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THE INEQUALITIES OF MORTGAGE CONDITIONS IN AN ASSET-BASED WELFARE SYSTEM
Debt- and wealth-driven housing

TIIVISTELMÄ

Tässä tutkielmassa tarkastelen mitkä tekijät vaikuttavat kotitalouksien asuntolainojen ehtoihin Yhdysvaltojen asuntomarkkinoilla. Yhdysvaltojen asuntomarkkinat ovat pitkään olleet velkavetoiset, mutta hiljattain ne ovat alkaneet kääntymään yhä enemmän varallisuusvetoisiksi. Tämä kehitys sulkee yhä useamman ihmisen ulos asunnon omistamisesta. Erityisesti nuoret ja ne jotka eivät omista rahoitusomaisuutta ovat uhkana jäädä asunnon omistamisen ulkopuolelle. Asuntojen hinnat ovat eri rahoitusvälineiden takia hyvin pitkälti sidottuja asuntolainavakuudellistettuihin arvopaperimarkkinoihin. Tämä tarkoittaa sitä, että asunnon omistaminen on joko suoraan asunnon hintojen, tai epäsuoraan rahoitusomaisuuden omistamisen tärkeyden takia sidottu rahoitusmarkkinoihin. Tämä on hyvin tärkeä tarkastelun asia, sillä Yhdysvaltojen hyvinvointijärjestelmä perustuu hyvin paljon yksityiseen omaisuuteen, josta tärkein ja yleisin on asunto. Asunnon arvoa vastaan voi saada lainaa, jolla voi maksaa muun muassa terveydenhuollollisia, koulutukseen liittyviä ja työttömyyden aiheuttamia kuluja.

Aineistoni on Federal Housing Finance Agency (FHFA) ja Consumer Financial Protection Bureau (CFPB) keräämä NATIONAL SURVEY OF MORTGAGE ORIGINATIONS (NSMO). Aineisto koostuu 43 506 asuntolainan omistavasta vastaajasta 2013-2020 vuosien välillä. Analyysimenetelminä käytin Pearsonin Khiin neliötestiä, Mann-Whitney-Wilcoxon testiä, logistista regressioanalyysiä ja keskiarvoista marginaalivaikutusta (Average marginal effect).

Analyysini pohjalta löysin että kotitaloudet, jotka eivät omistaneet rahoitusomaisuutta, olivat nuoria, eivät omistaneet korkeaa luottoluokitusta, tai omistivat korkean velka-tulosuhteen olivat todennäköisempiä saamaan asuntolainoja huonoimmilla ehdoilla. Analyysin tärkeimmiksi tekijöiksi nousivat kiinteistöpohjaisten omaisuuden omistaminen, velka-tulosuhde ja ikä. Tulokset mukailivat aiheen teoriapohjaa ja osoittivat että kotitalouksien on altistettava itsensä yhä enemmän rahoitusmarkkinoille saadakseen asuntolainan hyvillä ehdoilla. Tämä näyttäisi johtavan asuntomarkkinoita yhä eksklusiivisempaan suuntaan, joka tarkoittaa että yhä harvempi pystyy pärjäämään yksityiseen varallisuuteen perustuvassa hyvinvointijärjestelmässä.

Avainsanat: Loan-to-value ratio, financialization, mortgage, asset-based welfare, mortgage-backed securities

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1 Introduction

In the US, mortgage balances stood at $11.92 trillion at the end of December 2022, nearly two and a half times larger than student, auto, credit card, home equity line of credit and other debt combined (The Federal Reserve Bank of New York, 2023). Currently, mortgage payments on an average-price home with a standard 20% down payment and 30-year mortgage add up to 31% of the median American household's income (Winck et al., 2022). Despite this, for many Americans owning a home can be considered a higher measure of achievement and priority than having a successful career, raising a family or earning a college degree. Unfortunately, homeownership is becoming more and more exclusive, with non-homeowners – especially the young - struggling with stagnant income levels, soaring housing prices, poor access to credit, and the diminishing ability to make a down payment. (Schmidt, 2022.)

If mortgages are expensive and require extensive indebtedness, why do Americans want to become homeowners so desperately? Homeownership – in addition to being part of the "American dream" – grants several economic benefits, which allow households to accumulate wealth, such as allowing enhanced access to credit, building equity by virtue of asset appreciation (i.e your home's value grows over time) and by reducing housing costs (Robb, 2021). Often owning a home can grant these economic benefits better and easier than by other means. On the flip side, not owning a home, makes accessing credit, building equity and reducing housing costs more difficult for households, which could result in large-scale inequality. This inequality is especially noticeable in the US, where homes are becoming ever-exclusive assets and where they are extensively tied to one's welfare and economic security.

This paper will analyse households' access to mortgage loans in the debt- and wealth-driven housing market of the United States. Firstly, homeownership as a national goal, will be explained, as well as how it indirectly led to the US welfare system relying on private wealth and especially homeownership. Next, the creation of certain financial instruments and a brief history of the intertwinement of mortgages, the financial markets and the US economy at whole will be examined briefly. This will be done, because the financialization of mortgages allowed further access to credit for millions of households, raised housing prices and ultimately cemented mortgage debt as a feature of the US economic landscape. After this, new theories of wealth-driven housing markets will be described. The theory and background section of this

paper will commence in explaining mortgage conditions and especially the Loan-to-value ratio. After this, the aims and hypothesis of the analysis will be stated. Following this, there will be a brief section describing the NATIONAL SURVEY OF MORTGAGE ORIGINATIONS (NSMO) data file and the bivariate, regression and marginal effects methods used for the analysis, as well as a summary of the used variables. After disclosing the results of the analysis, they will be interpreted through the concepts and theories presented in the background and theory section. Finally, a conclusion section will tie the analysis, theory and discussion together, as well as ponder the future developments surrounding the US housing market and the welfare system which requires households to take part in it.

2   The goal of widespread private homeownership and asset-based welfare

2.1   Widespread homeownership in the United States of America

In the western capitalist governments of the late nineteenth century housing became an economic issue of interest, but only to the extent of it being a consumption good. However, after the second world war, housing became intrinsically linked to income support. In the United States of America, favorable economic and employment conditions and the nonessential need to rebuild infrastructure due to not having to fight on domestic soil allowed for its government to focus on the policy goal of widespread homeownership (Conley & Gifford, 2006.) Arundel and Ronald (2021) call this entrenched public and policy support for homeownership the *promise* of homeownership. This promise proffered a model of owner-occupation based on three key tenets: being widespread in access, being equalizing in wealth distribution and providing household economic security over the life course.

Between 1940 and 1960, the rate of home ownership increased from 44 to 62 percent, as younger individuals became homeowners at unprecedented rates. This can be attributed to the aforementioned favorable economic and employment conditions. This can also be attributed to increased rates of family formation due to the baby boom period and decreased transportation costs, that made living in suburbs cost-effective. However, a large part of the increase in home-ownership can be accredited to the actions of the federal government. The federal government gave favorable tax treatment to homeowners, guaranteed mortgage insurance to lenders from the federal housing agency (FHA) and veterans home loan benefits through the Veterans Affairs to WW2 and Korean war. (Fetter et al, 2010.)

2.2   Asset-based welfare

Conly and Gifford (2006) argue that whether wilfully or not, governments have allowed home ownership to substitute social-spending programs, where the investment costs of homeownership burden people in their early lives, and declining costs and rising collateral-asset values provide social insurance, especially at the end of one's working life. This essentially means that governments have allowed the market to determine social security in hopes that housing investments will constantly appreciate, and people will be able to use their ever-appreciating private wealth as private social security. This has been seen to be more attractive than paying for payroll

contributions, that often have been neglected in favor of the former. Forrest and Himayama (2018, 274) explain that middle class housing wealth is ever-increasingly being used for essential services, such as health, education and care in old age which have been progressively privatized by capitalist governments.

Doling and Ronald (2010, 165) call this system *asset-based welfare,* in which:

"...rather than relying on state-managed social transfers to counter the risks of poverty, individuals accept greater responsibility for their own welfare needs by investing in financial products and property assets which augment in value over time. These can, at least in theory, later be tapped to supplement consumption and welfare needs when income is reduced, for example, in retirement, or used to acquire other forms of investment such as educational qualifications."

They state that this system's entrenchment in the US can be attributed to the ageing of national populations and their expected impact on pensions and public welfare resources, as well as the neoliberal agenda of reducing resources given to public welfare programs. One of the most common forms of financial products and assets are homes, because they are a common and widespread asset, that usually increase in value over time. Additionally, they are popular, because home equity can be tapped into easily through home equity loans. Montgomerie and Büdenbender (2015) call this home equity withdrawal (HEW), in which equity release enables households to borrow against the value of their home.

