NON-DURABLE CONSUMPTION IN RECOURSE AND NON-RECOURSE STATES*

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ABSTRACT

This paper tests whether consumers in states with recourse law react differently to economic shocks in their consumption of non-durable goods than their counterparts in states with non-recourse. Recourse law affects housing market outcomes and housing wealth is a significant determinant of household consumption. I find that the plunge in overall house prices during the great recession and recovery period (2007-2012) was significantly smaller for recourse states. And during the easy credit period (2005-2006), recourse states have higher income elasticity of house prices and lower income elasticity of consumption.

Keywords: Recourse law; Non-durable consumption; Matching; PSM; Malahanobis; CEM Instrumental variable; Nielsen consumer panel data.

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1. INTRODUCTION

In the United States (US), different mortgage laws are adopted in different states and one such mortgage law is recourse mortgage law where the lender has the right of deficiency judgement in case a foreclosure takes place. In such a scenario, there are times when the house goes 'underwater' i.e. the market price of the foreclosing house becomes lower than the actual mortgage and in such cases, the lenders in recourse state can apply their right of deficiency judgement which cushions them from absorbing the loss of underwater situation. The right of deficiency judgement allows the lender to collect the remaining balance of the mortgage from the other assets or future income of the borrower. By giving this right to the lender, the recourse mortgage law insures the lenders in case the house goes underwater. Most of the states in the US practice recourse mortgage law except for 11 states. (section 1.1 explains recourse law and enlists the states in detail). For convenience, from here on, I will refer to the states that practice recourse mortgage law as 'recourse states' and the rest of those 11 states that do not maintain recourse mortgage law, will be referred to as 'non-recourse states'. Due to these differences in mortgage laws, one might expect the housing market to react differently and studies have found significant differences in house prices, house price volatility, foreclosure rate etc between states that practice recourse mortgage law and the ones that do not (Nam and Oh, 2021; Bao and Ding, 2014; Ghent and Kudlyak, 2011). Due to this differences in mortgage law, it can be the case that homeowners in these states have different lending power and budget constraints. And these might even fluctuate during different phases of economic cycles. And hence, due to this, these households might have difference in their consumption pattern and how they smooth their consumption throughout the business cycles.

Household consumption encompasses almost 70 percent of the US GDP and it is of great importance to understand the patterns of household consumption. Drastic plunge in household consumption was the core driver of the great recession Mian and Sufi, 2014

which had a circular effect of causing further recession. And hence, studying the pattern and determinants of household consumption has great importance. Of the many determinants of consumption, housing wealth is one of the most important one (Demyanyk, Hryshko, Luengo-Prado, and Sørensen, 2019; Mian and Sufi, 2014). And local housing market outcomes determine housing wealth which is heavily affected by the mortgage laws that are practiced in that particular area.

Then, if housing wealth can be affected by a mortgage law, is that effect big enough to pass it on to affect consumption through this housing wealth channel? Also, consumption is determined by a number of factors and also behaves differently in different economics conditions like boom, bust, recovery etc (Demyanyk, Hryshko, Luengo-Prado and Sørensen, 2019). So it is also of importance to know whether the difference in mortgage law between states lead the states' consumption to act differently during different economic conditions too. Figure figure B.1, figure B.2, figure B.3 and figure B.4 show the house price and consumption of recourse and non recourse states in levels and in one-year growth rates over time respectively, and these figures suggest varying differences between the two types of states' house price and consumption patterns.

In this paper, I am testing whether elasticity of consumption with respect to housing wealth and income differs in recourse and non-recourse states. And also, whether that difference also changes during different phases of the business cycle.

I use an instrumental variable approach to mitigate the issue of measurement error of housing wealth like the mainstream literature of consumption elasticity (Mian, Sufi, and Trebbi, 2015; Saiz, 2010; Glaeser, Gyourko, and Saiz, 2008) and also use matching techniques like propensity score matching, Malahanobis direct matching and coarsened exact matching to reduce the selection problem. As the difference in recourse law is expected to affect the housing wealth first and through this, can affect the consumption, I first test whether this recourse law affect the housing wealth in recourse and non-recourse states differently. I find that recourse and non-recourse states house price elasticity of income is

significantly different during the easy credit period of 2005-2006. And there is significant difference in house prices of recourse and non-recourse states during the recession and recovery period of 2007-2012. During this period, the entire economy faced a steep fall in house prices but in the states where recourse law is practiced, the fall in house prices is significantly smaller. Drawing the evidence of differential effect of economic shocks on housing wealth in recourse and non-recourse states, next, I test whether there is similar differences in consumption behavior.

I particularly test consumption of non-durable goods which by nature are basic necessity items including foods (not restaurant or gourmet food) and non-food grocery items. These are very inelastic in nature and hence, people from one state to another, are not expected to have very different reaction to this kind of consumption because of selection issues. For example, one might argue that someone who chose to live in Las Vegas might have a very different consumption bundle than someone who chose to live in Brownsville. Of course, this difference will be much more prominent in their basket of durable and luxury goods and services, but for non-durables, everyone needs these basic things to live and again, nobody buys these items in bulk when their income increase a lot or vice-versa.

As I am analyzing the pattern of consumption growth over different phases of business cycle, I am looking into data from 2004 to 2020 and I am dividing the phases as **'easy credit', 'recession and recovery'** and **'back to normal'** periods. 'Easy credit' period is from 2004 to 2006 when banks lent somewhat not-so-responsibly. I denote the period from 2007 to 2012 as the 'recession and slow recovery' period where 2007 to 2009 the economy suffered severely and faced the great recession, followed by a very slow recovery phase from 2010 to 2012. As economy didn't recover up until 2013, I account the years from 2010 to 2012 into the difficult phase and hence these years are also considered as the tough years and grouped together with the great recession and I call these years as 'recession and slow recovery'. And finally, I group 2013 to 2019 together and call them 'back to normal' phase where the economy came back to its normal flow but learning from the

mistakes of 'easy credit' era and having experienced the suffering of the era of 'recession and slow recovery', I expect to see a change in consumption growth's response to house price and income shocks in recourse and non-recourse states.

I find that elasticity of consumption to changes in income is positive and significant for all the periods and ranges from 0.07 to 0.09. But for recourse states, it is 0.03 percent lower during 2005-2006, when banks were liberally lending to subprime mortgages and credit was easy. But other than that, I don't find significant differences between recourse and non-recourse states' response to housing wealth and income on non-durable consumption.

1.1. Background of recourse and non-recourse in mortgage

Recourse on mortgages and commercial loans are not practised unanimously by all the states. Rather, different states practices the right of deficiency judgement to different extent and depending on that, states are classified as having recourse and non-recourse in mortgages and/or commercial loans. There are some states which adopts recourse in other loans but not in mortgage (North Carolina for example) and vice-versa. And there is the case of Nevada that changed from being a recourse state to a non-recourse state in 2014 Li and Oswald, 2017.Initially, almost all the states were recourse in mortgage until the crisis of the Great Depression. During the great depression in the 1930s, house price fell drastically and went underwater as even the foreclosure could not cover the owed balance to the lender. On top of that, in most cases, the lenders were the only bidders for those foreclosing houses and they bid far-less than the market value. Learning from this, many states took the law if deficiency law seriously and made amendments to put restrictions and reduce the power of the lenders' right of deficiency judgement and some states even went farther to completely prohibit the practice of deficiency judgement altogether Li and Oswald, 2017. So those are the states that completely prohibits or marginally gives some

right of deficiency judgement to the lenders the non-recourse states.

By the power of this deficiency judgement right, the lender can collect the remaining balance after a foreclosure from other assets or the future income of the borrower in case the house-foreclosure is not enough to raise the money to repay the mortgage. In a non-recourse state on the other hand, in such a scenario, the lender takes over the house and after foreclosure, if the price doesn't cover the owed amount, s/he cannot go after the borrower's other assets or future income. Foreclosing the house is the only compensation they get. So, in a non-recourse state, homeowners with mortgages i.e. the lenders in our example, have less liability in case of a default happens and the house price falls lower than the original price.

