Rent Deregulation, Tenure Choice, and Real Estate Price Expectations

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Abstract

We study implications of a natural experiment taking place in the Czech Republic where rents have been been de-regulated since 2007. The regulated rent appreciation depends explicitly on the price of real estate. In our analysis, we use a series of annual cross-sectional household consumption surveys from 2005 to 2008. Only about 20% of the sample is replaced each year, which enables us to follow households for subsequent years, including their tenure choice. The rent deregulation makes households in regulated apartments more likely to own real estate while the opposite is true for other renters. The de-regulation formula and a present-value model are then employed to deduce an expected real estate price growth rate distribution. The net present value of buying property vs. renting one is an increasing function of the real estate price appreciation. The appreciation, which makes the net present value equal to zero, is a lower bound for households that switched from renting a regulated apartment to owning one and a lower bounds for households that did not.

KEY WORDS: Czech Republic; Expectations; Rent regulation and deregulation; Real estate prices; Tenure choice;

JEL CLASSIFICATION: R21 - Housing Demand; R31 - Housing Supply and Markets; C33 - Models with Panel Data.

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1 Introduction

A majority of European rental markets are characterized by a certain degree of rent regulation. A simple non-targeted rent regulation represents setting upward ceilings on the rent level. This type of rent regulation was common prior to the year 2000 in many countries of Central and Eastern Europe. Its basic principles were inherited from communism. After 2000, some countries such as Bulgaria and Estonia abandoned the practice and other countries such as Poland significantly reformed this policy. The Czech Republic was slow to follow this trend and introduced its plan for rent deregulation only in 2006, two years after it joined the European Union. It set maximum appreciation for regulated rents, which explicitly depended on the market real estate price. This feature makes it very convenient to investigate the impact of the deregulation process on the tenure choice of households and it also enables us to deduce real estate price expectations of households living in rent-regulated apartments based on their choice between renting and owning.

We investigate the impact of the rent deregulation using a unique dataset for Czech households. It is based on a series of budgetary surveys in a rotating sample where only 20% of households are replaced each year. Using this fact we can follow a particular household for two years in a row and see if its status remained the same or changed during this period. Renters living in regulated apartments can become owners or renters for the market rent. Renters paying the market rent can become owners. Owners can become renters on the free rental market. We construct datasets for periods 2005-6, 2006-7, and 2007-8, respectively. The data contain information on rents and it can be matched with existing information on real estate prices and therefore expected appreciation of regulated rents. As far as we know, there is no nationwide step-by-step rent deregulation process in the US or in EU countries resembling the one in the Czech Republic, with available data enabling researchers to study it.

The effect of rent deregulation on tenure choice is analyzed for different groups of households. Specifically, households living in regulated rent apartments, free market

renters and owners. An increase in the rental costs for households living in regulated rent apartments implies either the necessity to pay higher rents closer to the free market rent or to switch to owning instead of renting. Our first objective is to quantify the effect of the deregulation on the households' home ownership decision. Our results demonstrate that appreciating regulated rents make households living in regulated apartments seek other alternatives more frequently. On the other hand, the rent deregulation implies that previously unavailable housing units become available for the free market renting and the free market rent is likely to decrease due to higher availability of rental housing. Such change should have an effect on probability of owning for free market renters and these effects are also quantified in this paper. As expected, increasing regulated rents decrease the probability of owning for renters on the unregulated market. Finally, the rent deregulation makes current owners more likely to sell their apartment and and rent since the market rent is expected to decrease.

In the next step, we exploit the specific nature of the Czech deregulation law to characterize real estate price expectations for households living in apartments with regulated rents. For these households, the present value of owning depends on a growth rate of regulated rents, which in turn depends explicitly on property prices. Therefore, the only source of uncertainty in the present value of renting an apartment is the price process. Similarly for the present value of property purchase, which takes into account the fact that property can be sold in the future. We assume that the price process is AR(1). We can then solve for the real estate price appreciation, which makes the net present value (NPV) of renting vs. owning zero. The net present value increases if the price appreciation increases. Therefore, the appreciation making NPV equal to zero imposes an upper limit on households opting to remain in regulated apartments to keep their choice rational. Similarly, this appreciation forms a lower bound for households that has become owners.

The rest of the paper is organized as follows. Section 2 reviews the relevant literature, Section 3 describes the evolution of rent regulation in Czech Republic, Section 4 describes

the used data, and Section 5 formulates an econometric model for tenure choice and discusses empirical results. Section 6 deduces real estate price expectations and Section 7 concludes.

2 Literature Overview

2.1 Rent Regulation and Deregulation

Depending on the perspective, rent regulation has been shown to have either adverse and/or positive effects. First, it affects real estate vacancies and household welfare and mobility. Moon and Rapoport (1997) use longitudinal Housing and Survey data from New York and find that a rent-controlled apartment is less likely to be vacant. Annas (1997) shows that rent regulation welfare improvements over laissez-faire only occur if gains from centralized matching can offset the decrease in housing quality, the possible increase in waiting times, and the risks of rationing induced by rent controls. Raess and Von Ungern Sternberg (2007) study the impact of tenancy rent control for short term contracts, which limits the owners possibilities to increase rents for a certain number of years. This type of rent control leads to lower equilibrium rents and higher social welfare. Munch and Svarer (2001) find that the presence of rent regulation on the private Danish housing market negatively affects household's mobility. Simons-Mosley and Malpezzi (2006) use panel data from New York City Housing and Vacancy Survey and find a significant impact of benefits of lowered rent and costs of distortions in housing consumption on mobility. The costs are larger then the benefits. Lux (2001) compares the development of the social housing sector in the Czech Republic, Poland and Slovakia during 1990s and concludes that maintenance of non-targeted rent regulation in the Czech Republic and Slovakia worsened the affordability of housing for low income households.

Under the pressure from the European Union, the Czech executive and legislative powers started the process of deregulation, which is the main focus of our paper. This implicitly accepts the point of view that the negative effects of the rent regulation in the

Czech Republic were greater then the positive effects. The impact of the deregulation process has been studied by some researchers. Roistacher (1992) analyzes three possible forms of partial rent deregulation on the New York City rental market: income targeted decontrol, high-rent decontrol and vacancy decontrol. She finds that combination of income targeted decontrol and vacancy decontrol seems the best option for reforming New York City's rent regulation system and would generate substantial new taxable rental income. Van der Klaauw and Kock (1998) develop a static partial equilibrium model to investigate the deregulation of Dutch housing market on private market prices and allocations of houses among households. They focus on three regulation measures: individual rent, supporting social housing projects, and social rules for owner occupied houses. They conclude that there are potential welfare gains as a result of simultaneous deregulation of the owner occupied and the rental segments of Dutch housing market. Lux and Sunega (2003) present the results of econometric simulation model on the determination of equilibrium market rents after a potential rent deregulation in the Czech Republic. They find that rent deregulation would lead to an increase of the income for landlords, a decrease of the currently biased free market rents and an improvement of affordability of housing in the Czech Republic. Finally, Lux (2003) compares state housing policies in six selected Central and Eastern European countries. The results imply that the most effective subsidies were implemented where general policy orientated towards the rental model was combined with deregulation in the rental sector.

In this paper, we offer a fresh perspective on the rent regulation and deregulation. We focus on the households rather than on housing units. This enables us to evaluate the impact of a sequential rent deregulation for the whole country and not for a regional housing market. Also, we do not analyze what *would be* the impact but what it actually *was* since the deregulation process is almost completed in the Czech Republic. In addition, the choices made by the households help us to deduce their expectations regarding property prices.

