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385

RENT CONTROL AND TENANTS' WELFARE: THE EFFECTS OF DEREGULATING RENTAL MARKETS IN FINLAND

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Helsinki 2006

The author wishes to thank Heikki A. Loikkanen, Peter Englund, and Paavo Miettinen for useful discussions. The usual disclaimers apply. The author works at the Government Institute for Economic Research in Finland within the "Economics of Housing" project funded by the Academy of Finland and led by Prof. Heikki A. Loikkanen. Part of the work was carried out when the author was visiting Stockholm School of Economics, Dept. of Finance, in spring 2005. Financial support from the Yrjö Jahnsson Foundation is also gratefully acknowledged.

ISBN 951-561-605-0 (nid.)
ISBN 951-561-606-9 (PDF)

ISSN 0788-5016 (nid.)
ISSN 1795-3359 (PDF)

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Oy Nord Print Ab

Helsinki, March 2006

LYYTIKÄINEN TEEMU: RENT CONTROL AND TENANTS' WELFARE: THE EFFECTS OF DEREGULATING RENTAL MARKETS IN FINLAND. Helsinki, VATT, Valtion taloudellinen tutkimuskeskus, Government Institute for Economic Research, 2006, (C, ISSN 0788-5016 (nid.), ISSN 1795-3359 (PDF), No 385). ISBN 951-561-605-0 (nid.), ISBN 951-561-606-9 (PDF).

Abstract: Private rental markets in Finland were subject to rent control from 1967 until the beginning of the 1990s when the rent control system was gradually abolished. This study estimates the costs and benefits of rent control to tenants in private rental dwellings in 1990 using the years 1998 and 2001 as benchmarks. Special emphasis is placed on the welfare costs of increased discrepancies between actual and desired housing consumption due to the over-demand situation caused by rent control. Earlier studies on the welfare effects of rent control usually assume that the household would consume on the estimated demand curve in the absence of rent control. Here it is shown that this assumption biases estimates of the net benefit of rent control to tenants downwards and welfare measures are derived that also allow for suboptimal housing consumption in the absence of rent control. The empirical implementation of these measures utilizes micro-simulation to differentiate between "natural" free market disequilibrium costs and additional disequilibrium costs caused by rent control. According to the results, the additional disequilibrium costs offset roughly 30 per cent of the benefits of lower rents to tenants and amounted to over 2 per cent of consumption expenditure of tenant households. The estimated net benefit of rent control to tenants, taking both low rents and disequilibrium costs into account, was 4.5 or 6.5 per cent of consumption expenditure, depending on the reference year. The ratio of the net benefit to tenants to the costs of lower rents to landlords was 64 or 72 per cent.

Key words: Rent control, consumer's surplus, disequilibrium costs

Tiivistelmä: Vuokrasääntely purettiin Suomessa vaiheittain vuosina 1992 ja 1995. Tässä tutkimuksessa arvioidaan vuokrasääntelyn vaikutuksia vuoden 1990 vuokralaiskotitalouksien taloudelliseen hyvinvointiin. Sääntelyn jälkeisiä vuosia 1998 ja 2001 käytetään vertailukohtana. Erityisen mielenkiinnon kohteena on vuokrasääntelyn aiheuttamista kulutusrakenteen vääristymistä aiheutuvat hyvinvointitappiot. Tutkimuksessa muodostetaan vuokrasääntelyn hyvinvointivaikutusten mittari, ottaen huomioon se että myös sääntelystä vapailla vuokramarkkinoilla on etsintä ja muuttokustannuksista aiheutuvia eroja halutun ja todellisen asuntokulutuksen välillä. Aiemmissa tutkimuksissa on oletettu, että sääntelemättömillä markkinoilla kotitalouden asuntokulutus vastaa täsmälleen sen haluamaa asuntokulutusta. Tutkimuksen empiirisessä osassa hyödynnetään kotitaloustason poikkileikkausaineistoja em. vuosilta. Empiirisessä sovelluksessa hyödynnetään mikrosimulointia vuokrasääntelyn aiheuttamien epätasapainokustannusten erottamiseen "luonnollisista" sääntelemättömillä vuokramarkkinoilla vallitsevista epätasapainokustannuksista. Tulosten mukaan vuokrasääntelystä koituvista kulutuksen epätasapainoista aiheutuvat hyvinvointitappiot olivat yli 2 prosenttia vuokralaisten kokonaiskulutuksesta ja veivät n. 30 prosenttia alhaisen vuokran hyödyistä. Vuokrasääntelyn nettohyöty vuokralaisille oli vertailuvuodesta riippuen 4,5 tai 6,5 prosenttia. Vuokralaisten saaman nettohyödyn suhde vuokranantajille koituneisiin kustannuksiin oli 64 tai 72 prosenttia.

Asiasanat: Vuokrasääntely, kuluttajan ylijäämä, epätasapainokustannus

Summary

Private rental markets in Finland were subject to rent control from 1967 until the beginning of the 1990s when the rent control system was gradually abolished. New tenancies were first decontrolled in 1992, and in 1995 existing tenancies were then also decontrolled. The effects of this reform have remained largely unstudied, and even descriptive studies are rare. This study fills some of the gap by examining the effects of the former rent control system on consumer welfare. We estimate the costs and benefits of rent control to tenants in private rental dwellings in the 1990 using the post-decontrol years 1998 and 2001 as two alternative benchmarks.

The focus of this study is on the costs and benefits of rent control to consumers who occupied a rent-controlled dwelling in 1990. Since the interest lies in the consumer's surplus of those who had managed to obtain a rental dwelling, the welfare cost of reduced supply, which is generally thought to be the main component of the dead weight losses of rent control, is beyond the scope of the paper. Special emphasis is placed on the welfare costs of disequilibrium in rental housing consumption. A model is constructed in which a household occupying a rent-controlled dwelling benefits from rent control in the form of low rent but may also suffer a welfare loss (disequilibrium cost), because the adjustment of housing consumption to changes in income, household size and other factors is more difficult under rent control than in the absence of rent control. As a result, for a typical household, the discrepancy between actual and desired housing consumption is larger under rent control than in the absence of rent control.

Earlier empirical studies on the welfare effects of rent control routinely assume that uncontrolled rental markets are perfectly competitive, i.e. a household always consumes on its demand curve in the absence of rent control. However, as Malpezzi and Turner (2003) note, because moving and transaction costs also exist in uncontrolled markets, the question is not whether disequilibrium costs exist under rent control but rather whether they are greater than in the absence of rent control. Here it is shown that the assumption of no disequilibrium in uncontrolled markets causes the net benefit of rent control to tenants to be underestimated, and welfare measures are derived that also allow for disequilibrium in consumption in the free market case. The empirical implementation of the welfare measures utilizes micro-simulation to estimate disequilibrium costs in the free market case for households in rent-controlled units, and to divide the disequilibrium costs under rent control into "natural" free market disequilibrium costs and additional disequilibrium costs due to rent control.

Finnish household level data from 1990, 1995, 1998 and 2001 are used in the empirical part of the study. The estimation of the price and quantity of housing

and households' housing demand parameters utilizes the 2001 data, because no uncontrolled rental sector existed in Finland in 1990. The net benefits of rent control and its components are calculated for households in the 1990 data, assuming that housing demand parameters obtained with 2001 data represent the behavioural parameters of tenants in 1990 and that rents in the absence of rent control would have been on the 2001 level in real terms. The year 1998 is used as an alternative benchmark to evaluate the robustness of the method.

According to the results, the additional disequilibrium costs offset roughly 30 per cent of the benefits of lower rents to tenants and amounted to over 2 per cent of the consumption expenditure of tenant households. The estimated net benefit of rent control to tenants, taking both low rents and disequilibrium costs into account, was 4.5 or 6.5 per cent of consumption expenditure, depending on the reference year. For over 10 per cent of tenants, the costs of rent control exceeded the benefits of lower rents. The ratio of the net benefit to tenants to the costs of lower rents to landlords was 64 or 72 per cent, depending on the reference year. The results also highlight the importance of relaxing the assumption of a perfectly competitive uncontrolled rental market. In this study, ruling out disequilibrium in consumption in the absence of rent control would have caused the net benefit to be underestimated by 30 or 60 per cent, depending on the reference year.

Contents

1. Introduction

The breadth of government intervention in the Finnish housing market was reduced significantly during the first half of the 1990s as private rental markets were liberalized by gradually abolishing the rent control system.[1] The effects of this reform have remained largely unstudied, and even descriptive studies are rare. This study fills some of the gap by examining the effects of the former rent control system on consumer welfare.

The focus of this study is on the costs and benefits of rent control to consumers who occupied a rent-controlled dwelling in 1990. Special emphasis is placed on the welfare costs of disequilibrium in rental housing consumption. Since the interest lies in the consumer's surplus of those who had managed to obtain a rental dwelling, the welfare cost of reduced supply, which is generally thought to be the main component of the dead weight losses of rent control, is beyond the scope of the paper. A household occupying a rent controlled dwelling benefits from rent control in the form of low rent, but may also suffer a welfare loss (disequilibrium cost) because the adjustment of housing consumption to changes in income, household size and other factors is more difficult under rent control than in its absence. This study introduces a new method to estimate the welfare costs of disequilibrium in housing consumption attributable to rent control.