This asset-based welfare is an attractive goal for governments who want to reduce welfare spending, but it has many downsides to it. One downside is that individuals are not rational economic agents who have financial literacy and knowledge of when and how to save and acquire assets. Another, far more important aspect is that as house prices have increased, the regular savings and costs associated with purchase have moved well beyond the capacity of many households. Meaning that the long-term strategies and savings plans required for asset-based welfare are ever increasingly becoming out of the reach of more and more households, especially low-income ones. This system can only continue as long as access to homeownership is guaranteed for each successive generation (Doling & Ronald, 2010.) This meant that to make up for rising housing prices with stagnant real-wage growth, households had to rely on credit to take part in the system. They do this by taking on mortgages. A mortgage is an agreement

between you and a lender that uses your property as collateral if you fail to repay the money you've borrowed plus interest (Consumer Financial Protection Bureau, 2022).

2.3 Mortgage-backed securities and government sponsored enterprises as a catalyst for extreme mortgage debt.

Although (in large part thanks to the FHA's mortgage standardization and insurance programs) mortgages had been nationally traded commodities already from the late 1930's (Hyman, 1977, 47), traditional lenders would generally only offer thirty-year fixed rate mortgages, with 20 percent down payments, to middle and upper-income Americans (Retsinas & Belsky, 2008). These loans were considered as secured lending. This meant that the collateral for the loan was property, the lender relied primarily on the borrower's ability to repay and only secondarily to the value at which the collateral can be liquidated in case of failure of repayment (Fabozzi & Kothari, 2008, 6).

In the late 1960's savvy bankers and policy makers realized that by making mortgages bond-like, they could radically expand their investment base. And so, with the housing act of 1968 congress privatized the Federal National Mortgage Association (FNMA) and created its signature financial instrument— the mortgage-backed security. (Hyman, 1977, 190-194.) Stephen Lumpkin (1999, 25) defines securitization as:

"...so-called "structured finance", the process by which (relatively) homogeneous, but illiquid, assets are pooled and repackaged, with security interests representing claims to the incoming cash flows and other economic benefits generated by the loan pool sold as securities to third-party investors."

Essentially this meant that mortgages were bought up and repackaged into mortgage-backed securities (MBS), that were sold in secondary markets, where investors were enticed by the steady cash flow coming from mortgage interest payments and the relative safeness of the MBS due to them being backed by pools of mortgages.

The creation of MBS was soon after bolstered by establishing and privatizing government sponsored enterprises (GSE), such as Fannie Mae in 1968 and allowing them to buy conventional (non-government-insured) mortgages. These all drastically stimulated the integration of the

mortgage market with capital markets, especially due to them being popular investment strategies for financialized welfare products, such as pension funds (Cho, 2007). These GSE's applied standards, stability and liquidity into the MBS markets, facilitating widespread MBS investment. Aalbers (2008) contributes the integration of mortgage markets throughout the US into one single mortgage market, the rise of securitization and secondary mortgage markets, and the rise of credit scoring and risk-based pricing all to the GSE's.

Risk-based pricing means that borrowers, who pose a greater risk for lenders, pay higher fees and higher interest rates. People eager to buy homes were more than willing pay those fees and interest rates to acquire a home, which caused a trend that changed the composition of household debt into consisting of higher levels of mortgage debt. This trend reached its climax, when mortgage debt went from 69 % of household debt in 2001 to 76 % in 2007. (Retsinas & Belsky, 2008.)

The creation of the mortgage-backed securities drastically enhanced households' access to credit, as mortgage lenders were able to sell off mortgages to investors, freeing up capital to lend to further borrowers (Hyman, 1977, 190-194). In turn, this was further enhanced by the creation of GSE's, which essentially meant that mortgage markets became backed by the government and that riskier borrowers were also allowed a loan, due to risk-based pricing (Aalbers, 2008). The expanded access to credit exacerbated the rise in housing prices, as suddenly people had more money to acquire housing with. This rise in housing prices resulted in the rise of debt, as more expensive houses meant that people had to take on larger mortgages for their homes. For households this was devastating, but for lenders, this all seemed like a fool-proof and safe system, as mortgages were considered as assets that would always be paid off. In hindsight, this was far from the truth.

I will not cover the 2008 market crash extensively, as it would require an in-depth analysis unfit for this thesis. Essentially in summation, in 2006 after a long housing boom, house prices fell and many homeowners who faced a bump in interest rates could not afford to pay the higher monthly payments on mortgages that were now worth less than their homes and defaulted, causing mortgage markets to crash in value (Retsinas & Belsky, 2008). By 2000 the market share of mutual funds and pension funds was over 50%, largely contributed to MBS (Cho, 2007). With welfare systems, such as pension funds being large investors in MBS, the market crash of 2008 did not just threaten asset prices, but the weakened welfare and pension system

in whole (Aalbers, 2008). The crisis showed how dangerous it is to have a welfare system that is either based on privately owned assets, such as homes or on funds that are dependent on the performance of the financial markets, such as pension funds. It also showed that due to the expansion of access to credit – largely because of MBS and GSE's -, debt-driven housing markets would cause households to take on unserviceable amounts of debt, just to acquire a home, and lenders were more than happy for this to happen.

2.4 The intertwinement of mortgage debt and asset-based welfare

The financial crises led to the realization of the system as a whole. A system where living is ever-increasingly tied to the financial markets. Homeownership is seen as an investment, form of equity, and as a substitute for social security. Home equity affects what homeowners can spend, how much credit they can get and how they think of the economy at large. Homeownership is fuelled through higher and longer mortgage loans, that sometimes entail life-long debt. Garcia-Lamarca and Kaika (2016) call this mortgage debt a biotechnology, in which - through a Foucaltian framework - mortgages are seen as a technology of power over life. Meaning that mortgages have become a technology which has caused people to have to sign off a significant portion of their future labor to service mortgage debt. At the same time the relative amount of this lifelong debt compared to income is rising. In Australia – a country with a similar system than the US - mortgage debt as a proportion of annual disposable income rose from 39% to 140% between 1993 and 2018, which disproportionately affected younger households whose wages remained relatively stagnant, with average real house prices rising three times the rate of increase in real wages during the same period (Wiesel et al, 2023, 291).

These securitized mortgage loans fuel the economy in secondary mortgage market that are backed by the US government. Lenders sell mortgages, but don't manage, service or fund them, as these duties are shifted to investors in the secondary markets. This means that they are incentivized to buy up as many mortgages as possible, package them and sell them in secondary mortgage markets, regardless of qualification. Pension funds that invest in these secondary mortgage markets tie individual workers' fates to them. (Aalbers, 2008.) Essentially, through the state sponsored use of financial instruments, mortgages have seeped their ways into every corner of the American economy, which has become dependent on them and their success in secondary mortgage markets. Additionally, the US social security infrastructure has been badly neglected. This deepens individuals and the economy's dependence on mortgage markets, as

people don't have an adequate social security net to fall onto in case of setbacks. Aalbers (2017, 543-544) calls this a *financialized* system. According to him financialization means:

"...the increasing dominance of financial actors, markets, practices, measurements and narratives, at various scales, resulting in a structural transformation of economies, firms (including financial institutions), states and households."

Households' homes became financialized, whether they liked it or not. Widespread access to credit, which was due to MBS allowing banks to sell mortgages, freeing up capital in order to lend more mortgages - which would then be sold, and the cycle continued – made housing prices skyrocket and essentially led them to be tied to the financial markets. Aalbers and Hostenbach (2023) call this a debt-driven housing market. Additionally, GSE's role in the mortgage markets means that most secondary mortgage markets are backed by the government, meaning that they are actually backed by taxpayer money, which further ties households and their homes fates to the financial markets.

