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How Home Equity Extraction and Reverse Mortgages Affect the Credit Outcomes of Senior Households

Abstract

This paper examines how the extraction of home equity, including but not limited to equity extracted through reverse mortgages, affects credit outcomes of senior households. We use data from the Federal Reserve Bank of New York/Equifax Consumer Credit Panel, supplemented with our unique credit panel dataset of reverse mortgage borrowers. We track credit outcomes for seniors who extracted equity through cash-out refinancing, home equity lines of credit or home equity loans between 2008 and 2011, and a random sample of nonextractors. We estimate differences-in-differences by extraction channel using individual, fixed-effects panel regression. We find that seniors extracting equity through reverse mortgages have greater reductions in consumer debt, and are less likely to become delinquent or foreclose three years post origination relative to other extractors and nonextractors. These effects are greater among households who experienced a credit shock within the two years prior to loan origination. To help isolate the effect of the extraction channel on credit outcomes, we re-estimate our models with a matched sample of consumers at the time of extraction. We find that otherwise similar HECM borrowers have larger reductions in credit card debt post-extraction than other equity borrowers and non-borrowers, with no significant difference in the rates of delinquency on non-housing debt post extraction. For HECM borrowers, we find that increased initial withdrawal and increased monthly cash flow contribute to the reduction in credit card debt.

Citation

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Introduction

More than 80 percent of senior households in the U.S. own their home, and nearly half of the net worth for the median senior is in the form of home equity.[1] Seniors tend to not spend down this asset for a variety of reasons. There is some evidence that seniors view the equity in their homes as precautionary savings to help buffer future shocks such as medical expenses or the death of a spouse, with rates of equity extraction through borrowing or home sale increasing after such life events (Benito, 2009; Davidoff, 2010; Nakajima and Telyukova, 2011; Venti and Wise, 1990; 2004; Poterba, Venti and Wise, 2011). Senior households who desire to consume home equity may be unwilling to sell their homes or may be unable to qualify for or afford an additional mortgage, particularly after experiencing a financial shock.

Reverse mortgages, including the federally insured Home Equity Conversion Mortgage (HECM), are designed to address this tradeoff, with limited underwriting and no required repayment until the borrower no longer lives in the home. The underlying policy assumption is that HECMs can provide seniors with "greater financial security" by providing a vehicle to "supplement Social Security, meet unexpected medical expenses, and make home improvements" without the monthly carrying costs of a forward mortgage . Following the financial crisis, the origination of HECMs increased from 5 percent of all types of home equity extractions by seniors in 2006 to 12 percent in 2009 .

What happens to seniors after they extract home equity through borrowing, particularly through a reverse mortgage? How do their financial outcomes change relative to similar seniors extracting equity through other channels or seniors unable or unwilling to borrow? The purpose of this analysis is to examine how equity extraction, including but not limited to equity extracted

[1] Authors' calculations using the 2013 Survey of Consumer Finances.

through HECMs, affected the financial outcomes of seniors both during and after the Great Recession. No prior studies have examined the relationship between equity extraction loans, generally, or HECMs, specifically, and senior household financial outcomes.

We focus on a specific set of financial outcomes—a senior's use and management of credit. We pay particular attention to revolving credit card debt, as distinct from nonhousing installment loans. While installment loans are typically used to purchase goods such as automobiles or to finance education, prior studies indicate that households fund a substantial portion of their consumption through credit cards, even if they hold money in checking or savings accounts (Fulford, 2015; Gross and Souleles, 2002). This finding is also true for senior households. About 90 percent of households over the age of 64 hold a credit card and report using a credit card for about 30 percent of their payment transactions (Fulford and Schuh, 2015). Among seniors age 70 and older using a credit card, 45 percent do not pay off their balances in full each month, indicating a need for liquidity that is met through borrowing on credit cards (Fulford and Schuh, 2015). Aside from the amount of debt held by a consumer, we also consider the ability of a household to pay their debts as indicated by payment delinquencies and credit scores.[2]

Using a panel dataset of credit records, we compare credit outcomes of seniors who extracted home equity using HECMs to those who extracted home equity using other mortgage products and those who did not extract any home equity. Our primary analysis uses data from the Federal Reserve Bank of New York (FRNBY)/Equifax Consumer Credit Panel (CCP) to identify seniors who extracted equity through cash-out refinancing, home equity lines of credit

[2] According to the Consumer Financial Protection Bureau (CFPB, 2015), paying bills on time, managing debt burdens, and having good credit are considered to be indicators of consumer financial well-being.

(HELOCs), or closed-end home equity loans (HELOANs) between 2008 and 2011. As reverse mortgages are not reported in consumer credit files, we supplement the CCP dataset with our unique reverse mortgage credit panel (RMCP) dataset of HECM borrowers who originated a reverse mortgage between 2008 and 2011. In both datasets, we track consumer credit records at the individual level for two years prior and three years after extraction. Using the CCP dataset, we also follow the credit records for a random sample of seniors not extracting equity during the same period. We supplement the credit analysis with a descriptive comparison of other financial outcomes for seniors extracting home equity, as reported on survey data from the Health and Retirement Study (HRS) and survey data from about 1,200 senior households in the RMCP dataset (see Appendix A).

For the credit analysis, we first estimate differences-in-differences by extraction channel using individual fixed effects panel regression. We find that seniors extracting equity through HECMs have greater reductions in credit card debt three years post origination relative to other extractors and nonextractors, and are significantly less likely to become delinquent on debt payments or experience foreclosure post-extraction. Subsample regressions indicate that much of the reduction in revolving debt and improvement in payment outcomes is concentrated among the HECM borrowers who had a credit shock immediately prior to extraction. Nearly one in four HECM borrowers experience a 25-point or more drop in credit score within the two years prior to originating the loan. These consumers may be unable to borrow from home equity through forward mortgage channels due to underwriting requirements. The HECM relaxes this borrowing constraint.

As a second component of our analysis, we attempt to isolate the impact of the channel of extraction on credit outcomes, as distinct from differences in consumers who select into particular products. To do this, we construct a matched sample of HECM borrowers and borrowers extracting equity through forward mortgages, as well as a matched sample of nonborrowers. The samples are matched on consumer credit profiles at the time of loan origination, geography, year of extraction, the amount of prior mortgage debt, and the amount of the initial withdrawal (for extractors). In addition to the amount withdrawn at origination, HECM borrowers experience an increase in monthly cash-flow from the reverse mortgage by paying off forward mortgage debt, not making any payment on the new loan until termination, and/or by receiving tenure or term payments from the loan for a set period of time. This increase in cash flow is expected to contribute to a reduction in revolving debt among HECM borrowers post extraction. We find that for an initial HECM withdrawal of $10,000, the reduction in credit card debt in the first year after extraction is $2,364, which rises by $166 for each additional $10,000 withdrawn. Further, for every $100 in additional annuitized monthly cash flow from the HECM, credit card debt balances decline by $45 in the first year after extraction.

The rest of this paper proceeds as follows. First, we describe trends in home equity borrowing among senior homeowners, as well as trends in senior credit outcomes in the U.S. over the past decade, drawing from the Survey of Consumer Finances and prior literature. We then discuss our data, key variables, and methodology. We present the results of the credit trend analysis, first for a random sample of the population and then for a matched sample of consumers. Appendix A includes a supplemental analysis with a descriptive comparison of changes in financial outcomes for borrowers and nonborrowers, using the HRS and reverse mortgage survey data.

Senior Home Equity Extraction and Credit Outcomes: Recent Trends and Prior Literature

In the U.S., senior homeowners collectively hold nearly six trillion dollars in the equity in their homes.[3] According to data from the 2013 Survey of Consumer Finances (SCF), home equity constitutes 55 percent of total net wealth for senior homeowners in bottom quarter of the income distribution (Table 1). Senior homeowners with household incomes of about $40,000 per year (seniors' median income in 2013) held an average of $127,900 in home equity. This is slightly higher than the average of $125,300 in financial assets held by the same households.[4]

Table 1: Financial Characteristics for Homeowners over the age of 62 (2013 SCF)

Income Decile	Income	Assts	Financial Assets	Home Equity	Net Worth	Home Equity as % of Net Worth
0-9.9	10,054	341,381	95,932	121,018	321,729	37.6%
10-19.9	17,453	211,629	50,872	102,810	194,964	52.7%
20-29.9	24,727	307,228	80,602	157,047	283,390	55.4%
30-39.9	32,795	267,670	88,303	118,270	237,533	49.8%
40-49.9	41,425	347,984	125,304	127,900	293,702	43.5%
50-59.9	52,904	478,292	208,548	148,130	418,214	35.4%
60-69.9	67,869	589,390	231,957	174,877	517,733	33.8%
70-79.9	89,620	1,019,148	489,703	238,396	943,874	25.3%
80-89.9	124,060	1,426,192	685,576	301,712	1,306,828	23.1%
90-94.9	187,183	1,993,239	1,158,184	299,297	1,851,258	16.2%
95-98.9	363,136	5,592,915	2,983,082	689,167	5,356,747	12.9%
99-100	1,619,041	20,700,000	10,400,000	1,575,398	20,300,000	7.8%

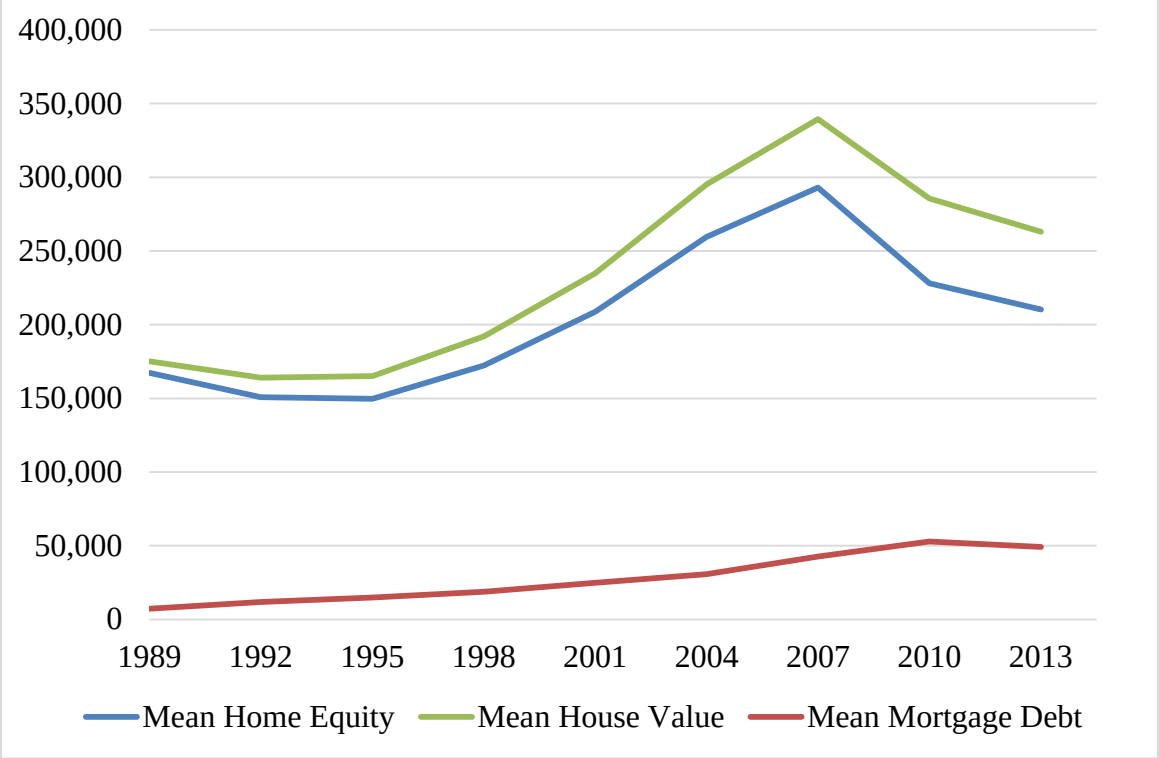
Source: Author's calculations from the 2013 Survey of Consumer Finances, weighted means

[3] Authors calculations from the 2013 Survey of Consumer Finances (SCF)

[4] Financial assets are defined by the SCF to include liquid assets, certificates of deposit, directly held pooled investment funds, stocks, bonds, quasi-liquid assets, savings bonds, whole life insurance, other managed assets, and other financial assets.

The amount of home equity held by senior homeowners has varied over time, corresponding to changes in the housing market associated with the Great Recession. Figure 1 shows a large increase in 2013 constant dollar average home equity from approximately $150,000 in 1989 to a peak of $292,000 in 2007 just before the recession began. Post-recession, average home equity levels dropped to their 2001 level by 2013. In addition to changes in house values, the average mortgage debt among senior homeowners has seen a steady incline from about $15,000 in 1995 to a 2010 peak of $52,000, followed by a minor decrease.

Figure 1: Home Equity, Mortgage Debt, and House Value for Homeowners Age 62+ Mean Values by Year (2013 Constant Dollars)

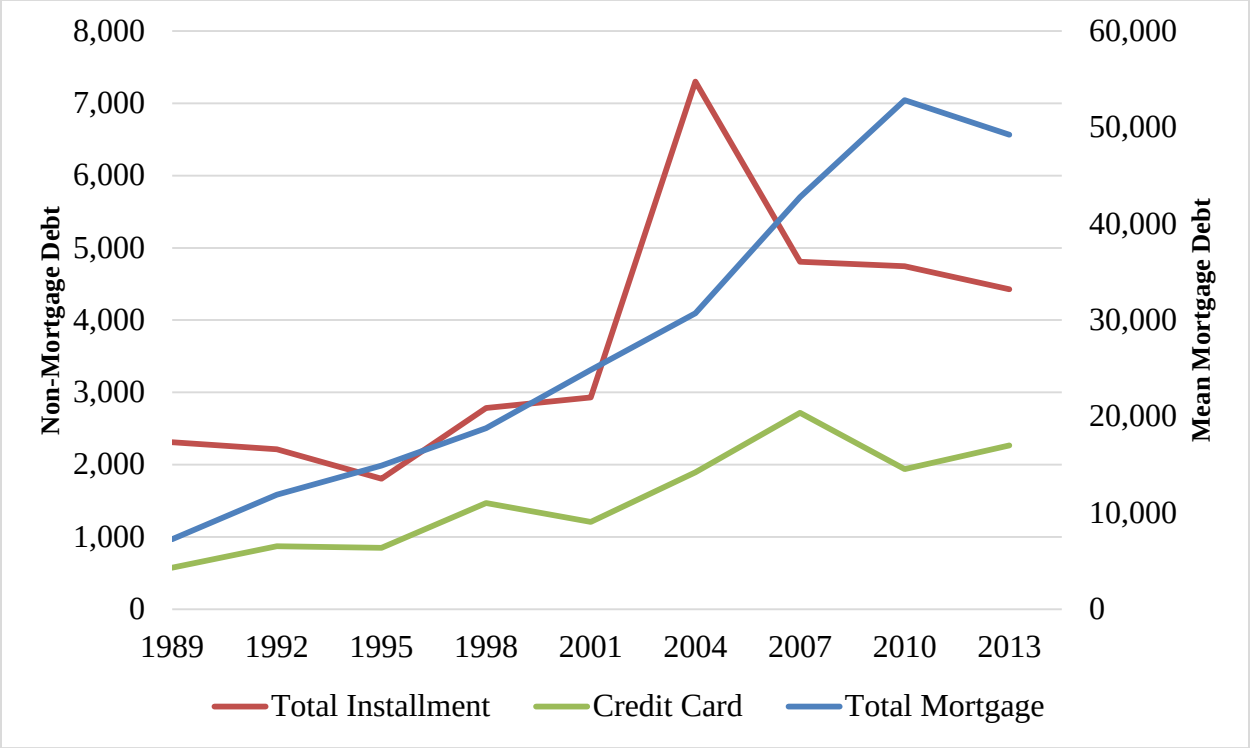


Source: Author's calculations from the Survey of Consumer Finances

The SCF shows that other types of debt have followed trends similar to mortgage debt over time. Figure 2 shows that real installment debts spiked in 2004 and remained about $2,000 higher from 2007-2013 than it was during the late 1990s. The average credit card balance

roughly doubled since the 1990s. However, between 2007 and 2013, credit card debt fell by 17 percent, the same decrease as for mortgage debt.[5] The interplay between various types of debt highlights the importance of focusing on a household's overall debt portfolio, as changes in housing and credit markets may prompt substitution of one debt type for another.

