

Almenberg, Johan; Karapetyan, Artashes

**Working Paper**

## The Hidden Costs of Hidden Debt

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# Working Paper

Financial Stability, Research Department

## The hidden costs of hidden debt

*Johan Almenberg and Artashes Karapetyan*

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# The Hidden Costs of Hidden Debt\*

Johan Almenberg<sup>†</sup> and Artashes Karapetyan<sup>‡</sup>

October 11, 2011

## Abstract

We report evidence that salience may have economically significant effects on homeowners' borrowing behavior, through a bias in favour of less salient but more costly loans. Survey evidence corroborates the existence of such a bias. We outline a simple model in which some consumers are biased and show that under plausible assumptions this affects prices in equilibrium. Market data support the predictions of the model.

Keywords: salience, debt, housing market, co-op, capital structure

JEL codes: D12, G14, G21, G32

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<sup>†</sup>Corresponding author. Swedish Ministry of Finance, 103 33 Stockholm. E-mail: johan.almenberg@finance.ministry.se.

<sup>‡</sup>Norges Bank, Bankplassen 2, P.O. Box 1179 Sentrum, Norway. E-mail: Artashes.Karapetyan@norges-bank.no.

# 1 Introduction

Households face many choices that require financial judgment. When this judgment falls short of the mark, households may make financially sub-optimal decisions. In some cases, failing to optimize entails a negligible cost; in other cases, the cost is large. Depending on the market in question, sub-optimal decisions of individual participants may or may not affect the market equilibrium.

This paper examines certain aspects of a decision faced by many households: making a debt-financed acquisition of a home. We document some strong indications that borrowing decisions are not always rational in the housing market. The setting we examine is the Swedish housing market, in which virtually all apartments are organized as housing co-operatives (“co-ops”). Co-ops can, and frequently do, take on debt. As a result, a household acquiring an apartment evaluates different combinations of personal loans and co-op loans.

The Swedish housing market is interesting because the cost of financing an apartment through a co-op loan and through a personal loan differ substantially. Interest payments on personal loans are tax deductible, whereas interest payments on co-op loans are not. As a result, individuals financing their apartments through co-op loans face considerably higher borrowing costs net of taxes. Despite this, co-op loans account for a considerable share of apartment financing: in 2008, the total debt held by Swedish co-ops amounted to 220 billion SEK or about 31 billion USD, equivalent to more than half of the total assessed value of these co-ops.<sup>1</sup> The amount of money left on the table is economically significant: in 2006, the most recent year for which there is information about co-op interest payments, co-ops on average paid interest equivalent to about 20 USD per square meter.<sup>2</sup> For an average sized apartment (about 90 square meters, see Statistics Sweden, 2010a), this would imply interest payments on co-op loans associated with their apartment amounting to about 1800 USD. This amounts to an average potential saving of about 540 USD per year and apartment if these loans were replaced with tax deductible personal loans.

Co-op loans are less salient, in the sense that they are less visible and easier for the consumer to ignore. Several factors contribute to make co-op

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<sup>1</sup>Source: Statistics Sweden. 1 USD  $\approx$  7 SEK.

<sup>2</sup>Source: Statistics Sweden.

loans less salient. Interest payments are not itemized in the monthly fees, and only the aggregate debt of the co-op is stated in annual co-op reports. When an apartment is for sale, the co-op loan which the buyer would be servicing is not specified in the ad.

Empirical work in public economics has shown that salience may be an important determinant of behavioral responses to taxation (Chetty et al, 2009; Chetty and Saez, 2009; Finkelstein, 2009). A parallel literature in consumer finance has reported that the salience of the act of payment affects consumption (see, for example, Soman, 2003). In the light of this research, it seems a priori plausible that loan salience may affect borrowing decisions.

In the first part of this paper, we report the results from a survey examining apartment owners' self-reported awareness of personal and co-op loans. The results corroborate the view that co-op loans are less salient than personal loans. Most survey participants reported being well-informed about the details of their personal mortgage loan but ignorant about loans taken out by their co-op, including the interest rate paid by the co-op. In addition, the vast majority had never considered the possibility of substituting co-op loans for personal loans, suggesting that they do not hold an integrated view of the financial question at hand, i.e. how to best finance an apartment through a combination of co-op loans and personal loans.

In the second part of the paper, we present a model in which biased and unbiased consumers interact in the housing market and the bias distorts market prices in equilibrium. We model the bias toward less salient debt as a benefit associated with co-op loans but not with personal loans. We think of this as a psychological benefit arising from co-op loans being less salient. We assume that there is an idiosyncratic component to the utility that an individual gets from an apartment. This is a realistic description of most housing markets and in our model it prevents the separating equilibrium that would arise if different apartments were perfect substitutes. In addition, we assume that individual market participants cannot carry out arbitrage. The Swedish market is characterized by rent control and other restrictions on renting out apartments (see Lind, 2003, for details). Converting owner-occupied apartments into rental apartments would typically entail a significant financial loss. When each household owns a single apartment at a time, transactions costs from moving make it unlikely that arbitrage will correct prices.

In the third part of the paper, we examine whether co-op loans are fully reflected in market prices. This question has previously been addressed by

Hjalmarsson and Hjalmarsson (2009) who examine the negative relationship between the sales price and the present value of monthly fee payments to the co-op. They base their analysis on the present value of co-op fees because their data does not contain information about co-op loans. Hjalmarsson and Hjalmarsson (2009) find that a 100 SEK increase in the present value of fee payments decreases the price by about 75 SEK, whereas market efficiency would require a price decrease of about 100 SEK.

We match market data from the source used by Hjalmarsson and Hjalmarsson (2009) with a proprietary database of co-op balance sheets, thus generating a unique data set in which we can observe actual co-op debt levels for each apartment sale. Since the data also contains the fraction of co-op ownership (and debt service) associated with each apartment we can identify the amount of co-op debt associated with each apartment and thus to test the capitalization hypothesis directly, rather than through a proxy such as the present value of co-op fees.

Our main finding is that co-op loans are undercapitalized in apartment prices and to a considerably larger extent than what is reported in Hjalmarsson and Hjalmarsson (2009). Their data is from the period 2002-2005, in which the tax treatment of personal and co-op loans was about the same, implying a marginal rate of substitution close to negative one. Following a tax reform implemented at the beginning of 2007 co-op loans became less favorable than personal loans, implying that the marginal rate of substitution should be larger (in absolute size) in our data which covers the period 2007-2009. By contrast, we find that a 100 SEK increase in the co-op loan associated with an apartment decreases its price by only 20-30 SEK.

As an additional test, we extend our sample to include observations immediately preceding a tax reform that changed the relative cost of personal loans and co-op loans. In the last quarter of 2006 the Swedish government announced that a change of the tax rules for co-ops would be enacted on 1 January 2007. Until this point, interest on co-op loans had been deductible against a special co-op tax. The abolishment of this tax resulted in the large wedge between the cost of financing an apartment through co-op loans and personal loans. All else being equal, this should make apartments with large co-op loans less attractive relative to those with little or no co-op loans. By contrast, our model predicts that apartment prices will be less responsive to such relative price changes if some of the market participants are biased in favor of less salient co-op loans. A comparison of the capitalization of co-op loans in 2006 and 2007 suggests that the market did not react to this change

in fundamentals. Apartment prices rose, consistent with the price effect one would expect following a decrease in the overall tax burden on co-ops, but co-op loans do not have a larger negative effect on apartment prices following the tax reform, despite the more disadvantageous tax treatment from 2007 onwards.

At the end of the paper we discuss some policy implications of our findings. The observed market patterns are not necessarily inefficient. If some consumers prefer less salient debt and are willing to pay for it, then it is not obvious that their welfare would be increased by switching to less costly personal loans. On the other hand, it is possible that some households do not realize the full costs of co-op loans. As we illustrate, the additional cost attached to co-op loans may be considerable.