Almost all the states in US practice recourse law in mortgage. The extent of the right of deficiency judgement of the lenders vary across states and depending on that extent, Ghent and Kudlyak, 2011 classified 11 states as recourse states and this classification has been widely used in the recourse mortgage literature (Ghent and Kudlyak, 2011; Nam and Oh, 2021; Bao and Ding, 2014). Alaska, Arizona, California, Iowa, Minnesota, Montana, North Carolina, North Dakota, Oregon, Washington, and Wisconsin- these 11 states have little to no rights of deficiency judgement rights and have been classified as non-recourse states and the rest of the states of US are classified as recourse states. The recourse status of the states have been pretty consistent since the great depression except for the case of Nevada. Nevada changed its statute of deficiency judgement and turned into a state that is non-recourse in mortgage in 2014 from being a recourse state earlier. But because this change took place after the great recession and the previous classification has been unchanged (except for the new case of Nevada) for a long time since the great depression in 1930s, I stick to the old classification that remained unchanged for this entire time to avoid errors in estimation. I have also dropped Nevada from my set of recourse states and my study includes the years before and after 2014 to avoid convolution by the change

in Nevada's recourse status. The above mentioned classification by Ghent and Kudlyak, 2011 fully matches with the classification of USFN (Americaís Mortgage Banking Attorneys) and for the states classified as non-recourse, USFN stated that deficiency judgement is highly impractical or not available in these states (2004, pp. 5-5 - 5-7). Non-recourse states, statistically, show to have higher probability of default Ghent and Kudlyak, 2011. Some studies argue these defaults and foreclosures to be strategic due to the lower liability characteristic of non-recourse states.

1.2. Hypotheses of recourse law affecting consumption through housing wealth

There is a growing interest in the literature of housing-wealth impacting real outcomes like consumption and aggregate economy in general. There's also a large literature that trails the pattern of household consumption over different phases of the business cycle. Extracting from the findings of the literature and also from the understanding of the recourse law mentioned above, I have two sets of hypotheses that I test in this study:

1. Non-durable consumption reacts differently in recourse and non-recourse states.
2. This differences in reaction is also different during different phases of business cycle.

The following passages explains the rationales behind these hypotheses.

> ***H1: Non-durable consumption reacts differently in recourse and non-recourse states.*** Non-durable consumption includes mostly food and grocery items which are very inelastic in nature. So this particular type of consumption might not react too much due to a shock because these are mostly basic needs to survive. So because of a difference in mortgage law (recourse law particularly) in two states, it is unlikely to have much difference in the elasticity of consumption due to a shock in those two states. However, due to the difference in this law in this two states, other variables can be affected differently which might affect the consumption of even the non-durables differently. So I suspect that there should be a difference in how non-durable consumption reacts to an economic change in recourse and non-recourse

states, but I also acknowledge that the difference should be very little or insignificant because of the inelastic nature of non-durables. The channels of this difference is discussed below:

H1(a): House price channel

Recourse impacts house prices directly (Bao and Ding, 2014,Reed, LaRue, and Ume, 2018) and the prices are found to be more volatile in non-recourse states (Nam and Oh, 2021) and also higher as the demand side plays stronger role Reed, LaRue and Ume, 2018. Because the borrowers can walk away without any additional liability in case their house go 'underwater', houses in non-recourse states are more risky for the lenders and have less value as collateral. So, compared to houses in non-recourse states, recourse states houses have higher value as collateral and entails higher probability of getting loans when used as collateral. So homeowners in recourse states are expected to have higher probability of getting a loan and smooth their consumption during any economic shock. As house price increases consumption through increased housing-wealth effect Mian, Sufi and Trebbi, 2015, I expect homeowners in recourse state to have some additional cushion during a shock as their houses have more credibility to be used as a collateral to smooth their consumption. So I assume consumption to react less in recourse states to a shock. That being said, this difference in reaction of consumption could be more significant for durables or luxury items whereas, for non-durables, this difference might be very small or insignificant as these are very inelastic in nature.

H1(b): Income channel

The other channel of difference is through income. In a recourse state, borrowers cannot simply walk away from their mortgage liability in case of an 'underwater' situation without having additional liability of paying the balance from their other

assets or future income. This makes it a binding constraint for them and hence, even during very bad economic conditions with very low house price, foreclosing is not a desirable option. In this kind of scenario, foreclosing will not only take away the house from them, but also they'll end up with credit/ payable from their existing other assets or future income. So unless its a dire situation where the borrower has no other way than foreclosing, they do not go for default and foreclosure and it is confirmed by studies too that just having the recourse status corresponds to lower likelihood of foreclosures Ghent and Kudlyak, 2011.

Given this situation, during a bad shock, unless the house goes completely 'under-water', the borrowers i.e. the homeowners will keep paying the mortgages. And in such scenario, the household is already experience lower income due to the bad economic shock and on top of that, they keep paying the mortgage, rather than simply give up and walk away like their counterparts in non-recourse states. This causes their disposable income to have a sharper fall and hence they end up having a much tighter budget than the non-recourse homeowners. Knowing this, I assume, homeowners in recourse states have lower income elasticity or MPC as they would want to smooth their consumption over the periods.

On the other hand, in the non-recourse states, I suspect that homeowners in similar situation have the 'luxury' of announcing foreclosure, give up the house and walk away without paying the remaining balance which puts them in a less constrained situation with less tighter budget constraint. And usually, people who move or change houses, do not move to other states that much unless its for job or education purpose Reed, LaRue and Ume, 2018. So I am assuming, although these people gave up the house in foreclosure, they still live in the same state and hence, their consumption is still accounted in the same state. Having this differences in the budget constraint that arose from the same economic distress for these homeowners in these two types of states, I suspect their consumption smoothing will be different.

I suspect the homeowners in recourse states, being more budget constrained for the entire mortgage-paying period, will be less responsive to changes in income to save up for the mortgage i.e. less income elastic in consumption. However, this assumption makes more sense during a positive income shock. For a negative income shock, I suspect the consumption sensitivity will be more for recourse state homeowners as there disposable income is now even less, unless they saved up before for the mortgage payment. My second set of hypotheses (H2) is about this issue of consumption reacting differently during different types (positive/ negative) of income shock or different phases of business cycle and I am elaborating that idea below.

H2: The difference in how non-durable consumption in recourse and non-recourse states react, also differs during different phases of business cycle

Here, after my initial assumption of consumption reacting differently to shocks because of the recourse status of the states, I now suspect that, even this difference also varies with the type of shock i.e. boom and bust phase shocks make these states react differently.

It is well documented in the literature that consumption growth reacts differently to various determinants in different phases of the business cycle. The 2000s having faced all the phases of boom, bust and recovery, literature find that consumption didn't react the same way in all the phases. Rather during different phases, consumption growth response to various factors was different (Demyanyk, Hryshko, Luengo-Prado and Sørensen, 2019). So, I expect that the consumption will react differently in recourse and non-recourse states in different phases of 2000s. The hypotheses are elaborated below:

H2(a): *During the 'easy-credit' period (2004-2006), consumption growth is positive and higher in non-recourse states than the recourse states.*

During the easy credit period, its widely documented that banks were lending at a

much higher rate than usual and also were lending on risky collateral (subprime mortgages) which otherwise they wouldn't lend as per their previous collateral standard. Because of this easy credit availability, demand for houses are supposed to increase overall. And this increased demand will pull the house prices as houses are pretty inelastic in supply. Because of the reduced liability nature of the non-recourse mortgage, I assume this house price increase will be higher in non-recourse states than the recourse states.

Houses in non-recourse states have lower value as a collateral as they are more risky to the lenders i.e. the banks. So in general, banks are supposed to be more reluctant to lend homeowners in non-recourse states who use their houses as collateral in general. But during the easy credit period, as banks were lending quite liberally and also, buying a house in a non-recourse state comes with much lower consequence in case of default, buying a house in those non-recourse states eventually are less costly in terms of future liability. So I suppose, demand for housing will be much higher in non-recourse states during the easy credit period. And supply of houses are usually very inelastic in the short run which eventually make the house price in non-recourse states to grow faster than the recourse states during this easy credit period because of this higher demand arising from low-liability aspect for the borrowers.

Now with this additional rise in house price in non-recourse states, homeowners there have higher housing-wealth during this easy credit period which makes them feel wealthier than their counterparts as we discussed in section 1.2. On top of being wealthier than the recourse homeowners, the non-recourse homeowners also have the limited liability of paying the full mortgage in the event of 'underwater' scenario. Whereas, in recourse states, the homeowners are more constrained in the sense that, although currently they have some positive wealth effect from the general house price increase, they have to make sure to save to be able to keep paying their mortgage in the future in the event of any bad shock. So, from these two

channels of non-recourse homeowners having higher housing wealth due to higher house price growth and also lesser budget constraints due to lesser future liability, I expect the consumption growth of the homeowners in non-recourse states will be much higher during the 'easy-credit' period.

H2(b): *During the 'crisis and recovery' period (2007-2012), consumption growth is negative but not significantly different among the recourse and non-recourse states.*

Because of the house-price crash during the great recession, houses in massive numbers went underwater and house price fell drastically overall. But because in non-recourse states borrowers face less consequence in case of a foreclosure, and lots of foreclosure actually took place during that time, I would assume non-recourse states to experience more foreclosures. And because house prices were already falling drastically, this marginal supply of houses in the market from the newly foreclosed mortgages, increases the supply of houses even more and reduces the price even lower.