2.2 Tenure Choice

The relationship between consumption, tenure choice of households, and real estate prices has been investigated. For example, Li and Yao (2005) offer a life-cycle model of tenure choice to study different welfare impact on young vs old households and on owners vs. renters to real estate price increases. They find that young households and renters are worse off. In our study, we conduct an empirical analysis using observations on households in two subsequent periods and besides the impact of the property price we also evaluate the effect of rent deregulation on the tenure choice. Beck, Kibuuka, and Tiongson (2010) is an empirical study that employs the data from the European Union (EU) Statistics on Income and Living Conditions (SILC). This is a series of cross-sections 2005-2007 from old and new member countries of EU.[1] It is used to investigate whether households with mortgages are more financially vulnerable then renters or outright owners - they are not. The study finds it difficult to explain the households tenure choice, which may be due to inability to follow households over time. In contrast, our data enable us to see actual choices made by households. Our main interest is again the impact of rent deregulation on the tenure choice, while controlling for other variables.

2.3 Real Estate Price Expectations

Research papers which explicitly deduce or survey expectations regarding real estate prices are scarce. Two exceptions close to our study are Case and Shiller (2004) and Clayton (1997). The former paper includes a survey of real estate price expectations of recent home buyers in four US counties from Los Angeles, San Francisco, Boston, and Milwaukee, respectively. The survey was conducted in 1988 and in 2003. It found unrealistically high expected annual rates of the growth for real estate prices in both periods and all locations. One-year forecasts ranged from 6.1% to 15.3% and forecasts of annual averages for the next

[1]Note that the SILC data are collected in the Czech Republic as well, in parallel with the sample used in this paper.

ten years ranged from 7.3% to 15.7%. The survey respondents mostly viewed their house purchase as a low-risk investment due to naturally occurring house price appreciation. Our analysis differs from this survey in several ways. The selection in Case and Shiller (2004) consists of households, which recently purchased real estate property. These households have already made a choice between renting and buying, either at the time of the survey or perhaps even before in the case of a second-home purchase. Moreover, there may be a self-attribution bias playing a role in their responses since they would like to think that purchasing real estate property was the right choice at the right time. In our case, we focus on renters living in apartments with regulated rents and distinguish between those who opted for owning and those who did not. We also have plenty of other information regarding the households such as their consumption, income, and other characteristics besides corresponding rent and property prices.

Clayton (1997) focuses on the implications of the present value model, which resembles our approach. He shows that there is a negative correlation between an ex post house prices appreciation and the forecast of risk neutral agents, which rejects the null hypothesis of rational expectations. In the long run though, the actual and predicted prices move together. Unlike us, Clayton (1997) uses data on condominiums in Vancouver metropolitan area rather then on households, which limits his available information set. Also, he employs a series of cross-sections (as opposed to panels) to construct a time series 51 quarters long for real estate price appreciation for just eight districts. This is due to the need to estimate real estate prices using hedonic regressions. On the other hand, we generate a cross-sectional distribution of the real estate price distribution across hundreds of households for just two years.

3 Regulation of Rents in the Czech Republic

In the Czech Republic, a permanent right of living in the apartments with low regulated rents was assigned in the 1980s. This right cannot be canceled and can be passed only to a family member. It applies to a particular apartment and its existence makes it very hard to evict current tenants from this apartment. Such regulation has made a part of the housing stock inaccessible for the new tenants and created a shortage of rental housing because regulated rent apartments constituted around 80% of the housing stock on the rental market. As a result, free market rents rapidly appreciated and a substantial gap appeared between them and the regulated rents. The presence of two separated segments of the rental housing with considerably differing rents appeared unjust from the social perspective and created public concerns. Moreover, since regulated rents explicitly depend only on location and size of the dwelling and the right of living in the regulated rent apartments was assigned 20 years ago, in many cases regulated rents do not reflect the social status and income of the tenants (see Lux M., P. Sunega, T. Kostelecký, and D. Čermák 2003).

Many municipal regulated rent apartments were either given to original owners in the restitution process in the 1990s and others were sold to private owners in the early 2000s. The low level of regulated rents did not allow the owners to cover maintenance costs. In the early 2000s, the Czech Constitutional Court ruled in favor of owners on a number of occasions. In its decisions, the Court approved that an owner was allowed to find a compensatory rental apartment for the tenant, with a rent corresponding to the free rental market level. The main justification of these decisions was the out-dated nature of the regulation based on the Ministry of Finance Bill 176 from 1993. The Czech government repeatedly attempted to re-instate legally this old regulation via formally new legislation, trying to sidestep the rulings of the Czech Constitutional Court. The Ministry of Finance for example tried to freeze the rent levels via a Bill 567 in 2002, which was also canceled by the Constitutional Court. The position of the Czech government was later affected

by the international case Hutten-Czapska vs Poland, which was heard at the European Court of Human Rights in Strasbourg. The plaintiff claimed the right to collect a rent at least sufficient to cover a cost related to real estate. This case ended later in 2008 with a friendly settlement. In the light of this process and due to rising concern of public about the consequences of rent regulation, the Act 107 of Unilateral Rent Increase was proposed and approved in 2006. The Act specified a gradual increase of a regulated rent starting from 2007 to 2010.[2]

One of the most important features of the Act 107 was the fact that the regulated rent level and rent appreciation rates became explicitly dependent on actual apartment prices. These prices reflected apartment price indices calculated by the Czech Statistical Office (CSO) based on the transaction real estate prices, which were available from the Ministry of Finance.[3] This change played a crucial role in the subsequent evolution of regulated rents since starting from 2006, the housing price appreciation rate in Czech Republic considerably increased (see Figure 1). This led to an increase in regulated rents and a reduction of the gap between free market rents and regulated rents. This is likely to have had and immediate effect on tenure choice of the households living in regulated rent apartments since the cost of staying in those apartments was now greater. Indirectly, there should be an impact on other types of households as well.

The Act specifies the target rent and the maximum annual percentage increase for the years 2007-2010. Specifically, the target regulated rent is given by

$$T_t = \frac{1}{12}\, c\, P_t \tag{1}$$

where T_t is the regulated monthly rent in terms of Czech koruna per 1 m.^{2} c is the coefficient reflecting the ratio of the annual rent to the price for a given apartment. $c = 0.05$ for apartments of a higher quality, previously referred to in the Czech Republic as apartments of the 1st and 2nd categories. $c = 0.045$ for apartments with a lower

[2]The possibility of increasing the regulated rent from 2010 to 2012 was further enabled by the Act 150 in 2009.

[3]The Ministry of Finance collects this information because there is a 3% sales tax on real estate.

quality i.e. apartments of the 3rd and 4th categories in the previous classification. P_t is the price per 1 m,^{2} which is published by the Czech Ministry for Regional Development. The maximum annual percentage increase is calculated as

$$M_{t+w} = 100\ ((T_{t+w-1}/R_{t+w-1})^{\frac{1}{4-w+1}} - 1), \tag{2}$$

where $w = 1$ for 2007, 2 for 2008, 3 for 2009, and 4 for 2010, respectively. R_{t+w-1} is the regulated rent at time $(t + w - 1)$. The formula is constructed to make the regulated rent equal to the target rent in 2011, assuming that the real estate price does not change.