Figure 2: Mean Debt Amounts for Homeowners Age 62+ By Debt Type, Year (2013 Constant Dollars)



Source: Author's calculations from the Survey of Consumer Finances

Home equity can be tapped by various means, including refinancing a first mortgage, a closed-end home equity loan or a home equity loan or line of credit (HELOC), selling the home, or a reverse mortgage. Forward mortgages require periodic repayments and the household must be sufficiently credit worthy and have a sufficient flow of income to qualify for the loan. Reverse

[5] Balances on mortgage and consumer debts may decrease because borrowers pay down debts, or due to bankruptcy, creditor charge-offs of delinquent accounts, or for mortgages due to foreclosures.

mortgages require no monthly repayment and have historically lacked credit-based underwriting criteria, making the loan accessible to borrowers with limited cash-flow and weaker credit profiles.[6] Alternatively, selling the home can be a way to access equity if the household subsequently rents, purchases a lower valued home (with a similar loan-to-value ratio), or purchases a similarly priced home with a higher loan to value ratio. However, relocation may be nonoptimal for seniors who have a strong desire to stay in their homes. Survey data indicates that 63 percent of homeowners age 55 and older and 70 percent of retired homeowners would like to remain in their current residence for the rest of their lives (Freddie Mac, 2016).

Prior research on home equity extraction among seniors tends to focus on either equity extraction generally , or specific borrowing channels such as the use of reverse mortgages . Recent research using credit data merged with data on HECMs finds that from 2004-2012, approximately 60 percent of new equity extraction loans originated by seniors were in the form of HELOCs, 19 percent were structured as cash-out refinancing, 16 percent as HELOANS, and 5 percent as HECMs .

One of the main findings from prior studies on equity extraction is that senior homeowners tend to not spend down housing wealth in retirement, as would be expected from the life-cycle model of consumption (e.g. Modigliani and Brumberg ,1954). Instead, equity extraction tends to occur after the senior household experiences a shock to their health, familial status or finances (Benito, 2009; Davidoff, 2010; Nakajima and Telyukova, 2011; Venti and Wise, 1990; 2004; Poterba, Venti, and Wise, 2011; Megbolugbe, Sa-Aadu, and Shilling, 1997).

[6] Historically, HUD has not imposed risk-based underwriting criteria (e.g., related to credit score, debt, or income). Eligibility for a HECM was based primarily on the borrower's age and residency requirements. However, beginning in April 2015, HUD required lenders to assess and document a borrower's "ability to pay" before originating a loan, following minimum credit, debt, and affordability standards (Mortgagee Letter, 2013-28; Mortgagee Letter, 2014-22; Mortgagee Letter, 2015-06).

These studies tend to rely on survey data to measure shocks to a household, such as death of a family member, loss of a job, or changes in health status.

Rather than analyzing equity extraction through borrowing, prior studies tend to focus on senior extraction of equity through home sale, as the proportion of seniors holding mortgage debt has historically been low (although this trend is changing as noted above). Our study contributes to this literature by focusing on senior equity extraction through borrowing, using credit data rather than survey data. Unlike prior studies, our purpose is not to predict equity extraction, but rather to explore the relationship between home equity borrowing and other credit outcomes, as moderated by the borrowing channel.

With regard to credit outcomes, prior research indicates a high degree of volatility in both the supply and demand for credit in the periods prior to and after the Great Recession (Brown et al., 2010; Fulford, 2015). This volatility influences the amount of debt held by households, as well changes in the composition of debt (Brown et al., 2015) and the extent to which borrowers meet their payment obligations (Brown et al., 2010; Bhutta and Keys, 2016). Using the FRBNY/Equifax CCP data, Brown et al. (2010) report an overall increase in consumer debt from 1999 to 2008, with a decline through 2010. They conclude the decline in debt is due both to a change in consumer behavior (demanding less debt) and to changes in lender supply of credit, where from 2008 to 2010, lenders reduced credit limits on credit cards by 28 percent and on HELOCs by 12 percent. Fulford (2015) estimates that credit card limits continued to decline through 2013.[7] To reduce their outstanding liabilities, lenders also initiated account closures in 2008 following the financial crisis with the number of open credit card accounts held by consumers remaining at the post-2008 levels through 2013. This is relevant to our study in that

[7] He finds that volatility in credit limits is greater than the volatility in household income, and that credit limit volatility contributes to variation in consumption.

we are tracking credit outcomes for seniors during this period of credit supply volatility, from 2006 to 2014.

Home equity borrowing may affect credit outcomes by serving as a substitute for other types of consumer debt. For example, homeowners may substitute less expensive mortgage debt for more expensive credit card debt when the housing market is favorable, and turn back to credit card debt when house prices decline. Using the FRBNY/Equifax CCP data from 1999-2012, Brown et al. (2015) find evidence of substitution, particularly among prime homeowners (with credit scores greater than 700) and older homeowners (older than 55).[8] Homeowners may also use a portion of extracted equity to pay down other consumer debts, with prior studies estimating about 10 percent of extracted equity is used for this purpose (Bhutta and Keys, 2016; Greenspan and Kennedy, 2008; Hurst and Stafford, 2004; Cooper 2010).

Home equity borrowing may affect not only the amount and composition of debt held by a household, but also the ability to meet debt payment obligations. There is a large body of literature that analyzes the relationship between home equity extraction and mortgage default. These studies tend to find that homeowners extracting equity during the boom in house prices from 2004 to 2006 often ended up in a negative equity situation in subsequent years that placed them at increased risk for foreclosure (e.g. Bhutta and Keys, 2016; LaCour-Little et al., 2014; Mian and Sufi, 2011). Most closely related to our analysis, Bhutta and Keys (2016) analyze households who extracted home equity from 1999 to 2008 using the FRBNY/Equifax CCP data. While the primary focus of their study is to explore the decision to extract equity in response to changes in the macro-economy, they also estimate the probability of default on mortgage and

[8] As house prices declined from 2007 to 2012, they find HELOC debt declined by an amount slightly less than the increase in the amount of nonhousing debt held by these homeowning households.

nonmortgage debt in the four years following equity extraction. They find that households extracting equity in 2006 were 90 percent more likely to become delinquent on mortgage debt than other homeowners and 40 percent more likely to become delinquent on nonmortgage debt than other homeowners during the same period.

Our study contributes to this prior literature by focusing home equity borrowing of senior homeowners and subsequent credit outcomes, including both changes in credit card and nonhousing installment debt levels as well as changes in debt payment delinquencies. Similar to other studies reviewed here (Brown et al., 2010; 2015; Fulford et al., 2015; Bhutta and Keys, 2016), we use the FRBNY/Equifax CCP data to track credit outcomes and to identify forward mortgage home equity extractions. Unlike Brown et al. (2015), we do not limit home equity borrowing channels to HELOCs, but also identify closed-end HELOANS and cash-out refinancing of existing first liens, following the strategy used by Bhutta and Keys (2016). Unique to our study, we also trace credit outcomes for HECM reverse mortgages borrowers.[9]

Data and Variables

The paper uses two primary datasets. The first dataset is the FRBNY/Equifax CCP data. The CCP is a panel dataset that begins in the first quarter of 1999 and is updated quarterly, with approximately 40 million credit files each quarter. Our CCP sample covers the years 2006 through 2014, and is limited to senior households over the age of 62 during our study period. The second dataset is the authors' proprietary reverse mortgage credit panel (RMCP) on a sample of more than 30,000 homeowners considering reverse mortgages from 2006 to 2011 with annual

[9] Reverse mortgages are not typically reported to credit bureaus until they are terminated, and thus prior studies cannot identify reverse mortgages by using credit report data alone. We are able to address this deficiency with our unique credit panel data on reverse mortgage borrowers.

credit updates through 2014, linked to data from HUD on HECM loan originations. Like the CCP dataset, the RMCP dataset follows the same individuals over time, and includes similar consumer credit report attributes from Equifax credit reports. Both credit panel datasets include information on individuals' consumer and mortgage debt holdings, payment histories, credit scores (the Equifax risk score), and geographic location (census tract and ZIP code).

In the CCP, we define extractors as those originating a new equity extraction loan between any two quarters of the CCP from 2008-2011.[10] Cash-out refinance originations are defined as those whose first mortgage balance increases by at least $1,000 or 5 percent of the total first mortgage balance from the prior quarter, and whose combined mortgage balance increases by at least the same amount (thus excluding consolidation mortgages).[11] Home equity loan originations are defined as those whose installment loan balance increases by at least $1,000 or 5 percent of the total balance of installment loans on the credit report from the prior quarter. HELOC originations are determined by the creation of a new HELOC trade line account as specified by the opening date in the credit file. For this analysis, we code as HELOC borrowers those consumers who originate a new HELOC and extract equity at the time of origination, as

[10] We are defining extraction at a single point in time (baseline year). While mortgage activity could occur after the baseline year, our analysis is estimating the effect of the extraction that occurred in the baseline year on credit outcomes. We do not model subsequent mortgage activity after the baseline year that could also affect credit outcomes.

[11] We exclude households from the sample whose first mortgage balance increased by $1,000 or more from one quarter to the next, but who are also 90+ days past due on their forward mortgage in either quarter. It is likely that these consumers have an increase in their mortgage balances due to default and/or loan modification (which were common during the 2008-2011 sample period), not cash-out refinancing. It would be very unlikely that a household in default on their first mortgage would be able to refinance and extract additional equity. This restriction excludes about 8,000 consumers from the dataset.

indicated by a positive balance on the HELOC.[12] In the RMCP dataset, HECM originations are identified by the closing date for the HECM origination.

We further limit our sample to those in the CCP who do not appear to be investors, that is, those with fewer than three installment loans or first mortgages and fewer than three HELOC accounts. To exclude mortgages originated to purchase a new principal residence, we exclude consumers that changed census blocks from the quarter prior to loan origination. Finally, we limit the CCP sample to those consumers residing in similar geographic areas to the HECM borrowers in the RMCP dataset.[13]

Using these definitions, we identify 74,603 senior equity extractors in the CCP from 2008 to 2011, of whom 37 percent originated a HELOC, 36 percent cash-out refinanced a first mortgage, and 27 percent originated a closed end home equity loan. We also generate a random sample of 80,000 nonextractors, or 20,000 per year from 2008 to 2011. We combine this dataset from the CCP with our RMCP dataset of 13,666 households. For the regression analysis, we drop individuals with missing or extremely large values for credit outcomes or equity extraction amounts, and individuals lacking three consecutive years of credit data, resulting in 157,680 unique individuals.[14] We follow each individual on an annual basis from the quarter of origination in the credit panel dataset for two years prior to loan origination (baseline) and three

[12] Approximately half of the senior consumers in the CCP dataset originate a HELOC but do not have positive balance in the period after origination, indicating that they did not extract equity at the time of origination. For our primary specification, we treat these consumers as missing from the sample. In alternative specifications we include these individuals as HELOC borrowers, with no substantial change in our results.

[13] We define geographic area using the 3-digit ZIP code, and include CCP consumers residing in a 3 digit ZIP code that matches a HECM borrower in our sample. This restriction results in 25,771 ZIP codes, comprising 60 percent of U.S. ZIP codes with 92 percent of the U.S. population.

[14] Extremely large values are defined as open credit card balances greater than $50,000, open (non-mortgage) installment balances greater than $500,000 and initial withdrawal amounts greater than $500,000.

years after loan origination—up to six years total for a given individual or loan origination, resulting in more than 700,000 observations during our sample period.[15] Because nonextractors do not have a quarter of extraction, they are randomly assigned a quarter from which their yearly observations are drawn.

From the credit panel data, we identify five credit outcomes: credit card balance, non-mortgage installment loan balance, credit score (the Equifax risk score), whether or not the consumer has any tradeline that is 60 days or more past due as of the time of the credit report, and whether or not the consumer has any mortgage with a foreclosure on file.[16] Summary statistics are reported in Table 2, first for the overall sample and then by extraction channel. All dollar amounts are deflated to constant dollar values for 2006.

[15] For some observations, we have fewer than six years of data due to death or attrition from the credit panel dataset. In addition, as households exit the CCP, new individuals are randomly added; thus, for newly added consumers we may be missing data for two full years prior to loan origination. For all observations, we have at least three consecutive years of data (including the baseline period).

[16] Credit scores are the proprietary Equifax credit scores that range from 250 to 850.