2.5 A shift from debt-driven to wealth-driven housing

Until recently, theory has focused on how the US is a society in which stagnant wages are being substituted by easy credit to acquire property to take part (or survive) in a system built on and around asset-based welfare. However, in the academic literature surrounding the financialization of housing and asset-based welfare, there are new theories emerging that question if this is still the case currently. Hostenbach and Aalbers (2023) explain that following the global financial crisis and accompanying housing market crash, governments imposed stricter mortgage lending practices. In spite of this the housing prices that were believed to have been driven by expanding mortgage markets kept rapidly increasing. They attribute this to a shift from debt-driven towards wealth-driven housing dynamics, in which private wealth has come to supplement rather than replace mortgage debt to fuel house price increases. That is, the possession of substantial stocks of capital is increasingly a prerequisite to buy into housing. Assets are not only vital to make a down payment or outbid competitors in housing markets, but also in the way they shape the economic position and security of households. This has additionally caused a paradoxical problem, wherein assets are an increasingly necessary prerequisite in the housing market, but housing is also the prime means to acquire these very same assets. According to

Hochstenbach and Aalbers, first time buyers are becoming even more leveraged than current owners, low-income homeownership rates are dropping, and young households are less likely to become homeowners and rely more on intergenerational financial support to become home-owners. For example, Smith et al. (2022, 170) explain that young home buyers rely on gifts and bequests to bridge the affordability gap for homeownership.

This means that currently the US has taken the asset-based welfare system to the extreme and because the US economy depends largely on secondary mortgage markets, it is unlikely that this will change anytime soon. Assets – which are required for adequate private welfare - are slowly becoming prerequisites for acquiring assets. The most important and commonplace asset in this system – a home – is both the prime means to acquire assets and difficult to obtain without assets. Debt has not exited this equation though. To own a home, one must usually take on a mortgage for finance. Previously, risk-based pricing has been discussed in regard to mort-gages. This pricing system creates different conditions for mortgage borrowers depending on many factors. This will be discussed in the following section.

3   Mortgage conditions: What do they mean?

In the previous section I have briefly discussed the history of how in the United States, home-ownership has become financialized. This overburdens households and their abilities to survive in an asset-based welfare system due to them being in a market in which house prices are grow-ing faster than wages, causing individuals to take on ever-expanding amounts of debt, which they have to service for long periods. However, even though taking on debt for housing is the norm, not all debts are equal. As discussed previously, because of risk-based pricing, mortgages terms and conditions can vary dramatically. Next, I will briefly describe the different kinds of mortgages and their conditions.

3.1 Mortgage conditions

Mortgage lenders assess the risk of borrowers not being able to pay back your loan plus interest through many factors. USA Mortgage's *The Ultimate Guide to Buying a Home* (n.d.) calls these factors the *Four C's of Credit.* The first C - that is the staple of the US economy - is Character. This is evaluated through a process called credit scoring. Credit scoring is a form of risk-based pricing, wherein credit customers are profiled by using available information to make predic-

tions about future payment behavior, usually through the means of computer systems and statistical methods (Aalbers, 2008). The second C is Capacity, which means one's income and assets are weighed against their monthly debts. This is usually done by assessing one's debt-to-income (DTI) ratio. The DTI ratio is calculated by dividing monthly debt by gross monthly income. Conforming loans (the most common loan type, which is backed by GSE's) can be acquired usually in the DTI range of 36-43%. Conforming loans maximum DTI usually is considered to be 50% and can only be acquired if the borrower has certain compensating factors (savings, reserves etc.). Other loans, such as VA loans may have higher DTI limits, or no limits at all. (Martin, 2022.) The third C is Collateral, which is the asset – usually the property - securing the loan. Finally, the fourth C stands for Capital. Capital, in this sense, is considered as the down-payment for the property, or how much cash you put into your property up front. This is usually measured by examining the loan-to-value (LTV) ratio of the loan. The LTV ratio is calculated by dividing the loan amount by the appraised value of a property. (USA Mortgage, n.d.)

3.2 The Loan-to-value ratio (LTV)

The LTV ratio is a commonly used universal way for measuring financial leverage and assessing credit risk. Essentially, the higher the LTV ratio the higher the credit risk. This is because higher LTV ratios increase the probability of negative equity (property value becomes less than the value of the mortgage), which was one of the causes of mass-defaults in the 2008 housing crises. In addition, collateralized property with high LTV ratios tend to bring insufficient proceeds in the case of foreclosure. (Bian et al., 2018.) Lenders prefer giving loans to people who put in a large down-payment and have a low LTV ratio, as it shows their commitment to paying off their loan and it is less risky for the lender in case of a default. Therefore, in a mortgage market based on risk-based pricing, better mortgage conditions are given to borrowers with lower LTV ratios and worse conditions are given to those with higher LTV ratios.

One of the most important mortgage conditions - interest rates – are largely determined by LTV ratios. In addition to this, when an LTV ratio is over 80% conventional lenders usually require borrowers to purchase private mortgage insurance (PMI), which covers the lender against loss if you fail to repay your loan. The PMI can cost between 0.5% to 1% of the loan amount every year and must be paid until the LTV ratio drops to 78%, potentially adding tens of thousands of dollars to mortgage payments. Additionally, higher LTV ratios can even include extra fees

in the closing costs. (Akin, 2020.) This means that borrowers that can manage lower LTV ratios can bargain better conditions for their mortgages, allowing them to pay far less in interest payments and not having to pay PMI or extra closing fees. Additionally, a high downpayment will allow borrowers to access equity in their homes faster than those with lower downpayments (See HEW on p.3).

4 Aims and Hypotheses

This study aims to examine the relationship between wealth-based assets and loan-to-value levels of mortgage loans at origination for borrowers purchasing property. This is important to examine, as (due to stagnant wages and ever-increasing house prices) mortgage debt is a prerequisite to acquiring a property in order to manage in an asset-based welfare system, that incentivizes homeownership. However, the conditions of this debt vary based on what kind of mortgage one can secure. The LTV ratio of a mortgage is a large determining factor of these conditions. Borrowers that can manage to secure a mortgage with a lower LTV ratio (make a larger downpayment) can get better conditions than those who have a higher LTV ratio. In a housing market that is ever increasingly wealth-driven, wealth-based assets such as financial assets (stocks, bonds, mutual funds, real estate, etc.) and intergenerational or social wealth (gift, loan or inheritance from family or friend) may determine who can manage to secure mortgage loans with better conditions and who cannot. Additionally, sociodemographic factors that indicate class and age and credit history-determining factors can also determine one's mortgage loan conditions and thus should not be left out of an analysis.

4.1 Hypotheses

This research has four hypotheses:

1. Not owning financial assets makes it more likely for a borrower to have a higher LTV ratio than those who own financial assets.
2. Not having intergenerational or social wealth makes it more likely for borrowers to have a higher LTV ratio than those who do.
3. Sociodemographic factors such as income, age and education have a relationship with LTV ratios.
4. Borrowers with better credit history tend to have lower LTV ratios.

5 Data, Methods and Variables

5.1 Data

The data used for this analysis is the NATIONAL SURVEY OF MORTGAGE ORIGINATIONS (NSMO) public use file, which is a is a quarterly mail survey jointly funded and managed by the Federal Housing Finance Agency (FHFA) and the Consumer Financial Protection

Bureau (CFPB). NSMO draws its sample from newly originated mortgages that are part of the National Mortgage Database (NMDB). Approximately 6,000 of the closed-end first-lien mortgage loans newly added to NMDB are selected for NSMO at the end of each quarter. At present this represents about a 1-in-300 sampling rate from the population of such loans as a whole. Loans are selected at random from mortgages that were newly reported to Experian (one of the three national credit bureaus) within a year of origination. Once selected to participate in NSMO, a borrower is ineligible to be selected again. The usable response rate for the first 30 waves of NSMO is 24.81%. The NSMO public use file was updated on December 13, 2022. It is based on the first 30 quarterly waves of the survey, containing 43,506 sample mortgages originated from 2013 through 2020. According to the terms and conditions of the NSMO I must state that "The opinions and analyses contained herein are solely of the users/authors of any data analyses or papers, and the FHFA cannot and does not attest to nor vouch for the quality, accuracy, or timeliness of the data, or analyses derived from these data after the data has been retrieved from FHFA.gov." (Federal Housing Finance Agency [FHFA], 2022.)

For the analysis the NSMO data was subset so that the population was defined by property buying, mortgage borrowing and credit score owning respondents. This was done by subsetting the data by the values of the following variables: X33, "Which one of these reasons best describes this most recent mortgage?", 1 = "To buy a property". Borrower_R, "Flag Indicating Respondent is a Borrower", 1 = "Borrower". Score_Orig_R ,"VantageScore 3.0 at Origination | Respondent", values = 300 – 850.

5.2 Methods

The used analysis methods focused on bivariate analysis methods of the Pearson's Chi squared test and Mann-Whitney-Wilcoxon test for initial screening of variables that would be used for the binary multiple logistic regression. Additionally, the variable "survey_wave", which showed which wave of the survey the respondent answered the survey in was subjected to a Mann-Whitney-Wilcoxon test, in order to rule out whether LTV ratios changed statistically significantly over time. After this a multiple logistical regression of all variables that were deemed significant by the bivariate analysis was performed. All of the variables that were significant in the multiple logistic regression were put through the Margins() command in R, to

look at the average marginal effects of the variables at their representative. Then a plot was made for the model showing the average marginal effect of each model variable.