4 Data

The data used in this paper are extracted from Family Accounts of the Czech Household Budget Survey for the years 2005-2008. This survey includes 3200+ households each year. 76-79% of the sample remains the same - see Table 1 for details. This feature makes it different from the EU-Statistics on Income and Living Conditions, which is a series of cross-sections, with a random sample drawn each year. The fact that only up to 1/4 of the sample of households is replaced enables us to record household tenure choice between years t and t+1. The consumption survey data is complemented by real estate prices from the Czech Statistical Office, which is also published by the Czech Ministry of Regional Development.

The information about the type of a rental apartment has been available only since 2006. In 2005, we had to separate households living in apartments with regulated vs. unregulated rents based on a comparison of reported rents with the market rents from the Institute of Regional Information in Brno. Actual rents significantly lower than marker rents corresponded to regulated apartments. However, in smaller cities the regulated rents were fairly close to market rents and we could not decide, to which group we should assign a given household. We therefore excluded these households from our 2005-2006 sample. Table 1 characterizes the sub-samples by the ownership types of the households.

20-22 % of the sample represent renters, and from this number on average about 81-84 % are renters in apartments with a regulated rent. The rest of the sample are owners. Note that the households in apartments with regulated rents can in addition switch to renting for the market rent. This can occur if they cannot afford the regulated rent and do not have a sufficient income and/or savings to purchase their own property. They are also not likely to qualify for a mortgage, especially if the people in the households are already retired. The ratio of households switching to owning among renters in regulated apartments increases from 5% for the period 2005-6 to 14% in 2006-7. This illustrates that the Act 107 had an immediate impact on the tenure choice. The ratio of households moving from regulated to unregulated apartments is very small, 1-2 %. Only 2-3% of owners become renters again. The two-year panels are constructed for each group. For example, we use the data on households living in apartments with regulated rents in 2005, which also remained in the sample in 2006. A similar approach is used for the other group and the remaining years.

We make use of a number of variables characterizing each household. The first group includes income per person, consumption per person exclusive of rents, an age and education of the household head, and the number of household members. The remaining variables are related to real estate: a mortgage interest rate, a regional real estate price, a maximum regulated rent appreciation for households paying the regulated rent, and the percentage of regulated apartments on the regional rental market for households paying the market rent. There are six datasets. Table 2 provides summary statistics. The monthly income per a household member in Czech crowns (Kč) is always higher for households living in apartments with regulated rents, which confirms that the rent regulation does not help poorer households as initially intended. The higher income translates into higher consumption levels. The households in regulated apartments are also somewhat older and slightly more educated as compared to the other renters. The number of household members is a proxy for needed space and/or a measure of the need for stability

attached to ownership.[4] The first five variables the ability of a household to accumulate the necessary wealth to purchase real estate and/or to qualify for a mortgage. Similarly to other countries, the banks in the Czech Republic provide mortgages in two steps. In the first step, the size of a maxiumum mortgage loan is determined. This depends on how much a household can afford to pay monthly, which is the amount that a household has left after income is spent on the standard consumption. Each bank uses a slightly different definition of this standard consumption but it is always above a legally given minimum.

The second step in the mortgage approval process is setting the interest rate. As a basis for the interest rate determination, we consider the mortgage calculator of the bank CSOB at www.csob.cz. There are only two determinants of the interest rates implicitly embedded in this calculator: the loan-to-value ratio (LTVR) and the fixation period for the interest rate. The maturity of the loan only matters if it changes jointly with the fixation period. In October 2010, the interest rate was 4.49 for LTVR ≤ 0.85 and 5.69 for for LTVR > 0.85. We implement this rule in our sample as follows. We assume that a household would be interested in buying an apartment of the same size and in the same location as its current rented apartment. We calculate the value of this apartment simply by multiplying its footage by a price per m^2 from the Czech Statistical Office. We subtract available savings for each household from the apartment value and compute LTVR. This LTVR translates into a mortgage interest rate for each household. if the household has sufficient savings to purchase the real estate without a need for the loan, we set the corresponding mortgage rate to zero. The calculator gives us an interest rate only for the year 2010. For example, a data point for a household from 2006 is used to get the interest rate, which would be charged for a household with the same characteristics in 2010. Clearly, the macroeconomic conditions are different in 2010 as compared to other

[4]In addition, we have considered the so called family structure, which is the number of children per a number of employed adults. This can be viewed as endogenous and we therefore opted simply for the number of persons living in a household. However, the results of our regressions do not change if the family structure replaces the number of household members.

years. To account for this change, we compute the difference of the mean mortgage interest rate for 1-5 year mortgage rates from the Czech National Bank between a given year and 2010. The rates in percentages are 4, 4.58, 4.92, 5.69, and 4.99 for years 2005-8 and 2010, respectively. We add the difference to rates of all households with a positive LTVR in the given year. For instance, we add 4.00-4.99=-0.99 to mortgage rates in 2005. We employ thus acquired interest rates in our tenure-choice regressions where they represent the cost of borrowing, which is a part of the opportunity cost of staying as a renter of a regulated apartment.

The next explanatory variable is the price of real estate in Kč per m^2. The source of the data is CSO. For the surveys before 2006, the coding of regions in the consumer survey corresponds exactly to real estate indices published by the CSO. Only a less detailed coding is available since then. For households, which remained in the sample since 2005 this is not a problem. For some households in smaller regions, we can use available information on the size of population in sub-regions to identify a finer location corresponding to the data from CSO. In addition, we can calculate the price from the maximum rent appreciation (2) for households which stayed in a regulated apartment and the actual rent appreciation equals the legal maximum. There is a handful of observations left in bigger cities and for these we use a price average for the bigger region. The apartment price is likely to be a stationary variable, as indicated by the panel data unit root tests for Czech apartment prices in Zemčík (2011). However, we can see that the price has increased. Figure 1 depicts the Apartment Price Index from CSO (it equals 100 in 2003). The regulated rent appreciation is calculated using equation (2) for households living apartments with a regulated rent. Prior to 2006, we use the actual regulated rent appreciation since the deregulation act was not yet passed. After the Act 107 became effective, the regulated rents appreciated much faster then the market rents (available but not included here) and the two were converging, as implied by the regulation. The next variable of interest is the supply shock in the free rental market measured by the ratio of regulated vs. non-

regulated apartments in the household's geographical location. The expected result of the rent deregulation is a larger number of apartments on the free rental market (i.e. a shift of the supply curve to the right) in the near future and hence lowered market rents.

5 Tenure Choice

In this section, we concentrate on the probability of switching to owning property. For the current renters, this means an actual purchase of property. This is in contrast to the standard analysis of cross-sectional data where the objective is to predict the current tenure status of households. Let us define a binary response variable $y_{i,t+1}$, which equals one if a household switches from renting to owning between years t and $t+1$, and zero otherwise. The response probability is given by

$$Prob(y_{i,t+1} = 1|x) = G(x'_{i,t}\beta). \tag{3}$$

In the case of the probit model, G is the standard normal cumulative distribution function. We also consider the logit model where G is the logistic function and the linear probability model, where $G = x'_{i,t}\beta$. The vector of explanatory variables is given by

$$x_{i,t} = (const., Y_{it}, age_{it}, age_{it}^2, educ_{it}, members_{it}, i_{it}, P_{it}, RRA_{it} \text{ or } SS_{it})'. \tag{4}$$

Estimates of β coefficients are calculated by the method of maximum likelihood. The first explanatory variable is the household income Y_{it}, which is a measure of the expected income. Characteristics of the household head such as age and education can themselves affect the tenure decision or they can proxy for income. age^2 accounts for the life-cycle related effects. For example, income can start declining after reaching a peak at the age about 50. Also, households can consider staying in a small rented apartment when they are getting closer to retirement. The variable *members* reflects a greater need for perceived stability often associated with property ownership, especially for families with children. A higher mortgage interest rate i_{it} should reduce the probability of a switch to

owning. The price of a current household dwelling P_{it} is a measure of the market price of the household potential future apartment. For renters of regulated apartments, the legally given regulated rent appreciation RRA should increase the probability of owning property. The supply shock SS_{it} is relevant for renters of the apartments on the free rental market. The greater the ratio of regulated vs. non-regulated apartments, the more likely it is that market rents will decline in the near future and the less likely a household purchases its own apartment.