## 2 Survey results

As a starting point, we conducted a survey of co-op residents. The participants were asked about their personal mortgage loans and about the loans of their co-ops. Survey data have a number of drawbacks, but Bucks and Pence (2006) find that homeowners in general report their mortgage terms reasonably accurately, suggesting that this may be a valid point of departure. We also asked if they were aware of the tax advantage of personal loans relative to co-op loans, and whether they had ever considered the possibility of substituting personal loans for co-op loans. The purpose of the survey was to get a better picture of how common it is for co-op residents to hold a view of co-op loans that departs from strict economic rationality, but not to attempt to identify the determinants of such a biased view.

The survey was conducted in February 2008, at the main train station in Stockholm. Participation in the survey was conditional on owning, and being resident in, a co-op apartment. 100 individuals took part in the survey, which lasted approximately 3 minutes for each participant. Participants were rewarded with a lottery ticket worth approximately USD 4. The mean age of the participants was 45 years, with a minimum of 17 and a maximum of 77. Equal numbers of men and women participated in the survey. About two thirds of the sample had college education. About one third was currently, or had previously been, a co-op board member.

The key results from the survey are as follows: (1) the vast majority of respondents self-reported being well aware of the size of their personal mort-

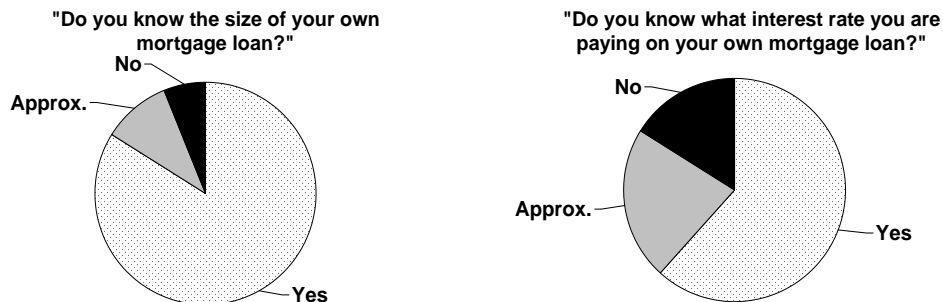


gage loan and the associated interest rate. (2) By contrast, the majority of respondents reported being not even approximately aware of their co-op loan size or the interest rate. (3) In addition, most respondents had never even considered the possibility of substituting individually held debt for co-op debt. These findings indicate that many apartment owners pay little attention to co-op loans, consistent with the view that co-op loans are less salient. The results are presented in more detail below.

We asked survey participants if they knew the size of their personal mortgage loan and the associated interest rate. As shown in Figure 1, the great majority reported knowing the exact size of their mortgage and the exact interest rate they were paying. Of those that did not know the exact numbers, about half knew them approximately. Only 5 percent of the participants did not even approximately know the loan size, and only 13 percent did not even approximately know the interest rate.

*Figure 1*

**Awareness of own mortgage size and interest rate**

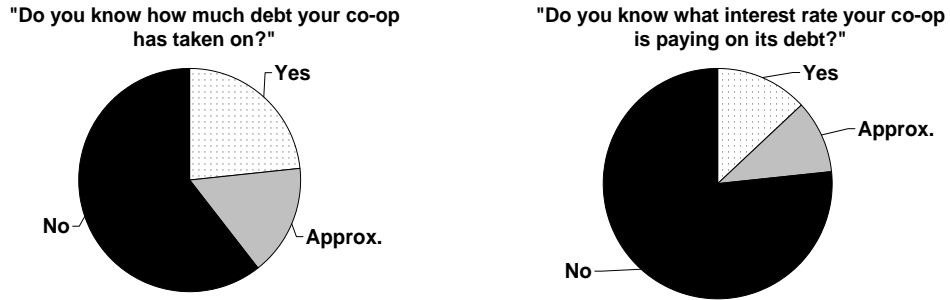


By contrast, only a minority of the participants in the survey reported knowing the size of their co-op loan or the associated interest rate. 60 percent of respondents did not even approximately know the loan size and 76 percent did not even approximately know the interest rate.

*Figure 2*

**Awareness of co-op debt size and interest rate**

## Awareness of co-op debt size and interest rate

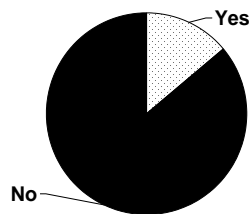


Not all co-ops have loans. Participants stating that their co-ops did not have loans were entered into the data as knowing the exact loan size and the exact interest rate. Participants reporting that they did not think that their co-ops had loans, but were uncertain, were entered into the data as knowing the approximate loan size and the approximate interest rate. This may cause our measure of co-op loan awareness to be biased upwards.

In a financial sense, personal loans and co-op loans are substitutes. An important difference is that personal loans are considerable more salient than co-op loans. The lower salience is underscored by the survey participants' poor awareness of co-op loan size and/or interest rate. The low salience of co-op loans may prevent them from being replaced with personal loans despite strong economic incentives for doing so. In fact, we found that the vast majority (86 percent) of the survey participants had never even considered the possibility of replacing co-op loans with personal loans.

*Figure 3*  
**Awareness of debt substitution**

"Have you ever considered replacing co-op debt with debt held individually by the co-op members?"



### 3 A simple model of the co-op market

Our survey results corroborate the view that many market participants have a biased perception of a less salient form of debt financing, co-op loans. An important question is whether a bias at the individual level translates into market prices that are inefficient in a narrow economic sense. In the following section, we make the assumption that some fraction of agents are biased and model the interaction of biased and unbiased agents in the market place.

One approach for modelling quasi-rational behavior is to treat it as a mistake that occurs when the agent converts raw information into a budget set (Russell and Thaler, 1985). This allows for a distinction between individual differences in (1) preferences, (2) information, and (3) the mapping from the real world to the mental representation of a budget constraint. Having arrived at a not-quite-accurate budget set, the agent optimizes in the same way that a fully rational agent would.

Our model builds on this approach. Biased and unbiased agents solve the same optimization problem, but the biased agents perceive a psychological benefit associated with less salient co-op loans. This captures the idea that salience has an effect on economic decisions that is similar to a higher cost, consistent with the empirical findings in Finkelstein (2009) and Chetty et al (2009). The psychological benefit of lower salience drives a wedge between the perceived costs of the two types of loans.

#### 3.1 The model

There is a continuum of agents on  $[0, 1]$  who live for two periods. At the beginning of the first period each agent is endowed with one unit of housing (an apartment). At the end of period 1 agents can sell their apartment and buy a new one. Apartments have associated co-op loans that are either high ( $D_h$ ) or low ( $D_l$ , where  $D_h > D_l$ ). We refer to these as high debt or low debt apartments. The apartment prices associated with high and low debt apartments are  $P_h$  and  $P_l$ , respectively.

Buyers use personal loans to pay the market price of an apartment, and the market price does not include the co-op loan associated with the apartment.<sup>3</sup> We assume that the interest payments are tax deductible for personal

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<sup>3</sup>The personal loan can be thought of as either personal mortgage loan or personal savings with a required return equal to the mortgage rate.

as well as co-op debt but the tax rates can differ. Letting  $\tau_c, \tau_p$  denote the tax rate, the net cost of a unit of co-op and personal debt are given by  $(1 - \tau_c)r$  and  $(1 - \tau_p)r$ , where the interest rate  $r$  is equal for the two types of loans.<sup>4</sup>

In order to consider a new apartment, agents make two searches at the end of the first period. The model is tractable for any finite number of searches, but extending the model in such a manner does not offer further insight. Apartments are heterogeneous, which is captured through a separately additive idiosyncratic utility  $u_i$  that agent  $i$  perceives for any new apartment, with  $u_i$  being uniformly distributed on the interval  $[-U, U]$ . This approach, which is similar to Stein (1995), captures gains from trade and drives the trading in our model.<sup>5</sup> For modelling convenience we assume that all agents have zero utility ( $v_0 = 0$ ) from their initial apartments. We also assume agents are not liquidity constrained, an assumption that is discussed in more detail in the empirical section.

