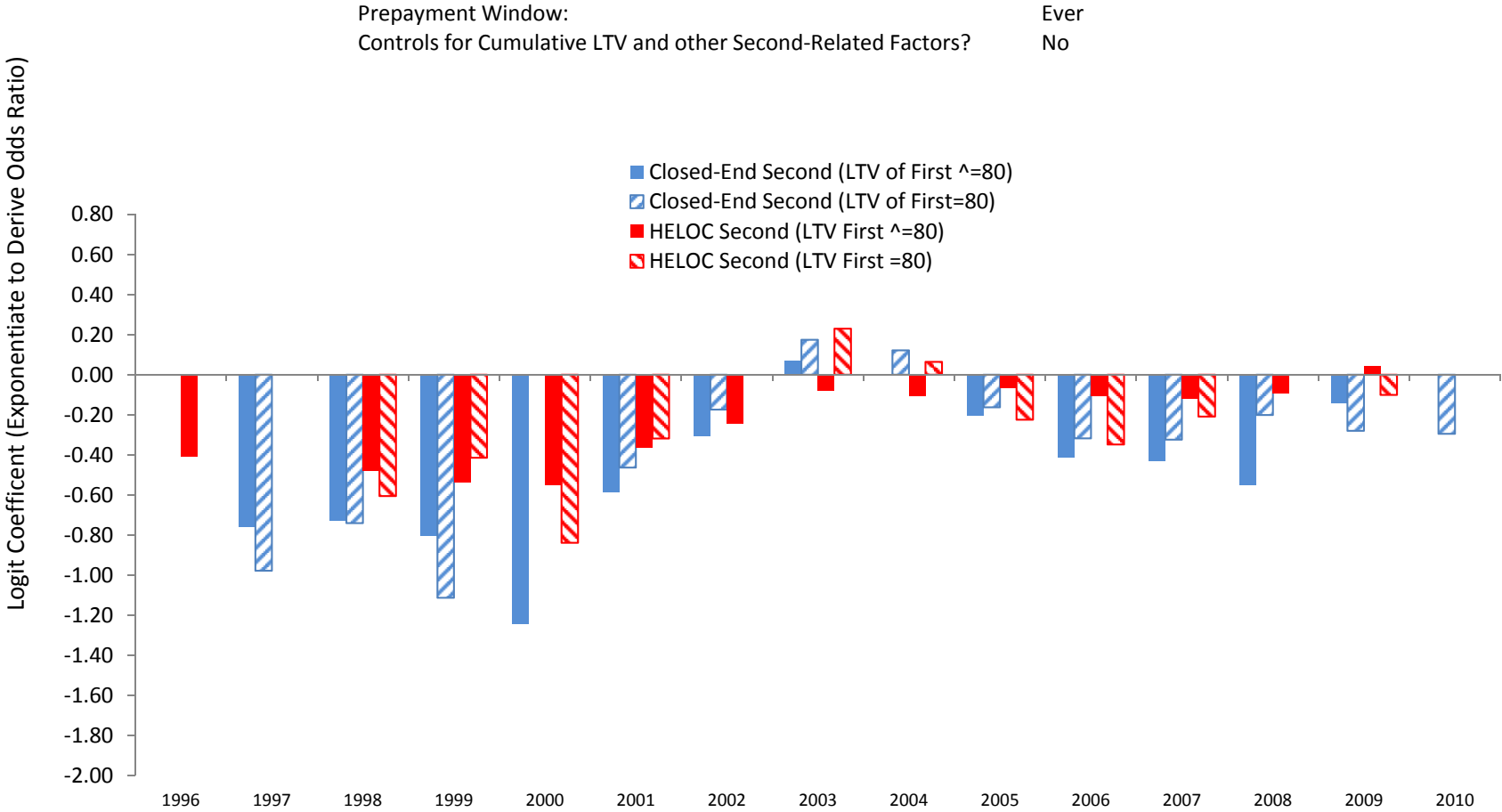
Figures are coefficient estimates for second lien indicator variables in multinomial logit models specified in text. The model is estimated separately for each loan origination year. Statistically insignificant coefficients are not shown.

Figure 8: Did Mortgages with Simultaneous Seconds <u>Prepay</u> More/Less Readily than Other Mortgages?

Impact of Having <u>Simultaneous</u> Second on Likelihood of Having "Prepay" Outcome

Prepayment Window: First Four Years
Controls for Cumulative LTV and other Second-Related Factors?   No

Figures are coefficient estimates for second lien indicator variables in multinomial logit models specified in text. The model is estimated separately for each loan origination year. Statistically insignificant coefficients are not shown.

Figure 9: Did Mortgages with Simultaneous Seconds <u>Prepay</u> More/Less Readily than Other Mortgages?