The results from estimation for the parameters of the probit model for renters with regulated rents are reported in Table 3. We estimate β also for the years 2005-2006 for the sake of comparison of effects of considered variables before and after the adoption of the deregulation act. Income is mostly significant with an always positive coefficient estimate, as expected. Coefficients of age and age^2 are positive and negative. Interestingly, the age effects became more pronounced after the change in the law. The opposite is true for education, whose coefficient has a varying sign. age, age^2, and $educ$ can serve as a proxy for income and the age related variables have an explanatory power in addition to income. The estimated coefficient for the number of household members is mostly positive and occasionally significant. The mortgage interest rate coefficient is with one exception significant and negative, in line with our intuition. Our main variables of interest are the real estate price and the regulated rent appreciation. The results provide a strong evidence of the impact of the rent deregulation on the tenure choice. Prior to 2006, higher apartment prices do reduce the probability of a switch to owning but the estimates are insignificant. This is because the benefits of living in an apartment with regulated rents outweigh any effect of the price. The RRA coefficient is insignificant since there is only a small change in the regulated rents and the new law has not yet been adopted. The situation changes dramatically when the deregulation starts. The effects of the real estate price and the regulated rent appreciation are both significant and in accordance with our prior. Higher prices lower the probability of owning and higher regulated rents increase

it.

The probit estimates for renters paying the market rent are given in Table 4. The estimated income coefficient is always positive and significant. The age related variables are not significant and with varying sings, which is in contrast with our previous results. The likely reason is that household heads of households in unregulated apartments are about 10 years younger and the variation in their age is smaller as compared to the age of the heads of households in regulated apartments- see Table 2. We therefore exclude them from our remaining regressions as well as education whose impact does not follow a regular pattern either. The coefficient for *members* is always significantly positive, which may be due to a stability of owning real estate as compared to renting for the market rent. The interest rate of coefficient is negative and significant. Our primary focus is again on real estate prices and a measure of the market rent appreciation, represented here by the supply shock. First, there does not seem to be any change after the deregulation start. The price is clearly more important to renters on the free market in 2005-2006 as ownership is a closer substitute for them as compared to renters in regulated apartments. The supply shock already matters in this sub-period as well. This is due to implicitly anticipated deregulation, even without an explicit form. As long as the rental market is deregulated some time in the future, the supply shock will play a role in households decisions. Second, both variables negatively affect the probability of switching to owning. The significance of estimates varies. This can be explained by the nature of the relationship between P and SS. The real estate price should be related to the market rent (represented by the supply shock). Ceteris paribus, if the market rents increase, households will demand more apartments to own, pushing up their price. Therefore unless there is a strong segmentation of these two markets, there may be collinearity between P and SS. We examine this hypothesis by including only one of these variables in our probit model at a time. In such cases, an estimate of at least one of the variables is always significant. The insignificant price in 2007-2008 is likely to be due to a somewhat less precise matching

between household region and the corresponding real estate price (see our discussion of this issue in Section 4).

We perform a number of checks to evaluate robustness of our results. First, we examine the sensitivity to the employed estimation method. Estimating the parameters using probit and linear probability models yields estimation results that are quantitatively and qualitatively similar to ones reported in Tables 3 and 4. Second, we experiment with alternates to some of the used key variables. We replace the mortgage interest rate by the total mortgage interest payment for a 25-year loan. We use the net present value of renting a regulated apartment vs owning one (discussed in detail in the next section) to proxy for the regulated rent appreciation. We also use the price of an apartment as opposed to the unit price. None of these alternations affects our results in any significant manner.

In addition to studying renters, we estimate the same regression for owners to investigate what affects their decision to switch to renting. The percentage of owners who actually switch to renting is very small (see Table 1) and we therefore do not report the results in detail. They indicate however, that higher prices in this case increase the probability of the switch, and so does a positive supply shock. In other words, higher prices induce households to realize capital gains related to a property purchase and lower expected rents make renting a suddenly cheaper substitute to owner-occupied housing. Finally, to account for the possibility that households living in regulated apartments can switch to renting a smaller apartment at the market rent, we use a multinomial probit/logit models where the renters living in regulated apartments can also switch to apartments with the market rent in addition to become owner. No clear pattern is identified here, most likely due to a very small number of households which swapped paying regulated rents to market rents (see Table 1). This is not a surprising outcome because such a decision is irrational in the context of our econometric model. The regulated rent for an apartment is typically much cheaper then the market rent for an apartment of the same size and the

moving household would have to have a good reason to abandon the regulated apartment - perhaps to get closer to a hospital or because of inappropriate behavior of the current landlord. We do not have information at our disposal to be able to address this particular issue.

The fact that 84% of renters still paid the regulated rent in 2005 even though the communist system collapsed already in 1989 and only 5% switched to owning in 2005-2006 support our conclusion that with rare exceptions, households living in regulated apartments prior to 2006 remained in the regulated apartments. In other words, there are no systemic unobserved characteristics of the households, which remained renters since the early 1990s. The last issue that we know off and that can affect our results is privatization. Especially in the 1990s, municipalities tried to off-load the burden of apartments with regulated rents by selling them to tenants for a fraction of the market price. This would reduce the effect of deregulation in our regressions. However, the privatization process was mostly completed by the end of the 1990s. Also, while only 5% of renters in regulated rents purchased real estate prior to the deregulation, this percentage increased to 14 and 18%, respectively, in the two subsequent periods. This increase is likely to be due to the deregulation. Moreover, some of the switchers prior to 2006 may have switched to owning because they already anticipated the forthcoming deregulation.

6 Property Price Expectations

In this section, we try to characterize the households expectations for the market real estate prices. We focus exclusively on the households initially living in apartments with regulated rents since in this case we can express the expected rent appreciation explicitly in the terms of real estate price appreciation. At each period, these households can choose if they wish to stay in the apartment with a regulated rent (*no switch*)or if they prefer to purchase an apartment of their own (*switch*). A present value model is

used to define rationality. The household choices impose bounds on the real estate price expectations. This approach is new and differs from simply asking households what are their expectations for property prices. It is also a non-standard use of the present value model, which can be employed to see if the household choices are rational, given their price expectations. Here we assume the households behave rationally and we do not attempt to make their tenure choice conditional on the price expectations.