Empirical studies on the welfare effects of rent control routinely assume that uncontrolled rental markets are perfectly competitive, i.e. a household always consumes on its demand curve in the absence of rent control. However, as Malpezzi and Turner (2003) note, because moving and transaction costs also exist in uncontrolled markets, the question is not whether disequilibrium costs exist under rent control but rather whether they are greater than in the absence of rent control. Here it is shown that the assumption of no disequilibrium in uncontrolled markets causes the net benefit of rent control to tenants to be underestimated, and welfare measures are derived that also allow for disequilibrium in consumption in the free market case. The empirical implementation of the welfare measures utilizes micro-simulation to estimate disequilibrium costs in the free market case for households in rent controlled markets, and to divide the disequilibrium costs under rent control into "natural" free market disequilibrium costs and additional disequilibrium costs due to rent control.

Finnish household level data from 1990, 1995, 1998 and 2001 are used in the empirical part of the study. The estimation of the price and quantity of housing

[1] Rent control, in the form of cost-based rents, still exists in public rental housing built with the support of government-subsidised loans (ARAVA), which are mainly granted to municipalities and non-profit organisations. Public rental housing is allocated on social criteria and there are strict rules regarding spaciousness etc.

and households' housing demand parameters utilizes the 2001 data, because no uncontrolled rental sector existed in Finland in 1990. The net benefit of rent control and its components are calculated for households in the 1990 data assuming that housing demand parameters obtained with 2001 data represent the behavioural parameters of tenants in 1990 and that in the absence of rent control rents would have been on 2001 level in real terms. The year 1998 is used as an alternative benchmark to evaluate the robustness of the method.

There are various possible reasons for wider discrepancies between actual and utility maximising housing consumption under rent control than without it. From a search theoretical point of view, it can be argued that, because of the excess demand situation in the controlled market, a household searching for a rent controlled dwelling receives fewer offers per time unit than in the absence of rent control. Since finding a suitable unit takes more time, the household tolerates wider discrepancies between actual and desired housing consumption before starting the costly search for a new unit and accepts worse matches when searching. Loikkanen (1982) derives these results from an explicit search-theoretical model. Also other studies use similar search theoretic arguments for the existence of disequilibrium in housing consumption under rent control (e.g. Malpezzi, 1998; Glaeser and Luttmer, 2003; Malpezzi and Turner, 2003). Glaeser and Luttmer (2003) refer to the same phenomenon as misallocation of housing under rent control. They argue that if rent controls are binding, there are more consumers willing to rent at the prevailing rent level than there are dwellings available, and the price mechanism is substituted by alternative allocation mechanisms, such as queuing or a lottery. If the alternative mechanisms taking the place of prices fail to allocate dwellings to those with highest valuations, there are additional welfare losses because households and dwellings are not as well matched as they could be.

Early studies of costs and benefits of rent control to tenants use Marshallian welfare measures to estimate the effect of rent control on consumers' surplus. One of the first empirical studies on welfare effects of rent control is Olsen (1972) who derives and applies a Marshallian measure of rent control benefit to tenants. The welfare measure is based on a model which allows disequilibrium costs under rent control but assumes that the uncontrolled rental sector is perfectly competitive. Olsen's model has been used later by Malpezzi (1993), for instance. More recent studies have preferred Hicksian welfare measures that allow for income effects of price changes. Ault and Saba (1990) derive Hicksian measures of rent control benefit to tenants assuming that the uncontrolled market is competitive. Early (2000) uses a similar model as Ault and Saba (1990) but relaxes the assumption that rents in the uncontrolled sector are unaffected by rent control. The assumption of no disequilibrium in the absence of rent control is still maintained. Malpezzi (1998) has a focus on the effect of side payments on tenants' welfare under rent control, but he also reports estimates of Hicksian welfare costs of rationing the household to consume a fixed amount of housing.[2] Glaeser and Luttmer (2003) estimate the degree of misallocation in the New York City rental markets without assuming perfectly competitive uncontrolled markets, but they do not calculate the welfare costs of this misallocation. This study is, to our knowledge, the first empirical analysis of costs and benefits of rent control relaxing the assumption that tenants are always in equilibrium in the uncontrolled market.

Malpezzi and Turner (2003) provide a more extensive survey of empirical studies of costs and benefits of rent control. Although the assumption of perfectly competitive uncontrolled housing markets is dropped in this study, the theoretical framework follows closely the traditional line of welfare analyses of rent control. Several complicating elements, such as the possibility that landlords have market power, are neglected in this study. Arnott (1995) summarizes critic on traditional analysis of rent control and surveys modern theories of rent control that take into account various market imperfections and model many aspects of "second generation" rent control systems.

The rest of this study is organized as follows. Chapter 2 provides a brief history of rent control in Finland and describes developments in rent level and tenure structure in Finland. Chapter 3 presents the theoretical framework of the study and derives welfare measures used in the empirical part. Chapter 4 presents the empirical procedure of the study. Chapter 5 reports the estimates of the net benefit of rent control to tenants and its components and evaluates the robustness of the results. Chapter 6 concludes.

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[2] Malpezzi (1998) applies Schwab's (1985) model which was developed to analyse welfare effects of government programs that offer certain goods at below market prices but also ration the amount consumed of that good. Here it is argued that the methodology lends itself poorly to the analysis of rent control because it yields positive rationing costs even if the household is in equilibrium under rent control.

2. A brief history and descriptive analysis of rent control in Finland

A brief history of Finnish tenancy law

The following description of the rent control system draws on Ralli (2005) and Bengs & Loikkanen (1991).

The first Finnish Tenancy Act was passed in 1925, eight years after Finland gained independence. The Act did not impose controls on rents but obliged the landlord to keep the dwelling in a certain condition. During the Second World War, rent control was introduced and retained until 1961, when a new Tenancy Act, which abandoned the wartime rent controls, was passed. However, only seven years later, in 1968, rent control was reintroduced as rents in buildings built before the end of 1968 were frozen as a part of a stabilization policy package related to the devaluation of the Finnish markka in 1967. Landlords reacted to the newly imposed rent control by increasingly giving notice and converting rental dwellings to owner-occupied dwellings. To prevent evictions, interim regulation protecting tenants against notice were introduced in 1969. The protection was transferred to an Act in 1970. A two-thirds majority in the Parliament was required because the law was thought to prevent landlords' constitutional freedom of use of their property. Earlier in 1957, a government committee had already proposed an act with Swedish-type protection of tenants against notice, but the proposition was rejected.

The period of tenancy rent control ended in 1974 when a new rent control system was introduced. The old system allowed rents to be set freely when a dwelling was rented for the first time, but no rent rises were allowed thereafter. Under the new system, the government annually made decisions on the maximum acceptable rents and rent rises for different types of dwellings. These controls applied to all private rental dwellings and were based on proposals of a board with tenant and landlord representatives. The acceptable rents and rent rises depended on the age of the house, the size of the dwelling, house type, and city size. The ten biggest cities had special housing courts that handled disputes on rents. The original plan was that rent increases would reflect changes in running and maintenance costs, but in practice the average rent level fell in real terms in many years (see Graph 1). In 1987, after twelve years of preparation, the rent control system was slightly modified to allow a reasonable profit to landlords, and real rents started to rise.