So, I would suspect that house price growth will fall more in non-recourse states during recession because more houses can be foreclosed there due to the fact that the borrower can walk away just by foreclosing the house without worrying about the remaining balance owed to the lender. This pattern in house price is expected to remain until the recovery phase is over till 2012.

With a deeper fall in house-price in non-recourse states, surely the homeowners in non-recourse states face a higher loss of housing wealth during the recession. And the ones who had to foreclose their houses, lost their entire housing wealth but also in an advantageous position of having no residue debt/ mortgage left on their name. This although makes them lose their housing wealth more than the recourse state homeowners, they also walks away with less or no debt which the homeowners in recourse states still have. So, I expect that consumption growth will

not fall much due to the house price or income reduction in non-recourse states, although they faced higher loss of housing-wealth. And hence, I don't expect the consumption growth of recourse and non-recourse states not to be much different during the recession and recovery phase.

H2(c): *During the 'back to normal' period (2013-2016), consumption growth is positive and not significantly different among the recourse and non-recourse states.*

In the post-recession period, things started to improve and market recovered itself. Eventually, that extreme low house price might have induced demand for houses again as economy was getting better and hence, house price growth becomes positive again, but learning from the mistake of easy lending in easy-credit period, I assume, less house loans will be approved by the banks. So, at one hand, the economy just recovered from a recession where house prices were record-low which itself induce higher demand for the houses, as prices are super low. On the other hand, because banks learned from the past mistake, they are not lending as easily. So a portion of the buyers who would depend highly on the mortgage loan, are not able to buy the houses which leads to lower demand for houses. This phenomenon will be stronger in the non-recourse state as houses in the non-recourse state has lower value as a collateral and also, during the recession, these were the houses that went underwater more. So, getting a subprime mortgage loan again will be harder in non-recourse state than the recourse state in the post crisis period. And due to this relative ease of credit in recourse state, more houses will be demanded which eventually will raise the house price in recourse state more. So I assume, during the post-crisis period, house price growth is positive again but this time, its higher in recourse states even with its consequential liabilities still being present which actually is indicating their credibility and hence raising the value of their collateral.

If the above mentioned hypothesis proves to be true, then again, I expect the con-

sumption to react positively with the positive house price and income changes during this post-crisis good times. But having said that, I also expect the consumption reaction to be not so different between recourse and non-recourse states again due to two reasons. First, this time, higher house prices in recourse states gives the homeowners in recourse states higher housing-wealth effect. But due to the additional liability of future payment in case of an event of the house going underwater, these homeowners are less elastic to income and house price increase. As they have to keep paying the mortgage even if in future bad shock hit them, they are more risk averse and don't increase their consumption drastically. And hence, despite of having higher housing-wealth than the non-recourse state homeowners, homeowners in recourse states is not expected to increase their consumption drastically to be significantly different than their counterpart. And second, although house prices recovered in non-recourse states too and positively growing in the 'back to normal' period, it's still expected to grow less than the recourse states. So even if they still have the luxury of having less liability and don't need to squeeze their consumption to insure for future shocks, this time, their housing wealth increase is lower than their counterparts in recourse states. So consumption is not expected to increase a lot like the 'easy credit' period just because house prices are growing back again.

On top of that, the homeowners who defaulted during the recession and walked away when their houses went underwater, enjoyed less liability of having rest of the debt on them to be payable through their other assets or future income. But with that, they also had to bear a cost and the cost is reflected in their credit score and their future loan-ability. As discussed in section 1.2, I am assuming those homeowners to still live in the same states as usually foreclosed homeowners do not move out of state except for job purposes Reed, LaRue and Ume, 2018. So I assume those homeowners to still remain in these same states mostly and their consumption is accounted in the same states. Given this scenario, I expect them to not be able to

increase their consumption significantly due to their lower credit-ability through lower credit score now.

So, during the 'back to normal' phase, although housing wealth starts to increase again, because of better discretion by the lenders and banks, this time I expect the house price in non-recourse and recourse state to act differently than the 'easy credit' period. And that corrected scenario this time does not let the borrowers in non-recourse states to be as elastic in consumption as before. So with reduced elasticity of consumption to housing wealth in non-recourse states, I expect consumption to increase but not significantly different than that of recourse state.

The remainder of the paper is organized as follows. Section 2 discusses the data I used in my analysis. Section 5 presents conclusions. **??** provides details on data.

2. DATA

To test my hypotheses, I have used data from multiple sources. I used consumption data from the Nielsen Consumer Panel data set. For my analysis, I use the data at household-year level and using the years from 2004 to 2016. I have aggregated the purchases of all types of product for my initial analysis here but have also analyzed by different product categories which is currently not in this paper but will be added soon. There are almost 1.5 million different products in the data set which basically falls into the criteria of different types of food, health and beauty products and non-food grocery products. This dataset has been widely used in literature (Stroebel and Vavra, 2019, Kaplan, Mitman, and Violante, 2020 and consumption growth of this dataset has been shown to be consistent with the non-durable consumption growth from National Accounts Data (Graham and Makridis, 2018). Nielsen has a wide variety of household demographics which I use as controls and also to construct the PSM, Malahanobis and CEM samples. Also, because recourse law affects consumers through the house price channel mainly, I keep only the homeowners in the sample. Unfortunately, Nielsen does not have the informa-

tion whether a household is homeowner or not, but it provides the information on which type of house they live in. I categorize the households living in a single family house or condo/coop to be homeowner which is a standard practice in the literature Graham and Makridis, 2018.

To measure house price growth, I use house price index (HPI) as a proxy for house price from Federal Housing Finance Agency (FHFA). The FHFA measures the movement of single-family house prices as HPI which is a weighted and repeat-sales index. It measures average changes in price in repeat sales or refinancings on the same properties. FHFA reviews repeat mortgage transactions on single-family properties whose mortgages have been purchased or securitized by Freddie Mac or Fannie Mae and they have this documentation from January 1975.

House price having the chance of high endogeneity and also measurement error, it is common practice in literature to instrument house price while estimating impact on consumption. I use the 'Bartik-like' instrument for house price introduced by Graham and Makridis, 2018.

I have household level income data in Nielsen. But that income is categorical and I converted into continuous by taking the mid-points. The problem with this is that when calculating income growth, may observations were dropped simply because within a year, its not a common phenomenon that people's income rise/ fall so much that it would move to a different income bracket. So, for another view, I use county level income data that come from Bureau of Economic Analysis (BEA). BEA counts income as wages, proprietors' income, interest, rents, dividends and government benefits. Also, one's income is counted in the county where they live, even if they work elsewhere. I utilize employment data from U.S. Bureau of Labor Statistics (BLS) which is at county level. Data on county level labor force and unemployment rate is used from BLS.

I adjust house prices and income for inflation using Consumer Price Index data from

the website of Federal Reserve Bank of St. Louis where index $1982 - 1984 = 100$ and the data is seasonally adjusted.

To gauge each county's credit health, I use percentage of population with a credit score lower than 660. This data is found at the website of Federal Reserve Bank of St. Louis and the primary source of this data in Equifax [1] This dataset contains the percentage of population in each county whose credit score is lower than 660, indicating a below average credit health. Counties with fewer than 20 people were dropped from the sample.

I also use county level debt-to-income ratio data from the Board of Governor for the Federal Reserve System. The data is available from 1999 and here, they calculate this variable using household debt data from Equifax/ FRBNY Consumer Credit Panel Data and also income from BLS.

3. Estimation approach

The differences that I expect to be in consumption of recourse and non-recourse states heavily relies on the hypotheses I mentioned in section 1.2. I test those two sets of hypotheses in the following two steps:

1. Test whether house price reacts differently in recourse and non-recourse states over different phases of business cycle.
2. Test whether consumption reacts differently because of that and also whether the difference varies over different phases of business cycle.

1. Equifax and Federal Reserve Bank of New York, Equifax Subprime Credit Population for New York County, NY [EQFXSUBPRIME036061], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/EQFXSUBPRIME036061, November 6, 2022.

3.1. Testing house price reaction

As my argument of consumption being affected by recourse law highly depends on the house price channel, I first test the hypothesis that house prices react differently in recourse and non-recourse states. And I also address the hypothesis of this difference in price reaction is also different in different phases of business cycle.