Impact of Having Simultaneous Second on Likelihood of Having "Prepay" Outcome

Prepayment Window: Ever
Controls for Cumulative LTV and other Second-Related Factors?   **Yes**
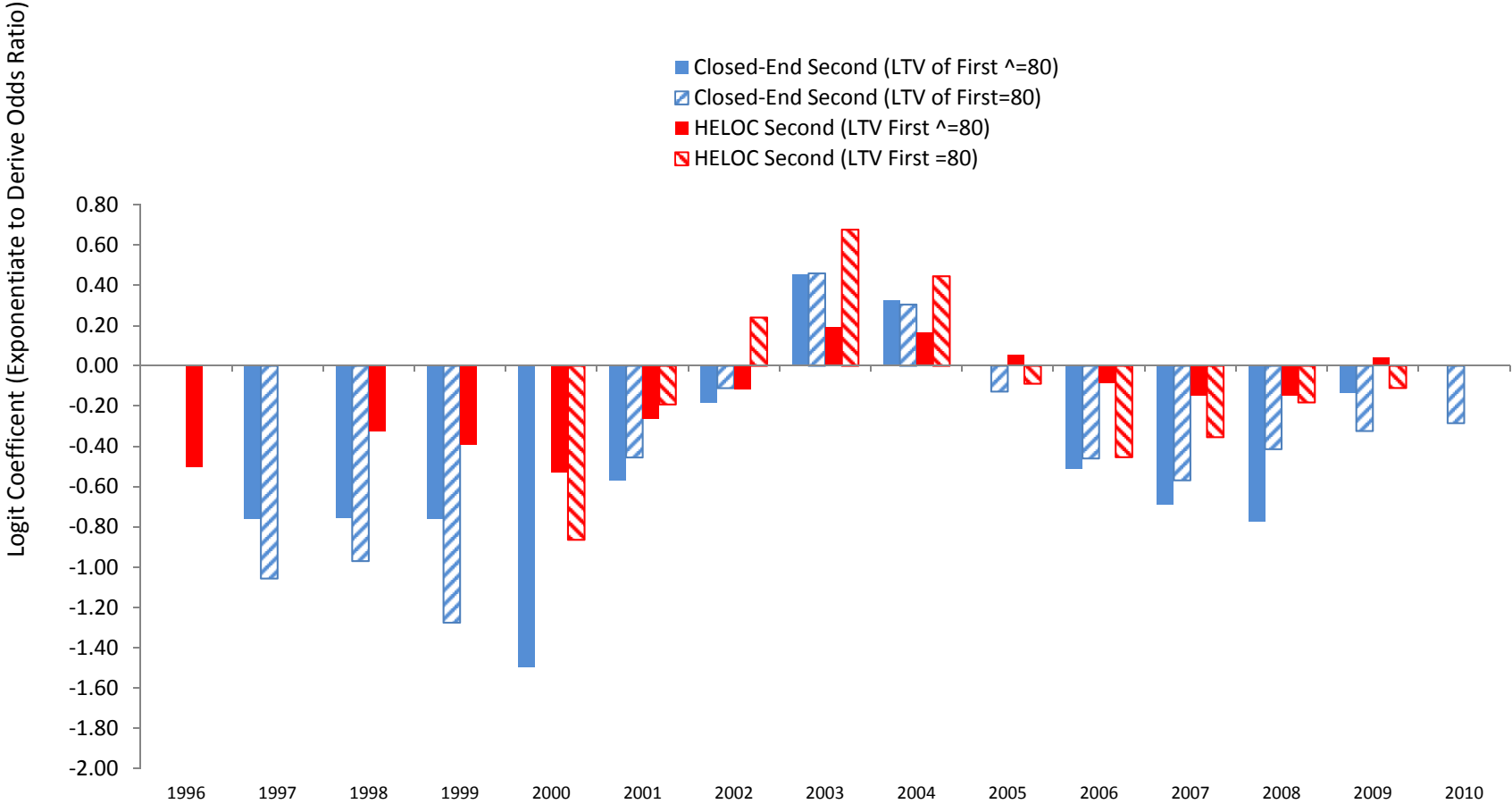

Figures are coefficient estimates for second lien indicator variables in multinomial logit models specified in text. The model is estimated separately for each loan origination year. Statistically insignificant coefficients are not shown.

Figure 10: Did Mortgages with Second Liens Prepay More or Less Readily than Other Loans?

Impact of Having <u>Subsequent</u> Second on Likelihood of Having Prepayment Outcome

Prepayment Window: Ever

Controls for Cumulative LTV and other Second-Related Factors?   No

- Subsequent CES (Second Amount<=10% of PropVal)
- Subsequent CES (10%<Second Amount<=20% of PropVal)
- Subsequent CES (Second Amount>20% of PropVal)
- Subsequent HELOC (Second Amount<=10% of PropVal)
- Subsequent HELOC (10%<Second Amount<=20% of PropVal)
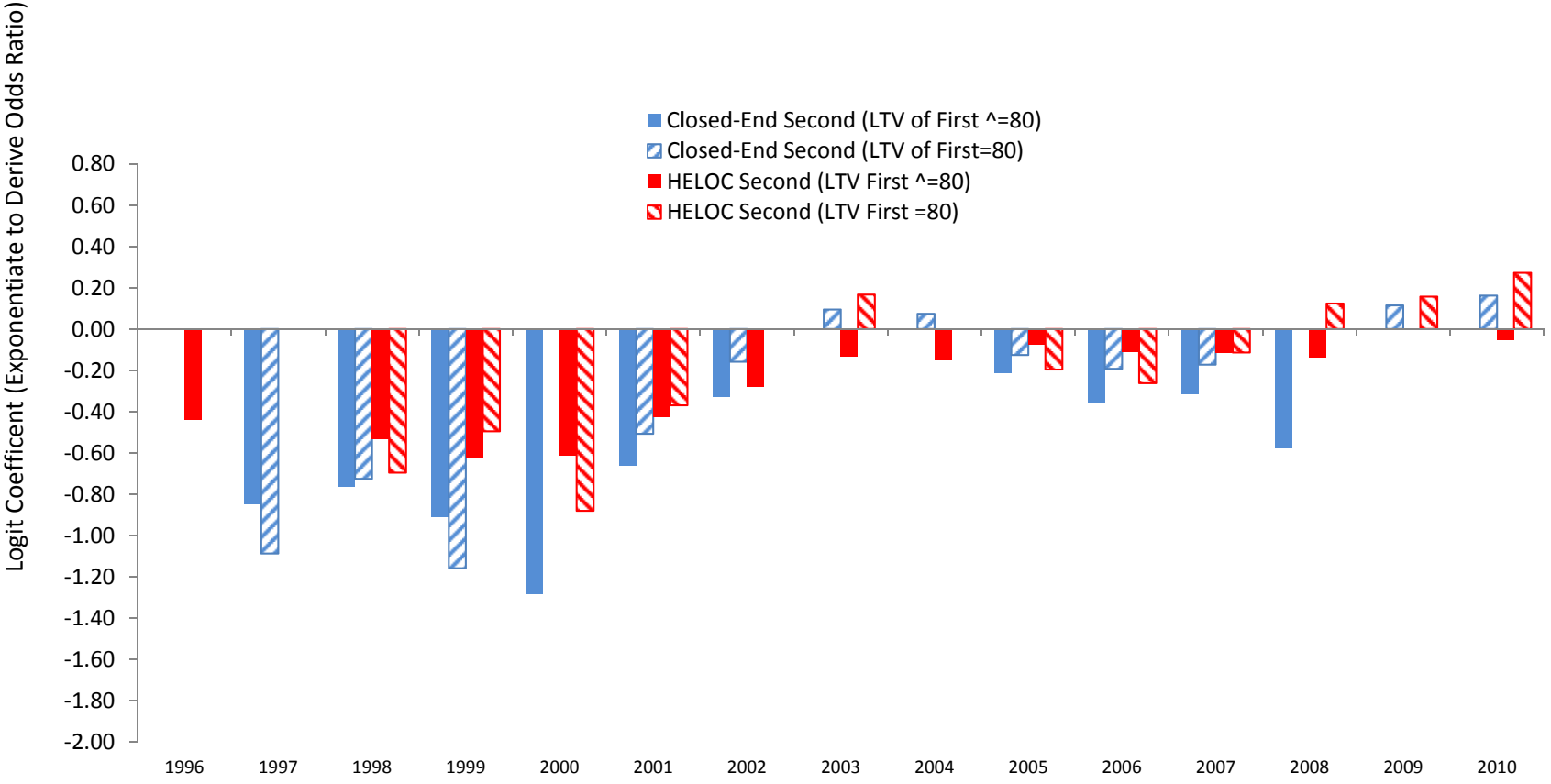- Subsequent HELOC (Second Amount>20% of PropVal)

Figures are coefficient estimates for second lien indicator variables in multinomial logit models specified in text. The model is estimated separately for each loan origination year. Statistically insignificant coefficients are not shown.