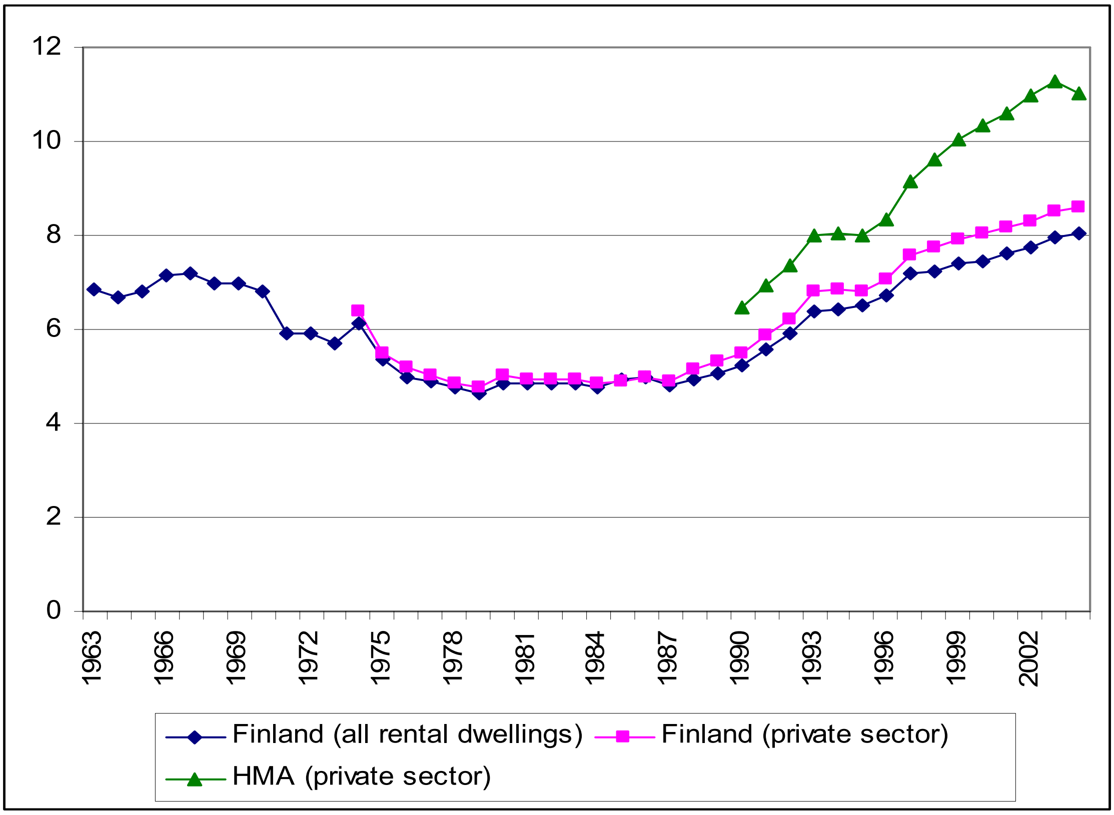
In 1991, the abolition of rent control was included in the programme of the first conservative government in twenty-five years. The motivation was to bring more rental apartments onto the market and to enhance the adjustment of the labour market to the big depression of the early 1990s. The share of private sector rental dwellings in the housing stock had declined from 33 per cent in 1970 to 12 per cent in 1990 (see Table 1).

The deregulation of private rental markets occurred in two phases. In the first phase of the reform at the end of 1992, new tenancies were deregulated, and in the second phase in 1995, existing tenancies were also deregulated and landlords were allowed to set rents freely. Together with the abolition of rent control, eviction laws were also relaxed, and the current Finnish tenancy law is among the most liberal in Europe. Before the reform, landlords were allowed to give notice only on very good grounds, e.g. unpaid rent or disturbance to neighbours, and the eviction still took a lot of time. Nowadays, giving notice is relatively easy. For example, sale of the dwelling or the tenant's reluctance to pay higher rent are valid reasons. Notice has to be given six months before the termination date if the tenancy has lasted over one year and three months before the termination date otherwise. Tenants have to give notice one month prior to the termination date. Fixed-term contracts are more difficult to terminate. Although landlords are allowed to unilaterally increase rents, tenancy agreements typically tie rent rises to the cost of living index.

What happened when rent control was abolished?

Graph 1 shows the development of the average real rent per square metre in all rental dwellings (including social housing) from 1963 to 2004, and the average real rent in the private rental sector during the period 1974–2004 for the whole country and from 1990–2004 for the Helsinki Metropolitan Area (HMA). The average rent declined in real terms from the introduction of rent control in 1968 to 1979, apart from 1974, when the system was modified. After 1979, the average real rent remained quite stable until 1987, when the rent control system was modified to allow slightly higher rent increases. From 1988 onwards, the rent level has risen and the average real rent per square metre in private rental dwellings was 57 per cent (71 per cent in HMA) higher in 2004 than in 1990. It seems that the average rent reacted with a one- or two-year lag to the two phases of deregulation in 1992 and 1995. The sluggish reaction of the rent level to the reform can be explained by the severe depression at the beginning of the 1990s. The depression probably dampened the immediate reactions of landlords because demand was weak, and because the depression resulted in a situation where large amounts of unsold owner-occupied dwellings were rented. The deregulation of financial markets in the mid-1980s had led to a housing boom which was followed by a bust in the early 1990s, leaving many households and investors with unsold dwellings. Graph 1 shows that real rents started to rise more quickly as demand recovered towards the end of the decade. A report by Statistics Finland shows that in 1992, when new tenancies were freed from rent control, the difference in average rent per square metre in new tenancies and in the whole stock widened to 25–35 per cent, depending on the size of the dwelling. Before the reform, the respective difference was 10–20 per cent. These developments lend support to the idea that rent control was indeed binding in a substantial part of the housing stock, at least at the beginning of the 1990s.

Graph 1. Average rent per square metre from 1963–2004 (in 2003 €, not controlled for dwelling characteristics).



Source: Statistics Finland

Table 1 shows the number of private rental dwellings and their share of the whole dwelling stock in 1970, 1990, 1995, 2000, and 2003. The number of private rental dwellings decreased from 1970 to 1990, when rent control was in effect, by almost 50 percent. On the contrary, from 1990 to 1995 the number of private rental dwellings increased by almost 50 per cent and has remained at a higher level thereafter. Part of the rapid increase in the number of private rental dwellings after 1990 may be explained by definition changes in the housing stock statistics collected by Statistics Finland. Nevertheless, the figures reported in Table 1 provide strong evidence that the controls were binding and resulted in a considerable under-supply of private rental housing.

Table 1. Private rental dwelling stock.

	1970	1990	1995	2000	2003
Private rental dwellings	478500	271465	401275	391189	449521
Share of the whole stock %	32.5	12.3	17.0	16.2	17.3

Source: Statistics Finland

It has to be kept in mind that in addition to the deregulation of rental markets, there are many other factors contributing to the changes in the tenure type distribution. The 1990s was a turbulent period in the Finnish economy, and alongside with the abolition of rent control various other reforms and institutional changes affecting the housing market also took place. These changes include introducing the dual income tax system in 1993, EU membership in 1995, and EMU membership in 1999. Lower interest rates and better availability of mortgage loans with a long maturity at the end of the 1990s and early 2000 made owner-occupied housing available for more households. Together with the abolition of rent control, eviction laws were also loosened, which made the conversion of rental units to owner-occupied units easier and made private rental housing less attractive for long-term tenants by reducing tenant security.[3]

[3] In Finland, the bulk of private rental dwellings are rented condominiums owned by individual investors, largely households, who are not as reliable landlords as institutional investors. The risk of being evicted by an individual investor is high, because they often have shorter planned holding periods than institutional investors.

3. Constructing welfare measures

As a starting point for the derivation of formulas for the costs and benefits of rent control to a tenant, dwellings are defined as heterogeneous goods producing housing services, the amount of which depends on the characteristics of the dwelling. This definition allows the use of hedonic techniques to estimate the one-dimensional quantity of housing services provided by each dwelling and the price per unit of housing services paid by the tenant residing in that dwelling. Alas, due to the lack of data on the quality and exact location of the dwellings, as well as neighbourhood characteristics, we are forced to define housing services quite narrowly to consist only of the physical characteristics of the dwelling. Hence, the price of housing services varies both across and within cities. The estimation of the price and quantity of housing will be discussed more thoroughly in Chapter 4.

Figure 1 illustrates the theoretical framework of this study. The figure depicts a household that has income Y and consumes two goods, housing service (volume H, price P) and non-housing goods (volume X, price normalized to 1). In the absence of rent control, the household faces the budget line with slope $-P_m$ and under rent control the budget line with slope $-P_c$.[4] It is assumed that in both cases the price of housing is fixed for the particular household. Thus, the variation in housing price within markets is ignored in the theoretical model. Disequilibrium in housing consumption is defined as the difference between equilibrium consumption, at the tangency point of the budget line and the indifference curve, and actual housing consumption.

If the household could perfectly optimize both under rent control and in the absence of rent control, the benefit of rent control to the household would be the difference of utility levels U_1 and U_4

(1) $$NB^* = U_4 - U_1,$$

which could be measured in terms of Hicks compensating or equivalent variation of the price change from P_m to P_c or as the change in Marshallian consumer's surplus when the household moves along the demand for housing curve from P_m to P_c.