I use the following regression specification to test the house price reaction of recourse and non-recourse states in different phases:

$$\Delta HPI_{jt} = \beta_0 + \beta_1 \Delta Income_{jt} + \beta_2 R + \beta_3 R \times \Delta Income_{jt} + \gamma Z_{jt} + \epsilon \tag{1}$$

where,

- R is Recourse dummy
- ΔX is 1 year growth rate of X calculated as the 1 year log difference of X (i.e. $logX_{it} - logX_{it-1}$)
- Z contains other county level variables

3.1.1. Expected signs

This model is estimated for three different time periods: "easy credit", "crisis" and "post-crisis" periods. The expected signs for the paramaters of interest i.e. β_0 and β_2 for each period is discussed below.

1. **For 'easy credit' period:**

   As per section 1.2 (H1(a) and H2(a)), during 'easy-credit' period (2005-2006), the house prices were rising sharply and because the banks were lending more liberally than before. Banks reduced their rejection rate drastically (Mian and Sufi, 2014) along with the additional feature of non-recourse states' reduced liability, demand for houses in non-recourse states increased more than the demand in recourse states. And housing supply being rigid everywhere at least in the short run, this increased

demand raised prices in both types of states but more so in non-recourse states because of this higher demand. So, the β_0 is expected to be positive and the β_2 is expected to be negative.

2. **For the 'crisis and recovery' period:** Again, as per H1(a) and H2(b) in section 1.2, during the 'crisis and recovery' period (2007-2012), non-recourse states were hurt most and hence β_0 is expected to be negative and β_2 positive to indicate that recourse states faced lesser price fall.
3. **For the 'back to normal' period:** After the crisis, as per my hypotheses in H1(a) and H2(c) in section 1.2, I expect bankers to learn from their actions during 'easy credit' period and modify their actions and make lending tighter and raise restrictions. If that holds, then β_0 is expected to be positive again indicating prices were rising again but here, the constant is expected to be less than the β_0 of the 'easy credit' period. β_2 is again expected to be negative here showing the demand increase in recourse states to be lower than the non-recourse states because of the additional liability characteristic. However, here, the absolute value of β_2 is expected to be less than that of the 'easy credit' period to indicate that, although price rises are higher in non-recourse states again, this time, banks being more careful and lending to less risky borrowers, the difference in the demand rise is lower than before.

3.2. Testing consumption reaction

After testing the house price reactions and having the claims in the hypotheses confirmed there, the next step is to test the consumption reaction and analyse the difference between recourse and non-recourse states and also over different phases of business cycle. For this, I use the following regression specification which is again, estimated for the three sub-periods separately and also altogether (from 2005-2016):

$$\begin{aligned}\Delta C_{ijt} =& \alpha_0 + \alpha_1 \Delta HPI_{jt} + \alpha_2 R \times \Delta HPI_{jt} + \alpha_3 R + \alpha_4 \Delta Inc_{ijt} + \alpha_5 R \times \Delta Inc_{ijt} \\ &+ \Psi HHDemog_{ijt} + \Omega CountyChars_{jt} + \nu_t + \epsilon\end{aligned} \tag{2}$$

where,

- ΔX_{ijt} is 1 year growth rate of X calculated as the log difference (log X_{ijt}-log $X_{ij(t-1)}$)
- R is Recourse dummy
- C is per-capita real consumption of all categories of non-durable goods calculated from Nielsen database
- HPI in house price index
- Inc is per capita real income from Nielsen and is at household level
- HHDemog is a vector of control variables containing household demographics like age of the household head, age square, education, household size, house type, presence of children, marital status etc.
- CountyChars is another vector of control variables that includes county level factors like unemployment rate, debt-to-income ratio, Equifax subprime ratio etc.
- Z contains demographic variables

3.2.1. Expected signs

The parameters of interest here are $\alpha_0, \alpha_2, \alpha_3$ and α_5. As per the discussion in section 1.2 and section 1.2, the expected signs in each of the periods are noted below:

1. **For 'easy credit' period:**

   During this period, if H1(a,b) and H2(a) hold, α_0 should be positive and α_2, α_3 and α_5 should be negative. An increase in housing wealth or income should will not make homeowners in recourse states to spend all of their gains on consumption as they have this additional liability which they know they have to pay. So, they will not be impulsive and will not show high MPC. Rather, they will be more prone to save for rainy days. Whereas in non-recourse states, homeowners having this

less liability, have the luxury of increasing consumption and show higher MPC. So higher elasticity of consumption is expected in the non-recourse states and hence, the difference between recourse and non-recourse consumption growth is expected to be large.

2. **For 'recession and recovery' period:**

   During the recession and recovery period, with house prices falling drastically, homeowners of both types of states will face loss of housing wealth and that will reduce their consumption growth unanimously. But in recourse states, the reduction in consumption is expected to be more because irrespective of them facing an economic shock which reduced their housing wealth and income, they still have to keep paying the mortgage. This lefts them with lower disposable income and their consumption is expected to fall sharply. Again, as we are looking into non-durables which are basically food items mostly, the fall in consumption here cannot be extremely low because people need to eat to survive and they cannot completely not buy food. So consumption will fall but not drastically. But the point of emphasize here is that even if the fall in consumption of non-durables is not significant (because these are food items mostly), I expect to the difference in this fall of recourse and non-recourse consumption to be significant. So, all of $\alpha_0, \alpha_2, \alpha_3$ and α_5 is expected to be negative.

3. **For 'back to normal' period:**

   Finally, in the back to normal period, if my hypothesis of banks correcting their lending behavior holds, then I expect the difference in the consumption growth between recourse and non-recourse states to diminish. During this period, house prices starts to rise again which raises both party's housing wealth and this eventually should increase their consumption. Hence, α_0 is expected to be positive again, but this time, it should be lower than that of 'easy credit' period simply because this time, house prices are not expected to be soaring like before because of the tightening from the banks, leaving them feel less wealthy. α_2, α_3 and α_5 are expected to

be negative again, but for the same reason, the absolute values of these parameters are expected to be smaller than those from the 'easy credit' period indicating that the difference between the consumption growth between the two types of states are smaller or insignificant.

3.2.2. Instrumenting house price index

As the my hypothesis of non-durable consumption being different in recourse and non-recourse status highly depends on the household channel (see section 1.2), how I estimate the effect of house price on consumption is of particular importance. House price and consumption have the problem of endogeneity problem and also, as I do not have the household level housing wealth or house price data for my sample and using the generic county level HPI, it also has the problem of measurement error. Literature on this field has tackled this problem by using cross-sectional variation in housing supply elasticity as instrument for house price changes (Mian, Sufi and Trebbi, 2015; Saiz, 2010; Glaeser, Gyourko and Saiz, 2008). However, several studies noted the problems of housing supply elasticities as instrument including this being correlated with unobserved factors and also only having cross sectional variation for a highly aggregated geographic area as the MSA. In a recent study by Graham and Makridis, 2018, the authors constructed a novel set of Bartik instrument which they termed as 'Bartik-like' instrument and exploited both the cross-sectional and time-series variation

They first measure cross-sectional variation in the composition of local (e.g. county-level) housing characteristics, such as age of the house, number of bathroom, number of bedrooms etc and combine this with time-series variation in the marginal prices of these housing characteristics. They estimate this through hedonic pricing regressions on housing transaction data grouped by US Census regions. Where geographic areas vary in the composition of housing characteristics, the instrument produces differential local exposures to regional changes in the prices of different house types. For example, if San Francisco consists mostly of two-bedroom houses built prior to the 1940s, while Las Vegas

has mostly four-bedroom houses built in the early 2000s, then an increase in the price of larger and newer houses in the Western US would result in relatively faster house price appreciation in Las Vegas.

I use the Bartik-like instrument for house price index from Graham and Makridis, 2018 to estimate the impact of house price growth on consumption growth. So my model for estimating consumption growth showed in equation (2) is actually instrumented and should look like the following:

$$\begin{aligned}\Delta C_{ijt} =& \alpha_0 + \alpha_1 \Delta \widehat{HPI_{jt}} + \alpha_2 R \times \Delta \widehat{HPI_{jt}} + \alpha_3 R + \alpha_4 \Delta Inc_{ijt} + \alpha_5 R \times \Delta Inc_{ijt} \\ &+ \Psi HHDemog_{ijt} + \Omega CountyChars_{jt} + \nu_t + \epsilon\end{aligned} \tag{3}$$

where, $\widehat{HPI_{jt}}$ is HPI instrumented by Bartik-like instrument which is also at county-year level.

3.2.3. Using matching methods

Another significant concern of estimating the difference in the reaction of consumption growth in recourse and non-recourse state is that, there can be significant selection problem. People choosing to live in non-recourse states can be very different than people who choose to live in recourse states and hence their consumption behavior can be vastly different in the first place.

