Viggo Nordvik og Per Medby
Boligkarrierer og flyttekostnader
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Forord


Fire av de fem papere er skrevet på engelsk. Dette er også en begrunnelse for at vi har valgt å starte rapporten med en relativ lang norskspråklig gjennomgang av resultatene. Samtidig med arbeidet i dette prosjektet har prosjektleder jobbet med en doktorgrad om markedet for leie av bolig. To av de paprene som inngår i denne rapporten ble også brukt i avhandlingen, mens en et tredje er en videre bearbeidet versjon av et av arbeidene i avhandlingen. I doktorgradsarbeidet var Professor Asbjørn Rodseth ved Økonomisk Institutt, Universitetet i Oslo veileder. Den foreliggende rapporten har forbedret ved hjelp av kommentarer fra og samtaler med han. Dette skal han ha stor takk for.


Rapporten er skrevet av Viggo Nordvik, med unntak for artikkelen ’Boligkarrierer, -etterspørsel, flytting og flyttekostnader’ som er skrevet av samfunnsøkonom Per Medby.

Thorbjørn Hansen
Avdelingssjef

Viggo Nordvik
Prosjektleder
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0. Introduksjon


Hovedinnretningen av prosjektet har vært å skrive frittstående papirre. Denne rapporten er kanskje mer en paper/artikkelasamling enn det er en helhetlig rapport. Formen hvor de fleste paprene er på engelsk mens ett paper og det innledende oversiktsskapittelet er på norsk illustrerer dette. En del forhold, spesielt knyttet til diskusjoner av den eksisterende litteraturen på feltet kan nok også komme igjen i flere av arbeidene.

Hensikten med denne introduksjonen/sammendraget er todelt. Den skal være en veiver av inn til de ulike artiklene i samlingen. I tillegg skal den være en ikke-teknisk presentasjon av hvordan flyttekostnader skaper tregheter i den dynamiske tilpasningen i boligmarkedet, og av hvilke mekanismer som skaper disse treghetene. Det igjen betyr at deler av innledningen kan fortone seg som nok en gjenfattelse av sentrale deler av litteraturen. Hovedveiken legges naturlig nok på bidragene fra vårt prosjekt. Lesere som er interessert i de formelle og tekniske resonnementene og også noe mer presise konklusjoner vises derfor til selve artiklene.

Det må nok innrommes at deler av de teoretiske analysene i rapporten er teknisk krevende og komplekse. Her i sammendraget har jeg etter beste evne forsøkt å gi intuitive beskrivelser av resultatene. Eventuelle lesere får selv vurdere i hvilken grad dette har lykkes. Forovrig må det sies at når analysene blir relativt komplekse har det sin naturlige årsak i at de fenomene som analyseres er komplekse og mange-faseterte.

0.1 Boligkarrierer som en rasjonelt utformet plan


Viktige forenklinger som Amundsen gjør er at han antar at boligkonsum kan måles entydig langs én dimensjon og at en lineær pris på boligkonsum er åpent kjent. Det er ingen forskjell mellom eide og leide boliger i modellen. Til sist kan en merke seg at det ikke er noen form for usikkerhet i verken prisen på boligetiene eller i inntektsstrømmen. Hushold møter heller
ingen skranker på kredittmarkedet og kan således velge tidsprofilen på sitt konsum gitt en budsjettsskranke over livslopet.

Forenklingene gjør blant annet at Amundsen kan behandle bolig som et rent konsumgode. Den viktigste innsikten fra analysene hans er at den vanlige 'first-best-regelen' for sammensetning av konsumet ikke gjelder når det er flyttekostnader. Innen en optimalt valgt boligkarriere kan den neddiskonterte grensenytytten av ressurser brukt til boligkonsum variere over tid. Dette påforer husholdene en 'mismatch-kostnad', nyttetapet ved å ta på seg en slik mismatchkostnad er imidlertid mindre enn kostnadene ved å endre boligkonsumet gjennomflytting. Videre viser han at antall flyttinger over livslopet er fallende i flyttekostnadenes størrelse og stigende i (permanent)intekt. Edin og Englund (1991) trekker fram den samme typen argumenter og viser at den samme typen strukturer gjenfinnes innen teoretiske analyser av optimalt lagerhold – i de såkalte sS-modellene.

