Mortgage Relief and Household Saving
Evidence from a natural experiment in Iceland using Administrative Data *

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Abstract

We take advantage of a unique experiment that took place in Iceland in 2015. Following the collapse of the country's banking system in 2008, the authorities decided on a program of mortgage relief that in effect lowered the principal of mortgages overnight. What sets our experiment apart from others is that the debt relief was financed by foreign creditors, that we have administrative data on all taxpayers in the country and that the mortgage relief was implemented many years after the end of the economic crisis when household balance sheets had been repaired. We measure the effect of the mortgage relief on the saving of every taxpayer in the country using households that were not eligible for debt relief as a control group. While a negative wealth effect on saving could have been expected, households amortized even more in response to the debt forgiveness. The increased amortization is not only due to lower interest costs but also due to higher saving, mostly by highly leveraged and liquidity constrained households.

Keywords: Mortgage relief, wealth, saving.

JEL Codes: E21

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1 Introduction

Debt has been a source of friction in societies going back to ancient times. While the owners of firms can often escape the burden of debt through bankruptcy, households have more difficulties escaping the bonds of debt. Declaring bankruptcy deprives a family of a place to live, while struggling to pay debt creates family distress and often great unhappiness. Hudson and Goodhart (2018) describe how the Hammurabi dynasty in ancient Babylon cancelled debt and was rewarded by loyal citizens while ancient Rome did not, causing disenfranchised indebted citizens to contribute to its collapse. In more recent times, the Biden-Harris administration has implemented a forgiveness of student debt that has wiped debt off 3.6 million Americans.[1] In the UK, the Labour Party plans to reduce the monthly repayments of student loans for graduates.

There is the obvious drawback of any debt moratorium that one person's debt is another person's asset. While governments can relief debt of some citizens by imposing taxes on others, such measures tend to be met by opposition of the latter. In this paper we describe debt relief where a government was in the unique position of being able to make foreigners, in particular foreign creditors that they do not have to fear at the voting booth, pay. The experiment we describe is that of a Robin Hood "robbing" foreign investors and giving money to indebted citizens. This setting provides ideal grounds for testing whether debt relief actually lowers debt or, conversely, induces people to increase their spending by borrowing.

Our study also benefits from the use of administrative data that contains the tax returns of all Icelandic taxpayers around the time of the debt relief. This enables us to measure consumption for each household, in addition to purchases of housing and durables in the form of cars. Using the administrative data has clear benefits over the use of credit card data, often used to study the consumption response to debt relief, because the fraction of transactions using credit car may vary over the business school and differ between age groups. There is also the issue of using cash to avoid having to pay taxes, which is not unheard of in Iceland.

Moreover, in contrast to other studies of debt relief during the Great Financial Crisis (GFC), the debt relief in Iceland was not implemented until 2015 when the average household had mostly recovered from the crash of 2008. The debt relief was designed to lower the principal of CPI indexed debt that had increased due to inflation after the collapse of the exchange rate in 2008. Figure 1 shows the ratio of a wage index and the CPI index, which is the one used to index mortgages. Note the fall in 2008 and 2009, which signifies increased debt burden, and then the subsequent recovery, which shows the fall in the debt burden. The index has the same level in 2015 as in 2007, which indicates that there was no real need for debt relief in 2015. Thus the relief was akin to a helicopter drop of wealth taking the form of lowering of mortgages.

We start by providing background to the mortgage relief operation, the prelude of the collapse of Iceland's banking system and the recovery efforts that followed. We then survey the literature from other countries on the effect of debt relief on amortization and the buying of consumer durables. We then delve into the mortgage relief as a natural experiment and the timing and the sequence of events, before describing our data. The results of a survey follow where people were asked about what their response to the

[1] See statement from the White House, 12 January, 2024 Statement from President Joe Biden on Early Student Debt Cancellation for Borrowers Enrolled in SAVE | The White House.

mortgage relief had been. We then turn to our empirical analysis. The final section has some concluding remarks.

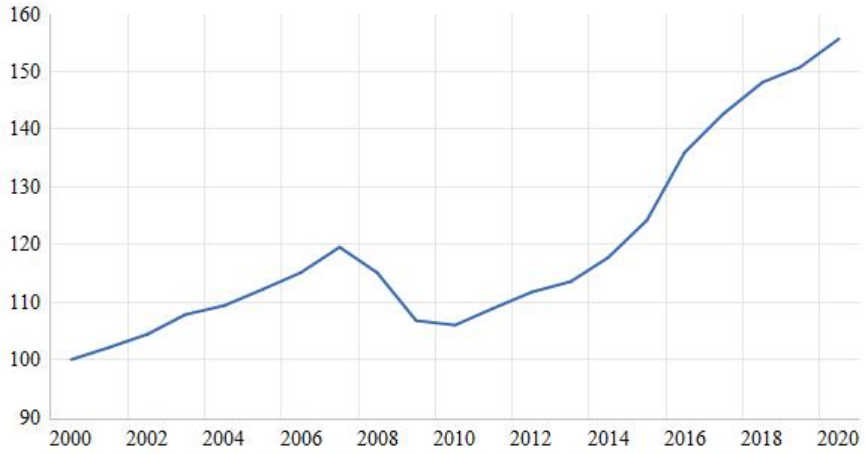


Figure 1: Ratio of the wage- and price index

2 Background

We study economic developments in Iceland, a country that became a symbol of the 2008 Global Financial Crisis when its banking system collapsed at the beginning of October 2008. The years before the collapse had been in many ways similar to the bubble years in London in the second decade of the 18th century, the 1920s in the United States or for that matter any other financial crisis. Increased credit went together with rising stock prices, justified by stories about the reason why times were so good.

This story, as so many other similar ones, starts with the privatization of a banking system. The government of Iceland, with a AAA rating, decided to privatize its three state banks after the turn of the century. By so doing, it in effect conferred its credit rating upon these banks, which they used to accumulate foreign debt, making them expand at around 50% per year from 2004 to 2008.[2] Most of the domestic credit creation, financed through the foreign borrowing, was in the form of foreign-currency loans to businesses and also some to households but most of the household debt took the form of CPI-indexed loans.[3] While much of the business loans was used to buy foreign businesses and assets, the capital inflow through the banking system created a steady appreciation of the currency and a stock market bubble, stock prices going up tenfold between 2003 and 2007 as well as the doubling of house prices over the same period. The rising asset prices and the appreciated currency raised private consumption and investment, resulting in persistent current account deficits, which peaked at 24.2% in 2006. The sudden stop of

[2]See Benediktsdottir et al. (2014) and Benediktsdottir et al. (2017).

[3]Businesses borrowed around 80% in FX loans and households around 80% in CPI-indexed loans. Of the remainder, car loans were mostly in foreign currencies.

capital inflows in 2008, both in the run up to the Global Financial Crisis in the spring of 2008, and especially after the collapse of Lehman Brothers in September of that year made the Icelandic currency tank, the stock market collapse and the domestic currency value of FX-linked and CPI-indexed debt jump.

Financial crises are by definition debt crises, which explains some of the societal and political upheaval that tends to accompany them. Aliber et al. (2023) describes the turmoil in the House of Commons and British society following the bursting of the South Sea bubble in 1720 and similar episodes in the last three hundred years. Galbraith (1954) gives a vivid account of the 1920s and the 1930s in the United States. Also in Iceland, the bankers had been celebrated as national heroes in the years before the financial meltdown and then became almost overnight objects of spite. Protesters threw paint at their houses, the media depicted them as criminals and a parliamentary investigative committee concluded that they were guilty of market manipulation, amongst other misdeeds. Many received prison sentences. It is in the years that followed this debt crisis, turmoil and national anger and resentment towards bankers and politicians that we find our natural experiment in debt relief.

The left-leaning government that came into power following the crash in 2009 implemented some debt relief measures, such as capping mortgages at 110% of the value of homes. While more comprehensive debt relief measures were being formulated by the government and the IMF, the country's supreme court ruled in 2010 that FX-linked loans had in fact been illegal. This came as a surprise because households and firms had been borrowing FX-linked for almost a decade without the legal profession expressing any doubt about their legality. The obvious injustice of some households having been given debt cancellation – that is the ones with the FX loans – while others had not – in particular those with the CPI-indexed loans, – set the stage for a populist political party to introduce proposals for the reduction of CPI-indexed debt. [4] Normally, both forms of debt cancellation would have run into the opposition of domestic creditors but these were non-existent, the banks having defaulted on their foreign debt.

What made mortgage relief popular among voters was the fact that it was financed through a tax on foreign investment funds. The operation was in the spirit of Robin Hood, and politicians justified it by claiming that foreign vulture funds had acquired the distressed assets at bargain prices. In effect, the government imposed a tax on the liability side of the failed banks, which were the assets of the different investment, or vulture, funds that had bought the distressed assets, which were the bonds issued by the banks before their collapse. Given the large size of the banks' balance sheets compared to the GDP of the country, the tax rate could be kept very low.[5] In effect, the debt cancellation was financed by foreign creditors who were trapped behind the shut gates of capital controls.

3 Literature review

Following the GFC other countries also implemented measures to relieve homeowners of some of the burden of their debt, although in contrast to Iceland the measures were im-

[4] See Mudde and Kaltwasser (2017) on the definition of populist political movements.

[5] Total assets of the banking system amounted to one year's GDP in 2000, one and a half year's GDP in 2003, then rose to 193% of GDP in 2004, 303% in 2005, 390% in 2006 and 744% at the end of 2007 see Benediktsdottir et al. (2014).

plemented during the times of distress. In the United States, the government introduced the Home Affordable Refinance Program (HARP) in the spring of 2009 to provide support to homeowners who had little equity in their homes in order to lower their interest expenses. HARP enabled eligible households with limited equity to refinance their mortgages at lower interest rates by giving federal credit guarantee to lenders. The program was confined to those who had mortgages that were guaranteed by government-sponsored enterprises (GSEs), in particular Fannie Mae or Freddie Mac, and included households with a high loan-to-value ratio.