The present value model is in general characterized by the first order condition from an optimization problem of a risk neutral consumer:

$$P_t = E_t \left[(P_{t+1} + D_{t+1}) \right] \tag{5}$$

where P_t is a price of the household's dwelling and D_t is a cash-flow associated with it. If a household decides to purchase real estate (a house or an apartment), the present value of owning is given by:

$$PV(own) = E_t \left[\beta D_{t+1} + ... + \beta^k D_{t+k} - \beta^k ((1 - \tau_{property})\ P_{t+k} - LB_{t+k}). \right] \tag{6}$$

$D_{t+1}, ...$ are cash outflows of the household, which take into account tax exemption of mortgage interest rates. We abstract from the possibility that the legal system can change.[5] D_{t+1} also includes the down payment on the real estate. $\tau_{property}$ are transaction costs as a portion of the sales price. They consist of the 3% sales tax and the common 2% fee for a real estate agent. The real estate agent fees are lower in the Czech Republic where their services are used less frequently then in the United States and therefore this is probably an upper limit. $\tau_{property}$ is then 5% in total. We first set the time of selling property to $k = 4$ years, which corresponds to the time when the annual regulated rent reaches 5% of the apartment price. In addition, we consider $k = 25$ to account for the possibility that the household resides in the acquired dwelling until it pays off the mortgage. Here we only consider households with the age of the head less or equal to 50 to abstract from the

[5]The system actually did change after the end of our sample period in 2009 when the Czech government introduced the notion of a "super-wage" flat tax. This reduced the tax exemption on mortgage interest payment for households in higher income categories with the marginal tax rate reduced from 32% to 15%.

possibility that a mortgage loan is denied due to potential death of the creditor. $\beta = 0.99$. We assume that $\beta = \frac{1}{1+i_{free}}$ where i_{free} is a risk-free rate. We further assume for the sake of simplicity that β and hence i_{free} are constant. LB_{t+k} is the mortgage balance at time $t+k$.

The cash outflow consists of a time-varying part d_t and a constant part $\bar{d}$, i.e. $D_t = \bar{d} + d_t$. $\bar{d}$ is an annual debt service for the mortgage with monthly compounding. i_t is the mortgage rate. Let us define the monthly interest rate $i^* = i_t/12$, the number of periods in months n, and the present value factor

$$PVF(i_t^*, n) = 1/(1+i_t^*)^n. \tag{7}$$

The annual mortgage payment is calculated as

$$\bar{d} = 12\ L\ \frac{i_t^*}{1 - PVF(i_t^*, T)}, \tag{8}$$

where the loan size L is computed as P_t minus the household's current savings. We set $T = 25 * 12 = 300$ months i.e. 25 years. Now we can write

$$PV(own) = E_t\left[d_t + \beta d_{t+1} + ... + \beta^k d_{t+k} + \bar{d}\frac{1-\beta^{k+1}}{1-\beta} - \beta^k((1-\tau_{property})\ P_{t+k} - LB_{t+k})\right]. \tag{9}$$

Let us further define the number of periods in months $n = 12t$, the loan balance at time t as LB_t, the principal at time t as $PRINCIPAL_t$, and the annual interest payment during the year t as $INTEREST_t$. Note that $LB_t = L$. Then

$$\begin{array}{lcl} LB_{t+j} & = & \frac{\bar{d}/12[1-PVF(i^*,T-12j)]}{i^*}, \\ PRINCIPAL_{t+j} & = & LB_{t+j-1} - LB_{t+j},\ j = 1, 2, ..., k, \\ INTEREST_{t+j} & = & \bar{d} - PRINCIPAL_{t+j}. \end{array} \tag{10}$$

The time-varying savings from interest payments in the year t are given by

$$\tau_{income}\ INTEREST_t \tag{11}$$

where τ_{income} is the income tax, which we set it equal to the highest marginal tax rate of 32%.

Real estate prices are assumed to follow an AR(1) process

$$P_{t+k} = a\ P_{t+k-1} + \epsilon_{t+k} = ... = a^k\ P_t + \sum_{i=0}^{k-1} a^{k-1-i}\epsilon_{t+i+1} \tag{12}$$

and $E_t P_{t+k} = a^k\ P_t$. This assumption reflects autocorrelation present in first-differenced property prices in OECD countries demonstrated for example in Englund and Ioannides (1997). This result implies that the current price level depends on the price level in the previous period. Also, this specification corresponds directly to testing for unit roots in levels - see for instance Mikhed and Zemčík (2009) for the US data and Zemčík (2011) for the Czech data. Real estate researchers are interested to know whether $a \geq 1$, in which case there is a unit root, the real estate price process is non-stationary, and there is a rational bubble. The bubble is rational since this price process does not violate equation (5) that represents first order conditions of the household optimization problem. Equation (9) simplifies somewhat to

$$PV(own) = d_t + \beta d_{t+1} + ... + \beta^k d_{t+k} + \bar{d}\frac{1-\beta^{k+1}}{1-\beta} - \beta^k((1-\tau)\ a^k P_t - LB_{t+k}). \tag{13}$$

The expectation is removed from this equation since the only uncertainty stemms from the future price in our set-up. The time varying cash-flows are predictable because they are determined at time t assuming the legal framework for real estate does not change. We do not take into account the possibility of a default on mortgage payments by the household.

We plan to draw information about a from the household decisions to rent vs to own. To filter out price expectations, we make use of the official formulae used to calculate the target rent and the maximum rent appreciation - see equations (1) and (2), respectively. We set $t = 2006$. Noting that we need the annual rent, we can write:

$$E_t[R_{t+1}] = \left(\frac{c\ P_t}{R_t}\right)^{1/4}\ R_t = (cP_t)^{1/4} R_t^{3/4}. \tag{14}$$

Using the process for the real estate price (12), we can also see that

$$E_t[R_{t+2}] = \left(\frac{c\ P_{t+1}}{R_{t+1}}\right)^{1/3}\ R_{t+1} = (c\ a\ P_t)^{1/3} R_{t+1}^{2/3} = c^{1/2} a^{1/3} P_t^{1/2} R_t^{1/2} \tag{15}$$

and

$$E_t R_{t+3} = c^{3/4} a^{7/6} P_t^{3/4} R_t^{1/4}. \tag{16}$$

From this point on, the rent should be equal to the target rent, i.e.

$$E_t R_{t+3+i} = c a^{3+i} P_t, \quad i = 1, 2, ... \tag{17}$$

Now we can determine the present value of living in an apartment with a regulated rent

$$\begin{aligned} PV(reg) &= E_t[R_t + \beta\ (cP_t)^{1/4} R_t^{3/4} + \beta^2\ c^{1/2} a^{1/3} P_t^{1/2} R_t^{1/2} + \beta^3\ c^{3/4} a^{7/6} P_t^{3/4} R_t^{1/4} \\ &\quad + \beta^4\ c a^4 P_t + ... + \beta^m\ c\ a^m P_t], \end{aligned} \tag{18}$$

where m is a life-expectancy of the household head in the Czech Republic. According to the data from the Czech Statistical Office in 2004, the life-expectancy was 73.1 years for 15-year old males and 79.6 for 15-year old females, respectively. We set m to be 75 minus the current age of the household head. This in part reflect more households with male heads who are older then 15 years (the available data then lists this information for 45-year olds). The present value of interest on the savings not used to pay a down payment is zero since we set the discount factor β is defined using the risk-free interest rate. The expression (18) can be further simplified to

$$\begin{aligned} PV(reg.rent) &= R_t + \beta\ (cP_t)^{1/4} R_t^{3/4} + \beta^2\ c^{1/2} a^{1/3} P_t^{1/2} R_t^{1/2} + \beta^3\ c^{3/4} a^{7/6} P_t^{3/4} R_t^{1/4} \\ &\quad + \beta^4\ c a^3 4 P_t\ \tfrac{1-(\beta\ a)^{m-3}}{1-\beta\ a}. \end{aligned} \tag{19}$$

The final step of comparison between owning vs. renting an apartment is a calculation of the Net Present Value (NPV):

$$NPV = PV(reg) - PV(own), \tag{20}$$

which is a function of a, the autoregressive parameter of the real estate price process. This parameter characterizes expectations of the household. Renters living in an apartment with a regulated rent should have NPV greater then zero if they purchased an apartment and lower then zero otherwise. We solve numerically for a, which sets NPV to 0 for all

renters from regulated apartments, i.e. we find a^* such that $NPV(a^*) = 0$. If households decide to purchase real estate, a^* is a lower bound on their price expectation and if they stay in the rental apartment, then a^* is an upper bound on their price expectation.