Figure 11: Did Mortgages with Second Liens Prepay More or Less Readily than Other Loans?

Impact of Having <u>Subsequent</u> Second on Likelihood of Having Prepayment Outcome

Prepayment Window: Ever
Controls for Cumulative LTV and other Second-Related Factors?   **Yes**

- ■ Subsequent CES (Second Amount<=10% of PropVal)
- ■ Subsequent CES (10%<Second Amount<=20% of PropVal)
- ■ Subsequent CES (Second Amount>20% of PropVal)
- ■ Subsequent HELOC (Second Amount<=10% of PropVal)
- ■ Subsequent HELOC (10%<Second Amount<=20% of PropVal)
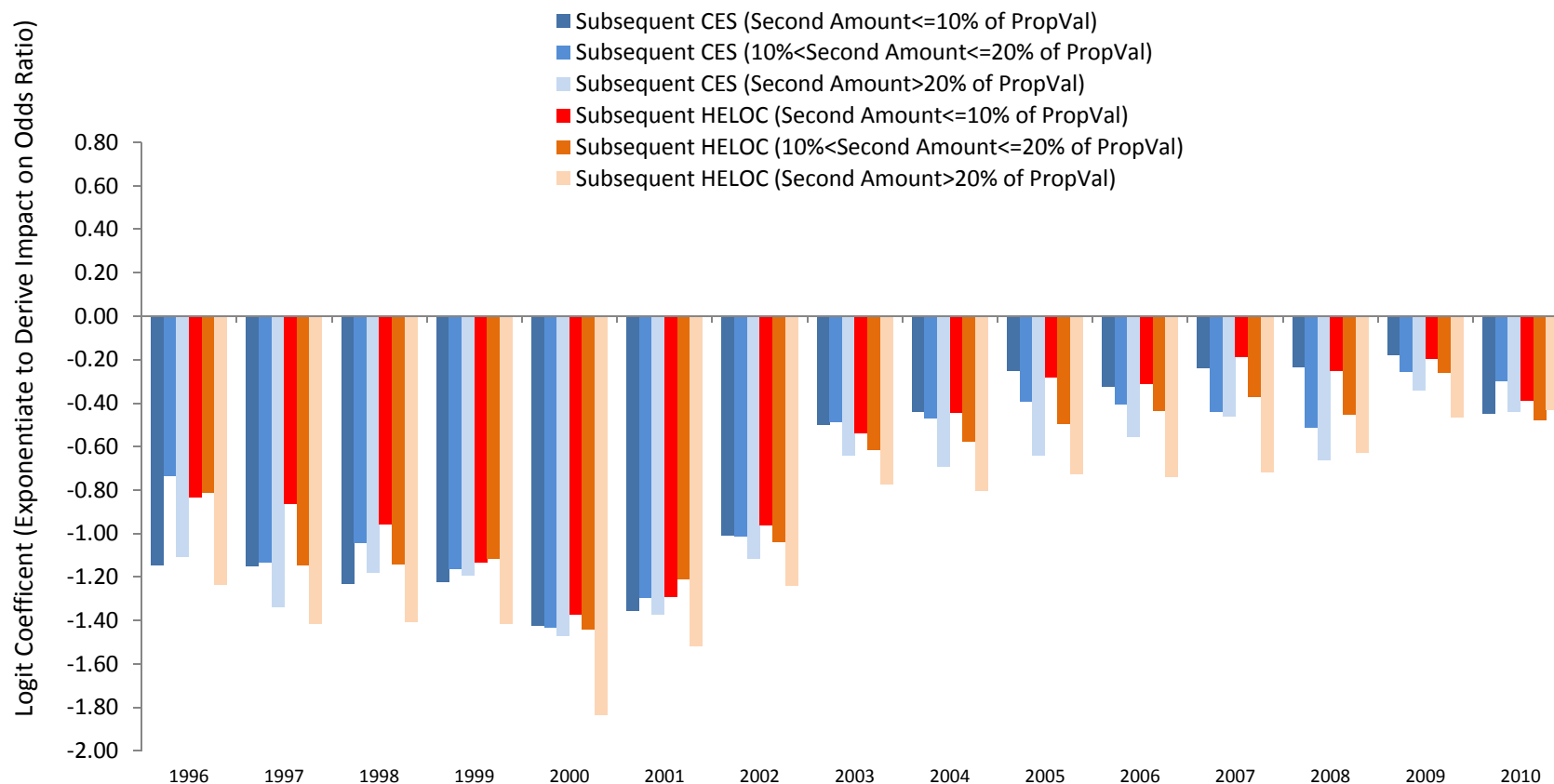- ■ Subsequent HELOC (Second Amount>20% of PropVal)
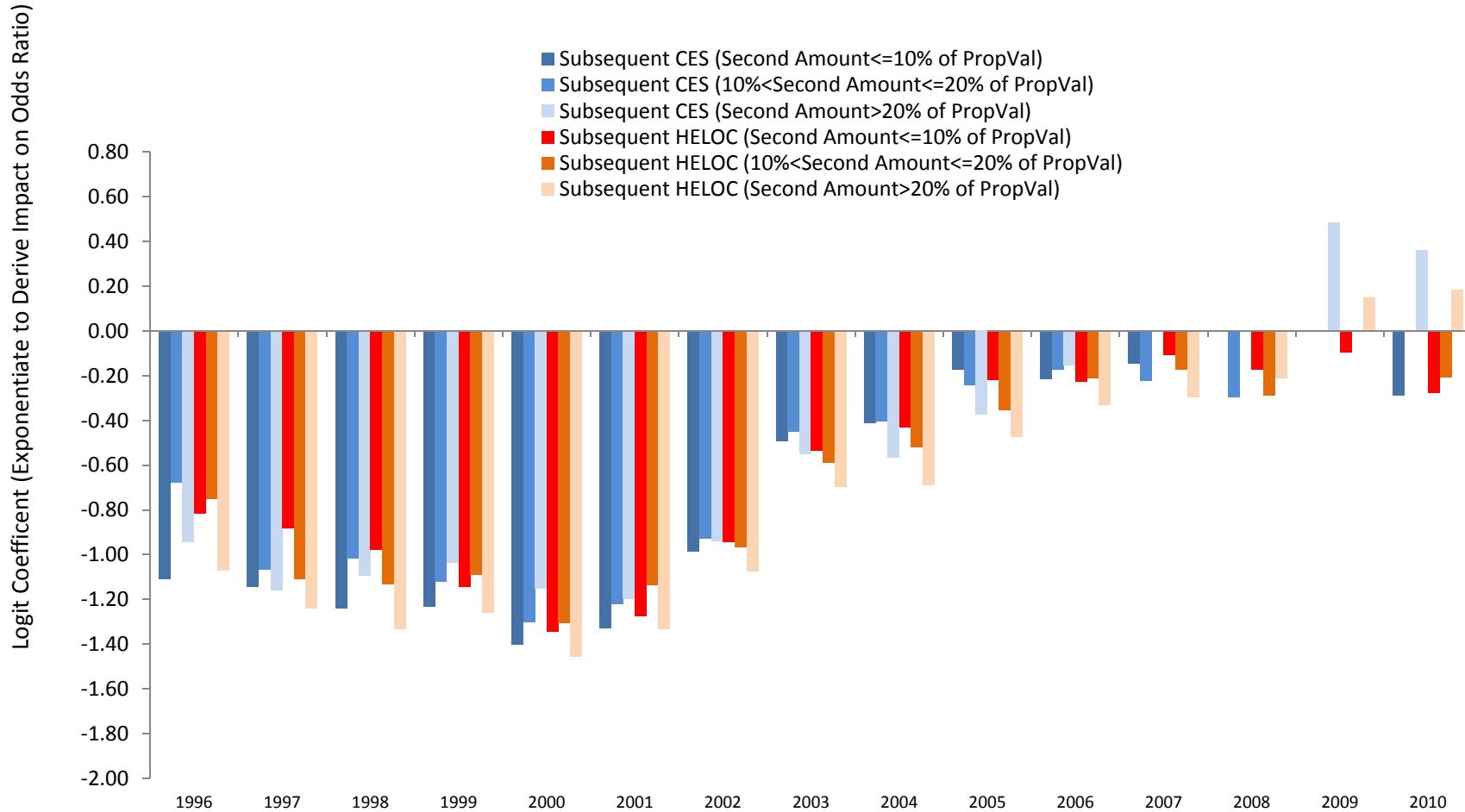
Figures are coefficient estimates for second lien indicator variables in multinomial logit models specified in text. The model is estimated separately for each loan origination year. Statistically insignificant coefficients are not shown.