The Chi-square test of independence (also known as the Pearson Chi-square test, or simply the Chi-square) is a non-parametric test that is used between variables, when both are categorical and more accurately nominal or ordinal. It is best used when the used variables are nominal or ordinal, the sample sizes of the study groups are unequal or when the original data was measured at an interval or ratio level but violated one of the assumptions of a parametric test. At the commonly used 95% confidence interval level a p-value resulting in $p>0.05$ means that the set null hypothesis stands. If the p-value is $p<0.05$, then it is considered statistically significant, and the null hypothesis is rejected. Additionally, the direction of the $\chi2$ value also provides information. A positive $\chi2$ value means that the observed value is higher than the expected value, and a negative $\chi2$ value means vice versa. Essentially, the larger the $\chi2$ value the higher the probability that there is a significant difference between observed and expected values, i.e. the more likely that the variables are related (McHugh, 2013.)

To compare two samples, the Wilcoxon rank-sum test is widely used and is sometimes referred to as the Mann-Whitney or Mann-Whitney-Wilcoxon test. It tests whether the samples come from distributions with the same median. Importantly, different from parametric tests – such as the t-test - it doesn't assume normality, but as a test of equality of medians, it requires both samples to come from distributions with the same shape. nonparametric tests are more suitable for data that come from skewed distributions or have a discrete or ordinal scale. Nonparametric tests such as the sign and Wilcoxon rank-sum tests relax distribution assumptions and are therefore easier to justify, but they come at the cost of lower sensitivity owing to less information inherent in their assumptions. This means that it is better for larger sample sizes. The test statistic, W, is the degree to which the sum of ranks is larger than the lowest possible in the sample with the lower ranks. (Krzywinski & Altman, 2014.) Just as in the Pearson's chi-squared test, the commonly used 95% confidence interval is used. This means that a p-value of $p>0.05$ means the null hypothesis stands and a p-value of $p<0.05$, means the null hypothesis is rejected.

In the Bivariate analysis Pearson's Chi-square test was used between each categorical variable and the dependent variable of "loan-to-value". For the two numerical variables "survey_wave" and "Vantage 3.0 credit score", a Mann-Whitney-Wilcoxon test was run between them and the dependent variable of "loan-to-value". This was due to them being numerical and because the

Mann-Whitney-Wilcoxon test is preferred over the similar and more sensitive t-test when a variables distribution is skewed, which was the case for both numerical variables (see appendix A and B for histograms). All of the statistically significant variables of the bivariate analysis were used in the binomial regression.

Logistic regression works very similar to linear regression, but with a binomial response variable. It is best used when trying to deduce the impact of various explanatory variables on the response variable, as if multiple explanatory variables are examined independently, the covariance among variables are ignored and are subjected to confounding effects. (Sperandei, 2014.) The logistic regression model has its basis in the odds (the ratio of the probability of the event happening divided by the probability of the event not happening) of a 2-level outcome of interest of the dependent variable. The logistic regression model takes the natural logarithm of the odds (log odds) as a regression function of the predictors. When exponentiated the regression coefficient shows us the odds ratio of a 1-unit change of the predictor (continuous) or the difference between levels of a variable considering the dependent variable (categorical). (La-Valley, 2008.) The regression coefficients – given in log odds - are by themselves very difficult to interpret. That is why usually the log odds are exponentiated into odds ratios (OR). Magdalena Szumilas (2010) explains that this means that the exponential function of the regression coefficient is taken. She continues that OR are used to compare the relative odds of the occurrence of the outcome of interest:

OR=1 Exposure does not affect odds of outcome

OR>1 Exposure associated with higher odds of outcome

OR<1 Exposure associated with lower odds of outcome

Schreiber-Gregory & Baders (2018) summary of the assumptions of logistic regression was used to examine whether the logistic model was adequate for the data:

1: ASSUMPTION OF APPROPRIATE OUTCOME STRUCTURE: The response variable "Loan-to-value" can only take two possible outcomes (0= "0-80%" and 1= "80%<").

2: ASSUMPTION OF OBSERVATION INDEPENDENCE: In the dataset each respondent is counted as one independent observation.

3: ASSUMPTION OF THE ABSENCE OF MULTICOLLINEARITY: The VIF() command from the CARDATA package was used to examine this. This looks at the variance inflation factor. If the variance inflation factor exceeds 5 or 10, it indicates a problematic amount of

collinearity. The largest VIF is 1.548599 (See Appendix C). This means that There is no problematic collinearity between my variables.

4: ASSUMPTION OF LINEARITY OF INDEPENDENT VARIABLES AND LOG ODDS: A scatterplot was made between the log-odds and the one continuous predictor variable "Vantage 3.0 credit score". The scatterplot shows adequate linearity (see Appendix D).

5: ASSUMPTION OF A LARGE SAMPLE SIZE: The model has N = 20786. The least frequent outcome has well over 10 cases.

Additionally, one further assumption was added, as a measure against influential outliers:

6: NO INFLUENTIAL OUTLIERS: The model does not have extreme outliers. This can be seen when both Cooks' distance (influential) and absolute standardized residual values (outliers) meet a certain determined threshold. Generally, an observation is considered to be influential when it is larger than 4/ (number of observations), which for the used models would be around 0.0002 . For this model any standardized residual with an absolute value greater than 3 was considered to be an outlier, as this is a common threshold (Zach, 2020). When the model was subjected to both of these conditions there was a total of 0 cases where the Cooks distance was larger than 0.0002 and a standardized residual with an absolute value was greater than 3.

Marcelo Coca Perraillon (2019) says that odds-ratios are often misinterpreted and don't have a sense of the magnitude (something might have a five-time risk for something, but that risk could only be 0.0001 probable). Marginal effects are a way of presenting results as differences in probabilities instead of OR. Average marginal effects (AME) can be thought of as getting an average derivative that starts by computing a small change for each observation. The numerical derivative of a variable Xj is computed for each observation using the other covariates Xk as they were observed. Essentially, the average change across observations is computed after changing the value of a predictor.

According to Mize, Doan and Long (2019) "marginal effects summarize how changes in a focal independent variable affect the predicted value of the outcome, holding other variables at specific values" they continue to talk about two types of marginal effects "…two types of marginal effects: (1) marginal effects at representative values (MER), in which covariates are held at theoretically interesting or representative values, and (2) average marginal effects (AMEs) that average the marginal effects computed at the observed values of the covariates for each observation."

Positive AME probabilities mean that every increase in the value of a continuous predictor variable means that the probability of having an LTV ratio of 80%< on average increases by the shown probability. Negative probabilities mean that the probability of having an LTV ratio of 80%< on average decreases by the shown probability for every increase in value of a continuous predictor variable. For categorical variables, positive probabilities show the average probability of having an LTV ratio of 80%< compared to the base level. For negative probabilities this effect is vice versa.

5.3 Variables

The recodes of the variables used in this analysis are shown in table 1. The dependent variable chosen for the entire analysis was LTV, "Mortgage Loan-to-Value (LTV) Ratio at Origination (Percent)" with values of 0-125. This was recoded into a dichotomous variable Loan-to-value, with the values of "0= 0-80% and 1= 80%<". This was done because of mortgage loans commonly having a maximum LTV limit of 80% before requiring compensating factors such as private mortgage insurance, and because of mortgage loans having lower interest rates before 80% LTV. The independent variables were divided between the aforementioned four hypotheses.

For the hypothesis about financial assets, the dichotomous variables "Proceeds from the sale of another property", "Assets such as savings or retirement account", "Does your household income include interests or dividends", "Does your household have stocks, bonds, or mutual funds", "Does your household have Certificates of deposit" and "Does your household have Investment real estate" were used. These variables did not need any recoding. For the hypothesis on intergenerational and social wealth, the dichotomous independent variable of "Gift or loan from family or friend" was used. This variable also did not require any recoding.

The hypothesis on social demographics was defined by using the independent variables age, education and income. Age was recoded from the integer X74R, "AGE AT LAST BIRTHDAY: | RESPONDENT", into a three levelled variable with the levels "19-39", "40-59" and "60-99". This was done so that different age cohorts could be compared with each another. The variable education level saw the recoding of three values: "Some schooling", "High school graduate" and "Technical school" into "Below college", because of low number of observations in these

values. Income level saw the combination of "Less than $35,000" and "$35,000 to $49,999" into "<$49,999", "$50,000 to $74,999" and "$75,000 to $99,999" into "$50,000-$99,999", as well as "$100,000 to $174,999" and "$175,000 or more" into "$100,000<".