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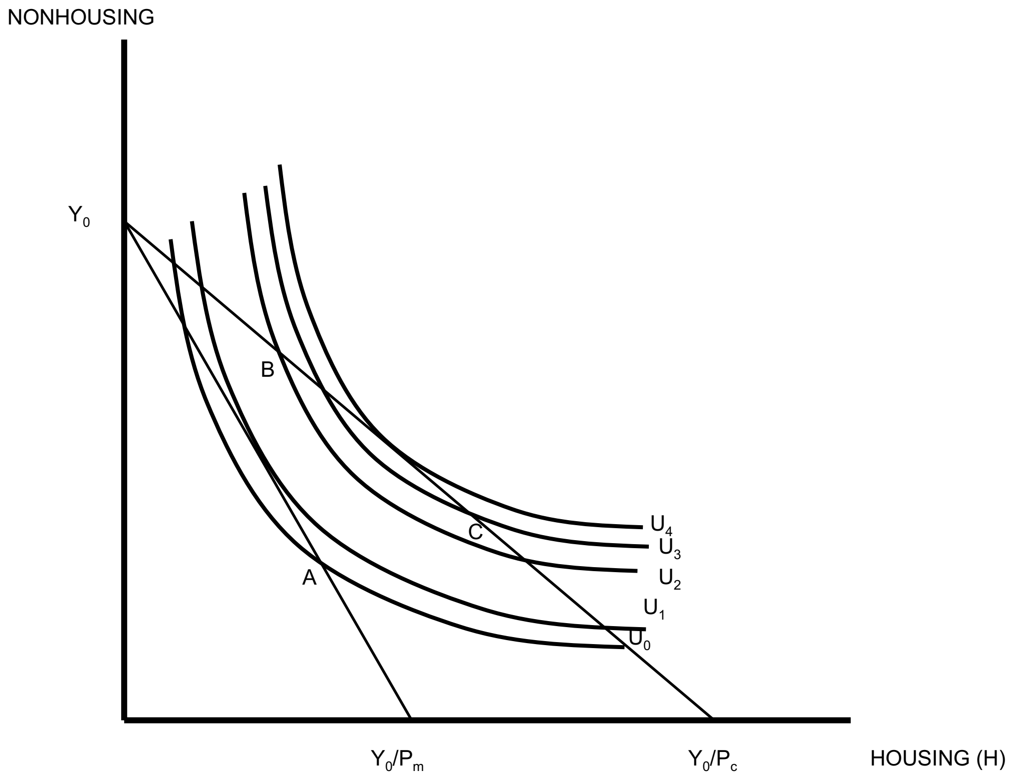
[4] Frankena (1975) notes that rent control does not necessarily lead to lower price per unit of housing service because the landlord can downgrade the amount of housing services produced by the dwelling by neglecting maintenance. However, the development of rent level and tenure structure presented in Chapter 2 give strong evidence that rent control was binding in Finland in 1990.

Figure 1.



However, a key feature of the housing market is that searching for a new dwelling and moving is costly (in terms of money and time), and thus, the household may consume significantly out of equilibrium. The magnitude of the discrepancy between actual and desired housing consumption that the household tolerates before moving is positively dependent on the search and moving costs. The excess demand situation caused by binding rent control leads to higher expected search costs because the arrival rate of offers is lower than in the absence of rent control. Therefore, the disequilibrium costs should on average be higher under rent control than in the absence of rent control. (Loikkanen, 1982.) Since moving and search costs also exist in uncontrolled markets, our measure of the net benefit of rent control to a tenant also allows for disequilibrium in consumption in the absence of rent control.

The household depicted in the figure consumes under rent control at point *B*, where its housing consumption is lower than the optimal consumption at price P_c. Under-consumption of housing is typical of rent controlled markets, but over-consumption is also possible. In the absence of rent control, the household consumes at point *A* where, in this case, housing consumption is higher than the utility maximising housing consumption. The net benefit of rent control to the particular household, taking into account disequilibrium in consumption, is given as

(2) $$NB = U_2 - U_0,$$

which may be higher or lower than NB^* depending on whether the utility loss due to disequilibrium in consumption is higher or lower under rent control than in the absence of rent control. The disequilibrium cost under rent control is the utility loss of consuming bundle B instead of the optimal bundle at the tangency point of U_4 and the upper budget line

(3) $$DECOST_c = U_4 - U_2.$$

Respectively, the disequilibrium cost in the absence of rent control is given as

(4) $$DECOST_m = U_1 - U_0.$$

From the figure and equations (1) – (4), it is easily seen that the net benefit of rent control can be decomposed as

(5) $$NB = NB^* + DECOST_m - DECOST_c.$$

Existing studies on the welfare effects of rent control omit the second component by assuming perfectly competitive uncontrolled markets, and thus underestimate the net benefit (e.g. Olsen 1972; Ault et al. 1990; Malpezzi 1998 and 1993; Early 2000). Note that the net benefit is negative if $DECOST_c$ exceeds the first two components. In his study on the New York City rental markets, Early (2000) constrained the net benefit of rent control to be positive because otherwise the tenant would move to an uncontrolled unit. This study also allows negative net benefits because no uncontrolled rental sector coexisted in Finland in 1990 and access to other housing sectors was also limited. Public rental housing was allocated on social criteria, and in the owner-occupied housing sector households faced extensive savings requirements to obtain personal non-assignable housing loans.

Comparing $DECOST_m$ and $DECOST_c$ calculated from different samples may give unreliable estimates of the additional disequilibrium costs due to rent control because disequilibrium costs and unobservable search and moving costs may depend on the housing price and household characteristics. If the two samples differ in these respects, the comparison may not be valid. Therefore, $DECOST_c$ is decomposed further into two components: 1) the "natural" disequilibrium cost ($NDECOST_c$) in the hypothetical case where the price of housing is P_c, but the household is able to optimize as well as in the absence of rent control, i.e. the conditional disequilibrium distribution is the same as in the absence of rent control; and 2) the additional disequilibrium cost ($ADECOST_c$) attributable to rent control.

(6) $$DECOST_c = NDECOST_c + ADECOST_c.$$

In the figure, point C represents the "natural" disequilibrium case. The point is drawn so that $ADECOST_c$ is positive. In the empirical analysis the estimated $ADECOST_c$ may be negative for some households, but positive values are more common. For the household in the figure

(7) $NDECOST_c = U_4 - U_3$ and

(8) $ADECOST_c = U_3 - U_2$.

Now, plugging (6) into (5) gives our final decomposition of tenant benefits

(9) $NB = NB^* + DECOST_m - (NDECOST_c + ADECOST_c)$.

Chapter 5 reports estimates of all the components of (9). The additional disequilibrium cost $ADECOST_c$ is particularly interesting because it gives an estimate of the welfare costs of rent control to tenants.

The empirical implementation of the model is not straightforward because the same household cannot be observed in the rent controlled and free markets at the same time. The empirical part of the study uses estimates of housing demand function and conditional residual distribution, obtained with post rent control data, to simulate the consumption of housing in the absence of rent control (point A in Figure 1), and in the case where the price of housing is P_c and the variation around the equilibrium housing consumption corresponds to free market variation (point C in Figure 1). The simulated housing consumption is the sum of the predicted housing demand from the estimated housing demand model and a random draw from the conditional residual distribution of the demand model (see Chapter 4).

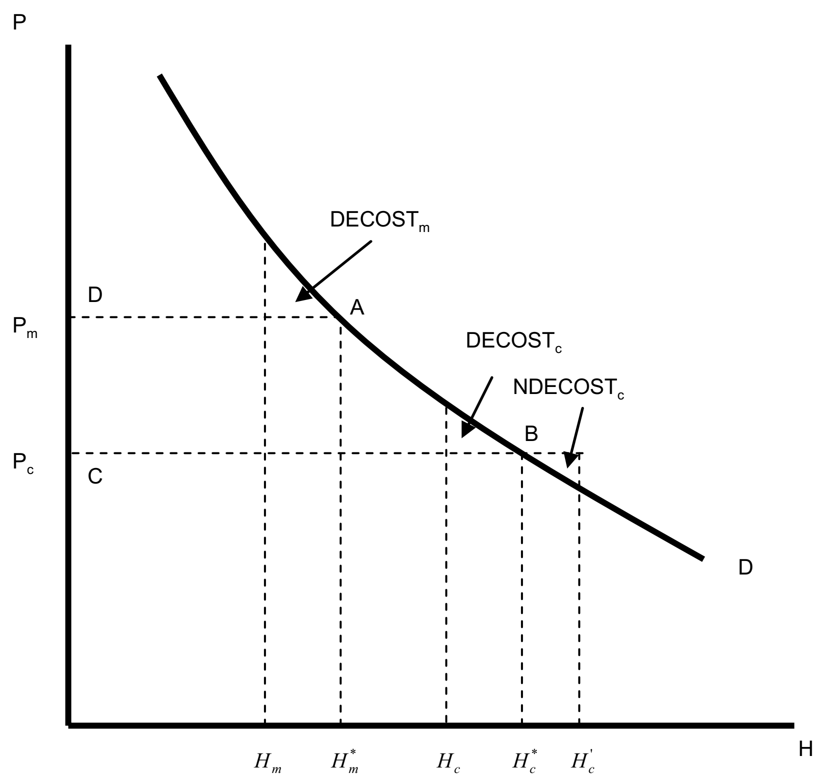
Next we derive both Marshallian and Hicksian measures for the four components of the net benefit of rent control to a tenant household. Only Marshallian estimates are reported in this study because of empirical difficulties in the implementation of Hicksian measures. The Hicksian approach aims at measuring the differences of the utility levels exactly but requires the specification of a direct utility function. The estimation of the parameters of the specified utility function often turns out to be troublesome. Because the residual distribution of the estimated demand for housing model implied by the Hicksian model was clearly non-normal, the simulation method outlined above could not be applied to generate unobserved consumption bundles C and A in Figure 1 for Hicksian measures. Marshallian consumers' surplus measures approximate the utility differences by areas constrained by the demand for housing curve, but they require less restrictive assumptions on the functional form of the demand function. Even though Hicksian welfare analysis is not applied in the empirical part, it is shown how the Hicksian welfare measures could be calculated assuming the Stone-Geary utility function.

