HOUSEHOLD DEBT, CONSUMPTION COMMITMENTS AND LABOR SUPPLY: WORKING MORE TO PAY THE MORTGAGE

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Abstract

This paper analyzes how a change in the size of mortgage payment affects household’s labor supply. Using income tax data for the universe of Polish population and exploiting variation in floating-rate mortgage payments driven by interbank rates fluctuations, I show that an increase in payment induces households to work and earn more. Higher income covers 30-45% of the increase in payment. The effect increases with households’ debt-to-income ratio, is higher for more flexible income sources and is accompanied by a decrease in proxies for consumption expenditures. The effect is driven by several mechanisms: spousal labor supply, change of job and additional income from after-hours work. Consistent with a model of labor decisions with consumption commitments, but contrary to other mechanisms such as debt overhang, household debt can increase labor supply.

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1 Introduction

Debt is an important element of households’ budgets which can have a significant impact on the whole economy. Two features contribute to its importance. First, it is large. Household debt exceeds 60% of GDP in developed countries and for many households mortgage payment is the single biggest expenditure in their budget\(^1\). Second, it is a commitment. Because bankruptcy costs make debt difficult to adjust, its evolution influences households’ behavior in other spheres, such as consumption (Chetty and Szeidl, 2016; Mian et al., 2013; Di Maggio et al., 2017) or employment.

This paper studies the relationship between household debt and labor supply - an important channel through which household debt and real economy interact, which has received limited attention so far. I show that an exogenous increase in mortgage payments leads households to work and earn more. The magnitude of this effect is substantial: 30-45% of the increase in payment is covered with the increase in income. The effect is higher for households with higher payments, more pronounced for more flexible sources of income and driven by several mechanisms, including spousal labor supply, change of job or additional after-hours work.

The result I am identifying is a combination of wealth effect and liquidity effect and can be interpreted through the consumption commitment model as in Chetty and Szeidl (2007). An increase in mortgage payment increases the price of consumption and reduces household’s wealth, which generically leads both to a drop in consumption and an increase in labor supply. But the commitment nature of mortgage payment makes adjusting the consumption more difficult, creating the liquidity effect and increasing the importance of labor supply response.

This mechanism captures an intuitive idea that people work harder when they want to avoid missing their obligations and is consistent with multiple stylized facts: more indebted households work more hours per week, delay retirement, are less likely to quit a job and are faster to find a new job when unemployed (see Appendix Figures 7.4, 7.5 and 7.6). The mechanism can also be considered a household finance analogy of Jensen (1986) free cash flows result. Jensen’s mechanism operates in corporate finance world through reduced agency problem, while the mechanism in this paper operates through the increase in effort, but both suggest that debt leads to higher income or profits. This is in contrast to alternative mechanisms, such as debt overhang (both for firms and households; Melzer, 2017) or house lock-in (Brown and Matsa, 2016), which predict that debt leads to lower income or profits.

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\(^1\)Share in GDP figure from IMF (2017). Total household debt in the United States amounts now to more than $13.5 trillion, exceeding the peak levels from 2008. On average, household debt service payments amount to 10% of disposable income (St Louis FED data). According to CEX survey, housing is the largest component of consumer spending.
I conduct the analysis in the context of mortgage market in Poland, using administrative income tax data for the universe of Polish population. There are two main advantages of this setup. First, mortgage market in Poland is dominated by floating-rate loans which provides an opportunity to use variation in mortgage payments driven by changes in reference rates of the loan. This variation could be large: in my data mortgage payments change by more than 50% in 2 years. Second, consumer bankruptcy in Poland is rare because of strong recourse laws, which allows me to disregard bankruptcy considerations.

I use changes in the interbank lending rate (WIBOR) as shocks to the size of payments for preexisting mortgages. Households decided to take on a mortgage in the past and chose its size. Later, however, due to changes in interbank lending rates, their mortgage payment changes. If it increases, households need to adjust to tighter budget constraint, and one possible way to do it is through the increase in income.

The main result of the paper is the positive effect of debt payments on labor income, which I interpret as the effect on labor supply. This effect is substantial - between 30-45% of the increase in mortgage payment is covered with increased labor income. My basic specification regresses household’s income on the size of the mortgage payment, controlling for household and year fixed effects as well as for age- and previous year income bin fixed effects. I compare how income of mortgage holders varies across years together with the size of their payment, using households without a mortgage as a control group. This basic specification is further enriched by using Instrumental Variable approach and including a rich set of control variables.

Consumption commitment framework predicts that the strength of the labor supply effect will depend on the size of consumption commitment and on the relative magnitude of adjustment costs for consumption and labor income. Consistent with these predictions, I document a clear pattern of heterogeneity with respect to payment-to-income ratio (PTI). The increase in income after the increase in mortgage payment is monotonic in PTI and varies from essentially zero for households with low PTI to over twice the size of average effect for those with large PTI. This heterogeneity pattern suggests that adjustment of labor supply is more important for relatively large mortgages, where responding to higher payments through reduced consumption may be very costly or not feasible.

The size of the effect varies also by income type. The relative increase of income from self-employment is 35% higher than the increase of wages, which reflects greater ability of the self-employed to benefit from adjusting labor supply. Nonetheless, the effect among wage-earners is also significant and sizable and I identify several mechanisms which shed light on the ways in

\footnote{Other countries where floating-rate mortgages are strongly dominant include Spain, Australia or Ireland and most countries in Europe have a large share of floating-rate mortgages (e.g. about half in the United Kingdom).}
which this adjustment takes place. The change in pension income is not significant, which can be thought of as a placebo check for the validity of the specification.

What is the mechanism for the income increase? I construct several proxies for additional labor market activities and show that they contribute to the observed effect. First, households whose mortgage payments increase are more likely to change jobs and their new position is more likely to be in a different town than where they live. This suggests that when individuals face higher mortgage payments, they are more likely to take a higher-paying job which they might have previously rejected because of negative compensating differentials (e.g. long commute). Second, higher interests increase the probability that households receive a supplementary income from additional income-bearing gigs. Third, exploiting the fact that my data allows me to observe couples who file taxes jointly, I document a significant effect of spousal labor supply channel: households are more likely to become dual-earner household after their mortgage payment increases. This set of mechanisms is not exhaustive. While I do not observe effort and hours worked, I expect that their increase also contributes to the observed income effect, in particular for households with more flexible sources of income (self-employment, piece rate compensation).

After analyzing the labor supply response, I study the impact of debt payment on other related outcomes. Using information on tax deductions for selected types of consumption and savings (charitable donations, private pension contributions, expenses on broadband internet), I show that they decrease following the increase in mortgage payment. While these measures do not represent overall household consumption, the results are consistent with the fact that consumption and savings adjustment is another way in which households respond to higher debt payments. I also analyze households’ propensity to become self-employed and show that it modestly decreases following the increase in mortgage payment, supporting the hypothesis that debt may suppress entrepreneurship.

My analysis includes several attempts to address the endogeneity concerns which arise in this setup. Because variation in mortgage payment is partially endogenous, due to possible prepayment and refinancing, I instrument payment size with interbank lending rate level (WIBOR) interacted with an indicator for mortgage or with a measure of mortgage size. The IV specification shows an effect which is similar to OLS estimate, suggesting that the reverse causality is not driving the results. A potential concern is also related to omitted variables. My identifying assumption is that, conditional on individual’s age and previous year household income, the effect of interest rates on household income is not systematically related to mortgage size except through the size of the payment. The key threat to validity of this assumption is that mortgage holders may have incomes which are differently sensitive to macroeconomic fluctuations and
merely happen to be higher in the years with high interest rates. But if that were the case, we would expect high interest rates also leading to higher consumption and savings for mortgage holders. I show that the opposite is true - consumption and savings of mortgage holders are lower in years with high interest rates, suggesting that different sensitivity to macroeconomic conditions is not driving the results.

My findings have several implications for public policy and for understanding of the economic mechanisms related to household debt and consumption commitments. Some existing studies show that household debt can depress labor supply through debt overhang effect (Bernstein, 2018; Donaldson et al., 2019). My findings suggest that debt can have the opposite effect and the existence of debt payments leads to higher labor supply. In reality, both positive and negative impact of debt on labor supply can coexist and their relative importance depends on the strength of recourse laws, labor market conditions and types of jobs under consideration. When designing programs aimed at helping distressed borrowers, optimal policy could involve directing resources to households with limited ability to increase income or structuring programs in ways which provide incentives to increase labor supply. The labor supply incentives should also be taken into consideration when designing bankruptcy laws or rules regarding the recourse. This consideration is important not only for mortgages but also for student loans, which may have even larger labor market implications. In addition, my findings have implications for the methods of risk assessment which banks and other institutions use when issuing the loan. The fact that labor income reaction is an important method of adjustment to tightened budget constraint suggests that ability to adjust income should be an important factor determining credit-worthiness of a potential borrower.