All agents solve the same maximization problem, but some agents use a different mapping from the information set to the budget set because they get an additional benefit from less salient co-op loans that they don't get from personal loans.<sup>6</sup> Fraction  $\alpha$  of all agents are *unbiased* (type  $j = u$ ). Fraction  $1 - \alpha$  are *biased* (type  $j = b$ ) and perceive a psychological benefit from less salient co-op loans. Saliency could also be modeled as a psychological cost, as in, for example, Chetty (2009), but since we are only concerned with the relative cost of the two loans such an approach is equivalent to ours.

The psychological benefit  $c_j$  is proportional to the annual debt service.

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<sup>4</sup>Frisell and Yasdih (2010) show that in recent years the spreads on personal mortgage loans have typically been in the 0.5-1.0 percent range. While it is possible that co-ops are able to negotiate slightly better rates, the small margins on personal mortgage loans suggest there is not much room for negotiation. While this supports the assumption of equal rates, it itself is innocuous for our result: as the relative cost of apartments with high vs. low co-op debt changes (due to change in taxation), we do not observe relative price changes.

<sup>5</sup>The gains from trade can be driven by a fixed parameter, like in Stein (1995). In this case the market is restricted to each agent trading only with its own type, but as we see later this does not alter our main results.

<sup>6</sup>We will abstract from the following aspects: (1) Co-op screening. The co-op has veto rights over new members, but in Sweden these rights are very weak. (2) Default. Rising prices over the last decade have resulted in lower LTV-ratios for co-ops. When the leverage is moderate, default is highly unlikely. In the sample used in the empirical section, the great majority of LTV-ratios are below 0.25, implying that prices would have to fall by 75 percent to trigger default.

Thus, a  $j$  type agent's utility net of costs is given by

$$u_i - (1 - \tau_p)rP_k - (1 - \tau_c)rc_jD_k \quad (1)$$

where  $(k = h, l)$ ,  $c_u = 1$  and  $c_b = c < 1$ .

Each agent compares her current apartment with two new apartments and chooses the apartment that maximizes her utility. For convenience, we assume that during the search an agent views one apartment of either capital structure (high or low co-op debt). Our results do not hinge on this assumption - all we need is that apartments and apartment tastes are sufficiently heterogeneous that a full separation, whereby either agent type trades only with itself, does not occur.<sup>7</sup>

The supply of high and low co-op debt apartments is exogenous in the model and is equal to  $s$  and  $1 - s$ , respectively. At the beginning of the first period, fraction  $x^*$  ( $y^*$ ) of unbiased (biased) agents live in low debt apartments, while the rest live in high debt apartments.

The market equilibrium is given by a price function

$$P_h - P_l = b^*(\tau_c, \tau_p, c)(D_h - D_l) \quad (2)$$

under which utility-maximizing trade results in a stable distribution of agent types across apartment types, and markets clear:  $x^*\alpha + y^*(1 - \alpha) = s$ . We can write this equilibrium as

$$(b^*(\tau_c, \tau_p, c), x^*, y^*). \quad (3)$$

### 3.1.1 Trading

**Proposition 1** *There is an equilibrium  $(b^*(\tau_c, \tau_p, c), x^*, y^*)$  with  $b^* = \alpha b_u + (1 - \alpha)b_b$ ,  $x^* = ((2sV + (1 - \alpha)(b_u - b_b)(D_h - D_l))/(2V)) + 0.5$  and  $y^* = \frac{1}{1 - \alpha}(s - x^*\alpha)$ . The equilibrium price relationship is thus given by*

$$P_h - P_l = 2sV - (\alpha b_u + (1 - \alpha)b_b)(D_h - D_l) \quad (4)$$

**Proof:** See Appendix A.

Our main hypothesis is that the co-op loans are not accurately reflected in market prices. To see whether this is true, the hypothesis  $b^* = b_u$  will

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<sup>7</sup>In Appendix A, we discuss the case where full market separation occurs. Are main result are qualitatively unchanged.

be rejected. In particular,  $b^* < b_u$  unless  $c = 1$ , or  $\alpha = 1$  (or both), that is, whenever there are agents who do not capitalize costs of debt fully into prices.

### 3.1.2 Changing the tax rules

**Proposition 2** *The price response to a change in the relative cost of personal loans relative to co-op loans is smaller, in absolute terms, when some agents are biased.*

**Proof:** See Appendix A.

In the next section we provide an empirical test of the muted price response, using sales prices of apartments and the associated co-operative debt, before and after a tax reform, that reduced the cost of financing coops with personal debt.

## 4 An empirical test

Our survey results show that many apartment owners are unaware of co-op loan size and interest rate, whereas they are well aware of their personal loan size and interest rate, and they have not even considered the possibility of replacing co-op loans with personal loans. These findings corroborate the view that co-op loans are less salient. Our model predicts that if lower salience gives rise to a psychological benefit then this bias may generate market prices that depart from economic fundamentals.

In this section, we use sales data provided by the Swedish association of real estate agents to examine whether co-op loans are fully capitalized in apartment prices. The data set consists of approximately 18,000 transactions taking place in central Stockholm during the period 2007-2009. Apart from the price and time of the transaction, the data also contains information about the apartment's size (in  $\text{m}^2$  and the number of rooms), the age of the building, whether the building has an elevator, what floor the apartment is on, how many floors the building has and the location of the building (by parish).

The question of whether co-op loans are capitalized in prices has recently been addressed by Hjalmarsson and Hjalmarsson (2009) using a proxy for

co-op debt. They examine the negative relationship between the sales price and the present value of monthly fee payments to the co-op that are due to underlying debt. The reason they base their analysis the present value of co-op fees is that the available sales data does not contain information about co-op loans.

We match sales data from the same source as Hjalmarsson and Hjalmarsson (2009) with a proprietary database of co-op balance sheets, provided by Boreda AB. The result is a unique data set in which we can observe the co-op loan associated with each apartment in the sales data.<sup>8</sup> The Boreda database contains balance sheet information for the majority of the co-ops in our market data, but we lose some observations. The matched sample contains about 12,700 observations for the period 2007-2009.

Matching the two data sets allows us to test the capitalization hypothesis directly, rather than through a proxy such as the present value of co-op fees. Table 1 contains summary statistics for the entire matched sample. The co-op loan is expressed in terms of the amount associated with the apartment and not as the total sum over all apartments in the co-op. In addition, the co-op loan is expressed as net debt, i.e. debt minus financial assets (again, at the apartment level), so in those cases where the co-op has financial assets exceeding its debt this variable takes on a negative value.

*Table 1*  
**Summary statistics, entire 2007-2009 sample.**

Variable	Mean	Std. Dev.	Min	Max
Price in SEK	2,867,889	1,501,572	60,000	36,000,000
Co-op loan (net debt) in SEK	307,969	360,942	-234,962	7,325,087
Size in m <sup>2</sup>	59.27	29.68	8	560
Number of rooms	2.12	1.03	1	18
Age of building	74.61	34.36	0	507
Elevator	0.78	0.42	0	1
Floor	2.45	2.04	0	23
# Floors	3.45	2.96	1	24

As a simple framework for thinking about the capitalization of co-op loans, we can draw on an analogy with corporate finance. Just like the value

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<sup>8</sup>The data contains information about the total loans held by the co-op. It also contains the fraction of co-op ownership (and debt service) associated with each apartment, thus allowing us to identify the co-op loan associated with each apartment.

of assets equals the sum of equity and debt, we can think of an apartment having a market value  $V$  that is the sum of a co-op loan  $D$  and a market price  $P$ . If personal loans and co-op loans are perfect substitutes and have the same pecuniary cost, then the price  $P$  should simply be the net value of the apartment less the co-op loan, i.e.  $P = V - D$ . Our regression framework assumes that the set of hedonic variables  $\mathbf{X}$  and their associated regression coefficients  $\boldsymbol{\beta}$  are a good measure of the apartment's value, i.e.  $V = \mathbf{X}\boldsymbol{\beta}$ , and hence  $P = \mathbf{X}\boldsymbol{\beta} - D$ . This is essentially the same framework as in Hjalmarsson and Hjalmarsson except that we use the actual co-op debt  $D_i$ , rather than an estimated present value of co-op fees. Letting  $P_i$  be the observed sales price of apartment  $i$ , we can write the regression equation as shown in Figure 5, there are also noticeable but moderate price differences between different time periods in our pooled sample, including some indications of seasonal variations, with prices rising in the first half of the year and declining in the second half. We include a set of time dummies, one for each of the twelve quarters in the period 2007-2009, to control for these changes over time.

$$P_i = \alpha + \mathbf{X}_i\boldsymbol{\beta} + \delta D_i + \varepsilon_i \quad (5)$$

where  $D_i$  is the amount of co-op debt associated with apartment  $i$  and  $\mathbf{X}_i\boldsymbol{\beta}$  is a vector of controls, including the aforementioned apartment characteristics as well as time and location fixed effects. Location is measured at the parish level. As shown in Figure 4 there are noticeable but moderate price differences between the 14 parishes in central Stockholm, with square meter prices spanning the 44,000-57,000 SEK. We include a dummy variable for each of the 14 parishes to capture these differences.