While the HARP debt relief lowered the interest expenses of households, the relief in Iceland lowered the principal of the mortgage debt and as a result also the interest expenses. Therefore, households in Iceland could respond to both their increased wealth as well as having lower monthly bills and more liquidity. We will therefore survey both the literature on HARP and also research on the effects of household wealth on their consumption. Both touch on the transmission channel of monetary policy.

Agarwal et al. (2023) take advantage of HARP to estimate the effect of lower interest payments on durable consumption using a large database of mortgages. They merge the mortgage data with data on each borrower's consumer credit records, which makes it possible to measure the effect of the lower interest payments on new auto purchases. They use DID comparing a treatment group that was eligible for the program and refinanced their fixed-rate mortgages under HARP to a control group that was not eligible and find that the treatment group benefited from around 140 basis points of interest rate savings. The lower interest expenditures affected spending on auto purchases, the increase in auto debt being around 24 percent of the magnitude of the saving in interest expenses. The effect was stronger for borrowers with lower housing wealth and lower credit ratings, which are the households that experienced the largest reduction in interest rates. At a regional level, there was a positive relationship between the prevalence of the HARP program, on the one hand, and car purchases, credit card spending and house prices, on the other hand, and a negative relationship with the level of foreclosures.

Abel and Fuster (2021) also study the effect of HARP but focus on eligibility variation within secured mortgages, in particular whether mortgages were guaranteed by a GSE before or after June 2009, the former being eligible for HARP. They find an increase in auto debt around 20 percent of the magnitude of the payment reduction due to HARP. Their data allow them to calculate the effect of HARP on other consumer spending than cars. They find that the reduced interest burden of borrowers benefiting from HARP responded by both accumulating new debt, amounting to 60 percent of the monthly savings on mortgage payments, while the reduction in debt amounted to 40 percent of the savings, generating a net increase in debt accumulation of around 20 percent of the savings created by HARP. Overall, HARP lowered the likelihood of default, especially for borrowers with low credit scores as in the study by Agarwal et al. (2023). These borrowers also tended to add to their auto and consumer debts to a greater extent than those with a better credit score.

The effect of monetary policy working through mortgages has been studied for many countries. Di Maggio et al. (2017) exploit variation between borrowers in the timing of resets of adjustable-rate mortgages (ARMs) using the period of low interest rates after the Great Financial Crisis (GFC). In particular, they compare the outcomes of borrowers holding five-year ARMs who have experienced interest rate reductions to those who have not and find an effect of interest reductions on auto purchases, although somewhat smaller

than in Agarwal et al. (2023) and Abel and Fuster (2021). They also find an increase of HELOC debt (home equity line of credit). These effects were attenuated by borrowers using part of the interest savings to pay down their debt. The authors point out that the interest rate reductions were unexpected at the time of loan origination, which is five years before the interest rates are adjusted, and occur automatically and irrespective of the financial position of the borrowers. Borrowers with low income and housing wealth, that is high loan-to-value ratios, turn out to have a much higher propensity to spend out of the lower interest expenses. At the regional level, a fall in central bank interest rates has a stronger effect in areas with a larger share of ARMs as measured by house price increases, car purchases and employment. An earlier paper using similar methodology is that of Keys et al. (2015). These authors also exploit the variation in the timing of changes in interest rates on both agency and non-agency mortgages during the period of interest rate cuts from late 2007 through 2012. They find that households use the interest savings to reduce credit card debt and credit card utilization but also to increase their auto debt. Again, we find that the cost of servicing mortgages comes at the expense of investment in durable consumer goods. Households with lower housing wealth are more responsive when it comes to car purchases while liquidity-constrained households are less responsive, choosing instead to reduce their credit card debt.

Cloyne et al. (2020) find that the response of consumption to interest rate changes in the U.S. and the U.K. is driven more by income effects than changes in cash flows. The authors point out that the main difference between the mortgage market in these two countries is that adjustable rate mortgages with short duration are more common in the U.K. and fixed rates with long duration more common in the U.S. Therefore, it did not come as a surprise when they found that the interest effect on mortgage repayments was greater in the U.K. Moreover, households with mortgage debt responded more to changes in central bank interest rates than those without it in both countries, in particular when it comes to durable consumer good spending. The more unexpected finding was that the difference between the expenditure effects on households with and without mortgages is no greater in the U.K. than in the U.S. The authors conclude that the main effect of interest rate changes works through household income rather than the cash flow effect, affecting households with mortgages more because of the liquidity constraints they face.

The mortgage relief in Iceland lowered both interest expenditures of households as well as increasing their wealth net of mortgage debt. Our study is therefore also related to the literature on the effect of changes in housing wealth on consumption. In a life-cycle model, higher house prices increase the current wealth of households more than the present discounted value of future cost of living and can therefore be expected to increase consumption (Sinai and Souleles (2005). Nevertheless, the permanent-income hypothesis would suggest that the consumption response to an increase in house prices is equal to the annuity value of the wealth changes, which amounts to a rather small consumption response. The presence of liquidity constraints can explain a stronger consumption response since higher house prices allow households to borrow more. Higher house prices also reduce the need for precautionary saving. In the Iceland case, the increase in net worth is caused by a reduction in debt so the wealth effect should be even stronger since increased wealth does not reflect higher future housing costs. Moreover, reduced debt loosens borrowing constraints by raising borrowing capacity.

Aladangady (2017) use geographically-linked microdata that link households to regional housing supply elasticities to measure the causal effect of changes in house prices

on consumer spending. Using the interaction between long-term real interest rates and housing supply elasticities as an instrument for house price growth, they find that a $1 increase in home values leads to a $0.05 increase in spending for homeowners but to a negligible change for renters. The IV method is used to remove the effect of factors that drive up house prices and spending for both households with mortgages, those without a mortgage and renters.[6] An increase in home values leads to the largest responses among credit constrained households since higher house prices relax borrowing constraints by providing increased collateral. The authors interpret these results as showing the importance of collateral effects behind the consumption response to housing wealth.

Our study has the benefit of an experiment where the causal chain between the debt relief and consumption is clear, no other factors affecting both debt relief and consumption. The difficulty of disentangling cause and effect hampered many studies that preceded Aladangady (2017) such as Mian and Sufi (2011) who found that households extracted around 0.25 dollars per dollar of home equity growth in the mid 2000s and Campbell and Cocco (2007) who find large effect of house prices on consumption for both homeowners and renters, which can be interpreted as indicating that a common factor may drive both consumption and house prices. Attanasio et al. (2009) using U.K. data also found a relationship between rising house prices and the spending of both home owners and renters, which is consistent with the existence of a common factor. Carroll et al. (2011) found a strong relationship between housing wealth and consumption in aggregate data without being able to pin down the exact nature of the relationship with a substantially larger marginal propensity to consume from housing wealth than from financial wealth. See also Case et al. (2005).

There are papers that find evidence for a direct wealth effect on consumption. Gan (2010) study a large panel dataset on housing wealth and credit card spending in Hong Kong. This author finds a stronger consumption response to housing wealth on consumption for households with multiple houses, which appears to be due to a fall in precautionary saving. Households that refinance their mortgages have a stronger consumption response, indicating a relaxation of credit constraints. For those that do not refinance, increased consumption appears to be due to a fall in precautionary saving. Other papers confirm the effect of the ability to access home equity on consumption. Agarwal and Qian (2017) studied the effect of a policy experiment in Singapore that decreased access to home equity by extending the minimum occupation period for public housing. They found, using DID, that the decrease in access to home equity leads to lower consumption, in particular in credit card spending, which suggest that home equity serves a consumption smoothing role. Leth-Petersen (2010) also studied the access-to-credit channel using credit market reform in Denmark that enabled homeowners to use housing equity as a collateral for consumption loans. He found that the larger is the amount of equity released, the greater the consumption response. However, the effect is moderate, much weaker than in Agarwal et al. (2017).

There is substantial heterogeneity (over income, leverage and liquidity) in responses. For example, Mian et al. (2013) find that poorer and more leveraged households have a higher marginal propensity to consume (MPC) than others and Aladangady (2017) finds that the MPC is highest among credit constrained households. This is easily explained

[6] Guren et al. (2021) find that a smaller housing supply elasticity in the 2000s than in the 1980 and the 1990s, implying that larger house price movements in the 2000s were responsible for the boom and bust of the 2000s

by more leveraged households benefiting from a relaxation of their collateral constraints, which allows them to borrow more, and having higher effective discount rates making them more responsive.

Other related studies are those on the effect of mortgage refinancing possibilities on default rates. Tracy and Wright (2016) compare the performance of borrowers with adjustable-rate mortgages and those with fixed-rate mortgages who have similar observed credit characteristics. They use a competing risk model to estimate the effect of a fall in monthly mortgage payments on defaults amongst borrowers with adjustable rate mortgages to predict the effect of HARP on borrower's default risk. They find that refinancing under HARP would lead to a 3.8 percentage points decline in the five-year default rate for borrowers with a loan-to-value ratio above 80 percent. Ehrlich et al. (2015) also study the effect of HARP on default rates by taking advantage of the cutoff date of May 31 2009 for eligibility for the program using regression discontinuity design. The results indicate that reducing mortgage payments by 1 percent lowers default rates by 2.75 percent with larger effect for borrowers with negative equity and lower credit scores. Overall, this study predicts that HARP would prevent the defaults of more than 35,000 mortgage borrowers. Mian and Sufi (2011) find that home equity-based borrowing between 2002 to 2008 accounted for at least 39 percent of new defaults from 2006 to 2008. Moreover, the borrowing appears to be mainly used to finance consumption and home improvement and it is stronger for households with low credit scores and high credit card utilization rates.