Other related papers include Di Maggio et al. (2017), which analyzes the reaction of consumption to the change in mortgage payments and shows that when the payment decreases, households pay off their other debt and increase debt-financed consumption of durables. Contrary to that paper, my analysis focuses on labor supply response to changes in mortgage payments, although I also show an evidence of consumption and savings drop, consistent with their findings. The theoretical relationship between mortgages and labor supply is analyzed by Bottazzi et al. (2007). Empirically, papers by Fortin (1995) and Del Boca and Lusardi (2003) show that women are more likely to work when their household has a mortgage, while the study of Bednarzik et al. (2017) shows that indebted individuals return to work faster after job dis-

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3In my setting, in the case of default the borrower remains liable for the portion of debt remaining after seizure and sale of the house. Moreover, throughout the analyzed period Polish economy was continuously growing and the labor market was healthy.
4Brown and Matsa (2016) show that indebted households apply for more local jobs, but fewer positions outside of their commuting zone.
placement. Rothstein and Rouse (2011) analyze student loans and show that higher debt leads students to choose higher-salary jobs.

This paper contributes also to the literature on the relationship between consumption and labor income, especially in the presence of consumption commitments. While it is generally recognized that the link between consumption and labor supply can go in both directions (Heckman, 1974), the existing literature focuses on analyzing how income shocks affect consumption adjustment (Jappelli and Pistaferri, 2010). I show the causal effect in the other direction: shocks to the consumption prices can affect labor supply and thus income. The income response is a mechanism through which households can smooth their consumption, contributing to widely documented “excess smoothness” (Blundell et al., 2016). This effect is most evident when analyzing change in prices for a category of expenditures which is large and has high adjustment costs. While mortgage payment is a prime example of such category, many other expenditures can have these characteristics (e.g. child care). The approach taken in this paper can also be interpreted as studying elasticity of labor supply with respect to consumption prices. If the consumption truly cannot be changed, this is analogous to studying the elasticity of labor supply with respect to wealth or unearned income (Imbens et al., 2001; Deshpande, 2016; Cesarini et al., 2017).

2 Data and Institutional Details

2.1 Data Source

This paper uses administrative data on the universe of income tax declarations in Poland in 2005-2015. Because every person receiving income in a given year is required to file a tax declaration, the data is very rich and contains almost the entire adult population of Poland. This is the first paper which uses the entire population of this data set. The data is confidential and has been anonymized so that it is impossible to identify any single person. However, every

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5Chetty and Saeid (2007) discuss how consumption commitments can explain added worker effect, i.e. the labor supply response of spouse to the loss of job by the primary earner.

6I simplify the exposition by referring to debt payments as consumption. While technically debt payments are not consumption, the debt-financed purchases are. We can therefore think about increases in mortgage payments as increases in the cost of housing.

7Debt-financed consumption is likely to involve commitment by the very nature of debt, i.e. the fact that it is a way to pay for consumption which already took place. In the most stark example, student loan is a way of paying for consumption which cannot be adjusted, since an individual cannot go back in time and change its education.

8Kopczuk (2012), who analyzes the effects of business tax reform on income and tax revenues, is another paper which uses micro data from the same source. However, he only analyzes a subsample of all the taxpayers.
individual in the data has its unique, synthetic identifier which allows for following people over
time.

The data is based on the income tax declarations filled by individuals every year, usually
in March-April of the following year. Employers send tax forms with income information to
their employees and to the Tax Administration. Employees use the forms they receive to fill
tax declarations where they include their total income, amount of taxes already withheld and
deductions they would like to apply. These declarations are later send to the Tax Administration
who processes them, making returns or requesting payments. Because the tax is normally
withheld at source (by employers), a typical taxpayer receives a modest return. Even though
taxpayers declare their incomes themselves, the Tax Administration has employer records to
validate the declarations and hence the measure of income is highly reliable. The amount of tax
evasion in Poland, as proxied by the size of shadow economy (see Medina and Schneider, 2017),
is fairly similar to countries like Spain or Norway (share of shadow economy in GDP around
20%) and slightly larger compared to Germany or France (around 15%).

2.2 Mortgage Tax Deduction

I identify mortgage holders using information about their mortgage interests tax deduction. I
observe the amount of interests deducted every year and hence can follow the evolution of the size
of mortgage payment (since interests are the only stochastic part of the payment). Until 2006\textsuperscript{9}
households who purchased a new house or apartment and financed it with a mortgage could
start deducting interests on this mortgage from their taxable income. In 2007 the deduction
was abolished\textsuperscript{10} but households who started deducting interests earlier were allowed to keep
the right to deduct them until the end of their mortgage contract. Therefore, if a household
originated a mortgage and started deducting interests e.g. in 2002, they keep the right to
deduct throughout the entire life of the mortgage (usually 25-30 years) and I am able to observe
the amount deducted in the whole period of my data (and hence I identify them as mortgage
holders). However, if a household originated a mortgage in 2007, they are not allowed to use
the deduction and in my data I do not identify them as mortgage holders.

\textsuperscript{9}The law introducing the deduction went into effect in 2002, so only mortgages originated in 2002 or later
are covered. However, before 2002 standard mortgage contracts were less popular in Poland since memberships
in building societies were common way of house acquisition. Also, before 2002 different tax deductions could be
used for housing-related expenses.

\textsuperscript{10}The official reason for abolishing the deduction is related to the incompatibility of the law with the rules
of European Union (which Poland joined in 2004). However, the fact that the law was abolished instead of
being just slightly modified suggests that budgetary reasons were an important motivation. Interestingly, public
discussion and opposition to abolishing the deduction was very limited.
As a result, I identify a near-universe of households who had a mortgage in 2006 (while households did not have to use the deduction, there were no incentive not to do so), which means that my control group contains households with a mortgage originated after 2006. While blurring the difference between the treatment and control, this classification is convenient because at the time of large interest rate changes - which are the shocks which I want to exploit - all the mortgages are preexisting. I can therefore abstract from the problem of mortgage origination endogenously responding to the level of interest rate. Notice that identifying only a subset of all mortgage holders biases my results towards zero. That is, if an increase in mortgage payment increases labor supply, my estimate will be biased downwards because part of the control group consists of households who have mortgages and also increased their labor supply. In practice, however, this problem should not be very severe since mortgage holders form less than 20% of the control group (see the statistics for the entire mortgage market in Poland in AMRON, 2015).

The amount of interest deducted is declared by the household based on the documentation received from the bank. While this documentation is not sent to the Tax Office with the tax declaration, it should be archived for at least 5 years for the purposes of potential tax audit. There is no limit on the amount of interests which can be deducted but there is a time-varying limit on the size of the mortgage which is covered by the deduction. Most of the mortgages are below the cap but for some the limit might be binding. As a result, in some cases I see true interests paid by the households, but in other cases the amount in tax declaration is proportional to the true interests, but smaller. For example, for a cap of 300 thousand zlotys and a mortgage of 600 thousand zlotys, the household is allowed to deduct half of their interests. This feature, while not critical for the analysis, needs to be taken into account when interpreting the magnitudes.

2.3 Mortgage and Labor Markets in Poland

Vast majority of mortgages in Poland have floating interest rate (only 0.2% of all mortgages in 2016 had fixed interest rate). Strong dominance of floating-rate mortgages is not unique for Poland. Other countries where floating-rate mortgages are strongly dominant include Spain, Australia or Ireland and most countries in Europe have a large share of floating-rate mortgages (e.g. about half in the United Kingdom). In a typical mortgage contract in Poland interest rate is defined as reference rate (usually 3-month Warsaw Interbank Offer Rate, WIBOR) plus a fixed markup. There is no initial period during which the rate is fixed. When the reference rate changes, so does interest rate of the mortgage (not continuously, however; while reference
rate changes daily, most banks update mortgage rates once in 3-6 months; some banks may not change the rate if the reference rate did not change significantly). Therefore, the variability in reference rate leads to changes in monthly mortgage payments. Mortgage’s length can vary but most of the borrowers have 25-30 year contracts.

There are few other characteristics of Polish mortgage market which are important for interpreting my results. Refinancing is very rare because the main motivation to refinance - to benefit from a decrease in interest rates - is not relevant, as mortgage payments automatically incorporate changes in the interest rate. Only around 3-4% of mortgages are refinanced, usually when the situation of the borrower significantly changes. While there is no exact data on prepayment, it is also a rare event. All mortgages in Poland are recourse loans which means that borrower still has to pay back the rest of the debt when the house is foreclosed and revenue from its sale is not enough to cover total liability. Therefore there are no strategic bankruptcies and consumer bankruptcy, while possible, is rare in general. Around 2% of mortgages have delays in payments of more than 30 days, substantially less than 3.7% delinquent loans in the US. Another characteristic of Polish mortgage market is its currency composition. Large fraction (while the exact data for this time period is not available, I estimate it to be around 25%) of mortgages are denominated in foreign currency, mostly Swiss Franc or Euro. This is not unique to Poland (large share of Swiss Franc mortgages existed also in Hungary, Iceland or Croatia) and is caused by the difference in interest rates between the currencies. I do not observe currency in my data and hence I will treat all mortgages as if they were denominated in Polish Zloty. If anything, this should introduce additional noise to my analysis, biasing the coefficients towards zero. However, as shown in the Appendix Figure 7.2, the evolution of WIBOR and exchange rate adjusted LIBOR is closely related and hence variation in WIBOR can be a proxy for changes in LIBOR-based payments as well.