Table 2: Summary Statistics, at Loan Origination or Baseline Period

	Full sample (n=157,680)[1]		HECM (n=12,464)	HELOC (n=25,753)		CASH-OUT (n=24,728)		HELOAN (n=18,968)		Non-Extract (n=75,767)	
	Mean (SD)	Median	Mean (SD)	Mean (SD)		Mean (SD)		Mean (SD)		Mean (SD)	
Credit outcomes											
Credit card balance	$4,452	$749	$7,647	$5,891	***	$5,616	***	$6,673	***	$2,504	***
	(8,764)		(11,693)	(9,715)		(9,472)		(10,284)		(6,457)	
Installment loan balance	$6,655	$0	$6,099	$7,880	***	$10,329	***	$11,449	***	$3,930	***
	(20,867)		(18,841)	(22,022)		(27,189)		(27,005)		(15,523)	
Equifax risk score	750	780	696	776	***	752	***	741	***	751	***
	(82.56)		(97.73)	(49.16)		(79.92)		(84.93)		(84.63)	
Any >60 days past due	0.108		0.250	0.024	***	0.095	***	0.118	***	0.115	***
	(0.310)		(0.433)	(0.153)		(0.294)		(0.323)		(0.319)	
Any foreclosure on file	0.008		0.001	0.000	***	0.785	***	0.020	***	0.008	***
	(0.089)		(0.038)	(0.019)		(0.088)		(0.141)		(0.092)	
Other variables											
Initial extraction amount (ten thousands)	$2.96	$0.12	$4.81	$3.69	***	$9.20	***	$4.40	***	$0.00	***
	(5.85)		(5.58)	(5.16)		(9.28)		(4.96)			
Mortgage balance	$64,660	$9,182	$62,769	$78,189	***	$153,168	***	$85,361	***	$26,303	***
	(120,169)		(109,150)	(137,276)		(151,862)		(114,156)		(81,854)	
% with mortgage at baseline	0.53		0.57	0.67		1.00		0.88		0.23	
Δ risk score (2 yrs prior)	1.01	2.00	-12.21	1.83	***	1.68	***	-0.95	***	3.45	***
	(46.66)		(62.00)	(33.08)		(45.05)		(51.39)		(46.02)	
% with a credit shock	0.170	0.000	0.289	0.142	***	0.178	***	0.188	***	0.151	***
	(0.376)		(0.453)	(0.349)		(0.383)		(0.391)		(0.358)	
Age of borrower	71.12	69.00	71.86	69.08	***	68.03	***	68.47	***	73.36	***
	(8.79)		(7.38)	(7.24)		(7.05)		(7.07)		(9.69)	
Origination year, 2008	0.271		0.148	0.374	***	0.242	***	0.331	***	0.250	***
Origination year, 2009	0.229		0.143	0.219	***	0.232	***	0.212	***	0.250	***
Origination year, 2010	0.254		0.383	0.201	***	0.266	***	0.249	***	0.249	***
Origination year, 2011	0.246		0.327	0.205	***	0.260	***	0.208	***	0.251	***

*** p<0.01, ** p<0.05, * p<0.1

[1]Summary statistics and sample size correspond to observations for the baseline period. Some individuals are missing observations for the two years prior to baseline, and thus the sample size for the credit shock and change in credit score two years prior to baseline is Withdrawal <$10ker (n=134,003)

There are noticeable differences between HECM borrowers and other types of extractors, as well as between extractors and nonextractors. Across all channels, those extracting home equity tend to have larger credit card and installment loan balances than nonextractors. HECM borrowers also tend to have higher credit card balances at baseline than extractors and nonextractors, but lower installment balances relative to other extractors. At the time of loan origination, HECM borrowers have much lower credit scores on average than other seniors, both extractors and nonextractors. In addition, HECM borrowers are more likely to be past due on any trade-line and to have a foreclosure on file at the time of loan origination.

HECM borrowers are also twice as likely to have experienced a drop in credit score within the two years prior to loan origination, which we label a "credit shock. Overall, nearly 30 percent of HECM borrowers experienced a drop in their credit score of greater than 25 points in the two years prior to baseline, compared to 14 to 19 percent for other extraction channels, and 15 percent of nonextractors. The average HECM borrower had a drop in credit score of 12 points, whereas for other extraction channels, the average borrower's credit stayed the same or increased slightly in the two years prior to extraction. Seniors with compromised credit or prior credit shocks who desire to extract equity may be unable to qualify for forward mortgages, but were able to qualify for a HECM. During the sample period (2008-2011), there was no credit based underwriting criteria for origination a HECM.[17]

In alternative specifications, we model the initial extraction amount in addition to the channel of extraction. The initial extraction amount is defined as the amount extracted above and

[17] Historically, HUD has not imposed risk-based underwriting criteria (e.g., related to credit score, debt, or income). Eligibility for a HECM was based primarily on the borrower's age and residency requirements. However, beginning in April 2015, HUD requires lenders to assess and document a borrower's "ability to pay" before originating a loan, following minimum credit, debt and affordability standards (Mortgagee Letter 2013-28; Mortgagee Letter 2014-22; Mortgagee Letter 2015-06).

beyond existing mortgage balances (for forward extraction loans) or after paying off forward mortgage balances (for HECMs). For a HECM borrower, the average pay-off was $62,769 in prior mortgages, and the average extraction equaled an additional $48,122. HELOC borrowers tend to extract a smaller amount, on average, while those cash-out refinancing a first mortgage tend to extract the most. With regard to prior mortgage balances at the time of origination, HECM borrowers have significantly higher balances than nonextractors (which includes non-homeowners and those who own their homes outright), but smaller balances than seniors extracting equity through other channels.

In addition to the amount extracted at origination, we also estimate a set of models that include the amount of monthly cash that results from the HECM. HECM borrowers face a requirement to payoff forward mortgage debt with the proceeds of the HECM, this frees up cash flow that would otherwise be used to make their forward mortgage payment. On credit report data, we observe the amount of the monthly mortgage payment in the period prior to originating the HECM, with an average monthly amount of $520 (including those with no prior mortgage). In addition, about 5 percent of HECM borrowers in our sample structured their HECM to receive monthly payments from the equity for a set period of time (term) or until loan termination (tenure). The average amount of a monthly payment is about $1,500 for those receiving monthly payments. When averaged across all HECM borrowers, this amount equals about $40 per month. We measure monthly cash from the HECM as the sum of the prior monthly mortgage payment and the tenure or term payments from the HECM.

Empirical Models

We estimate the impact of equity extraction by channel on credit outcomes using an individual, fixed-effects panel regression:

$$(1)\quad y_{it} = a_i + \theta \mathrm{Prior}_t + \lambda \mathrm{Post}_t + \phi\left(\mathrm{Channel}_{ijt} * \mathrm{Prior}_t\right) + \delta\left(\mathrm{Channel}_{ijt} * \mathrm{Post}_t\right) + \beta_j x_{it} + \varepsilon_{it}$$

where y_{it} is a particular credit outcome for consumer (i) at time (t). The baseline period for each consumer is omitted from the analysis, and is defined as the quarter immediately before origination for those originating an equity extraction loan. We include an indicator, "Prior", coded as 1 for the observations that occur during the two years prior to baseline or 0 otherwise and thus θ measures the average difference in the outcome from two year prior to extraction to the baseline period. Post is coded as 1 if the observation occurs after the extraction (baseline) period, and λ measures the average change in the outcome across the three years after extraction. The interaction coefficient ϕ measures the difference in the outcome for given channel (j) of extraction prior to extraction. The interaction coefficient δ can be interpreted as the differences-in-differences estimate for a given channel (j) of extraction after extraction and it is the key coefficient of interest.[18] Each model includes a vector of controls for time varying borrower age and year, measured by β, and an error term for each individual and year, ε_{it}. Year fixed effects are included to absorb changes in the macro-economy over time, including supply-side factors

[18] This is the effect of the extraction that occurs in the baseline period on outcomes for three years post extraction. It is possible that other mortgage activity (such as subsequent extractions) occur after the baseline period. To the extent that this varies systematically by channel, this effect also would be picked up by the interaction term.

that may affect credit availability and account balances (e.g., due to charge-offs or account closures).

In alternative specifications to the base model, we measure each year of the post period (and their interactions) separately for the three years following extraction (baseline), in addition to the measure for the pre period. This allows us to track the evolution of credit outcomes over time throughout the post period. We also estimate the model separately for those with and without a credit shock, allowing all of the model parameters to vary for the respective subsamples, as consumers with credit shocks may respond differently to different channels of extraction.

Our primary identification strategy is differences-in-differences estimation, comparing differences within the same individuals over time by channel of extraction, relative to those not extracting equity. We also control for observable time varying characteristics that may influence credit outcomes, including the age of the senior and the calendar year of the observation period. It is possible that unobserved differences among seniors may influence the likelihood of extraction through a particular channel, and these differences may be correlated with the credit outcomes. To account for this, we include individual fixed effects. However, individual fixed effects only account for time invariant unobserved characteristics between individuals. There may still be unobserved differences between individuals that vary over time or interact with the channel of extraction to effect credit outcomes.

To better isolate the relationship between the channel of extraction and credit outcomes, we construct a matched sample of observations using coarsened exact matching (CEM). We then re-estimate the individual fixed effects models using the matched sample. While CEM only matches on observable characteristics, the CEM approach assumes that some of the unobservable

characteristics that may affect credit outcomes are correlated with the observed characteristics used for matching. We use the k2k match procedure (Blackwell et al., 2009). For each HECM observation, we use CEM to identify two matched observations in the CCP dataset: a household with a new forward equity extraction (HELOC, cash-out refinance, or closed-end home equity loan) during the observation period; and a senior household with no new equity extraction during the observation period. We treat the baseline period for matching in the RMCP and CCP sample (time t) as the quarter immediately prior to the equity extraction.

For the CEM, we match characteristics in the CCP and RMCP datasets at time t, including the date (quarter and year) of origination, three digit ZIP Code, credit score, the mortgage balance at baseline, an indicator for mortgage payment delinquency, and the amount of the initial withdrawal for extractors.[19] For the HECM to extractor match, the CEM procedure is able to identify a matched observation for 34 percent of the HECM borrowers in our sample. This indicates that only about one-third of the HECM borrowers in our sample have characteristics that would also be observed among seniors extracting equity through other borrowing channels who are in the CCP sample (of about 75,000 equity extractors). For the HECM to nonextractor match, the CEM procedure generates a match for 98 percent of the HECM borrowers. Part of the reason for the higher match rate is the larger pool of nonextractors from which a match can be generated. For the HECM to nonextractor match, we do not limit the match pool to the 80,000 randomly selected nonextractors used in the initial regression, but

[19] For credit score, we coarsen the match based on the following credit buckets: <300, 300-619, 620-719, 720-849, and 850+. Mortgage delinquency is an exact match, measured by an indicator for whether or not the consumer was 60 days or more delinquent on their mortgage in the quarter prior to baseline. For mortgage amount and the initial withdrawal amount, we coarsen the match based on the following buckets: $0; $1-$49,999; $50,000-$149,999; $150,000-$1,000,000).

instead use the entire CCP dataset of nonextractors age 62 and older, which includes more than two million observations during our sample period.

For the analysis, we retain only those HECM observations with a match to the extractor sample, and the nonextractors who are linked to those HECM observations. We include the same restrictions applied to the full sample of CCP observations, resulting in a final dataset of 15,311 individuals, including 5,472 HECM borrowers, 4,422 CCP extractors and 5,417 CCP nonextractors.[20] Table 3 provides summary statistics for the matched samples.

[20] The HECM/nonextractor match does not include the initial withdrawal amount as part of the match criteria, so there are fewer unique strata generated for the HECM/nonextractor match than the HECM/extractor match. Thus, for a single HECM/extractor matched set of observations, we may have multiple HECM/nonextractor matched sets identified. This results in a slightly larger sample size for the HECM and nonextractor observations than the extractor observations.

Table 3: Summary Statistics for Matched Sample, at Loan Origination or Baseline Period

	HECM (n=5,472)	Any Extract (n=4,422)	HELOC (n=1,428)	CASH-OUT (n=1,735)	HELOAN (n=1,259)	Non-Extract (n=5,417)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Credit outcomes						
Credit card balance	$8,251 (11,745)	$6,019 *** (9,517)	$6,179 *** (9,375)	$5,083 *** (8,562)	$7,126 ** (10,728)	$5,218 *** (9,508)
Installment loan balance	$6,805 (19,745)	$9,359 *** (24,054)	$7,951 ** (19,263)	$9,849 *** (30,126)	$10,279 *** (18,922)	$7,147 (19,837)
Equifax risk score	723 (81.97)	745 *** (81.17)	768 *** (55.50)	741 *** (85.69)	723 (91.75)	733 *** (91.75)
Any >60 days past due	0.140 (0.347)	0.105 *** (0.307)	0.041 *** (0.197)	0.116 ** (0.320)	0.164 ** (0.370)	0.162 ** (0.368)
Any foreclosure on file	0.001 (0.030)	0.017 *** (0.130)	0.000 (0.000)	0.018 *** (0.133)	0.036 *** (0.186)	0.019 *** (0.136)
Other variables						
Initial extraction amount (ten thousands)	$3.99 (4.90)	$4.43 *** (5.62)	$3.09 *** (4.24)	$5.96 *** (7.14)	$3.84 (3.82)	$0.00 ***
Mortgage balance	$103,790 (101,862)	$106,613 (111,836)	$88,611*** (114,502)	$133,925*** (112,089)	$89,394*** (100,354)	$112,853*** (112,228)
% with a mortgage at baseline	1.00	0.89	0.75	1.00	0.90	1.00
Δ Equifax risk score (2 yrs prior)	-5.85 (52.45)	0.43 *** (48.04)	2.01 *** (36.09)	1.22 *** (48.33)	-2.53 * (58.48)	-1.08 *** (56.20)
% with a credit shock	0.239 (0.426)	0.185 *** (0.388)	0.151 *** (0.358)	0.192 *** (0.394)	0.215 (0.411)	0.199 *** (0.400)
Age of borrower	71.49 (6.99)	68.73*** (7.23)	69.02 *** (7.47)	68.33*** (6.85)	68.94*** (7.46)	70.71 *** (7.62)
Origination year, 2008	0.186	0.166 **	0.209 *	0.124***	0.172	0.155 ***
Origination year, 2009	0.147	0.146	0.140	0.172 **	0.115 ***	0.152
Origination year, 2010	0.388	0.353***	0.306 ***	0.364 *	0.391	0.349 ***
Origination year, 2011	0.280	0.336***	0.345 ***	0.339 ***	0.322 **	0.343 ***

*** p<0.01, ** p<0.05, * p<0.1

Ideally, the CEM procedure would reduce the imbalance on observable characteristics between the HECM sample and the CCP samples. While there are still statistically significant differences between the HECM samples and CCP samples (Table 3), the magnitude of these differences has been substantially reduced relative to those in the random sample comparisons (Table 2).

Using the matched sample, we re-estimate the same models specified in equation (1) for each credit outcome. We also estimate a specification that includes the amount of the initial extraction by channel (and their interactions) in addition to the channel of extraction. This allows us to separate the effect of originating a loan through a particular channel and the dollar amount of equity extracted as we might expect the intensity of equity extraction to have a different effect than origination. In the amount specification, we also include the amount of monthly cash generated from the HECM (which is $0 for HECM borrowers in the period prior to extraction). This allows us to explore any added impact of additional monthly cash flow from the HECM on credit outcomes.

Results

Descriptive Credit Trends

Prior to presenting the regression results, we graph the trends over time for each of the five credit outcomes, by extraction channel. We first graph the trends for the full random sample (Figures 3.1-3.5). There are notable differences in credit trends. With regard to credit card balances (Figure 3.1), HECM borrowers see a sharp increase prior to extraction, and then a substantial drop and leveling off after extraction, in line with increased demand for liquidity that is met through credit card use and then substituted with home equity after the origination of the HECM. By contrast, other equity extractors tend to have declining or flat revolving credit

balances prior to extraction, that then drop off slightly after extraction. This pattern of paying down debt prior to (and after) extraction is observed for installment loan balances as well (Figure 3.2). Unlike the pre-extraction spike in revolving credit card balances, installment loan balances decline for HECM borrowers before and after extraction.