Figure 12: Pre- and Post-Origination Trend in Non-Mortgage Balances
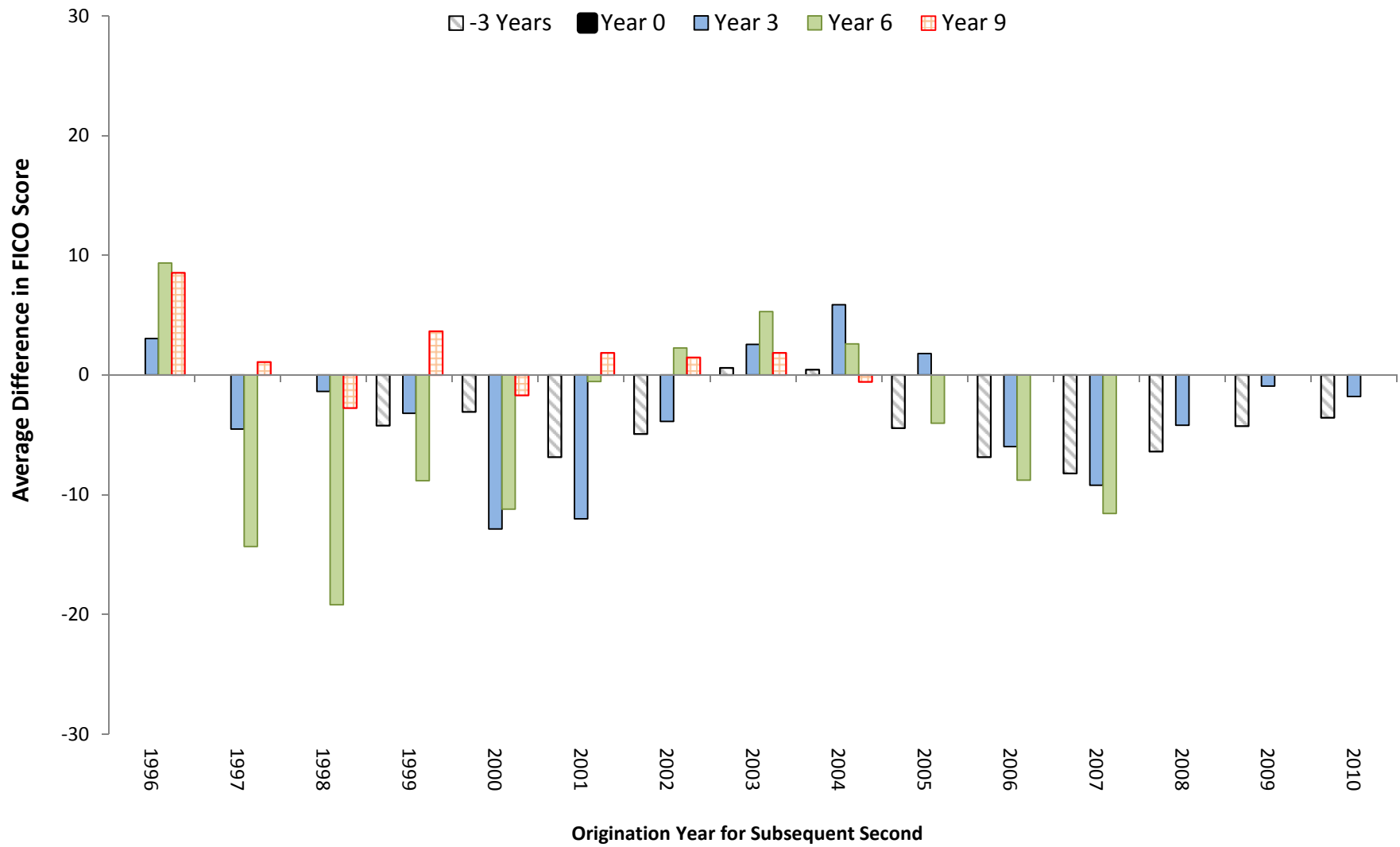By Year of Subsequent Second
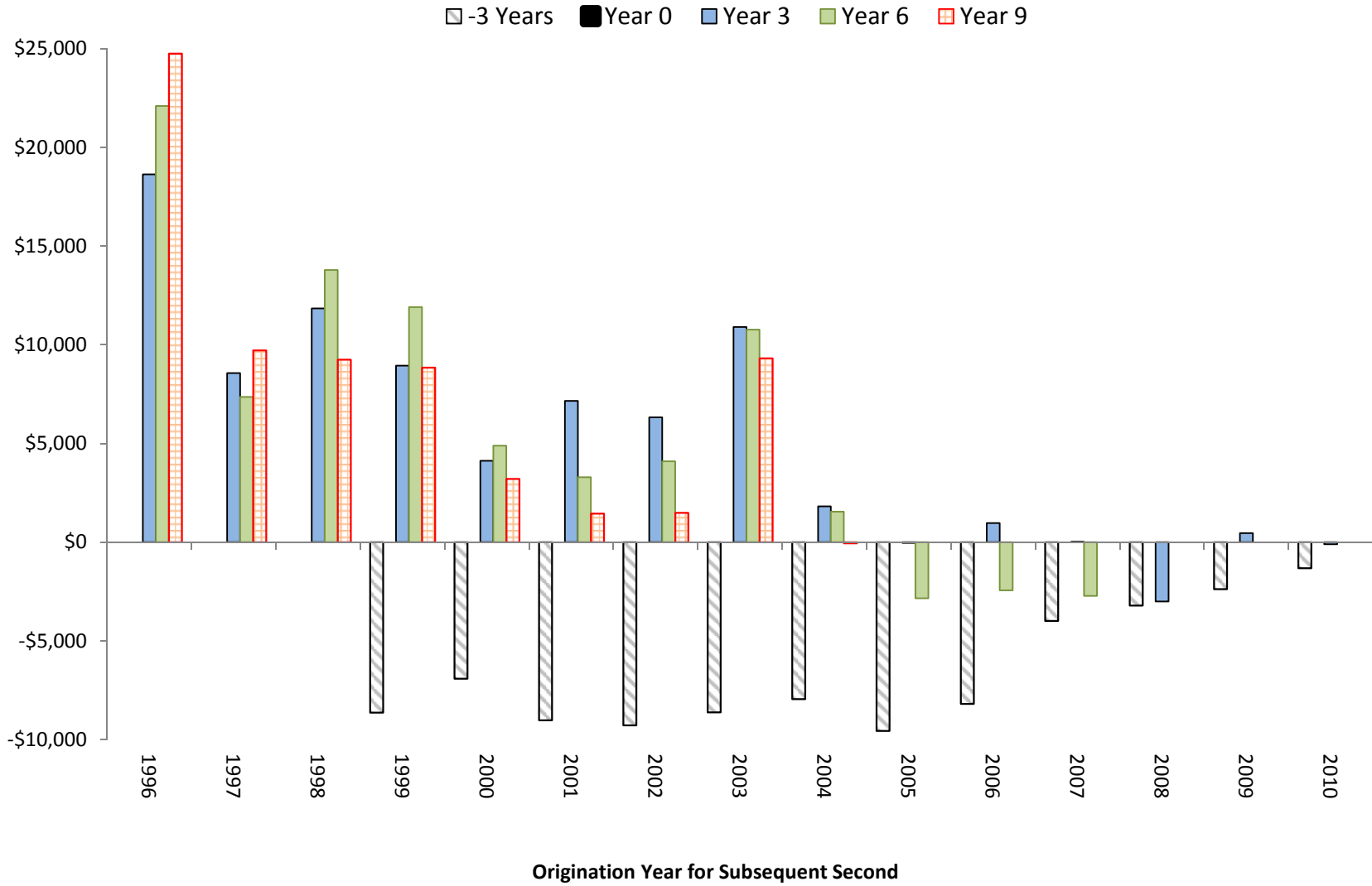
Figure 13: Pre- and Post-Origination Trend in FICO® Score of Primary Borrower