Marshallian welfare measures

The Marshallian consumer's surplus measures are only approximations of the welfare effects of rent control because the income effect of the price change is neglected. Willig (1976) derives bounds on the percentage errors of approximating the Hicksian compensating and equivalent variations with the consumer's surplus and shows that in most applications the error will be very small. Furthermore, the approximation error positively depends on the local income elasticity. Our estimate of the income elasticity of rental housing demand is roughly 0.2, and thus the approximation error is likely to be very small in this study.

Figure 2 illustrates the calculation of Marshallian measures of the net benefit of rent control and its components to a tenant household. The model closely resembles Olsen's (1972) model with the exception that the assumption of perfectly competitive markets in the absence of rent control is relaxed. In the figure, *D* is the demand for housing service curve of the household. Under rent control, the household faces price P_c. With that price, the household would like to consume H^*_c units of housing, but it actually resides in a dwelling that produces H_c units of housing (cf. point *B* in Figure 1). H_c' represents the "natural" disequilibrium case where the household faces price P_c but is able to optimize as well as in the absence of rent control (cf. point *C* in Figure 1). In the absence of rent control, the household would face price P_m. With this price, it would like to consume H^*_m units of housing but actually consumes H_m units (cf. point *A* in Figure 1).

Figure 2.



The consumer's surplus (*CS*) extracted from an arbitrary amount of housing services *H* is the area under the demand curve and left of *H* minus housing expenditure *PH*.

(10) $$CS(P,H) = \int_{o}^{H} DdP - PH .$$

Thus, the first term in the net benefit equation (9) can be written as

(11) $$NB^{*} = CS(P_c, H_c^{*}) - CS(P_m, H_m^{*}) = (P_m H_m^{*} - P_c H_c^{*}) + \int_{H_m^{*}}^{H_c^{*}} DdP .$$

In the figure, NB^* is the area *ABCD*. The remaining components of *NB* are disequilibrium costs that can be calculated as the difference of *CS* from the optimal housing consumption and *CS* from the suboptimal housing consumption. For example, the disequilibrium cost under rent control is given as

(12) $$DECOST_c = CS(H_c^{*}, P_c) - CS(H_c, P_c) = P_c(H_c - H_c^{*}) - \int_{H_c}^{H_c^{*}} DdP .$$

In Figure 2, the household consumes under rent control less housing than it would like to consume at the controlled price, and $DECOST_c$ is the area bounded by the demand curve, P_c, and H_c. For this household, the first term on the RHS of the second equality is the amount of money saved in housing expenditure by consuming less than H^* and the second term is the utility loss of consuming less than H^*. In the over-consumption case, the first term is negative and the second term is positive. $DECOST_m$ and $NDECOST_c$ are calculated similarly to $DECOST_c$, and $ADECOST_c = DECOST_c - NDECOST_c$.

The Marshallian welfare measures derived above are operationalized by assuming that the individual demand for housing function takes the form

(13) $$\ln H = d_0{}'C + d_1 \ln(P) + d_2 \ln(Y) ,$$

where *P* is price of housing, *Y* is income, and *C* is a vector of indicators for household characteristics. The corresponding inverted demand function is

(14) $$P = AH^{1/d_1} ,$$

where $A = (1/(e^{d_0{}'C} Y^{d_2}))^{1/d_1}$. With this demand function, NB^* can be written in terms of prices, quantities and demand parameters as

(15) $$NB^{*} = (P_m H_m^{*} - P_c H_c^{*}) + A \tfrac{d_1}{d_1+1} (H_c^{*\frac{d_1+1}{d_1}} - H_m^{*\frac{d_1+1}{d_1}}) ,$$

and the disequilibrium cost components of (9) can be written as

$$\text{(16)} \qquad DECOST_c = P_c(H_c - H_c^*) - A\tfrac{d_1}{d_1+1}(H_c^{\frac{d_1+1}{d_1}} - H_c^{*\frac{d_1+1}{d_1}}),$$

$$DECOST_m = P_c(H_m - H_m^*) - A\tfrac{d_1}{d_1+1}(H_m^{\frac{d_1+1}{d_1}} - H_m^{*\frac{d_1+1}{d_1}}),$$

$$NDECOST_c = P_c(H_c^{'} - H_c^*) - A\tfrac{d_1}{d_1+1}(H_c^{'\frac{d_1+1}{d_1}} - H_c^{*\frac{d_1+1}{d_1}}), \text{ and}$$

$$ADECOST_c = DECOST_c - NDECOST_c.$$

Equations (15) and (16) are used to calculate the estimates of costs and benefits of rent control to private rental sector tenants in 1990. It is seen that the calculation requires information on the price of housing paid by the household in controlled and uncontrolled rental markets, demand parameters, and housing consumption in three cases; 1) actual housing consumption (H_c) under rent control, 2) housing consumption (H_c') at the controlled price in the case where variation around the desired consumption corresponds to the "natural" variation in the uncontrolled market, and 3) housing consumption (H_m) in the absence of rent control. The actual housing consumption (H_c) under rent control is observed for each household, but H_m and H_c' are unobserved and therefore have to be simulated. The next chapter discusses the estimation of the price and quantity of housing, reports estimates of the demand parameters, and presents the simulation method used to generate housing consumptions H_m and H_c'.

Hicksian welfare measures

Hicksian estimates of the benefit of rent control (NB^*) in the no-disequilibrium case could be calculated simply as the compensating or equivalent variation of the price change from P_m to P_c. The calculation would only require the estimation of an ordinary demand equation and the derivation of the implied indirect utility and expenditure functions (Hausman, 1981). However, the calculation of disequilibrium costs requires that a specific functional form is given to the direct utility function $U(H,X)$ because the minimum expenditure required to reach utility extracted from a sub-optimal consumption bundle cannot be directly calculated by inserting values of indirect utility and price in the expenditure function.

Hicksian measures of the net benefit of rent control and its components in equation (9) can be defined as differences in minimum expenditure required to reach the five utility levels $U_0,\ldots,U_4$ in Figure 1. Either the controlled price of housing P_c or the market price P_m can be used as the base. The former is used in what follows.

The minimum expenditure required to reach U_4 is simply the observed expenditure Y_0. The minimum expenditure related to any other utility level can be calculated by setting the indirect utility $V(Y,P_c)$ equal to U and solving for expenditure. For example, the welfare cost of consuming at point B instead of the optimal point at the tangency point of the indifference curve U_4 and the budget line can be found by first inserting the amount of housing consumption and non-housing consumption in the specified direct utility function to obtain the utility level U_2. Then, the minimum expenditure required to reach U_2 at price P_c is calculated by setting the indirect utility, with the price of housing fixed at P_c, equal to U_2

(17) $$V(Y,P_c) = U_2$$

and solving for expenditure Y. The disequilibrium cost is the difference $Y_0 - Y$. The minimum expenditure required to reach any utility level in Figure 1 can be calculated in this way.

An explicit functional form for the income changes is obtained assuming a specific utility function. A commonly used utility function is the Stone-Geary utility function

(18) $$U(H,X) = (H - \theta_h)^{\gamma} (X - \theta_x)^{1-\gamma},$$

where θ_h and θ_x are the displacement parameters, often interpreted as subsistence levels of consumption, and γ is the marginal propensity to consume housing. The Stone-Geary utility function has been used in housing related studies by Kim et al. (2004), Early (2000), Ault et al. (1990), and Loikkanen (1988), among others. The price of non-housing goods is again normalised to unity. Thus, the household maximizes utility subject to budget constraint

(19) $$Y = PH + X.$$

Solving the utility maximization problem yields the following demand for housing equation

(20) $$H^* = \gamma Y / P + (1-\gamma)\theta_h - \gamma\theta_x / P$$

and the following demand for other goods equation

(21) $$X^* = (1-\gamma)(Y - P\theta_h) + \gamma\theta_x.$$

Plugging the demand equations into the direct utility function (18) gives the indirect utility function

(22) $$V(Y,P) = [\gamma Y / P - \gamma\theta_h - \gamma\theta_x / P]^{\gamma}[(1-\gamma)(Y - P\theta_h - \theta_x)]^{1-\gamma} .$$

There is no closed form solution for the expenditure function, but the minimum expenditure required to reach any utility level can be obtained by solving for Y iteratively. The components of the net benefit of rent control could then be measured as differences in minimum expenditures related to different utility levels. However, Hicksian estimates of the costs and benefits of rent control are not reported here because the residual distribution was clearly skewed in all the specifications of (20) and its transformations that we tried to estimate. The simulation procedure described in the next chapter requires that the error distribution is approximately normal.