Table 1: Analysis variables and re-codes

ORIGINAL VARIABLE NAME	Recode	New variable Name
DEPENDENT VARIABLE:		
LTV "MORTGAGE LOAN-TO-VALUE (LTV) RATIO AT ORIGINATION (PERCENT) TOP CODED"	Recoded integer into a dichotomous factor with the values: 0-80= "0-80%" and 81:125= "80%<"	"loan-to-value"
INDEPENDENT VARIABLES:		
SURVEY-WAVE	Turned into numeric for Mann-Whitney-Wilcoxon Test	survey-wave
X36A "DID YOU USE ANY OF THE FOLLOWING SOURCES OF FUNDS TO BUY THIS PROPERTY? | PROCEEDS FROM THE SALE OF ANOTHER PROPERTY"	Renamed	Proceeds from the sale of another property
X36B "DID YOU USE ANY OF THE FOLLOWING SOURCES OF FUNDS TO BUY THIS PROPERTY? | SAVINGS, RETIREMENT ACCOUNT, INHERITANCE, OR OTHER ASSETS"	Renamed	Assets such as savings or retirement account
X36E "DID YOU USE ANY OF THE FOLLOWING SOURCES OF FUNDS TO BUY THIS PROPERTY? | GIFT OR LOAN FROM FAMILY OR FRIEND"	Renamed	Gift or loan from family or friend
X74R "AGE AT LAST BIRTHDAY: | RESPONDENT"	Recoded integer into an ordered factor with three levels: 19-39="19-39", 40-59= "40-59", 60-99= "60-99"	age
X76R "HIGHEST LEVEL OF EDUCATION ACHIEVED: | RESPONDENT"	Recoded to combine 1 = "Some schooling", 2 = "High school graduate" and 3 = "Technical school" into 1= "Below college", because of low number of observations in these levels.	Education level
X83 "APPROXIMATELY HOW MUCH IS YOUR TOTAL ANNUAL HOUSEHOLD INCOME FROM ALL SOURCES (WAGES, SALARIES, TIPS, INTEREST, CHILD SUPPORT, INVESTMENT INCOME, RETIREMENT, SOCIAL SECURITY, AND ALIMONY)?"	Recoded to combine: 1 = "Less than $35,000" and 2 = "$35,000 to $49,999" into 1= "<$49,999", 3 = "$50,000 to $74,999" and 4 = "$75,000 to $99,999" into 2= ""$50,000-$99,999", and 5 = "$100,000 to $174,999" 6 = "$175,000 or more" into 3= "$100,000<"	Income level
X85C "DOES YOUR TOTAL ANNUAL HOUSEHOLD INCOME INCLUDE ANY OF THE FOLLOWING SOURCES? | INTEREST OR DIVIDENDS"	Renamed	Does your household income include interests or dividends
X86B "DOES ANYONE IN YOUR HOUSEHOLD HAVE ANY OF THE FOLLOWING? | STOCKS, BONDS, OR MUTUAL FUNDS (NOT IN RETIREMENT ACCOUNTS OR PENSION PLANS)"	Renamed	Does your household have stocks, bonds, or mutual funds
X86C "DOES ANYONE IN YOUR HOUSEHOLD HAVE ANY OF THE FOLLOWING? | CERTIFICATES OF DEPOSIT"	Renamed	Does your household have Certificates of deposit
X86D "DOES ANYONE IN YOUR HOUSEHOLD HAVE ANY OF THE FOLLOWING? | INVESTMENT REAL ESTATE"	Renamed	Does your household have Investment real estate
FIRST_MORT_R "FLAG INDICATING FIRST MORTGAGE IN CREDIT FILE | RESPONDENT"	Renamed variable and levels: = First mortgage in credit file = "First mortgage", Not a first mortgage in credit file = "Not First Mortgage"	First mortgage in credit file
SCORE_ORIG_R "VANTAGESCORE 3.0 AT ORIGINATION | RESPONDENT"	Recoded integer into numeric for Mann-Whitney-Wilcoxon test	Vantage 3.0 credit score
DTI "MORTGAGE DEBT-TO-INCOME (DTI) RATIO AT ORIGINATION"	Recoded integer into ordered factor with three levels: 0-27= "0-27%", 28-43="28-43%", 44-100="44-100%"	Debt-to-income ratio

The final hypothesis - credit history - was defined by three variables. The first one was the dichotomous variable "First mortgage in credit file", which did not require any recoding. The second variable used for this hypothesis was the integer Vantage 3.0 credit score. It had the values 300 through 850. It was recoded into a numeric variable for the Mann-Whitney-Wilcoxon test. The final variable was "Debt-to-income ratio", which was recoded from a integer into an ordinal variable with three levels: "0-27%", "28-43%" and "44-100%".

6 Results

6.1 Descriptive statistics

Descriptive statistics are shown in table 2. In this population over half of the borrowers (55%) have LTVs of over 80%, meaning that they possibly have more stringent mortgage conditions. Most households did not use proceeds from the sale of another property (70%), which is interesting, as most respondents had more than one mortgage on their credit file (64%). Additionally, most households' income did not include stocks bonds or mutual funds (56%), interest or dividends (77%), certificates of deposit (89%), or investments in real-estate (82%). This is in line with the notion of wealth and assets accumulating to few and being out of the hands of many. However, most households used assets such as savings or retirement accounts for a home purchase (65%). This however, is not surprising as most home purchases require some kind of downpayment. Most households did not use a gift or loan from family or friends while purchasing their home (83%), meaning that intergenerational wealth is out of reach of the vast majority.

Age cohorts of 19-39 and 40-59 were of similar sized of around 40% and a fifth of respondents were 60-99 years old. A majority of responders were college graduates (37%) or had done postgraduate studies (30%), with only just under a fifth of people having some college education and 15% having only below-college-level education. Nearly half of all responders were in the over $100,000 income level and 38% were in the $50,000-$99,999 income level, leaving only 15% of respondents in the under $50,000 income level. This is not surprising as the median household income for US families is around $70,000 (US Census Bureau, 2022). The mean and median credit scores were 747 and 759 respectively, meaning that most respondents had a credit score at the high end of the spectrum. The lowest credit score was 463 and the highest was 839.

Table 2: Summary Statistics

Variable	N/ Count	Mean/ Percent	Std. Dev.	Min	Pctl. 25	Pctl. 50	Pctl. 75	Max
Proceeds from the sale of an other property	20786							
... Used	6199	30%						
... Not Used	14587	70%						
Assets such as savings or retirement account	20786							
... Used	13563	65%						
... Not Used	7223	35%						
Gift or loan from family or friend	20786							
... Used	3603	17%						
... Not Used	17183	83%						
Education level	20786							
... Below college	3062	15%						
... Some college	3768	18%						
... College graduate	7731	37%						
... Postgraduate studies	6225	30%						
Income level	20786							
... <$49,999	3196	15%						
... $50,000-$99,999	7848	38%						
... $100,000<	9742	47%						
Does your household income include interests or dividends	20786							
... Yes	4804	23%						
... No	15982	77%						
Does your household have stocks, bonds, or mutual funds	20786							
... Yes	9119	44%						
... No	11667	56%						
Does your household have Certificates of deposit	20786							
... Yes	2371	11%						
... No	18415	89%						
Does your household have Investment real estate	20786							
... Yes	3741	18%						
... No	17045	82%						
Vantage 3.0 credit score	20786	747	62	463	706	759	799	839
Debt-to-income ratio	20786							
... 0-27%	4492	22%						
... 28-43%	11357	55%						
... 44-100%	4937	24%						
First mortgage in credit file	20786							
... First Mortgage	7423	36%						
... Not First Mortgage	13363	64%						
loan-to-value	20786							
... 0-80%	9344	45%						
... 80%<	11442	55%						
age	20786							
... 19-39	8397	40%						
... 40-59	8201	39%						
... 60-99	4188	20%						
survey_wave	20786	14	8.4	1	6	14	21	30

6.2 Assets and age vary between LTV levels and high credit scores are the norm

The bivariate analysis was used to determine whether there was a relationship between each individual independent variable and the dependent variable "loan-to-value", as well as analyse the strength and direction of the relationship. All but two variables were statistically significant at the 95% confidence interval level and thus rejected the null hypothesis. The non-significant variables being "Assets such as savings or retirement account" and "survey_wave". This means that using assets such as savings or a retirement account has no relationship with whether one has a lower (0-80%) or higher (80%<) LTV ratio level. Additionally, the survey wave in which one responded in has no relationship with whether one has a lower or higher LTV ratio level. In other words, no trend can be seen over time regarding whether one has the lower or higher LTV ratio level.