Labor market institutions in Poland are similar to other European countries. The dominant type of contract is permanent employment which usually features 40-hour work week. However, average Polish worker works around 1950 hours per year, significantly more than a worker in Germany (1400 hours) and even United States (1800 hours) and hence popularity of overtime or side jobs might be higher than elsewhere. The personal income tax rates have been 18% and 32% throughout most of the analyzed period, on top of social security contributions. In total, employees typically take home around 70% of their gross salary and 60% of the total cost to the employer. Unemployment rate throughout most of the analyzed period was between 9% and 12%. The unemployment was to large extent driven by rural areas (where mortgages are significantly less popular) and hence unemployment faced by my treatment group was significantly lower. Importantly, the entire analyzed period was a period of economic growth and
relievly healthy labor market. Poland was the only member of European Union which did not experience recession as an aftermath of the financial crisis. Due to healthy financial system, no construction boom in the previous years and large demand for infrastructural investments, every quarter in the analyzed period had positive GDP growth. While unemployment hit the lows in 2008 and it increased slightly afterwards, the change was small (from 9 to 10-11%) compared to other European countries (e.g. in Spain unemployment went up from around 10% to 20-25%). As a result, in the entire analyzed period both nominal and real incomes were growing, as illustrated in Figure 7.1 in the Appendix.

2.4 Sample Construction

I limit the sample to individuals who are observed in the entire analyzed period. The treatment group includes persons who are identified as mortgage holders and the control group contains the rest of the population. To better tailor the control to the treatment group, I drop all people born before 1946 or after 1986, who were either too old or too young to be a potential mortgage holder in 2006. My final data set is strongly balanced panel with 9.9 million individuals and over 100 million observations. The data has yearly frequency and contains information on income (separately from different sources, e.g. wages, pensions, business income) and tax deductions, together with several control variables like sex, year of birth and area of residence (roughly corresponding to the county level). I do not have information on employers nor hours worked. For self-employed, I observe their industry classification.

There are over 160 thousands of individuals identified as mortgage holders but I drop those individuals whose interests deductions time series seems incomplete, i.e. interests bounce back and forth between zero and positive value. This has minor effect on the data: there are 156 thousands of mortgage holders in the final sample. Mortgage holders are younger than the control group and their income is higher. Hence, on top of individual fixed effects, I include age and previous year income in my regression analysis. The summary statistics are presented in Table 6 in the Appendix.

3 Methods

3.1 Relevant Model of Individual Behavior

The goal of this paper is to identify and measure the importance of the following mechanism: when the mortgage payment increases, households cover part of this increase by increasing
labor supply. There are two theoretical approaches which can be used to understand this effect: budget constraint effect and consumption commitment effect.

The budget constraint effect can be illustrated in a very basic model of individual behavior. Suppose that an individual chooses labor supply and consumption bundle, given wages, prices and preferences over leisure. Suppose also, that individual’s consumption includes mortgage payment. An exogenous increase in the size of mortgage payment can be interpreted as an increase in the price of consumption, which tightens the budget constraint. Household can respond in two ways (ignoring possibility of bankruptcy and additional borrowing): increase labor supply or reduce consumption. In the generic case individual will do both and hence there will be a non-zero effect of debt on labor supply. In this simple model, debt is just a standard consumption - higher mortgage payments make individual poorer for any given level of labor and hence increase labor supply.

A more sophisticated model, which captures the specific characteristics of debt contracts, can be constructed based on the approach of Chetty and Szeidl (2007). Debt can be interpreted as consumption commitment, i.e. a part of consumption which can be adjusted only after paying a cost. This is particularly true for mortgages: reducing mortgage payment on an intensive margin is virtually impossible (while household can try to renegotiate with the bank, it is rather uncommon for individual borrowers) and extensive margin adjustment, that is stopping to pay the mortgage, is costly. It would either require selling a house, repaying the debt and buying another, cheaper house (which presumably requires another mortgage) or declaring the bankruptcy. Both of these are costly processes which households may prefer to avoid.

In such a setting, Chetty and Szeidl (2007) show that in the presence of consumption commitment income responds more strongly to negative shocks to household wealth. One could perform similar analysis in which instead of exogenously changing wealth, one exogenously increases debt payments. The implications remain the same: consumption commitment leads to larger income reaction (compared to the scenario in which debt is not a commitment, i.e. there are no adjustment costs). This is the exercise performed in this paper: I analyze the labor response to the exogenous increase in the debt payment. Consistent with Chetty and Szeidl results, I find that income responds positively to these shocks.

Another implications of Chetty and Szeidl (2007) relates consumption commitment and risk aversion. Individuals with debt will be more risk averse with respect to moderate-stake gambles. This can have important implications for the effect of debt on entrepreneurship - commitment to debt payments may lower propensity to become an entrepreneur. Another approach to this problem, explicitly modeling the relationship of homeownership, debt and entrepreneurship, is presented in Bracke et al. (2013). While this is not the main focus of this paper, I briefly
investigate this relationship in subsection 6.2.

3.2 Empirical Methodology

The goal of the empirical analysis is to check whether within-household variation in the size of mortgage payments causes changes in household income. That is, do households cover part of the increase in mortgage payment by increasing labor income? Do they reduce their income if the mortgage payment goes down? A framework to address this question would use exogenous, within-household variation in the interests paid and include additional variables which may determine changes in household income. My main specification is therefore FE panel estimation with interests instrumented with reference rate variation multiplied by the mortgage size (size of exposure).

\[ Y_{i,t} = \alpha \cdot (Interests_{i,t} = WIBOR_t \cdot X_{Exposure_i}) + \sum_{t=2005}^{2015} Year_t + \mu_i + \beta X_{i,t} + \epsilon_{i,t} \]

The main explanatory variable is the amount of interests paid in year \( t \). While interests are only one part of total mortgage payment, they capture the entire non-deterministic variation in the payment (since capital payments are set in advance) and constitute often more than a half of the entire payment in the initial few years. In the basic panel regression I directly include interests which I observe in the data. To deal with potential endogeneity concerns (e.g. refinancing the loan), I instrument the interests with reference rate multiplied by a measure of exposure: an indicator for paying any mortgage or such indicator multiplied by a proxy for mortgage size.

The main specification controls for time dummies \( Year_t \), previous income (included as income bin fixed effects; width of bin in the basic specification is 10k zloty), age and individual fixed effects \( \mu_i \). Additional specifications introduce interaction of previous income quintile and year fixed effects, as well as time trends specific to age, income groups and local area. Outcome variable \( Y_{i,t} \) is a measure of household income: the default is gross income but I also use additional measures such as wages, pension or business income. The economic mechanism I am trying to analyze suggest that appropriate specification involves variables in levels, not logarithms: I expect absolute income increase to be proportional to interest increase (because the extra income is supposed to cover an increase in interests) as opposed to relative change in income being proportional to change in interests. However, in robustness analysis I also include specification in logs. Income and interests payments are measured at family level since
couples file taxes jointly and they claim only one tax deduction. The sample contains individual-level observations and my main results are obtained with weights of 0.5 for 2-person household observations. Standard errors are clustered on the household level.

I am trying to capture the following mechanism: in years in which household is paying high interests, I expect their income to be higher because household increases labor supply to cover additional expenses. In a perfectly flexible world we would expect that one additional unit of interests increases income by a fraction of unit. In practice, however, it is possible that due to labor market inflexibility households must increase income more than interests payments would require (e.g. to meet mortgage payments individual needs to work in a second job which does not have flexible hours). The effect may therefore be larger than the increase in the payment. On the other hand, it is entirely possible that households cover the entire increase in the mortgage payment via reduction of consumption or savings (or by additional borrowing), which means that the effect on income is zero.

3.3 Identifying Variation

Because all regressions include individual fixed effects, the entire identifying variation comes from time-variation in interests paid by the household. Conditional on paying interests in a given year, this variation reflects mostly fluctuations in the reference rate, usually WIBOR 3M (Warsaw Interbank Offer Rate for 3 months). Figure 3.1 shows that there is a strong relationship between average level of interests in the data and WIBOR rate. The relationship is not perfect for several reasons: interest payments consists of reference rate and fixed markup, banks adjust contract rate with some delays or do not adjust them at all if the changes are too small, some mortgages are denominated in foreign currencies and use LIBOR rate, etc. Nevertheless, the graph clearly shows that WIBOR rate is an important driver of interests payments (I later provide more formal regression-based evidence for the strong relationship between WIBOR and interests variable). Moreover, the magnitude of changes is large. Between 2006 and 2008 interests increased by over 40% and they went down again by almost 50% between 2008 and 2010. The distribution of interests payments in 2008 and 2015 is shown in Figure 7.3, illustrating both the large changes in interest payments across years as well as substantial cross-sectional variation in exposure.

Reference rates are influenced by macroeconomic conditions such as National Bank of Poland interest rates, foreign exchange rates, and international money market situation. Of course these factors cannot be affected by individual household and hence from household perspective reference rate change is an exogenous shock to the size of their mortgage payment. While
National Bank of Poland sets interest rates taking into account macroeconomic situation, Poland is a small open economy and the interests rates are to large extent driven by international conditions (see Appendix Figure 7.2 for comparison of payments for WIBOR-based mortgage in Polish zloty and LIBOR-based mortgage in Swiss franc).

Value of interests shown in Figure 3.1 is corrected for the payment-schedule factor: each subsequent payment consists of higher share of capital and lower share of interests, due to the fact the capital is being gradually paid back and hence interests are calculated out of lower base. However, while interests decrease due to this mechanism, capital part of the payment increases for most mortgages and hence household does not face lower payment. Therefore this part of variation in interests is not useful for my analysis and hence the correction is appropriate. The adjustment is small and ranges from 1.5% to 3% of total interests.