By Year of Subsequent Second

Appendix 1: Year-Specific Estimates of the Relationship between States and "Negative" Outcomes: State Coefficients in Default Logit Models

Coefficients reflect marginal impact on the relative likelihood of negative outcomes, controlling for other explanators.

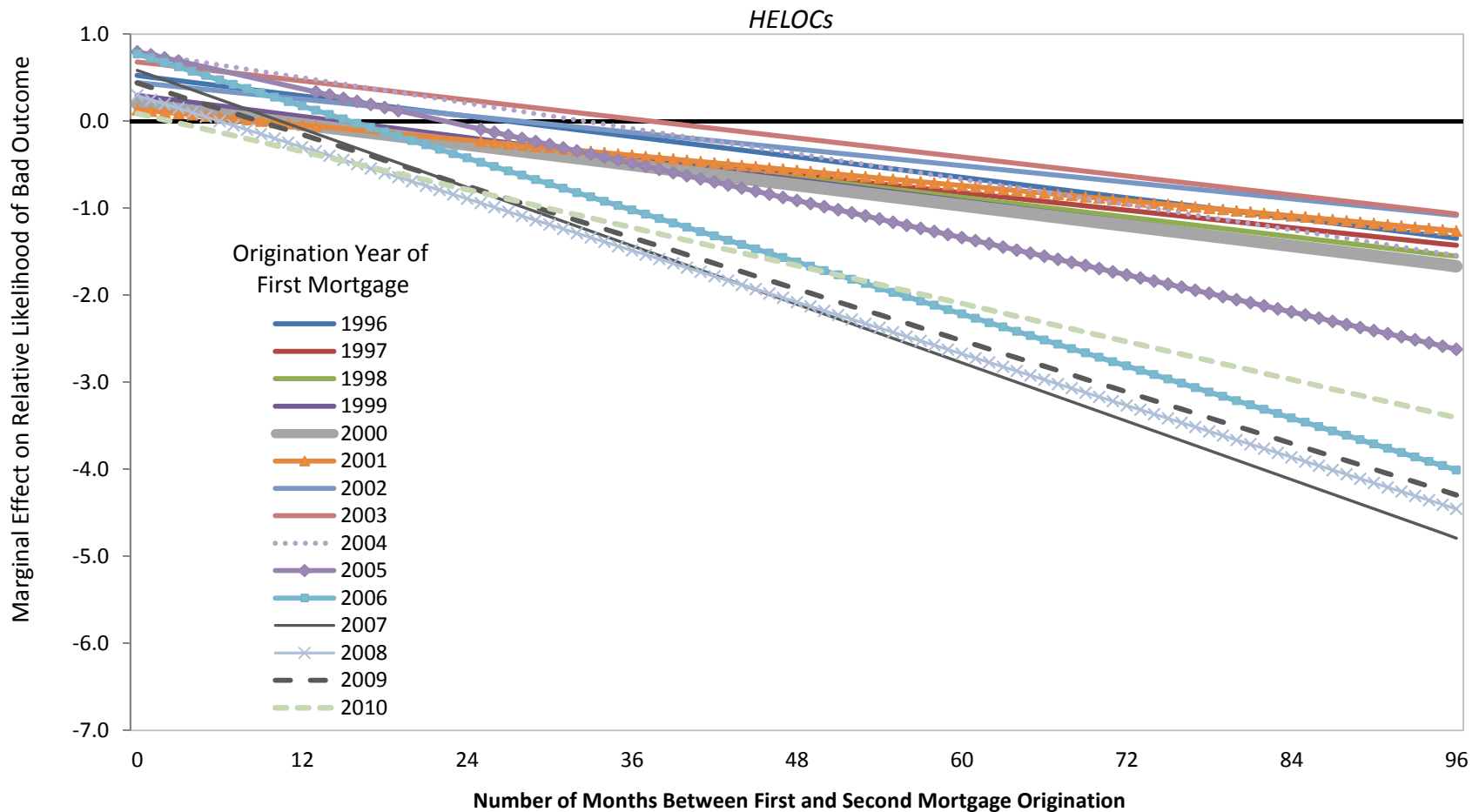| Census Division	State	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10
Pacific	HI	0.60	0.36	-0.43	-1.18	-0.51	-0.74	-1.06	-1.07	-0.74	-0.26	-0.36	-0.42	-0.41	-0.50	-0.30
	AK	0.76	-0.73	-0.70	-0.64	0.03	-0.46	-0.58	-0.32	-0.29	-0.75	-0.66	-0.95	-1.02	-1.12	-0.71
	OR							Omitted								
	WA	0.47	0.01	-0.07	0.17	0.37	0.28	0.05	-0.16	-0.06	-0.23	0.19	0.23	0.29	0.11	0.21
	CA	0.10	-0.71	-0.99	-0.84	-0.28	-0.67	-0.54	-0.18	0.37	0.89	1.11	0.82	0.34	-0.33	-0.15
Mountain	NV	0.79	0.60	-0.03	0.17	0.76	-0.04	-0.08	0.17	1.08	1.49	1.60	1.36	1.03	0.29	-0.17
	UT	1.09	0.39	0.68	1.19	1.13	1.07	0.56	0.29	0.14	-0.15	0.27	0.42	0.36	-0.02	-0.36
	AZ	0.56	-0.31	-0.19	-0.01	0.43	0.16	0.09	-0.03	0.16	0.90	1.42	1.30	0.84	0.17	-0.18
	NM	-0.15	-0.56	-0.53	-0.32	-0.07	-0.03	-0.04	-0.27	-0.37	-0.54	-0.19	-0.30	-0.40	-0.15	-0.52
	CO	0.86	0.68	0.43	0.48	0.51	0.35	0.20	0.10	0.09	0.14	0.15	0.22	0.61	0.68	0.62
	WY	0.63	-1.13	0.30	0.11	0.59	-0.12	-0.78	-0.26	-0.13	-0.85	-0.52	-0.48	-0.41	-0.24	-0.09
	ID	0.82	0.45	0.14	0.47	0.94	0.30	0.31	0.06	0.30	0.16	0.64	0.52	0.38	0.07	-0.13
	MT	0.78	-0.32	0.28	-0.07	0.17	0.33	-0.04	-0.34	0.07	-0.10	-0.01	-0.13	0.05	-0.23	-0.29
West North Central	ND	0.46	0.04	-1.01	-0.45	0.67	0.09	0.02	-0.42	-0.13	-0.14	-0.54	-0.61	-1.10	-0.70	-1.11