Fuster and Willen (2017) study the predicament of households with negative equity and compare the efficacy of lowering their monthly interest payments, on the one hand, and reducing the principal of their mortgage, on the other hand, in reducing the probability of default. They find that cutting required mortgage payment in half reduces the probability of default by about two-thirds. The effect of lowering payments turns out to be much stronger than that of lowering the loan-to-value ratio. Thus cutting the mortgage payment in half has an equivalent effect on the probability of default as lowering the borrower's loan-to-value ratio from 145 to 95 holding the payment fixed. These results go against Foote et al. (2012) who argued that the foreclosure crisis following the GFC in the U.S. was not causes by mortgage payment increases of adjustable-rate loans.

4 Data, natural experiments and institutions

4.1 The mortgage relief

The debt relief in Iceland was justified as a correction for the jump in the principal of the CPI-indexed debt caused by the financial crash, the idea being that it could not have been anticipated by households. During and after the crash, the value of the Icelandic krona fell significantly, causing an inflationary spike, with inflation of around 12% in both 2008 and 2009.[7] Because mortgages with CPI indexed principals are common in Iceland, the inflation spike, which peaked at 19% in January 2009, caused household debt to increase.[8] Households also borrowed in foreign currency during those years both

[7]Between 2007 and 2009 the Icelandic Krona had devaluated by almost 50 percent relative to the US dollar.

[8]The rising household debt coupled with a stagnating housing market caused the average LTV ratio to jump from around 0.35 in 2007 to above 0.5 in 2010.

to finance auto purchases but also, although to a lesser extent, the buying property. Households had borrowed in foreign currencies in the years 2003-2007, while the currency was gradually appreciating and no one predicted its collapse.[9] With the exchange rate gradually appreciating over this period, the domestic currency value of these loans fell from year to year. Similarly, inflation had been moderate during the same years, so CPI-indexed debt was also considered safe. The jump in the principal of both forms of debt could therefore not have been anticipated by people without expertise in finance and economics, and even in that select group there were few who warned of the dangers.

A new government took power in the spring of 2013 and its main promise to voters was to further reduce the level of debt, in particular CPI-indexed debt because loans linked to exchange rates had been judged to be illegal by the country's supreme court in 2010 relieving households of the burden of FX debt. The debt reduction provides a natural experiment as it only applied to a subset of households and some households benefited more from it while others benefited less. The government implemented the ambitious mortgage relief in 2015 and the amount of debt relief was calculated to compensate households for the increase in the principal of their mortgage caused by inflation indexation after the financial crash. Therefore, eligibility for debt relief was restricted to households who had CPI-indexed mortgages in 2008 to 2009, granted for the purchase of existing housing or the construction of new residential housing for own use. At the time, approximately 73% of household debt was inflation indexed and another 16% was linked to foreign currencies. The parliament approved of the measures in May of 2014 and the tax authorities were asked to prepare facilities that would be used in the mortgage relief operation.

Individuals did not automatically have their debt reduced. In order to be eligible for the mortgage relief they had to submit an application to the tax authorities between May 18th and September 1st 2014 in which they listed their mortgage debt owed to one or more banks or pension funds. The amount of the relief was then calculated for each household and the results were announced to most applicants on November 11th, 2014. As of December 23rd, households were given three months to approve of the calculation. From the borrower's point of view, their debt burden was lowered from the time they approved of the measure. The Ministry of Finance and Economic Affairs estimates that 63,820 households were eligible for mortgage relief. Our data shows that 56,979 households benefited from the measure, giving an application rate of 89% among eligible households. Figure 2 below gives the timeline for major events.

From the timeline we can infer that although expectations of a debt relief were created in May 2013, it was not until the spring of 2014 that the legislation was passed, which actually provided much less relief than promised by the Progressive Party before the elections in 2013. Therefore, households had an idea about the coming debt relief from May 2014 until the the relief was granted to most households in early 2015.

Figure 3 shows the effect of the mortgage relief on the group that benefited from it and the remaining households that did not benefit. The latter consists of households that had paid up their mortgages by 2008 as well as those that bought their first property after year 2009.

[9]Before the crash, almost all car loans had been linked to foreign currencies and some mortgages. However, the overwhelming majority of mortgages were linked to the CPI since only 9% of households had FX linked debt.

Figure 2: Main events leading up to the mortgage reduction

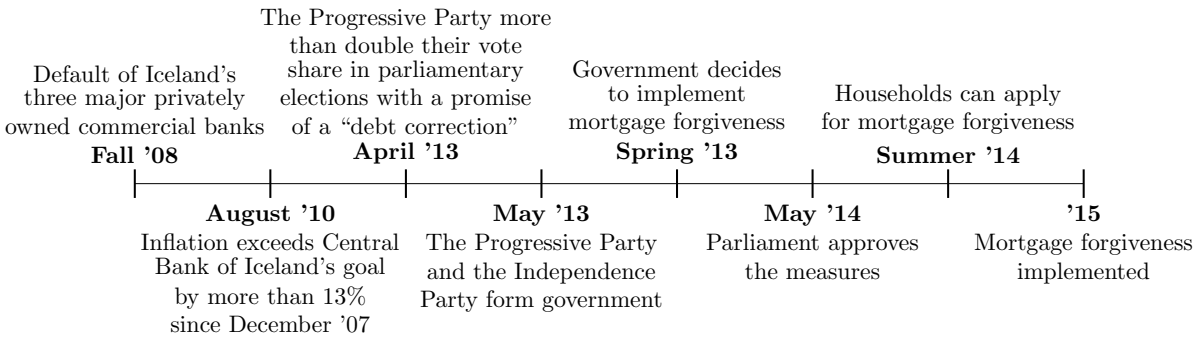
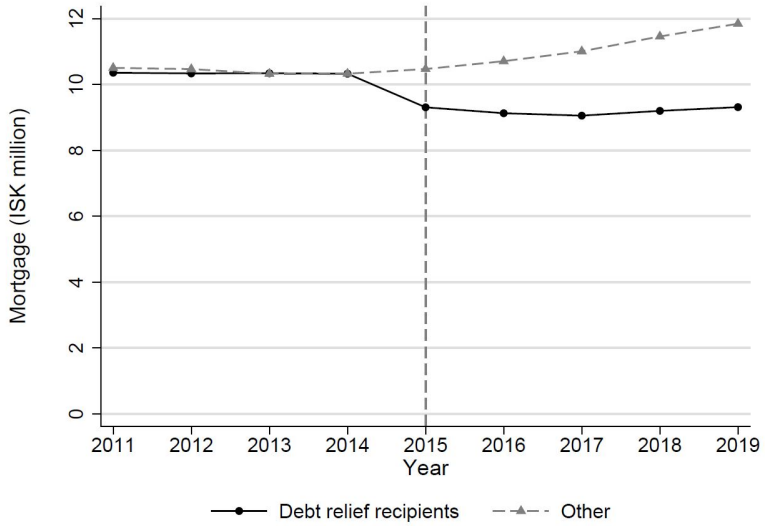


Figure 3: The effect of the mortgage relief: treatment and control groups compared



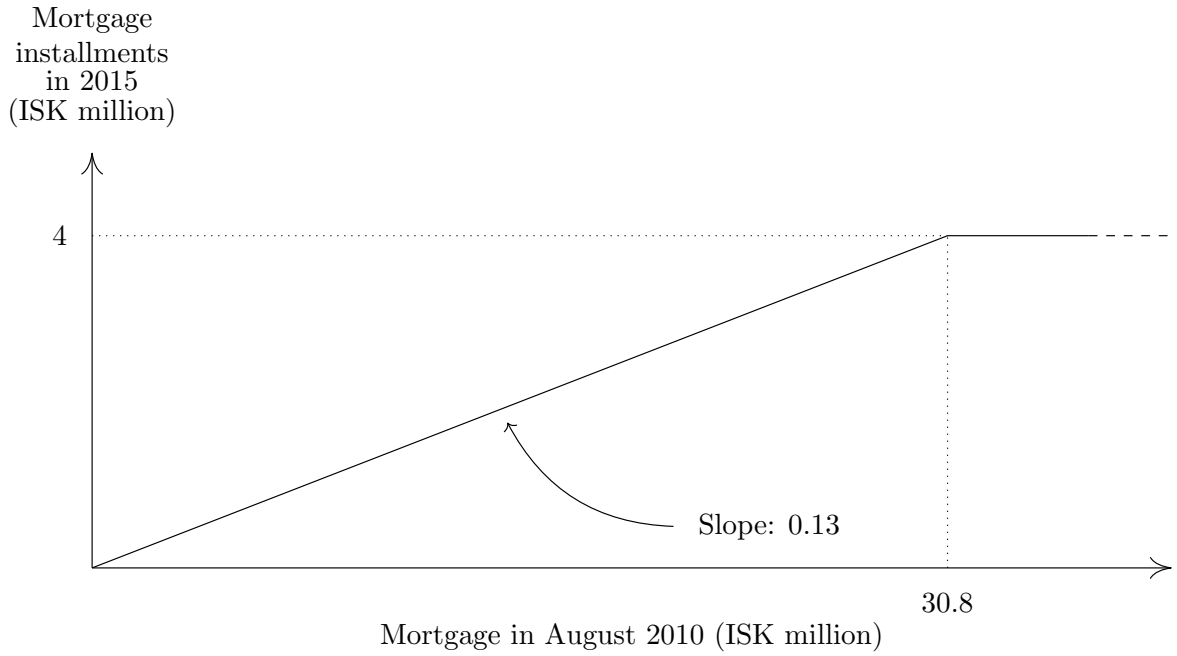
The average mortgage debt in the two groups is similar before 2015 but then falls in the treatment group in 2015 due to the debt cancellation. Notice that less than 10% of the debt is cancelled. We will study the evolution of debt in subsequent years but the Figure 3 above already suggests that the debt relief recipients did not respond to the debt relief by borrowing more, at least not enough to offset the debt relief.

The debt relief implemented in 2015 enables us to use difference-in-differences to study the effect of reduced debt on households' saving and consumption behaviour. We use administrative data that includes all taxpayers in Iceland. The data measure each household's level of debt, the value of housing, income (earnings, capital income and benefits) and taxes, enabling us to calculate the level of consumption and saving for each household. We combine the data on tax returns with data on how much each household received in the form of debt cancellation in 2015. The debt reduction therefore provides a natural experiment as it only applied to a subset of households and some households benefited more from it than others.