With regard to credit score (Figure 3.3) HECM borrowers are more likely to undergo a credit shock prior to extraction, and then recover from the shock after extraction. Other seniors tend to have higher and relatively flat credit score trends before and after extraction. In an analysis of credit trends over the life cycle, Fulford and Schuh (2015) find that credit scores increase gradually as people age, this matching the trend we observe for nonextractors in our sample. The credit shock for HECM borrowers is also evident in a spike in past due trade lines (Figure 3.4) prior to extraction, that declines immediately after extraction and then begins to rise again over time. Seniors extracting equity through cash-out refinancing exhibit the reverse trend, with a slight decline in past due accounts prior to extraction and an increase that begins immediately thereafter. The spike in delinquency after extraction is even more pronounced for foreclosures on mortgage debt (Figure 3.5), where cash-out refinancing is associated with a stark increase in foreclosure rates each year after extraction. By contrast, the rate of foreclosures among HECM borrowers declines with extraction and remains low for the three years following extraction.

Figure 3.1 Credit Card Balances

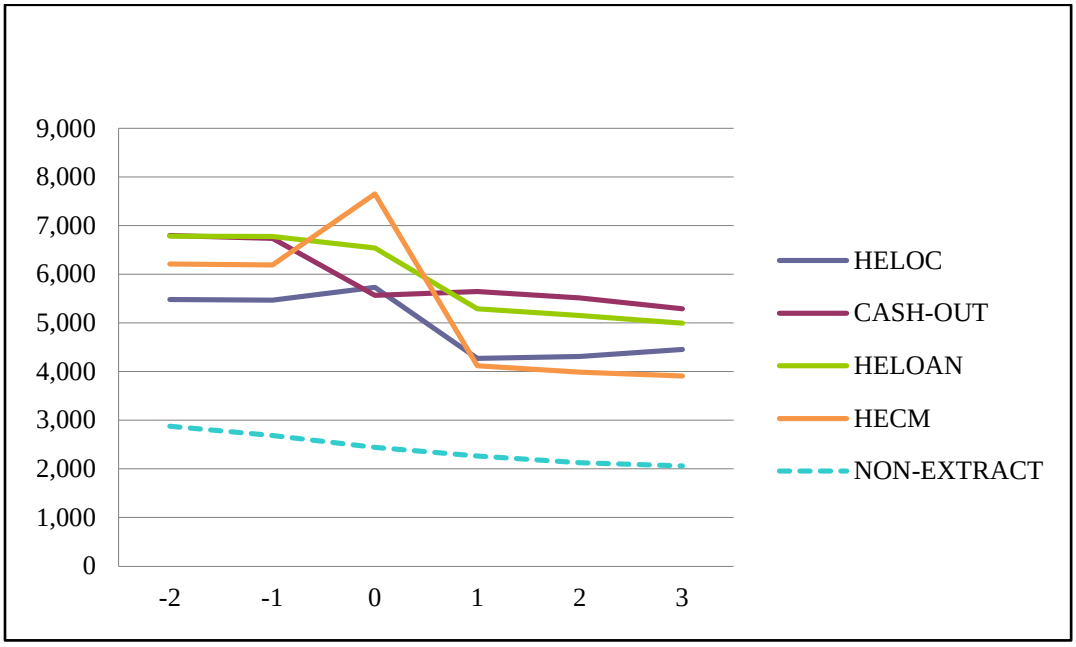


Figure 3.2 Nonhousing Installment Loans

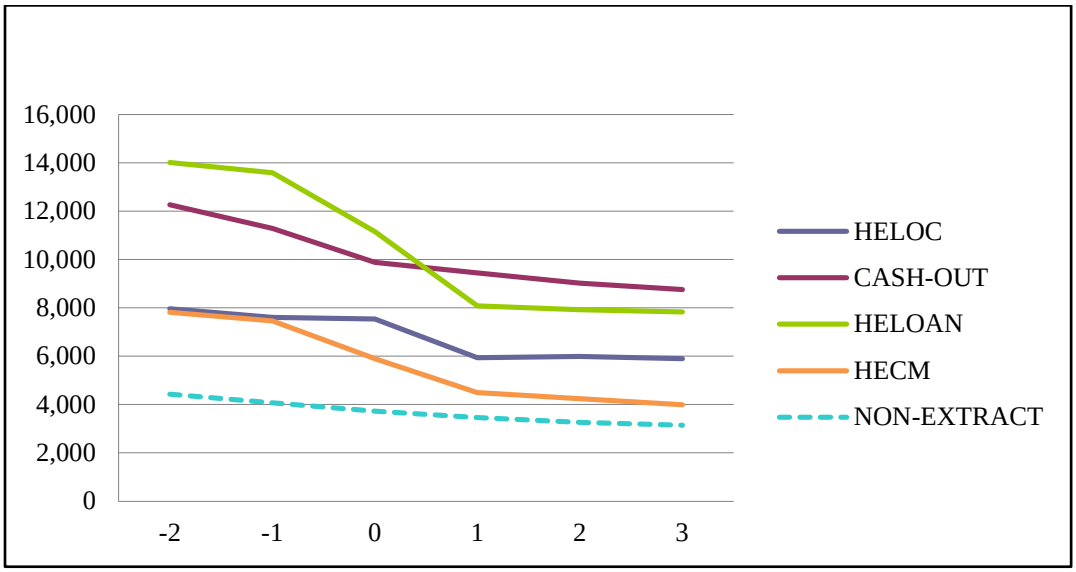


Figure 3.3 Equifax Risk Score

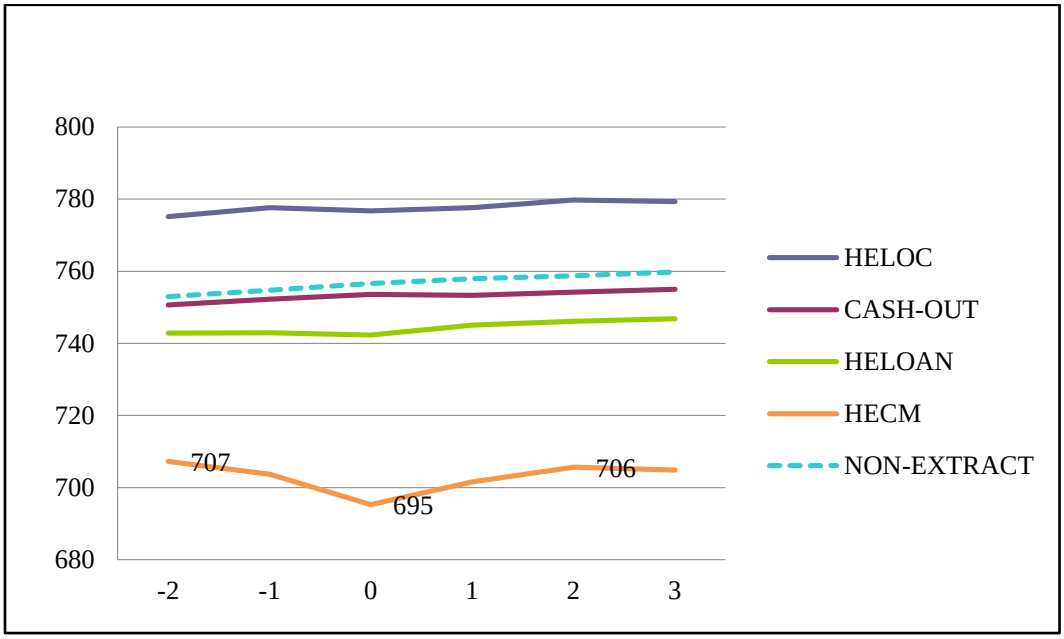


Figure 3.4 Past Due any Tradelines

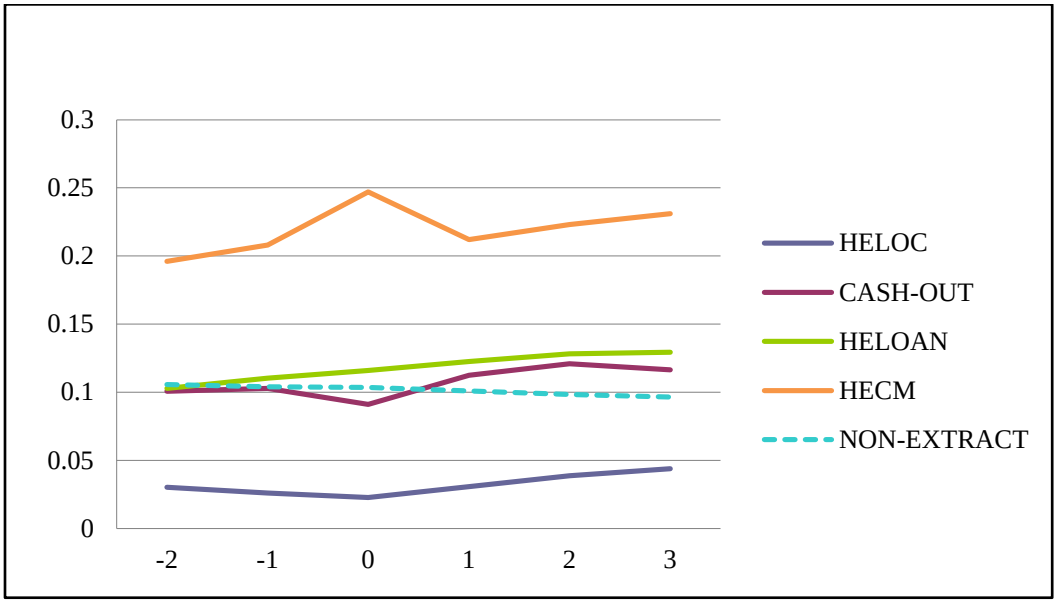
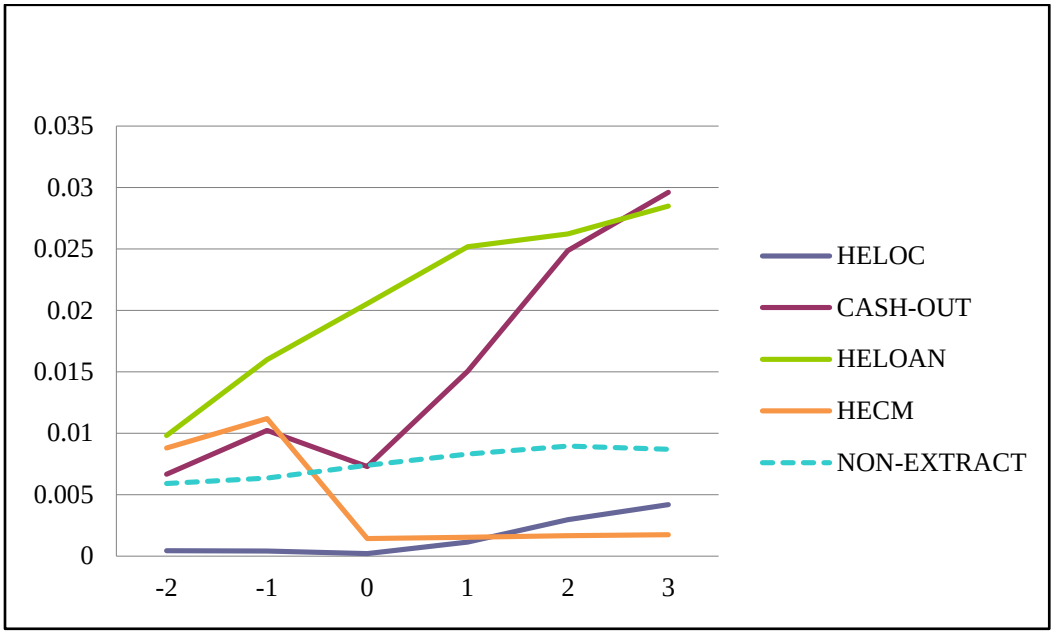


Figure 3.5 % with Foreclosure on Credit File



Figures 4.1-4.5 graph the same credit trends, but this time for the matched samples generated through the

CEM procedure. Even with the more restrictive matched sample, we observe an increase in credit card balances at the time of extraction for HECM borrowers (Figure 4.1) that substantially declines in the period after extraction, a trend that is not observed for other extractors. However, HECM borrowers in the matched sample do not have as noticeable of a drop in credit score prior to extraction as the full sample of HECM borrowers (Figure 4.3 relative to Figure 3.3), and the credit score remains relatively flat after extraction (Figure 4.3). This indicates that HECM borrowers with a credit shock were less likely to find a comparable match in the sample of forward mortgage extractors, and those finding a match were less likely to have had a credit shock. With regard to payment delinquencies, the matched sample of HECM borrowers have a steady increase in the likelihood of being past due on a payment from the period prior to the period after extraction, this being different than the trend observed for the full

sample of HECM borrowers (Figure 4.4 relative to Figure 3.4). The other credit trends are relatively similar between the unmatched and matched samples.

