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The Case of the Czech Republic

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# House Prices and Household Consumption: The Case of the Czech Republic

Jan Brůha, Michal Hlaváček and Luboš Komárek *

## Abstract

In this paper, we investigate whether movements in property prices have detectable effects on Czech households' consumption and saving decisions. We concentrate on three episodes of movements in house and apartment prices and ask whether property owners have significantly different consumption and saving choices from households living in rented properties. We found that, on average, property owners tend to have a lower propensity to consume and a higher saving rate independently of whether property prices move up or down. This casts doubts on the strength of the collateral channel linking the housing market to the macroeconomy in the Czech Republic.

## Abstrakt

V tomto článku zkoumáme, zda mají změny cen nemovitostí znatelný dopad na rozhodování českých domácností o spotřebě a úsporách. Zaměřujeme se na tři období pohybů cen domů a bytů a klademe si otázku, zda vlastníci nemovitostí činí významně odlišná rozhodnutí ohledně spotřeby a úspor než domácnosti bydlící v nájmu. Zjišťujeme, že vlastníci nemovitostí mají v průměru vyšší míru úspor a nižší míru spotřeby bez ohledu na směr změny cen nemovitostí. Intenzita kolaterálního kanálu mezi cenami nemovitostí a makroekonomikou je tedy v případě České republiky zpochybněna.

**JEL Codes:** D12, D14, E21, R31.
**Keywords:** Consumption and saving decisions, property prices.

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## Nontechnical Summary

Property prices tend to co-move with the business cycle. This link strengthened during the Great Recession and has been intensified by expansionary monetary policy in many countries in recent years. In response, both academics and policymakers have begun to enquire about the links between the housing sector and the rest of the economy. The search is on for the underlying causes of the observed co-movement between house prices and macroeconomic aggregates. There are various possible explanations of the association of property prices and macroeconomic fluctuations. One possibility is that movements in house prices cause business and financial cycles. In such case, it is reasonable to consider including them in monetary policy objectives to reduce economic fluctuations. If, however, house prices are a mere symptom of cyclical fluctuations, then they need not be a part of the systematic monetary policy reaction function and should lie in the realm of financial stability policy. Finally, if house price fluctuations are primarily caused by behavioural failures, they should be the domain of financial literacy policy or macroprudential policy.

One of the most popular macroeconomic approaches arguing that house price movements cause macroeconomic fluctuations via the collateral channel is centred on the ground-breaking paper by Iacoviello and Neri (2010). The collateral channel creates a boom-bust cycle in the following way. An exogenous rise in housing prices increases the value of property as loan collateral, leading to credit expansion. This expansion increases aggregate demand, which, in turn, fosters a temporary rise in economic activity. Then, as the rise in housing prices dissipates, the value of the collateral falls and economic agents have to repay their debts and curb their spending. This, in turn, causes a downturn in economic activity.

The aim of this paper is to test for the collateral channel for the Czech Republic. We use data from the Household Budget Statistics, combined with regional data on property transaction prices, to empirically test the strength and extent of the effect of housing price movements on households' borrowing and consumption decisions. We use several approaches (several types of regression analysis and the propensity score matching approach) to determine whether property-owning households did indeed borrow significantly more than households living in rented dwellings when housing prices were high. We also investigate the relationship between housing prices and households' propensity to save. We focus our analysis on three separate episodes of rapid movements in house and apartment prices (2002/2003, 2007/2008 and 2009/2010), where the collateral channel would be most likely to be detected. We also apply our analysis to the full data sample as a time-varying regression.

We find that, on average, property owners tend to have a lower propensity to consume and a higher saving rate, independently of whether property prices move up or down. Therefore, the relationship between home ownership and saving/consumption decisions is the reverse of what the theory of the collateral channel as an economic driver suggests. We also find a significant negative influence of debt servicing on consumption and a positive influence of house ownership on saving. These effects were stronger in the recent period of 2007/2008. The effect of debt servicing seems to be stronger than the effect of house/apartment ownership. Therefore, Czech households appear to be conservative and house price growth appears not to influence their consumption.

# 1. Introduction

Property prices tend to co-move with output and consumption.[1] Before the Great Recession, house prices reached historical highs in many countries. The Great Recession was associated with significant or even dramatic falls in house prices, which have since started to rise again, in line with the business cycle. In reaction to this, many economists have constructed early warning systems in which property prices often play a prominent role (see, among others, Reimers, 2012, Babecký et al., 2013, and Laina et al., 2015). The subsequent recovery of property prices was intensified by expansionary monetary policy in many countries, where interest rates reached and remained at the zero lower bound. In response, both academics and policymakers have begun to enquire again about the links between the housing sector and the rest of the economy. The search is on for the underlying causes of the observed co-movement between house prices and macroeconomic aggregates. The importance of this search is being magnified by the increasingly recognised interdependence between monetary and macroprudential policies (see, for example, Frait and Malovaná, 2016, and Hampl and Havránek, 2017).

There are various possible explanations of the association of property prices and macroeconomic fluctuations. One possibility is that fluctuations in house prices cause business and financial cycles.[2] If this is so, then it is reasonable to consider including them in monetary, or more generally stabilisation, policy objectives, because house price stabilisation would then help to reduce economic fluctuations with all their social costs. If, however, house prices are a mere symptom of cyclical fluctuations,[3] then it is less obvious why macroeconomic stabilisation policy should react to them; they should lie in the realm of financial stability policy but should not necessarily be a part of the systematic monetary policy reaction function.[4] Finally, there are voices that argue that house price fluctuations are caused primarily by behavioural failures (irrationality), such as excessive optimism during booms (Kahn, 2008, and Tomura, 2010). If so, house prices should be the domain of financial literacy policy or macroprudential policy rather than macroeconomic stabilisation policy. Macroeconomic policymakers may find it necessary to react to house price fluctuations in some situations, but the response should not consist in changing the systematic part of macroeconomic policy.

The lack of a consensus on the nature of the link between the housing market and the macroeconomy is unfortunate, as different mechanisms naturally have different implications. It is therefore important to analyse the mechanisms underlying the observed relationship between house prices and macroeconomic dynamics.

[1] Brůha and Polanský (2014, section 3.1) provide international evidence on the cyclicality of house prices.

[2] Leamer (2007) identifies housing as an important predictor of the national business cycle.

[3] This is implicitly assumed by dynamic general equilibrium models containing the housing sector without financial frictions, such as Davis and Heathcote (2005). Moreover, Brůha and Polanský (2014) explicitly argue that the international evidence on co-movement between house prices and the macroeconomy can be replicated in this framework.

[4] The reduced-form policy rule may still contain house prices if they provide real-time information about future economic developments. However, if house price movements are just symptoms, there is no reason for house prices to be a part of the structural policy rule.

One of the most popular macroeconomic approaches is centred on the ground-breaking paper by Iacoviello and Neri (2010). This paper belongs to the stream of literature arguing that house price movements *cause* macroeconomic fluctuations through the collateral channel. The collateral channel works as follows. An exogenous rise in housing prices increases the value of property as loan collateral, leading to credit expansion. This expansion increases aggregate demand, which, in turn, fosters a temporary rise in economic activity. Then, as the rise in housing prices dissipates, the value of the collateral falls and economic agents have to repay their debts and curb their spending. This, in turn, causes a downturn in economic activity. In this way, housing price shocks, which can be due to exogenous preference shocks, create a boom-bust cycle.

On the aggregate level, the different mechanisms can and do imply a similar reduced-form relationship between property prices and output or consumption. On the other hand, household-level data can be more informative and can be employed to test various hypotheses. In particular, the collateral channel can be tested by looking at whether the consumption and saving decisions of households are dependent on property ownership. If, during periods of house price surges, consumption rises more for property-owning households than for the rest of households, this may be evidence of the collateral channel. If, on the other hand, consumption is not dependent on property ownership, then the positive correlation between house prices and macroeconomic aggregates cannot be explained by the collateral or income channels. In such case, house price movements would be more likely to represent symptoms, rather than causes, of business cycles, irrespective of whether the symptoms reflect rational decisions of agents (as in Bruha and Polansky, 2015) or over-optimism of agents (as in Kahn, 2008).

The aim of this paper is to test for the collateral channel for the Czech Republic. We use data available for Czech households to empirically test the strength and extent of the effect of housing price movements on households' borrowing and consumption decisions. The main identification mechanism explored is to determine whether property-owning households did indeed borrow significantly more than, for example, households living in rented dwellings when housing prices were high, after controlling for households' characteristics. We also investigate the relationship between housing prices and households' propensity to save. Here, we test whether property-owning households have a lower propensity to save than households that live in rented accommodation when housing prices are rising, even when different income levels are taken into account.

We made a similar enquiry in our previous paper, Brůha et al. (2013). It examined the extent to which housing prices affect the balance sheets and borrowing and consumption decisions of households in the Czech Republic and indirectly also their ability to repay their debts. It concluded that in the period of fast growth in housing prices there were differences between households not only in consumption and net savings, but also in saving structure. However, the analysis did not confirm the existence of the collateral channel.

The present paper represents a significant improvement over this earlier work. The improvement is due to better methodology, data and coverage of the periods analysed. However, the conclusions of the two papers are similar.

The paper is structured as follows. Section 2 discusses related literature. In section 3 we describe the data sources used and define the variables under study. Section 4 applies econometric

techniques to analyse the effects of property prices on the consumption and saving behaviour of Czech households. The final section concludes.

## 2. Related Literature

On the theoretical level, there are arguments for credit and collateral effects of house prices on consumption. Buiter (2008) shows that housing wealth effects[5] should be of second-order importance for non-housing consumption, as increases in housing value result in higher housing consumption costs that offset the housing wealth effect on non-housing consumption; any effect of increases in housing value on non-housing consumption should therefore be small and primarily reflect the impact of the relaxation of borrowing constraints on consumers (given housing's special value as collateral for consumer borrowing).

The results of empirical studies, however, are mixed. Some studies tend to confirm the collateral channel. For example, Cooper's (2013) findings are consistent with house price appreciation affecting household spending through the borrowing collateral effect. Similarly, Bayomi and Edison (2003) estimated the wealth effect on consumption of both equity and housing wealth across selected industrial countries. They found that the impact of an increase in housing wealth on consumption is higher than in the case of an equivalent increase in equity wealth. In a similar way, Carrington and Madsen (2011) demonstrate – using survey data on banks' willingness to lend – that house prices are positively related to credit in the short run, i.e. they can stimulate the consumption spending of households, but are negatively related to the availability of credit in the long run. If the above-mentioned mechanisms of transmission of housing prices to the real economy are indeed relevant, a rise in housing prices should be accompanied by an increase in debt and/or a fall in the saving rate among the types of households that own property, and conversely the debt of households living in rented dwellings should not react to housing prices.

On the other hand, there are studies interpreting the evidence in favour of a common cause behind house price increases and consumption or business cycles. As a response to Leamer (2007), who argues that housing *is* the business cycle, Ghent and Owyang (2010) analyse the relationship between housing and the business cycle for metropolitan areas in the United States. They find that the relationship between housing and cyclical indicators holds on the aggregate level only. On the local level, declines in house prices are often not followed by declines in employment. This, according to the authors, raises the possibility that housing movements are merely a proxy for other consumption or wealth indicators.

Attanasio et al. (2009) studied house price movements and consumption growth over a period of 25 years and found them to be closely synchronised. They investigated three hypotheses, namely whether: (i) an increase in house prices raises household wealth and subsequently consumption, (ii) house price growth implies an increase in the collateral available to homeowners and thus reduces the credit constraint of households and (iii) house prices and consumption are jointly influenced by common factors.