	SD	1.02	-0.10	-0.18	-0.13	0.26	-0.04	0.25	-0.02	0.00	-0.13	0.11	-0.12	-0.53	-0.67	-0.61
	NE	0.66	-0.68	0.11	-0.02	0.47	0.46	0.28	0.17	0.37	-0.05	-0.19	-0.43	-0.38	-0.48	-0.50
	KS	0.15	-0.24	-0.17	0.23	0.29	0.57	0.22	0.21	0.39	-0.06	-0.10	-0.29	-0.45	-0.36	-0.30
	MO	0.34	-0.52	-0.21	-0.01	0.22	0.43	0.46	0.39	0.55	0.11	0.20	0.10	-0.17	-0.07	-0.02
	IA	0.62	-0.41	-0.54	-0.08	0.81	0.52	0.39	0.28	0.44	0.02	0.14	-0.18	-0.39	-0.18	-0.36
	MN	0.11	-0.49	-0.26	-0.42	0.61	0.35	0.34	0.46	0.66	0.42	0.46	0.27	0.04	-0.23	-0.15
East North Central	WI	-0.01	-0.37	-0.15	0.15	0.05	0.52	0.64	0.45	0.47	0.27	0.25	0.06	0.07	-0.05	-0.10
	IL	0.44	-0.18	-0.22	-0.08	0.60	0.29	0.42	0.37	0.50	0.31	0.50	0.45	0.54	0.26	0.28
	IN	0.26	-0.20	0.07	0.14	0.59	0.53	0.65	0.60	0.55	0.23	0.19	-0.02	-0.22	-0.19	-0.25
	MI	0.48	-0.21	0.08	0.23	0.55	0.77	0.97	0.92	1.07	0.74	0.69	0.44	0.22	-0.14	-0.34
	OH	0.12	-0.25	-0.21	0.05	0.52	0.52	0.57	0.53	0.54	0.11	0.10	-0.12	-0.29	-0.21	-0.22
West South Central	TX	-0.35	-0.77	-0.79	-0.76	-0.18	-0.18	-0.05	-0.07	-0.12	-0.57	-0.53	-0.73	-0.92	-0.78	-0.79
	LA	0.17	-0.56	-0.03	0.04	-0.11	0.53	0.88	1.09	1.10	0.19	-0.16	-0.25	-0.45	-0.23	-0.29
	OK	0.10	-0.76	-0.69	-0.44	0.05	0.12	0.12	0.04	0.07	-0.34	-0.26	-0.49	-0.63	-0.41	-0.64
	AR	-0.11	-0.31	-0.52	-0.36	0.41	-0.05	0.20	0.17	0.08	-0.17	0.03	-0.06	-0.46	-0.17	-0.26

Appendix 1: Year-Specific Estimates of the Relationship between States and "Negative" Outcomes: State Coefficients in Default Logit Models

Coefficients reflect marginal impact on the relative likelihood of negative outcomes, controlling for other explanators.