As shown in Figure 5, there are also noticeable but moderate price differences between different time periods in our pooled sample, including some indications of seasonal variations, with prices rising in the first half of the year and declining in the second half. We include a set of time dummies, one for each of the twelve quarters in the period 2007-2009, to control for these changes over time.



Figure 4  
Average price, by parish.

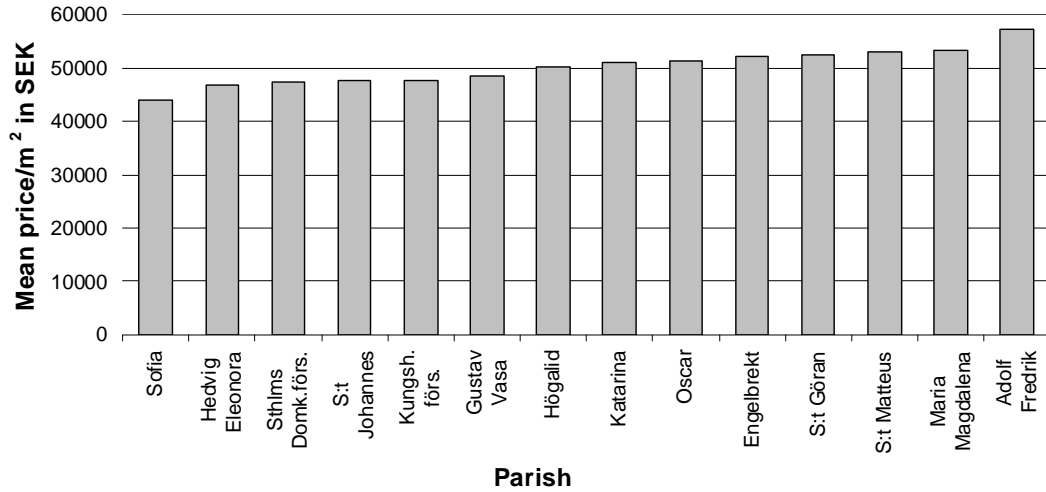
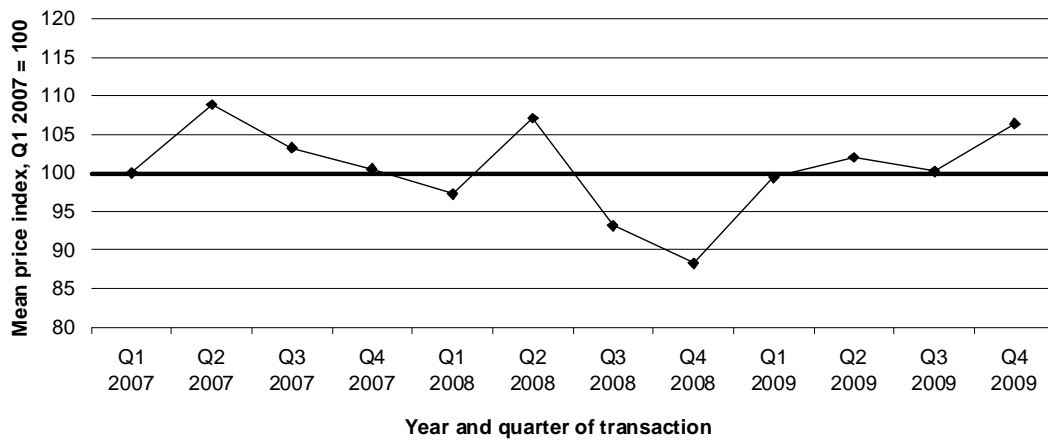


Figure 5  
Average price, by quarter.



The coefficient  $\delta$  reflects the extent to which co-op loans are capitalized in apartment prices. If the tax treatment of personal loans and co-op loans is

similar, then we should expect the coefficient  $\delta$  to be close to negative one (see section 3.1 in Hjalmarsson and Hjalmarsson, 2009). In this case, a 100 SEK increase in the size of the co-op loan associated with an apartment should decrease the price by about 100 SEK. Hjalmarsson and Hjalmarsson (2009) use the present value of fee payments, a proxy for debt, to estimate values for  $\delta$  in the range  $[-0.5, -1.0]$  with  $\delta = -0.74$  in their main specification. Their estimate implies that a 100 SEK increase in the co-op loan associated with apartment decreases its price by 74 SEK, i.e. less than full capitalization.

We have reason to expect the coefficient  $\delta$  to be larger, in absolute terms, because our data is from the period 2007-2009, whereas Hjalmarsson and Hjalmarsson use data from 2002-2005. In October 2006 the government announced a change to the tax rules for co-ops. The change which was implemented 1 January 2007 abolished a supplementary annual housing tax on co-ops that amounted to about 1 percent of the assessed value of the building. Previously, co-op interest payments had been tax deductible against this tax. at a rate of 28 percent (lowered to 26.3 percent in 2008). The deductibility of co-op interest payments applied at the co-op level, and would be passed on to the co-op residents in the form of lower co-op fees. Prior to the tax reform, the economic value of the tax break for co-op loans was approximately comparable to the interest payments on personal loans which are tax deductible at a rate of 30 percent. In the wake of the reform, there was no longer a tax break for co-op loans, implying that they should become relatively less attractive compared to co-op loans. A simple benchmark for the coefficient  $\delta$  would be the marginal rate of substitution given by the relative cost, net of taxes, for the two types of loans, i.e.  $-1/(1 - \tau)$ , or about  $-1.4$  at a tax rate of 30 percent (see Appendix A for details).

Table 2 summarizes the results from four regressions aimed at estimating  $\delta$ . Column (1) is the baseline specification using all observations in the period 2007-2009.