One reason to particularly examine non-durable consumption is to somewhat reduce this problem. The problem of selection leading to choosing different bundles of consumption is most severe for luxury items or big purchases. This problem is also present very starkly in the consumption of services like tourism, cosmetic surgeries or even the services from the restaurants and the wellness industries like having spas. However, when it comes to non-durable consumption that basically captures food and non-food grocery items, it is less likely to find significant difference in the consumption behavior as these are basic need items with very low elasticity. People living in bay area might not neces-

sarily have a very different eating habit than the people living in the south. Still there is the issue of selection again by how the food is grown. For example, people choosing certain areas to live in (for amenities reason or those places to be a hub for their job like Silicon Valley) can also follow a certain pattern of food habit (like preferring vegan or organic etc). While this study is not looking into that, but from Nielsen, that can be examined as Nielsen have detailed product level data and it is in the future plan of this study. However, for now, this study do not look at particular type of food items consumption differences between states which still might carry a significant selection problem, but in general, if we don't have evidence for people living in certain area are more likely to consume particular prodcts like vegan/ organic, we can safely say, for non-durable consumptions, people all over the country should have more similar consumption patterns and hence the difference I'm examining is also expected to be very little. So here, its not about the size of the difference, but more about the presence- whether there is any difference even if it is little.

Having said the argument for choosing non-durables to mitigate the selection problem, it is still not enough. In order to tackle this problem further, I use several matching methods to match households from recourse and non-recourse states who have similar demographic characteristics and group them together and then estimate equation (3) on these refined samples again. For matching, I use Propensity Score Matching (PSM), Nearest Neighbor Matching with Malahanobis Distance and Coarsened Exact Matching (CEM) techniques. Details on the matching techniques and the balance tests are discussed in the appendix.

4. RESULTS

I lay down the results in two steps as it is outlined in section 3:

1. By examining house price reaction in different phases of business cycle for recourse and non-recourse states.

2. By examining if consumption reacts differently in recourse and non-recourse states and also if the reaction is different for different phases of business cycle.

4.1. House price reaction

Table 1 shows the estimates for equation (1) for three different phases of the recent business cycle: 'easy credit' period i.e. 2005-2006 in column (1), 'recession and recovery' period i.e. 2007-2012 in column (2) and 'back to normal' period i.e. 2013-2016 in column (3). As per the hypotheses in section 1.2, the β_0s (the constants) for all three period follow the expected sign and are significant.

1. **Easy credit period (2005-2006):** In column (1), for the 'easy credit' period, β_0 is very high and statistically significant indicating the sharp soar in house prices all over the country. Then β_2 (coefficient of recourse dummy R) is negative indicating that in recourse states, this price growth is lower than the non-recourse state. In section 1.2 I discussed that during easy credit period, there many borrowers entered the market who previously did not have access to this credit before because of banks' stricter policy. But during this housing bubble period with banks being more liberal and allowing lending to subprime mortgages, a new set of borrowers entered the market which raised overall housing demand. And supply being inelastic in the short run, the prices rose significantly. And non-recourse states having lesser liability, are expected to have more demand, especially from this marginal group who did not have access to credit before because of poor credit health. So having this additional demand pull in non-recourse states, house price growth is expected to be higher in non-recourse states and the sign of β_2 is as I expected; however not statistically significant. The coefficient of $RInc$ i.e. β_3 also suggests similar story where increase in income (during this period, income growth was positive) raises overall house price growth through increased demand, but in recourse states, its higher. What this means? It means, just by being in a recourse state, the house price is not as

much growing from other factors but only when income is growing, house prices in recourse states are growing more. So the demand pull in the recourse states are coming from credible increase in income, not from other factors that are jumbled up in β_0 and its statistically significant as well. These other factors also include those increased demand by the new pool of people who got access because of the 'easy credit' policy of the banks, not because they have credible income growth which increases their payability. And the negative recourse dummy coefficient suggests that those factors play less role in recourse states leading to a lower house price growth in recourse state.

TABLE 1
HOUSE PRICE GROWTH ON INCOME AND RECOURSE

	(1)	(2)	(3)
	2005-2006	2007-2012	2013-2020
ΔInc	0.0423	0.197***	0.0784*
	(0.59)	(6.50)	(2.44)
R	-0.385	**0.396****	-0.0232
	(-1.13)	(2.73)	(-0.15)
R X ΔInc	0.202*	-0.0453	0.0497
	(2.46)	(-1.33)	(1.47)
Constant	6.572***	-1.411***	2.961***
	(21.22)	(-10.72)	(20.38)
N	1517	5044	5933
adj. R^2	0.059	0.240	0.070
F	11.37	43.95	26.28

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

2. **Recession and recovery period (2007-2012):**

β_0 for the 'recession and recovery' period (column 2) being negative, captures the sharp overall decline in house price growth. And finally, the most interesting result here, is the value of β_2 (coefficient of recourse dummy R) during this period is starkly positive and statistically significant. This suggests that, during the crisis

period, house price growth fell sharply all over, but in recourse states, the fall was less and this result is statistically significant. As per the hypothesis of house price in recourse states being less affected seems to have some backup here. Just by being in recourse state, during the 'recession and recovery' period, house prices growth fell less and the coefficients have the expected sign too. The the signs of β_1 and β_3 also aligns with the hypotheses that during this period, income growth fell and with the falling income growth, house price growth also fell (a positive β_1) overall, but for recourse states, this fall is less (β_3, the coefficient of $RInc$ being negative).

3. **Back to normal period (2013-2016):** In the 'back to normal' period (column 3), the signs and rationale for the signs are exactly like the 'easy credit' period but with a slight tightness and less difference between the two types of states. β_0 is again positive and statistically significant but much smaller than the 'easy credit' period indicating lower pull of demand from factors other than income. And a positive and significant β_1 refers to the house-price growth to be significantly driven by demand that induced from increased income. And also, this time, the magnitude of this coefficient is larger than that of the 'easy credit' period which means, during this period, income growth played larger role in the house price growth than compared to the 'easy credit' period.

   The intuition of the negative sign of recourse dummy, β_2 is the same as 'easy credit' period but again, the absolute value of this coefficient in this period is smaller than 'easy credit' period. This indicates the initial difference between recourse and non-recourse state house price growth has reduced during this 'back to normal' period. β_3 i.e. the coefficient of $RInc$ also follows the same pattern of having the same sign as 'easy credit' period but the magnitude is smaller. So income growth in recourse state do not increases house price growth difference between the two types of states as much as before. However, β_2 and $beta_3$ during this period are not statistically significant in spite of having the expected signs that support the hypotheses.

4.2. *Non-durable consumption reaction*

The reaction of house price shock and income on non-durable consumption of recourse and non-recourse state is estimated using equation (2). To be more precise, house price is instrumented with the Bartik-like instrument which take account of the different characteristics of houses and exploits both the cross-sectional and across-time variations as explained in equation (3). Then to minimize the selection problem, matching techniques like PSM, MDM and CEM is also applied. Table 4.2 shows the results for these estimations for the entire period of 2005 to 2016.

TABLE 2
CONSUMPTION GROWTH ON HPI (INSTRUMENTED), INCOME AND OTHER CONTROLS

	(1)	(2)	(3)	(4)	(5)	(6)
ΔHPI	0.193	0.0758*	0.0640*	0.0978*	0.0964*	0.0692
	(1.74)	(2.15)	(2.00)	(2.34)	(2.30)	(1.73)
ΔInc	0.0653***	0.0916***	0.0861***	0.0667***	0.0665***	0.0530***
	(11.56)	(15.96)	(15.26)	(9.79)	(9.77)	(3.63)
R	1.181	0.491	0.217	-0.310	-0.360	-0.106
	(1.61)	(0.60)	(0.29)	(-0.31)	(-0.36)	(-0.09)
R X ΔInc	-0.00218	-0.0240***	-0.0233***	-0.0154*	-0.0156*	0.0109
	(-0.36)	(-3.99)	(-3.91)	(-2.14)	(-2.16)	(0.69)
R X ΔHPI	0.0235	0.0247	0.0186	0.0567	0.0566	0.0429
	(0.38)	(1.04)	(0.85)	(1.67)	(1.67)	(0.10)
Constant	2.160	-4.542	20.73***	20.39***	20.89***	24.63
	(1.61)	(-1.33)	(4.86)	(3.32)	(3.40)	(1.20)
Instrument	No	Yes	Yes	Yes	Yes	Yes
Sample	All	All	All	PSM	Malahanobis	CEM
HH demog	No	No	Yes	Yes	Yes	Yes
Cnty demog	No	No	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	112434	87031	81150	55529	55317	5077

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

For all the columns, the regressand is consumption growth ΔC_{it} where C_{it} is log of

per capita real consumption of non-durable goods. Column (1) shows the result for equation (2) except fot the fact that no household demographics or county level characteristics are controlled here. So the model for column (1) here is:

$$\Delta C_{ijt} = \alpha_0 + \alpha_1 \Delta HPI_{jt} + \alpha_2 R \times \Delta HPI_{jt} + \alpha_3 R + \alpha_4 \Delta Inc_{ijt} + \alpha_5 R \times \Delta Inc_{ijt} + \nu_t + \epsilon \quad (4)$$

Column (2) reports the results for equation (3) where house price is instrumented and no household level or county level characteristics are controlled for whereas, column (3) is the same, but controlled for household and county level characteristics. Column (4), (5) and (6) report the results for the same instrumented specification of equation (3) for the samples matching by PSM, MDM and CEM respectively. All the columns control for year fixed effects. Except for α_3, the coefficient for the recourse dummy R, almost all the coefficients have consistent signs for all the specifications, although not statistically significant in all cases.

