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Abstract

Determinants of the probability of homeownership are analysed using a 20 per cent random sample of Danish homes with data covering characteristics of both the homes and their inhabitants. The sample data are from the beginning of the year 2004 and the analysis is based on a logistic regression. The paper adds to earlier papers by the same authors where determinants of the homeownership rate were found using (average) data for 270 Danish municipalities. By using data directly related to individual households whose inhabitants have chosen to be or not to be homeowners, the analysis reveals characteristics and restrictions that influence the choice between renting and ownership. Among the determinants investigated is civil and social status of the breadwinner and various household characteristics including income. The empirical results generally suggest that the impact of the determinants corresponds to theory.

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1. Introduction

The housing standard in Denmark is high with 2.6 million dwellings and 5.4 million inhabitants in 2005, i.e. 2 persons per dwelling. Owner occupied housing (excluding private cooperative ownership) covers 52 per cent of occupied homes. The homeownership rate has been fairly constant over the last decade with a slight reduction after 2000. Other European countries have witnessed a tendency towards continued increase in the rate. The present study of determinants of homeownership uses a 20 per cent random sample of Danish homes. The data are pulled from various register data files to include information both on home and inhabitant characteristics. After deletion of a number of irregular homes like old age care centres, student dormitories etc. 374,331 homes and their inhabitants are analysed. The paper adds to an earlier paper by Lauridsen, Nannerup and Skak (2006) in which determinants of the homeownership rate were found using (average) data for 270 Danish municipalities. By using data directly related to individual households whose inhabitants have chosen to be or not to be homeowners, the analysis reveals characteristics and restrictions that influence the choice between renting and owning.

The paper is structured in the following way. Theories on determinants of homeownership are summarised in section two. The data to be applied for the study and relevant methodological issues are considered in section three with results presented in section four. Finally, section five concludes.

2. Theoretical determinants of homeownership

Basically, individuals or households choose to own the stock from which housing services flow if it is optimal or welfare maximizing given their specific economic conditions. Changes of the economic environment may lead to change in the optimal choice away from ownership or into ownership. It follows that a listing of the deciding factors in the economic environment will also be a listing of factors that influence the demand for owner occupied homes. Linneman (1986), Rothenberg, Galster, Butler and Pitkin (1991), and Hansen and Skak (2005) provide theoretical arguments for a range of economic determinants for homeownership. This research thus contributes with a list of potential explanatory variables for homeownership for the present empirical analysis. In the following, only determinants included in the empirical part of the paper are discussed. Hence, e.g. relative prices and price expectations are left out because the data do not contain variables that are able to indicate relative prices and price expectations.

A *favourable tax (or subsidy) treatment* of owners relative to renters is seen as an important factor behind ownership. In Denmark, personal taxable income is divided into labour income and capital income with the possibility of subtracting interest payments from capital income. In principle this gives high marginal tax bracket income earners lower after tax interest rates, but the effect is dampened by a maximum of 30 per cent tax deduction when the capital income becomes negative. Nevertheless, one should expect to see more homeownership among high income earners.

Insofar as buying a house is costly for most consumers, another important factor influencing homeownership is *financial capacity* of individuals or households. In industrialised countries real estate is typically financed by a combination of down payments and a loan to be repaid with interests over a number of years. In Denmark, property is used as collateral for real estate loans implying that the lending institution can sell the housing unit to recoup the loan when the borrower fails to service the debt. But lenders will prefer to provide loans to individuals with good credit rating because the recouping procedure is costly and the revenue thus insecure. In practice, many households may prefer to be homeowners, but are prevented from this due to low borrowing or financial capacity. A survey by Hargreaves (2003) indicates that financial constraints dominate the reasons for renters in New Zealand not to switch to ownership. With credit rating increasing with (expected future) annual income level of individuals, one can expect ownership rates to increase with *household income*. Other factors that may affect credit rating and ownership rates are *educational level or job perspectives* and in general a range of *personal characteristics* a lender finds important for the credit rating.

Owning a home is costly not only because of the debt servicing that typically follows after the purchase, but also because salaries to real estate agents and lawyers plus document stamps make the buying process expensive. Similar costs are low or non existent for a renter, which clearly shows that owning must carry compensating advantages. Because the buying or *closing costs* are high for owners and the advantages from owning are part of the annual flow of housing services for owner-occupiers, it follows that *expected occupation time* and factors that influence the closing costs will influence homeownership probabilities. For example, one would expect students to be primarily renters as they do not expect to stay put for many years. High closing costs furthermore give a *locking-in effect* that reduces geographical mobility as noted by Oswald (1997).