Households with an indexed mortgage registered in 2008 and/or 2009 were eligible for the debt relief. There was great uncertainty in 2013 about the terms of the mortgage relief. As it turned out, indexed housing mortgages were written down by an amount equivalent to their increase due to inflation exceeding 5.8% in 2008 and 2009. This is equivalent to a 12% adjustment to the consumer price index (CPI) used for indexation

of the mortgage in August '10. There was a maximum amount of ISK 4 million per household (≈ € 27 thousand ≈ avg. disposable income) but this maximum only applied to 10% of households. Previous debt relief, implemented by the left-wing government from 2009-2013, was deducted from the amount of debt cancelled. Figure 4 shows the level of debt relief as a function of the principal of CPI-indexed debt in August 2010. There is a linear relationship between the two up to 4 million ISK, which is the cap on the relief. The government-funded debt relief was financed by the levying of a tax on the estate of the failed banks, as explained above, in effect by taxing the foreign creditors.

Figure 4: Mortgage prior reduction and the debt relief



Note: The figure shows the debt relief in 2015 that households were eligible to based on their mortgage in August 2010.

As an additional measure, households with mortgages could use their Pillar 3 pension savings to lower their mortgages further without paying any income tax (maximum ISK 500,000 per household each year or €3,400). The total scope of these actions was estimated at around ISK 150 billion (€1 billion) spread over a four-year period. Of this, the government funded debt relief was estimated to be ISK 80 billion (€544 million) and the use of Pillar 3 savings was ISK 70 billion (€475 million).

The mortgage relief reduced households' indebtedness by directly paying down their debt. The relief was first paid into mortgages which had lost their collateral following a forced sale. An example of this would be a lender that initiates foreclosure proceedings, leading to a forced sale of a property. The lender is only able to recover a part the outstanding loan balance, and, therefore, what is left of the loan is unsecured. Second, after the financial crisis a legal amendment allowed households to reduce their debt service burden by deferring a part of their mortgage payment. The difference between the contractual payment and the actual payment was put into a deferral account. The mortgage relief was next paid into arrears and those deferral accounts. The remaining mortgage relief, if it was above 200,000 ISK (€1,360 at 2015 exchange rates), was paid

Table 1: Mortgage relief by years

	2014	2015	2016	2017
Relief amount (m. ISK)	3,410	67,713	270	1
Share of total amount	4.8%	94.8%	0.4%	0.0%

into mortgages. In cases where no mortgages existed anymore, e.g. households no longer owned a home or all mortgages were fully paid up, the relief was allocated into debt secured by collateral in the property of another individual. Finally, if no such loans existed, the remainder was paid to households through a special personal tax credit in equal installments in 2015 to 2018.

The sum total of the mortgage relief amounted to 79.4 billion ISK according to our data (€540 million). The data include four variables for the mortgage relief, in addition to an ID variable for personal identification. They are the following:

- Loan installments: 71.4 billion ISK (89.9%)
- Special personal tax credit: 5.9 billion ISK (7.4%)
- Borrowed collateral: 1.0 billion ISK (1.3%)
- Mortgages without collateral: 1.1 billion ISK (1.4%)

Below, we focus solely on loan installments, which account for almost 90% of the total relief. Table 1 shows that the lion's share of the mortgage relief was implemented in 2015 and 5% of the total amount was paid out in the last week of 2014. A small minority saw their mortgage debt decline in 2016 and 2017.

4.2 The data

We use a database comprising the administrative tax records of all Icelandic taxpayers from 2006 to 2019 of individuals aged 30 to 70 year old. As such, the sample period covers a period of vast macroeconomic fluctuations and uncertainty. It includes rapid growth rates leading up to the GFC and the collapse of Iceland's banking system followed by the post-crisis recovery. The data includes comprehensive third-party reported information on multiple sources of income and various assets and liabilities, including bank deposits, the value of real estate, some financial assets, mortgage debt and other liabilities. Moreover, the data is merged with other administrative data and, thus, includes socio-economic information such as education, occupation and information on loan repayments and interest payments.[10]

We use the tax records to construct measures of each household's saving and consumption. First, we construct household measures of income, assets, and liabilities by aggregating information across household members using unique household identifiers. As such, we abstract away from intra-household inequality. Couples with joint finances are, thus, assumed to make financial decisions based on their total income and wealth, rather than independently based on each of their financial situations.

[10]The data are collected by Statistics Iceland and Iceland Revenue and Customs.

We compute consumption for each household using the accounting identity that a household's consumption equals its disposable income minus changes in net wealth plus unrealized capital gains (Browning and Leth-Petersen (2003); Eika et al. (2020); Fagereng and Halvorsen (2017))

$$C_{it} = Y_{it} - \Delta W_{it} + \sum_{k} \Delta p_{kt} A_{ikt-1} \tag{1}$$

where Y_{it} is disposable income for individual i at time t, ΔW_{it} is the change in net wealth from the previous year and $\Delta p_{kt} A_{ikt-1}$ is unrealized capital gains on asset A_k.

Having derived consumption, saving is the part of disposable income which is not consumed.

$$S_{it} \equiv Y_{it} - C_{it} \tag{2}$$

where S_{it} denotes individual's i saving at time t.

By definition, income is either saved, thus leading to increasing net wealth, or consumed. However, net wealth is also affected by unrealized capital gains/losses. To derive consumption from equation (2) it is, therefore, necessary to distinguish between changes in net wealth due to unrealized capital gains, which do not change current consumption but do influence net wealth, and changes in net wealth due to a household saving some of its income, which in turn reduces current consumption.

As a further illustration, consider a household whose only asset is the house in which they live. The household earns an income that is either used for consumption or to pay down its zero-interest-rate mortgage. In the absence of price changes, the household's consumption is accurately identified as the share of its income not devoted to paying down the mortgage. However, if the price of their home rises, then the wealth of the household is not only influenced by its income and consumption decisions but also by the unrealized capital gain in their real estate asset. Unless accounted for, the increase in net wealth due to rising home prices would lead to an overestimation of the households' savings.

The Icelandic tax registries include information on the estimated market value of each household's real estate, which allows us to precisely measure consumption in the above example. The example above points to two key challenges in measuring consumption and saving using accounting identities (1) and (2). First, the method requires accurate information on all sources of households' income and their level of assets and liabilities. Second, to account for the effect of a households' asset portfolio on its consumption we either need information on the price and quantity of each asset on its balance sheet or information on asset transactions for all its assets. Such data are scarce, but third-party reported information from tax registries that cover labor income, capital income, various government transfers, and tax payments plus value of housing and the principal of the mortgage debt are tough to beat.

We now turn to outline in detail the information on income, unrealized capital gains, assets, and liabilities available in the Icelandic tax registries.

4.2.1 Income

Our measure of household income is a comprehensive one. It includes labor income, capital income, income from pension funds, government transfers and other income, such

as lottery winnings. Naturally, the tax registries do not include information on undeclared income. However, the consumption measure includes consumption in the informal sector as long as the income used for financing such consumption is declared. Unfortunately, we do not have information on inheritances.

Another source of income not reported in the tax registries stems from homeowners' income from owner-occupied housing services. If a household buys an apartment it had previously occupied as renters, its consumption expenditures would drop by the amount of the rent they used to pay while its consumption of housing services would remain unchanged. By adding imputed rent for owner-occupied housing services to income, we obtain measures of income and consumption which are comparable across renters and homeowners.[11]

Finally, we add this measure of imputed rent to a measure of disposable income defined and computed by Statistics Iceland as all labor income, capital income, and other income, consisting of government transfers, pension income, grants and lottery winnings net of total direct tax payments.[12]

4.2.2 Net wealth

The tax records include information on each household's assets and liabilities. The data on assets include ownership of real estate and vehicles, money in savings accounts, and stocks and bonds in equity funds, bond funds or mixed funds. A key feature of Icelandic tax records is that direct ownership of stocks is not registered at market values. As a result, the level of households' assets is not affected by changes in the market value of stocks, unless the ownership of stocks is indirect through funds, in which case it is registered at market values. Although in general a drawback, the fact that capital gains/losses in stocks are not observed in cases of direct ownership actually facilitates an accurate identification of a household's consumption and saving in years in which it does not engage in stock transaction. On the other hand, it can raise issues in years in which they do engage in such transactions. This is discussed further in the following section.

4.2.3 Unrealized capital gains/losses

To derive consumption from equation (1), it is necessary to distinguish between changes in net wealth due to unrealized capital gains, which do not change current consumption but do influence net wealth, and changes in net wealth due to households saving some of their income, which reduces current consumption. This is a key challenge in determining households' consumption and saving using tax records, as they typically contain information on the value of assets at the end of the year, but they generally do not contain information on unrealized capital gains or the purchases and sale of assets.

A key difference between the Icelandic administrative data and, for example, that of other Nordic countries stems from the fact that stocks in direct ownership, as opposed to indirect ownership through funds, are not registered at market values. Having no information on the market value of ownership of shares creates complications as mere

[11] Statistics Iceland estimates the value of owner occupied housing services using a simple user cost method. To compute imputed rent at the household level, we distribute the aggregate value of owner occupied housing services across households according to each household's share of the total value of real estate.

[12] Specifically, imputed rent is added to capital income

changes in households' portfolio allocation, the buying/selling of shares, can lead to changes in measured net wealth, when no such changes really occur. On the other hand, the measure of net wealth is not influenced by unrealized capital gains/losses in stocks that need to be accounted for. So as long as households do not engage in transactions in individual stocks, we do not need to rely on any assumptions in this regard to accurately measure their consumption and saving.

Such assumptions are, however, needed for ownership of financial assets through funds, such as equity funds, which are registered at their end-of-year market values. In this regard, we follow Eika et al. (2020) in measuring unrealized capital gains/losses by assuming no within-year transactions and, thus, allowing for heterogeneous returns. However, we assume unrealized capital gains in such financial assets are zero for those who have such assets in a given year but did not in the previous year. In such cases, a within-year transaction clearly took place and likely drives the change in the value of such assets from one year to the next.