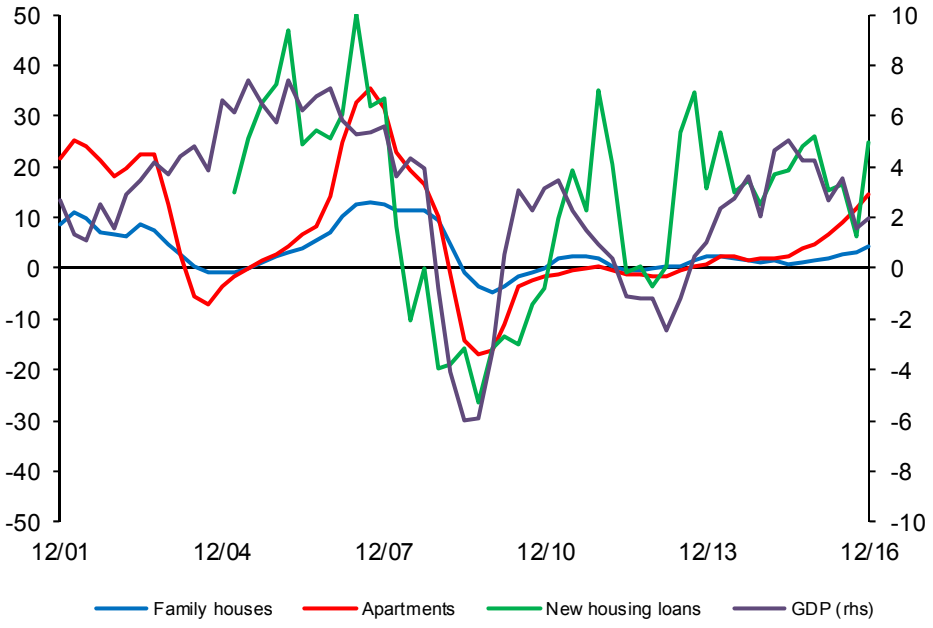
[5] The wealth effect works as follows: a growth in housing prices increases the value of households' financial assets and thus also their marginal propensity to consume (see Case, Quigley and Shiller, 2005).

Calomiris et al. (2009) find that housing wealth has a small and insignificant effect on the consumption of households. They perform fresh checks – in comparison with other studies – on their estimates for how changes in housing wealth may correlate with changes in the expected permanent income of household, which biased previous results.

## 3. Data Sources, Basic Definitions and Motivation

This paper uses a combination of two primary data sources. The main data source for our empirical analysis is microeconomic information from the Household Budget Statistics (HBS) published annually by the Czech Statistical Office (CZSO). This paper uses the HBS data for the period 2000–2015, which spans at least one housing price cycle and covers periods of dramatic housing price developments (a bubble-like increase in 2003, strong growth in 2007 and 2008 and a massive drop in 2009; see Figure 1). The content of HBS database and related definitions are discussed in section 3.1.

***Figure 1: Cyclicality of Housing Prices in the Czech Republic (year-on-year growth in %)***




***Source:*** CZSO, CNB

***Note:*** Transaction prices of apartments/family houses; 2016 data are preliminary estimates.

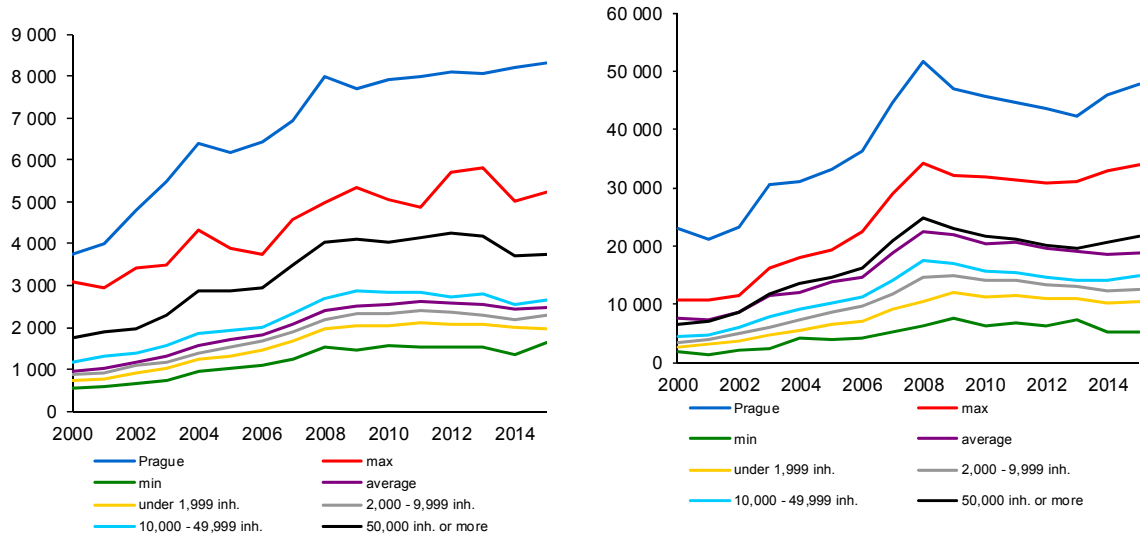
The HBS data is combined with regional data on property transaction prices, also published by the CZSO ("Prices of Observed Types of Real Estate"). These prices are broken down by property type (apartment versus family house) and by region (district). For each region, the prices are further broken down by municipality size. This means that for each household we can estimate the typical value of properties in its location. By large numbers, we can estimate how price changes are reflected in its consumption and saving decisions. The price data are shown in Figure 2.

Besides the general trends in housing prices, they reveal increasing price differentiation across regions over time, with apartment prices in smaller municipalities rising more slowly than prices in the biggest cities. Another interesting piece of information is that although housing prices show similar trends across regions, their dynamics are not entirely homogeneous and there are frequent changes in the price rankings of individual regions. In section 3.2 below, we discuss some issues related to the price data and illustrate our choice of "interesting episodes" of house price developments that are subject to deeper analysis.

In section 3.3, we present some stylised facts that illustrate the relation between consumption and housing in our data and that motivate the overall analysis.

***Figure 2: Structure of Housing Prices in the Czech Republic***

***a) Family house prices (CZK/m$^3$)*** ***b) Apartment prices (CZK/m$^2$)***




***Source:*** CZSO, authors' calculations.

***Note:*** Transaction prices; maximum for the Czech Republic excluding Prague; likewise average prices for municipalities with a population of 50,000 or more.

## 3.1 HBS Statistics

The HBS database contains primarily the following information:

(i) detailed information on the income and expenditure of individual households broken down by type (flow data for the given year);

(ii) other socio-economic characteristics of households (e.g. age of household members, number of children, economic activity of household members, education of household members, living minimum of household);

(iii) information on debt type and repayment size for various types of loans (broken down into goods repayments, house purchase loan repayments and other loan repayments);

(iv) information on housing type (regulated/unregulated rent, cooperative, own house/ apartment, etc.). The HBS database also contains information on the locality in which the household lives/owns property (region and municipality size) and on housing type, period of construction, equipment, floor area and so on.

For the purposes of this paper we work with the following categories derived from the Household Budget Survey. Note that all variables in the HBS are yearly flow variables. Therefore, for example, household deposits do not reflect the household's actual saving account balance at the end of the year, but only new deposits on this account for the given year.

(i) *Consumption* contains households' expenditure on food, manufactured goods and services, excluding consumption in kind.

(ii) *Gross income* comprises all money income of all household members net of savings drawn, loans received and income from the sale of property and securities.

(iii) *Gross savings* consist of financial savings (new bank deposits, purchases of financial securities, insurance, savings in mutual funds, supplementary pension schemes and similar), newly granted loans to other entities (mainly wider family members), savings in households' private business (private enterprise costs) and savings in housing (property purchase expenditure and other investment in dwellings, such as new construction and repairs) and loan repayments.

(iv) *Gross borrowings* comprise items that reduce households' assets. Specifically, they contain deposits withdrawn from banks (or other financial institutions), loans received from financial institutions and other entities (e.g. loans from wider family), income from the sale of securities and income from the sale of movables and immovables in the given period.

(v) *Net savings* are calculated as gross savings less gross borrowings

(vi) *Taxes* consist mainly of income tax, property and inheritance tax and administrative and other fees.

According to the above definitions, the following identity must hold:

*Gross income - Taxes = Consumption + Net savings*

We calculate the *average propensity to consume* (APC) as the ratio of consumption to net income and use it as the main explained variable. We also use the *gross saving rate* (GSR), defined as the ratio of gross savings to gross income, the *gross borrowing rate* (GBR), defined as the ratio of gross borrowings to gross income, and the *net saving rate* (NSR), defined as the ratio of net savings to net income. Note that in the case of loan-financed purchases of new residential property, both the gross saving rate and the gross borrowing rate increase strongly in the given year. This effect is netted out by using the net saving rate. Nevertheless, we also experimented with saving and borrowing rates excluding housing-related investments and loans and the results were not dramatically different.

### 3.2 Housing Price Statistics and Selection of Interesting Periods

The HBS information on housing type allows us to link the HBS data to regional data on property transaction prices, which are also published by the CZSO. This linking is done primarily by type of property (family house vs. apartment), district (breakdown into 14 districts[6]) and, within each district, by municipality size (under 1,999 inhabitants, from 2,000 to 9,999 inhabitants, from 10,000 to 49,999 inhabitants and over 50,000 inhabitants[7]). We obtain 107 possible values for the shadow price of housing property per square meter, which give us different values of house/apartment price growth.[8] We are therefore unable observe the true prices of the relevant property and can only infer this calculated shadow price, which limits the explanatory power of this variable. Our analysis is thus subject to attenuation bias, which makes it relatively difficult to find evidence for the collateral channel. On the other hand, if we did find any significant effect of house ownership on saving and consumption decisions, this effect would be relatively strong. A more precise alternative for calculating the shadow price would be to use the result of hedonic regression (see Eurostat, 2013, or Hill, 2011, for methodology), which would allow us to link housing characteristics to the shadow price. This, however, would require access to individual housing price data, which are not available at the moment.

For some combinations of housing type and location, the detailed CZSO housing price data show non-fundamental upward and downward price movements from one year to another. This reflects a low number of transactions underlying the price data; any individual non-standard transaction is able to distort the price data significantly. More specifically, transactions in apartments are quite rare in the smallest municipalities (under 1,999 inhabitants), where people live mainly in family houses. On the other hand, the biggest cities (more than 50,000 inhabitants) also show, quite surprisingly, a low number of transactions in family houses. The data on the number of transactions are shown Tables A.1 and A.2 in Appendix A. As we do not want non-fundamental movements to obscure our analysis, we decided to exclude households owning apartments in the smallest municipalities and households owning family houses in the largest municipalities from our analysis. Nevertheless, this did not strongly influence the size of our sample (such households represented less than 10% of the sample for all the episodes investigated). For the same reason, we also looked at the prices over longer time periods, over which one-off shifts in prices are likely to be cancelled out, and we decided to focus on property price growth over a 2-year period. Nevertheless, we checked the results for the full sample without excluding any households (see Appendix B) and the results were similar. This data also helps us to identify the "interesting periods" that we devote particular attention to.

*Episodes related to 2003*:

In 2002–2003, the Czech Republic experienced the first housing price bubble in its history. The rapid growth in apartment prices (and, to a lesser extent, family house prices) was mainly due to speculation on an acceleration in house price convergence after the Czech Republic's accession to

[6] For apartments in Prague, we also distinguish between apartments in the historical city centre (Prague 1), the wider centre (Prague 2, 6 and 7) and other districts (Prague 3–5 and 8–28), which report significant differences in prices.

[7] In the majority of districts, the last category covers the regional capital only.

[8] For family houses, the CZSO database contains data in cubic meters. We convert this price into square meters by dividing this price by the average floor height.

the European Union on 1 May 2004. Unlike other periods of rapid house price growth, the 2002–2003 episode was clearly speculative and was not related to improving fundamentals (see Hlaváček and Komárek, 2011). Apartment prices therefore fell in 2004 and stagnated in 2005 (see also Figure 1).

*Episodes related to 2007–2008*

In 2007–2008, housing prices experienced the highest price growth in the data, exceeding 30% for apartment prices and 13% for family houses. Although the price growth was driven partly by improving fundamentals (record-high real GDP growth, improving labour market indicators and rapid growth in housing loans), it led to housing price overvaluation estimated in the range of 6% to 15% depending on the type of model used (see Hejlová et al., 2016).

*Episodes related to the price drop in 2009–2010*

In reaction to the spread of the financial crisis and the resulting worsening of housing price fundamentals (for example, a decline in Czech GDP growth of 11.6 p.p. in just a year and a half), housing prices dropped rapidly in 2009 (apartment prices by 17.1% y-o-y and family houses prices by a milder 4.6%). This one-off drop in prices was followed by a period of more moderate house price decline in 2010 and virtual stagnation until 2014. This period was associated with house price undervaluation of 4%–7% according to various models (see Hejlová et al., 2016). The house price drop was reflected in a doubling of the share of NPLs in total housing loans (from 1.6% at the end of 2008 to 3.2% in the course of 2010) and a sharp slowdown in lending activity.