![Figure 3.1: Average Mortgage Interests in the Data and WIBOR Rate.](image)

The solid line is the average value of interests deducted by all mortgage holders using the deduction in a given year. Dashed line is the yearly average of end-of-month 3-month Warsaw Interbank Offer Rate which is the typical reference rate for mortgage denominated in Polish zloty. Average interests rates are corrected by payment-schedule factor: since in typical mortgage with fixed monthly installment interests decrease in every month, I correct interests observed in the data by the scheduled factor calculated for mortgage originated for 25 years in 2004 with 3% markup and WIBOR 3M reference rate. The size of correction varies from 1.5% to 3%, depending on the year (notice that this mechanism leads to lower interests in subsequent periods but not to lower payment - interests part of the payment decreases but capital part increases accordingly).

While most of the variation in interests paid is caused by the movements of reference rate, it
is possible that some variation is related to household decisions. For example, when household member loses job, bank may sometimes allow for suspending debt payments for a couple of months. Alternatively, when household increases its income e.g. because of getting better paid and more stable job, it may decide to refinance the mortgage and receive lower rate due to being now less risky borrower. While all these factors seem to be rarely playing a role and there is no clear indication in which direction they would bias the result, they do cast some doubt on the exogeneity of the amount of interests.

To alleviate these concerns and explicitly use only the variation from reference rate I use instrumental variable strategy. I instrument interests paid with WIBOR 3M rate, which is the most common reference rate for mortgages in Poland, multiplied by the mortgage size or mortgage presence indicator. While I do not observe the mortgage size directly, I use the average interest payment as a proxy. In fact, size of interests paid is probably better predictor of the exposure than the size of the mortgage. The identifying assumption is that the influence of macroeconomic situation captured by WIBOR, after controlling for age and previous year’s income, does not depend on the presence and size of the mortgage except through the size of mortgage payment. This assumption, while reasonable, is clearly not innocuous. What it precludes is that mortgage holders are more reactive to interest rate changes and that within mortgage holders group people with larger mortgage are more reactive than those with smaller mortgages. The rationale for the assumption is that there is no direct link between mortgage status and individual’s job. Mortgage holders are hardly a very special group - it is common to have a mortgage and while there are demographic and income-level differences between mortgage holders and overall population (since purchasing a house is a decision usually made by young adults who are relatively well off), after controlling for these effects mortgage holders should not stand out as unique.

Nonetheless, to support the identifying assumption, I present results which suggests that macroeconomic considerations are not driving my results. I look at the patterns of consumption proxies and show that they move in the opposite direction than income. If the effects were due to different exposure to macroeconomic conditions, we would expect that income and consumption go in the same direction. However, if the observed effect is due to responding to higher mortgage payments, we should expect income and other consumption to go in opposite directions, which indeed is the case. I also look at the heterogeneity of the effect with respect to debt-to-income ratio and observe a clear monotone pattern, which would not to be expected if the effect was due to macroeconomic factors.
3.4 Endogeneity of Exposure

It is clear that households make a rational choice about the size of a mortgage and whether or not to get mortgage at all. When making this decision, the expectation about household’s income stream is one of the key variables taken into account. I now discuss the implications of this potential endogeneity of the size of the exposure.

There are two elements of this potential concern. The first one is understanding whether observed effect can be generalized to the whole population. Suppose that we observe that mortgage holders increase income when their debt payment increases. If we randomly allocated debt in the entire population, should we observe the same reaction to the increased debt payments? Not necessarily, because people self-select into having a mortgage and may do so on the basis of their earnings upside potential. For example, a household considering taking a mortgage may rationally expect that payment may increase in the future, if the interest rates go up. If household members have limited possibilities of increasing earnings in case of payment increase, they may decide not to get the mortgage. This self-selection issue means that the results may not generalize to the whole population, even if we ignore demographic differences between mortgage holders and rest of the population. The results obtained in this paper should be understood as effects observed in the population of mortgage holders. However, mortgage holders are large and important group and sheer size of mortgage balance sheets makes it important for the overall economy.

The second concern is related to the causal interpretation of the results. If the exposure is not randomly assigned but chosen by a household, can we interpret the results as the effect of debt on labor supply? If the choice of mortgage and its size is driven by some unobserved characteristics, such as expectations of high earnings growth, is not mortgage just a proxy for these characteristics? While this concern can be to some extent valid, its severity is greatly reduced by features of my analysis. All mortgages in my data are preexisting at the time of shock: a typical scenario is a household who decides to originate a mortgage in 2004, makes the payments for 4 years and in 2008 sees large increase in their payment. Of course it is theoretically possible that when choosing their mortgage 4 years earlier, the household had expected the increase in payment in 4 years and increase in their income in 4 years but this simple expectation story does not seem plausible (and it is very unlikely that the timing of the increase in payments and incomes would be the same, a feature which I am going to investigate). What is more likely is that household had a sophisticated belief about their earnings are sensitive and to macroeconomic conditions. While I am not able to fully rule out this possibility, it does not seem very plausible given that the shock in interest rates in a small open economy does not
always have clear relationship to conditions relevant for labor market (large part of movement in interest rates is related to international financial markets but while most of Europe saw large GDP and employment drops during the last recession, Poland had no single quarter during which GDP decreased).

4 Results - Labor Supply

4.1 Main Results

The main result of the paper is presented in Table 1 which shows that an increase in interests paid by the household is associated with higher income. Basic specification in column 1 shows that 1 zloty increase in interests deducted leads to income higher by 0.55 zloty. Column 2 includes additional controls: age- and income-group fixed effects. I control for the previous year income in a non-parametric way, including indicator for 10 thousand zloty bins in the regression. I use 20 bins and incomes above 200 thousand zlotys are grouped in the last bin. In columns 3 and 4 instrumental variable approach is implemented. Column 3 instruments interests paid with WIBOR multiplied by the indicator for paying any interests, therefore ignoring cross-sectional variation in mortgage size. Column 4 uses product of WIBOR and mortgage size as an instrument, therefore using both cross-sectional variation in exposure and time variation in interest rates. Both approaches produce estimates which are very similar to the OLS specifications. The first stage regressions for IV specifications are presented in Table 7 in the Appendix. Dependent variable in all regressions is gross household income which is the sum of incomes of both spouses. Similarly, interests is the total amount of interests deducted by the household (since spouses are filing jointly, there is only one deduction; in fact even if they decided to file separately, they would be allowed to deduct interests only once). Standard errors are clustered on the household level.

To interpret the magnitudes I need to discuss the cap on the mortgage size, out of which interests can be deducted, as well as highlight that the analysis is performed for gross as opposed to net income. These factors have the opposite consequences for the relationship of the estimated coefficient to the true effect of debt on labor supply and their joint effect is likely to be small. The original estimates, therefore, end up being a good approximation of the true effect but it is worth discussing these magnitudes consideration.

Consider a household with mortgage size of 400 thousand zlotys and an applicable cap of 200 thousand zlotys. Suppose that the yearly interests for such household amount to 20 thousand zlotys. When these interests go up by 10%, it is a 2 thousand zlotys increase in the
real amount of interest paid. However, in my data I only see half of this increase which will lead to overestimating the true effect of debt on labor supply. Unfortunately, my data is not rich enough to directly compute by how much the true effect is overestimated. However, based on auxiliary sources I perform back-of-envelope calculations which suggest that this mechanism reduces the effect from 55% in the basic specification, to 50% or, more conservatively, 45%. The applicable cap on the size of mortgage is approximately 191 thousand zlotys\textsuperscript{11}. Based on Amron Sarfin Reports (AMRON, 2009), the average size of newly originated mortgage varied between 76 and 139 thousand zlotys between 2002 and 2006, with the volume-weighted average being equal to 107 thousand. I do not have more information about the distribution of mortgage size between 2002 and 2006, but I use the information for 2008 and 2009 to estimate the share of mortgages above the 191 thousand and their average value\textsuperscript{12}. This allows me to estimate that on average, the interests reported in my data represent around 90% of interests paid and hence to obtain the true magnitudes we need to divide the coefficients by roughly 1.11.

To understand the effect of debt on labor supply one also needs to take into account that the dependent variable in my analysis is the gross income. By construction, part of the increase in interest payment is also automatically countered by the increased tax deduction. Each 1 zloty of extra interests decreases taxable income and hence the net increase in mortgage expenditures is typically 0.82 zloty. But because some share of mortgages is denominated in Swiss francs (see section 2.3), the tax effect is a bit smaller - while on average these mortgages face similar change in monthly payments (see Fig. 7.2), they are driven not only by tax-deductible interests but also by changes in non-deductible capital payments driven by exchange rate fluctuations. In the end the cap on the mortgage size means that I overestimate the true effect while the tax shield means that I underestimate the effect on the net income. Back of envelope calculations suggest that these two effects nearly offset each other and hence the original estimates provide meaningful estimates for the effect of debt on labor supply.