4.2.4 Real estate prices

Arguably, the largest unrealized capital gains/losses of most households stem from price changes in their real estate assets. The data set includes information on the market value of real estate for each household as estimated by Register Iceland (RI), a public institution responsible for maintaining a property register and national register in Iceland. RI estimates the market value of all real estate properties in Iceland each year and its valuations form the basis for property charges and inheritance taxes. Hence, the yearly change in RI's property valuation is a natural measure of capital gains/losses in real estate.

While the above measure of price changes in real estate is accurate for the vast majority of households, challenges arise in cases of households that engage in real estate transactions in a given year. Such transactions do not imply a change in a household's net wealth but merely a rebalancing of its asset portfolio. We do not have information on transactions in real estate and, thus, need to make assumptions. In particular, we assume no within-year transactions for the vast majority of households. However, we assume transactions took place if the change in real estate assets is either at the top 5% or the bottom 5% of the distribution of changes in the value of real estate in a given year. In such cases, we assume the transaction occurred in the middle of the year and that the price of the new real estate asset followed Statistics Iceland's property price index.

4.2.5 Loan indexation

A large share of household debt in Iceland is CPI-indexed, meaning that the loans' principal is tied to the CPI index. This is relevant for measuring consumption and saving as the indexation is a form of unrealized capital loss and, therefore, would lead to an overestimation of households' consumption if not accounted for. We compute the indexation by summing a household's repayment of a loan and the change in the loan's principal. For non-indexed loans, re-payments would explain all changes the loan's principal but for indexed loans repayments are typically lower

4.2.6 The mortgage relief

The mortgage relief itself constitutes an unrealized capital gain for household that benefited from it as it raised their net wealth without showing up in their disposable income. As such, it needs to be accounted for in identifying households' consumption and saving. We have data from the tax auhorities on the relief received by each household, which we merge with the data on tax returns.

4.2.7 Durable consumption

Durable goods generate expenditures solely at the moment of purchase while generating a flow of consumption services until they are replaced or scrapped. While the tax registries do not include detailed data on durable consumption, they include the value of vehicles for each household, which is arguably the largest source of durable consumption for the average household after housing services which we have already accounted for. According to Icelandic tax laws, vehicles are depreciated by 10% per year. We assume that the consumption flow from vehicles equals their depreciation value.

4.2.8 Consumption and saving

Finally, we measure consumption in the Icelandic administrative tax registries using equation (1), which, considering the discussion above, takes the following form:

$$C_{it} \equiv Y_{it} - \Delta W_{it} + \Delta HP_{it} - Index_{it} + DC_{it} + MR_{it} \tag{3}$$

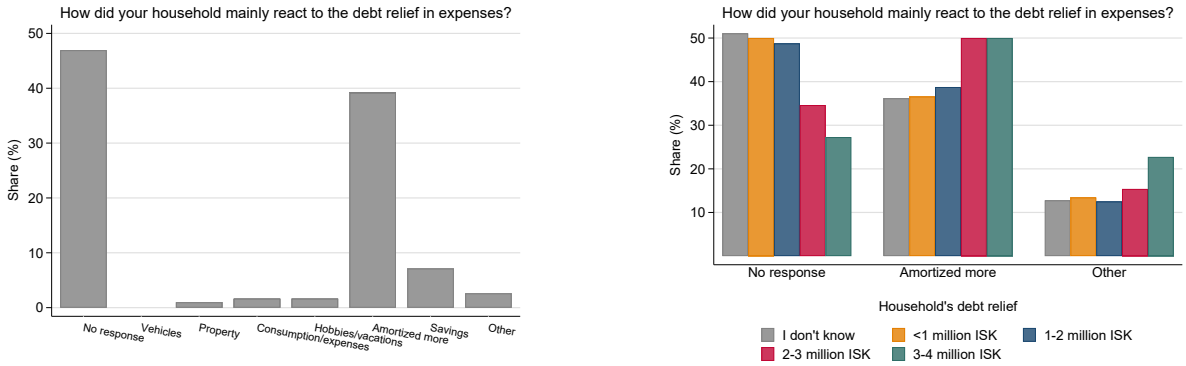
ΔHP_{it} denotes the change in real estate prices for household i in year t, $Index_{it}$ denotes the effect of loan indexation, DC_{it} is durable consumption in vehicles, and MR_{it} captures unrealized capital gains from the mortgage relief. As before, saving is computed as the share of disposable income not consumed.

5 Survey

We start by using a survey to assess the effect of the mortgage relief on the propensity to save, in particular to amortize debt.[13] The survey included 946 individuals. In 2015, 35.4 percent worked in the private sector, 23.7 percent in the public sector, 13.3 percent were not employed, 13.8 percent were self-employed and 13.7 percent worked for non-governmental organizations or did not specify their sector. We confine our sample to the age group 25 to 65.

Figure 6 shows the results. Figure 6a show how individuals responded to the mortgage relief in terms of expenditures and saving, including amortization of debt, while Figure 6b shows the proportion who decided to amortize more as a function of the level of the debt relief in millions of ISK.

[13]The survey was conducted by Maskina for the purpose of this study between 27 September and October 2021.



(a) Response to debt relief (ISK million)

(b) Amortization as a share of debt relief

Responses in the left-hand figure: 1) Did not respond, 2) Bought a vehicle or a more expensive vehicle than I had otherwise done, 3) Bought a vehicle or a more expensive vehicle than I had otherwise done, 4) Increased consumption and/or other expenses, 5) Spent a higher amount on hobbies and/or vacations, 6) Amortized mortgages, beyond the debt forgiveness, 7) Increased savings, 8) Other

Figure 5: Amortizations

The pattern in Figure 6a is very clear, almost 40% of respondents decided to amortize more in response to the debt relief while more than 7% decided to save more. Very few increased their consumption. In Figure 6b the pattern is also clear in that the individuals who got the most debt relief decided to amortize more of their debt. For those receiving 2-4 million ISK, 50% decided to amortize more.

We next turn to the empirical analysis using tax data.

6 Empirical analysis

We exploit exogenous variation in household debt stemming from the implementation of the mortgage debt forgiveness program to study how the level of household debt affects household spending. We use a balanced panel with individuals aged 30 to 70 years old over the years 2010-2019. We focus on households who got their mortgage paid down, excluding those who benefited from the mortgage relief through a special personal tax credit and those who had their unsecured debt reduced following foreclosure and a forced sale of their property. We also exclude those who had the mortgage relief paid into debt secured by collateral in the property of another individual.

Table 2 shows the sample averages for the full sample, the treatment group, which did receive mortgage relief, and the control group, which did not receive any mortgage relief.

Consider first the property owners in the control group. Here, the control and the treatment groups are similar in terms of age, the gender ratios and the number of children but differ in the proportion married, the mortgage and net wealth. Thus the treatment group has a higher share of married (cohabiting) couples, has a higher mortgage and lower net wealth. There are smaller differences in disposable income and the value of the property, the treatment group having slightly higher income and more valuable property.

Now consider the full control group. The treatment group is slightly older, a much higher proportion is married, there are more children, proportionately more women, and,

Table 2: Summary statistics

	Full	Sample			
		Treatment & control	Control		Treatment
			Full	Property owners	
Mortgage relief *	.27	.43	0	0	.9
Age	45.2	48	46.7	49.4	49.4
Married (%)	49.4	65.5	52.2	71.5	80.1
# Children	.5	.8	.7	.8	.9
Female (%)	50	50	47.6	50.5	52.5
Disposable income *	3.5	4.37	3.95	4.76	4.84
Property *	12	16.01	11.59	20.43	20.89
Mortgage *	4.68	7.23	4.33	7.64	10.42
Net Wealth *	19.76	24.85	21.13	36.73	28.96
Individuals	271,804	147,272	77,184	43,802	70,088

* ISK million

most importantly, it has much higher disposable income, the value of property is almost twice that of the control group, the mortgage more than twice as high and net wealth also much higher.

Because the households who benefited from the mortgage relief had higher disposable income, more valuable property and higher net wealth than those who did not we can conclude that the debt relief was regressive in nature. It benefited primarily higher income and higher net-worth individuals who had larger balance sheets, both more wealth and higher mortgage debt, but also higher disposable income and net worth.

6.1 Main results

We estimate the effect of the mortgage relief with the difference-in-differences estimator. Individuals differ in whether they received mortgage relief or not. Those who did not have any CPI indexed debt before the financial crisis did not receive any relief and serve as a control group while those who did receive relief are the treatment group.

The outcome variables (y) include the level of amortization of debt and consumption measured from tax returns and saving. The Wald-DiD estimator gives an estimate of the marginal propensities (MP) for the different outcome variables. For each krona in mortgage debt forgiveness (DF), $MP(y)$ kronas are spent on y.

The Wald-DiD estimator for individual i, household j, follows. The first equation shows the outcome variable with a fixed individual effect, a time effect for the years after the mortgage relief, 2015, a vector of individual characteristics X – age, gender, marital status and education – and our variable of interest $MP(y)$ – which is the number of units of local currency spent on the outcome variable for each unit of local currency in mortgage relief.

$$y_{ijt} = \alpha_j + \alpha \cdot \mathbf{1}(t \geq 2015) + MP(y) \cdot DF_j + \boldsymbol{X}_{it}\boldsymbol{\beta} + \varepsilon_{it}$$

The second has the mortgage debt relief (DF) instrumented with the number 1 for those individuals who received such relief DF_j>0.

$$DF_{jt} \text{ instrumented with } \mathbf{1}(t \geq 2015) \times \mathbf{1}(DF_j > 0)$$

The third defines the effect of the mortgage relief on the outcome variable $MP(y)$:

$$\widehat{MP}(y) = \frac{DID\ y}{DID\ DF}$$

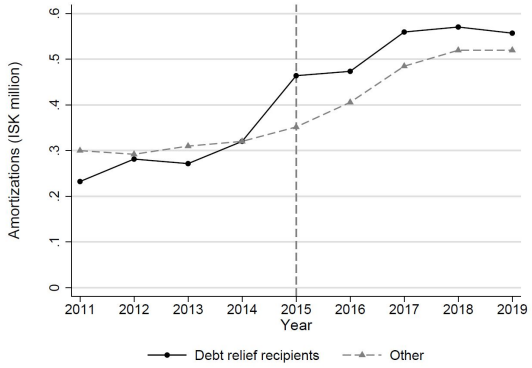
Our results can be summarised as follows. We find that while the level difference in disposable income is unchanged in the years around the debt forgiveness, mortgage debt fell in excess of the forgiveness in response to the debt forgiveness (DF) because households responded to the forgiveness by amortizing more.