*Table 2*  
**Regression results: pooled regression.**

	(1)	(2)	(3)	(4)	(5)
	Baseline specification	Excluding buildings older than 10 years	Excluding top and bottom deciles of co-op loans	Excluding co-ops with commercial premises	Excluding small apartments
Co-op loan	-0.14 [0.04]***	-0.28 [0.10]***	-0.27 [0.05]***	-0.38 [0.10]***	-0.17 [0.05]***
Size in m <sup>2</sup>	41,499.58 [1,681.73]***	42,320.17 [2,734.29]***	41,896.84 [1,784.01]***	41,647.14 [2,092.80]***	43,064.59 [2,900.69]***
2 rooms	63,735.03 [32,151.33]**	117,193.09 [72,896.68]	59,098.67 [31,342.13]*	82,431.05 [43,073.92]*	
3 rooms	284,214.72 [75,988.45]***	158,958.46 [117,860.84]	290,805.68 [76,999.77]***	274,709.87 [98,801.72]***	-254,198.71 [164,099.09]
4 rooms	443,528.32 [111,828.97]***	381,763.55 [168,778.28]**	458,525.58 [115,469.94]***	449,813.44 [137,326.77]***	-137,217.81 [117,007.18]
5 or more rooms	668,972.95 [173,731.39]***	328,517.79 [281,631.19]	760,911.99 [197,232.75]***	752,485.63 [277,364.88]***	
10-20 years old	-95,597.70 [36,136.91]***		-126,622.46 [35,119.83]***	-177,069.86 [163,323.75]	-207,544.08 [60,576.82]***
20-30 years old	49,940.67 [41,395.45]		-70,340.32 [47,131.34]	213,547.73 [170,016.45]	-5,289.93 [66,510.49]
30-40 years old	156,559.57 [38,225.88]***		8,302.76 [37,592.16]	124,625.35 [112,285.35]	-19,801.06 [72,987.78]
40-50 years old	16,542.15 [38,556.37]		-96,094.37 [41,787.87]**	0.00 [0.00]	-145,256.88 [78,393.28]*
50-60 years old	80,951.54 [50,423.83]		-53,934.00 [47,588.61]	156,629.37 [637,427.35]	-45,543.69 [133,712.17]
60-70 years old	208,967.57 [33,649.10]***		70,132.45 [31,194.69]**	138,631.87 [92,135.26]	19,326.39 [95,548.41]
70-80 years old	304,291.05 [29,762.25]***		178,768.23 [27,367.02]***	265,204.08 [76,009.60]***	334,129.65 [66,014.35]***
80-90 years old	368,133.28 [31,675.32]***		213,518.69 [30,524.90]***	455,913.90 [88,961.32]***	425,715.76 [73,110.95]***
90-100 years old	501,026.59 [34,957.47]***		360,171.00 [34,126.61]***	538,334.06 [116,158.63]***	519,296.75 [73,630.11]***
100-110 years old	558,097.44 [35,757.08]***		415,477.77 [34,687.44]***	593,816.33 [85,392.27]***	603,534.18 [75,167.32]***
> 120 years old	582,732.49 [34,984.04]***		446,802.70 [33,735.77]***	566,948.48 [85,916.57]***	567,592.68 [72,688.58]***
Elevator	69,160.02 [12,050.92]***	187,395.98 [103,585.91]*	63,134.02 [12,678.08]***	51,326.79 [38,164.21]	93,762.81 [39,603.81]**
Floor	59,073.47 [2,712.73]***	66,727.20 [10,729.65]***	55,805.05 [2,756.91]***	57,503.26 [8,044.18]***	97,431.93 [7,237.36]***
# Floors	-2,795.24 [1,549.34]*	-18,462.98 [6,193.57]***	-2,069.78 [1,606.33]	-2,525.42 [4,278.36]	-2,961.02 [4,358.55]
<i>Controls for:</i>					
Quarter dummies	Yes	Yes	Yes	Yes	Yes
Parish dummies	Yes	Yes	Yes	Yes	Yes
Observations	12,725	1,011	10,148	1,398	3,426
R-squared	0.88	0.77	0.89	0.88	0.77

Robust standard errors in brackets. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

The main result is that co-op debt is greatly undercapitalized in apartment prices. In the baseline specification, the coefficient on co-op debt is

-0.14, implying that a 100 SEK increase in the co-op loan associated with an apartment decreases the price by 14 SEK.

Columns (2)-(5) contain four robustness checks. First, if co-op debt is incurred to undertake major building repairs, then a co-op might have low debt because it has not yet undertaken such repairs and hence its apartments have lower value. In column (2) we address this by excluding all buildings that are older than 10 years. The estimated coefficient for co-op loans increases but only to -0.28, well below anything that would imply full capitalization of co-op loans.

In column (3) we omit the top and bottom deciles of the co-op loan distribution, to make sure that our results are not driven by extremes. The estimated value for  $\delta$  is about the same as in column (2).

Our measure of co-op debt is net of financial assets but does not include real assets. With regard to the real value of the apartments, we assume this is captured by the apartment and building characteristics in the regression. Some co-ops, however, also have real assets in the form of commercial premises in the building. Our data does not have detailed information about the value of any commercial premises that the co-op might have, but it does allow us to identify whether a co-op has such premises or not. In column (4) we omit all apartments in co-ops with any commercial premises at all. The estimated value for  $\delta$  increases slightly in absolute size, to -0.38, but this is still very far from anything that would imply full capitalization.

Another possible omitted variable might be liquidity constraints on behalf of buyers, a hypothesis that we discuss more extensively in the discussion section at the end of the paper. We may expect liquidity constraints to be more severe for small apartments, since these can be expected to be more popular with first-time buyers who will not have realized capital gains on previous properties and may not have accumulated enough other savings to use as a down payment. In column (5) we exclude all apartments with less than 3 rooms to test for the potential importance of liquidity constraint. A similar strategy is used by Hjalmarsson and Hjalmarsson (2009). When we restrict the sample in this way the estimated value for  $\delta$  is about the same as in the baseline specification, -0.17.

Thus even when restricting the sample as in columns (2)-(5) the regression estimates suggest that a 100 SEK increase in the co-op loan associated with an apartment decreases its price by at most 38 SEK. This indicates that the extent of undercapitalization is in fact considerably larger than that reported in Hjalmarsson and Hjalmarsson (2009), despite the more disadvantageous

tax treatment of co-op loans from 2007 onwards.

As an additional test, we look at how the estimated value for  $\delta$  is affected by a tax reform at the end of 2006. Our data stretches back to 2006, but we excluded observations from 2006 from the regressions in table 2 because different tax rules applied before 2007. Now we instead focus our attention on how the coefficients change if we fit the regression in column (2) above to observations from 2006 and 2007 respectively.

The supplementary housing tax on co-ops was abolished at the end of 2006. Since co-op interest rate payments were deductible against this tax it was in effect only paid by co-ops with little or no loans. For such co-ops the change in tax rules resulted in a considerable cost reduction. Rational consumers should have anticipated that co-ops with low leverage would either (1) reduce their monthly fees in the future, or (2) maintain the same monthly fee but increase the flow of services to the residents. Thus, in an efficient market we would expect the relative price of apartments with high and low co-op loans to shift in favor of apartments with low co-op loans when comparing sales in 2007 with sales in 2006. The relative price change should be captured by the coefficient  $\delta$  which should increase in magnitude following the tax reform but our model predicts less response to changes in the relative cost of the two types of loans if some of the market participants are biased in favor of less salient co-op loans.

To examine how the capitalization of co-op loans was affected by the change in the tax treatment of co-ops, we fit equation (5) to data from 2006 and 2007 separately and compare the coefficients. Summary statistics presented in the appendix show that these two subsamples are similar. Co-op loan levels are closely similar and the difference is not statistically significant. For some other variables, the difference in means is statistically significant but small in magnitude. Price levels, however, are significantly higher in 2007, consistent with the positive effect one would expect from a lowering of the effective tax rate on the housing sector.

The data do not indicate that co-op loans were capitalized differently in 2007 than in 2006, despite the tax reform. The estimated value for  $\delta$  is -0.16 for the 2006 sample and -0.15 for the 2007 sample. The standard errors are 0.04 and 0.05 respectively, implying that the two estimated values are not significantly different from one another. The regression results are reported in full in the appendix.

## 5 Discussion

It is well documented that many consumers fail to minimize borrowing costs. Agarwal et al (2006) report that a substantial fraction of consumers choose ex-post sub-optimal credit contracts.<sup>9</sup> Many credit card holders fail to minimize costs by switching to a cheaper available source of credit, such as another credit card, checking balances or other liquid and low-yielding assets (Gross and Souleles, 2002; Stango and Zinman, 2009). Consumers take out pay-day loans at very high interest rates even when they have access to cheaper sources of financing (Agarwal et. al, 2009).

For many households, their home represents the bulk of their assets, and their mortgage contract is the most important financial contract they ever enter into (Campbell and Cocco, 2003). Sweden, which is the focus of our study, is no exception: real estate amounts to over 70% of household assets (Campbell, 2006) and the total amount of mortgages outstanding is equivalent to almost 60% of GDP.<sup>10</sup> If households make poor mortgage choices it may have serious consequences for their economic well-being and in countries with deep credit markets it may also affect financial stability.