*Episodes related to the most recent house price jump in 2016–2017*

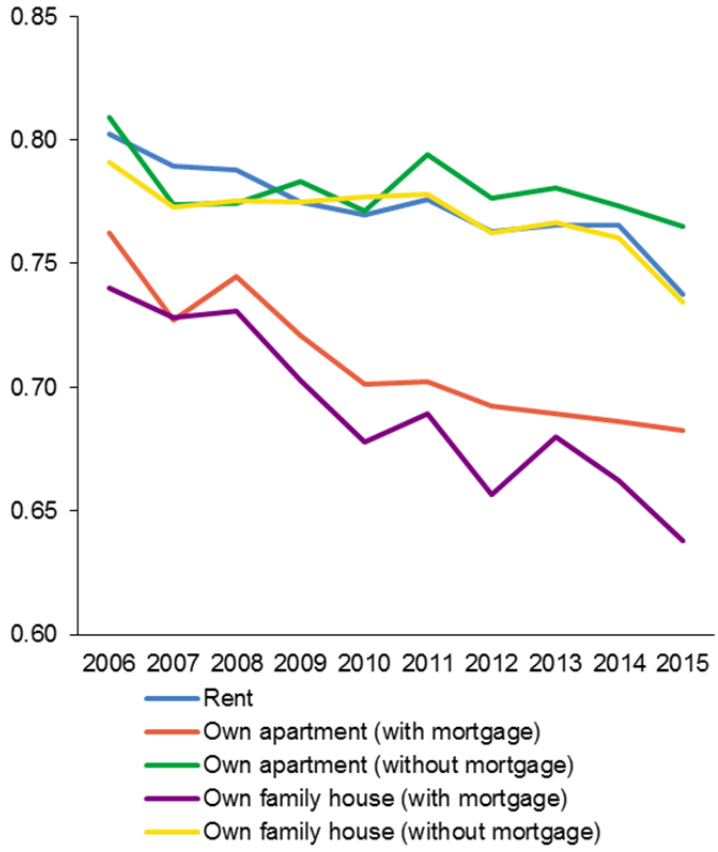
Apartment prices recorded renewed growth in 2016 and a further acceleration in 2017. This growth was again linked to improving fundamentals (a renewal of GDP growth, a rapid decrease in unemployment, eased monetary policy and relaxed credit conditions). Apartment prices were overvalued by an estimated 3%–11% at the end of the first half of 2017. Nevertheless, the recent episode is specific in its higher level of new housing credit – the average new loan in 2016–2017 was about 50% higher and its ratio to the wage around 35% higher than in 2007–2008. We were not able to include this episode in our analysis due to data unavailability. Our HBS and regional house price datasets are available only until 2015, when housing prices were still stagnating. Even if we had access to the HBS 2016 data, the problem is that this database contains data covering all periods of the year, while the house price surge occurred mainly in the second half of the year.

### 3.3 Impact of Housing Prices on Households' Consumption – Stylised Facts and Motivation for Analysis

The HBS data can be used to perform simple calculations of the average propensity to consume (APC) broken down by different groups of households according to their home ownership status and whether their home is subject to a mortgage. Besides a showing a general decrease in the APC, Figure 3 below illustrates large differences between basic household categories. We analyse five basic home ownership categories: (i) households living in a house/apartment under a contract of lease, (ii) and (iii) households living in their own house/apartment without a mortgage and (iv) and (v) households living in their own house/apartment under a mortgage. The chart illustrates that the main difference relates not to sole ownership of the property (the APC for

renting households is similar to that for households that own a house/apartment without a mortgage), but rather to whether the household finances its house/apartment with a mortgage loan. The APC for households with a mortgage is significantly lower than for any other household type and has decreased the most.

***Figure 3: Average Propensity to Consume Broken Down by Household Types***




***Source:*** CZSO, CNB.

The conclusions derived from Figure 3 are robust to regional changes (APCs for different household categories in Prague, regions with above-average house price growth and regions with falling prices). The main differences are apparent from Table 1 below, which shows a higher APC for households living in rented apartments in Prague. This is outweighed by a stronger negative credit effect for Prague households with a mortgage, which is probably linked with the higher apartment price level in Prague and is stronger than in the rest of the Czech Republic. The APC distribution among different types of households is generally similar, although one can see a slightly higher APC in regions with higher price growth than in regions with falling prices. However, this may be driven by the generally better economic situation in these regions. Table 1 also supports the hypothesis of a negative credit effect for mortgage-financed house purchases.

***Table 1: Average Propensity to Consume Broken Down by Household Types***

**Average propensity to consume in 2015**

| | CZ | Prague | Regions with price growth | Regions with price decline |
|---|---|---|---|---|
| Rent | 0.738 | 0.790 | 0.740 | 0.696 |
| Own apartment (with mortgage) | 0.683 | 0.584 | 0.699 | 0.682 |
| Own apartment (without mortgage) | 0.765 | 0.755 | 0.768 | 0.768 |
| Own family house (without mortgage) | 0.638 | 0.571 | 0.646 | 0.623 |
| Own family house (with mortgage) | 0.734 | 0.751 | 0.742 | 0.714 |

**Change in APC** (in p.p. between 2013 and 2015)

| | CZ | Prague | Regions with price growth | Regions with price decline |
|---|---|---|---|---|
| Rent | -0.028 | -0.013 | 0.006 | -0.078 |
| Own apartment (with mortgage) | -0.006 | -0.067 | 0.014 | -0.018 |
| Own apartment (without mortgage) | -0.016 | 0.027 | -0.015 | -0.028 |
| Own family house (without mortgage) | -0.042 | 0.043 | -0.028 | -0.057 |
| Own family house (with mortgage) | -0.032 | -0.002 | -0.009 | -0.078 |

Generally, the stylised facts presented above illustrate that the standard price-credit mechanism does not function in the Czech Republic and that the credit effect of mortgage-financed house purchases is negative. In addition, the aggregate decrease in the APC may reflect an increase in the share of households with mortgages with a lower APC.

# 4. Econometric Analysis

## 4.1 Methods Used

Having identified several episodes of large house price movements, we ask whether house or apartment ownership has a statistically and economically significant effect on consumption, saving and borrowing. To do this, we employ two techniques – regression analysis and the propensity score method.

In the regression models, we include a dummy variable for house ownership or house price change as the explanatory variable of interest. The typical regression estimation is defined as follows:

$$y_i = \alpha + \beta HO_i + \gamma DSTI_i + Z_i\theta + \varepsilon_i, \quad (1)$$

where $y_i$ is the variable of interest (i.e. APC, gross savings, gross borrowings or net savings) for household $i$, $HO_i$ is the home/apartment ownership dummy for household $i$, $DSTI_i$ is its debt service-to-income ratio, $Z_i$ is the vector of control variables (statistical confounders), which are not of primary interest to us, and $\varepsilon_i$ is the error term. There are many potential confounders that can influence the variable of interest. They include net income, the ratio of net income to the minimum living standard, dummy variables for the composition of the household (i.e. the number of economically active persons and the number of children), education dummies and dummies related to geographical location.[9] These control variables are not of direct relevance to our analysis and, as there are many of them, only a subset should be included in the regression.[10] We follow the suggestion of Belloni et al. (2014) and use elastic net regression to select the relevant ones. Having found the relevant controls, we estimate the resulting regression model by both standard OLS regression and robust regression assuming a Cauchy distribution for errors (the results of which are denoted as RLS).

As an alternative to regression analysis, we use the propensity score method (PSM). This method, introduced by Rosenbaum and Rubin (1983), uses a propensity score to balance for confounders in two sets of units: in our case, those who own a house/apartment and those who do not.[11] The propensity score is the probability of being "treated" (in our case, of having a house/apartment) based on observable characteristics of the household. If the propensity score is consistently estimated and if it is balanced between the two groups, the effect of having a house/apartment can be consistently estimated. There are various ways of achieving a balance between the samples.

[9] In general, it would be interesting to include lagged consumption as an explanatory variable and thus test internal habits. This is impossible, as we do not have panel data. On the other hand, it is possible to test external habits, i.e. to explain the consumption decision based on the average past propensity to consume. However, this variable does not prove to be significant. It should also be noted that testing habit formation is not a goal of this paper and is only marginally related to the main issue of the paper.

[10] Appendix C contains an example of the regression specification with the full set of variables chosen by the elastic net approach. Typically, the set of variables chosen contains various income measures and the number of economically active members of households.

[11] The idea behind the PSM is to avoid comparing two large groups when the dimensionality of the potential confounders is large. This method reduces the dimensionality of the problem by estimating a propensity score, which is a one-dimensional variable.

We opt for the non-parametric approach by Hirano et al. (2003). The effect of having a house on the variable of interest y is estimated as follows:

$$\frac{1}{N}\left(\sum_{i=1}^{N}\frac{HO_i y_i}{\pi(Z_i)}-\sum_{i=1}^{N}\frac{(1-HO_i)y_i}{1-\pi(Z_i)}\right), \quad (2)$$

where $\pi(Z_i)$ is the estimated propensity score for household *i* given its characteristics $Z_i$, i.e. the probability of the household owning a house/apartment given its characteristics. The propensity score is estimated using a logit model and the relevant controls from the vector $Z_i$ were again selected by the elastic net applied to the logistic regression. The standard errors were computed using the non-parametric bootstrap.

Additionally, for selected episodes, we regress the variables of interest for property owners on property price movements and controls. The effect of property prices is then identified by geographical differences in the price dynamics. In such case, we run the following regression model:

$$y_i = \alpha + \beta_0\pi_{oi} + \beta_1\pi_{1i} + \gamma DSTI_i + Z_i\theta + \varepsilon_i, \quad (3)$$

where $\pi_{oi}$ is property price growth before and $\pi_{1i}$ is property price growth after year *t* (property prices are imputed individually for each household, as explained in section 3). The first term captures possible backward-looking behaviour, while the latter is a forward-looking variable. Again, we control for the same set of potential confounders and the relevant ones are selected using elastic net regression. As is the case for Equation (1), Equation (3) is estimated by both OLS and the robust regression technique.

As an additional robustness check, we estimate the analogous equation over the whole sample and allow for limited time variation in coefficients $\beta_0$ and $\beta_1$. See Appendix B for details.

### 4.2 Results – Property Ownership

In this part of the paper, we report and comment on the results for the effect of property ownership on the variables of interest. The results are reported separately for each interesting period.

*The property price boom in 2003*

For this episode we consider two sets of households. The first set is composed of households living in cities with more than 10,000 inhabitants where apartment prices grew by more than 5% in 2002 and 2003. We compare households who own an apartment with those who rent an apartment (so we exclude households living in such cities in their own house or declaring another type of residency). The second set is composed of family house owners and non-owners in regions where family house price growth was higher than 5% in both 2002 and 2003. We include households living in villages and cities with less than 50,000 inhabitants.

First, we use the non-parametric regression line to estimate the dependency of the variables of interest (propensity to consume, gross savings and borrowings and net savings) on household net income (divided by the minimum living standard) for the two sets. The results are displayed in Figures 4 and 5. The non-parametric regression lines for owners and non-owners are very close to

each other, i.e. there is no evidence for the collateral effect. We then estimate Equation (1) for the two sets of households and report the coefficient of interest $\beta$ and the related PSM estimator; the results are presented in Table 2.