4. Empirical implementation

Data used

Data used in this study are drawn from the Household Expenditure Survey from 1990, 1995, 1998 and 2001, collected by Statistics Finland. The year 2001 is chosen as the benchmark representing the uncontrolled situation, and the estimates of the costs and benefits of rent control are calculated from the 1990 data. The 1998 data are used as an alternative benchmark to evaluate the robustness of the results. As a further robustness check, costs and benefits of rent control are calculated as if rent control was still in effect in 2001, 1998, and 1995. All the monetary variables are repriced to a common base of 2001 using the consumer price index.

Annual total sample sizes vary around 9 000 households. The size of sub-samples containing only tenants in private rental dwellings is annually about 500–700, but it reduces to 400–600 as we drop households living in rural municipalities and some outliers with unrealistic values for relevant variables. Households living in rural municipalities are dropped because there are no well-functioning rental markets in most of the rural municipalities, which would make the measurement of the price and quantity variables highly unreliable. The share of private sector tenants in the sample is lower than in the population, since the sampling design is such that higher income households, who are also more often owner occupiers, are over-sampled. Sampling weights are not used in the demand for housing regressions or in the hedonic regressions, but results reported in Chapter 5 are made representative of the population by using sampling weights.

Price and quantity of housing

The first step of the empirical implementation of the welfare measures is to estimate the price (P) and quantity (H) of housing services. Studies of costs and benefits of rent control typically use a coexisting uncontrolled rental sector as a benchmark when estimating market rents for rent controlled units. Since no identifiable uncontrolled rental sector coexisted in Finland in 1990, the year 2001 is used as a benchmark, i.e. we assume that in the absence of rent control, rents would have been on the 2001 level in real terms in 1990. The year 2001 is preferred to 1998, the other post deregulation dataset available, because it can be argued that the adjustment to the new deregulated situation was not yet complete in 1998. The final phase of the abolition of rent control took place only three years earlier in 1995. However, results are also reported that use the year 1998 as the benchmark. Note from equation (16) that the formulas for $DECOST_c$, $ADECOST_c$ and $NDECOST_c$ do not include the free market price of housing. Thus, the estimation of disequilibrium costs caused by rent control does not hinge on assumptions on the market price in 1990. Furthermore, the use of a coexisting uncontrolled housing sector as a benchmark is also problematic because rent control may affect the price of housing in the uncontrolled sector (Early, 2000).

A common approach to estimate the price and quantity of housing is to use the hedonic technique. This study also uses hedonic regression. Because the data used in this study lack information on local amenities, neighbourhood characteristics, location attributes and the quality of the dwelling, housing services are defined quite narrowly to only consist of the physical characteristics of the dwelling.[5] This definition implies that the variation in rents not attributable to variation in physical characteristics is interpreted to be due to price differences. As a result, the price of housing services also varies within housing market areas, not only between markets, as with the more common wider definition of housing services.[6]

In order to calculate the price and quantity of housing consumed by tenants in the private rental housing sector in the four datasets, we use a sample of private rental sector tenants in 2001 and estimate the hedonic price model

$$(23) \qquad \ln R = a'Z + \upsilon\,,$$

where R is the annual gross rent paid by the household and Z is the physical characteristics of their dwelling, such as floor area, the number of rooms, the age of the house, and house type. The results of the model are reported in Table 3. The predicted rent from this model is then used as a measure of the quantity of housing services for each household

$$(24) \qquad \hat{H} = \exp(\hat{a}'Z)\,.$$

Thus, the amount of housing services produced by each dwelling is defined as the estimated nationwide conditional expectation of rent for a similar dwelling in 2001. Equation (24) is used to estimate the amount of housing services consumed by each household in private rental dwellings not just in 2001 but also in 1990, 1995, and 1998.

Because $R = P*H$, the price per unit of housing services can now be calculated for each household by dividing the actual rent paid by that household by the imputed amount of housing services

$$(25) \qquad \hat{P} = \frac{R}{\hat{H}} = \frac{\exp(\hat{a}'Z + v)}{\exp(\hat{a}'Z)} = \exp(v)\,.$$

[5] This definition of housing services is consistent with Olsen (1987, p. 998.).

[6] Zabel (2004) provides a thorough discussion on the definitions and measurement of price and quantity of housing.

The quantity definition effectively normalizes the price of housing services in a dwelling with rent predicted by model (23) to unity, and the price definition exploits residuals from (23) to deduce whether the rent in a dwelling is high or low relative to the nationwide average rent for a similar dwelling.

Having estimated the actual housing consumption and price of housing services, the next step is to calculate the hypothetical price of housing in the absence of rent control, P_m, for each household in the 1990 sample. To obtain rough but reasonable estimates of P_m in 1990, we estimate a second hedonic model on 2001 data

$$\ln R = \lambda' Z + \eta' G + \omega . \tag{26}$$

This hedonic model differs from (23) in that the covariates now include a group of geographical indicators G. The prediction of this model for a household in 1990 data gives an estimate of the actual rent paid by the household for the dwelling they occupy, if the price of housing in that area is on the 2001 level. The market price (P_m) of each unit is then calculated by dividing the predicted rent from model (26) by the quantity of housing services estimate from model (23). Table 3 shows results of both hedonic models. The models seem to explain variation in rents quite well. The R-squared is 0.49 in model (23) and 0.58 in model (26).

Table 3. Results of hedonic regressions, dep. var. ln(rent), 2001 data.

	Quantity model (23)		*Market price model (26)*	
	Coef	P>t	Coef	P>t
Floor area (m2)	0.026	0.000	0.026	0.000
Floor area sqr. /100	-0.011	0.000	-0.010	0.000
Number of rooms	-0.184	0.004	-0.173	0.003
Number of rooms sqr.	0.028	0.011	0.025	0.013
Age of the house	-0.011	0.000	-0.009	0.000
Age of the house sqr./100	0.015	0.000	0.011	0.000
House type (ref. Single family detached house)				
Two family detached house	-0.114	0.243	-0.091	0.316
Row house	0.175	0.026	0.185	0.010
Apartment block	0.268	0.000	0.211	0.001
Other	-0.123	0.372	-0.077	0.542
Area (ref. Helsinki metropolitan area)				
Area 2			-0.284	0.000
Area 3			-0.438	0.000
Area 4			-0.304	0.000
Area 5			-0.361	0.000
Area 6			-0.216	0.000
Area 7			-0.379	0.000
Constant	7.581	0.000	7.852	0.000
R-squared	0.490		0.584	
N	450		450	

Area2 = Urban municipalities, Southern Finland
Area3 = Densely populated municipalities, Southern Finland
Area4 = Urban municipalities, Central Finland
Area5 = Densely populated municipalities, Central Finland
Area6 = Urban municipalities, Northern Finland
Area7 = Densely populated municipalities, Northern Finland

Housing demand estimation

The next step of the empirical procedure is to estimate the parameters of the demand for housing function. Because the estimated demand model is also used in the simulation of H_m and H_c', we are interested not only in the demand parameters, but also in the residual distribution. Therefore, we include a multiplicative heteroskedasticity term in the model. The multiplicative heteroskedasticity model was introduced by Harvey (1976), and Weesie (1998) provides a *Stata* program for estimating the model by the maximum likelihood method. The model is written as

$$(27) \qquad \ln H = d_0'C + d_1 \ln P + d_2 \ln Y + \sigma\varepsilon$$

$$\sigma^2 = \exp(k_0 + k_1 \ln P),$$

and is estimated with 2001 data. In the demand equation, H denotes the amount of housing services consumed, P denotes the price of housing services, Y denotes the total consumption expenditure, and C is a vector of other household characteristics. Consumption expenditure was chosen as the income variable because it is generally thought to represent the relevant longer term income concept affecting housing consumption better than disposable income (Olsen, 1987). The error term is the product of a standard normal distributed random variable ε and a heteroskedasticity term σ. The square of the heteroskedasticity term is a function of the price of housing. Other covariates were also included in the variance equation, but they turned out to be insignificant.

The reason for using the 2001 data rather than 1990 data in the demand estimation is because if rent control distorts consumption patterns, those distortions might be reflected in the estimates of demand parameters obtained with the 1990 data. The 2001 data should give us consistent estimates of the underlying behavioural parameters, provided that the model is correctly specified. The underlying assumption is that the preferences of private sector tenants in 1990 are similar to those in 2001.

The results of ML estimation of model (27) are reported in Table 4. The estimated income elasticity of demand for housing is 17.4 per cent and the price elasticity is -18.6 per cent. The elasticities are rather low, but we use them because no better estimates for rental housing demand with Finnish data from the uncontrolled period are available. Household size has a positive effect on housing consumption. The effect of age is non-monotone. Female-headed households consume more housing than male-headed households. The results of the variance equation show that the percentage deviation from the predicted housing demand depends negatively on the price of housing. Consumption expenditure and household characteristics were insignificant in the variance equation and were omitted. The explanatory power of the model is high (R-squared 0.61). The residual distribution seemed to be approximately normal. Table A1 in the appendix reports descriptive statistics for the variables of the demand model in all four years of data (no sampling weights used).