Linneman (1986) invokes *differences in production efficiency between landlords and owner-occupiers* as an important factor behind ownership. For example, landlords internalise externalities that cause problems among neighbours in multi family structures, and landlords may be able to use their buying power to reduce maintenance costs. But this higher efficiency of landlords in the supply of housing services may well be more than fully offset by costs from monitoring the renter and limitations on the renter's use of the housing unit – and so the housing services that flow from unit. Linneman (1986) holds the opinion that high production efficiency by landlords in high density residences is the reason why ownership rates tend to fall when one travels from the countryside and into city centres. In the empirical analysis, we seek evidence for Linneman's hypothesis by testing the significance of a town size variable with an expected negative relation between town size and homeownership.

Another relevant point in the present setting is made by Ærø (2002), who points to an exceptionally high renovation and repair activity among homeowners relative to renters. *Persons or households obviously differ with respect to the benefit they gain from individual adaptation of housing units*, i.e. by changing and painting rooms to suit their preferences. Because of contracting problems (such as a lack of allowance or compensation to renters for repair activity), owner-occupiers have more freedom in estate adaptation and this potentially offsets the closing costs of owner-occupancy. Taking benchmark in this, Hansen and Skak (2005) establish in a theoretical setting a sorting mechanism in which owners are individuals with strong preferences for individual adaptation of their home. With high rent levels in cities, this model also explains why ownership rates tend to fall from the countryside and into city centres. Though the model does not identify or rank persons after their preference for individual home adaptation, a presumption could be that self-employed persons are more individualistically oriented than wage earners. Hence, the analysis tests for the significance of this difference for homeownership probability.

If landlords are unable to distinguish between households with high versus low tear and wear rates, adverse selection implies that renters are found among high wear households, see Miceli (1989). As a consequence of this, households with many children may - ceteris paribus - have reduced probability of ownership.

3. Data and methodology

The data are cut from of a 20 per cent random sample of Danish homes with data drawn from various register data files to include information on home and inhabitant characteristics. The sample is from the beginning of the year 2004. After deletion of a number of irregular homes like old age care centres, student dormitories, summer cottages etc. 374,331 homes and their inhabitants are analysed. Table 1 gives an overview of the variables used. The personal characteristics are those of the breadwinner of the household. The fraction of the sample that falls in the different categories is shown in the Mean column when no quartiles are shown, e.g. 60 per cent of the dwellings (households) have a man as breadwinner, and 43 per cent have a married or cohabitating breadwinner.

A logistic regression is used for the analysis. Hence the results show how determinants influence the probability of homeownership among Danish citizens.

4. Results

Table 2 gives the estimation results. Coefficients with positive sign indicate that the probability of homeownership increases either when the variable increases or, if compared with a reference variable, the probability of homeownership increases compared to the probability in the reference case. Note that the table is cut into sections, where a "-" before a variable indicates that its impact on the probability of homeownership has been tested against the impact of a reference variable, which is written with capital letters highest in the section. For variables with no reference variable, the reference is the "opposite" of the variable.

The first observation is that homeownership increases with the labour income of the breadwinner and also with the total labour income of the household. Taxation of labour income is different from taxation of capital income in Denmark, which explains why data on the two types of income are available. Because paid interests, e.g. on housing loans, are deductible from capital income with the implication that many homeowners have negative capital income, labour income is preferred to total income in the analysis.

Table 1: Descriptive statistics (Number of observations = 374331)

Variable	Mean	Lower Quartile	Upper Quartile
Labour income of breadwinner in DKK	193,402	0	315,118
Labour income of household in DKK	308,301	0	487,201
Breadwinner is a man	0.597	-	-
MARRIED/COHABITATING	0.429	-	-
- widow	0.115	-	-
- divorced	0.131	-	-
- single	0.325	-	-
WAGE EARNER	0.595	-	-
- unemployed	0.025	-	-
- on sick-leave	0.009	-	-
- social pensioner	0.027	-	-
- pre pensioner	0.053	-	-
- old age pensioner	0.188	-	-
- early old age pensioner	0.038	-	-
- self-employed	0.049	-	-
- undergoing education	0.016	-	-
With final education	0.584	-	-
Immigrant	0.056	-	-
Descendant of immigrant	0.004	-	-
COUPLE WITH CHILDREN	0.206	-	-
- single without children	0.408	-	-
- single with children	0.051	-	-
- couple without children	0.335	-	-
Number of persons in household	2.069	1	3
Number of children in household	0.450	0	1
Age of youngest person	39.503	17	61
Age of breadwinner (Abw)	49.143	35	61
Duration of marriage (Dm)	8.621	0	12
COPENHAGEN AREA	0.253	-	-
- town above 100,000 inhabitants	0.112	-	-
- town 50,000 - 99,999 inhabitants	0.040	-	-
- town 20,000 - 49,999 inhabitants	0.080	-	-
- town 0 - 19,999 inhabitants	0.515	-	-
Built 1991-97	0.038	-	-
Built 1998 and after	0.027	-	-