***Figure 4: Consumption and Saving Lines: Comparison of Apartment Owners and Non-owners***

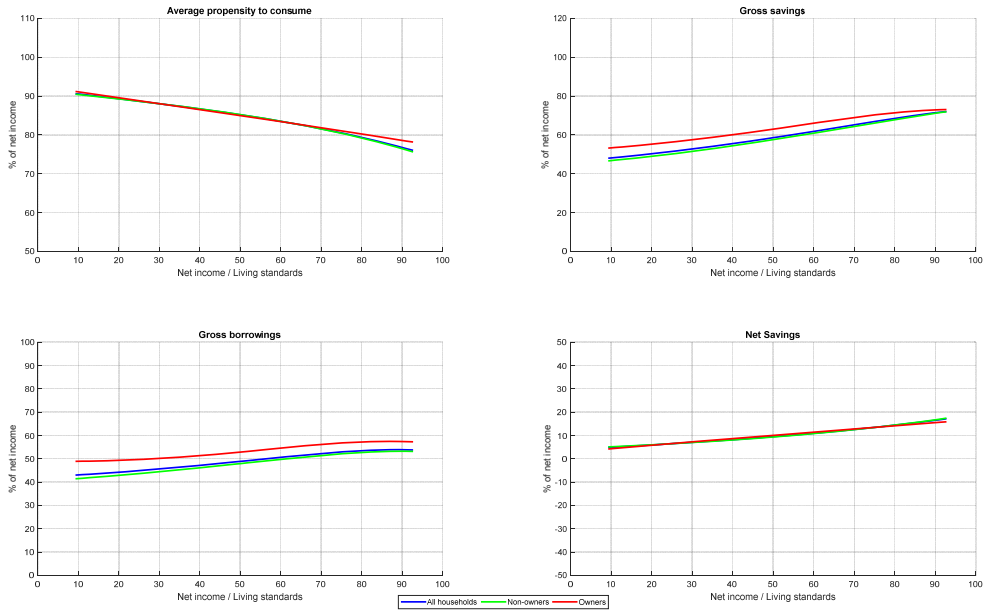
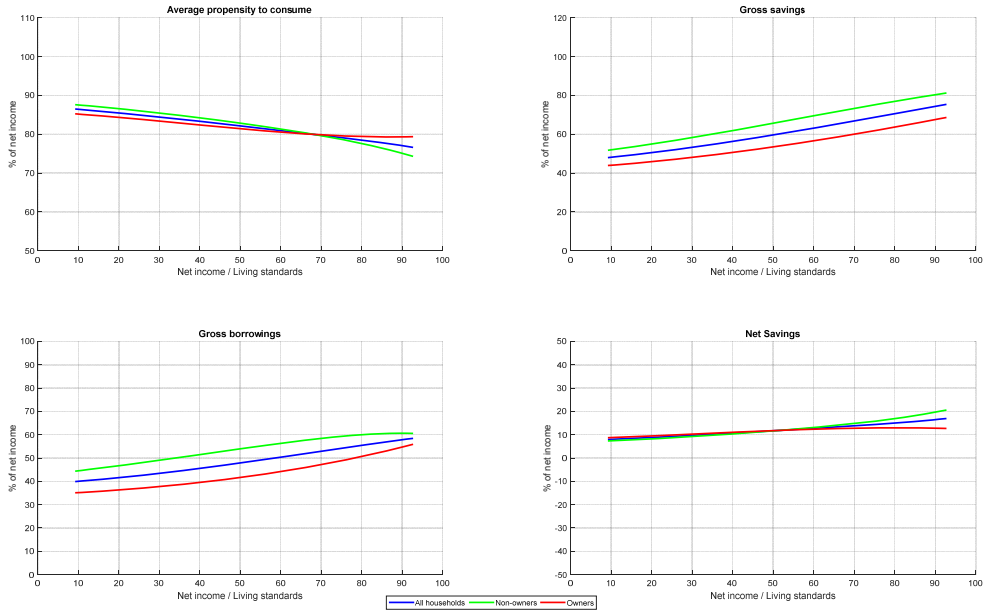



***Figure 5: Consumption and Saving Lines: Comparison of House Owners and Non-owners***




The first three columns report the results for house owners and non-owners in regions where family house growth was higher than 5% in both 2002 and 2003 (in villages and cities with less than 50,000 inhabitants). Among them, the regression estimates suggest that households owning a house have a lower propensity to consume (after controlling for confounders) than non-owners

and the results are both statistically and economically significant. They suggest that house ownership was associated with a propensity to consume about 2 p.p. lower than that among non-owners. House owners had also lower gross borrowings and savings, with a net effect of almost zero. The results of the PSM are economically small and insignificant.

The last three columns of Table 2 report the results for apartment owners and non-owners in cities where family house growth was higher than 5% in both 2002 and 2003 (in cities with more than 10,000 inhabitants). All the results (with the exception of the PSM for the propensity to consume) are small and insignificant. The PSM results suggest that the propensity to consume was about 9 p.p. lower among apartment owners.

***Table 2: The Effects of Property Ownership on Consumption/Saving Choices in 2003***

| | House ownership | | | Apartment ownership | | |
|---|---|---|---|---|---|---|
| | OLS | RLS | PSM | OLS | RLS | PSM |
| **Propensity to consume** | -0.0195 | -0.0205 | 0.0060 | -0.0031 | 0.0016 | -0.0918 |
| *p-value* | 0.045 | 0.013 | 0.550 | 0.792 | 0.880 | 0.057 |
| **Gross savings** | -0.0878 | -0.0584 | -0.0562 | 0.0166 | 0.0157 | -0.0403 |
| *p-value* | 0.000 | 0.015 | 0.110 | 0.499 | 0.560 | 0.209 |
| **Gross borrowings** | -0.0980 | -0.0491 | -0.0580 | 0.0108 | 0.0334 | -0.0243 |
| *p-value* | 0.000 | 0.034 | 0.072 | 0.660 | 0.216 | 0.278 |
| **Net savings** | 0.0066 | 0.0094 | 0.0014 | 0.0070 | -0.0097 | -0.0156 |
| *p-value* | 0.523 | 0.251 | 0.520 | 0.591 | 0.383 | 0.190 |

So, when we compare property owners and non-owners in 2003, we do not find any evidence for the collateral effect. In fact, the results suggest the opposite: property owners had a lower propensity to consume than non-owners.

Finally, we look at the effect of property prices on consumption/saving decisions among property owners. We estimate Equation (3) for the set of apartment owners in cities with more than 10,000 inhabitants in 2002–2003 and we include apartment price changes in the regression. The results for the two coefficients of interest are reported in the first part of Table 3. We also estimate Equation (3) for house owners in villages and cities with less than 50,000 inhabitants with family house price changes as the explanatory variable of interest. The results are displayed in the second part of Table 3.

***Table 3: The Effect of Property Prices on Consumption/Saving Decisions among Owners (in 2003)***

| | House owners | | | | Apartment owners | | | |
|---|---|---|---|---|---|---|---|---|
| | $\beta_0$ | | $\beta_1$ | | $\beta_0$ | | $\beta_1$ | |
| | OLS | RLS | OLS | RLS | OLS | RLS | OLS | RLS |
| **Propensity to consume** | -0.0171 | -0.0184 | 0.0004 | 0.0024 | 0.1718 | 0.1603 | -0.0995 | -0.0925 |
| *p-value* | 0.708 | 0.645 | 0.992 | 0.943 | 0.123 | 0.112 | 0.408 | 0.396 |
| **Gross savings** | 0.1245 | 0.1564 | 0.1943 | 0.1789 | 0.3193 | 0.4241 | -0.0737 | 0.0664 |
| *p-value* | 0.091 | 0.057 | 0.067 | 0.126 | 0.201 | 0.097 | 0.777 | 0.800 |
| **Gross borrowings** | 0.0266 | 0.0155 | 0.0724 | 0.0410 | 0.2568 | 0.3936 | -0.1077 | 0.1970 |
| *p-value* | 0.726 | 0.850 | 0.414 | 0.664 | 0.197 | 0.069 | 0.659 | 0.440 |
| **Net savings** | 0.0614 | 0.0313 | 0.0089 | -0.0044 | -0.0685 | -0.1145 | 0.1699 | 0.0640 |
| *p-value* | 0.243 | 0.498 | 0.825 | 0.899 | 0.602 | 0.256 | 0.201 | 0.534 |

In both cases, the effects of lagged or future property price changes on consumption are statistically insignificant. The only significant results are for gross savings: in regions (cities) with higher growth in property prices, property owners tended to exhibit higher gross savings. This result also does not support the collateral channel.

***Table 4: The Effect of Debt Service on Consumption/Saving Decisions among Owners (in 2003)***

| | House owners DSTI | | Apartment owners DSTI | |
|---|---|---|---|---|
| | OLS | RLS | OLS | RLS |
| **Propensity to consume** | -0.0753 | -0.0776 | -0.2107 | -0.1892 |
| *p-value* | 0.003 | 0.001 | 0.000 | 0.000 |
| **Gross savings** | 0.0603 | 0.0472 | 0.4219 | 0.3578 |
| *p-value* | 0.246 | 0.420 | 0.000 | 0.003 |
| **Gross borrowings** | -0.0074 | 0.0229 | 0.3808 | 0.3848 |
| *p-value* | 0.885 | 0.681 | 0.001 | 0.002 |
| **Net savings** | 0.0561 | -0.1737 | -0.0116 | -0.0527 |
| *p-value* | 0.042 | 0.000 | 0.843 | 0.293 |

In addition to the impact of housing ownership on consumption and saving decisions, we included an analysis of the role of debt servicing costs in these decisions. For the 2003 episode, the coefficients show some statistically significant impacts that are mostly in line with economic intuition (see Table 4). Higher debt servicing costs generally reduce the propensity to consume and increase savings as indebted households try to pay off their debts first. This result is generally stronger for apartment owners than for house owners. This result is in line with our findings that do not support the collateral channel, as the effect of indebtedness on consumption and saving seems to be stronger.

*The property price boom in 2008*

Again, for this episode we consider two sets of households. First, we analyse households living in cities with more than 10,000 inhabitants where apartment prices grew more than 5% in both 2007 and 2008. We compare households who own an apartment with those who rent an apartment (so we exclude households living in such cities who live in their own house or declare another type of residency). The second set consists of house owners and non-owners in regions where family house price growth was higher than 5% in both 2002 and 2003 in villages and cities with less than 50,000 inhabitants.

First, we again look at the non-parametric regression line to estimate the dependency of the variables of interest (average propensity to consume, gross savings and borrowings and net savings) on household net income (divided by the minimum living standard) for the two groups. The results for the two groups are displayed in Figures 6 and 7. The non-parametric estimates of the propensity to consume of owners are below the lines for non-owners, and the opposite holds for net savings. These simple non-parametric regressions thus do not support the collateral channel.

We then estimate Equation (1) for the two sets of households and report the coefficient of interest $\beta$ and the related PSM estimator. The results are given in Table 5. The point estimates of the effect of property ownership on consumption are large and some of them are statistically significant, meaning that households owning a house/apartment tend to have a lower consumption-to-net income ratio than non-owners. The owners also had a significantly (both statistically and economically) higher net saving rate (by about 4 p.p.) than similar non-owners. Neither of these results is consistent with the collateral channel.