Yet many households pay considerably higher mortgage interest rates than they need to, either by failing to refinance their mortgages (Campbell, 2006; Agarwal et al, 2008) or by taking out a subprime mortgage when they would have qualified for a prime mortgage (Lax et al, 2004). Campbell (2006) reports indications that many households choose their mortgage product on non-economic grounds. Borrowers also overpay brokers for mortgage origination (Woodward and Hall, 2010). In doing so, large amounts of money are left on the table, leading Woodward and Hall to conclude that many consumers are confused about mortgage origination and do not realize the financial costs of overpaying.

We add to the existing research by identifying an apparent inefficiency with regard to housing market debt. When buying co-op apartments, a co-op loan associated with an apartment is far from fully capitalized in the price. Our estimates suggest that an increase in the co-op loan of 100 SEK decreases the price by about 20-30 SEK, despite the fact the personal mortgage loans receive more favorable tax treatment.

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<sup>9</sup>Switching is no panacea: Wilson and Waddams Price (2010) show that in the UK electricity market about one in six consumers actually reduce their surplus by switching supplier.

<sup>10</sup>Source: Swedish Bankers' Association.

We argue that the observed outcomes may be the result of a bias in favour of less salient loans. Empirical work in public economics has shown that salience may be an important determinant of behavioral responses to taxation, and a parallel literature in consumer finance shows that salience of payments affects consumers' willingness to spend. We outline a simple model that predicts that when some fraction of market participants are biased apartment prices will not fully reflect the associated co-op loans. We test this using market data and the resulting estimates suggest that co-op loans are greatly undercapitalized in prices. The extent of undercapitalization is considerably larger than that estimated by Hjalmarsson and Hjalmarsson (2009) who use a proxy for co-op debt, rather than actual debt levels as we do. In addition, the tax reform at the end of 2006 does not seem to have changed the pricing of co-op loans, despite giving more disadvantageous tax treatment to co-op loans relative to personal loans.

Our results add to the existing research on how behavioral biases may affect the housing market (see, for example, Genovese and Mayer, 2001; Brunnermeier and Julliard, 2005; Mayer and Sinai 2007). We also extend the line of inquiry in Hjalmarsson and Hjalmarsson (2009) in several ways. First, we identify plausible microfoundations for why prices may depart from economic fundamentals. At the individual level, Hjalmarsson and Hjalmarsson (2009) don't offer an explanation for why individual assessments should be biased in one direction. By contrast, we suggest that some market participants display a bias in favor of less salient loans, and present survey evidence that corroborate this view. Second, we address the question of whether this bias may affect market prices also in the presence of unbiased market participants. Our model shows that under reasonable assumptions equilibrium prices may depart from economic fundamentals even when only a fraction of the market is biased. Third, our empirical strategy is broader: We use actual debt levels, rather than a proxy, and we examine not only the extent of capitalization in pooled data but also the change in the capitalization following a tax reform that affected the relative cost of the two types of loans.

Co-op loans are less salient but they are also more costly, and a bias in favor of less salient co-op loans may impose substantial costs on individual households. The money left on the table can be large, as illustrated by the numerical example presented in Table 3. The example is based on a personal loan of 2 million SEK, equal to the average price of a Stockholm apartment in 2007. The co-op loan associated with the apartment is 1 million SEK, implying that the value of the apartment is 3 million. At an interest rate of

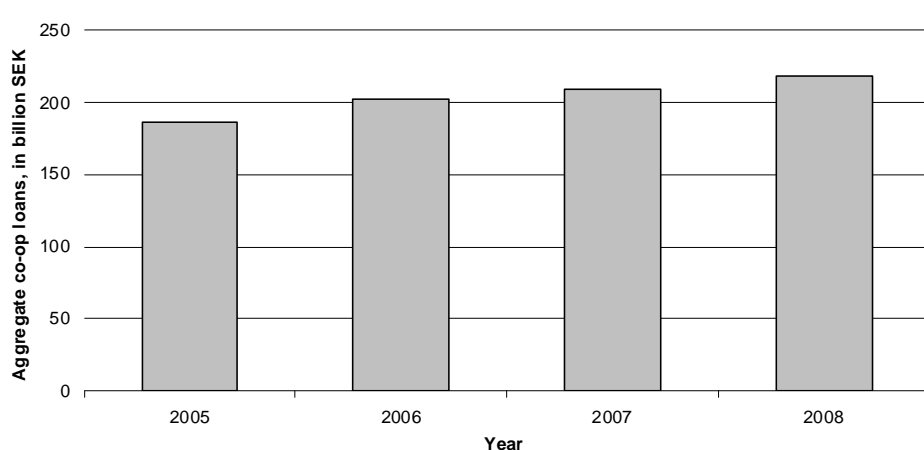
5 percent, the apartment owner could reduce their monthly borrowing cost by about 1,250 SEK (about 180 USD) by substituting a personal loan for the co-op loan. The monthly saving is equivalent to about 6% of the average pre-tax monthly wage.<sup>11</sup>

*Table 3*  
**Potential cost reduction: a numerical example**

	Value of apartment	Loan financing		Interest net of taxes, per month		Total interest payments, per month
		co-op	personal	co-op	personal	
Apartment A	3,000,000	1,000,000	2,000,000	4,167	5,833	10,000
Apartment B	3,000,000	0	3,000,000	0	8,750	8,750
Difference	0	-1,000,000	1,000,000	-4,167	2,917	-1,250

Despite the costs imposed on individual households, co-op debt remains prevalent. Co-op debt has in fact been increasing steadily, despite the higher cost following the tax reform at the end of 2006 (Source: Statistics Sweden, 2010b). The pattern applies to overall debt as well as the average debt per square meter, as shown in Figure 6.

*Figure 6*  
**Aggregate stock of co-op loans 2005-2008**



<sup>11</sup>Source: Statistics Sweden. SEK 18,000  $\approx$  USD 2,600.



The popularity of co-op debt, despite the disadvantageous tax treatment, may in part be due to some households being borrowing constrained. If banks are unwilling to lend to households but are willing to lend to the co-ops inhabited by those same households, then co-op debt may be a way to circumvent borrowing constraints, albeit at a high price. On the other hand, disposable income net of co-op fees and interest payments are key determinants when the banks approve mortgage loans, and collateral requirements are typically very low (see, for example, Finansinspektionen, 2010). Using co-op loans instead of personal loans reduces the individual's disposable income by an amount equal to 30 percent of the interest paid. That borrowing constraints also play a part is an interesting prior that merits further study, but to the best of our knowledge there is no research showing that a significant share of Swedish co-op residents are borrowing constrained. By contrast, we have documented that many apartment owners have poor awareness of the details of their co-op loan compared to their personal mortgage loan. We have also outlined a model that predicts that a bias in favor of less salient co-op loans may distort prices in equilibrium. The market data that we examine are consistent with this prediction.

Do co-op residents really need to know the terms of the co-ops' loans in order to make economically rational choices? Possibly not. The co-op fee might in fact be a sufficient proxy. But this does not diminish the fact that most of the respondents in our survey, including present and former co-op board members, had never reflected on the substitutability of co-op loans and personal loans. This insight is clearly essential if one is to envisage anything like the correct optimization problem for which either the co-op loan or a proxy like the co-op fee is an input. Individuals lacking this insight will most likely be engaging in mental accounting, treating co-op loans and personal loans as fundamentally separate parts of their personal finances. Their low awareness of co-op loans are likely to prevent them from perceiving the cost of doing so.

What economic policies might mitigate the bias and its effects on market equilibrium? It is quite possible that regulation could go some way in reducing the scope for costly mistakes in this market. Regulation, however, often comes at the cost of imposing restrictions on all market participants. It is important to consider both costs and benefits of different policy options. To give an example, the problem of sub-optimal capital structures could clearly be dealt with by simply banning co-op leverage. We believe this to be an unwise policy choice. Short-term debt is a convenient way for co-ops to dis-

tribute unforeseen expenditures, such as the need to adjust the premises to fit new building laws, over slightly longer time periods. Banning such debt might protect naive consumers, but also imposes an inconvenience cost on all consumers in the market.