\textsuperscript{11}The cap varied between years and changed from 189 thousand zloty between 2002 and 2007 to over 326 thousand zloty in 2013 and later. To determine the size of the cap household first determines in which year their investment was completed (e.g. the house was built) and then use the applicable value of the mortgage size limit. That is, even though the mortgage origination moment needs to be between 2002 and 2006 to use the deduction, the applicable limit depends not on the mortgage origination moment, but rather on the moment when investment was completed. I assume that each investment is completed within 3 years of mortgage origination with uniform probability and take 191 thousand zlotys as the applicable cap.

\textsuperscript{12}For mortgages denominated in Polish zlotys, the growth in average mortgage size between 2006 and 2008 was around 60% and hence a mortgage of size 191 tho. in 2002-2006 would represent mortgage of size 305 tho. in 2008. In the first quarter of 2008 almost 22% of all mortgages were above 300 thousand zlotys with the average mortgage size in this tail being 602 thousand. I am going to assume that between 2002-2006 there were 22% of mortgages above the cap with the average value of the mortgage being 383 thousand (191 \cdot \frac{602}{300}). This implies that the true value of interests paid for 22% of mortgage holders was higher than interests deducted and on average they have paid 2 times more than they deducted.
Table 1: Regressions of Interests Payments and Income.
The dependent variable is the total gross household income in Polish zlotys. The main independent variable is the amount of mortgage interests deducted from the taxable income. The amount deducted may be smaller than the true amount paid for some borrowers which means the true effect on the gross income is lower - see the main text for the discussion of magnitudes. All columns use strongly balanced panel with individuals fixed effects with observations weighted by the inverse of number of people in the household (1 or 2). The data includes 9.1 mln individuals in 2005-2015 period. In column 2, age fixed effects represent individuals age in years and previous year income fixed effects represent previous year household income rounded to nearest 10 000 zl. Columns 3 and 4 present the specification from column 2 in which interests variable is instrumented with the interaction of WIBOR rate (the usual reference rate for the mortgage) with either an indicator for paying interests (column 3) or with this indicator multiplied by the proxy for mortgage size (average value of interests paid in the entire period, column 4). Standard errors are clustered on the household level. (***) denotes significance at 0.001 level.

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<td>0.302***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.022)</td>
<td>(0.019)</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>100</td>
<td>314</td>
<td>612</td>
</tr>
<tr>
<td></td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
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<td>Year FE</td>
<td>Y</td>
<td>Y</td>
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<td>Age FE</td>
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<td>Y</td>
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<tr>
<td></td>
<td>Prev Income FE</td>
<td>-</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>-</td>
<td>-</td>
<td>WIBOR X</td>
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<tr>
<td></td>
<td>F-Stat</td>
<td>-</td>
<td>-</td>
<td>6.0 · 10^7</td>
</tr>
</tbody>
</table>
4.2 Effects by Type of Income

Tax declaration requires individuals to report their total income divided into different categories. While some of the income types are sparsely populated or rather obscure (e.g. other income), others can be used to get additional insights about the observed effect and test its plausibility. In Table 2 I analyze the effect of mortgage interests on wages, pensions and income from self-employment. Employment contracts may often be rigid: salary may not be directly related to effort and there may be no possibility for increasing the amount of hours worked (although, as demonstrated in Section 5, there are other ways in which employed persons can adjust their income). I expect that self-employed individuals have more opportunities to increase their labor supply and therefore the effect for business profits should be larger. Pensions, on the other hand, cannot be adjusted in the short term and hence provide a useful placebo check. In fact, the characteristics of pension system may lead to an effect of the opposite sign: if an individual collects pension and receives income from employment which exceeds certain threshold, his pension can be reduced (the reduction is not proportional and hence from the individual’s perspective it still makes sense to work). This mechanism may be especially important in my sample (in which only persons younger than 65 are included) because most persons receiving pensions are in working-age and are part of some early-retirement scheme. Such recipients are, compared to a typical retiree, more likely to work and have their pension reduced.

To analyze these predictions I employ two approaches. First, I analyze the absolute change in income from different sources in the full sample. This approach, however, does not take into account the baseline values of income from different sources and conflates both intensive and extensive margin response. For example, while higher interests can encourage extra effort of self-employed individuals and thus increase business profits, they may also discourage households from taking the risk of starting a new business. Second approach, therefore, analyzes the relative changes in each income class and limits the sample to households with positive value of income from given source in the last year. Table 2 presents the results. While in absolute terms (columns 1-3) increase in wages is the dominant mechanism of the increase in income, this follows from the fact that wages are by far the most common source of income (see Table 6). In relative terms (columns 4-6) the effect for business profits is 35% higher than the effect for wages. Nonetheless, we still see a positive and quite sizable response of the employment income. Coefficient for pensions is negative in absolute terms and positive, but insignificant in relative terms. The lack of intensive margin response confirms the lack of effect in the category of income which does not directly depend on individual’s choice. The negative coefficient in column 2 suggests that extensive margin negative response, e.g. individuals delaying retirement
Table 2: Regressions of Interests Payments and Income from Different Sources.
All columns include individuals fixed effects as well as year, age, total previous income bin fixed effects (10 tho. bins) as well as binary variables for the previous year value of the level of dependent variable (wages, rounded to nearest 10 tho.; pensions and profits; rounded to nearest 5 tho.). Dependent variable is family gross wages or log wages (columns 1 and 4), pensions and log pensions (columns 2 and 5) and business profits and log profits (column 3 and 6). Main independent variable is the value of interests paid by the family in a given year expressed in thousands of zl (i.e., the value of interests divided by 1000, for readability of coefficients). Columns 1, 2 and 3 include the entire sample (and thus analyze both intensive and extensive margin effect), while columns 4, 5 and 6 only include those individuals whose family had non-zero income from given source in the previous year (focusing on intensive margin effect). (*** denotes significance at 0.001 level. Standard errors clustered on the household level are displayed in parentheses.

<table>
<thead>
<tr>
<th></th>
<th>(1) Wages</th>
<th>(2) Pensions</th>
<th>(3) Profits</th>
<th>(4) Log(Wages)</th>
<th>(5) Log(Pensions)</th>
<th>(6) Log(Profits)</th>
</tr>
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<tbody>
<tr>
<td>Interests /1000</td>
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<td>-10.3***</td>
<td>30.4***</td>
<td>0.0078***</td>
<td>0.0007</td>
<td>0.0105***</td>
</tr>
<tr>
<td>N</td>
<td>91 164 643</td>
<td>91 164 643</td>
<td>91 164 643</td>
<td>75 126 227</td>
<td>16 886 003</td>
<td>8 176 337</td>
</tr>
<tr>
<td>Controls</td>
<td>Individual FE, Year FE, Age FE, Previous Income FE, Previous Income from Given Source FE</td>
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or not applying for disability benefits, may contribute to lowering the pension income. Notice, however, that this decrease likely does not lower total income, since it is provoked by receiving high income from employment.

4.3 Heterogeneity with Respect to Debt-to-Income Ratio

Income response to mortgage payment changes may not be uniform in the whole population. In fact, one could intuitively expect that income adjustment should be coming from those households who have tighter budget constraints and hence it is more difficult for them to cover payment increase by reducing other consumption. A useful proxy for tightness of budget constraint could be the relative size of the mortgage. Figure 4.1 presents coefficients from the regression in which interests variable is interacted with average interests-to-income ratio (the specification is otherwise the same as the basic specification in column 1 of Table 1). Notice that while the measure of mortgage size underestimates the true size of the mortgage (because it is based only on interests paid and does not include capital payment), it nonetheless allows for correct ordering of households from lowest to highest DTI ratio.

The coefficients show a clear monotone pattern. Relationship of income and mortgage payment is stronger for those households, for whom mortgage payment constitutes larger share of their income. In fact, the effect for households with share of interests in income of less than
5% (which are around 25% of the sample) is not significantly different from zero. The effect is much higher for households with very large mortgages but importantly it is also positive and significant for a large part of the population with interests-to-income ratio around 10-15%, which includes majority of the sample.

![Diagram](image)

**Figure 4.1: Heterogeneity of the Effect of Interest Depending on Payment-to-Income Ratio.** The bars represent the coefficients from income-interests regression (analogous to the main specification) in which interests paid are interacted with the average size of interests paid divided by initial income (“mortgage size”; notice that the true mortgage size is higher because it also includes capital payment, although in the initial period of mortgage repayment, which is dominant in the data, interests constitute majority of the payment). The bars represent 95% confidence intervals. Only observations with mortgage size in the interval (0.05,0.5) are included; average mortgage size in this sample is 13% and the median is 10%.

The monotone pattern supports the proposed mechanism: households increase their labor supply because their budget constraint is tight and they need to cover increased mortgage payment to avoid costly bankruptcy. Intuitively, an increase in mortgage payment should matter less for high-income household with very small mortgage, compared to a household with large mortgage and relatively low income. For the first household the change in payments could be negligible and it can adjust other consumption more easily. The second household might have more troubles adjusting the consumption: given their low income and tight budget, their consumption may consists of higher share of necessities and be much harder to adjust.

Notice that while observed pattern of heterogeneity is not inconsistent with an alternative
explanation based on different sensitivity to macroeconomic conditions, it is much less expected in this scenario. If we believe that mortgage holders are richer and therefore more sensitive to interest rates (e.g. high-level managers may have bonuses which vary greatly with business cycle, while factory-floor workers compensation is less volatile), we should expect to see an opposite pattern - relationship between income and payment changes should be increasing in income level and thus decreasing in DTI ratio (while richer households have also larger mortgages, the effect of higher income dominates and their DTI ratio is typically lower).