Our results are summarized in Table 5. We calculate the distribution of a^* for households who shifted from renting to owning and from those which did not. We do this for all three sub-periods, i.e. 2005-2006, 2006-2007, and 2007-2008, respectively. The first sub-periods serves as a control group since the rent regulation law was effective only since 2006, though there may have been some anticipation of the law passing through the Czech parliament. The present value model fits the data worse in the first sub-period because in some cases there was no interest rate, which would make NPV positive for non-shifters. These households by definition cannot be rational according the the present value model and we eliminated them from our further calculations. No such case has been found for the other two sub-periods. We have also tested for equality of means using a standard t-test and a Welch F-test, which accounts for potentially differing variances. There are no meaningful patterns emerging either from a comparison between shifters and no-shifters within a sample period nor from a comparison of the same groups across time.

The appreciation means are fairly reasonable as compared with the actual gross growth of prices though the especially non-shifters seem to be more conservative with their upper bound on the growth lower then the realized growth. This can also reflect an element of surprise in increasing real estate prices after 2006. Figure 1 indicates a period of decline of apartment prices from 2003 to 2005. This in part occurred due to a public expectation of a rapid increases in 2004, which was the year when the Czech Republic joined the European Union. The prices increased prior to 2004 due to this expectation and then stagnated. The accelerated growth starting in 2006 therefore could have come as a surprise. The household expectations in any case do not appear to be irrationally high as often occurs when surveys are used. To gain additional insights, we tabulate the empirical distribution of the expected growth of apartment prices for k=25 in Figure 2. We choose k=25 since

the present value model implies values of growth closer to their ex post realizations and it is more likely that the households do not buy apartments from purely speculative reasons and intend to keep them for an extended period.The most frequent values for non-shifters tend to be the higher ones at the right hand side of the histogram. The lowest reported values for shifters are greater then the ones for non-shifters since 2006, suggesting again a greater optimism of the shifters.

7 Summary

The rent deregulation in the Czech Republic is a natural experiment where regulated rents explicitly reflect real estate prices. This dependance induces predictability of regulated rent appreciation, which can be usefully exploited. The impact of de-regulation is studied using unique household consumption survey data. The advantage of this data set is the possibility of recording actual households tenure choice's due to the fact, that only 20% of the sample is changed every year.

Our first objective is the analysis of the impact of the rent-deregulation in the Czech Republic on the tenure choice of the households. We control for household characteristics such as income, age, education, and the number of household members. The real estate price and expected mortgage interest rates predictably lower the probability of owning for all renters. The regulated rent appreciation does in fact increase the probability of a real estate purchase for households currently living in rent-controlled apartments. The households in unregulated apartments anticipate lower market rents. This is because the supply on the free rental market is going to increase due to regulated apartments becoming unregulated in the near future. This effect implies a lower probability of owning for free market renters. The policy implications of these results are clear. Deregulation makes it more likely for households in regulated apartments to seek their own property. If home ownership is a priority of the Czech government then deregulation of rents is an alternative

to supporting savings with the target of purchasing real estate and to exempting mortgage interest payments from income taxes. This option may be more attractive since it is not as likely to lead to real estate bubbles and it is less expensive from the fiscal perspective.

The second objective is deduction of real estate price expectations using present value analysis for households in regulated apartments. These households compare the present value of owning with the present value of renting of the regulated apartment. Using the fact that the regulated rents explicitly take into account the real estate prices and assuming that these follow an AR(1) process, we solve for the real estate price appreciation, which makes households indifferent between an apartment purchase and renting. This appreciation is the upper bound for expectations of the households, which remained renters and the lower bounds for households, which did not. The distributional characteristics of the price appreciation are more realistic when we assume that households mainly consider holding their potentially acquired property until a mortgage is paid off. The implied upper bound for expected real estate price growth was on average 1.018 in 2006-7 and 1.023 in 2007-8. The implied lower bound was on average 1.0223 and 10224, respectively in the same two sub-periods. This indicates that household expectations were fairly realistic at the time, showing no signs of irrationality.

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Figure 1: Apartment Price Index from the Czech Statistical Office, 100 in 2003

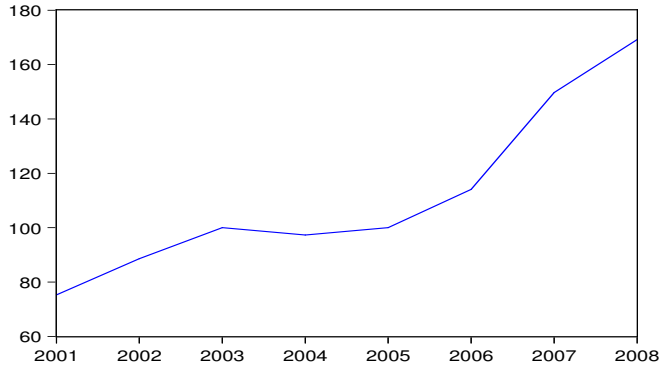

Figure 2: Expectations of the Real Estate Price Appreciation for k=25

Notes
1) *switch* refers to those households that purchased property. *no switch* denotes households that stayed in the regulated apartments.
2) $k = 25$ are number years of holding property before it is sold.