In particular, we find that for each krona in debt forgiveness:

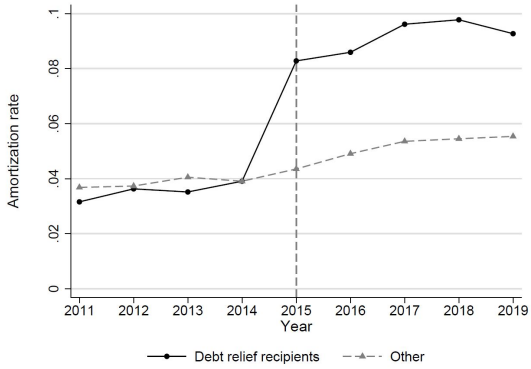
- Costs related to the mortgage *fell* by 0.06 kronas.
- Consumption *fell* by 0.13 kronas.
- Amortizations *increased* by 0.12.

Figure 6 below shows the time paths for amortization both in local currency and as a ratio to mortgage debt for both the treatment and the control group - top two panels - and the difference-in-difference estimates in terms of both local currency and the fraction of the outstanding mortgage. Figure 6a shows that the treatment group on average reduced their mortgages by close to 0.5 million ISK while the control group lowered their mortgage by on average 0.35 million. Figure 6b shows that the debt of the treatment group fell by more than 8% in 2015 while it fell by just over 4% for the control group. The difference-in-differences estimates in the lower two panels paint a similar story. Figure 6c shows that there is a statistically different change in the level of mortgage debt for the treatment group when compared to the control group, the difference is more than 0.1 million ISK while Figure 6d shows a difference in the proportional reduction of debt by 4% of the level of debt. The figure shows that the treatment group continues to amortize its debt after receiving the initial debt reduction. In contrast to what we might have expected, the treatment group does not respond by spending and borrowing more. Quite the opposite, the debt relief appears to have spurred it to lower its debt further.

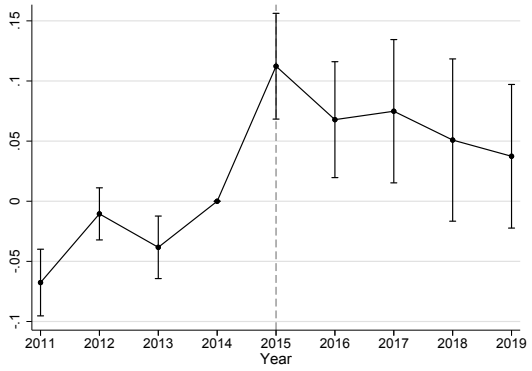
In Figure 7, we show the differences in the level of consumption between the two groups. The consumption measure is the group average residualized on a number of control variables. Figure 7a shows the path of total consumption in local currency of the two groups and this is very similar. There is no visible difference between the two groups except a drop in 2015 for the treatment group, which suggests that it lowered its debt in excess of the debt relief. Figure 7c shows the difference-in-differences estimates, which show that the difference between total consumption for the two groups is statistically insignificant. The right-hand side panel shows the changes in the average stock of vehicles in local currency (Figure 7b) and the difference-in-differences estimates (Figure 7d). Here



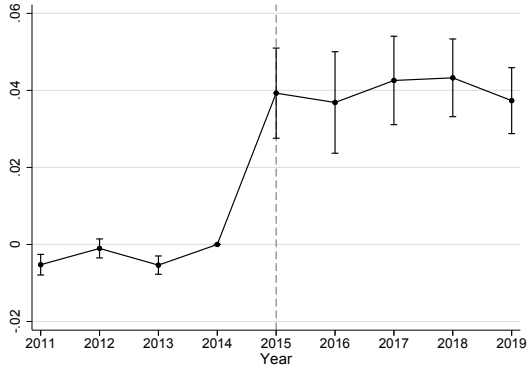
(a) Amortizations (ISK million)



(b) Amortization rate (out of debt)



(c) Amortizations (ISK million) DiD



(d) Amortization rate (out of debt) DiD

Notes: (a) and (b) are the group averages residualized on a number of control variables.

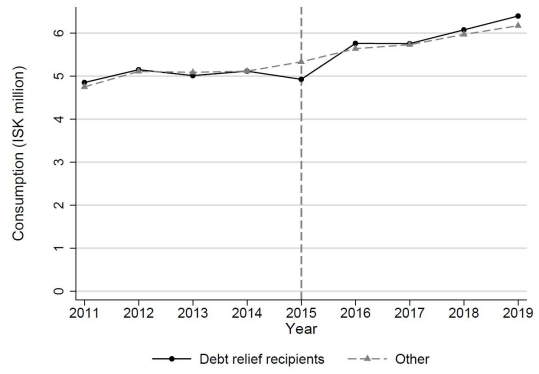
Figure 6: Amortizations

there is a noticeable difference in that the treatment group increases its purchases of vehicles compared to the control group. The lower panel shows that the difference between the groups is statistically significant so that the ownership of vehicles of the treatment group increases significantly more than the ownership of the control group.

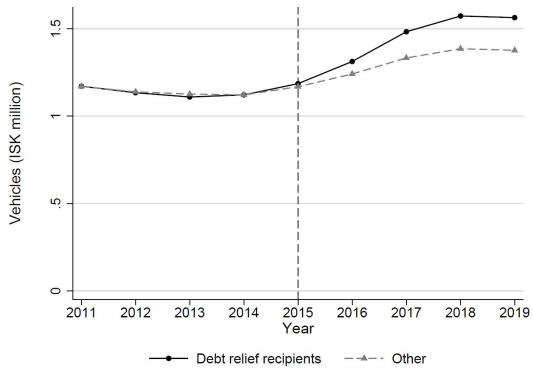
We have found that total consumption did not increase on average for those benefiting from the mortgage relief in comparison to the control group and fell in 2015. However, their purchases of vehicles increased compared to the control group, although by a small amount. The magnitude of the increased spending on cars is modest. In 2015 the price of medium-sized cars was just above 3 million ISK (just under 23 thousand dollars at the 1 July dollar exchange rate) while the ownership of cars in the treatment group increased by less than 200 thousand ISK (1,503 dollars euros) in the years 2015-2019, that is 15 percent of the value of an average car.

6.2 Interest expenses

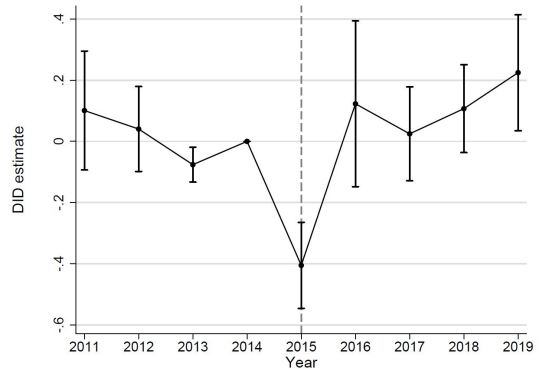
We need to dissect what is happening here. The story is that households responded by amortizing even more than what they got in debt forgiveness. The only direct effect the mortgage forgiveness had on households' disposable income is through lower interest expenses of mortgages. The question is whether households simply responded by taking



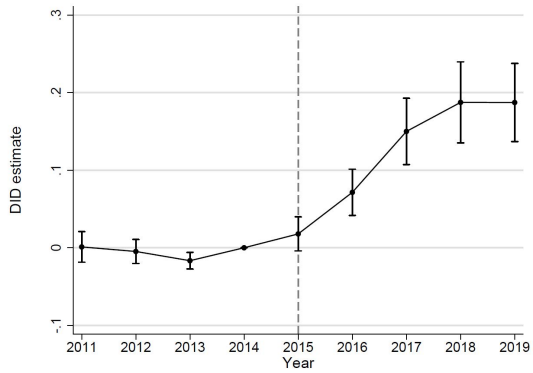
(a) Total consumption



(b) Durable consumption (vehicles)



(c) Total consumption DiD



(d) Durable consumption (vehicles) DiD

Notes: (a) and (b) are the group averages residualized on a number of control variables.

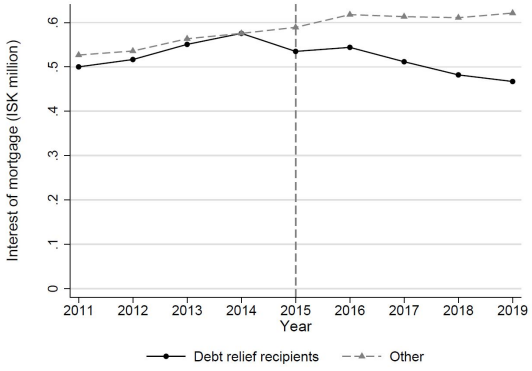
Figure 7: Consumption

the amount they saved in interest expenses and used it to amortize or whether they reduced their consumption to finance further amortizations.