5 Mechanisms

What is the mechanism for observed income increase? Given that vast majority of gross income in my data is labor income, important mechanism likely works through increased labor supply, e.g. increase in hours worked in current job. Unfortunately the tax data does not have information on hours worked, but the fact that income from self-employment increases more than earnings does lend indirect support to this mechanism. Nonetheless, on top of increased hours, there are several alternative channels which I am going to investigate: spousal labor supply, supplementary income, changing jobs and working in multiple jobs. Not all of these channels can be directly observed and hence I am unable to quantitatively assess their contribution to the income response. Instead, I provide qualitative evidence that they are operating which helps to understand the composition of the main effect. Some other channels, which I am not able to directly investigate, can also be playing a role. For example, an increase in interests can push individuals to take a tougher stance in bargaining with their employees and receive a wage increase.

5.1 Spousal Labor Supply

If only one spouse in a family works, household can increase its income by having the other spouse enter the employment. Existing literature (Fortin, 1995; Del Boca and Lusardi, 2003) shows that women are more likely to work if their household has a mortgage. In a similar way, one could expect that when mortgage payment increases, non-working spouse (who usually is a woman in my data) enters labor force. But women labor participation in Poland is relatively high and, consistent with the mentioned literature, is even higher in households with mortgage. The margin for this adjustment can be therefore very limited. Nonetheless, I investigate this channel in column 1 of Table 3. I limit the sample to couples who are filing jointly in the entire period (which allows me to disregard phenomena such as divorce etc.; on the other hand this
Table 3: Mechanisms of the Increase in Income

All columns use panel data with individuals fixed effects and yearly time dummies. Additional controls include age dummies. Dependent variables are indicators for: single-earner household (columns 1 and 2; only job-related income included in 2), getting supplementary income (column 3, personal income on top of wages) and for working in the same town (column 4) or on multiple contracts (column 5). Main independent variable is value of interests paid by the family in given year expressed in thousands of zl. Dependent variables are expressed in percentage points. Sample in column 1 is limited to all married couples filling declarations jointly through the entire time period; sample in columns 3-5 is limited to individuals with employment contracts (for whom decreases in taxable income can be used to proxy for job change). (***) denotes significance at 0.001 level. Standard errors clustered on the household level are displayed in parentheses. Mean of dependent variables are presented in the bottom of the table.

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<tbody>
<tr>
<td></td>
<td>Single Earner (%)</td>
<td>Supplemental Income (%)</td>
<td>Change Job (%)</td>
<td>Local Worker (%)</td>
<td>More Contracts (%)</td>
</tr>
<tr>
<td>Interests / 1000</td>
<td>-0.0888***</td>
<td>0.0178***</td>
<td>0.2300***</td>
<td>-0.0495***</td>
<td>-0.0075</td>
</tr>
<tr>
<td>Mean Dep. Var</td>
<td>31%</td>
<td>1.1%</td>
<td>12.6%</td>
<td>68%</td>
<td>2.7%</td>
</tr>
<tr>
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<td>42 296 262</td>
<td>91 164 643</td>
<td>48 034 080</td>
<td>48 034 080</td>
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</tr>
</tbody>
</table>

may bias my estimates downwards because it is possible that when one spouse does not work, the other files taxes individually and hence this household is dropped from the sample). I define single earner household as a household where only one of two persons declares positive income from wages or personal income. This is to exclude categories in which income may be arbitrarily assigned to both spouses (for example, income from financial assets) and may not reflect true labor force participation.

The results indeed suggest that spousal labor supply adjustment is a significant contributor to the observed income effect. 1000 PLN increase in interest makes household 0.1 pp less likely to be single earner household.

5.2 Supplementary Income

Another possible way of adjustment is to perform additional, income-bearing gigs. An individual who works on a typical full time contract may decide to take extra after-hours jobs to supplement his main source of income. I am able to identify such activity to some extent by looking at the “personal activity” income category in the tax form. This category includes income obtained from activity performed personally but not subject to a formal employment contract (subject to labor regulations). An example of income which should be reported in this category could be a consulting fee which a professor - who receives a salary from a university - gets from an
outside firm. The indicator does not perfectly capture additional gigs - this category of income can also include standard employment income (for tax purposes declared as subcontracting) and the extra gig can also occasionally be reported as normal employment. Nonetheless, it is a very useful proxy for capturing this type of adjustment.

I define supplemental income indicator as 1 when individual receives salary income and declares non-zero personal activity income in a given year; and 0 otherwise. The result are presented in column 2 of Table 3. The coefficient of interests is positive and significant. Its magnitude is small in absolute terms but quite large relative to the base levels: it indicates about 16% increase in the probability of receiving supplemental income (the baseline rate is 1%). The result shows that even individuals with rigid employment contract may increase their income by performing income-bearing activities outside of their normal workplace.

5.3 New and Another Job

An individual who works can increase his income by changing the job to a better-paid position or deciding to take a second job. The latter is self-explanatory, but the former may sound a bit surprising: of course it is true that better-paid job increases income, but in the context of adjusting to higher mortgage payments, why should we expect that an individual takes better-paid job only when the mortgage payment increases? After all, if the better-paid job was available, why not to take it earlier? It is possible though that jobs which pay more are worse in terms of non-monetary benefits: working conditions, required effort or location (Sorkin, 2017). An individual may be therefore hesitant to accept the better-paid position in normal times, but when extra money is badly needed, he can reconsider his choice and decide to take the job, sacrificing some non-pecuniary benefits for the sake of higher income.

I am using proxies for changing a job and an indicator for working in multiple jobs based on the tax deduction available to every employee. Every worker with an employment contract can decrease its taxable income by an amount determined in the tax code. This amount is almost fixed and depends only on two factors: 1) whether an individual works in the same town in which he lives or not (higher deduction if needs to commute to different town); 2) whether individual works in a single job or in multiple jobs (higher deduction for multiple jobs). Based on this deduction I can define indicators for working locally and for working in multiple jobs. I define “change job” variable as any change in the local worker status: the variable takes value 1 if worker who worked in different town in year \( t - 1 \) works locally in year \( t \) and when worker who worked locally in year \( t - 1 \) works in different town in year \( t \). In addition, I define a binary indicator of working locally. Change in these variables will capture either change of job or
change of the place of residence but given the fact that I focus on mortgage holders, the second seems less likely.

The results are presented in columns 3, 4 and 5 of Table 3. When interests payments are high, workers are more likely to change jobs. Moreover, their new job is more likely to be outside of town of their residence. This is consistent with the compensating differential explanation if we agree that working locally is better because it reduces time needed for commute. Workers may therefore take more distant - and presumably better paid - jobs when their mortgage payment increases, sacrificing their short commute time to obtain higher income. There is no significant change in the probability of working on multiple contracts, possibly because this arrangement is rarely observed in general.

6 Additional Results

6.1 Consumption Response

An increase in mortgage payment can be covered in two ways: increasing income or decreasing other expenses. The main results confirm the importance of the first channel, but the magnitudes of the effect leave a lot of room for consumption adjustment. Unfortunately, the tax data does not contain a good measure of consumption and hence it is impossible to perform a comprehensive analysis of consumption response in this data set. Nevertheless, because the tax code allows for several deductions, I am able to create some consumption proxies. While they are very imperfect and by no means can be treated as good measures of consumption, they can provide some evidence for the existence of consumption reduction response.

Proxies include charitable donations, contributions to private pension funds and expenses on internet access. Deduction of internet access expenses is very popular, but every household can only use it twice and has to do it in 2 consecutive years. For that reason, I limit my sample to households which used the deduction in the previous and current year, since for them the decrease in reported expenses indeed captures the reduced expenditures, as opposed to starting or stopping deducting them. Donations and contributions to private pension funds are less popular (Poland has a public pension system and private pensions are in infancy) but can be deducted each year. The results for all three proxies are presented in Table 4. Notice that some other deductions are available but are very sparsely populated in the data, e.g. deduction for purchasing disability-related equipment such as wheelchairs. The results for these proxies were never significant and therefore are not reported.

The results confirm the negative consumption response. When interests payments are high,
Table 4: Regressions of Interests Payments and Consumption Proxies.

All columns include individuals fixed effects as well as year, age and previous income bin fixed effects. Dependent variable is log of charitable donations (column 1), log of contributions to private pension account (IKZE, column 2) and log of expenses on internet access (column 3). The sample in column 3 is limited to households which have used internet deduction in the previous year and have non-zero deduction in the current year (because of 2 consecutive years limit for using the deduction). Main independent variable is value of interests paid by the household in a given year expressed in thousands of zł. (***) denotes significance at 0.001 level and (*) at 0.05 level. Standard errors clustered on the household level are displayed in parentheses.

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<td>Log(Expenses - Internet)</td>
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</tbody>
</table>

Households reduce charitable donations, private pension contributions and their expenses on the internet access (notice that all the coefficients are relative to other households; in absolute terms consumption may be increasing but at a slower pace). This is consistent with findings of Di Maggio et al. (2017) and highlights the importance of performing additional analysis, perhaps with consumption survey data, which would allow for better analysis of the consumption response.