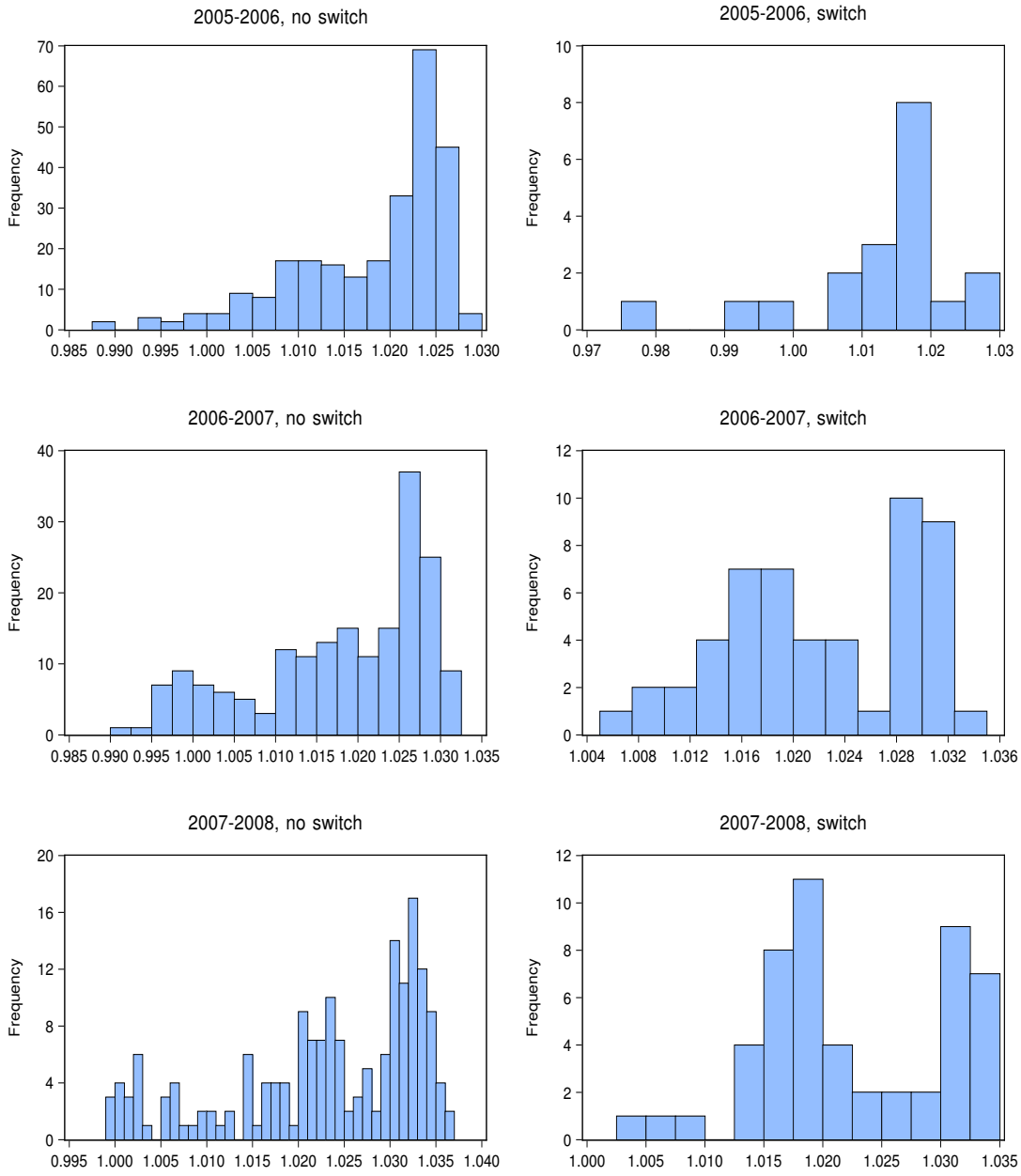

Table 1: Household Status and Sample Size

Notes:
There are three types of a status: renters living in apartments with regulated rents, renters living in apartments with market rents, and owners living in their own apartments. Renters paying regulated rents can become owners or rent for the market rent. Renters paying market rents can become owners. Owners can switch to renting for the market rent.

	Sample			Status in the following year					
	Initially	Remaining		Regulated rent		Owners		Mkt. rent	
	count	count	%	count	%	count	%	count	%
				2005-2006					
all groups	3223	2529	78	459	18	1943	77	127	5
renters, reg. rent	720	487	68	459	94	25	5	3	1
renters, mkt. rent	123	91	74	0	0	15	16	76	84
owners	2380	1951	82	0	0	1903	98	48	2
				2006-2007					
all groups	3242	2448	76	359	15	1940	79	149	6
renters, reg. rent	625	427	68	359	84	61	14	7	2
renters, mkt. rent	154	100	65	0	0	19	19	81	81
owners	2463	1921	78	0	0	1860	97	61	3
				2007-2008					
all groups	3221	2556	79	344	13	2056	80	156	6
renters, reg. rent	600	425	71	344	81	75	18	6	1
renters, mkt. rent	172	99	58	0	0	14	14	85	86
owners	2449	2032	83	0	0	1967	97	65	3

Table 2: Summary Statistics for Renters

Notes: Y is the monthly household income per person; C is the monthly household consumption exclusive of a rent, also per person; *age* is the age of the household head in years; *educ* is the education of the household head in years; *members* is the number of household members; i is the mortgage interest rate to be paid for a loan covering up to LTVR % of the value for a household apartment P is the regional real estate price in Kč per m^2; RRA is the regulated rent appreciation given per m^2 in % - it is the actual appreciation for the period 2005-2006 and the legally given maximum for the subsequent periods; and SS is the supply shock, i.e. the ratio in % of regulated to non-regulated apartments in the households' location.

	Y	C	*age*	*educ*	*members*	i	P	RRA	SS
					2005-2006, regulated rents, 484 obs.				
mean	19,304	6,852	46.07	12.01	2.44	4.14	11,887	2.37	
min	4,786	1,611	18.00	9.00	1.00	0.00	3,729	0.00	
max	68,550	35,879	87.00	20.00	6.00	4.70	4,1026	5.33	
st. dev.	11,047	4,222	14.79	2.72	1.19	0.90	7,260	0.99	
					2005-2006, mkt. rents, 91 obs.				
mean	18,385	6,624	35.56	11.91	2.45	3.95	11,725		21.12
min	6,963	1,417	21.00	9.00	1.00	0.00	3,729		9.50
max	55,748	15,263	77.00	20.00	6.00	4.70	41,076		36.50
st. dev.	8,261	3,406	11.53	2.43	1.14	0.94	6,798		10.00
					2006-2007, regulated rents, 420 obs.				
mean	20,937	8,991	47.84	12.10	2.38	4.41	12,255	19.80	
min	4,620	1,349	21.00	9.00	1.00	0.00	3,520	0.00	
max	78,852	66,506	84.00	20.00	6.00	5.28	44,275	91.69	
st. dev.	11,497	5,623	14.15	2.85	1.18	1.37	7,857	17.06	
					2006-2007, mkt. rents, 100 obs.				
mean	19,208	8,704	35.62	12.05	2.22	3.87	13,091		21.38
min	4,783	1,890	21.00	9.00	1.00	0.00	4,014		6.50
max	60,690	21,581	81.00	20.00	5.00	5.28	44,725		36.00
st. dev.	10,813	4,916	10.88	2.82	1.09	1.84	10,521		10.69
					2007-2008, regulated rents, 419 obs.				
mean	22,636	10,037	48.86	12.23	2.35	4.81	13,427	24.19	
min	4,215	1,699	23.00	9.00	1.00	0.00	3,824	0.00	
max	139,027	67,786	90.00	20.00	6.00	5.62	45,537	96.00	
st. dev.	13668	6508	14.05	2.98	1.21	1.39	8,518	20.77	
					2007-2008, mkt. rents, 100 obs.				
mean	19,849	9,558	38.54	11.84	2.16	4.43	14,314		22.98
min	4,005	2,288	24.00	9.00	1.00	0.00	3,824		6.00
max	51,790	23,078	82.00	20.00	5.00	5.62	45,337		36.00
st. dev.	9,696	5,451	13.03	2.85	1.10	1.60	11,394		10.33

Table 3: Probit Model Estimation: Renters, Regulated Rents

Notes:
Variables are defined in Notes to Table 1; *, **, and *** are significance levels at 10%, 5%, and 1%, respectively.