Note: Personal characteristics are those of the breadwinner of the household. The fraction of the sample that falls in the different categories is shown in the Mean column where no quartiles are shown. The translation from Danish is sygedagpenge = on sick-leave, kontanthjælp = social pensioner, førtidspension = pre pensioner, folkepension = old age pensioner, efterløn = early old age pensioner, selvstændig = self employed, erhvervskompetencegivende uddannelse = with final education.

Source: A 20 per cent randomly picked sample of Danish homes and their inhabitants.

Homeownership also increases when the breadwinner is a man. The odds ratio shows that the probability of homeownership increases by 23 per cent when the breadwinner is a man. This, or at least its significance, ought to be surprising keeping in mind that the analysis controls for a number of other characteristics like income, composition of household etc. However, it may reflect that the average man is better equipped for the financial transactions, negotiations etc. that are part of the acquisition of a home.

When the breadwinner is divorced or single the probability of homeownership falls compared to the probability of homeownership for married or cohabitating breadwinners. This is expected because divorced or single breadwinners typically have reduced financial capacity. According to Bech-Danielsen and Gram-Hansen (2006), a divorce implies an abrupt move out of the home by one part, who seeks temporary housing - and so non-ownership - for a time until a new life path is found. The increased probability for widows is less evident because the financial capacity of widows typically is lower than for the average married or cohabitating couple. A plausible explanation is that widows typically have a longer period of marriage behind them than the average married or cohabitating couple and are able to stay in their pre-widowhood housing type.

Compared to the average wage earner, other signs of low financial capacity are unemployment, sick-leave, and receipt of social or pre pension. Furthermore, public financial housing support or housing allowance is only paid to renters in Denmark, which makes renting comparatively cheaper for people with modest income. However, old age pension is not significant, and for breadwinners on pre old age pension the coefficient is positive. The positive coefficient for pre old age pension may reflect endogeneity because homeowners with high wealth and ample financial means (e.g. owner occupiers' housing wealth) more typically opt for pre old age retirement than the average wage earner.

Table 2: Determinants of homeownership

Variable	Expected sign	Coefficient	Odds ratio
Labour income of breadwinner	+	0.0015***	
Labour income of household	+	0.0013***	
Breadwinner is a man	+	0.204***	1.226
MARRIED/COHABITATING	reference variable		
- widow	-	0.330***	1.391
- divorced	-	-0.481***	0.618
- single	-	-0.199***	0.820
WAGE EARNER	reference variable		
- unemployed	-	-0.075**	0.928
- on sick-leave	-	-0.141***	0.868
- social pensioner	-	-1.629***	0.196
- pre pensioner	-	-0.725***	0.484
- old age pensioner	-	-0.027	0.973
- early old age pensioner	+	0.377***	1.458
- self-employed	+	1.387***	4.003
- undergoing education	-	-0.359***	0.699
With final education	+	0.395***	1.484
Immigrant	-	-1.014***	0.363
Descendant of immigrant	-	-0.210***	0.811
COUPLE WITH CHILDREN	reference variable		
- single without children	-	-0.956***	0.385
- single with children	-	-1.052***	0.349
- couple without children	?	-0.610***	0.544
Number of persons in household	+	0.371***	
Number of children in household	+	-0.272***	
Age of youngest person	?	0.012***	
Age of breadwinner (Abw)	+	0.125***	
Abw squared	?	-0.001***	
Abw in power of three	?	3.01E-7***	
Duration of marriage (Dm)	+	0.024***	
Dm squared	?	-0.0003***	
COPENHAGEN AREA	reference variable		
- town above 100,000 inhabitants	+	0.507***	1.660
- town 50,000 - 99,999 inhabitants	+	0.848***	2.335
- town 20,000 - 49,999 inhabitants	+	1.032***	2.805
- town 0 - 19,999 inhabitants	+	1.532***	4.627
Built 1991-97	+	-1.825***	
Built 1998 and after	+	-0.815***	