The largest relationship was between households with interests and dividends incomes and the dependent variable. This means that there is a high probability that there is a relationship between whether or not one's household income includes interests or dividends and which LTV ratio level they have. This is hardly surprising as relatively there are over two times more households whose incomes include interests or dividends in the lower LTV ratio level than in the higher level. Another highly significant relationship was found between the dependent variable and households who used the proceeds from the sale of another. These results are also hardly surprising as there were over two times as many households that used proceeds from the sale of another property with lower LTV ratios than there were with higher one's. In fact, some of the strongest relationships were found between asset-owning households and LTV ratios. This could show that assets are an important way to acquire mortgages with good conditions.

Age cohorts varied drastically between LTV levels, with younger age cohorts making up nearly half of those with higher LTV ratios. The middle age cohort was relatively as large in both LTV levels, leaving the oldest age cohort as underrepresented in the higher LTV ratio level. This means that younger age people are taking on loans with lower downpayments and more debt, compared to their older counterparts and people around or after the retirement age are taking on loans with healthy amounts of debt.

A final interesting observation can be seen in how the median Vantage 3.0 credit score differed between LTV ratio levels. Those with lower LTV ratios had a median credit score of 788 and those with higher LTV ratios had a median credit score of 734. A statistically significant difference, however both being at the high end of the credit score spectrum.

Table 3: Cross table, Mann-Whitney-Wilcoxon and Pearsons X2-test

	0-80% (N=9344)	80%< (N=11442)	P-value	W- Or X2-value
Proceeds from the sale of another property				1269
Used	3956 (42.3%)	2243 (19.6%)	<0.001	
Not Used	5388 (57.7%)	9199 (80.4%)		
Assets such as savings or retirement account				2.099
Used	6147 (65.8%)	7416 (64.8%)	0.147	
Not Used	3197 (34.2%)	4026 (35.2%)		
Gift or loan from family or friend				52.75
Used	1422 (15.2%)	2181 (19.1%)	<0.001	
Not Used	7922 (84.8%)	9261 (80.9%)		
Education level				366.6
Below college	1124 (12.0%)	1938 (16.9%)	<0.001	
Some college	1409 (15.1%)	2359 (20.6%)		
College graduate	3464 (37.1%)	4267 (37.3%)		
Postgraduate studies	3347 (35.8%)	2878 (25.2%)		
Income level				576
<$49,999	1202 (12.9%)	1994 (17.4%)	<0.001	
$50,000-$99,999	2904 (31.1%)	4944 (43.2%)		
$100,000<	5238 (56.1%)	4504 (39.4%)		
Does your household income include interests or dividends				1604
Yes	3371 (36.1%)	1433 (12.5%)	<0.001	
No	5973 (63.9%)	10009 (87.5%)		
Does your household have stocks, bonds, or mutual funds				1179
Yes	5322 (57.0%)	3797 (33.2%)	<0.001	
No	4022 (43.0%)	7645 (66.8%)		
Does your household have Certificates of deposit				420.8
Yes	1534 (16.4%)	837 (7.3%)	<0.001	
No	7810 (83.6%)	10605 (92.7%)		
Does your household have Investment real estate				719
Yes	2421 (25.9%)	1320 (11.5%)	<0.001	
No	6923 (74.1%)	10122 (88.5%)		

Table 3: Continued

Vantage 3.0 credit score				77214559
Mean (SD)	772 (51.0)	726 (63.3)	<0.001	
Median [Min, Max]	788 [463, 839]	734 [490, 839]		
Debt-to-income ratio				758.1
0-27%	2771 (29.7%)	1721 (15.0%)	<0.001	
28-43%	4887 (52.3%)	6470 (56.5%)		
44-100%	1686 (18.0%)	3251 (28.4%)		
First mortgage in credit file				1166
First Mortgage	2163 (23.1%)	5260 (46.0%)	<0.001	
Not First Mortgage	7181 (76.9%)	6182 (54.0%)		
age				1330
19-39	2713 (29.0%)	5684 (49.7%)	<0.001	
40-59	3853 (41.2%)	4348 (38.0%)		
60-99	2778 (29.7%)	1410 (12.3%)		
survey_wave				52758638
Mean (SD)	13.8 (8.40)	13.9 (8.33)	0.104	
Median [Min, Max]	13.0 [1.00, 30.0]	14.0 [1.00, 30.0]		

6.3 Not owning financial assets, young age and debt increases odds of high LTV, intergenerational and social wealth, education and high credit scores decrease odds of high LTV

The binary logistic regression was done to show the nature of the relationship between the independent variables collectively and the dependent variable, taking into account the relative impact each independent variable has on the dependent variable. The summary has the coefficients exponentiated into odds ratios (OR) for easier interpretation (Table 4). All but one variable was statistically significant. That variable being "First mortgage in credit file". This means that in this model - taking into account other variables – there is no significant relationship between whether one is a first-time mortgager or not and their LTV ratio.

The variable that best explained high LTV ratios was households, that did not use proceeds from the sale of another property (OR 2.6). This means that the odds of having an LTV ratio exceeding 80%, are 2.6 times higher for those who did not use proceeds from the sale of another property to finance their mortgages than those who did. Additionally, not owning real estate (OR 1.85), interests or dividends (OR 1.90), stocks bonds or mutual funds (OR 1.47) or certificates of deposit (OR 1.26) were all in connection with higher LTV ratios. This gives large

support to the hypothesis that not owning financial assets makes it more likely for one to have higher LTV ratios.

The odds of having a high LTV ratio decreases by 55% for every one-unit increase in age level. Meaning, that old age cohorts have lower odds in having high LTV ratios than younger age cohorts. Similarly higher levels of education show decreasing odds of having a high LTV ratio (OR 0.86). These results show that sociodemographic factors play a large role, even when financial assets are taken into account. However, most interestingly the odds of having a higher LTV ratio increased for higher income earners.

Not having intergenerational and social wealth saw households having higher odds of having higher LTV ratios. This backs the idea of intergenerational wealth playing a part in mortgage conditions.

An interesting result is found when examining credit scores, which show decreasing odds with increasing score. Comparing the minimum measured credit score recorded in the dataset (463) with the maximum measured credit score (839), would result in the odds of having a high LTV ratio being 3.76 times lower for the higher credit score owner compared to the lower credit score owner. In addition to this having higher levels of debt (OR 1.96) increased the odds of having a higher LTV ratio. These results back the idea of credit history playing a large part in LTV ratios of mortgages.

Table 4: Logistic regression summary

Predictors	Model loan-to-value		
	Odds Ratios	std. Error	CI
(Intercept)	80.26 ***	20.26	48.99 – 131.78
Proceeds from the sale of another property [Not Used]	2.60 ***	0.10	2.41 – 2.80
Gift or loan from family or friend [Not Used]	1.78 ***	0.08	1.63 – 1.94
Education level [linear]	0.86 ***	0.03	0.79 – 0.93
Income level [linear]	1.11 **	0.04	1.03 – 1.19
Does your household income include interests or dividends [No]	1.90 ***	0.08	1.74 – 2.06

Table 4: Continued

Does your household have stocks, bonds, or mutual funds [No]	1.47 ***	0.05	1.37 – 1.58
Does your household have Certificates of deposit [No]	1.26 ***	0.07	1.13 – 1.40
Does your household have Investment real estate [No]	1.85 ***	0.08	1.69 – 2.02
Vantage 3 0 credit score	0.99 ***	0.00	0.99 – 0.99
Debt-to-income ratio [linear]	1.96 ***	0.07	1.82 – 2.10
First mortgage in credit file [Not First Mortgage]	0.93	0.04	0.86 – 1.01
age [linear]	0.45 ***	0.02	0.41 – 0.48
Observations	20786		

PseudoR2: McFadden 0.214, CoxSnell 0.255, Tjur 0.268, Nagelkerke 0.342

$* p<0.05$ $** p<0.01$ $*** p<0.001$

6.4 Age, property assets and debt have largest impact on LTV ratio

Marginal effects were used to assess the impact of variables on the outcome, so that the absolute change in the predicted probability of the outcome can be seen. Each result is reported while holding all other variables constant. There is a clear difference in probabilities of having a higher LTV in different age cohorts. Ages 40-59 and 60-99 are on average a tenth and fifth less probable to have a higher LTV ratio than their 19–39-year-old counterparts. Education level has an interesting effect as some college education increases the probability of having a higher LTV ratio level by a small margin compared to below-college-level education. However, having a college degree or postgraduate studies both decrease the probability of this. Income levels of $50,000-$99,999 and $100,000< actually increased the probability of having a higher LTV ratio level when compared to their <$49,999 income-level counterpart. Clearly out of socio-demographic factors the largest impact on ones probability of having a higher LTV ratio was age, with older people being less probable in having higher LTV ratios by up to 20%. Education or income did not that much of an impact on the probability of having a high LTV.