	Int.	Y	age	age^2	$educ.$	$members$	i	P	RRA	Pseudo R^2	Obs.
						2005-2006					
coef.	-2.53E+00	5.13E-05	2.22E-02	-4.53E-04	-4.53E-04	2.09E-01	-3.44E-01	-4.28E-05	-1.09E-01	0.43	484
(z-stat)	(-1.11)	(3.13***)	(0.21)	(-0.36)	(2.14**)	(1.70*)	(-2.97***)	(-1.21)	(-0.82)		
coef.	-1.95E+00	5.48E-05	-	-	-	2.39E-01	-3.10E-01	-4.37E-05	-9.42E-02	0.41	484
(z-stat)	(-3.32***)	(3.53***)				(2.22**)	(-2.59***)	(-1.22)	(-0.68)		
coef.	-2.43E+00	-	4.24E-02	-5.85E-04	1.12E-01	3.41E-01	-5.26E-01	-9.69E-06	-1.00E-01	0.34	484
(z-stat)	(-1.27)		(0.53)	(-0.66)	(3.37***)	(3.61***)	(-5.43***)	(-0.39)	(-0.77)		
						2006-2007					
coef.	-7.06E+00	1.79E-05	2.21E-01	-3.02E-03	4.92E-02	-1.56E-03	-1.12E-01	-8.79E-05	1.14E-01	0.62	420
(z-stat)	(-3.20***)	(1.40)	(2.05**)	(-2.36**)	(1.11)	(-0.01)	(-1.42)	(-4.27***)	(7.90***)		
coef.	-2.95E+00	2.00E-05	-	-	-	1.95E-01	-1.22E-01	-6.93E-05	8.73E-02		
(z-stat)	(-6.64***)	(2.12**)				(2.08**)	(-1.90*)	(-3.47***)	(7.28***)		
coef.	-7.15E+00	-	2.30E-01	-3.10E-03	6.56E-02	8.32E-02	-1.68E-01	-7.62E-05	1.13E-01	0.61	420
(z-stat)	(-3.28***)		(2.17**)	(-2.48**)	(1.66*)	(0.80)	(-2.53**)	(-3.83***)	(7.89***)		
						2007-2008					
coef.	-6.38E+00	2.30E-05	2.36E-01	-2.75E-03	-3.07E-02	2.42E-02	-1.77E-01	-2.45E-05	5.40E-02	0.48	419
(z-stat)	(-3.32***)	(2.45**)	(2.76***)	(-2.89***)	(-0.88)	(0.23)	(-2.64***)	(-2.03**)	(7.88***)		
coef.	-2.35E+00	1.91E-05	-	-	-	1.77E-01	-1.38E-01	-3.04E-05	4.98E-02	0.42	419
(z-stat)	(-5.09***)	(2.39**)				(2.15**)	(-2.14**)	(-2.41**)	(8.43***)		
coef.	-6.37E+00	-	2.47E-01	-2.82E-03	-1.17E-02	1.19E-01	-2.49E-01	-1.79E-05	5.46E-02	0.46	419
(z-stat)	(-3.41***)		(3.00***)	(-3.17***)	(-0.38)	(1.43)	(-4.32***)	(-1.52)	(7.85***)		

Table 4: Probit Model Estimation: Renters, Market Rents

Notes:
Variables are defined in Notes to Table 1; *, **, and *** are significance levels at 10%, 5%, and 1%, respectively.

	Int.	Y	*age*	age^2	*educ.*	*members*	i	P	SS	Pseudo R^2	Obs.
						2005-2006					
coef.	-2.40E-01	7.50E-05	-5.04E-02	8.66E-04	8.64E-04	4.63E-01	-5.14E-01	-8.98E-05	-7.07E-03	0.39	91
(z-stat)	(-0.10)	(3.16***)	(0.50)	(0.80)	(0.01)	(2.28**)	(-2.53**)	(-1.66*)	(-0.20)		
coef.	-9.58E-01	6.75E-05	-	-	-	4.66E-01	-4.36E-01	-	-5.28E-02	0.34	91
(z-stat)	(-1.11)	(3.08***)				(2.78***)	(-2.25**)		(-1.92) *		
coef.	-8.70E-01	6.72E-05	-	-	-	4.14E-01	-4.48E-01	-9.06E-05	-	0.36	91
(z-stat)	(-0.99)	(3.16***)				(2.32**)	(-2.45**)	(-2.07**)			
						2006-2007					
coef.	-5.99E+00	5.09E-05	1.43E-01	-1.67E-03	1.29E-01	5.10E-01	-1.88E-01	-4.24E-05	-3.07E-02	0.42	100
(z-stat)	(-2.00**)	(2.78***)	(1.20)	(-1.26)	(1.69*)	(2.64***)	(-2.03**)	(-1.36)	(-1.36)		
coef.	-1.47E+00	4.35E-05	-	-	-	5.06E-01	-2.13E-01	-	-4.75E-02	0.38	100
(z-stat)	(-1.94) *	(2.67***)				(2.84***)	(-2.41**)		(-2.25**)		
coef.	-1.97E+00	4.80E-05	-	-	-	4.80E-01	-1.66E-01	-5.48E-05	-	0.35	100
(z-stat)	(-2.86***)	(2.49**)				(2.76***)	(-1.81*)	(-1.95) *			
						2007-2008					
coef.	2.55E+00	5.54E-05	-9.42E-02	8.97E-04	-1.33E-01	3.39E-01	-2.73E-01	-1.03E-05	-4.20E-02	0.38	99
(z-stat)	(1.21)	(2.72***)	(-1.04)	(1.07)	(-1.45)	(2.03**)	(-2.41**)	(-0.39)	(-2.08**)		
coef.	-8.78E-01	4.97E-05	-	-	-	3.50E-01	-3.06E-01	-	-4.69E-02	0.35	99
(z-stat)	(-1.27)	(2.56**)				(2.06**)	(-2.85***)		(-2.11**)		
coef.	-1.54E+00	4.34E-05	-	-	-	3.66E-01	-2.53E-01	-3.83E-05	-	0.30	99
(z-stat)	(-2.24**)	(2.22**)				(2.07**)	(-2.52**)	(-1.16)			

Table 5: Real Estate Price Expectations

Notes:
1) *Actual appreciation* is the actual gross price increase of prices of all apartments with a regulated rent based on regional market prices.
2) *switch* refers to those households that purchased property. *no switch* denotes households that stayed in the regulated apartments.
3) $k = 4, 25$ are number years of holding property before it is sold.

	2005-2006		2006-2007		2007-2008	
Actual appreciation	1.0310		1.0956		1.1291	
	no switch	switch	no switch	switch	no switch	switch
			k=4			
Mean	0.9944	0.9884	0.9933	1.0099	1.0169	1.0083
Median	0.9993	0.9907	0.9998	1.0083	1.0197	1.0072
Maximum	1.0225	1.0150	1.0319	1.0354	1.0487	1.0379
Minimum	0.9002	0.9193	0.9225	0.9828	0.9855	0.9675
Std. Dev.	0.0198	0.0228	0.0220	0.0135	0.0156	0.0161
Observations	264	19	187	52	180	52
			k=25			
Mean	1.0180	1.0125	1.0180	1.0223	1.0230	1.0224
Median	1.0218	1.0159	1.0204	1.0209	1.0246	1.0201
Maximum	1.0284	1.0261	1.0322	1.0327	1.0360	1.0343
Minimum	0.9887	0.9776	0.9922	1.0073	0.9996	1.0031
Std. Dev.	0.0084	0.0119	0.0105	0.0073	0.0104	0.0079
Observations	263	19	187	52	180	52