Figure 4.1 Credit Card Balances

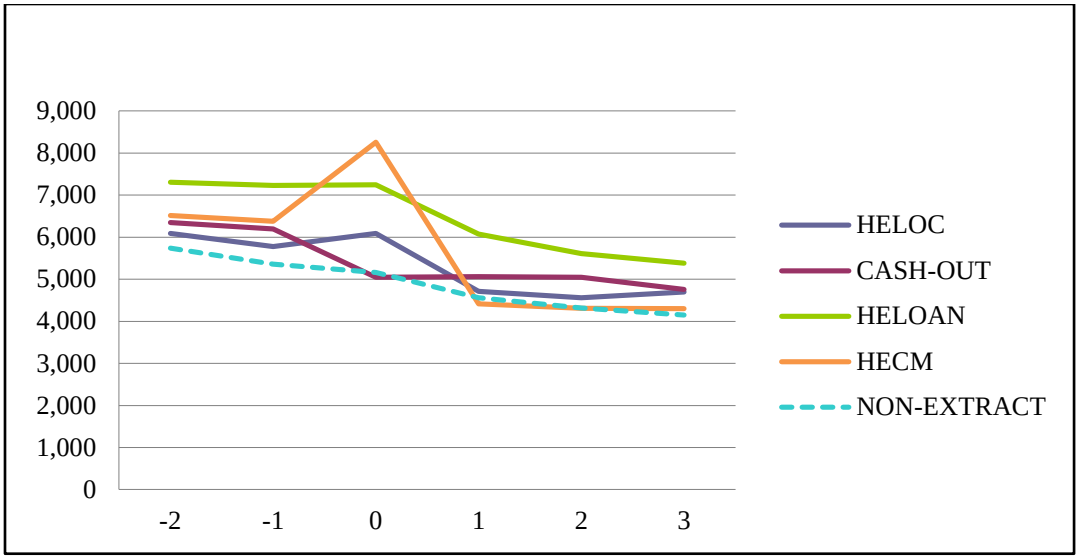


Figure 4.2 Nonhousing Installment Loans

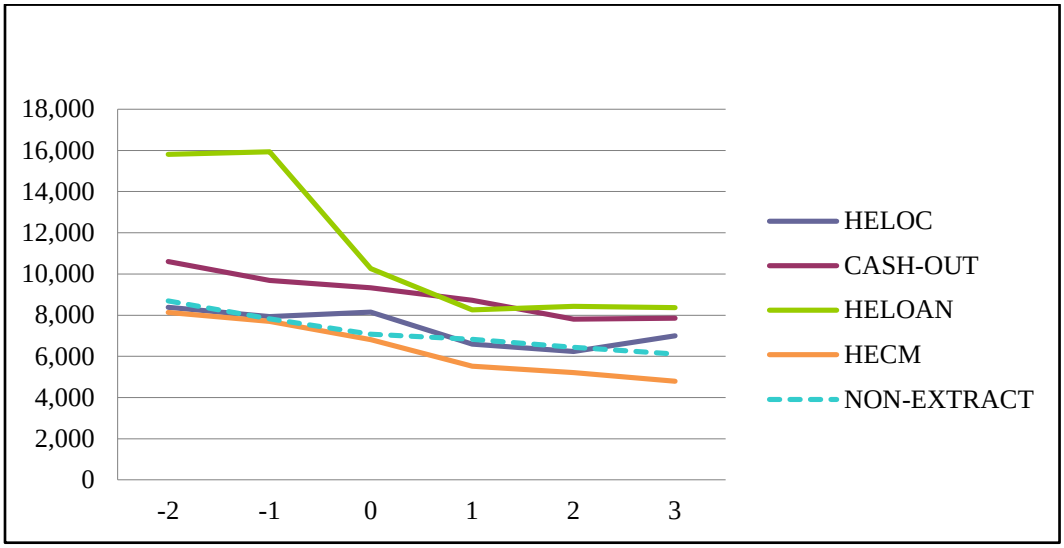


Figure 4.3 Equifax Risk Score

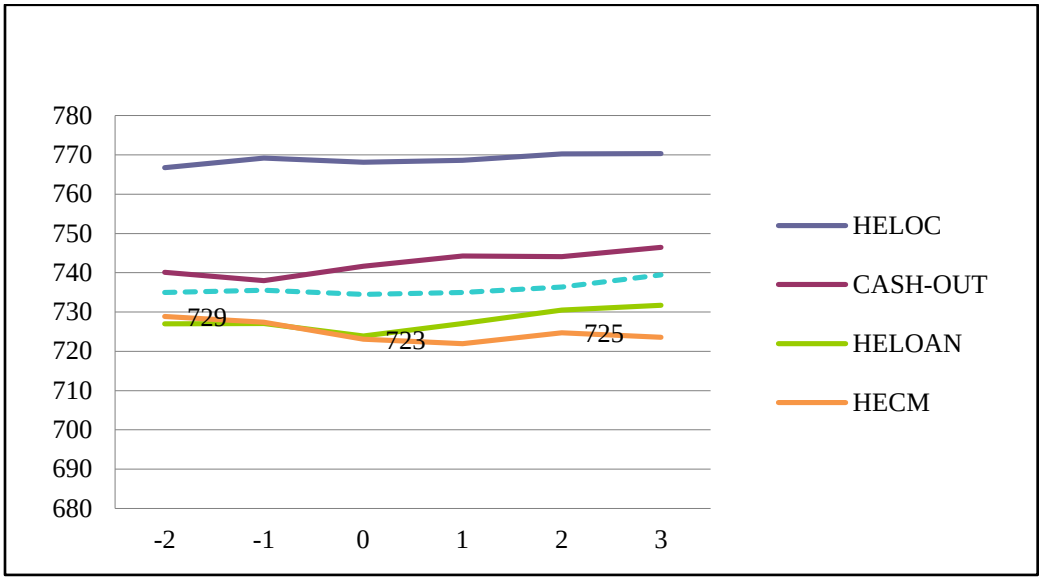


Figure 4.4 Past Due any Tradelines

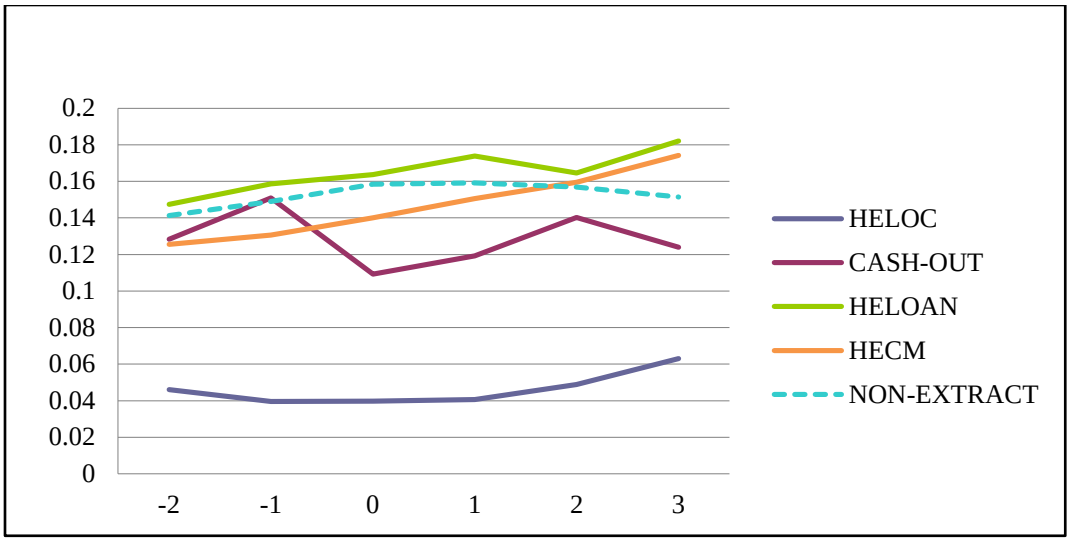
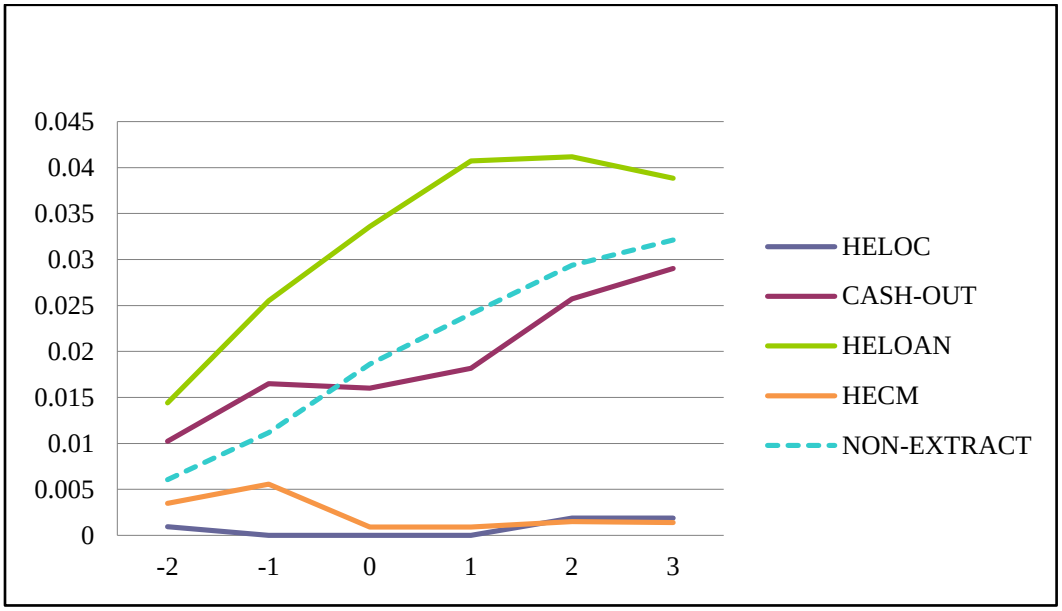


Figure 4.5 % with Foreclosure on Credit File



Full Sample Regression Results

Table 4 presents the results of the fixed-effects panel regression specified in equation (1) for each of the five credit outcomes. The interaction coefficients for each channel of extraction and the after period can be interpreted as the differences-in-differences for a change in credit outcomes post extraction by channel, where the reference category is nonextractors. The before period interactions are the differences by channel two years prior to extraction (or baseline) relative to the baseline period.

The regression results confirm the descriptive trends. HECM borrowers have significantly larger reductions in credit card balances post extraction relative to nonextractors and other extractors. Post extraction, HECM borrower credit balances are more than $3,000 lower than balances at baseline. Installment balances are also significantly lower for HECM borrowers relative to nonextractors, cash-out refinancing and HELOC borrowers. HELOAN extractors have the greatest reduction in installment balances relative to other seniors.

Aside from changes in debt balances, HECM borrowers have about a five-point increase in credit score after extraction, relative to very little change (or decrease) for seniors extracting equity through other channels. HECM borrowers are also the only channel of extractors who are significantly less likely to be delinquent on trade-lines post-extraction; all other channels of extractors have an increased rate of delinquency relative to nonextractors. Seniors extracting equity through cash-out refinancing and HELOANS also have higher rates of foreclosure post-extraction relative to nonextractors. HELOC and HECM borrowers, by contrast, do not have significantly higher rates of foreclosure. This adds nuance to the Bhutta and Keys (2016) finding that extractors have higher rates of default and foreclosure. Our results indicate that changes in default rates differ by channel of extraction.

Table 4: Differences-in-Differences, Full Sample

	(1) Credit Card Bal.	(2) Installment Balance	(3) Equifax Risk Score	(4) Past Due (any)	(5) Foreclosure
Prior to baseline (2 yrs)	-4.109	142.9	-0.916***	0.0125***	0.0057***
	(36.95)	(94.02)	(0.294)	(0.002)	(0.001)
Post baseline	-10.82	54.38	0.620***	-0.0110***	-0.0036***
	(21.11)	(53.86)	(0.175)	(0.001)	(0.000)
HELOC*post	-1,017***	-1,017***	-0.006	0.0182***	0.0007*
	(49.48)	(121.7)	(0.272)	(0.001)	(0.000)
CASH-OUT*post	251.0***	-404.6***	-1.101***	0.0298***	0.0141***
	(49.53)	(139.3)	(0.333)	(0.002)	(0.001)
HELOAN*post	-1,031***	-2,581***	1.825***	0.0132***	0.0042***
	(57.59)	(160.9)	(0.383)	(0.002)	(0.001)
HECM*post	-3,352***	-1,164***	4.886***	-0.0133***	-0.0001
	(88.17)	(134.5)	(0.491)	(0.003)	(0.000)
HELOC*prior	-572.0***	-154.6	1.870***	0.0028*	0.0018***
	(55.29)	(139.4)	(0.299)	(0.002)	(0.000)
CASH-OUT*prior	856.5***	1,660***	1.380***	0.0026	0.0003
	(68.28)	(204.5)	(0.382)	(0.002)	(0.001)
HELOAN*prior	-80.17	2,368***	4.262***	-0.0194***	-0.0093***
	(70.02)	(221.5)	(0.457)	(0.003)	(0.001)
HECM*prior	-1,937***	1,309***	14.895***	-0.0559***	0.0089***
	(104.8)	(226.1)	(0.720)	(0.005)	(0.001)
Constant	14,990	4,334	529.442***	-0.5235	-0.2819*
	(14,078)	(26,448)	(92.911)	(0.609)	(0.146)
Observations	741,308	741,308	741,343	741,308	741,308
R-squared	0.022	0.010	0.006	0.002	0.005
Number of individuals	157,680	157,680	157,680	157,680	157,680

Robust standard errors in parentheses; all models are estimated with individual fixed effects and age and year indicators (not shown)

*** p<0.01, ** p<0.05, * p<0.1

Table 5 presents the results of the regression that includes channel interactions for each post period, allowing for nonlinearities over time. If the coefficient is the same for the first through third years after extraction, this indicates that the impact of extraction on the outcome occurs in the first year and persists (but does not increase or decrease) over time. By contrast, if the coefficient is larger (smaller) in subsequent periods, this indicates that the effect grows (declines) over time.

For most of the outcomes and extraction channels, the majority of the impact on a given outcome occurs in the first year. For HECMs, the largest reductions in revolving and installment debts occur in the first year, and persist for the following two years. The impact on credit score is the greatest in the second year after extraction, and then declines slightly thereafter. For non-HECM channels, the rate of default on trade-lines and foreclosure increases each year after extraction. By the third year after extraction, only the HECM extractors are not significantly more likely to experience a foreclosure relative to nonextractors.

Table 5: Differences-in-Differences, Full Sample, By Period Post Extraction

	(1) Open Credit Card Balance	(2) Open Installment Balance	(3) Equifax Risk Score	(4) Past Due (any)	(5) Foreclosure
HELOC*post y1	-1,260***	-1,251***	-0.306	0.0097***	0.0000
	(50.10)	(119.6)	(0.264)	(0.001)	(0.000)
HELOC*post y2	-1,001***	-967.3***	0.980***	0.0196***	0.0006
	(54.22)	(138.3)	(0.316)	(0.002)	(0.000)
HELOC*post y3	-781.0***	-821.5***	-0.694**	0.0252***	0.0015***
	(59.14)	(146.9)	(0.349)	(0.002)	(0.001)
CASH-OUT*post y1	280.9***	-207.0	-0.811**	0.0239***	0.0066***
	(48.06)	(135.4)	(0.325)	(0.002)	(0.001)
CASH-OUT*post y2	291.5***	-417.0**	-1.066***	0.0347***	0.0157***
	(56.93)	(162.6)	(0.397)	(0.002)	(0.001)
CASH-OUT*post y3	176.8***	-599.8***	-1.454***	0.0307***	0.0205***
	(61.80)	(173.2)	(0.419)	(0.002)	(0.001)
HELOAN*post y1	-1,053***	-2,684***	2.008***	0.0077***	0.0035***
	(57.04)	(151.6)	(0.368)	(0.002)	(0.001)
HELOAN*post y2	-1,011***	-2,594***	2.173***	0.0146***	0.0040***
	(63.86)	(177.7)	(0.444)	(0.003)	(0.001)
HELOAN*post y3	-1,030***	-2,459***	1.271***	0.0172***	0.0053***
	(68.50)	(189.0)	(0.488)	(0.003)	(0.001)
HECM*post y1	-3,401***	-1,093***	4.231***	-0.0282***	-0.0003
	(86.82)	(121.0)	(0.465)	(0.003)	(0.001)
HECM*post y2	-3,385***	-1,118***	6.170***	-0.0107***	-0.0002
	(94.25)	(148.1)	(0.573)	(0.004)	(0.001)
HECM*post y3	-3,278***	-1,314***	4.188***	0.0005	0.0002
	(100.7)	(171.9)	(0.651)	(0.004)	(0.001)
Constant	24,311	7,517	515.284***	0.6533	-0.2976
	(15,043)	(30,909)	(105.263)	(0.673)	(0.192)
Observations	741,308	741,308	741,343	741,308	741,308
R-squared	0.022	0.010	0.006	0.003	0.005
Number of individuals	157,680	157,680	157,680	157,680	157,680

Robust standard errors in parentheses; all models are estimated with individual fixed effects, age and year indicators, and indicators for the post periods and indicators for the prior period and their interactions by channel (not shown)

*** p<0.01, ** p<0.05, * p<0.1

Credit Shock Subsample Regressions

We next explore subsample regressions based on the presence of a prior credit shock, defined as a drop in credit score of 25 points or more in the two years prior to the baseline period. Table 6 presents the results of the primary model specification (Equation 1) for the subsample of seniors who had a prior credit shock (23,485 individuals), while Table 7 presents the results for the subsample without a prior credit shock (111,617 individuals).