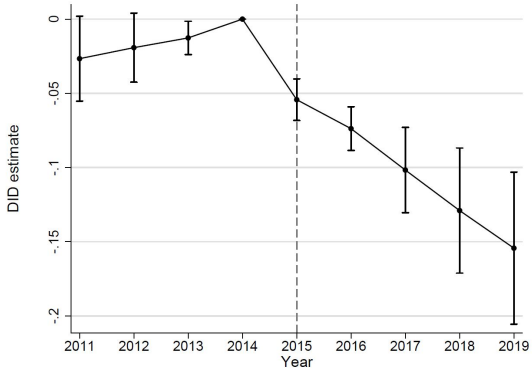
Figures 7a and 7c suggest that in 2015, the year the debt forgiveness was implemented, households decreased their consumption to finance amortizations. This is consistent with Figure 6a, which suggests that the amortizations response was especially strong in 2015. However, in the years that followed, it is possible the consumption went up in the treatment group (although the difference is only 20 thousand ISK in 2019, which is 141 euros at 2019 exchang rates). This is also consistent with Figures 8a and 8b, which show that interest expenses in the years after 2015 fell in excess of what could be expected from debt relief (-150 thousand ISK compared to 50 thousand ISK in 2019).

6.3 Heterogeneity analysis

We next explore heterogeneity in the response to the debt relief. Figure 9 shows heterogeneity for amortization. We find that the relative change in amortizations is linearly increasing in debt forgiveness. That is, irrespective of the amount received in debt forgiveness, roughly the same share of that amount (0.12) is spent on increased amortization. The response to the debt relief in terms of amortization is also increasing in the 2014 loan-to-value ratio using the DID estimate. There is also a positive relationship to dis-



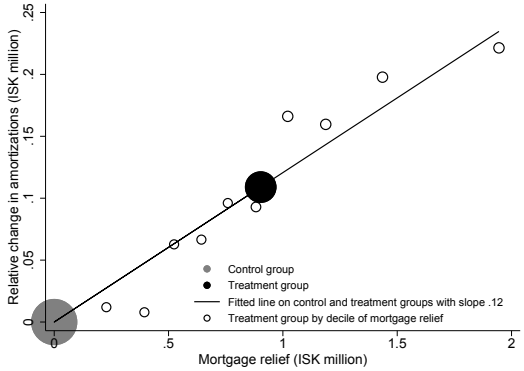
(a) Residualized group averages



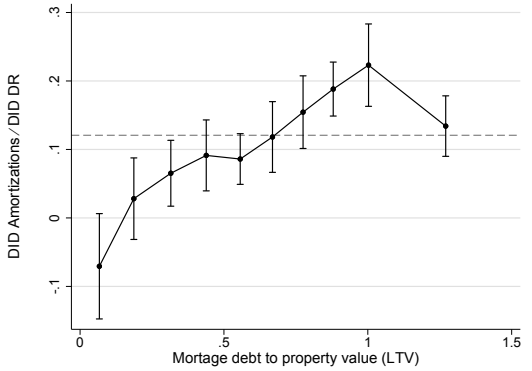
(b) DID

Figure 8: Interest expenses

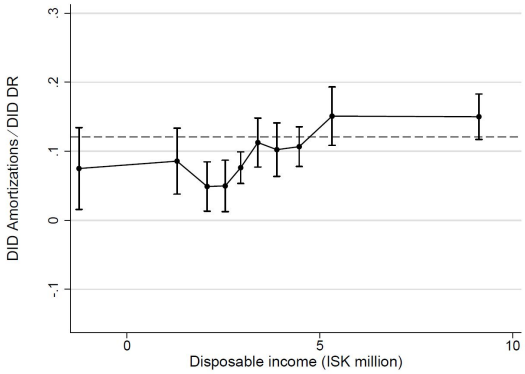
posable income, so that higher income households amortized their debt more. Finally, there is a weak negative relationship between liquidity measured by bank deposits and amortization. Thus, we have found that the amortization and consumption MP is driven by highly leveraged, high income and liquidity constrained households.



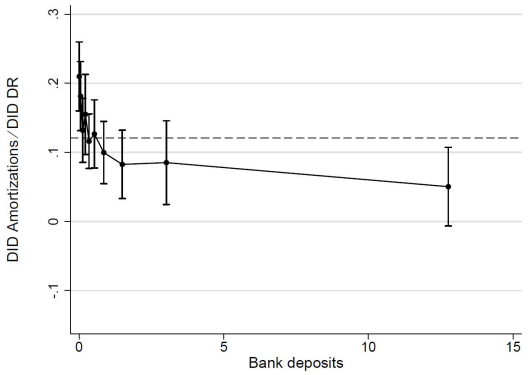
(a) By debt forgiveness



(b) By 2014 loan to value (LTV) ration



(c) By 2014 income

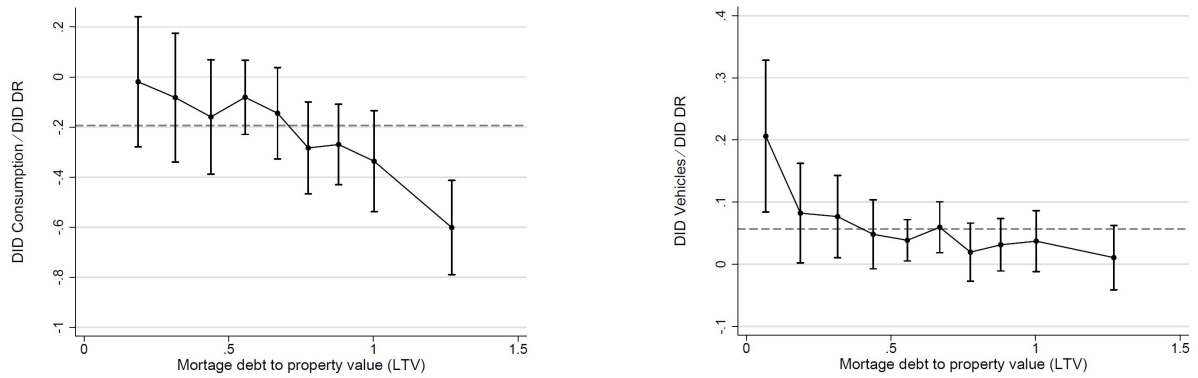


(d) By 2014 liquidity (bank deposits)

Figure 9: Amortizations heterogeneity

Figure 10 shows the heterogeneity for consumption. The DID estimates show that the difference between the fall of consumption in the treatment group and the control group

is increasing in the ratio of mortgage debt to property value. Thus the more indebted households lowered their consumption more in response to the debt relief. Figure 10b shows that it is the less indebted households who increased their purchases of cars more than the more indebted ones. This stands in contrast to the findings of the studies on the effect of the HARP reforms surveyed above.



(a) Total consumption

(b) Durable consumption (vehicles)

Figure 10: Consumption heterogeneity by 2014 loan to value (LTV) ratio

6.4 Other assets

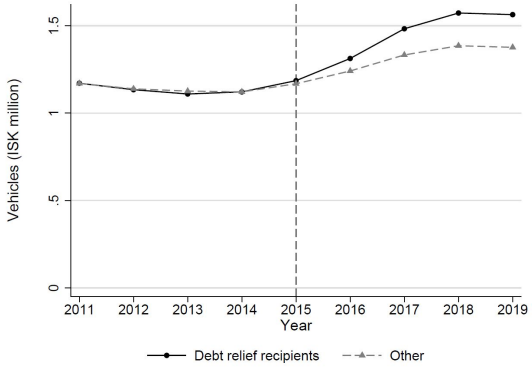
The literature surveyed above on the effects of debt relief in the U.S. found that households tended to increase their auto loans while reducing their credit card debt, for example Agarwal et al. (2023), Abel and Fuster (2021) and Di Maggio et al. (2017). Figure 11 tells a similar story as Figure 10b. It shows the evolution of the value of vehicle ownership, other debt than mortgages and net wealth excluding property and mortgages. These findings suggest that the main effect of the debt relief on spending is to make households borrow to buy a car, raising both the value of ownership of cars and debt other than mortgage debt.

There is a greater increase in the ownership of vehicles in the treatment group as in Figure 7d above. Also, the level of other debt does not fall by as much in the treatment group as in the control group. Finally, there is no visible difference in the evolution of net wealth excluding property and mortgages between the two groups.

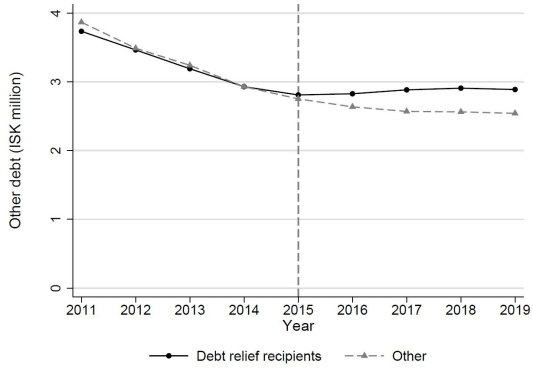
6.5 Robustness

As described in an earlier section, households with mortgages could use their 3rd pillar pension savings to lower their mortgages further, that is on top of the relief given by the government in 2015, without paying any income tax (maximum ISK 500,000 per household each year or €3,400). Although the direct debt relief was more significant, the use of pillar 3 pensions amounted to 45% of the total. However, note that this is savings used to lower mortgages, the government's contribution being not to tax the withdrawals.

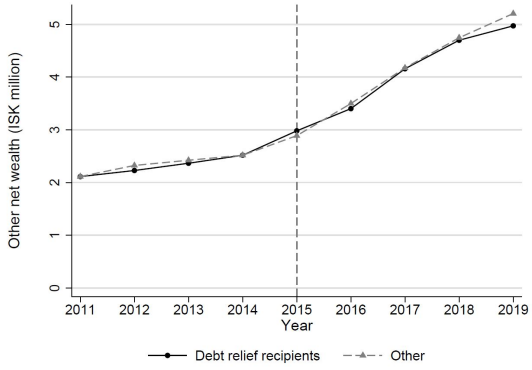
In Appendix A, we plot the withdrawals from the 3rd pillar pensions savings funds between 2011 and 2019 for both the treatment and the control groups and do a difference-in-differences estimate with 2014 being the base year. The results show that the increase



(a) Other assets (vehicles)



(b) Debt, other than mortgages



(c) Net wealth excluding property and mortgages

Notes: These are the group averages residualized on a number of control variables.