Households that do not have certificates of deposits (4.2%), investment real estate (11.4%) or stocks/bonds/mutual funds (7.2%) are more probable of having higher LTV ratios than those

who own those assets. In a similar fashion, households whose incomes don't include interests or dividends (12.2%) are also more probable of having higher LTV ratios. Additionally, not using proceeds from another property while purchasing a property had the largest probability of all variables at 18.2%. Out of the financial assets, one can see that that the largest impacts on the probability of having a high LTV ratio are property-based assets, such as real estate and a former property. Nearly on par with the financial assets, not using a gift or loan from family or friends (10.3%) increased the probability of having a high LTV ratio, showing that intergenerational and social wealth are nearly as important as owning real estate.

Finally, showing the importance of credit history, the probability of having a higher LTV ratio level decreased by 0.2% per increase of credit score. Additionally. Households with DTI levels of 28-43% and 44-100% at origination are more probable to have a higher LTV ratio level than those in the 0-27% DTI range. This means that more debt predicts higher LTV ratios, with better managed debt predicting lower LTV ratios in turn.

Graph 1: Average Marginal Effects
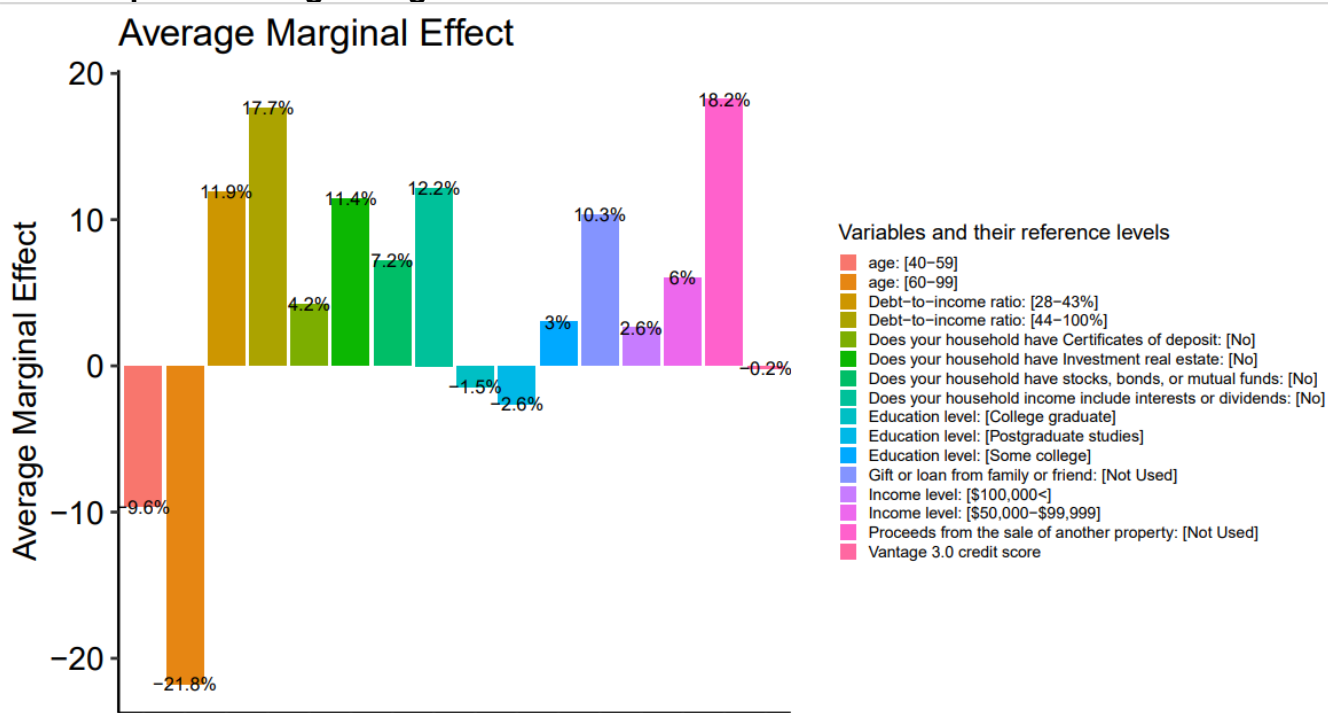
7   Discussion

In this section the results of each of the analysis's hypotheses will be explored and compared to the theory presented in sections 2 and 3. Each hypothesis holds, with a few interesting caveats. Those caveats being that the model showed no statistical significance between whether one was a first-time mortgager or not and their LTV ratio level, and that higher levels of income predicted higher probabilities of having a higher LTV ratio level than lower income levels.

The first hypothesis that stated that not owning financial assets makes it more likely for a borrower to have a higher LTV ratio than those who don't was clearly visible based on the results of the analysis. Whether it was not owning certificates of deposit, stocks bonds or mutual funds, investment in real-estate or not receiving income from interest or dividends, households that did not own or receive income from these assets were more probable to have an LTV ratio exceeding 80%. However, savings or pension fund-based assets were not considered to have a relationship with LTV ratio levels.

These results conform to Hochstenbach and Aalbers (2023) idea of wealth-driven housing dynamics, especially their arguments about assets being vital to make a down payment and in shaping the economic position and security of households. Clearly not owning these assets, meant that households were more probable in having an LTV ratio exceeding 80%, meaning that they made a downpayment that was worth less than 20% of the property they were purchasing. This also means that the economic position and security of those households that failed to make the 80% LTV ratio threshold could be threatened or at least disadvantaged, by the conditions that plague those not meeting the set threshold, such as private mortgage insurance, higher closing costs and higher interest rates. Additionally, their claims of housing paradoxically being the prime means to acquire housing can be seen in the results of the analysis. This could be seen in how the largest impact on having a higher LTV ratio level was not using proceeds from the sale of another property.

Not having intergenerational or social wealth predicted a higher LTV-ratio level. This also plays into Hochstenbach and Aalbers (2023) ideas of wealth-driven housing dynamics. They explain that households – especially ones consisting of young people – are relying more and more on intergenerational wealth to become homeowners. However, it is important to realize that the variable included social wealth with a gift or loan from friend included in the variable. This

weakens the predictive power of intergenerational wealth playing a part, but still is an interesting find.

Sociodemographic factors provided an interesting look at the relationship between LTV ratios and age and income. Older age cohorts are less probable in having higher LTV ratios than younger ones. It seems that younger cohorts have to take on more debt than their older counterparts to own a home. This could show signs of the US having similar problems than Australia, with younger cohorts with stagnant wages needing to take on more debt for homeownership (Wiesel et al. 2023, 291). Additionally, this could mean that Garcia-Lamarca and Kaika's (2016) concept of the biotechnology of debt is ever-increasingly burdening younger cohorts.

Higher income earning households being more probable to have higher LTV ratios than lower income earning households is an interesting find. Cox et al. (2002) showed that from 1995 to 2000, households with the highest absolute levels of debts tended to also have the highest incomes and net wealth, with a large proportion of this wealth being held in housing assets. Could the results of the analysis be interpreted as high income earners willing to live with large levels of debt because they don't care about mortgage conditions. This could also be interpreted as high income earners buying more expensive homes or not saving up for downpayments as much as lower income earning households. Or perhaps, higher income earning households are using their wealth as proof of capacity or as collateral for their mortgage, to get better interest rates or other more lenient mortgage conditions. Further research is required to understand these results.

Finally, borrowers with better credit history tend to have lower LTV ratios, especially levels of debt play a large role in LTV ratios. This follows the logic of risk-based pricing, which rules the financial markets, as well as the mortgage markets. Interestingly, different from Hochstenbach and Aalbers (2023) claims that first time buyers are becoming even more leveraged, this analysis showed no signs of this. Though, a relationship between whether one was a first-time mortgager or not and their LTV ratios was observed in the bivariate analysis. More research is needed to understand the relationship between these variables.