We suggest two policies that would reduce the scope for mistakes without significant infringements on consumer choice. First, the co-op monthly fee could be itemized so that it is readily apparent what fraction of the fee is used for service and maintenance on the one hand, and interest payments on the other hand. This increases the salience of co-op loans. Second, real estate agents could be encouraged to disclose the co-op loan associated with an apartment in their advertisements. This information can be inferred from a co-op's annual statement. It is unlikely, however, that consumers will read annual statements and make the necessary calculations at the early stages of choosing an apartment. Providing the information in the advertisement itself would serve as a timely reminder to the consumer that the value of assets is the sum of equity and debt, and facilitate quick comparisons between apartments with different capital structures.

Both policies would be inexpensive to implement and would help consumers make more informed decisions. We believe that both policies would be well suited to field experiments, and encourage further research along these lines.

## 6 References

Agarwal, S., Chomsisengphet, S., Liu, C. and Souleles, N. (2006), “Do Consumers Choose the Right Credit Contracts”. Federal Reserve Bank of Chicago Working Paper.

Agarwal, S., Driscoll, J. and Laibson, D. (2008), “Optimal Mortgage Refinancing: A Closed Form Solution”. NBER Working Paper no 13822.

Agarwal, S., Amromin, G., Ben-David, I., Chomsisengphet, S. and Evanoff, D. D. (2009) “Do Financial Counseling Mandates Improve Mortgage Choice and Performance? Evidence from a Legislative Experiment”. Fisher College of Business Working Paper.

Bucks, B. and Pence, K. (2006), “Do Homeowners Know Their House Values and Mortgage Terms?”. Finance and Economics Discussion Series 2006-3. Washington: Board of Governors of the Federal Reserve System, 2006.

Brunnermeier, M. K. and Julliard, C. (2008), “Money Illusion and Housing Frenzies”. *Review of Financial Studies* 21(1), 135-180.

Campbell, J. Y. (2006), “Household Finance”. *Journal of Finance* 61(4), 1553-1604.

Campbell, J. Y. and Cocco, J. F. (2003), “Household Risk Management and Optimal Mortgage Choice”. *Quarterly Journal of Economics* 118(4), 1449-1494.

Chetty, R., Looney, A. and Kroft, K. (2008), “Salience and Taxation: Theory and Evidence”. *American Economic Review* 99(4), 1145-1177.

Chetty, R. and Saez, E. (2009), “Teaching the Tax Code”. NBER Working Paper No 14836.

Finkelstein, A. (2009), “EZ-tax: Tax Salience and Tax Rates”. *Quarterly Journal of Economics* 124(3), 969-1010.

Finansinspektionen (2010), *Allmänna råd om begränsning av lån mot säkerhet i bostad*. FFFS 2010:2.

- Frisell, L. and M. Yasdi (2010), The Price Development in the Swedish Housing Market – a Fundamental Analysis. *Sveriges Riksbank Economic Review* 2010:3.
- Genesove, D. and Mayer, C. (2001), “Loss and Aversion and Seller Behavior”. *Quarterly Journal of Economics* 116(4), 1233-1260.
- Gross, D. and Souleles, N. (2002), “Do Liquidity Constraints and Interest Rates Matter for Consumer Behavior? Evidence from Credit Card Data”. *Quarterly Journal of Economics* 117(1), 149-185.
- Hjalmarsson, E. and R. Hjalmarsson (2009), “Efficiency in Housing Markets: Which Home Buyers Know How to Discount”. *Journal of Banking and Finance* 33, 2150-63.
- Lax, H., Manti, M., Raca, P., and Zorn, P. (2004), “Subprime Lending: An Investigation of Economic Efficiency”. *Housing Policy Debate* 15(3), 533-71.
- Lind, H. (2003), “Rent Regulation and New Construction: With a Focus on Sweden 1995-2001”. *Swedish Economic Policy Review* 10(1), 135-167.
- Regeringens proposition 2006/07:1. *Budgetpropositionen för 2007*.
- Russell, T. and Thaler, R. H. (1985), “The Relevance of Quasi Rationality in Competitive Markets”. *American Economic Review* 75(5), 1071-1082.
- Soman, D. (2003), “The Effects of Payment Transparency on Consumption: Quasi-Experiments from the Field”. *Marketing Letters* 14(3), 173-183.
- Stango, V. and Zinman, J. (2009), “What do Consumers Really Pay on the Checking and Credit Card Accounts? Explicit, Implicit and Avoidable Costs”. *American Economic Review: Papers and Proceedings* 99(2), 424-429.
- Statistics Sweden (2010a), *Yearbook of Housing and Building Statistics 2010*.
- Statistics Sweden (2010b), *Intäkts- och kostnadsundersökningen för flerbostadshus (IKU) 2008*.
- Woodward, S. and Hall, R. (2010), “Diagnosing Consumer Confusion and Sub-Optimal Shopping Effort: Theory and Mortgage-Market Evidence.” Working paper.

# Appendix A

## Proof of Proposition 1

Denote  $\frac{u_i}{(1-\tau_p)r} = v_i \in [-V; V]$ ,  $V = \frac{U}{(1-\tau_p)r}$ ,  $b_u = \frac{(1-\tau_c)}{(1-\tau_p)}$  and  $b_c = \frac{(1-\tau_c)c}{(1-\tau_p)}$ . The utility expression (1) can be now rewritten as  $(v_i - P - b_j D)(1 - \tau_p)r$ . By assumption each agent considers one apartment with high debt and one with low debt. Both types may settle for an apartment with high or low debt, depending on which gives them the higher utility given the realization of the random variable  $v$ . Agent  $i$  of type  $j$  will trade her current apartment with high co-op debt level  $D_h$  (and a realized valuation of  $v_0$ ) for an apartment of co-op debt level  $D_l$  if the following two conditions hold:

$$v_i^l - P_l - b_j D_l > v_0 - P_h - b_j D_h \quad (\text{A.6})$$

and

$$v_i^l - P_l - b_j D_l > v_i^u - P_h + b_j D_h \quad (\text{A.7})$$

where  $v_i^l$  denotes the utility from the low debt apartment.  $P_h$  and  $P_l$  are the prices of high debt and low debt apartments. It reflects both the psychological benefit of less salient co-op loans and the value of the tax shield. Condition (A.6) states that the agent will move to a new apartment if the net utility from living in the new low debt apartment less the costs of purchasing it exceeds what the agent earns by staying in the initial high debt apartment (subscript 0).

The demand by an agent of type  $j$  living in a low debt  $l$  apartment (high debt) for an apartment of low debt is denoted by  $\Pi_j^{l,l}$  ( $\Pi_j^{h,l}$ ) (it is the probability that the agent will end up in an  $l$  debt apartment). Thus,  $\Pi_u^{l,l}$  is equal to:

$$\begin{aligned} \Pi_u^{l,l} &= P\{v_i^l - P_l - b_u D_l > v_i^h - P_h - b_u D_h\} \times \\ &\quad \times (P\{v_i^l > v^0\} + P\{v_i^l < v^0\}) \\ &= P\{P_h - P_l + b_u(D_h - D_l) + v_i^l > v_i^h\} \\ &= \frac{P_h - P_l + b_u(D_h - D_l)}{2V} + 0.5 \end{aligned}$$

since  $v_i^h$  and  $v_i^l$  are random draws from a uniform distribution.