House price growth and income growth has positive and significant impact on the overall growth of non-durable consumption during the entire time-frame of 2005 to 2016. This confirms the generic finding of literature that housing wealth (proxied by house price) and income influence household consumption positively. In the literature, the elasticity of non-durable consumption to house prices using instrumental variables varies from 0.09 to 0.38 Graham and Makridis, 2018; Campbell and Cocco, 2007; Kaplan, Mitman and Violante, 2020; Gan, 2010. My estimates range from 0.06 to 0.19 for different specification which consistent with the literature but a bit on the lower end. So a 10 percent increase in housing wealth seems to increase the non-durable consumption by 0.6 to 1.9 percent. In all the specifications, the elasticity of consumption to housing wealth is positive and statistically significant except for specification (1) and (6).

But for recourse states, these estimates could be higher, as α_2, the coefficient for the interaction term of house price growth with recourse dummy ($RHPI$) is positive for each specification. But none of these are statistically significant at 10 percent or lower sig-

nificance level. So we cannot credibly argue that the response of house price shock to consumption in recourse state is significantly different for the overall period of 2005 to 2016.

Income on the other hand, shows some difference among recourse and non-recourse states. The coefficient of income growth α_4 follows the hypothesis and has the expected positive and statistically significant coefficients for each of the specification signifying that growth in income affects growth in non-durable consumption positively in non-recourse states. The estimate here ranges from 0.05 to 0.09 for the elasticity of consumption to income which means a 10 percent increase in income leads to 0.5 to 0.9 percent increase in the consumption of non-durable goods.

However, for recourse states, these estimated might be a bit lower as α_5, the coefficient for the interaction term of income growth with recourse dummy ($RInc$) is negative and statistically significant for all the specification except for specification (1) and (6) again. This suggests that in recourse states, similar increase in income growth leads to higher consumption growth but less than that of the non-recourse states and the difference is around 0.02. So for the similar 10 percent increase in income leads to an approximate increase in non-durable consumption of 0.3 to 0.7 percent in recourse states, whereas, for non-recourse states, this estimate ranges from 0.5 to 0.9 percent. This completely confirms the hypotheses of income channel discussed in section 1.2 where income growth is expected to affect consumption growth positively, but for recourse states, borrowers having additional liability, need to secure for future and hence, they will be less spontaneous and show a lower elasticity of consumption than their counterparts, because they need to save for future shocks to smooth out their mortgage payments.

From all these specifications, I choose specification (3) for now to test the hypothesis of differential reaction to different phases of business cycle (section 1.2), as it controls for all the additional information at household level and county level, instruments the house price and also have a good number of observations. Later, for more robustness, I will

add the similar exercise for the subsamples derived from PSM and Malahanobis (MDM) matching.

Table 4.2 reports specification (3) for the entire sample timeline from 2005 to 2016 in column (1) from 4.2. And then the results for the same specification for the 'easy credit' period (2005-2006), 'recession and recovery' period (2007-2012) and 'back to normal' period (2013-2016) are reported in column (2), (3) and (4) respectively.

TABLE 3
CONSUMPTION GROWTH ON HPI (INSTRUMENTED), INCOME AND OTHER CONTROLS

	(1) All	(2) 2005-2006	(3) 2007-2012	(4) 2013-2016
ΔHPI	0.0640*	0.0214	-0.1540	0.0194
	(2.00)	(0.17)	(-0.73)	(0.35)
R X ΔHPI	0.0186	0.0330	-1.942	-0.0835
	(0.85)	(0.18)	(-1.20)	(-0.99)
R	0.217	-0.910	-42.98	3.899
	(0.29)	(-0.08)	(-1.19)	(1.06)
ΔInc	0.0861***	0.0955***	0.0713***	0.0941***
	(15.26)	(5.43)	(5.30)	(12.16)
R X ΔInc	-0.0233***	-0.0399*	-0.0182	-0.0134
	(-3.91)	(-2.21)	(-1.33)	(-1.62)
Constant	20.73***	64.41***	152.1	39.01***
	(4.86)	(3.50)	(1.62)	(8.22)
Instrument	Yes	Yes	Yes	Yes
Sample	All	All	All	All
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	81150	9453	41642	30055

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

1. **Easy credit period (2005-2006):** During easy credit period, banks were lending liberally to subprime mortgages which induced higher demand in the housing market stemming from borrowers entering the market who previously didn't have the access to credit like this. As per my hypothesis, this phenomena should be more seen

in non-recourse states due to the lower future liability on the borrowers and hence house prices should soar higher in non-recourse states which my data confirms in table 1. So, during this phase when house prices soar in both the states but more in non-recourse states, my hypothesis was that consumption growth will increase due to increase in housing wealth more in non-recourse states. The coefficients of house price growth and its interacting term with recourse dummy in column (2) in 4.2 is seen to be positive which says that during this period, a house price rise of 10 percent increased non-durable consumption in non-recourse states by 0.2 percent and in recourse states it was even higher, somewhat like 0.5 percent which goes completely against my hypothesis. However, none of these are statistically significant and I cannot claim during this period, recourse and non-recourse states' homeowners' consumption reacted differently to the rapid house price increase.

However, for income, the hypothesis holds. A 10 percent increase in income raises consumption by 0.9 percent in non-recourse states and in recourse states, this increase in consumption is almost 0.4 percent lower than the non-recourse states and both the estimates are statistically significant. So, these coefficients are consistent with the hypotheses of income increase during this easy credit period increases consumption overall but in recourse states, this increase in a little bit suppressed but still positive. The constant is also very high and statistically significant suggesting that consumption grew a lot during this phase.

2. **Recession and recovery period (2007-2012):** During the recession and recovery period, house prices and income fell steeply. Recourse states houses having more credibility as collateral and hence higher likability of getting loans against, homeowners of recourse states are expected to be able to smooth out consumption better than the non-recourse counterparts from a housing-wealth shock like this. The negative sign of the coefficient of the interaction term α_2 of house price and recourse dummy kind of aligns with the hypothesis that in recourse states, consumption growth is af-

fected less than the recourse state, but this do not make much sense as the coefficient of house price growth is also negative. This suggests during this recessionary period, a 10 percent decrease in house prices raised the consumption by 1.5 percent in non-recourse states and almost 20 percent in recourse states which completely goes against my hypotheses and also the literature. But all these are statistically insignificant too. So I cannot make any claim of my hypotheses of house prices impacting consumption of recourse and non-recourse states during the recession and recovery period.

For income though, it has the similar pattern as before suggesting positive relationship to consumption for both states, but a little bit lesser for the recourse states. To be more precise, a 10 percent decrease in income during this recession and recovery period, consumption falls by 0.7 percent in non-recourse states and 0.6 percent in recourse states indicating that consumption is less elastic and better smoothed out in recourse states. However, the argument of recourse states having lower elasticity and being less impacted by the reduced income of this period does not hold strong because the coefficient is not statistically significant.

3. **Back to normal period (2013-2016):** Finally, in the back to normal period, again, there is no significant result for the impact of house prices increase on the consumption of either recourse and non-recourse states. But for income, it aligns with the hypotheses of increased income leading to increased consumption in both type of states but less for the recourse states. Again, like the recession and recovery period, although the positive coefficient of overall income elasticity of consumption is statically significant at 1 percent level, the claim of recourse states to have a difference of 0.01 percent less, is not statistically significant and hence I cannot make that claim of these two types of states reacting differently to income changes.