In comparing the results for the two subsamples, there is a generally larger reduction in debt balances for all extraction channels for those with a prior shock (Table 6). This is expected to the extent that those who needed liquidity turned to credit card debt prior to equity extraction, and then paid off the debt and borrowed from home equity after extraction. The negative coefficient for revolving debt on the CHANNEL*before for those with a shock suggests this might be the case—as the revolving debt balances were higher at baseline relative to two years prior for each extraction channel (credit card debt increased in the two years prior to extraction), then decreased after extraction. With regard to HECMs, the results indicate that a majority of the impact on debt reduction and credit score is for those who had a prior shock (Table 6). There is still some debt reduction for those without a shock (Table 7), but no significant impact on credit score or default.

Table 6: Differences-in-Differences, Full Sample, Credit Shock

	(1) Open Credit Card Balance	(2) Open Installment Balance	(3) Equifax Risk Score	(4) Past Due (any)	(5) Foreclosure
Prior to baseline (2 yrs)	-894.5***	179.2	77.234***	-0.1971***	-0.0056**
	(134.5)	(305.1)	(0.892)	(0.006)	(0.002)
Post baseline	-392.6***	-175.3	12.196***	-0.0585***	-0.0022
	(74.76)	(176.0)	(0.620)	(0.004)	(0.002)
HELOC*post	-2,190***	-476.3	-3.283***	0.0521***	-0.0021
	(185.9)	(388.1)	(1.020)	(0.006)	(0.002)
CASH-OUT*post	-1,024***	-872.2**	-0.827	0.0372***	0.0263***
	(156.5)	(392.1)	(1.135)	(0.008)	(0.003)
HELOAN*post	-2,553***	-3,178***	6.651***	-0.0182**	0.0032
	(188.4)	(405.8)	(1.334)	(0.009)	(0.004)
HECM*post	-5,333***	-1,627***	7.187***	-0.0451***	-0.0023
	(203.1)	(310.7)	(1.140)	(0.009)	(0.002)
HELOC*prior	-4,290***	-1,269***	-18.078***	0.1473***	0.0157***
	(189.5)	(479.2)	(0.775)	(0.007)	(0.002)
CASH-OUT*prior	-1,588***	536.9	-6.024***	0.0418***	0.0062**
	(197.4)	(534.6)	(0.958)	(0.008)	(0.003)
HELOAN*prior	-1,672***	4,084***	5.313***	-0.0430***	-0.0370***
	(230.7)	(640.9)	(1.223)	(0.010)	(0.005)
HECM*prior	-3,539***	1,452***	18.766***	-0.1411***	0.0209***
	(262.2)	(490.6)	(1.244)	(0.011)	(0.002)
Constant	126,292***	745.8	-175.966	1.1185	-0.2329
	(36,535)	(59,245)	(171.332)	(1.372)	(0.299)
Observations	108,872	108,872	108,880	108,872	108,872
R-squared	0.071	0.020	0.291	0.082	0.020
Number of individuals	23,485	23,485	23,485	23,485	23,485

Robust standard errors in parentheses; all models are estimated with individual fixed effects and age and year indicators (not shown)

*** p<0.01, ** p<0.05, * p<0.1

Table 7: Differences-in-Differences, Full Sample, No Credit Shock

	(1) Open Credit Card Balance	(2) Open Installment Balance	(3) Equifax Risk Score	(4) Past Due (any)	(5) Foreclosure
Prior to baseline (2 yrs)	187.8***	163.9*	-16.080***	0.0531***	0.0076***
	(37.22)	(98.53)	(0.277)	(0.002)	(0.001)
Post baseline	56.18**	122.3**	-1.737***	-0.0024**	-0.0035***
	(22.20)	(58.01)	(0.186)	(0.001)	(0.000)
HELOC*post	-843.0***	-1,157***	0.689**	0.0128***	0.0013***
	(53.52)	(139.2)	(0.293)	(0.001)	(0.000)
CASH-OUT*post	567.6***	-221.8	-1.419***	0.0282***	0.0114***
	(56.15)	(160.7)	(0.365)	(0.002)	(0.001)
HELOAN*post	-637.8***	-2,496***	-0.143	0.0246***	0.0038***
	(63.58)	(193.1)	(0.407)	(0.002)	(0.001)
HECM*post	-2,335***	-838.8***	0.155	0.0102***	-0.0000
	(94.13)	(151.4)	(0.518)	(0.003)	(0.000)
HELOC*prior	23.67	-3.270	5.915***	-0.0230***	-0.0004
	(54.01)	(142.0)	(0.228)	(0.002)	(0.000)
CASH-OUT*prior	1,421***	1,932***	0.455	0.0014	-0.0005
	(71.96)	(222.3)	(0.288)	(0.002)	(0.001)
HELOAN*prior	317.0***	1,839***	0.261	-0.0007	-0.0023***
	(67.89)	(232.6)	(0.313)	(0.002)	(0.001)
HECM*prior	-1,294***	1,057***	-3.301***	0.0293***	0.0079***
	(103.0)	(254.2)	(0.529)	(0.005)	(0.001)
Constant	-15,373	20,790	1,047.993***	-2.3945***	-0.3426**
	(14,114)	(29,661)	(86.108)	(0.618)	(0.174)
Observations	534,938	534,938	534,956	534,938	534,938
R-squared	0.019	0.009	0.044	0.009	0.003
Number of individuals	111,617	111,617	111,617	111,617	111,617

Robust standard errors in parentheses; all models are estimated with individual fixed effects and age and year indicators (not shown)

*** p<0.01, ** p<0.05, * p<0.1

Matched Sample Regression Results

Table 8 presents the overall results of the matched sample regressions. Recall that the purpose of the matched sample is to identify the channel effect on credit outcomes, holding constant the characteristics of borrowers who select into different channels. The matched sample results continue to show a drop in credit card balances for HECM borrowers of about $3,000; a decline that is larger relative to other channels of extraction. However, HECM borrowers in the matched sample have declining credit scores post-extraction relative to non-borrowers and other extractors and have significantly higher rates of delinquency on debt payments relative to non-borrowers. This suggests that the improvements in credit score and payment patterns observed in the full sample (Table 4) may be due to characteristics of borrowers that select into the HECM channel, rather than an effect of the HECM itself. Foreclosure rates for HECM borrowers in the matched sample are significantly lower than non-borrowers, this being similar to the results for the full sample.[21]

[21] While extractors (other than HECM borrowers) in the full sample tend to be more likely to foreclose than non-borrowers in the full sample, we see that the sign switches for extractors in the matched sample, where HECM and HELOC borrowers are significantly less likely to foreclose post-extraction than non-borrowers. This "sign switching" is in part because the non-borrowers in the matched sample regression are much more likely to have had a mortgage in the baseline period (one of the matching criteria) and thus be vulnerable to foreclosure than non-borrowers in the full sample.

Table 8: Differences-in-Differences, CEM Sample, Overall Results

	(1) Open Credit Card Balance	(2) Open Installment Balance	(3) Equifax Risk Score	(4) Past Due (any)	(5) Foreclosure
Prior to baseline (2 yrs)	222.3	773.1**	0.847	0.0049	0.0011
	(168.4)	(381.9)	(1.204)	(0.008)	(0.003)
Post baseline	-507.1***	81.00	0.059	-0.0127***	0.0041**
	(93.96)	(257.0)	(0.722)	(0.005)	(0.002)
HELOC*post	-563.7***	-503.2	-0.285	0.0127*	-0.0092***
	(214.3)	(530.3)	(1.215)	(0.007)	(0.002)
CASH-OUT*post	802.9***	-681.9	1.128	0.0172**	-0.0050
	(178.6)	(591.1)	(1.343)	(0.008)	(0.004)
HELOAN*post	-680.4***	-1,008**	3.066*	0.0158	-0.0054
	(231.9)	(464.0)	(1.657)	(0.010)	(0.004)
HECM*post	-3,042***	-852.8***	-2.509***	0.0216***	-0.0103***
	(159.3)	(279.6)	(0.908)	(0.006)	(0.002)
HELOC*prior	-582.6**	-1,024*	-1.558	0.0231***	0.0134***
	(259.2)	(564.5)	(1.355)	(0.008)	(0.002)
CASH-OUT*prior	800.7***	-619.1	-2.148	0.0336***	0.0044
	(243.8)	(840.9)	(1.554)	(0.010)	(0.004)
HELOAN*prior	-440.1	4,163***	1.999	0.0078	-0.0095*
	(283.8)	(808.8)	(2.031)	(0.012)	(0.006)
HECM*prior	-2,371***	-292.7	4.321***	0.0117	0.0156***
	(184.2)	(406.5)	(1.199)	(0.008)	(0.002)
Constant	29,574	57,418	789.750***	-1.9154**	-0.5812***
	(21,356)	(40,574)	(123.814)	(0.776)	(0.135)
Observations	72,932	72,932	72,189	72,932	72,932
R-squared	0.044	0.011	0.005	0.003	0.009
Number of individuals	15,311	15,311	15,311	15,311	15,311

Robust standard errors in parentheses; all models are estimated with individual fixed effects and age and year indicators (not shown)

*** p<0.01, ** p<0.05, * p<0.1

Table 9 presents the results of the specifications that include the initial extraction amounts by channel and the amount of monthly cash available to HECM borrowers post extraction. With regard to credit card balances, an increase in the initial extraction amount is associated with a decrease in the balance for HECM and HELOAN borrowers. For example, a HECM extraction of $10,000 at origination is associated with a $2,364 reduction in credit card balances in the first year, with the marginal effect being an additional $166 decrease in the credit card balance per $10,000 increase in the initial withdrawal amount. In addition, for each $100 increase in the monthly cash amount from the HECM loan, credit card balances decline by about $45 in the first year after extraction, an effect that persists through the second year and begins to decline by the third year.

For a HELOC extraction of $10,000 at origination, the decline in credit card balance is $720 in the first year, but we find no effect of additional withdrawal amounts. Further, the $720 decline falls over time, being not different than 0 by the third year. The reduction in credit card debt of a cash-out refinancing withdrawal of $10,000 is about $500, this persisting over time. There is no marginal effect of higher withdrawals in the first year and only a small effect in the second year after origination. For HELOANs, the change in credit card debt is very small in all three years after origination.

With regard to installment loan balances, an increase in the extraction amount for HELOAN borrowers is associated with reduced balances by the third year after extraction; for HECM borrowers, balances are modestly lower in the first year after extraction corresponding to an increase in the extraction amount, but this does not persist beyond the first year. Few of the interactions for initial extraction amounts are significant for credit score, payment delinquencies, or foreclosures. An exception is cash-out refinance borrowers, where an increase in the initial

withdrawal amount is associated with a decline in credit score and an increase in the probability of being past due on debt payments.

Table 9: Differences-in-Differences, CEM Sample, Extraction Amounts by Period

	(1) Open Credit Card Balance	(2) Open Installment Balance	(3) Equifax Risk Score	(4) Past Due (any)	(5) Foreclosure
HELOC*$ post y1	-23.45	-165.5	-0.108	0.0013	0.0003
	(36.53)	(207.8)	(0.191)	(0.001)	(0.001)
HELOC*$ post y2	-39.57	-261.6	-0.123	0.0007	0.0007
	(35.50)	(199.8)	(0.235)	(0.001)	(0.001)
HELOC*$ post y3	-23.69	-550.8***	-0.268	0.0011	0.0009
	(40.25)	(208.2)	(0.205)	(0.001)	(0.001)
CASH-OUT*$ post y1	18.77	-78.26	-0.425***	0.0023**	0.0002
	(23.63)	(105.7)	(0.147)	(0.001)	(0.000)
CASH-OUT*$ post y2	66.29**	-51.35	-0.615***	0.0020*	0.0009
	(30.54)	(101.0)	(0.179)	(0.001)	(0.001)
CASH-OUT*$ post y3	43.60	32.13	-0.695***	0.0021*	0.0010
	(26.72)	(124.6)	(0.196)	(0.001)	(0.001)
HELOAN*$ post y1	-73.96*	-70.18	-0.108	0.0014	0.0003
	(39.34)	(193.7)	(0.331)	(0.002)	(0.001)
HELOAN*$ post y2	-100.7**	-35.97	0.081	0.0001	0.0002
	(42.56)	(203.0)	(0.316)	(0.002)	(0.001)
HELOAN*$ post y3	-112.0**	-235.4**	0.039	-0.0022	-0.0004
	(50.72)	(118.5)	(0.343)	(0.002)	(0.002)
HECM*$ post y1	-165.9***	-107.5**	0.065	-0.0016**	0.0001
	(29.50)	(51.86)	(0.134)	(0.001)	(0.000)
HECM*$ post y2	-127.7***	-73.77	-0.031	-0.0006	0.0002
	(32.28)	(55.47)	(0.144)	(0.001)	(0.000)
HECM*$ post y3	-126.2***	-72.94	-0.036	-0.0011	-0.0001
	(34.34)	(64.31)	(0.167)	(0.001)	(0.000)
HELOC*post y1	-719.6***	-588.2	0.724	-0.0017	-0.0076***
	(226.6)	(620.7)	(1.266)	(0.007)	(0.002)
HELOC*post y2	-453.7*	122.9	0.871	0.0082	-0.0116***
	(251.1)	(656.0)	(1.568)	(0.009)	(0.003)
HELOC*post y3	-285.9	1,684**	-0.863	0.0225**	-0.0143***
	(273.1)	(816.9)	(1.595)	(0.010)	(0.003)
CASH-OUT*post y1	549.7***	-108.0	4.450***	-0.0061	-0.0078*
	(202.8)	(769.4)	(1.507)	(0.011)	(0.004)
CASH-OUT*post y2	564.4**	-565.3	4.871**	0.0144	-0.0090*
	(247.7)	(918.8)	(1.979)	(0.013)	(0.005)
CASH-OUT*post y3	568.1**	-842.3	4.013*	0.0064	-0.0100
	(260.3)	(1,042)	(2.133)	(0.013)	(0.006)
HELOAN*post y1	-360.2	-1,141	3.066	0.0077	-0.0018
	(267.7)	(889.4)	(1.965)	(0.012)	(0.006)