Census Division	State	Year														
		96	97	98	99	00	01	02	03	04	05	06	07	08	09	10
East South Central	KY	0.49	-0.09	-0.11	0.33	0.60	0.58	0.64	0.57	0.59	0.11	0.12	-0.10	-0.40	0.05	-0.34
	TN	0.25	-0.15	-0.11	0.05	0.56	0.44	0.44	0.42	0.38	-0.14	0.03	-0.03	-0.15	-0.16	-0.21
	MS	0.26	-0.34	-0.72	0.02	0.15	0.40	0.59	0.71	0.81	0.03	-0.04	-0.05	-0.03	-0.23	0.03
	AL	0.35	0.06	-0.30	0.01	0.38	0.27	0.39	0.37	0.51	-0.02	-0.04	-0.11	-0.29	-0.09	0.11
South Atlantic	FL	0.01	-0.44	-0.57	-0.35	-0.05	-0.11	0.01	0.19	0.52	0.84	1.19	0.92	0.68	0.03	-0.12
	GA	-0.16	-0.34	-0.36	-0.12	0.54	0.37	0.64	0.69	0.59	0.20	0.32	0.27	0.19	0.12	-0.09
	SC	-0.29	-0.37	-0.38	-0.07	0.61	0.35	0.51	0.35	0.23	-0.08	0.00	-0.09	-0.16	-0.20	-0.23
	NC	0.07	-0.32	-0.15	-0.18	0.19	0.30	0.46	0.36	0.28	-0.16	-0.04	-0.04	-0.16	0.00	-0.16
	WV	0.06	-0.72	-0.81	-0.95	0.56	-0.07	0.40	0.06	0.25	-0.10	-0.09	-0.34	-0.42	-0.05	-0.03
	VA	-0.14	-0.67	-0.84	-0.90	-0.24	-0.51	-0.46	-0.45	-0.21	-0.08	-0.03	-0.20	-0.38	-0.44	-0.40
	DC	-0.82	-0.49	-0.60	-0.21	0.60	-0.14	-0.31	-0.44	-0.09	-0.48	-0.18	-0.48	-0.41	-0.39	-0.50
	MD	-0.03	-0.74	-0.63	-0.41	0.35	-0.34	-0.35	-0.44	-0.12	-0.10	0.24	0.14	0.06	-0.21	-0.33
	DE	0.24	-0.11	-0.81	-0.48	-0.29	-0.05	-0.13	0.01	-0.17	-0.09	-0.07	-0.07	-0.04	-0.15	-0.29
Mid Atlantic	PA	0.43	-0.17	-0.29	-0.19	0.27	0.17	0.23	0.08	0.15	-0.15	-0.06	-0.31	-0.28	-0.24	-0.23
	NJ	0.37	-0.36	-0.73	-0.63	0.16	-0.13	-0.01	0.11	0.33	0.29	0.42	0.16	0.18	0.12	0.25
	NY	-0.39	-0.81	-1.01	-0.83	-0.32	-0.37	-0.17	0.00	0.10	-0.01	0.04	-0.20	-0.19	-0.17	0.04
New England	CT	-0.34	-0.51	-1.00	-0.59	0.41	-0.17	-0.02	0.06	0.17	0.12	0.19	-0.08	0.01	-0.18	0.22
	RI	-0.18	-0.35	-0.78	-0.47	-0.40	-0.06	-0.22	0.01	0.42	0.59	0.51	0.27	0.31	0.08	-0.01
	MA	-0.20	-0.84	-0.76	-0.65	-0.15	-0.07	0.15	0.33	0.48	0.34	0.29	-0.03	-0.12	-0.16	-0.08
	VT	0.36	-0.83	-0.23	-0.88	-0.25	0.14	0.12	0.12	-0.17	-0.12	-0.23	-0.49	-0.23	0.02	-0.32
	NH	-0.16	-0.08	-0.48	-0.54	0.22	0.13	0.08	0.37	0.41	0.28	0.28	0.06	0.00	-0.19	-0.24
	ME	-0.19	-0.63	-0.29	-0.11	0.13	0.16	-0.05	0.07	0.35	0.10	0.19	0.11	0.11	-0.01	0.15

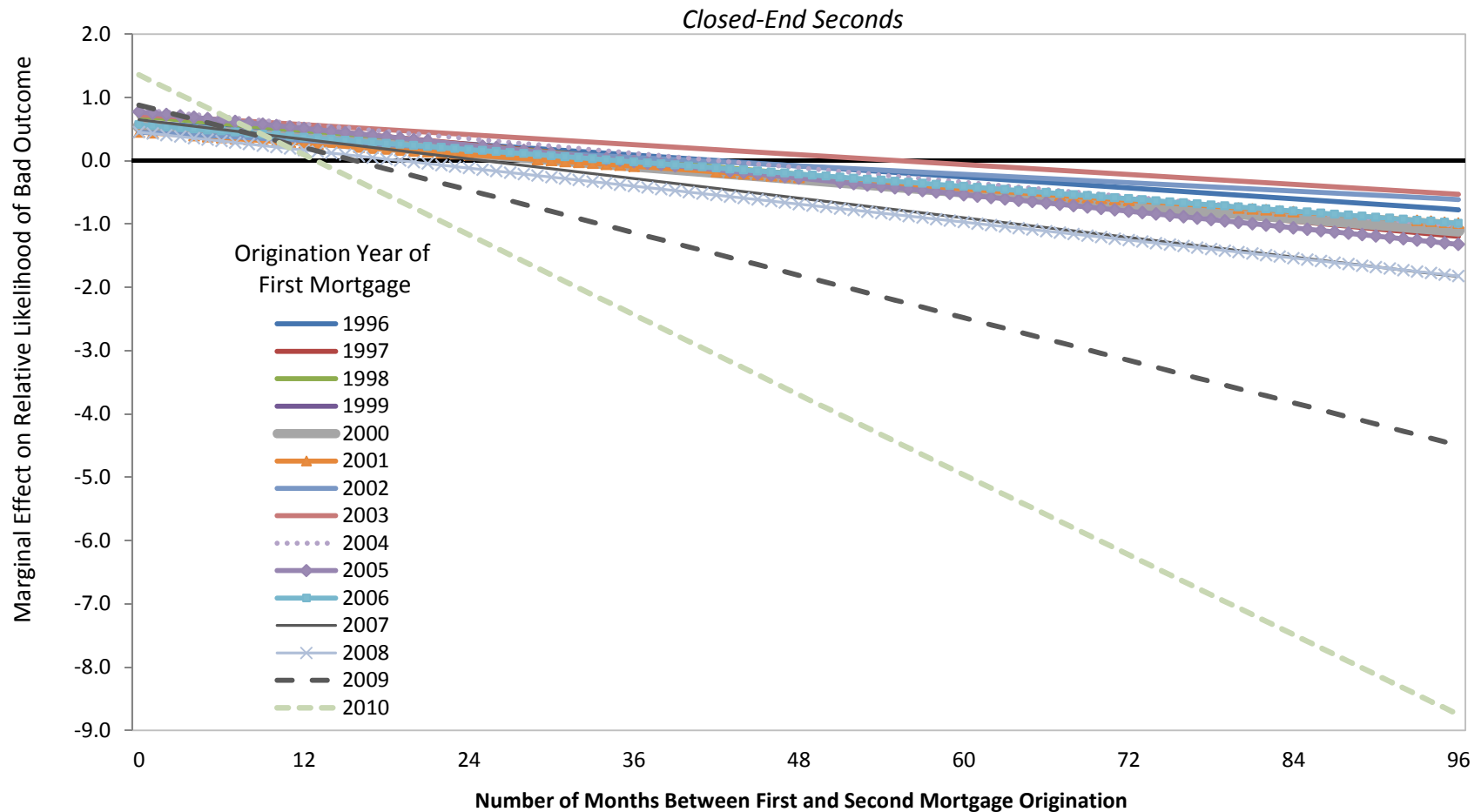# Appendix 2a: Loan Outcomes and the Time Between First and Second-Lien Originations