Similar exercise is implemented on more refined samples derived from different matching techniques. Table **??** A and A in appendix reports the results for regressing specifica-

tion (3) on PSM, MDM and CEM samples respectively. The samples drawn using PSM and Malahanobis matching reports similar pattern in the result reported in 4.2. But the sample drawn using CEM gives very different results but still maintains the core pattern of having overall house price and income elasticity of consumption to be positive but no significant difference between recourse and non-recourse states. More details will be added.

5. Conclusion

Consumption being one of the biggest component of national accounting, impacts economy at a large scale and hence one of the focal points of research among economists. This study investigates whether a particular mortgage law i.e. recourse mortgage law which is adopted by some states and not by other, impacts the consumption of those states differently. In other words, whether difference in a certain kind of mortgage law causes the consumers to react differently to income and house price changes. Also, whether these reactions differ during different phases of business cycle.

One significant determinant of consumption is housing wealth channel which is being studied widely and a common practice is to proxy housing wealth with local house price, which again is instrumented to correct for endogeneity and measurement error problems (Mian and Sufi, 2014; Kaplan, Mitman and Violante, 2020; Campbell and Cocco, 2007). In the very recent study of Graham and Makridis, 2018, they compared various widely used instruments and their novel Bartik-instrumetn that they constructed utilizing both the cross-sectional and time-series variation of housing-characteristics. The novel Bartik-like instrument outperformed the other instruments and hence, in this study, I used that Bartik-like instrument for house prices.

As housing wealth channel plays a big role in consumption pattern and also, the mortgage law affects housing wealth itself, my first exercise here is to examine whether this mortgage law affects housing wealth i.e. local house prices differently. If not, then there is not much essence in assuming the consumption to be different in these states as the main channel for this recourse law to affect consumption is through the housing wealth or house prices. I find that house prices vary significantly in recourse and non recourse states which conforms with the current literature (Bao and Ding, 2014) and also across different phases. During the easy credit period, the income elasticity of housing wealth was significantly higher in recourse states indicating the demand pull in the recourse states

mainly stemmed from income increase. Whereas, the pull of demand in non-recourse state was not from higher income, rather other ways including the excess demand from the subprime mortgage borrowers who got access to loan during this period. During the recession and recovery period, house prices fell sharply but in recourse states this fall was much lower compared to non-recourse states. The result also suggests that during the post-crisis period when economy came back to normal, the difference in house price reaction between recourse and non-recourse states minimized with no statistical significance and also, house price growth is tamed at a much lower level than the easy credit period. And also, even in the non-recourse states, the house price growth was explained more by income growth rather than outside excess demand from availability of subprime loan.

These house price results assures the housing wealth channel of recourse law to consumption and then I tested the impact of recourse law on the consumption elasticity of housing wealth (house price) and income. I estimate different specifications at household level controlling for household and county characteristics. I find that for the entire timeline of 2005 to 2016, income elasticity and house price elasticity of income are statistically significant for non-recourse states. Although house price elasticity of consumption in recourse state is not significantly different than non-recourse states, income elasticity of consumption in recourse states are significantly lower than their non-recourse counterpart. This results holds consistent when the timeline is divided in different phases of boom and bust but the difference of recourse and non-recourse states is significant only during the easy credit period.

This work is not complete yet and I am testing this again with more balanced samples that use matching techniques like PSM, MDM and CEM and will update soon. I also plan to instrumentize income to refine the estimates further. Further research on this topic can explore the behavior of durable goods and luxury services where it is more expected to find significant difference between recourse and non-recourse states.

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APPENDIX A: CONSUMPTION GROWTH WITH MATCHED SAMPLES

TABLE A.1
CONSUMPTION GROWTH ON HPI (INSTRUMENTED), INCOME AND OTHER CONTROLS ON PSM SAMPLE

	(1) All	(2) 2005-2006	(3) 2007-2012	(4) 2013-2016
g1_hpi	0.978*	-0.320	-0.00120	0.328
	(2.34)	(-0.18)	(-0.00)	(0.46)
recHPI	0.567	-0.338	-4.241	-0.329
	(1.67)	(-0.12)	(-0.77)	(-0.25)
rec	-0.310	2.411	-9.269	1.868
	(-0.31)	(0.16)	(-0.87)	(0.33)
g1_inc_nielsen	0.0667***	0.0965***	0.0476***	0.0734***
	(9.79)	(5.16)	(5.05)	(6.96)
1.recc.g1_inc_nielsen	-0.0154*	-0.0412*	-0.0122	0.0196
	(-2.14)	(-2.15)	(-1.24)	(1.64)
_cons	20.39***	72.95**	89.22**	43.11***
	(3.32)	(3.09)	(3.10)	(6.42)
Instrument	Yes	Yes	Yes	Yes
Sample	All	All	All	All
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	55529	9092	32901	13536

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

APPENDIX B: FIGURES

TABLE A.2

CONSUMPTION GROWTH ON HPI (INSTRUMENTED), INCOME AND OTHER CONTROLS ON MALAHANOBIS SAMPLE

	(1) All	(2) 2005-2006	(3) 2007-2012	(4) 2013-2016
g1_hpi	0.964*	-0.373	0.0287	0.298
	(2.30)	(-0.21)	(0.02)	(0.42)
recHPI	0.566	-0.516	-3.602	-0.256
	(1.67)	(-0.19)	(-0.67)	(-0.19)
rec	-0.360	3.562	-8.248	1.501
	(-0.36)	(0.23)	(-0.78)	(0.26)
g1_inc_nielsen	0.0665***	0.0962***	0.0463***	0.0737***
	(9.77)	(5.12)	(4.95)	(6.99)
1.recc.g1_inc_nielsen	-0.0156*	-0.0411*	-0.0116	0.0180
	(-2.16)	(-2.14)	(-1.19)	(1.51)
_cons	20.89***	73.62**	88.53**	43.80***
	(3.40)	(3.07)	(3.15)	(6.48)
Instrument	Yes	Yes	Yes	Yes
Sample	All	All	All	All
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	55317	9062	32767	13488

t statistics in parentheses

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

TABLE A.3

CONSUMPTION GROWTH ON HPI (INSTRUMENTED), INCOME AND OTHER CONTROLS ON CEM SAMPLE

	(1) All	(2) 2005-2006	(3) 2007-2012	(4) 2013-2016
g1_hpi	0.692	0.201	-0.369	5.071***
	(1.73)	(0.41)	(-0.74)	(3.44)
recHPI	0.0429	0.847	-1.387	-1.726
	(0.10)	(1.09)	(-0.25)	(-0.34)
rec	-0.106	-7.789	-1.065	8.092
	(-0.09)	(-1.31)	(-0.08)	(0.38)
g1_inc_nielsen	0.0530***	0.226***	0.0243	0.285**
	(3.63)	(4.73)	(1.80)	(3.15)
1.recc.g1_inc_nielsen	0.0109	-0.0994	0.0420**	-0.243**
	(0.69)	(-1.95)	(2.93)	(-2.61)
_cons	24.63	31.35	28.60	-22.44
	(1.20)	(0.88)	(1.01)	(-0.35)
Instrument	Yes	Yes	Yes	Yes
Sample	All	All	All	All
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	5077	1092	2986	999