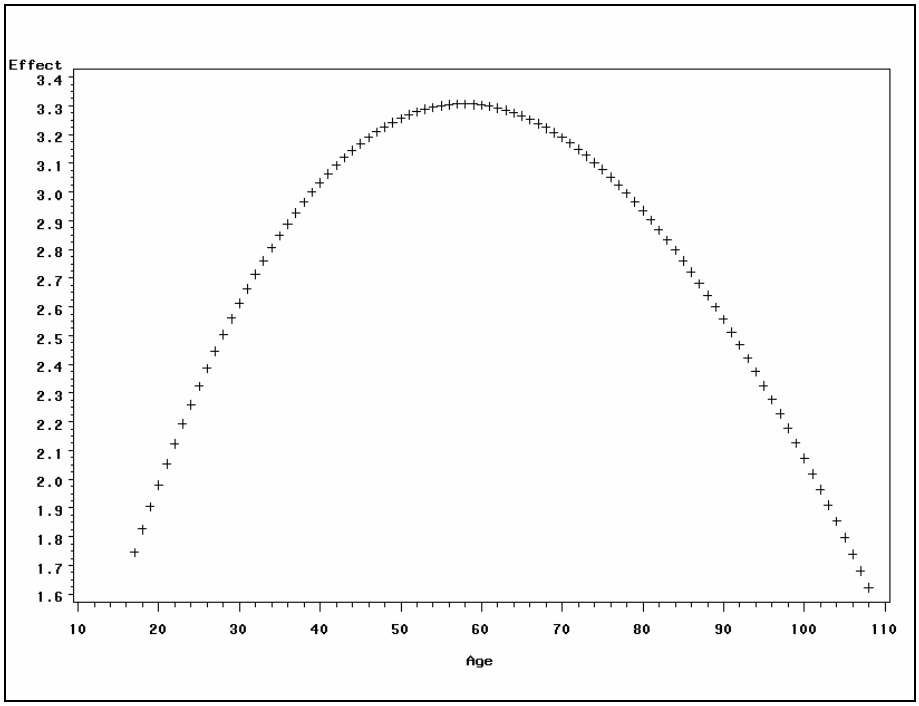
Note: Personal characteristics are those of the breadwinner of the household. The odds ratio is the ratio of the probability of finding an owner in the respective category divided by the probability of finding an owner in the reference category. Where no reference category is mentioned, the opposite characteristic is the reference category. Significance is indicated by *** for 1%, ** for 5%, and * for 10%.

Source: Logistic regression on a 20 per cent sample of Danish homes and their inhabitants.

Self employed persons have not less than four times higher probability of homeownership than the average wage earner, which may reflect a higher degree of individualism among self employed persons. This corroborates the assumption made by Hansen and Skak (2005) that homeowners get comparatively more welfare from individual adaptation of their homes[1]. Finally, the probability of homeownership falls as expected when the breadwinner is undergoing education. Both a low financial capacity and a short horizon for the occupation of the home explain the negative coefficient.

It is no surprise that households with breadwinners with final (job qualifying) education have higher owner probability, and that the opposite is the case for immigrants. Note, however, that the negative coefficient is lower for descendants of immigrants.

Figure 1: The effect of breadwinner's age on the probability of being homeowner



Source: Table 1

[1] In a regression not shown in this paper, wage earners have been divided into groups according to the skill level needed in their position, and also self employed persons have been divided into groups based on the number of their employees. No clear pattern is revealed for wage earners, but for self employed persons there is a tendency towards higher homeownership probability when one goes from 0 to more than 5 employees, after which it stabilises.

Couples with children are more often owners than are singles with or without children and couples without children. The wish for ownership for couples with children is presumably because of a greater need for (or welfare from) adaptation of homes when there are children in the family.