The consumption response supports the labor supply adjustment explanation for the main results of the paper, as opposed to an alternative explanation based on differential sensitivity of mortgage holders to changes in interest rates. If we believe that the results are driven by unobservable characteristics of mortgage holders which make their income more sensitive to interest rate changes, we should expect positive response in consumption. Normally, when income increases, consumption also increases and hence if mortgage holders merely happen to earn more in years with higher interest rates, we should also see that they consume more. If household responds to the increase in payment, we should see the opposite: households need to cover higher payment and they do so by both increasing their income and decreasing their other consumption. Even though my measures of consumption are very specific proxies, the fact that I find significant, negative response lends support to the labor supply effect.
6.2 Entrepreneurship

Another question related to labor market behavior which can be asked in my setting is related to propensity to start a new business. Financial commitments, such as mortgage, not only influence the amount of labor supplied but can also influence the career choices of individuals. In general, households choose between salaried positions and self-employment. Salaried positions provide stable income but allow for lower upside potential and do not provide many self-employment perquisites (flexibility, satisfaction).

In the presence of debt commitment the attractiveness of self-employment may be lower. Chetty and Szeidl (2007) show that presence of financial commitments increases risk aversion with respect to moderate-stakes gambles. In light of this we would expect that increased mortgage payments reduce entrepreneurship. Moreover, the literature (e.g. Moskowitz and Vissing-Jørgensen 2002) has consistently found that returns from self-employment are lower than from salaried work. This finding was rationalized e.g. by non-monetary perquisites of being self-employed. If this explanation is indeed true, one might expect that higher mortgage payment will deter individuals from self-employment. A person valuing non-monetary benefits may be willing to sacrifice some income and become self-employed in normal times. When their mortgage payment increases, however, it may be very costly to reduce earnings and hence the person would prefer paid employment to guarantee themselves higher income (in Subsection 5.3 I show that related effect takes place among employed; that is, individuals are willing to trade off non-monetary benefits for higher income).

I study how probability of starting a new business depends on the size of the mortgage payment. Entrepreneurship is measured using the information on business revenues from the tax declarations. I define an event of starting a new business as situation when an individual declares positive revenues from self-employment in year $t$ but did not declare such revenues in year $t-1$. This approach captures also part-time self-employment. One pitfall of this approach, common to many studies of entrepreneurship, is inability to distinguish between types of self-employment. It may be the case that salaried person starts a new business purely as a way to gain tax advantage and he continues his old job without any real changes, selling their services to only one customer (previous employer). Also, I will not be able to observe income from entrepreneurship which is reported as capital gains.

The empirical framework for this analysis is similar to labor supply analysis presented earlier. Using panel data and time-variation in interests rates I estimate the effects of increased mortgage payments on probability of starting a new business. To deal with potential endogeneity, I instrument for interest changes with WIBOR reference rate level. The results are presented in
Table 5: Regressions of Interests Payments and New Business Indicator.

All columns use strongly balanced panel with individual and year fixed effects. Additional controls include age and previous income fixed effects. Dependent variable is 100 x indicator for starting a new business, which takes value 1 if in given year individual reports positive business revenues and has not reported them in the previous year. Main independent variable is value of interests paid by the family in given year expressed in thousands of zl. Column 4 contains IV regression where interests payments are instrumented with WIBOR rate X Mortgage size. (***), (**), and (*) denote significance at 0.001, 0.01, and 0.05 level respectively. Standard errors clustered on the household level are displayed in parentheses.

<table>
<thead>
<tr>
<th></th>
<th>Start Business (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Interests</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
</tr>
<tr>
<td>N</td>
<td>100 314 612</td>
</tr>
<tr>
<td>Individual FE</td>
<td>Y</td>
</tr>
<tr>
<td>Year FE</td>
<td>Y</td>
</tr>
<tr>
<td>Age FE</td>
<td>-</td>
</tr>
<tr>
<td>Prev Income FE</td>
<td>-</td>
</tr>
<tr>
<td>Prev Inc X Year FE</td>
<td>-</td>
</tr>
<tr>
<td>IV</td>
<td>-</td>
</tr>
<tr>
<td>F-Stat</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 5. While in the basic specification the results are not significant, including additional controls reveals that increased interests lead to lower probability of starting a new business. Additional 1000 zl of interests reduces probability of starting a new business in a given year by 0.013 percentage point. Compared to base probability of 1.4% this means that one standard deviation of interests decreases chances of starting a new business by around 1%. It is worth remembering, however, that this estimate is obtained within a population of mortgage holders and uses only intensive margin variation in interests. It is possible that extensive margin may have larger effects.

These findings have to be interpreted with caution. In 2008 tax-treatment of self-employed changed and hence there was a large movement between employment and self-employment which to large extent did not correspond to changes in real economic activity. Unfortunately the timing of this change corresponds to the peak in the interest rates and hence happens exactly in the period which has a large contribution to the identifying variation in my model. While the change of tax-treatment is not in any way related to the mortgage status and hence in principle should not bias the results, it did change the dynamic of self-employment and hence the reliability and
applicability of the results in other contexts may be limited.

7 Discussion

In this paper I present an evidence that households cover increases in their mortgage payments with increased labor income. The effect is quantitatively sizable, as around 30-45% of the increase in payment is covered in that way, and hence might have important implications for understanding of the relationship between consumer debt and labor markets, as well as for selected aspects of policy.

The results I find are consistent with some evidence in existing papers which have different focus. For example, Brown and Matsa (2016) use border-discontinuity design to analyze job search behavior of mortgage holders depending on whether their loan is a recourse loan or not. While they focus on ability to relocate, their results also show that households in states with recourse are in general more active in their job search. Stronger commitment to pay back the debt causes households to increase their labor supply and search effort which is consistent with my results.

More generally, various data sources show positive association between debt and labor market outcomes. While causality is difficult to establish, separate analyses of Survey of Consumer Finance, Current Population Survey and Health and Retirement Study all suggest that debt is associated with working harder. Figures 7.4, 7.5 and 7.6 in the Appendix contain some graphical evidence from these analyses. It is evident that the positive relationship between debt and supply of labor is widespread and can have widespread implications.

On the other hand, it should be noted that in the period of my analysis (2005-2015) Polish economy was constantly growing and labor market conditions were relatively good, contrary to other countries in the same period. The positive effect which I document may be therefore large because it was relatively easy for households to increase income. During the recession the change in income may be more modest.

There are several practical implications of my findings. First, policymakers are often interested in helping households with high debt burden. US Government’s HAMP program is a recent example of such an action. My research shows that when designing such policies, it is worth taking into account household’s potential to increase labor supply. Optimal policy would probably give higher benefits to households which cannot easily increase labor supply, e.g. because they are located in areas with high unemployment. It might be also optimal to introduce some built-in incentives which encourage labor supply adjustment.
More generally, my results have implications for design of bankruptcy and recourse laws. Debt has important implications for labor supply and hence personal bankruptcy law can have important implications for labor market. The more lenient is the law in terms of bankruptcy and recourse, the lower is the motivation for households to increase labor supply. On the one hand this can be treated as moral hazard costs. On the other hand, if increasing labor supply leads to misallocation of resources (e.g. because highly-educated people are forced to accept jobs below their qualifications), more lenient laws can improve allocative efficiency.

Finally, my results have implications for assessing credit worthiness of individual. The potential to increase labor supply seems to be an important predictor of whether a household is a good or bad borrower. While this potential is not directly observable, it can be proxied with education, sector, labor market situation in local area and industry and current workload (i.e. persons with low current workload have more room for increasing labor supply).

Consequences of household debt are important and broad area of research. On top of labor supply mechanism documented in this paper, many other questions should be tackled in future research. The consumption adjustment is natural complement of the mechanism described here and its more thorough analysis would be very valuable. Analyzing extensive margin changes in debt or looking at different populations (e.g. graduates with student debt) is another promising avenue for future research.