Relationship between the Between-Lien Time Interval and the Relative Likelihood of Negative Outcomes for First Liens

HELOCs

Origination Year of First Mortgage
- 1996
- 1997
- 1998
- 1999
- 2000
- 2001
- 2002
- 2003
- 2004
- 2005
- 2006
- 2007
- 2008
- 2009
- 2010

(Y-axis: Marginal Effect on Relative Likelihood of Bad Outcome; X-axis: Number of Months Between First and Second Mortgage Origination)

Each line reflects estimates from the logit model computed for first mortgages originated in the denoted year. The marginal impact of the presence of a subsequent second on the likelihood of a bad outcome is calculated as the cofficient on the (subsequent) second lien dummy variable plus Z, where Z is the number of months between the first and second loan origination times the number of months indicated on the X-axis.

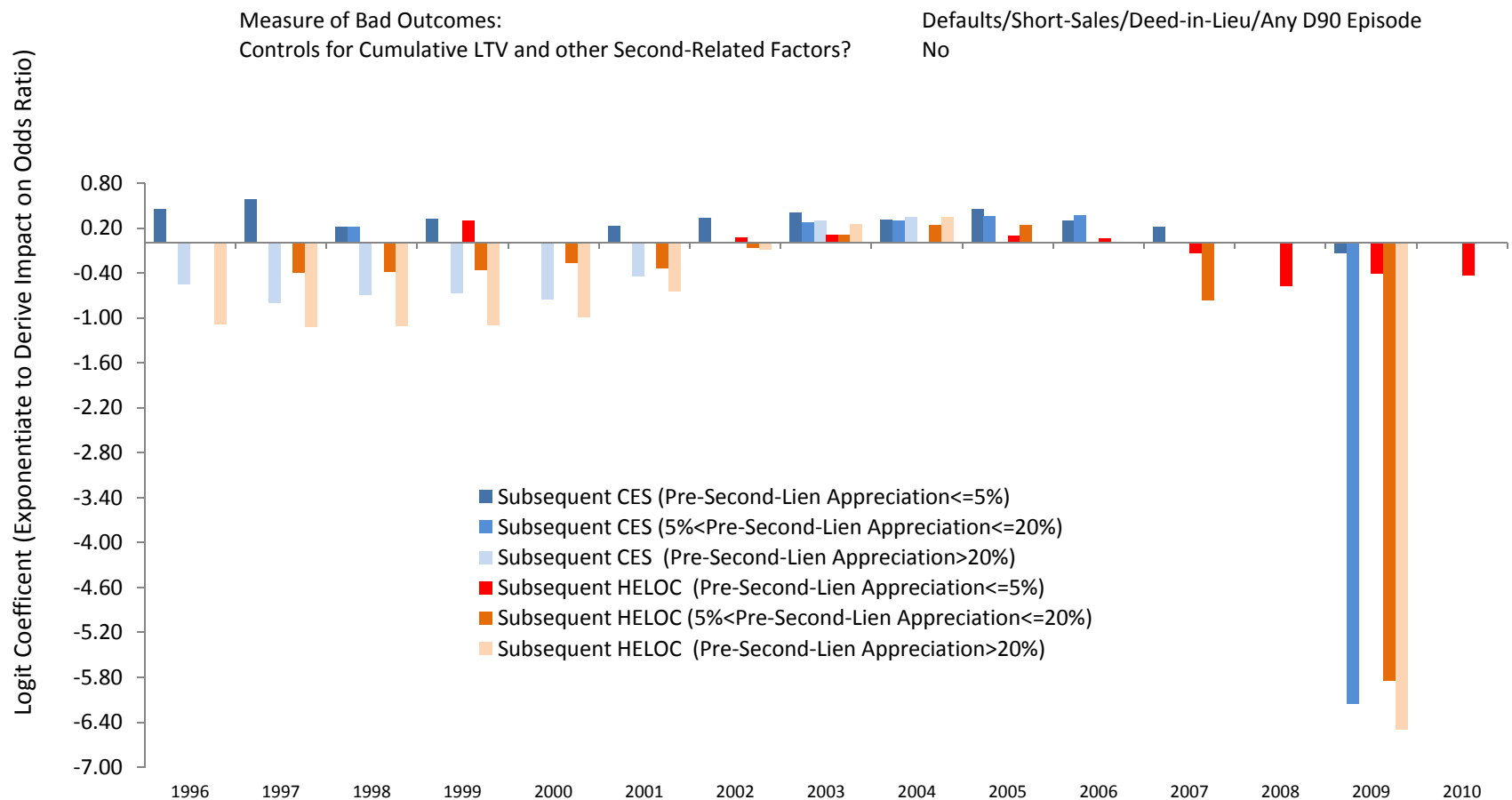# Appendix 2b: Loan Outcomes and the Time Between First and Second-Lien Originations

Relationship between the Between-Lien Time Interval and the Relative Likelihood of Negative Outcomes for First Liens

Closed-End Seconds

Each line reflects estimates from the logit model computed for first mortgages originated in the denoted year. The marginal impact of the presence of a subsequent second on the likelihood of a bad outcome is calculated as the cofficient on the (subsequent second lien dummy variable plus Z, where Z is the number of months between the first and second loan origination times the number of months indicated on the X-axis.

Appendix 3: Did Mortgages with Second Liens have Worse Outcomes than Other Mortgages?

Subsequent Second Liens Origenated in Different House Price Conditions (<=5 Percent Appreciation Since First-Lien Origination, 5-20 Percent Appreciation, >20 Percent Appr

Measure of Bad Outcomes: Defaults/Short-Sales/Deed-in-Lieu/Any D90 Episode
Controls for Cumulative LTV and other Second-Related Factors?   No

Figures are coefficient estimates for second-lien indicator variables in multinomial logit models specified in text. The model is estimated separately for each loan origination year. Statistically insignificant coefficients are not shown.