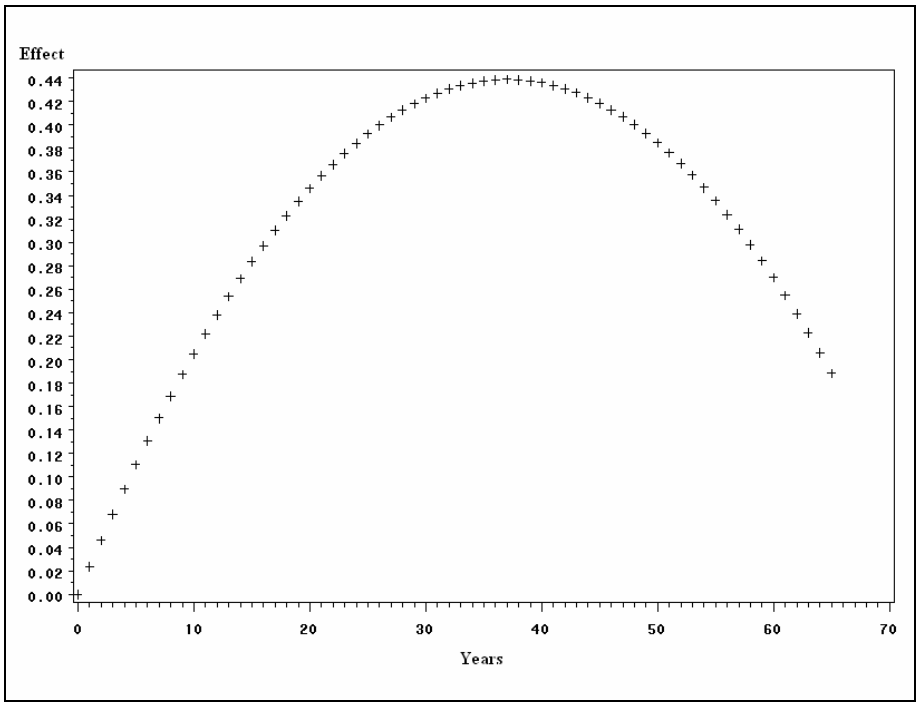
One way to interpret the coefficient of the two variables *Number of persons in household* and *Number of children in household* is to say that more persons in a household increases the financial capacity of the household and so the probability for home ownership, but households that are loaded with children are typically high wear households, which – because of adverse selection – tend to be renters. The age of the youngest person and the breadwinner are both positively correlated with home ownership, both probably reflecting that homeownership increases with the "average" age of the household. By using the age of the breadwinner in the power of two and three, the age-ownership relation presented in figure 1 is found.

As shown, the probability of ownership increases up to the late 50s and then gradually reduces. A somewhat similar effect is found for the duration of marriage, where the probability increases during the first 40 years of marriage and then falls, see figure 2.
Both Linneman (1986) and Hansen and Skak (2005) expect the probability for homeownership to fall the longer away from city cores one is and this is confirmed significantly by the town size variables in comparison with Copenhagen. A clear increase of the coefficients and the odds ratio for homeownership is found the smaller is the town. The smallest – or countryside – towns have more than 4 times higher probability of homeownership compared to the probability in the Copenhagen region.

Because all major cities in Denmark have rent regulation for apartments in buildings with building year 1990 or earlier, if not thoroughly renovated, a dummy for building years 1991-97 was tested. The expectation was that homeownership would be more present among newer buildings with no rent regulation, but table 1 shows coefficients with the opposite sign. The explanation is that a tax reform in 1986 reduced the tax rebate on interest payments considerably, which gave a marked reduction in the demand for homeownership. Consequently a profound drop in the building of houses for private ownership took place and lasted until the mid 1990s. After 1997 the exceptional drop in the building rate of houses for private ownership levelled out, but the effect of the tax reform of 1986, making it comparatively more expensive to be

homeowner, is obviously still working and gives a negative coefficient for building in the years 1998 and after[2].

Figure 2: *The effect of marriage duration on the probability of being homeowner*



Source: Table 1

In an earlier paper by Lauridsen, Nannerup and Skak (2006) determinants of the homeownership rate were found using (average) data for 270 Danish municipalities. The data used in the present analysis are in principle better suited for the task of finding significant determinants of homeownership. It is therefore interesting to see whether or not similar explaining variables have the same signs. Among 8 variables that can be said to be similar, two come out differently. One is the impact of "widow", which had a negative coefficient on the homeownership rate when the widow-rate in municipalities was used as explanatory variable. In the present analysis the status of the breadwinner is used and the coefficient on the probability of homeownership comes out significantly positive. The other variable is "education", where the percentage having higher education in municipalities came out with an insignificant and unexplainable negative coefficient on the homeownership rate, probably because people with higher education are overrepresented in greater cities where homeownership rates are low for other reasons. In the present analysis a

[2] The data are from the beginning of the year 2004 and do not cover the most recent upswing in building activity.

breadwinner with final education has a significant positive impact on the probability of homeownership.

5. Conclusion

Determinants of the probability of homeownership was analysed based on a 20 per cent random sample of Danish homes from the beginning of the year 2004. The analysis is based on a logistic regression and reveals characteristics and restrictions that influence the choice between renting and owning. The empirical results generally suggest that the impact of the analysed determinants corresponds to theory. The probability of homeownership increases with the income of the breadwinner, his or her age and duration of marriage, and when the breadwinner has a final (job qualifying) education. The probability falls with various indicators of reduced financial capacity, e.g. the receipt of social pensions, and for single or divorced breadwinners. Interesting results are a higher probability for men and for self-employed breadwinners. Finally, the probability of homeownership clearly decreases when one travels from the countryside towards city centres.

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