***Figure 6: Consumption and Saving Lines: Comparison of Apartment Owners and Non-owners***

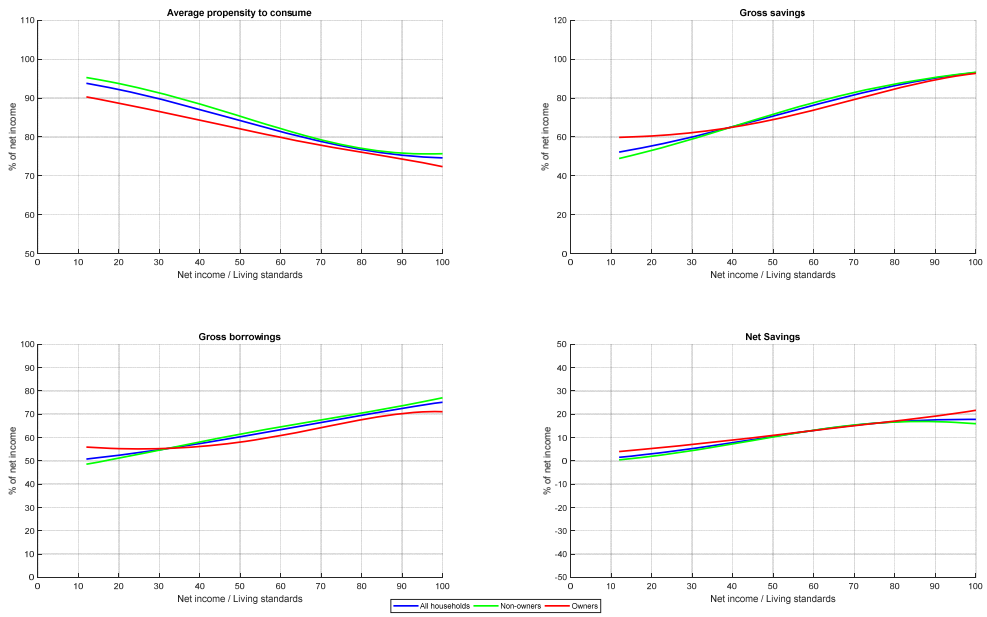


***Figure 7: Consumption and Saving Lines: Comparison of House Owners and Non-owners***

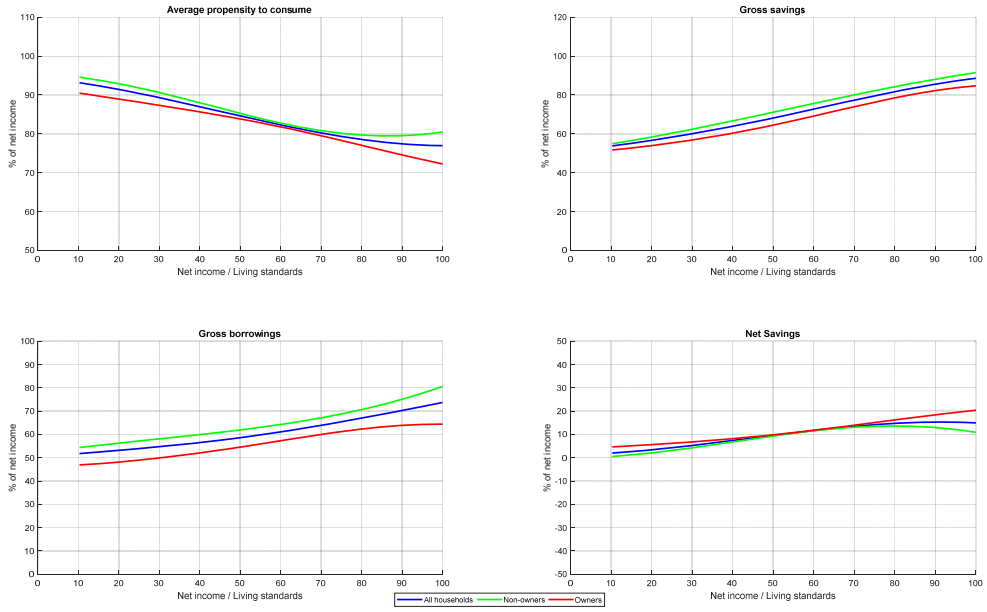



***Table 5: The Effect of Property Ownership on Consumption/Saving Choices in 2008***

| | House ownership | | | Apartment ownership | | |
|---|---|---|---|---|---|---|
| | OLS | RLS | PSM | OLS | RLS | PSM |
| **Propensity to consume** | -0.0319 | -0.0280 | -0.0773 | -0.0417 | -0.0333 | -0.0990 |
| *p-value* | 0.100 | 0.122 | 0.2060 | 0.040 | 0.058 | 0.1450 |
| **Gross savings** | -0.0086 | 0.0171 | -0.0450 | -0.0049 | 0.0305 | -0.0095 |
| *p-value* | 0.862 | 0.707 | 0.2900 | 0.905 | 0.410 | 0.4700 |
| **Gross borrowings** | -0.0299 | -0.0141 | -0.0866 | -0.0286 | -0.0012 | -0.0486 |
| *p-value* | 0.508 | 0.769 | 0.1070 | 0.473 | 0.975 | 0.2750 |
| **Net savings** | 0.0391 | 0.0455 | 0.0411 | 0.0329 | 0.0532 | 0.0396 |
| *p-value* | 0.113 | 0.022 | 0.9050 | 0.162 | 0.002 | 0.9330 |

Finally, we look at the effect of property prices on consumption/saving decisions among property owners. We estimate Equation (3) for the set of apartment owners versus renters in cities with more than 10,000 inhabitants in 2002–2003 and we include apartment price changes in the regression. The results for the two coefficients of interest are reported in Table 6. In addition, we estimate Equation (3) for house owners versus renters in villages and cities with less than 50,000 inhabitants with family house price changes as the explanatory variable of interest. The results are displayed in Table 6, too.

***Table 6: The Effect of Property Prices on Consumption/Saving Decisions among Owners (in 2008)***

| | House owners | | | | Apartment owners | | | |
|---|---|---|---|---|---|---|---|---|
| | $\beta_0$ | | $\beta_1$ | | $\beta_0$ | | $\beta_1$ | |
| | OLS | RLS | OLS | RLS | OLS | RLS | OLS | RLS |
| **Propensity to consume** | -0.0070 | -0.0291 | -0.0697 | -0.0575 | 0.0311 | -0.1433 | 0.0955 | 0.0856 |
| *p-value* | 0.935 | 0.722 | 0.419 | 0.497 | 0.899 | 0.538 | 0.734 | 0.745 |
| **Gross savings** | 0.1077 | -0.0380 | 0.1325 | 0.0770 | -0.0894 | -0.2672 | -0.9099 | -0.8999 |
| *p-value* | 0.562 | 0.825 | 0.498 | 0.676 | 0.831 | 0.535 | 0.049 | 0.060 |
| **Gross borrowings** | -0.1065 | -0.1275 | 0.0512 | 0.0383 | 0.0135 | -0.2576 | -0.5217 | -0.6605 |
| *p-value* | 0.526 | 0.437 | 0.756 | 0.815 | 0.975 | 0.568 | 0.270 | 0.186 |
| **Net savings** | 0.0788 | 0.0289 | 0.0296 | 0.0019 | -0.0322 | -0.0094 | -0.2277 | -0.0502 |
| *p-value* | 0.441 | 0.703 | 0.793 | 0.982 | 0.900 | 0.970 | 0.440 | 0.857 |

Similarly to the 2003 episode, debt service played an important role in 2008 (see Table 7). Generally, the effects of debt service on saving and borrowing were stronger than in 2003, as the 2007–2008 housing price bubble was accompanied by stronger loan growth. The effect on the propensity to consume was relatively small and insignificant in this period; however, the increase in both gross savings and gross borrowings was much stronger. The effect on net savings (netting out the effects on gross savings and borrowings) was significant only for OLS.

***Table 7: The Effect of Debt Service on Consumption/Saving Decisions among Owners (in 2008)***

| | House owners | | Apartment owners | |
|---|---|---|---|---|
| | DSTI | | DSTI | |
| | OLS | RLS | OLS | RLS |
| **Propensity to consume** | 0.0116 | -0.0389 | -0.0581 | 0.0405 |
| *p-value* | 0.873 | 0.500 | 0.683 | 0.725 |
| **Gross savings** | 3.7230 | 0.6842 | 1.2849 | 0.4642 |
| *p-value* | 0.000 | 0.000 | 0.000 | 0.066 |
| **Gross borrowings** | 1.5712 | 0.5808 | 0.8153 | 0.7121 |
| *p-value* | 0.000 | 0.000 | 0.005 | 0.007 |
| **Net savings** | 2.1349 | -0.0974 | 0.3438 | -0.1309 |
| *p-value* | 0.000 | 0.200 | 0.045 | 0.258 |

*The property price decline in 2009/2010*

For this episode, we consider two sets of households. We analyse households living in cities with more than 10,000 inhabitants where apartment prices declined in both 2009 and 2010. We compare households who own an apartment with those who rent one (so we exclude households living in these cities who live in their own house or declare another type of residency).

Owners tend to have a lower propensity to consume and higher net savings than non-owners. Given that we are dealing with a period of falling property prices, this result may speak in favour of the collateral channel. A similar conclusion pertains to the estimation of equation (1). The effect of apartment ownership in cities when apartment prices were falling is negative, although statistically insignificant, and the effect on borrowings is also negative.

On the other hand, since the same sign is obtained for episodes of property price booms, we interpret this rather as evidence for systematic differences between owners and non-owners, differences that are not explainable by observable household characteristics.

***Figure 8: Consumption and Saving Lines: Comparison of Apartment Owners and Non-owners***

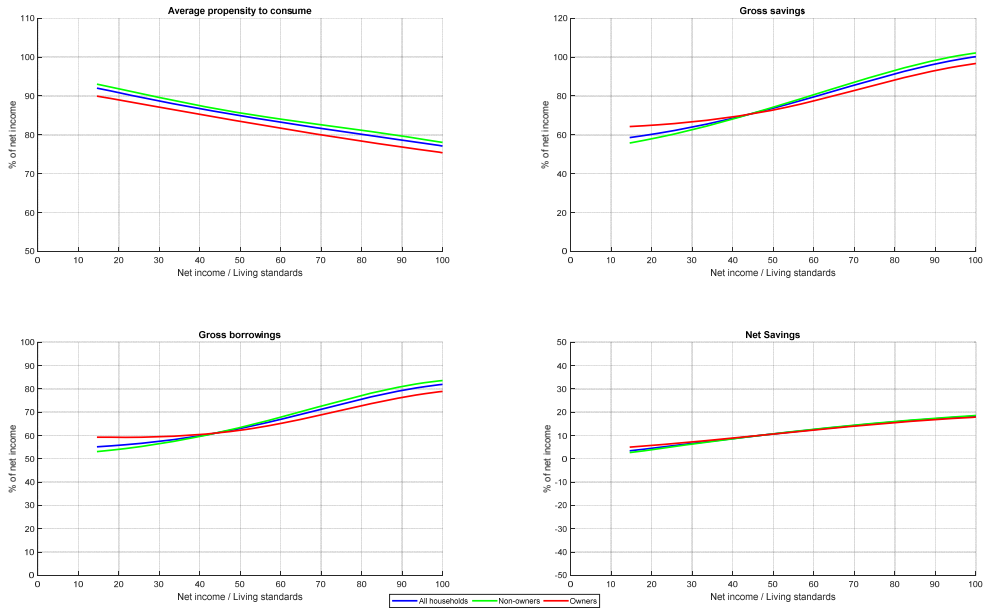



***Table 8: The Effect of Apartment Ownership on Consumption/Saving Choices in 2009/2010***

| | Apartment ownership | | |
|---|---|---|---|
| | OLS | RLS | PSM |
| **Propensity to consume** | -0.0133 | -0.0200 | -0.0731 |
| *p-value* | 0.337 | 0.104 | 0.134 |
| **Gross savings** | -0.0377 | 0.0222 | -0.0565 |
| *p-value* | 0.357 | 0.460 | 0.219 |
| **Gross borrowings** | -0.0301 | -0.0138 | -0.0472 |
| *p-value* | 0.375 | 0.653 | 0.230 |
| **Net savings** | -0.0157 | 0.0194 | -0.0087 |
| *p-value* | 0.443 | 0.146 | 0.373 |

Generally, we find little evidence of the existence of collateral channel effects on the saving and consumption decisions of Czech households. In fact, house/apartment ownership influences the

average propensity to save and savings rates in the opposite way than the collateral channel suggests. This effect was slightly stronger in the 2007/2008 episode than in the previous growth episode of 2002/2003, but was weaker in the house price drop episode of 2009/2010.

In addition, our analysis suggests that debt servicing plays a significant role in influencing consumption and saving. Its effect on consumption is negative and its effect on net savings positive. Again, this effect was strongest in the period 2007/2008. The effect of debt servicing is also stronger than the effect of sole house/apartment ownership.

## 5. Conclusion

In this paper, we tested for the existence of the collateral effect for Czech households by investigating whether movements in property prices have detectable effects on Czech households' consumption and saving decisions. To do so, we combined the CZSO household budget survey database with "shadow" housing prices obtained from the CZSO house price statistics. Our analysis is focused on three episodes of significant house price movements: two periods of house price overvaluation (2002/2003 and 2007/2008) and one of house price falls (2009/2010). We differentiate between households living in rented houses or apartments and households living in their own premises. We employ two estimation techniques: regression analysis and the propensity score method. Generally, we find no support for the existence of the collateral channel, as house price ownership leads to higher saving rates and a lower propensity to consume. Though our data sources and the way we link individual households to housing prices are far from perfect, which could lead to attenuation bias, we view this result as relatively robust. In fact, attenuation bias could lead to a situation where the collateral effect would be wrongly seen as insignificant even in a situation where the link between house prices and consumption and savings would be vital. Nevertheless, according to our results the effect of home ownership is significant, but with the reverse significance sign. We also found a significant negative influence of debt servicing on consumption and a positive influence of home ownership on saving. These effects were stronger in the recent period of 2007/2008. The effect of debt servicing seems to be stronger than the effect of house/apartment ownership. Therefore, Czech households appear to be generally conservative and risk averse; house price growth seems not to influence their consumption. This is also reflected in a low and decreasing reported share of housing loans for consumption ("American mortgages"), which formed only 3.2% of the total amount of housing loans in 2016. After controlling for the usual characteristics such as income and demographics, it thus seems that home ownership works as a general mechanism distinguishing between high and low saving households. It could thus be seen as a proxy for the unobservable willingness to save. However, our analysis does not cover the most recent period of rapid house price growth in 2016/2017, as the newest data from the HBS database are for 2015. As the current period of house price growth seems to be different from previous periods of high growth in housing loans, this opens up the possibility of extending our research to cover this period in future. Nevertheless, as the current increased demand for housing could be related to investment motives and increased credit growth, our finding of a strong negative effect of debt servicing on consumption and a positive effect of home ownership on saving suggests that the collateral channel should not be positive even in the current episode.