References


Appendix

Table 6: Summary Statistics by Mortgage Status.
Statistics are calculated for the main sample used in the analysis. The sample contains all individuals born between 1946 and 1986 who have tax records for the entire 2005-2015 period. I drop individuals with seemingly incomplete mortgage interests information, i.e. those with more than one hole in the series of interests deductions (drops around 5% of mortgage holders). Family income is calculated as the sum of incomes of two individuals who file taxes jointly in a given year. Number of observations in each row is the same and given in the last row of the table, except for rows which condition on positive value (e.g. of wages or donations), where total number of observations is given next to variable name. For internet expenses top 1% of outliers was dropped, because of unrealistically high values most likely reflecting data error. For interests, only positive values were included (to exclude zero values for mortgage holders who started paying mortgage later than in 2005).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mortgage = 0</th>
<th>SD</th>
<th>Mortgage = 1</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Household Income</td>
<td>54004</td>
<td>6262</td>
<td>104271</td>
<td>88729</td>
</tr>
<tr>
<td>Wages</td>
<td>43459</td>
<td>55220</td>
<td>91414</td>
<td>86205</td>
</tr>
<tr>
<td>Business Profits</td>
<td>2724</td>
<td>30233</td>
<td>4783</td>
<td>20187</td>
</tr>
<tr>
<td>Pension</td>
<td>4924</td>
<td>12803</td>
<td>2962</td>
<td>11803</td>
</tr>
<tr>
<td>Share Self-Employed</td>
<td>15.5%</td>
<td>-</td>
<td>20.8%</td>
<td>-</td>
</tr>
<tr>
<td>Share Receiving Pension</td>
<td>20.6%</td>
<td>-</td>
<td>6.7%</td>
<td>-</td>
</tr>
<tr>
<td>Wages (</td>
<td>&gt;0) (N = 84.8 mln)</td>
<td>51559</td>
<td>56568</td>
<td>97378</td>
</tr>
<tr>
<td>Business Profits (</td>
<td>&gt;0) (N = 10.0 mln)</td>
<td>27483</td>
<td>92406</td>
<td>32901</td>
</tr>
<tr>
<td>Pension (</td>
<td>&gt;0) (N = 20.5 mln)</td>
<td>23879</td>
<td>18498</td>
<td>30611</td>
</tr>
<tr>
<td>Interests Paid</td>
<td>-</td>
<td>-</td>
<td>4376</td>
<td>3823</td>
</tr>
<tr>
<td>Donations</td>
<td>33.4</td>
<td>1096</td>
<td>91.2</td>
<td>2450</td>
</tr>
<tr>
<td>Expenses - Private Pension</td>
<td>6.37</td>
<td>191</td>
<td>16.5</td>
<td>310</td>
</tr>
<tr>
<td>Expenses - Internet</td>
<td>147</td>
<td>268</td>
<td>220</td>
<td>317</td>
</tr>
<tr>
<td>Donations (</td>
<td>&gt;0) (N = 2.6 mln)</td>
<td>1284</td>
<td>6681</td>
<td>2407</td>
</tr>
<tr>
<td>Expenses - Private Pension (</td>
<td>&gt;0) (N = 0.2 mln)</td>
<td>3280</td>
<td>2840</td>
<td>3998</td>
</tr>
<tr>
<td>Expenses - Internet (</td>
<td>&gt;0) (N = 25.7 mln)</td>
<td>581</td>
<td>177</td>
<td>606</td>
</tr>
<tr>
<td>Year Born</td>
<td>1966.8</td>
<td>10.5</td>
<td>1971.7</td>
<td>8.3</td>
</tr>
<tr>
<td>Number of Individuals (tho.)</td>
<td>8 998 141</td>
<td>-</td>
<td>156 229</td>
<td>-</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>98 644 025</td>
<td>-</td>
<td>1 713 939</td>
<td>-</td>
</tr>
</tbody>
</table>
Table 7: Main Results: First Stage for IV Specifications
The table presents the first stage regressions for 2 IV specifications presented in column 4 and 5 of Table 1. The dependent variable ise is the amount of mortgage interests deducted from the taxable income. The independent variables are interaction of WIBOR rate (the usual reference rate for the mortgage) with either an indicator for paying interests (column 1) or with this indicator multiplied by the proxy for mortgage size (average value of interests paid in the entire period, column 2). All columns use strongly balanced panel with individuals fixed effects with observations weighted by the inverse of number of people in the household (1 or 2). The data includes 9.1 mln individuals in 2005-2015 period. Age fixed effects represent individuals age in years and previous year income fixed effects represent previous year income rounded to nearest 10 000 zl. Standard errors are clustered on the household level. (*** ) denotes significance at 0.001 level.

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interests</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WIBOR X</td>
<td>1.030***</td>
<td></td>
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<tr>
<td>Pays Mortgage</td>
<td>(0.003)</td>
<td></td>
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<tr>
<td>WIBOR X</td>
<td>0.221***</td>
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<tr>
<td>Mortgage Size</td>
<td>(0.001)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th></th>
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<tbody>
<tr>
<td>Individual FE</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Year FE</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Age FE</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Prev. Year Income FE</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>F-Stat</td>
<td>$6.0 \cdot 10^7$</td>
<td>$1.3 \cdot 10^8$</td>
</tr>
</tbody>
</table>
### Table 8: Robustness Tests for Regressions of Interests and Income

All columns use strongly balanced panel with individuals fixed effects and yearly time dummies. In column 1 age-specific time trends are included (as age dummies interacted with linear time trend). Column 2 includes last year income (rounded to nearest 10’000 zl) specific trends, while column 3 includes geographic area (roughly equivalent to county level) trends. Dependent variable is the log-change of family gross income. Main independent variable is value of interests paid by the family in given year expressed in thousands of zl. In all regressions standard errors are clustered on household level. (***) denotes significance at 0.001 level and t-statistics are displayed in parentheses.

<table>
<thead>
<tr>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
<th>(9)</th>
<th>(10)</th>
<th>(11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log(Income)</td>
<td>∆Income</td>
<td>∆ Log(Inc)</td>
<td>Income</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interests</td>
<td>0.0124***</td>
<td>0.357***</td>
<td>0.210***</td>
<td>0.546***</td>
<td>0.301***</td>
<td>0.334***</td>
<td>0.302***</td>
<td></td>
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<tr>
<td>(0.0002)</td>
<td>(0.018)</td>
<td>(0.019)</td>
<td>(0.019)</td>
<td>(0.019)</td>
<td>(0.019)</td>
<td>(0.019)</td>
<td>(0.015)</td>
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</tr>
<tr>
<td>Log(Interests)</td>
<td>0.0767***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(0.0009)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>∆Interests</td>
<td>0.0667***</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>(0.0204)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>∆Log(Interests)</td>
<td>0.043***</td>
<td>0.064***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(0.002)</td>
<td>(0.0025)</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

| N | 90 284 333 | 90 284 333 | 90 983 141 | 89 757 540 | 89 980 022 | 91 164 643 | 91 164 643 | 91 164 643 | 91 164 643 | 91 164 643 |
| Clustering | Individual, Age, Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Weights | Yes | Yes | Yes | Yes | Yes | Yes | - | - | Yes | - |
| Income Percentile FE | - | - | - | - | - | Yes | - | - | - | - |
| Income-Trends | - | - | - | - | - | - | Yes | - | - | - |
| Age-Trends | - | - | - | - | - | - | - | Yes | - | - |
| Area-Trends | - | - | - | - | - | - | - | Yes | - | - |
Figure 7.1: Median Household Income By Mortgage Status
The Figure shows the evolution of median household income by mortgage status. The upper panel shows nominal income, while the lower panel shows real income in 2005 prices (CPI used as the deflator). Both nominal and real incomes were consistently growing for the entire analyzed time period. Throughout the whole period mortgage holders were typically richer than households without a mortgage.
Figure 7.2: Average Mortgage Interests in the Data, WIBOR Rate and simulated LIBOR-based CHF payment.

Average interests rates are corrected by payment-schedule factor: since in typical mortgage with fixed monthly installment interests decrease in every month, I correct interests observed in the data by the scheduled factor calculated for mortgage originated for 25 years in 2004 with 3% markup and WIBOR 3M reference rate. The size of correction varies from 1.5% to 3%, depending on the year (notice that this mechanism leads to lower interests in subsequent periods but not to lower payment - interests part of the payment decreases but capital part increases accordingly). Estimated CHF-payment shows rescaled hypothetical Swiss Franc denominated mortgage payments with interests based on LIBOR 3M. It incorporates both changes in LIBOR and in the CHF/PLN exchange rate.
Figure 7.3: Distribution of Interests Paid in 2008 and 2015
The Figure shows the distribution of interests paid in 2008 (gray bars, year with highest interest rates) and 2015 (white bars, year with lower interest rates). The graph illustrates both the cross-sectional dispersion in the amount of interests paid, as well as the extent of changes in the size of interest payments over time. The value of interests is censored at 15 thousand zloty.

Figure 7.4: Hours Worked by Age and Mortgage Status (Survey of Consumer Finance 2016)
The data comes from Survey of Consumer Finance 2016 of United States Federal Reserve. Mortgage status is based on variable X723. Respondents with answer different than yes (1) and no (5) were dropped. Hours worked use variable X4110. Age, defined as the difference between 2016 and the year of birth, is rounded to the nearest multiple of five.
Figure 7.5: Share of Retirees by Age for Mortgage Holders and Non-Holders (Health and Retirement Study)
The data comes from RAND 2014 Health and Retirement Study longitudinal file. The sample includes all respondents between 50 and 80 years old. Retirement status is a binary indicator based on respondent’s declaration if considers himself retired. If partly retired, the variable takes value 0.5. Respondents with answer “question irrelevant” were dropped. Has any debt is defined as total debt being above zero, where total debt is the sum of mortgage, other home loans, other debt and 2nd home mortgage. Age is rounded value of respondent age (ageym variable).

Figure 7.6: Quitting and Unemployment Duration by Housing Status (Current Population Survey)
The data comes from IPUMS CPS data (Sarah Flood, Miriam King, Renae Rodgers, Steven Ruggles, and J. Robert Warren. Integrated Public Use Microdata Series, Current Population Survey: Version 6.0 [dataset]. Minneapolis, MN: IPUMS, 2018. https://doi.org/10.18128/D030.V6.0). The sample contains observations from years between 2010-2017. Individuals are included in the sample if in any of these years their mortgage status is not missing (variable spmmort, which also defines the three groups presented on the graph). Quitting and firing identified based on declared reason for being unemployed. Duration of unemployment is measured using variable durunemp. The bars show the share of all respondents who are unemployed and declare that they are other job loser (excludes layoffs). The line shows the average value of unemployment duration (in weeks) for respondents who are currently unemployed and were fired.