HELOAN*post y2	-377.8	-739.4	3.610	0.0069	-0.0058
	(301.7)	(951.5)	(2.295)	(0.014)	(0.006)
HELOAN*post y3	-291.3	34.19	2.706	0.0355**	-0.0093
	(340.1)	(676.6)	(2.499)	(0.016)	(0.008)
HECM*post y1	-2,198***	-217.6	0.181	0.0094	-0.0068***
	(240.3)	(545.8)	(1.396)	(0.009)	(0.002)
HECM*post y2	-2,096***	-10.28	0.487	0.0116	-0.0115***
	(261.6)	(570.4)	(1.603)	(0.010)	(0.002)
HECM*post y3	-2,010***	-222.7	-2.392	0.0366***	-0.0138***
	(286.3)	(597.4)	(1.784)	(0.011)	(0.003)
HECM monthly cash*post y1	-45.18**	-43.16	-0.319***	0.0007	0.0000
	(22.19)	(52.61)	(0.112)	(0.001)	(0.000)
HECM monthly cash*post y2	-60.40**	-69.64	-0.193	0.0014*	0.0000
	(23.92)	(57.24)	(0.124)	(0.001)	(0.000)
HECM monthly cash*post y3	-43.07	-71.38	-0.251*	0.0007	0.0000
	(27.61)	(61.13)	(0.141)	(0.001)	(0.000)
Constant	-15,434	-31,801	947.655***	-1.8117	-2.3403**
	(37,225)	(141,011)	(269.741)	(1.573)	(0.984)
Observations	72,932	72,932	72,189	72,932	72,932
R-squared	0.046	0.013	0.006	0.004	0.011
Number of individuals	15,311	15,311	15,311	15,311	15,311

Robust standard errors in parentheses; all models are estimated with individual fixed effects, age and year indicators, and indicators for the post periods and indicators for the prior period and their interactions by channel (not shown)
*** p<0.01, ** p<0.05, * p<0.1

Matched Subsample Regressions by Initial Withdrawal Amount

Our last set of specifications estimates subsample regressions with the matched sample based on the amount of the initial withdrawal, placing extractors into three groups: small, with initial withdrawals of less than $10,000; medium, with initial withdrawals between $10,000 and $50,000; and large, with initial withdrawals of greater than $50,000. Nonextractors are included as the reference group for all of the subsamples. We estimate the period regressions, including each year post extraction interacted with the channel of extraction. We also include the HECM monthly cash amount for each period post extraction. While the full model is estimated as specified in equation (1), we report only the coefficients for the channel and post period interactions, and the HECM monthly cash amount interactions by post period. The results are grouped by outcome and withdrawal amount in Table 10.

Table 10: Differences-in-Differences, CEM Sample, Results by Initial Withdrawal Amount

	(1)	(2)	(3)	(4)	(5)	(6)
	Open Credit Card Balance			Open Installment Balance		
	Withdrawal <$10k	Withdrawal $10k-$50k	Withdrawal >$50k	Withdrawal <$10k	Withdrawal $10k-$50k	Withdrawal >$50k
HELOC*post y1	314.7	-1,061***	-1,971***	-403.6	-1,332**	-1,563
	(296.8)	(287.3)	(661.8)	(507.6)	(529.5)	(2,821)
HELOC*post y2	763.7**	-935.8***	-1,913***	-181.8	-310.3	-2,456
	(337.1)	(317.4)	(643.1)	(615.1)	(630.0)	(1,941)
HELOC*post y3	1,066***	-949.5***	-1,224	877.4	318.8	-1,907
	(348.5)	(346.0)	(807.4)	(685.7)	(1,040)	(2,363)
CASH-OUT*post y1	217.8	518.1**	1,018***	-163.4	-1,121	116.8
	(230.9)	(235.0)	(297.9)	(475.0)	(743.7)	(1,002)
CASH-OUT*post y2	201.1	635.7**	1,687***	137.8	-1,510	-321.6
	(289.7)	(285.4)	(351.0)	(886.7)	(991.6)	(1,258)
CASH-OUT*post y3	54.29	582.4*	1,461***	274.1	-1,282	-112.3
	(355.4)	(303.7)	(366.2)	(888.9)	(1,073)	(1,319)
HELOAN*post y1	638.4*	-790.2***	-953.5**	-823.6	-1,034*	-2,843**
	(387.7)	(297.7)	(432.1)	(821.3)	(549.3)	(1,116)
HELOAN*post y2	615.9	-799.7**	-1,392**	94.90	-572.4	-2,254*
	(417.1)	(339.8)	(541.4)	(1,014)	(630.5)	(1,317)
HELOAN*post y3	898.8*	-808.0**	-1,371**	1,111	-652.2	-2,304*
	(514.0)	(361.3)	(594.5)	(1,129)	(630.5)	(1,360)
HECM*post y1	-778.6**	-2,662***	-4,922***	-1,714**	-453.8	-81.50
	(375.5)	(303.7)	(446.9)	(824.5)	(407.7)	(1,212)
HECM*post y2	-893.9**	-2,300***	-4,510***	-1,363*	-28.07	345.2
	(418.9)	(318.9)	(475.8)	(816.6)	(500.9)	(1,256)
HECM*post y3	-926.4*	-2,350***	-4,076***	-1,395*	-10.67	-27.65
	(473.1)	(347.5)	(497.9)	(811.5)	(563.1)	(1,399)
HECM monthly cash*post y1	-89.44**	-56.32	-15.33	29.22	-6.846	-142.0
	(36.03)	(36.37)	(44.75)	(68.58)	(43.11)	(139.8)
HECM monthly cash*post y2	-104.7***	-78.15**	-14.67	-19.46	-64.42	-113.1
	(39.39)	(39.60)	(48.18)	(66.45)	(72.54)	(147.1)
HECM monthly cash*post y3	-62.81	-58.36	-32.17	-66.36	-52.59	-64.54
	(47.48)	(44.98)	(53.18)	(66.71)	(81.13)	(163.0)
Constant	57,705	-31,823	92,880*	211,890**	-62,400	162,001
	(50,826)	(47,942)	(54,212)	(99,654)	(175,648)	(116,992)
Observations	37,992	49,427	38,506	37,992	49,427	38,506
R-squared	0.024	0.040	0.049	0.009	0.009	0.013
Number of individuals	7,841	10,313	7,990	7,841	10,313	7,990

Robust standard errors in parentheses; all models are estimated with individual fixed effects, age and year indicators, and indicators for the post periods and indicators for the prior period and their interactions by channel (not shown)

*** p<0.01, ** p<0.05, * p<0.1

Table 10 (cont.): Difference-in-Difference, CEM Sample, Results by Initial Withdrawal Amount

	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	Equifax Risk Score			Past Due (any)			Foreclosure		
	Withdrawal <$10k	Withdrawal $10k-$50k	Withdrawal >$50k	Withdrawal <$10k	Withdrawal $10k-$50k	Withdrawal >$50k	Withdrawal <$10k	Withdrawal $10k-$50k	Withdrawal >$50k
HELOC*post y1	-0.241	1.060	-0.717	0.0030	-0.0020	0.0155	-0.0065***	-0.0069***	-0.0065***
	(1.742)	(1.590)	(3.198)	(0.010)	(0.009)	(0.016)	(0.002)	(0.002)	(0.002)
HELOC*post y2	-0.031	0.426	1.340	0.0043	0.0118	0.0192	-0.0095***	-0.0104***	-0.0068
	(2.089)	(2.007)	(3.419)	(0.011)	(0.012)	(0.016)	(0.003)	(0.002)	(0.005)
HELOC*post y3	-1.044	-2.497	-0.867	0.0249*	0.0288**	0.0206	-0.0137***	-0.0115***	-0.0094*
	(2.173)	(2.083)	(3.260)	(0.014)	(0.012)	(0.017)	(0.002)	(0.003)	(0.005)
CASH-OUT*post y1	10.828***	4.043**	-4.780**	-0.0172	-0.0052	0.0350***	-0.0144*	-0.0127**	0.0060
	(3.145)	(1.609)	(2.046)	(0.025)	(0.012)	(0.013)	(0.008)	(0.005)	(0.006)
CASH-OUT*post y2	10.196**	4.111*	-6.509***	0.0026	0.0163	0.0492***	-0.0060	-0.0120**	0.0085
	(4.101)	(2.171)	(2.322)	(0.031)	(0.013)	(0.014)	(0.013)	(0.006)	(0.006)
CASH-OUT*post y3	8.044*	3.077	-7.812***	-0.0108	0.0125	0.0391***	-0.0253**	-0.0036	0.0044
	(4.513)	(2.317)	(2.456)	(0.032)	(0.014)	(0.014)	(0.011)	(0.007)	(0.006)
HELOAN*post y1	2.607	2.885	1.717	0.0083	0.0131	0.0156	0.0002	-0.0006	-0.0014
	(3.796)	(1.937)	(3.161)	(0.026)	(0.013)	(0.019)	(0.006)	(0.005)	(0.007)
HELOAN*post y2	11.517***	1.442	5.779	-0.0206	0.0182	-0.0060	-0.0085	-0.0032	-0.0087
	(4.312)	(2.466)	(3.826)	(0.025)	(0.015)	(0.021)	(0.012)	(0.006)	(0.010)
HELOAN*post y3	7.523*	0.237	7.215*	0.0083	0.0473***	-0.0189	-0.0037	-0.0034	-0.0372***
	(4.511)	(2.702)	(4.148)	(0.029)	(0.016)	(0.024)	(0.013)	(0.007)	(0.013)
HECM*post y1	-4.701**	1.014	2.910	0.0298*	-0.0057	-0.0064	-0.0058	-0.0062***	-0.0079***
	(2.124)	(1.729)	(2.262)	(0.016)	(0.011)	(0.015)	(0.005)	(0.002)	(0.002)
HECM*post y2	-1.883	0.336	1.517	0.0205	0.0110	-0.0009	-0.0093*	-0.0116***	-0.0107***
	(2.445)	(2.028)	(2.545)	(0.017)	(0.012)	(0.017)	(0.005)	(0.002)	(0.003)
HECM*post y3	-4.276	-1.624	-3.288	0.0329*	0.0323**	0.0294	-0.0125**	-0.0143***	-0.0158***
	(2.790)	(2.246)	(2.934)	(0.018)	(0.013)	(0.018)	(0.006)	(0.002)	(0.003)
HECM monthly cash*post y1	-0.325*	-0.182	-0.281	0.0003	0.0009	0.0003	0.0000	-0.0000	0.0001**
	(0.187)	(0.167)	(0.229)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
HECM monthly cash*post y2	-0.333	-0.044	-0.099	0.0018	0.0007	0.0013	-0.0000	-0.0000	0.0001
	(0.210)	(0.192)	(0.247)	(0.001)	(0.001)	(0.002)	(0.001)	(0.000)	(0.000)
HECM monthly cash*post y3	-0.414*	-0.136	-0.081	0.0010	0.0012	-0.0001	0.0000	-0.0000	0.0001*
	(0.241)	(0.225)	(0.274)	(0.001)	(0.001)	(0.002)	(0.001)	(0.000)	(0.000)
Constant	992.615**	869.784**	1,147.100***	-0.9892	-1.5373	-1.9065	-3.7502**	-2.6351**	-2.8903*
	(393.552)	(343.689)	(404.748)	(2.638)	(2.011)	(2.604)	(1.579)	(1.224)	(1.524)
Observations	37,824	49,093	38,265	37,992	49,427	38,506	37,992	49,427	38,506
R-squared	0.007	0.004	0.005	0.004	0.004	0.003	0.013	0.012	0.014
Number of individuals	7,841	10,313	7,990	7,841	10,313	7,990	7,841	10,313	7,990

Robust standard errors in parentheses; all models are estimated with individual fixed effects, age and year indicators, and indicators for the post periods and indicators for the prior period and their interactions by channel (not shown)

*** p<0.01, ** p<0.05, * p<0.1

With regard to credit card balances, the amount of the decline in the balance post extraction appears to be correlated to the initial withdrawal amount. The decline greatest for those making large initial withdrawals, and in particular for HECM borrowers making large initial withdrawals where the balance declines by nearly $5,000 in the first year post extraction (which is the period with the largest decline). For HECM borrowers making small initial withdrawals, the decline in credit card balances is more modest at about $800 in the first year post extraction. However, the monthly cash from the HECM has a larger effect on credit card balances for borrowers making small initial withdrawals, where a $100 increase in the monthly cash amount is associated with about $90 less in credit card balances in the first year after extraction. For HECM borrowers with large initial withdrawals, there is no significant impact of the amount of monthly cash from the HECM on credit card balances.

The differences in the change in debt balances by extraction amount for HECM borrowers make sense, given the constraint that HECM borrowers must pay off existing mortgages prior to originating the HECM loan. Holding discretionary withdrawal amounts constant, HECM borrowers who had a prior mortgage (or larger prior mortgage balances) will have less money available to withdraw at origination and will have a greater increase in monthly cash flow from the HECM (due to the foregone mortgage payments) than those without a prior mortgage (or with smaller balances).

For other extraction channels, borrowers with small initial withdrawals either have no significant decline in credit card balances or observe an increase in credit card balances post-extraction. HELOC and HELOAN borrowers making large initial withdraws have a decline in credit card balances of about $2,000 and $1,000 respectively in the first year post extraction. Cash-out refinance borrowers making large initial withdrawals have a significant increase in

their credit card balances post-extraction—an increase of about $1,000 in the year post extraction that continues (and increases slightly) through the third year.

The amount of the initial withdrawal amount also moderates trends observed for installment debt by channel. HECM borrowers making small initial withdrawals have the greatest reduction installment debt post-extraction, with no significant change for those HECM borrowers making large initial withdrawals. The amount of monthly cash from the HECM is not significantly associated with changes in installment debt amounts across any of the initial withdrawal amount categories. For other channels of extraction, a reduction in installment debt is only consistently observed for HELOAN borrowers with large initial withdrawals.

Table 11 reports the regression results for credit score, delinquencies on debt payments, and foreclosure by initial withdrawal amount subsample. With regard to credit score, the biggest difference by withdrawal amount is observed for cash-out refinance borrowers. Cash-out refinance borrowers with small initial withdrawal amounts have a significant increase in credit score post extraction (about 10 points), whereas cash-out refinance borrowers with large initial withdrawal amounts have a decline in credit score post extraction (about five points). A similar trend in payment delinquencies is observed for cash-out refinance borrowers making large initial withdrawals—they are significantly more likely to be 60 or more days late on a debt payment in the years following extraction (3.5 to 5 percentage points) than nonborrowers. There is no significant change in the probability of debt payment delinquency post-extraction for other channels of borrowers with large initial withdrawals. By contrast, HECM borrowers with small initial withdrawals have an increase probability of being late on debt payments in the three years following extraction, a trend that is not observed for HECM borrowers making large initial withdrawals. With regard to foreclosures, HELOC, cash-out, and HECM borrowers making

small initial withdrawals are less likely to experience foreclosure by the third year post-extraction than nonborrowers, a trend that continues for HELOC and HECM borrowers making large initial withdrawals. However, cash-out refinance borrowers with large initial withdrawals have no significant change in the probability of foreclosure relative to non-borrowers.