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# Appendix A

### *Table A.1: Family Houses, Number of Transactions – Regional and Municipality Size Breakdown*

| | | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Prague (Capital)** | | **101** | **103** | **98** | **109** | **89** | **74** | **48** | **30** | **18** |
| Středočeský Region | under 1,999 inhab. | 2 582 | 2 220 | 1 912 | 2 062 | 2 139 | 1 878 | 1 613 | 571 | 709 |
| | 2,000 - 9,999 inhab. | 807 | 697 | 613 | 846 | 897 | 878 | 710 | 267 | 296 |
| | 10,000 - 49,999 inhab. | 429 | 367 | 266 | 332 | 384 | 324 | 273 | 91 | 112 |
| | 50,000 inhab. or more | 83 | 63 | 37 | 45 | 44 | 24 | 19 | 12 | 28 |
| **Total Středočeský** | | **3 901** | **3 347** | **2 828** | **3 285** | **3 464** | **3 104** | **2 615** | **941** | **1 145** |
| Jihočeský Region | under 1,999 inhab. | 961 | 846 | 756 | 710 | 746 | 744 | 697 | 322 | 273 |
| | 2,000 - 9,999 inhab. | 438 | 406 | 366 | 391 | 369 | 394 | 347 | 143 | 141 |
| | 10,000 - 49,999 inhab. | 116 | 112 | 76 | 96 | 76 | 82 | 76 | 35 | 38 |
| | 50,000 inhab. or more | 48 | 51 | 44 | 52 | 69 | 57 | 57 | 26 | 26 |
| **Total Jihočeský** | | **1 563** | **1 415** | **1 242** | **1 249** | **1 260** | **1 277** | **1 177** | **526** | **478** |
| Plzeňský Region | under 1,999 inhab. | 643 | 479 | 432 | 451 | 413 | 413 | 334 | 246 | 196 |
| | 2,000 - 9,999 inhab. | 307 | 211 | 163 | 184 | 186 | 203 | 132 | 95 | 96 |
| | 10,000 - 49,999 inhab. | 72 | 55 | 50 | 45 | 39 | 30 | 34 | 21 | 19 |
| | 50,000 inhab. or more | 36 | 25 | 21 | 22 | 28 | 31 | 22 | 25 | 20 |
| **Total Plzeňský** | | **1 058** | **770** | **666** | **702** | **666** | **677** | **522** | **387** | **331** |
| Karlovarský Region | under 1,999 inhab. | 190 | 205 | 166 | 163 | 149 | 137 | 111 | 45 | 65 |
| | 2,000 - 9,999 inhab. | 134 | 121 | 120 | 127 | 108 | 89 | 76 | 32 | 24 |
| | 10,000 - 49,999 inhab. | 45 | 53 | 51 | 56 | 49 | 40 | 31 | 23 | 20 |
| | 50,000 inhab. or more | 17 | 13 | 10 | 6 | 14 | 9 | 14 | 5 | 6 |
| **Total Karlovarský** | | **386** | **392** | **347** | **352** | **320** | **275** | **232** | **105** | **115** |
| Ústecký Region | under 1,999 inhab. | 585 | 498 | 579 | 563 | 641 | 581 | 548 | 226 | 219 |
| | 2,000 - 9,999 inhab. | 282 | 247 | 268 | 246 | 291 | 268 | 250 | 100 | 75 |
| | 10,000 - 49,999 inhab. | 183 | 147 | 169 | 174 | 171 | 188 | 183 | 92 | 80 |
| | 50,000 inhab. or more | 57 | 74 | 79 | 105 | 103 | 87 | 85 | 34 | 32 |
| **Total Ústecký** | | **1 107** | **966** | **1 095** | **1 088** | **1 206** | **1 124** | **1 066** | **452** | **406** |
| Liberecký Region | under 1,999 inhab. | 327 | 303 | 308 | 307 | 338 | 319 | 318 | 148 | 146 |
| | 2,000 - 9,999 inhab. | 212 | 181 | 201 | 190 | 210 | 206 | 195 | 58 | 62 |
| | 10,000 - 49,999 inhab. | 74 | 41 | 64 | 63 | 63 | 58 | 61 | 26 | 23 |
| | 50,000 inhab. or more | 18 | 22 | 43 | 55 | 57 | 43 | 26 | 20 | 8 |
| **Total Liberecký** | | **631** | **547** | **616** | **615** | **668** | **626** | **600** | **252** | **239** |
| Královéhradecký Region | under 1,999 inhab. | 758 | 666 | 557 | 456 | 479 | 438 | 357 | 205 | 224 |
| | 2,000 - 9,999 inhab. | 409 | 378 | 286 | 325 | 278 | 246 | 208 | 93 | 81 |
| | 10,000 - 49,999 inhab. | 137 | 92 | 83 | 99 | 106 | 89 | 67 | 47 | 40 |
| | 50,000 inhab. or more | 39 | 38 | 41 | 29 | 43 | 31 | 29 | 26 | 16 |
| **Total Královéhradecký** | | **1 343** | **1 174** | **967** | **909** | **906** | **804** | **661** | **371** | **361** |
| Pardubický Region | under 1,999 inhab. | 639 | 607 | 522 | 499 | 551 | 417 | 434 | 186 | 216 |
| | 2,000 - 9,999 inhab. | 203 | 184 | 156 | 229 | 205 | 167 | 138 | 72 | 60 |
| | 10,000 - 49,999 inhab. | 166 | 153 | 122 | 117 | 124 | 75 | 101 | 47 | 31 |
| | 50,000 inhab. or more | 29 | 23 | 35 | 35 | 28 | 46 | 33 | 37 | 23 |
| **Total Pardubický** | | **1 037** | **967** | **835** | **880** | **908** | **705** | **706** | **342** | **330** |
| Vysočina Region | under 1,999 inhab. | 614 | 646 | 531 | 524 | 594 | 525 | 383 | 184 | 154 |
| | 2,000 - 9,999 inhab. | 234 | 241 | 206 | 183 | 202 | 200 | 142 | 55 | 70 |
| | 10,000 - 49,999 inhab. | 118 | 88 | 98 | 95 | 104 | 84 | 77 | 40 | 43 |
| | 50,000 inhab. or more | 30 | 29 | 19 | 21 | 29 | 18 | 26 | 20 | 10 |
| **Total Vysočina** | | **996** | **1 004** | **854** | **823** | **929** | **827** | **628** | **299** | **277** |
| Jihomoravský Region | under 1,999 inhab. | 1 142 | 1 216 | 1 134 | 1 268 | 1 404 | 1 402 | 1 183 | 331 | 264 |
| | 2,000 - 9,999 inhab. | 608 | 588 | 652 | 732 | 820 | 821 | 614 | 191 | 139 |
| | 10,000 - 49,999 inhab. | 189 | 212 | 147 | 208 | 203 | 200 | 159 | 77 | 68 |
| | 50,000 inhab. or more | 225 | 198 | 217 | 172 | 170 | 154 | 124 | 61 | 56 |
| **Total Jihomoravský** | | **2 164** | **2 214** | **2 150** | **2 380** | **2 597** | **2 577** | **2 080** | **660** | **527** |
| Olomoucký Region | under 1,999 inhab. | 728 | 816 | 665 | 665 | 577 | 472 | 548 | 240 | 236 |
| | 2,000 - 9,999 inhab. | 211 | 256 | 187 | 243 | 237 | 200 | 227 | 61 | 55 |
| | 10,000 - 49,999 inhab. | 147 | 145 | 145 | 128 | 108 | 86 | 103 | 51 | 52 |
| | 50,000 inhab. or more | 71 | 61 | 39 | 51 | 49 | 54 | 39 | 13 | 29 |
| **Total Olomoucký** | | **1 157** | **1 278** | **1 036** | **1 087** | **971** | **812** | **917** | **365** | **372** |
| Zlínský Region | under 1,999 inhab. | 610 | 636 | 496 | 536 | 553 | 538 | 366 | 143 | 125 |
| | 2,000 - 9,999 inhab. | 466 | 428 | 339 | 382 | 368 | 376 | 279 | 83 | 81 |
| | 10,000 - 49,999 inhab. | 169 | 152 | 156 | 140 | 173 | 140 | 86 | 35 | 56 |
| | 50,000 inhab. or more | 85 | 84 | 63 | 76 | 96 | 105 | 84 | 40 | 36 |
| **Total Zlínský** | | **1 330** | **1 300** | **1 054** | **1 134** | **1 190** | **1 159** | **815** | **301** | **298** |
| Moravskoslezský Region | under 1,999 inhab. | 406 | 434 | 418 | 378 | 431 | 413 | 355 | 189 | 153 |
| | 2,000 - 9,999 inhab. | 424 | 390 | 381 | 442 | 481 | 436 | 367 | 144 | 145 |
| | 10,000 - 49,999 inhab. | 159 | 126 | 135 | 130 | 148 | 144 | 93 | 57 | 56 |
| | 50,000 inhab. or more | 109 | 170 | 147 | 156 | 201 | 149 | 139 | 79 | 46 |
| **Total Moravskoslezský** | | **1 098** | **1 120** | **1 081** | **1 106** | **1 261** | **1 142** | **954** | **469** | **400** |
| **Total ČR** | | **17 872** | **16 597** | **14 869** | **15 719** | **16 435** | **15 183** | **13 021** | **5 500** | **5 297** |