t statistics in parentheses

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

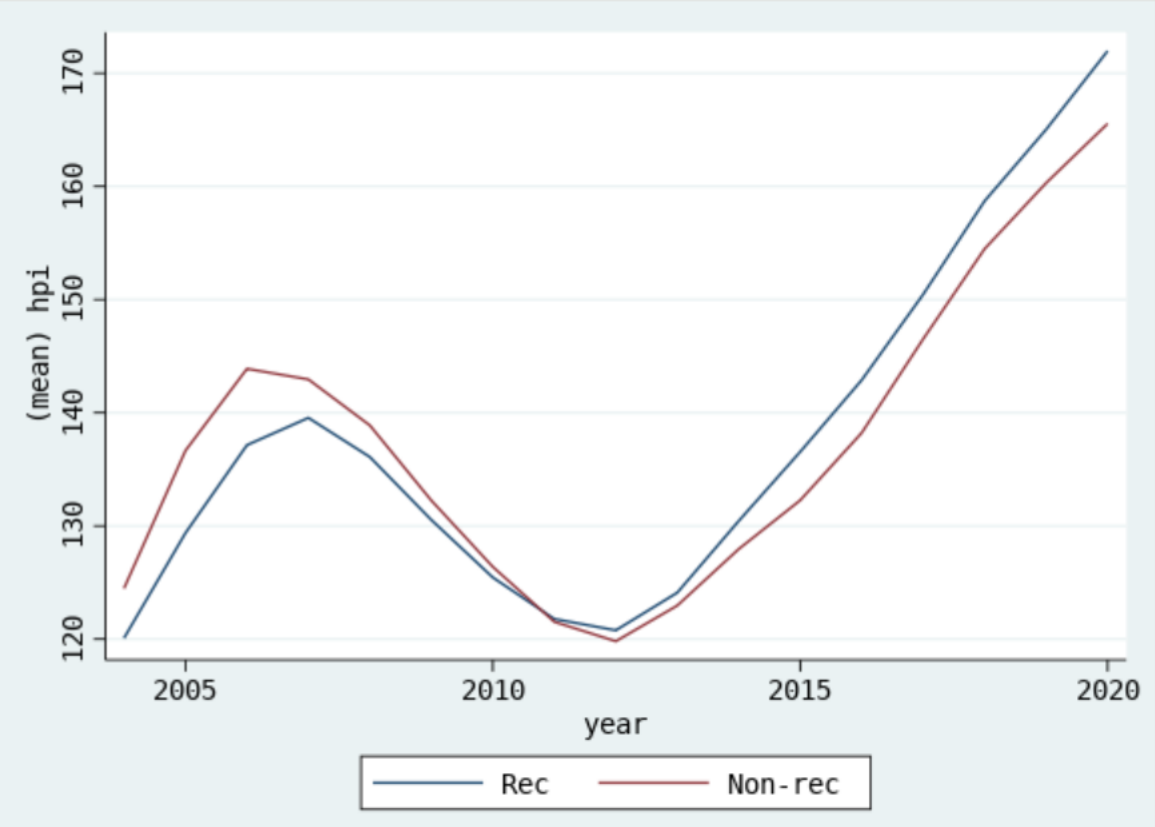

FIGURE B.1
HOUSE PRICE IN RECOURSE AND NON-RECOURSE STATES

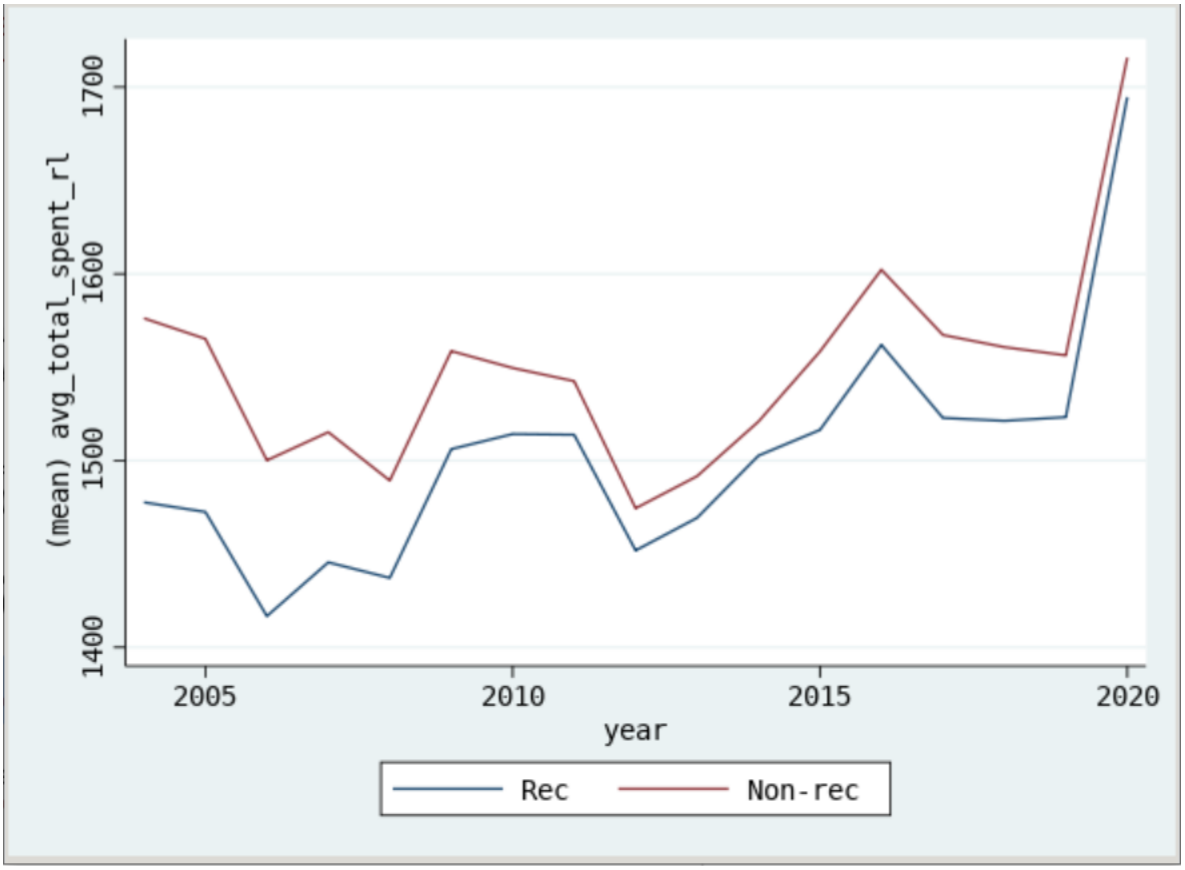

FIGURE B.2
TOTAL CONSUMPTION IN RECOURSE AND NON-RECOURSE STATES

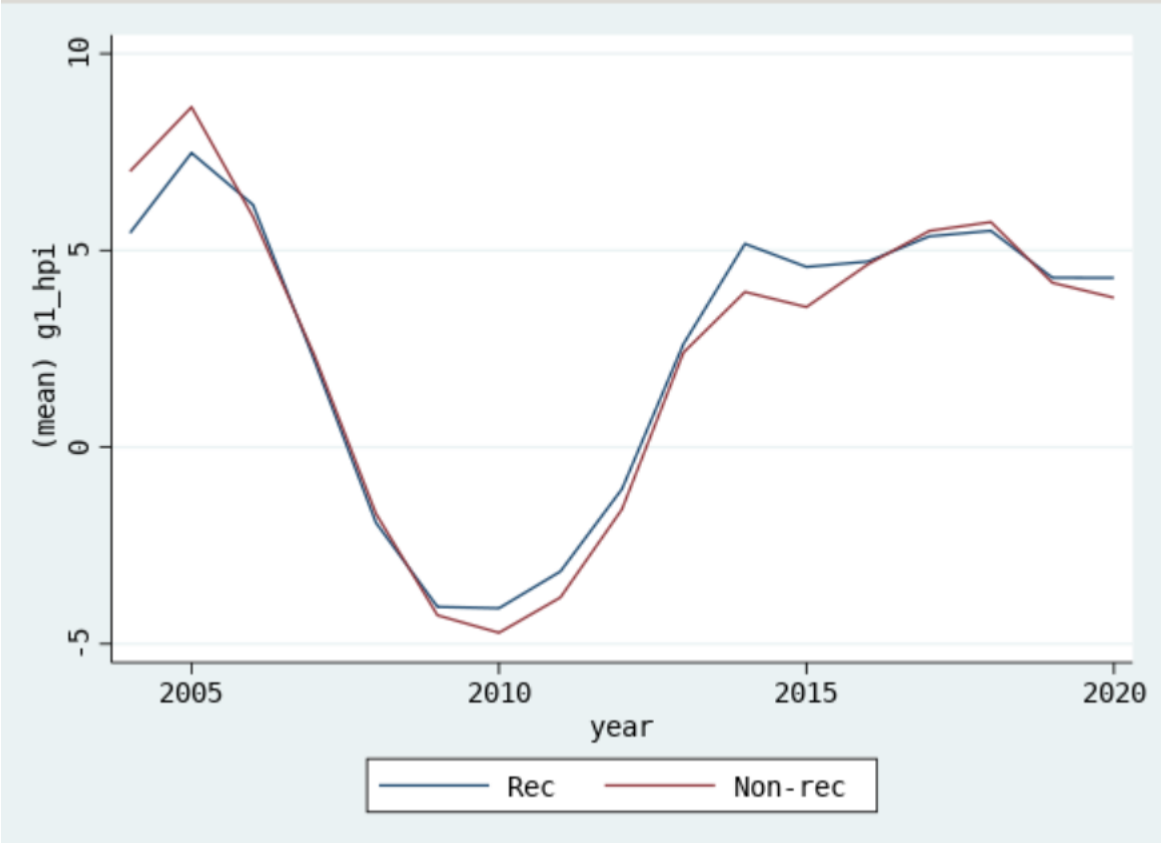

FIGURE B.3
HOUSE PRICE GROWTH IN RECOURSE AND NON-RECOURSE STATES

FIGURE B.4
CONSUMPTION GROWTH IN RECOURSE AND NON-RECOURSE STATES