8 Conclusions

This paper examined the factors that could influence US households' ability to secure mortgages with good conditions in a debt- and wealth-driven housing market. The main find of the analysis shows that owning different forms of financial wealth makes acquiring a mortgage with a lower LTV ratio easier, thus allowing more lenient mortgage conditions, such as lower interest rates and closing costs as well as not needing private mortgage insurance. This is especially interesting given that income levels showed the opposite, with higher income earners being more probable in having higher LTV ratios. This could show that Hochstenbach and Aalbers (2023) theorized wealth-driven housing market is taking more of a hold in the US.

This development is concerning, as housing - the world's largest capital asset - is an ever-increasingly important form of private wealth to be used for welfare purposes, such as for healthcare, in case of unemployment or to fund one's retirement (Forrest & Himayama, 2018, 274 ; Doling & Ronald, 2010, 165). This system of – mostly housing - asset-based welfare is only becoming more cemented into the US, as its economy relies more and more on secondary markets, in which mortgage debt is bundled and sold to investors. Mortgage markets sheer volume and their ability to fuel the economy both directly and indirectly (through equity withdrawal), has created a monster, in which a stagnation or decline in home equity will affect other economic sectors, in particular consumer markets (Aalbers, 2008, 151, 161). This means that the government is incentivized to keep asset-based welfare going, as needing a home to survive increases homeownership, which fuels the mortgage markets, which fuel the economy at whole.

In this system housing – which people and the economy at whole depend on – is becoming an asset that fewer and fewer people can acquire. There are claims of different societal classes that depend on housing tenure: those that have no housing wealth at all and must live as renters perpetually, those whose housing wealth dissipates throughout generations, and a small class whose housing wealth accumulates throughout generations (Forrest & Himayama, 2018). This – just as the analysis shows – is disproportionately affecting financial asset non-owners, younger age cohorts and those without generational or social wealth. The larger picture of this looks even more bleak, with large corporate landlords or real estate investment trusts (REIT) steadily buying up extensive tracts of residential real estate for buy-to-let purposes, further exacerbating the difficulty of households to become homeowners (Smith et al., 2022, 180).

In this fragile system of asset-based welfare that is mostly reliant on housing wealth - which is paradoxically difficult to acquire without wealth -, people are required to take on risks exposing themselves to the markets even further, or to go without. A system which would not require individual risk-taking could be achieved by strengthening the welfare system, so that it would be publicly funded and not rely on private wealth. This change could result in housing being viewed as something else than as a financial asset which facilitates welfare and wealth accumulation: perhaps as a human right instead.

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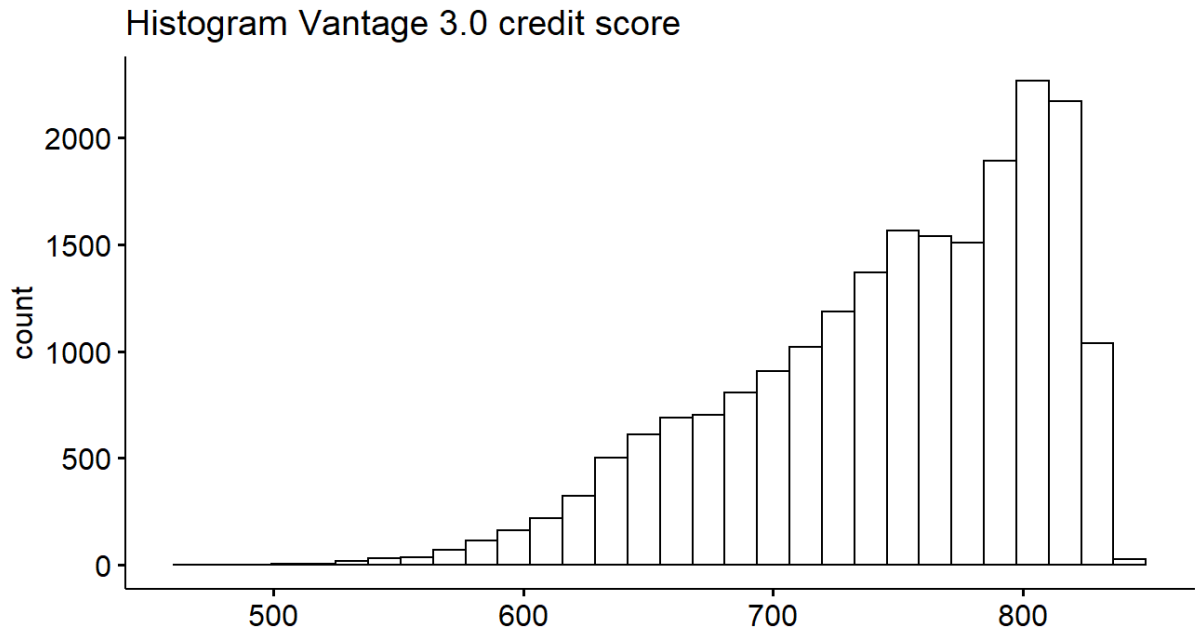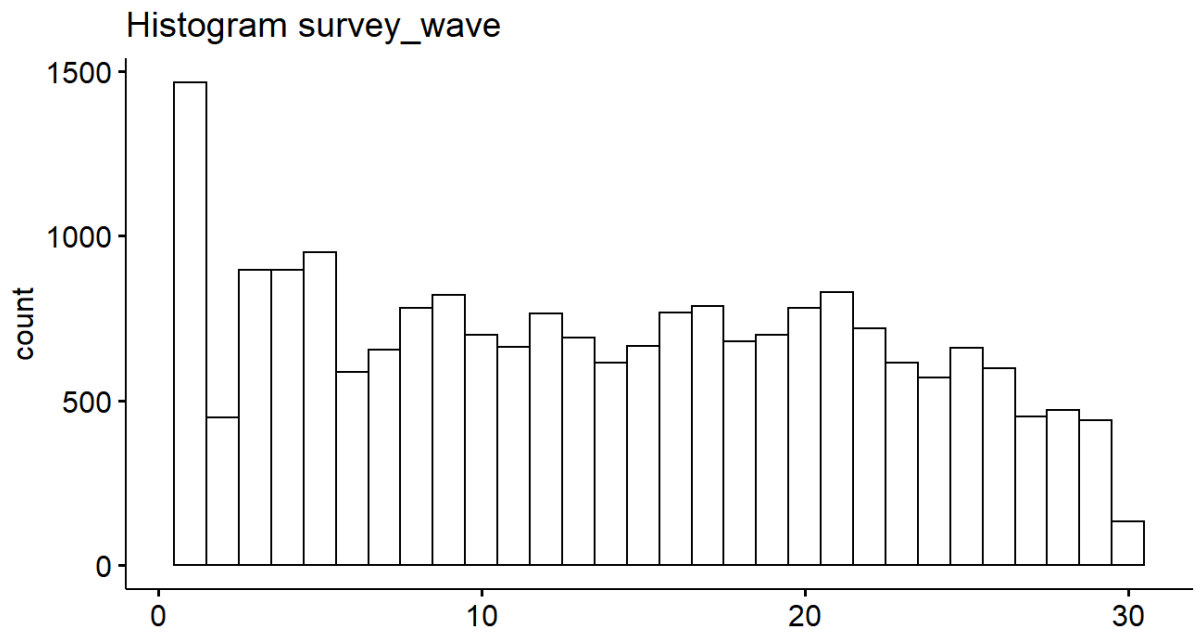of the typical American income — the highest share since 2007. Business Insider.

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10   Appendix A

Histogram Vantage 3.0 credit score

11 Appendix B

Histogram survey_wave

12 Appendix C

Appendix C: VIF

	GVIF	Df	GVIF^(1/(2*Df))
Proceeds from the sale of another property	1.212993	1	1.101359
Gift or loan from family or friend	1.137763	1	1.066660
Education level	1.233565	3	1.035604
Income level	1.357668	2	1.079440
Does your household income include interests or dividends	1.206353	1	1.098341
Does your household have stocks, bonds, or mutual funds	1.243446	1	1.115099
Does your household have Certificates of deposit	1.059578	1	1.029358
Does your household have Investment real estate	1.166886	1	1.080225
Vantage 3.0 credit score	1.130515	1	1.063257
Debt-to-income ratio	1.063893	2	1.015604
First mortgage in credit file	1.548599	1	1.244427
age	1.411656	2	1.090014

13 Appendix D

Scatterplot of log odds and Vantage 3.0 credit score