*Source: Czech Statistical Office*

*Note: Highlighted cells with less than 50 transactions*

***Table A.2: Apartments, Number of Transactions – Regional and Municipality Size Breakdown***

| | | 2001-2003 | 2004-2006 | 2007-2009 | 2010-2012 | 2013-2015 |
|---|---|---|---|---|---|---|
| Prague (Capital) | Praha 1 | 167 | 368 | 580 | 494 | 189 |
| | Praha 2, 6, 7 | 501 | 710 | 1 232 | 1 771 | 668 |
| | Praha 3-5, 8-28 | 1601 | 2 745 | 4 382 | 5 357 | 2 870 |
| **Total Praha** | | **2269** | **3 823** | **6 194** | **7 622** | **3 727** |
| Středočeský Region | under 1,999 inhab. | 206 | 622 | 845 | 884 | 483 |
| | 2,000 - 9,999 inhab. | 291 | 1 041 | 1 973 | 1 871 | 1 016 |
| | 10,000 - 49,999 inhab. | 1195 | 3 713 | 4 549 | 4 803 | 2 383 |
| | 50,000 inhab. or more | 601 | 1 236 | 1 778 | 1 155 | 508 |
| **Total Středočeský** | | **2293** | **6 612** | **9 145** | **8 713** | **4 390** |
| Jihočeský Region | under 1,999 inhab. | 405 | 513 | 676 | 516 | 380 |
| | 2,000 - 9,999 inhab. | 755 | 1 231 | 1 251 | 1 239 | 734 |
| | 10,000 - 49,999 inhab. | 712 | 1 306 | 1 508 | 1 796 | 1 073 |
| | 50,000 inhab. or more | 875 | 1 168 | 1 405 | 1 411 | 842 |
| **Total Jihočeský** | | **2747** | **4 218** | **4 840** | **4 962** | **3 029** |
| Plzeňský Region | under 1,999 inhab. | 128 | 363 | 362 | 440 | 269 |
| | 2,000 - 9,999 inhab. | 231 | 823 | 826 | 903 | 679 |
| | 10,000 - 49,999 inhab. | 192 | 563 | 702 | 772 | 564 |
| | 50,000 inhab. or more | 277 | 990 | 1 630 | 2 220 | 1 372 |
| **Total Plzeňský** | | **828** | **2 739** | **3 520** | **4 335** | **2 884** |
| Karlovarský Region | under 1,999 inhab. | 62 | 171 | 349 | 315 | 188 |
| | 2,000 - 9,999 inhab. | 265 | 569 | 908 | 835 | 457 |
| | 10,000 - 49,999 inhab. | 1140 | 2 012 | 2 646 | 2 320 | 1 215 |
| | 50,000 inhab. or more | 137 | 439 | 1 031 | 1 129 | 840 |
| **Total Karlovarský** | | **1604** | **3 191** | **4 934** | **4 599** | **2 700** |
| Ústecký Region | under 1,999 inhab. | 24 | 76 | 178 | 236 | 125 |
| | 2,000 - 9,999 inhab. | 64 | 362 | 702 | 965 | 479 |
| | 10,000 - 49,999 inhab. | 226 | 1 312 | 2 789 | 3 704 | 1 946 |
| | 50,000 inhab. or more | 853 | 2 980 | 3 276 | 3 808 | 2 146 |
| **Total Ústecký** | | **1167** | **4 730** | **6 945** | **8 713** | **4 696** |
| Liberecký Region | under 1,999 inhab. | 15 | 129 | 153 | 204 | 181 |
| | 2,000 - 9,999 inhab. | 99 | 368 | 521 | 609 | 469 |
| | 10,000 - 49,999 inhab. | 174 | 671 | 825 | 1 009 | 671 |
| | 50,000 inhab. or more | 18 | 913 | 987 | 540 | 618 |
| **Total Liberecký** | | **306** | **2 081** | **2 486** | **2 362** | **1 939** |
| Královéhradecký Region | under 1,999 inhab. | 71 | 153 | 272 | 278 | 222 |
| | 2,000 - 9,999 inhab. | 204 | 494 | 879 | 880 | 475 |
| | 10,000 - 49,999 inhab. | 372 | 1 036 | 1 303 | 1 448 | 666 |
| | 50,000 inhab. or more | 445 | 858 | 1 358 | 1 801 | 956 |
| **Total Královéhradecký** | | **1092** | **2 541** | **3 812** | **4 407** | **2 319** |
| Pardubický Region | under 1,999 inhab. | 103 | 252 | 358 | 323 | 140 |
| | 2,000 - 9,999 inhab. | 388 | 476 | 608 | 736 | 430 |
| | 10,000 - 49,999 inhab. | 416 | 830 | 1 064 | 845 | 431 |
| | 50,000 inhab. or more | 411 | 1 709 | 1 631 | 1 759 | 1 290 |
| **Total Pardubický** | | **1318** | **3 267** | **3 661** | **3 663** | **2 291** |
| Vysočina Region | under 1,999 inhab. | 132 | 193 | 192 | 235 | 116 |
| | 2,000 - 9,999 inhab. | 342 | 418 | 566 | 590 | 275 |
| | 10,000 - 49,999 inhab. | 385 | 1 019 | 1 255 | 1 512 | 549 |
| | 50,000 inhab. or more | 291 | 595 | 860 | 1 143 | 555 |
| **Total Vysočina** | | **1150** | **2 225** | **2 873** | **3 480** | **1 495** |
| Jihomoravský Region | under 1,999 inhab. | 78 | 194 | 258 | 379 | 206 |
| | 2,000 - 9,999 inhab. | 601 | 1 263 | 1 180 | 1 550 | 692 |
| | 10,000 - 49,999 inhab. | 509 | 979 | 1 813 | 2 494 | 1 394 |
| | 50,000 inhab. or more | 974 | 2 230 | 4 227 | 5 839 | 2 888 |
| **Total Jihomoravský** | | **2162** | **4 666** | **7 478** | **10 262** | **5 180** |
| Olomoucký Region | under 1,999 inhab. | 74 | 139 | 262 | 254 | 170 |
| | 2,000 - 9,999 inhab. | 98 | 251 | 373 | 507 | 336 |
| | 10,000 - 49,999 inhab. | 349 | 1 159 | 1 832 | 1 692 | 1 306 |
| | 50,000 inhab. or more | 74 | 709 | 2 081 | 2 539 | 1 366 |
| **Total Olomoucký** | | **595** | **2 258** | **4 548** | **4 992** | **3 178** |
| Zlínský Region | under 1,999 inhab. | 32 | 66 | 47 | 116 | 52 |
| | 2,000 - 9,999 inhab. | 353 | 672 | 779 | 859 | 489 |
| | 10,000 - 49,999 inhab. | 1252 | 2 164 | 2 351 | 2 771 | 1 248 |
| | 50,000 inhab. or more | 311 | 1 022 | 1 195 | 1 260 | 754 |
| **Total Zlínský** | | **1948** | **3 924** | **4 372** | **5 006** | **2 543** |
| Moravskoslezský Region | under 1,999 inhab. | 35 | 106 | 174 | 192 | 100 |
| | 2,000 - 9,999 inhab. | 110 | 339 | 538 | 694 | 370 |
| | 10,000 - 49,999 inhab. | 189 | 998 | 1 547 | 1 563 | 715 |
| | 50,000 inhab. or more | 776 | 2 306 | 3 668 | 5 169 | 2 481 |
| **Total Moravskoslezský** | | **1110** | **3 749** | **5 927** | **7 618** | **3 666** |
| **Total ČR** | | **20589** | **50 024** | **70 735** | **80 734** | **44 037** |

*Source: Czech Statistical Office*

*Note: Highlighted cells with less than 200 transactions*

# Appendix B

In this appendix, we provide two sets of sensitivity checks. First, we re-estimate equations (1)–(3) on all the data, i.e. without excluding households living in family houses in municipalities with more than 50,000 inhabitants and households living in apartments in municipalities with less than 1,999 inhabitants. The tables below thus represent an alternative to Tables 2–8 in the main text of the paper. Generally, the estimated coefficients and their significance are close to the baseline presented in the main text.

***Table B.1: The Effect of Property Ownership on Consumption/Saving Choices in 2003***

| | **House ownership** | | | **Apartment ownership** | | |
|---|---|---|---|---|---|---|
| | OLS | RLS | PSM | OLS | RLS | PSM |
| **Propensity to consume** | -0.0212 | -0.0194 | 0.0078 | -0.0003 | 0.0018 | -0.0965 |
| *p-value* | 0.064 | 0.034 | 0.548 | 0.788 | 0.884 | 0.062 |
| **Gross savings** | -0.0909 | -0.0573 | -0.0583 | 0.0159 | 0.0123 | -0.0377 |
| *p-value* | -0.003 | 0.030 | 0.113 | 0.496 | 0.563 | 0.206 |
| **Gross borrowings** | -0.1009 | -0.0493 | -0.0622 | 0.0077 | 0.0305 | -0.0194 |
| *p-value* | 0.001 | 0.037 | 0.077 | 0.658 | 0.218 | 0.282 |
| **Net savings** | 0.0031 | 0.0120 | 0.0037 | 0.0085 | -0.0104 | -0.0164 |
| *p-value* | 0.523 | 0.249 | 0.516 | 0.594 | 0.385 | 0.188 |

***Table B.2: The Effect of Property Prices on Consumption/Saving Decisions among Owners (in 2003)***

| | **pi0** | | **pi1** | | **pi0** | | **pi1** | |
|---|---|---|---|---|---|---|---|---|
| | OLS | RLS | OLS | RLS | OLS | RLS | OLS | RLS |
| **Propensity to consume** | -0.0249 | -0.0205 | 0.0139 | -0.0004 | 0.1766 | 0.1704 | -0.1086 | -0.1058 |
| *p-value* | 0.699 | 0.639 | 0.836 | 0.946 | 0.135 | 0.140 | 0.400 | 0.405 |
| **Gross savings** | 0.1329 | 0.1686 | 0.2076 | 0.1912 | 0.3140 | 0.4122 | -0.0662 | 0.0777 |
| *p-value* | 0.102 | 0.048 | 0.070 | 0.126 | 0.214 | 0.092 | 0.785 | 0.800 |
| **Gross borrowings** | 0.0138 | 0.0289 | 0.0743 | 0.0342 | 0.2623 | 0.3990 | -0.1205 | 0.2104 |
| *p-value* | 0.738 | 0.844 | 0.410 | 0.676 | 0.196 | 0.075 | 0.664 | 0.448 |
| **Net savings** | 0.0612 | 0.0387 | 0.0014 | 0.0072 | -0.0702 | -0.1222 | 0.1631 | 0.0617 |
| *p-value* | 0.243 | 0.511 | 0.836 | 0.912 | 0.614 | 0.262 | 0.209 | 0.535 |

***Table B.3: The Effect of Debt Service on Consumption/Saving Decisions among Owners (in 2003)***

| | House owners DSTI | | Apartment owners DSTI | |
|---|---|---|---|---|
| | OLS | RLS | OLS | RLS |
| **Propensity to consume** | -0.0743 | -0.0823 | -0.2186 | -0.1923 |
| *p-value* | 0.016 | 0.011 | 0.014 | 0.013 |
| **Gross savings** | 0.0617 | 0.0412 | 0.4119 | 0.3503 |
| *p-value* | 0.251 | 0.427 | 0.005 | 0.086 |
| **Gross borrowings** | -0.0062 | 0.0146 | 0.3875 | 0.3962 |
| *p-value* | 0.885 | 0.689 | 0.006 | 0.004 |
| **Net savings** | 0.0662 | -0.1824 | 0.0013 | -0.0612 |
| *p-value* | 0.046 | 0.015 | 0.830 | 0.285 |

***Table B.4: The Effect of Property Ownership on Consumption/Saving Choices in 2008***

| | House ownership | | | Apartment ownership | | |
|---|---|---|---|---|---|---|
| | OLS | RLS | PSM | OLS | RLS | PSM |
| **Propensity to consume** | -0.0925 | 0.0312 | -0.0831 | -0.0185 | -0.0166 | -0.0913 |
| *p-value* | 0.138 | 0.206 | 0.177 | 0.108 | 0.104 | 0.182 |
| **Gross savings** | -0.0902 | -0.0631 | -0.0927 | -0.0690 | 0.0062 | 0.0752 |
| *p-value* | 0.820 | 0.760 | 0.327 | 0.866 | 0.421 | 0.512 |
| **Gross borrowings** | 0.0525 | 0.0221 | -0.1242 | 0.0528 | -0.0297 | 0.0271 |
| *p-value* | 0.594 | 0.833 | 0.112 | 0.480 | 1.033 | 0.323 |
| **Net savings** | 0.0915 | 0.0445 | 0.1179 | 0.1098 | 0.0624 | 0.0773 |
| *p-value* | 0.040 | 0.037 | 0.841 | 0.076 | 0.091 | 0.865 |

***Table B.5: The Effect of Property Prices on Consumption/Saving Decisions among Owners (in 2008)***

| | $\beta_0$ | | $\beta_1$ | | $\beta_0$ | | $\beta_1$ | |
|---|---|---|---|---|---|---|---|---|
| | OLS | RLS | OLS | RLS | OLS | RLS | OLS | RLS |
| **Propensity to consume** | -0.0074 | -0.0341 | -0.0678 | -0.0613 | 0.0266 | -0.1510 | 0.0878 | 0.0771 |
| *p-value* | 0.932 | 0.732 | 0.427 | 0.500 | 0.902 | 0.540 | 0.741 | 0.745 |
| **Gross savings** | 0.1112 | -0.0382 | 0.1188 | 0.0693 | -0.0901 | -0.2663 | -0.9210 | -0.9134 |
| *p-value* | 0.573 | 0.811 | 0.510 | 0.684 | 0.833 | 0.523 | 0.056 | 0.070 |
| **Gross borrowings** | -0.1063 | -0.1411 | 0.0381 | 0.0478 | 0.0087 | -0.2596 | -0.5123 | -0.6571 |
| *p-value* | 0.540 | 0.449 | 0.756 | 0.805 | 0.978 | 0.570 | 0.276 | 0.182 |
| **Net savings** | 0.0665 | 0.0359 | 0.0225 | -0.0003 | -0.0417 | -0.0209 | -0.2294 | -0.0632 |
| *p-value* | 0.437 | 0.701 | 0.792 | 0.996 | 0.893 | 0.962 | 0.438 | 0.854 |

***Table B.6: The Effect of Debt Service on Consumption/Saving Decisions among Owners (in 2008)***

| | House owners DSTI | | Apartment owners DSTI | |
|---|---|---|---|---|
| | OLS | RLS | OLS | RLS |
| **Propensity to consume** | 0.0023 | -0.0357 | -0.0622 | 0.0516 |
| *p-value* | 0.884 | 0.507 | 0.677 | 0.719 |
| **Gross savings** | 3.7345 | 0.6946 | 1.2910 | 0.4510 |
| *p-value* | 0.013 | 0.013 | 0.015 | 0.077 |
| **Gross borrowings** | 1.5830 | 0.5803 | 0.8227 | 0.7128 |
| *p-value* | 0.010 | 0.018 | 0.001 | 0.017 |
| **Net savings** | 2.1516 | -0.0815 | 0.3418 | -0.1344 |
| *p-value* | 0.006 | 0.186 | 0.026 | 0.267 |