Figure 11: Ownership of cars and non-mortgage debt

in amortizations by the treatment group following the debt relief is not funded by pension wealth withdrawals.

Finally, we changed the definition of the control group to include the subset of households in the original control group that owned a property in 2008 or 2009. A similar pattern emerges as in Figure 6, indicating after the debt forgiveness there is a noticeable increase in amortizations in the treatment group.

7 Conclusions

We have studied the effect of the mortgage debt relief in Iceland in 2015 following the country's financial crisis in 2008-2010 using administrative data that includes all taxpayers in Iceland. We differ from earlier studies of mortgage relief in using administrative data that includes the tax returns of all tax payers enabling us to calculate their consumption and savings. The experiment itself is unique in two ways. First, the debt relief was financed by taxing foreign creditors so that the cost did not fall on domestic taxpayers. Second, the debt relief occurred seven years after the financial crash of 2008 when the debt-to-income ratios had recovered.

The debt relief was intended to compensate households for the rise in the principal of CPI-indexed mortgages caused by the collapse of the currency and the ensuing price inflation. Eligibility for the debt relief was therefore restricted to households which had CPI-indexed mortgage loans in 2008 to 2009. Because some households did not have CPI-indexed mortgage debt at the time of the financial crash and those who did varied in the level of the debt, the mortgage relief benefited some housholds and not others and it benefited some more than others, providing us with a natural experiment.

Perhaps surprisingly, we found that households responded to the debt relief by amortizing even more when they received the debt forgiveness instead of reducing their saving due to a positive wealth effect and lower monthly interest payments. The degree of amortization turns out to be positively related to the level of the debt relief, the more households received in relief, the more they amortized their debt. The amortization is also positively related to the loan-to-value ratio and to disposable income. It is declining in liquidity. Thus, high-income, leveraged households that benefited more from the mortgage relief increased their amortization of debt more than other households. The only direct effect the mortgage forgiveness had on households' disposable income was through lower interest expenses on mortgages. As it turned out, households did more than use their interest savings to lower their mortgages further, they actually reduced their consumption, increased saving, to increase the amortization of debt.

While total consumption did not increase on average for those benefiting from the mortgage relief when compared to the control group and fell in 2015, their purchases of vehicles increased by more consistent with studies of the effect of debt relief following the GFC in the U.S., although only by a small amount. This increase is mainly due to increased purchases of cars by households with little mortgage debt and are financed primarily by borrowing.

We conclude that mortgage relief can induce households to increase their savings in order to lower their mortgages further instead of having a positive wealth effect on consumption. It appears that having seen the principal of their debt fall, the recipients of the mortgage relief in Iceland discovered the utility of having lower debt. This result stands in contrast to results on the HARP relief in the U.S., which suggest that households respond to lower interest payments by increasing their consumption expenditures. This could be explained by the mortgage relief in Iceland taking place in Iceland seven years after the banking crisis and five years after the end of the financial crisis when the need for such relief did no longer exist while in the U.S. households benefited from HARP in the the immediate aftermath of the 2008 crash.

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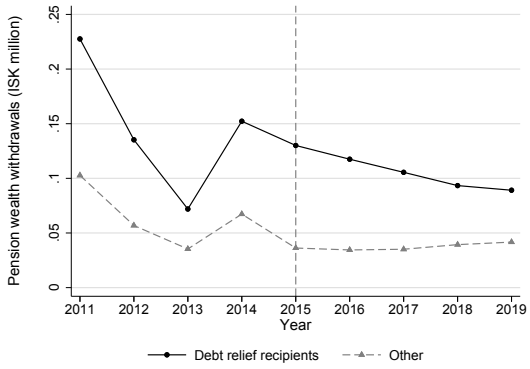
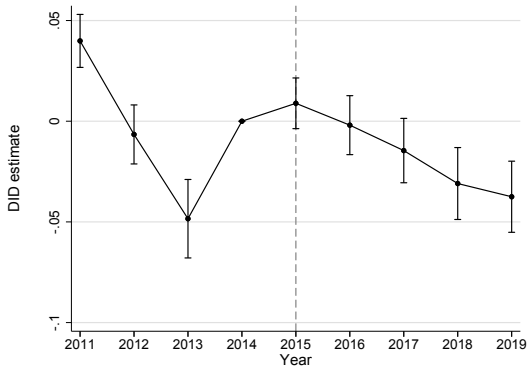
A Pension wealth withdrawals

Panel a in Figure 12 illustrates the withdrawals of pension wealth from third pillar pension savings funds between 2011 and 2019 in both the control and treatment groups. Such withdrawals were allowed for individuals younger than 60 years of age after the financial crisis to pay down mortgage debt. Panel b shows the corresponding difference-in-differences estimates, with 2014 serving as the base year. Although the trends are not parallel between the two groups prior to the relief, making it inappropriate to draw conclusions about the causal effect of debt relief on pension wealth withdrawals, we can argue that it is unlikely that the increase in amortizations following the debt relief is funded by pension wealth. From 2011 to 2019, the recipients of debt relief consistently withdrew more pension wealth than the control group. However, in the years following the debt forgiveness, the difference between the two groups narrowed.



(a) Pension wealth withdrawals (ISK million)



(b) Pension wealth withdrawals (ISK million) DiD

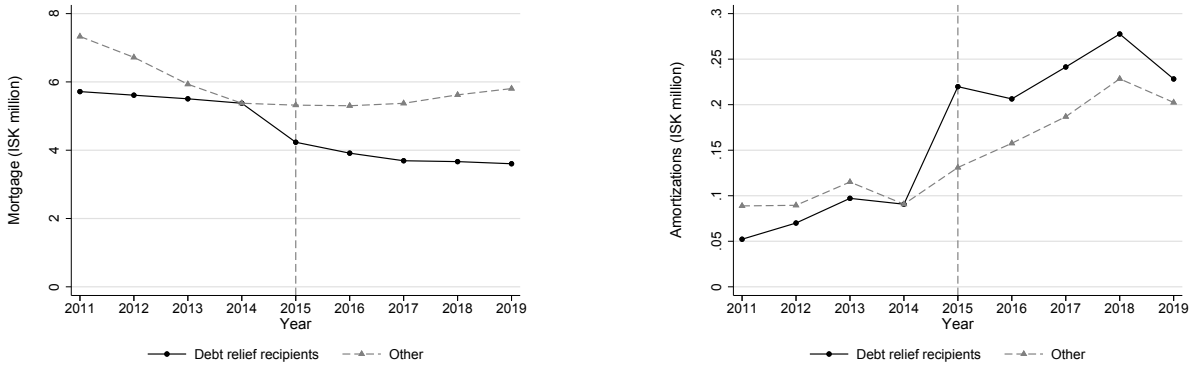
Notes: (a) are the group averages.

Figure 12: Pension wealth withdrawals

B Alternative control groups

Figure 13 shows residualized mortgages and amortizations for both the treatment group and the subset of households in the original control group that owned a property in either 2008 or 2009. From panel a, it is evident that there was a slight difference in the trend of mortgages between the two groups before the debt forgiveness. However, when examining the amortizations (panel b), a similar pattern emerges as observed when using the original control group in Figure 6. Specifically, prior to the debt forgiveness, both groups exhibit a relatively similar trend in amortizations. However, after the forgiveness, there is a noticeable increase in amortizations among households who received debt relief.

Residualized mortgages and amortizations for the treatment group and a subset of households in the original control group who owned a property without a mortgage in 2008 and 2009 are shown in Figure 13. These figures present similar evidence to what was discussed earlier when the control group consisted of the subset of households in the original control group that owned a property in either 2008 or 2009. In other words, from



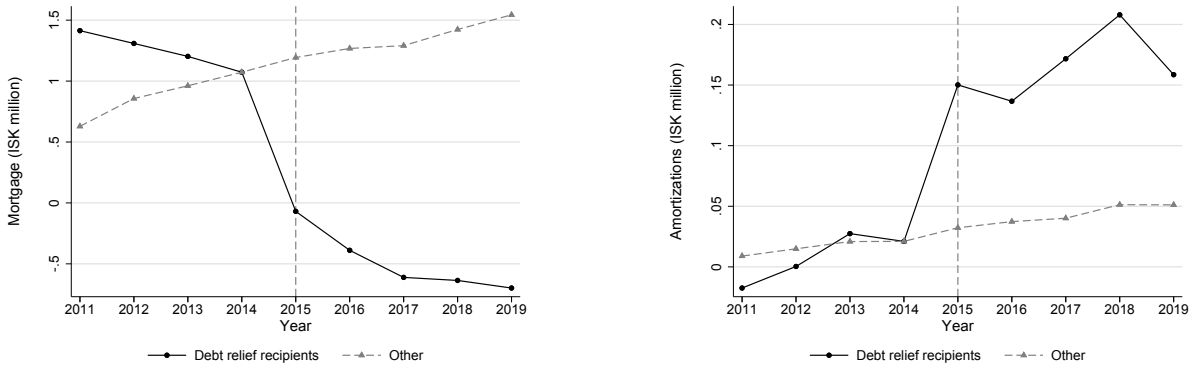
(a) Mortgages (ISK million)

(b) Amortizations (ISK million)

Notes: The control group consists of the subset of households in the original control group which had a property in either 2008 or 2009.

Figure 13: Only house owners in control group

panel a, it is clear that there was a slight difference in the trend of mortgages between the two groups before the debt forgiveness. However, when analyzing the amortizations (panel b), a comparable pattern becomes apparent, mirroring what was observed when using the initial control group (Figure 6). Specifically, prior to debt forgiveness, both groups exhibit a relatively similar trend in amortizations. However, following the forgiveness, there is a noticeable rise in amortizations among households that were granted debt relief.



(a) Mortgages (ISK million)

(b) Amortizations (ISK million)

Notes: The control group consists of the subset of households in the original control group that had debt-free property in 2008 and 2009.

Figure 14: Only debt-free house owners in control group