Conclusions

The findings from this study help inform the relationship between equity extraction and credit outcomes of senior households. Prior studies have theoretically and empirically examined conditions under which senior households are more likely to spend down home equity during retirement. However, less is known about what happens to seniors after they make the decision to extract home equity. Using a differences-in-differences approach, we compare the credit trajectories for seniors extracting equity through various borrowing channels, including a reverse mortgage, relative to the credit trajectories for seniors not originating an equity extraction loan.

A primary takeaway from our analysis is that different borrowing channels are associated with very different credit trajectories, both prior to and after extraction. Prior to extraction, seniors extracting through a HECM were much more likely to have had a credit shock: nearly 30 percent of HECM borrowers experienced a shock two years prior to origination, compared to 15 percent of other extractors. Across all channels of extraction, seniors with a credit shock who extract equity demonstrate an increase in credit card balances prior to extraction that subsequently decline post extraction. This is in line with households turning to credit cards for liquidity in the short term before turning to their home equity. To the extent that HECMs and other types of mortgages have lower interest rates and fees than credit card borrowing, this type of substitution may be associated with improved financial position over the longer term. Future analyses could estimate these impacts.

One of the hypothesized reasons that senior homeowners do not spend down housing wealth is that they want to preserve home equity as precautionary savings, in case of a future shock (e.g., Megbolugbe, Sa-Aadu, and Shilling, 1997; Poterba, Venti, and Wise, 2010). However, in order to extract equity through borrowing, the senior homeowner must be able to qualify for and afford a mortgage. In contrast to HECMs, forward channels of equity extraction have stringent credit based underwriting requirements that may prevent seniors experiencing a financial shock from tapping their equity through borrowing. The predominant form of equity extraction among seniors in our sample is borrowing through a HELOC. Our results indicate that HELOC borrowers tend to have strong credit profiles prior to extraction that remain strong post-extraction.

Post-extraction, there are noticeable differences in credit outcomes by extraction channel. While there is some decline in nonhousing debt across all borrowing channels, the decline is the greatest among seniors extracting equity through a HECM, and particularly for credit card debt. For example, our matched sample differences-in-differences estimates indicate that credit card balances for HECM borrowers decline by $3,000 more than nonextractors over the same period. Credit card balances for HELOC and HELOAN borrowers decline by only about $500 relative to nonextractors, and credit card balances increase post-extraction for cash-out refinance borrowers. Future research is needed to unpack the mechanisms by which the HECM impacts credit card balances.

With regard to payment delinquencies, we find that all types of extractors have an increase in the probability of being 60 days or more late on a debt payment post extraction relative to nonborrowers in the matched sample. The results for foreclosure are more nuanced by channel, where cash-out and HELOAN borrowers tend to perform worse post-extraction, and

HELOC and HECM borrowers tend to perform relatively better. To the extent that equity extraction increases total monthly debt payments, the household may be at greater risk of default on their mortgage, particularly if the senior experiences a shock to his or her income. Given that the HECM does not require a monthly payment, extracting equity through a HECM does not increase the monthly debt to income burden as it may for other channels of extraction.

Relative to other borrowing channels, the HECM appears to play a unique role in providing seniors with access to equity through borrowing, particularly to help seniors recover from financial shocks. Historically, the HECM program has had no credit- or income-based underwriting criteria. However, increased rates of default on property taxes and homeowners insurance have led to significant policy changes since 2014, such as limitations on the initial withdrawal amount and changes to underwriting criteria to include consideration of credit history and income (Moulton, Haurin, and Shi, 2015b). A policy challenge for the HECM program moving forward is to preserve program access to seniors who may be cut-off from other home equity borrowing channels, while minimizing the risk that borrowers will be unable to afford to maintain the home, including payment of property taxes and homeowners insurance.

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Appendix A

Supplemental Comparison of Financial Outcomes

The primary analysis in this paper is the analysis of credit outcomes. However, we also include a supplemental analysis of changes in financial outcomes from survey data. The first source of data for this supplemental analysis is the Aging in Place (AIP) reverse mortgage survey, administered by the research team between July 1, 2014 and June 30, 2015. This survey includes information on financial indicators for a subset of about 1,100 HECM borrowers in the RMCP dataset, including income, financial assets, mortgage debt, and house values.[22] We also have baseline information on income, mortgage debt, and house values for these same households from the data collected at the time of counseling. We limit the AIP survey sample to those HECM borrowers counseled between 2008 and 2011. The number of observations in the HECM sample changes slightly depending on the financial variable.

We compare the financial indicators for HECM borrowers to financial indicators for seniors in the general population using HRS survey data. The HRS is a nationally representative biennial panel survey of more than 26,000 adults over the age of 50. For our study, we use the "core" public dataset, including detailed information at the individual level on household financial characteristics.[23] We limit the HRS sample to individuals residing in households where at least one member was age 62 or older as of the 2008 or 2010 survey wave and who were a homeowner at that time, and thus would have been eligible for a reverse mortgage.[24] The 2008

[22] For more information on the AIP survey, including the survey design and response rates, please see the complete survey report: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2749368

[23] Our analysis is at the household level. For questions asked of multiple household members, we use the responses of the primary respondent as coded in the HRS. If the primary respondent is under the age of 62, we use responses for the household member who is age 62 or older.

[24] Approximately 75 percent of HRS households were homeowners as of the 2008 or 2010 survey wave.

and 2010 survey waves are comparable in time to the baseline period counseling period for our HECM borrowers.

Within the HRS dataset, we identify households who extract equity through a forward mortgage after the 2008 or 2010 survey wave. To do this, we follow the same logic that we use with the CCP dataset. We code households in the HRS as home equity borrowers if they have an increase in their mortgage amount of 5 percent or more (or at least $1,000) from the 2008 or 2010 waves of the HRS to the 2014 wave of the HRS, excluding those households who purchased a home or moved during the time period, or who were in foreclosure. We separate those who have an increase in their first and/or second mortgage balances (closed-end extractors) from those who have an increase in HELOC balances (HELOC extractors). Using this logic, we identify 364 households in the HRS who extracted equity through cash-out refinancing and 338 households in the HRS who extracted equity through a HELOC between the 2008/2010 wave and the 2014 wave of the HRS. We identify about 5,300 households who were homeowners age 62 or older as of the 2008 or 2010 waves, but who did not extract additional home equity prior to the 2014 survey wave.

Table A1 presents summary statistics for the financial indicators as of the baseline period. For HECM borrowers, the baseline period occurs at the time of counseling prior to the origination of the HECM loan, between the years 2008 and 2011. For the HRS, we include respondents from both the 2008 and 2010 waves, so long as the household responded either in 2008 or 2010 *and* the 2014 wave, has at least one household member aged 62 or older, and is a homeowner. This makes the timing of responses comparable between the HRS and HECM samples.

Table A1: Baseline Financial Characteristics

	HECM Borrowers	HRS	HRS Closed-end extractors	HRS HELOC extractors
	Mean/Median N	Mean/Median N	Mean/Median N	Mean/Median N
Total household income	2,983 / 2,493 1,153	5,560*** / 3,844 10,264	7,356*** / 5,269 635	7,252*** / 5,315 626
Home value of primary residence	309,925 / 248,850 1,217	245,328*** / 183,940 10,329	311,850 / 232,630 646	312,310 / 259,680 629
Mortgage debt for primary residence	84,073 / 52,105 1,216	46,216*** / 0 10,328	127,966*** / 99,540 646	78,658 / 44,240 629
Home equity of primary residence	226,101 / 176,960 1,216	199,043*** / 150,416 10,328	183,884*** / 125,512 646	233,653 / 176,366 629
Monthly mortgage payment	700 / 483 1,179	376*** / 0 9,562	1,057*** / 920 595	762 / 691 421

The means columns show statistical significance of t-tests between HECM borrowers and the appropriate column; HECM borrowers include active and terminated. Means shown are weighted.
*** p<0.001, ** p<0.01, * p<0.05

As indicated on the table, HRS respondents have significantly higher incomes than HECM borrowers, with the median income of the HECM borrower of around $2,500 per month, relative to a median income of about $3,800 per month for a homeowner in the HRS. Those extracting equity through closed-end channels or HELOCs have even higher median incomes in the period prior to extraction—more than twice that of the HECM borrower (about $5,300 per month). Interestingly, the home values of the HECM borrowers are not significantly different from the average home values of seniors extracting equity through forward channels in the HRS- an average of about $300,000 across extraction channels (median of around $250,000). HECM borrowers tend to have significantly higher amounts of mortgage debt than other seniors in the HRS ($84,000 on average compared to $42,000), but they have significantly less mortgage debt

and significantly more home equity than closed end extractors in the HRS, with no significant differences between HECM and HELOC extractors.

Table A2 presents the summary statistics for the HECM borrowers as of the 2014/15 AIP survey, and for HRS respondents as of the 2014 wave of the HRS. Here, we also include an indicator of financial assets, as this is collected comparably between the two surveys. With regard to financial assets, the HECM borrowers have an average amount of about $61,000 (median of only $10,000). Nonextracting homeowners in the HRS have a significantly higher average amount of about $185,000 (median of $49,000) in financial assets, with HELOC borrowers in the HRS having even higher asset amounts, and closed-end equity extractors having lower average and median asset levels.

Table A2: 2014 Financial Characteristics

	HECM Borrowers	HRS	HRS Closed-end extractors	HRS HELOC extractors
	Mean/Median N	Mean/Median N	Mean/Median N	Mean/Median N
Total household income	3,234 / 2,168 943	5,166*** / 3,553 5,562	7,379*** / 5,168 358	6,763*** / 4,876 333
Total nonhousing financial assets	61,483 / 10,000 871	185,222*** / 49,000 5,426	153,432*** / 17,500 356	209,326*** / 75,000 329
Home value of primary residence	266,676 / 200,000 992	198,479*** / 150,000 5,587	284,501 / 200,000 362	266,614 / 200,000 336
Mortgage debt for primary residence	131,242 / 100,000 1,111	34,913*** / 0 5,596	154,663** / 123,000 362	88,022*** / 50,000 336
Home equity of primary residence	130,676 / 80,000 986	163,391*** / 120,000 5,586	129,839 / 75,000 362	178,592***/135,000 336
Monthly mortgage payment	77 / 0 1,040	260*** / 0 5,227	1,022*** / 880 337	1,124*** / 1,000 99

The means columns show statistical significance of t-tests between HECM borrowers and the appropriate column; HECM borrowers include active and terminated. Means shown are weighted.
*** p<0.001, ** p<0.01, * p<0.05

We next estimate fixed effects differences-in-differences models, tracking the changes in home values, mortgage debt, home equity and the monthly mortgage payment amount. The model specification is similar to model (1) in the full period, but includes only two periods: the baseline period prior to extraction, corresponding to the 2008 or 2010 HRS survey wave or the time of counseling for HECM borrowers, and the period after extraction, corresponding to the 2014 HRS survey wave and the 2014 RMCP survey. Specifically, we group HECM borrowers counseled in 2008 or 2009 with the 2008 HRS survey wave, and HECM borrowers counseled in 2010 or 2011 with the 2010 HRS survey wave, and track changes from the baseline period to 2014. Covariates include only those indicators that may change between survey waves, including age of the youngest household member and marital status. We include an interaction term for the channel of extraction and the post-period, this being the coefficient of interest for interpreting the channel effect on financial outcomes. Table A3 presents the results.

Table A3: Difference in Differences, Home Equity Extraction from Baseline to 2014

	Home value of primary residence		Mortgage debt		Home equity of primary residence		Monthly mortgage payment	
	2008 to 2014	2010 to 2014	2008 to 2014	2010 to 2014	2008 to 2014	2010 to 2014	2008 to 2014	2010 to 2014
Post Period (2014)	-45,253***	-14,213***	-15,248***	-9,978***	-30,031***	-4,134	-79***	-61***
	(6,452)	(3,965)	(3,034)	(2,258)	(6,884)	(4,353)	(28)	(18)
HECM*Post	-14,239*	-1,926	71,429***	69,207***	-84,398***	-69,803***	-593***	-436***
	(8,426)	(4,271)	(3,998)	(2,436)	(9,069)	(4,696)	(34)	(19)
Closed End HRS*Post	-22,055***	-4,181	45,881***	43,345***	-67,944***	-47,525***	41	68**
	(8,523)	(7,131)	(4,008)	(4,061)	(9,093)	(7,827)	(36)	(33)
HELOC HRS*Post	-12,839	-13,128*	28,942***	26,795***	-41,785***	-39,925***	19	64
	(7,812)	(6,931)	(3,673)	(3,947)	(8,334)	(7,608)	(62)	(58)
Age of youngest household member	-298	-80	137	-245	-429	140	-4	-3
	(1,037)	(993)	(488)	(566)	(1,107)	(1,090)	(4)	(5)
Unmarried Male	3,894	-19,126*	2,188	-7,068	1,617	-12,129	21	6
	(10,256)	(9,796)	(4,823)	(5,579)	(10,943)	(10,753)	(44)	(46)
Unmarried Female	10,085	-679	5,314	2,700	4,672	-3,515	11	46
	(6,878)	(7,476)	(3,234)	(4,258)	(7,338)	(8,206)	(29)	(34)
Constant	262,104***	231,381***	26,784	60,287	234,908***	172,860**	596*	520*
	(71,741)	(69,331)	(33,742)	(39,486)	(76,549)	(76,105)	(311)	(314)
Observations	8,427	10,850	8,423	10,847	8,423	10,847	7,828	10,080
R-squared	0.144	0.023	0.114	0.143	0.129	0.066	0.137	0.160
Number of unique individuals	4,217	5,437	4,217	5,437	4,217	5,437	4,102	5,258

Standard errors in parentheses; all specifications are individual fixed-effects regressions

*** p<0.01, ** p<0.05, * p<0.1

With regard to housing values, the average senior homeowner in 2008 observed about a $45,000 decline in house value through 2014, and the change from 2010 to 2014 was more modest, at about $14,000. Those extracting equity through closed end loans in 2008 saw a statistically significant greater decline in their home values than nonextractors in the sample. It could be that these seniors lived in areas with more volatile house prices with a steeper increase in house prices prior to 2008 (prompting extraction), followed by a steeper decline in prices post bust. Mortgage debt post extraction (in 2014) is a function of both the amount extracted and the change in the balance due to interest, fees and payments post extraction. Not surprisingly, HECM borrowers see the greatest increase in their mortgage balances, followed by closed-end extractors and HELOC extractors. The amount of home equity (home value less mortgage debt) declines for all extractors, but declines the most for HECM borrowers, then closed-end extractors, followed by HELOC borrowers. One of the stark differences between HECM borrowers relative to other home equity borrowers in the HRS is the change in the monthly mortgage payment. Recall that HECM borrowers must pay off any prior forward mortgages at the time of extraction, and then make no repayment of the HECM until loan termination. Based on the estimation results, this results in a $400 to $600 per month savings for HECM borrowers relative to senior homeowners who are non-borrowers in the HRS. By contrast, HELOC and closed-end extractors see a modest increase in their monthly mortgage payments, although this increase is only statistically significant for closed-end extractors in the 2010 HRS survey wave.