***Table B.7: The Effect of Apartment Ownership on Consumption/Saving Choices in 2009/2010***

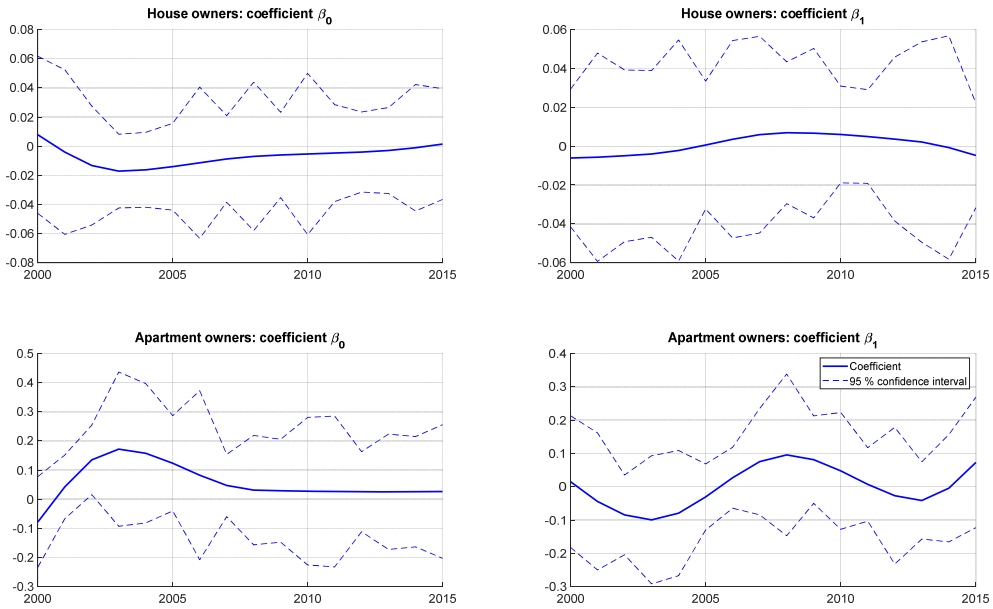
| | Apartment ownership | | |
|---|---|---|---|
| | OLS | RLS | PSM |
| **Propensity to consume** | -0.0154 | -0.0075 | -0.0613 |
| *p-value* | 0.348 | 0.105 | 0.124 |
| **Gross savings** | -0.0243 | 0.0260 | -0.0644 |
| *p-value* | 0.357 | 0.464 | 0.222 |
| **Gross borrowings** | -0.0241 | -0.0062 | -0.0588 |
| *p-value* | 0.362 | 0.650 | 0.222 |
| **Net savings** | -0.0224 | 0.0235 | -0.0161 |
| *p-value* | 0.433 | 0.154 | 0.371 |

Second, as an additional robustness check, we estimate the analogous equation to Equation (3) over the whole sample and allow for limited time variation in coefficients $\beta_0$ and $\beta_1$. The equation then reads as:

$$y_{it} = \alpha + \beta_{0t}\pi_{oit} + \beta_{1t}\pi_{1it} + \gamma DSTI_{it} + Z_{it}\theta + \varepsilon_{it}. \qquad \text{(B.1)}$$

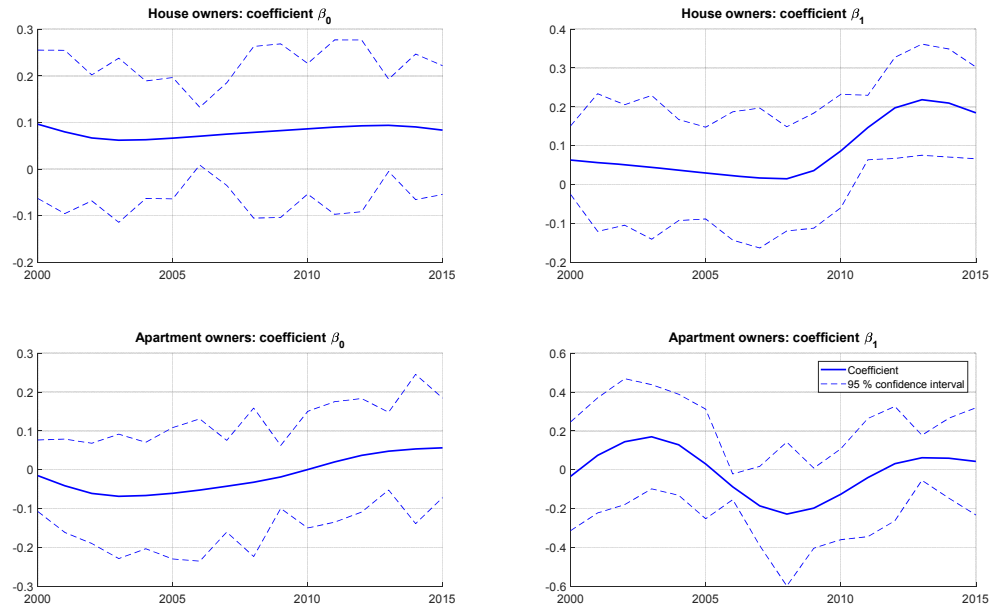
As is usual in the literature, the time-varying coefficients are estimated using the Kalman filter. Selected results are illustrated in the following Figures B.1–B.2.

***Figure B.1: Propensity to Consume***




As is apparent from Figure B.1, the coefficients of the regression (B.1) for the average propensity to consume oscillate around zero and the confidence intervals are relatively large, containing zero in most cases. That means that the extension of equation (3) to the whole panel does not provide any additional useful information. A similar comment applies to net savings, for which the results are displayed in Figure B.2.

***Figure B.2: Net Savings***



# Appendix C: The Full Regression Specification for the 2007/2008 Episode

***Table C.1: The Effects of House Ownership on Consumption/Saving Choices in 2008***

| **Propensity to consume** | **OLS** | | | **RLS** | | |
|---|---|---|---|---|---|---|
| | ***Coefficient*** | *t*-statistic | *p*-value | ***Coefficient*** | *t*-statistic | *p*-value |
| Intercept | ***0.966*** | 40.363 | 0.000 | ***0.967*** | 38.658 | 0.000 |
| Own house | ***-0.032*** | -0.644 | 0.100 | ***-0.040*** | -0.167 | 0.122 |
| DSTI | ***0.012*** | -0.351 | 0.873 | ***-0.039*** | -1.331 | 0.500 |
| Number of economically active (EA) persons | ***-0.025*** | -1.772 | 0.077 | ***-0.032*** | -2.253 | 0.025 |
| Children/number of EA persons | ***0.122*** | 2.215 | 0.027 | ***0.191*** | 4.296 | 0.000 |
| Net income/min. living standards | ***-0.520*** | -0.623 | 0.534 | ***-0.975*** | -1.245 | 0.214 |
| Net income | ***-0.398*** | -2.475 | 0.014 | ***-0.402*** | -2.701 | 0.007 |

| **Gross savings** | **OLS** | | | **RLS** | | |
|---|---|---|---|---|---|---|
| | ***Coefficient*** | *t*-statistic | pValue | ***Coefficient*** | *t*-statistic | *p*-value |
| Intercept | ***0.295*** | 4.678 | 0.000 | ***0.185*** | 2.816 | 0.005 |
| Own house | ***-0.009*** | -0.186 | 0.862 | ***0.017*** | 0.628 | 0.707 |
| DSTI | ***3.723*** | 17.932 | 0.000 | ***0.684*** | 65.951 | 0.000 |
| EA | ***0.426*** | 6.610 | 0.000 | ***0.553*** | 8.528 | 0.000 |
| Children/number of EA persons | ***0.457*** | 4.023 | 0.000 | ***0.304*** | 3.347 | 0.001 |
| Net income | ***0.388*** | 2.400 | 0.017 | ***0.467*** | 3.367 | 0.001 |

| **Gross borrowings** | **OLS** | | | **RLS** | | |
|---|---|---|---|---|---|---|
| | ***Coefficient*** | *t*-statistic | *p*-value | ***Coefficient*** | *t*-statistic | *p*-value |
| Intercept | ***0.373*** | 8.530 | 0.000 | ***0.302*** | 5.648 | 0.000 |
| Own house | ***-0.029*** | -0.859 | 0.508 | ***-0.014*** | -0.489 | 0.769 |
| DSTI | ***1.571*** | 2.057 | 0.000 | ***0.581*** | 5.262 | 0.000 |
| EA | ***0.343*** | 6.305 | 0.000 | ***0.411*** | 6.584 | 0.000 |
| Children/number of EA persons | ***0.414*** | 4.318 | 0.000 | ***0.400*** | 4.459 | 0.000 |
| NUTS: 52 | ***-0.077*** | -1.487 | 0.138 | ***-0.084*** | -1.609 | 0.108 |

| **Net saving rate** | **OLS** | | | **RLS** | | |
|---|---|---|---|---|---|---|
| | ***Coefficient*** | *t*-statistic | *p*-value | ***Coefficient*** | *t*-statistic | *p*-value |
| Intercept | ***-0.076*** | -3.096 | 0.002 | ***-0.069*** | -3.717 | 0.000 |
| Own house | ***0.039*** | 1.270 | 0.113 | ***0.046*** | 2.360 | 0.022 |
| DSTI | ***2.135*** | 7.759 | 0.001 | ***-0.097*** | -2.138 | 0.200 |
| EA | ***0.038*** | 2.333 | 0.020 | ***0.035*** | 2.676 | 0.008 |
| Net income | ***0.485*** | 5.754 | 0.000 | ***0.489*** | 7.785 | 0.000 |

***Table C.2: The Effects of House Ownership on Consumption/Saving Choices in 2008***

| **Propensity to consume** | **OLS** | | | **RLS** | | |
|---|---|---|---|---|---|---|
| | ***Coefficient*** | *t*-statistic | *p*-value | ***Coefficient*** | *t*-statistic | *p*-value |
| Intercept | ***0.966*** | 40.363 | 0.000 | ***0.967*** | 38.658 | 0.000 |
| Own apartment | ***-0.042*** | -0.644 | 0.040 | ***-0.033*** | -0.167 | 0.058 |
| DSTI | ***-0.006*** | -0.351 | 0.683 | ***0.041*** | 0.331 | 0.725 |
| EA | ***-0.025*** | -1.772 | 0.077 | ***-0.032*** | -2.253 | 0.025 |
| Net income/min. living standards | ***0.122*** | 2.215 | 0.027 | ***0.191*** | 4.296 | 0.000 |
| Net income | ***-0.520*** | -0.623 | 0.534 | ***-0.975*** | -1.245 | 0.214 |

| **Gross savings** | **OLS** | | | **RLS** | | |
|---|---|---|---|---|---|---|
| | ***Coefficient*** | *t*-statistic | *p*-value | ***Coefficient*** | *t*-statistic | *p*-value |
| Intercept | ***0.368*** | 8.471 | 0.000 | ***0.284*** | 7.492 | 0.000 |
| Own apartment | ***-0.005*** | -0.120 | 0.905 | ***0.031*** | 0.824 | 0.410 |
| DSTI | ***0.815*** | 4.287 | 0.005 | ***0.712*** | 1.841 | 0.007 |
| EA | ***0.083*** | 1.949 | 0.052 | ***0.032*** | 0.876 | 0.382 |
| EA/number of persons | ***0.256*** | 3.319 | 0.001 | ***0.410*** | 6.138 | 0.000 |
| Net income | ***0.545*** | 3.412 | 0.001 | ***0.697*** | 5.036 | 0.000 |

| **Gross borrowings** | **OLS** | | | **RLS** | | |
|---|---|---|---|---|---|---|
| | ***Coefficient*** | *t*-statistic | *p*-value | ***Coefficient*** | *t*-statistic | *p*-value |
| Intercept | ***0.368*** | 8.471 | 0.000 | ***0.284*** | 7.492 | 0.000 |
| Own apartment | ***-0.005*** | -0.120 | 0.905 | ***0.031*** | 0.824 | 0.410 |
| DSTI | ***0.815*** | 4.287 | 0.000 | ***0.712*** | 1.841 | 0.066 |
| EA | ***0.083*** | 1.949 | 0.052 | ***0.032*** | 0.876 | 0.382 |
| EA/number of persons | ***0.256*** | 3.319 | 0.001 | ***0.410*** | 6.138 | 0.000 |
| Net income | ***0.545*** | 3.412 | 0.001 | ***0.697*** | 5.036 | 0.000 |

| **Net saving rate** | **OLS** | | | **RLS** | | |
|---|---|---|---|---|---|---|
| | ***Coefficient*** | *t*-statistic | *p*-value | ***Coefficient*** | *t*-statistic | *p*-value |
| Intercept | ***-0.068*** | -2.858 | 0.004 | ***-0.080*** | -4.699 | 0.000 |
| Own apartment | ***0.033*** | 1.402 | 0.162 | ***0.053*** | 3.129 | 0.002 |
| DSTI | ***0.344*** | 2.014 | 0.045 | ***-0.131*** | -1.133 | 0.258 |
| EA/number of persons | ***0.085*** | 2.854 | 0.005 | ***0.116*** | 5.137 | 0.000 |
| Net income | ***0.507*** | 6.803 | 0.000 | ***0.487*** | 9.218 | 0.000 |

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