Table 4. Results of the demand for housing model with multiplicative heteroskedasticity, 2001 data.

	Demand equation		Variance equation	
	Coef.	P>z	Coef.	P>z
ln(consumption expenditure)	0.174	0.000		
ln(price)	-0.186	0.000	-0.600	0.037
Household size (ref. 1 person)				
2 persons	0.177	0.000		
3 persons	0.232	0.000		
4 persons	0.363	0.000		
>4 persons	0.401	0.000		
Age of household head (ref. < 26 years)				
26-35 years	0.047	0.017		
36-45 years	0.061	0.017		
46-55 years	0.148	0.000		
56-65 years	0.125	0.000		
> 65 years	0.165	0.000		
Female hh head (ref. male)	0.058	0.000		
Constant	6.511	0.000	-3.695	0.000
VWLS R^2	0.612			
Log Likelihood	191.9			
N	445			

Table 5 reports descriptive statistics of the estimated disequilibrium in housing consumption in 1990–2001. The table suggests that there was significant under-consumption of housing under rent control in 1990. The mean deviation from the predicted housing consumption was -8 per cent in 1990. Already in 1995, when the final phase of deregulation took place, the mean disequilibrium turned out to be positive, but it was only 1.4 percent. In 1998 and 2001 the mean disequilibrium was practically zero.

Table 5. Disequilibrium in housing consumption.

	ln(actual housing consumption) – ln(predicted housing consumption)				
Year	Obs	Mean	Std. Dev.	Min	Max
1990	559	-0.081	0.229	-0.935	0.538
1995	585	0.014	0.191	-0.786	0.747
1998	439	0.002	0.192	-0.734	0.972
2001	449	0.001	0.159	-0.622	0.581

Simulation

The simulated housing consumption ($\hat{H}_m$) in the free market case for each tenant in the 1990 data is obtained by taking the predicted log of housing consumption with observed household characteristics and price of housing P_m, adding a random draw from the conditional residual distribution, and then exponentiating to obtain $\hat{H}_m$.

(28) $$\ln \hat{H}_m = +\hat{d}_0' C + \hat{d}_1 \ln P_m + \hat{d}_2 \ln Y + \hat{\sigma}\hat{\varepsilon}$$

$$\hat{\sigma}^2 = \exp(\hat{k}_0 + \hat{k}_1 \ln P_m)$$

The simulated residuals are obtained by drawing a $N(0,1)$ distributed random number which is then multiplied by the predicted heteroskedasticity term $\hat{\sigma}$. Respectively, the simulated housing consumption with the controlled price and free market residual variance ($\hat{H}_c'$) is the predicted housing consumption with the observed household characteristics and price P_c plus the simulated residual.

(29) $$\ln \hat{H}_c' = +\hat{d}_0' C + \hat{d}_1 \ln P_c + \hat{d}_2 \ln Y + \hat{\sigma}\hat{\varepsilon}$$

$$\hat{\sigma}^2 = \exp(\hat{k}_0 + \hat{k}_1 \ln P_c).$$

Recall from Chapter 3 that our model divides disequilibrium costs under rent control into "natural" and additional disequilibrium costs. The negative effect of the price of rental housing on residual variance implies that the "natural" disequilibrium in housing consumption should be on average higher under rent control in 1990 than in the absence of rent control in 2001. Thus, neglecting heteroskedasticity in the simulation of the natural disequilibrium would under-estimate the natural disequilibrium costs and over-estimate the additional disequilibrium costs caused by rent control.

Discussion on the empirical procedure

One potential source of error in the demand regression, and in the subsequent analysis, is that the model does not take into account the Finnish housing allowance system. Low income households and students may have up to 80 per cent of their rent compensated, causing the income variable to be endogenously determined for some households. Here it is argued that this is not a major problem, since there is a tight upper threshold for the compensable rent, which is binding for most recipients. After the ceiling is met, small changes in housing consumption do not affect income. Loikkanen (1988) provided evidence that the impact of housing allowance on housing consumption is small, which hints that treating housing allowance as pure income supplement may be a valid simplification. In this study, housing allowance is treated as any other income in the demand regression, and the possible impact of higher rents on housing allowance is ignored when calculating the costs and benefits of rent control.

It is important to note that together with the abolition of rent control, eviction laws were also relaxed (see Chapter 2). The changes in eviction laws may have affected the distribution of disequilibrium in housing consumption through its effect on moving. Hence, besides the phase out of rent control, the results of this study may also reflect changes in tenant security. It is not clear how increased forced moves should influence the perceived disequilibria in housing consumption. Theoretical evidence is mixed. Loikkanen (1982) shows that an increased probability of being evicted widens the equilibrium sets of housing consumption because the expected discounted disutility of current disequilibrium depends negatively on the probability of being evicted. By contrast, Nordvik (2001) finds that as the probability of being forced to move increases, the willingness to accept mismatch in housing consumption, in order to avoid moving costs, decreases. Edin and Englund (1991) provide empirical evidence that in Sweden the absolute values of the residuals of a housing demand model fall with duration in the present dwelling. This suggests that reduced tenant security is likely to increase the variance of residual distribution of the housing demand model. Thus, the change in the eviction law probably worked in the opposite direction to the abolition of rent control and may have caused the estimated additional disequilibrium costs ($ADECOST_c$) to be lower and the estimated net benefit (*NB*) to be higher than if the eviction law had remained unchanged.

5. Results

Before presenting the results on the costs and benefits of rent control, the effects of rent control on the consumption of housing services and non-housing goods in 1990 are briefly discussed. Table 7 reports the average price (*P*) and volume (*H*) of housing consumption, the average housing expenditure, as well as the average share of housing expenditure out of the total consumption expenditure in three cases. The first column is based on actual housing consumption in 1990. The second column represents the situation where the disequilibrium distribution around the desired housing consumptions (with the controlled price) corresponds to the free market case. The last column illustrates how things would have been in the absence of rent control if rents had been on the 2001 level in 1990. The first row shows that the average controlled price per unit of housing service was 35 per cent lower than the average market price. The observed average consumption of housing services was 5.2 per cent lower than the simulation model predicts. This suggests that rent control distorted consumption decisions and led to a situation where tenants were unable to increase their housing consumption and were forced to substitute housing for other goods. If each household had consumed the simulated amount of housing, they would have spent on average € 230 per annum more on housing and less on other goods. The last column suggests that, in the absence of rent control, tenants would have spent on average € 1550 more on housing and less on other goods, and the expenditure share of housing would have been 33 per cent instead of 21 per cent.

Table 7. Actual and simulated housing consumption in 1990, reference year 2001.

	Controlled market		Uncontrolled market
	Actual (mean)	Simulated (mean)	Simulated (mean)
Price of housing (P)	0.679	0.679	1.041
Housing services consumed (H)	4679.7	4938.3	4577.7
Rent (P*H)	3205.6	3435.2	4758.8
Non-housing consumption	15515.5	15285.9	13962.2
Rent/consumption expenditure %	20.9	22.4	33.1

Table 8 reports the main results of this study. The first six columns describe the location and shape of the distribution of the net benefit of rent control and its components (see Chapter 3, equations (15) and (16)). Percentiles do not sum up because they are calculated separately for each row. The two last columns of the table give the total value of each item and the ratio of the total to total consumption expenditure. The estimates of net benefit are subject to criticism because assuming that in the absence of rent control real rents would have been on the 2001 (or 1998) level in 1990 is somewhat arbitrary. However, the estimates of disequilibrium costs under rent control do not hinge on this assumption, because market price P_m does not appear in the formulas for these components of the net benefit (see eq. (16)).

Table 8. Net benefit of rent control to tenants and its components, year 1990, benchmark year 2001.

	Percentile (for each row separately)							
	p10 (€)	p25 (€)	p50 (€)	p75 (€)	p90 (€)	Mean (€)*	Total (€ million)*	% of consumption expenditure
Net Benefit (NB)	-281	744	1457	2340	3250	1227	237	6.6
Equilibrium benefit (NB*)	456	968	1627	2371	3134	1705	329	9.2
DECOSTm	8	40	155	432	931	336	66	1.8
DECOSTc	7	45	168	590	1570	814	157	4.4
ADECOST	-409	-103	45	420	1340	493	93	2.6
NDECOST	3	22	107	312	645	321	64	1.8

* Disequilibrium cost estimates exceeding consumption expenditure were replaced with consumption expenditure when calculating means and totals.

The first row of Table 8 shows that the median net benefit was € 1457 (mean € 1227) per year and the total net benefit amounted to over 6.5 per cent of tenants' consumption expenditure. However, the 10th percentile of NB is negative, indicating that a substantial share of tenants would have been better off in the absence of rent control. More exactly, 13 per cent of tenants had negative net benefits.