Similarly,

$$\begin{aligned}\Pi_u^{h,h} &= P\{v_i^h - P_h - b_u D_h > v_i^l - P_l - b_u D_l\} \times \\ &\quad \times (P\{v_i^h > v^0\} + P\{v_i^h < v^0\}) \\ &= \frac{P_l - P_h + b_u(D_l - D_h)}{2V} + 0.5\end{aligned}$$

By definition,

$$\Pi_u^{h,l} = 1 - \Pi_u^{h,h} \quad (\text{A.8})$$

Thus,  $\Pi_u^{h,l} = \Pi_u^{l,l}$ . The total demand by agents of type  $j = u$  for low co-op debt apartments is given by the sum of those moving from low debt apartments and those moving from high debt apartments

$$\Pi_u^l = x\Pi_u^{l,l} + (1-x)\Pi_u^{h,l} = \frac{P_h - P_l + b_u(D_h - D_l)}{2V} + 0.5 \quad (\text{A.9})$$

Similarly, for biased agents, by only changing the discount factor,

$$\Pi_b^{l,l} = \frac{P_h - P_l + b_b(D_h - D_l)}{2V} + 0.5 \quad (\text{A.10})$$

Also,  $\Pi_b^{h,l} = 1 - \Pi_b^{h,h}$  and

$$\begin{aligned}\Pi_b^{h,h} &= P\{v_i^h - P_h - b_b D_h > v_i^l - P_l - b_b D_l\} \times \\ &\quad \times (P\{v_i^h > v^0\} + P\{v_i^h < v^0\}) \\ &= \frac{P_l - P_h + b_b(D_l - D_h)}{2V} + 0.5\end{aligned}$$

The total demand by agents of type  $j = b$  for low co-op debt apartments is given by

$$\Pi_b^l = y\Pi_b^{l,l} + (1-y)\Pi_b^{h,l} = \frac{P_h - P_l + b_b(D_h - D_l)}{2V} + 0.5 \quad (\text{A.11})$$

The total demand by two types of agents for low debt apartments must be equal to its supply:

$$\alpha\Pi_u^l + (1-\alpha)\Pi_b^l = s \quad (\text{A.12})$$

Respectively,

$$\alpha\Pi_u^b + (1-\alpha)\Pi_b^b = 1 - s \quad (\text{A.13})$$

and thus

$$P_h - P_l = 2sV - (\alpha b_u + (1 - \alpha)b_b)(D_h - D_l) \quad (\text{A.14})$$

### Distribution

To assure that the distribution is stable, it must be that  $\Pi_u^{h,l} = \Pi_u^{l,h}$  (and hence  $\Pi_b^{h,l} = \Pi_b^{l,h}$ ). The equilibrium level of the distribution of agent types  $x^*$  solves the following:

$$x^*(1 - \Pi_u^{l,l}) = (1 - x^*)\Pi_u^{h,l} \quad (\text{A.15})$$

implying that

$$x^* = \frac{2sV - (\alpha b_u + (1 - \alpha)b_b)(D_h - D_l) + b_u(D_h - D_l)}{2V} + 0.5 \quad (\text{A.16})$$

$$= \frac{2sV + (1 - \alpha)(b_u - b_b)(D_h - D_l)}{2V} + 0.5 \quad (\text{A.17})$$

Similarly,

$$y^* = \frac{1}{1 - \alpha}(s - x^*\alpha) \quad (\text{A.18})$$

$$= \frac{2sV + \alpha(b_u - b_b)(D_h - D_l)}{2V} + \frac{0.5\alpha}{1 - \alpha} \quad (\text{A.19})$$

### Proof of proposition 2

After the tax removal,  $b'_u = \frac{1}{1 - \tau_p}$ ,  $b'_b = \frac{c}{1 - \tau_p}$ . In an efficient market  $b_u - b'_u = \frac{1 - \tau_c}{1 - \tau_p} - \frac{1}{1 - \tau_p} = \frac{-\tau_c}{1 - \tau_p} < \alpha \frac{-\tau_c}{1 - \tau_p} + (1 - \alpha) \frac{-\tau_c c}{1 - \tau_p} < 0$ ,

where the last expression derives from (4).

## A.1 Market Separation

As an extension, consider the case where there is no heterogeneity in apartments or apartment tastes ( $V = 0$ ) but (agents still trade according to (A.6) and (A.7)).

In the market with unbiased agents (efficient markets), the annual cost of living in either type of the apartment (given similar valuations) would be

the same and equal to

$$(1 - \tau_p)rP_h + (1 - \tau_c)rc_uD_h = (1 - \tau_p)rP_l + (1 - \tau_c)rc_uD_l \quad (\text{A.20})$$

where  $c_u = 1$ . This in turn implies that in the separate market with unbiased agents

$$P_h + \frac{(1 - \tau_c)rc_u}{(1 - \tau_p)r}D_h = P_l + \frac{(1 - \tau_c)rc_u}{(1 - \tau_p)r}D_l \quad (\text{A.21})$$

Similarly, in the separate market with biased agents

$$P_h + \frac{(1 - \tau_c)rc_b}{(1 - \tau_p)r}D_h = P_l + \frac{(1 - \tau_c)rc_b}{(1 - \tau_p)r}D_l \quad (\text{A.22})$$

The pricing relationship is hence given by  $P_h - P_l = b_b(D_h - D_l)$  and  $P_h - P_l = b_u(D_h - D_l)$  in the biased and unbiased agents' markets, respectively, and thus the average price will be similar to the one in equation 8 ( $V = 0$ ).

## Appendix B

*Table A1*  
**Summary statistics: comparing 2006 and 2007**

Variable	2006		2007		t-test, equality of means
	Mean	Std. Dev.	Mean	Std. Dev.	
Price in SEK	2,564,168	1,332,237	3,063,253	1,603,534	-18.95
Co-op loan (net debt) in SEK	290,957	365,399	287,739	323,258	0.46
Size in m <sup>2</sup>	58.04	28.76	59.28	29.94	2.33
Number of rooms	2.04	1.01	2.13	1.04	-4.49
Age of building	77.08	31.88	75.62	31.70	2.55
Elevator	0.76	0.43	0.76	0.43	-0.09
Floor	2.11	1.92	2.56	2.02	-12.62
# Floors	2.87	2.80	3.68	2.84	-15.93



*Table A2*  
**Regression results: comparing 2006 and 2007.**

	(1)	(2)
	Year = 2006	Year = 2007
Co-op loan	-0.16 [0.04]***	-0.15 [0.05]**
Size in m <sup>2</sup>	37,477.08 [1,200.09]***	45,311.12 [1,203.56]***
2 rooms	81,303.63 [24,577.91]***	25,619.59 [25,174.24]
3 rooms	279,718.20 [55,074.11]***	211,699.35 [58,446.26]***
4 rooms	365,770.11 [79,709.68]***	377,843.34 [86,343.38]***
5 or more rooms	456,602.76 [133,846.82]***	446,853.50 [155,448.82]***
10-20 years old	-139,291.48 [63,475.45]**	-174,950.55 [70,405.85]**
20-30 years old	-35,298.18 [63,589.17]	21,666.67 [84,697.37]
30-40 years old	3,235.46 [56,906.56]	-194.95 [74,734.74]
40-50 years old	-57,344.00 [66,904.76]	-50,599.54 [70,077.45]
50-60 years old	112,380.83 [69,693.77]	-119,945.18 [97,366.17]
60-70 years old	208,463.38 [54,684.27]***	133,504.04 [54,366.22]**
70-80 years old	229,821.19 [51,202.31]***	223,085.44 [51,737.99]***
80-90 years old	271,280.73 [59,331.71]***	249,544.47 [56,368.01]***
90-100 years old	322,706.15 [55,274.10]***	369,709.00 [58,663.83]***
100-110 years old	401,733.05 [55,687.34]***	447,712.56 [61,109.64]***
> 120 years old	417,723.21 [56,793.04]***	470,812.48 [59,093.94]***
Elevator	71,037.38 [13,604.68]***	35,020.79 [16,439.05]**
Floor	46,488.99 [3,804.47]***	66,015.37 [4,610.80]***
# Floors	-1,627.00 [2,303.39]	-5,497.34 [2,822.36]*
<i>Controls for:</i>		
Quarter dummies	Yes	Yes
Parish dummies	Yes	Yes
Observations	5,158	4,644
R-squared	0.88	0.89

Robust standard errors in brackets. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%