The second row of the table shows that if tenants had been able to optimize perfectly, the estimated net benefits would have been higher and always positive. The median net benefit (NB) allowing for disequilibrium costs was only € 170 lower than NB*, but measured in terms of means, the difference was almost € 500. The reason for this is that the distribution of disequilibrium costs under rent control ($DECOST_c$) has a much longer right tail than the distribution of simulated disequilibrium costs in the absence of rent control ($DECOST_m$). It seems that even though the medians are roughly equal, very high disequilibrium costs are more common under rent control than in uncontrolled markets. The two last rows show that the biggest part of $DECOST_c$ was attributable to additional disequilibrium costs due to rent control ($ADECOST_c$). The average $ADECOST_c$ was almost € 500 and the total amounted to 2.6 per cent of total consumption expenditure of tenants. These results are in line with the hypotheses presented in Chapter 3, according to which tenants accept greater discrepancies from utility maximizing housing consumptions under rent control than in the absence of rent control.

A methodologically important observation is that if disequilibrium costs in the absence of rent control were neglected, the total net benefit would have been under-estimated by 28 per cent. This result highlights the importance of relaxing the assumption of perfectly competitive rental markets in the absence of rent control and also allowing for imperfections in this case.

We also estimated the total cost of lower rents to landlords, $(P_m - P_c)*H$, to be € 328 million. The ratio of the total net benefit to tenants and total cost of subsidy (transfer efficiency) was 72 per cent.

Robustness check

The use of the year 2001 as a benchmark is somewhat arbitrary because we do not know how high rents would have been in the absence of rent control in 1990. Therefore, the whole estimation procedure was repeated using the year 1998 as the benchmark representing the uncontrolled rental markets. Estimated housing demand parameters were very close to those obtained with 2001 data (see Table A2 in the appendix). Table 9 reports the final results. The most important difference between the use of the year 1998 as benchmark as compared to 2001 is that in 1998 the estimated real rents were lower than in 2001, and thus the estimated net benefit was lower (mean € 858) than in Table 8 (mean € 1227). Also, the mean ($ADECOST_c$) was lower (€ 382) with 1998 as the benchmark, but total $ADECOST_c$ was still over 2 per cent of the consumption expenditure. The estimated total cost of lower rents to landlords was € 258 million and transfer efficiency was 64 per cent.

Table 9. Net benefit of rent control to tenants and its components, year 1990, benchmark year 1998.

	Percentile (for each row separately)							
	p10 (€)	p25 (€)	p50 (€)	p75 (€)	p90 (€)	Mean (€)*	Total (€ million)*	% of consumption expenditure
Net Benefit (NB)	-1177	395	1221	2113	3247	858	164	4.6
Equilibrium benefit (NB*)	62	642	1286	1938	2793	1328	254	7.1
DECOSTm	6	41	192	563	1268	488	93	2.6
DECOSTc	6	52	232	710	1824	958	183	5.1
ADECOST	-808	-263	11	446	1400	382	73	2.1
NDECOST	6	44	178	477	1206	576	110	3.1

* Disequilibrium cost estimates exceeding consumption expenditure were replaced with consumption expenditure when calculating means and totals.

Glaeser and Luttmer (2003) use bootstrapping methods to derive standard errors for their estimates of the amount of misallocation of housing. In this study, bootstrapping procedures are skipped, since the calculation of costs and benefits involves so many steps that bootstrapping would be very cumbersome. As the robustness check, the same method that was used to obtain the results reported in Table 7 was also applied to 1995, 1998, and 2001 data, as if rent control was still in effect in these years. Table 10 reports the total net benefit and its components as percentage of total consumption expenditure of tenants in these years.

Table 10. Robustness check, benchmark year 2001.

	% of consumption expenditure			
	1990	1995	1998	2001
Net Benefit (NB)	6.64	1.38	1.68	-0.74
Equilibrium benefit (NB*)	9.22	3.52	1.92	-0.46
DECOSTm	1.84	1.67	2.02	1.59
DECOSTc	4.40	3.80	2.28	1.86
ADECOST	2.59	1.89	0.84	0.12
NDECOST	1.80	1.91	1.44	1.74

The estimates of $ADECOST_c$ in 1998 and 2001 can be used to evaluate the possible error stemming from the simulation procedure and random variation in estimates of demand parameters. Theoretically, $ADECOST_c$ should be zero after the phasing out of rent control in 2001, and also in 1998, if the rental market had already adapted to the new uncontrolled situation. The estimated $ADECOST_c$ deviates from zero in 2001 because of randomness involved in the simulation procedure. In 1998 $ADECOST_c$ is different from zero, in addition to the simulation error, also because the housing demand model estimated with 2001 data does not fit as well the 1998 data. In 2001, the estimated $ADECOST_c$ was 0.12 per cent of the total consumption expenditure, which hints that the simulation error is not very large. The simulation error might also work in the opposite direction. In 1998 the estimated ADECOST was somewhat bigger (0.84 per cent) than in 2001, indicating that random variation in the demand parameters is potentially a bigger problem than simulation error. $ADECOST_c$ was probably also over-estimated in 1990, but even if the upward bias were as high as in 1998 the remaining ADECOST in 1990 would be almost 2 per cent of the consumption expenditure.

6. Conclusions

The results of this study demonstrate that empirical studies on costs and benefits of rent control that assume that households always consume on the estimated demand curve in the absence of rent control give a too negative view of rent control. This criticism also applies to studies that analyze the welfare effects of public rental housing programs that impose constraints on housing consumption. This study also allowed for disequilibrium in consumption in the absence of rent control. According to the results, assuming perfectly competitive rental markets in the absence of rent control would have caused the total net benefit of rent control to tenants in 1990 to be underestimated by almost 30 per cent when the year 2001 was used as the benchmark, and by almost 60 per cent when the year 1998 was used as the benchmark.

The main source of welfare costs of rent control is generally thought to be the lower supply of rental housing. Second generation rent control programmes often impose restrictions on conversions of rental dwellings to owner-occupied dwellings to prevent the negative supply effect. The results of this study indicate that, even if the main component of welfare losses is left outside the calculations, the welfare costs of rent controls may offset a significant part of the benefit of lower rents to tenants. The additional disequilibrium costs attributable to rent control offset roughly 30 per cent of the benefits of lower rents to tenants and amounted to over 2 per cent of the total consumption expenditure of tenants. The estimated net benefit was 4.5 or 6.5 per cent of consumption expenditure, depending on the reference year.

APPENDIX

Table A1. Descriptive statistics.

Year		Obs	Mean	Std. Dev.	Min	Max
1990	Housing services	559	4856.6	1281.2	1775.0	9436.0
	Consumption expenditure	559	20571.7	12189.0	2113.2	75037.5
	Price of housing	559	0.674	0.257	0.051	1.954
	Household size	559	1.987	1.082	1	6
	Age of household head	559	39.535	17.108	17	88
	Female household head (1/0)	559	0.470	0.500	0	1
1995						
	Housing services	585	4937.1	1233.8	1872.3	9876.4
	Consumption expenditure	585	18597.6	9253.0	5284.9	64169.5
	Price of housing	585	0.896	0.286	0.169	4.439
	Household size	585	2.039	1.114	1	8
	Age of household head	585	35.677	14.262	18	90
	Female household head (1/0)	585	0.446	0.498	0	1
1998						
	Housing services	439	4890.2	1314.0	1936.1	10965.8
	Consumption expenditure	439	20716.0	11456.3	4284.2	78207.8
	Price of housing	439	0.957	0.256	0.194	1.929
	Household size	439	2.002	1.107	1	7
	Age of household head	439	37.196	15.306	18	87
	Female household head (1/0)	439	0.426	0.495	0	1
2001						
	Housing services	449	4706.7	1169.8	1874.6	9612.1
	Consumption expenditure	449	20871.4	11373.5	3358.3	72415.2
	Price of housing	449	1.034	0.260	0.137	2.007
	Household size	449	1.855	1.050	1	8
	Age of household head	449	35.167	14.769	17	85
	Female household head (1/0)	449	0.506	0.501	0	1

Table A2. Results of the demand for housing model with multiplicative heteroskedasticity, 1998 data.

	Demand model		Variance model	
	Coef.	P>z	Coef.	P>z
ln(consumption expenditure)	0.203	0.000		
ln(price)	-0.192	0.000	-0.598	0.031
Household size (ref. 1 person)				
2 persons	0.159	0.000		
3 persons	0.309	0.000		
4 persons	0.424	0.000		
>4 persons	0.463	0.000		
Age of household head (ref. < 25 years)				
26-35 years	0.012	0.641		
36-45 years	0.024	0.458		
46-55 years	0.081	0.012		
56-65 years	0.099	0.040		
> 65 years	0.183	0.000		
Female hh head (ref. male)	0.044	0.027		
Constant	6.192	0.000	-3.241	0.000
VWLS R^2	0.561			
Log Likelihood	88.1			
N	428			

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