Amundsen analyseres viser altså at hushold ikke umiddelbart vil endre sitt historisk gitte boligkonsum selv om de historisk gitte betingelsene endres. Perfekt informasjon (perfect foresight) innebærer at konsumenten kjenner treghetene i sin tilpasning allerede når hun flytter inn i en bolig. Hun velger derfor slik at den passer noenlunde bra gjennom den perioden hun bor i boligen. Noenlunde bra betyr mer presist at summen av neddiskontert mismatch i boligkonsumet over botiden skal være lik null. Med en stigende boligkarriere betyr dette at konsumenten 'overkonsumerer bolig' den første tiden etter flytting og underkonsumerer rett før flytting.

Den empiriske relevansen til disse resultatene ligger primært i at de viser at en bolig forvente sprangwise endringer i boligets tilpasningsrom når de etterspøringsbestemmende faktorene forandrer seg. F.eks vil endringer i rentene for mange hushold ikke virke direkte inn på boligkonsumet, men heller på likviditet og på annet konsum. En kan også si at de gir håndtak til å diskutere hensiktsmessigheten i politiske virkemiddel som påvirker flyttekostnadene. Dette gjelder først og fremst stempelavgiften. Indirekte kan det også sies å gjelde utformingen av gevinstbeskatningen.


Mitt arbeid Moving Costs and the Dynamics of Housing Demand er et grunnlag for hele dette prosjektet. Et første utkast av paperet ble skrevet før prosjektet startet opp – en kan også si at den første versionen var grunnlaget for min interesse for videre studier av boligkarrierer og flyttekostnader. Det tas med her dels fordi det er en basis for hele prosjektet og dels fordi det har blitt revidert og videreutviklet gjennom hele prosjektperioden. Arbeidet inneledes med at Amundsen resultater i kontinuerlig tid blir reproduseret i et resonnemement i diskret tid.

De deterministiske analyserne i den tidligere litteraturen utvides i paperet på to måter. Den kalibrerte simuleringsmodellen brukes til å vise hvordan planlagte boligkarrierer påvirkes når priser og preferanser endres uventet. En uventet endring i preferansene høres kanske litt merkelig ut. Tanken er at atferden i boligmarkedet bestemmes av husholdets preferanser. En uventet endring i sammensettingen av husholdet kan da generere en uventet endring i preferansene. Generelt kan en si at simuleringene viser at jo senere en endring (eller et sjokk) blir kjent for husholdet jo mindre tilbøyelig vil det være til å endre boligkonsumet. En konsekvens av dette er at hushold kan bli "innelast" av sine tidligere beslutninger og således få en realisert boligkarriere som er suboptimal. Hadde de kjent til endringene da de valgte boligkarriere ville de ha valgt annerledes, den mismatchen de får som følge av dette kan imidlertid være mindre enn ulempen knyttet til flyttingen – dvs flyttekostnaden.

Paperet stiller spørsmålet om hvordan en planlagt boligkarriere påvirkes om husholdet tilordner sannsynligheten for at karieren må avbrytes en positiv verdi. Dette modelleres som at husholdet står overfor en kjent stokastisk eksponerte prosess som kan generere utkastelse. Jo høyere utkastelsesrisikoen er jo mindre villig vil husholdet være til å akseptere en umiddelbar mismatch. De vil velge en bolig som passer bedre til det umiddelbare behovet, og vil legge mindre vekt på at boligen skal passe i framtida perioder. En følge av dette er at den planlagte flytteaktiviteten kan bli høyere som følge av stor risiko for ikke-planlagte flyttinger! Eksogen utkastelsesrisiko kan selvfølgelig tolkes som at en leietaker blir kastet ut, det kan også tolkes som at et hushold blir nødt til å flytte f.eks som følge av hendelser på arbeidsmarkedet.


Selv om analysene i mitt paper gir visse indikasjoner på hvordan usikkerhet påvirker optimalt valgte boligkarrierer har det ingen måte gitt noen generell analyse av dette spørsmålet. Ulike former for usikkerhet behandles partielt og analyserne av endringer i bakgrunnsvARIABLENE er en form for sjokkanalyser. En naturlig videreføring hadde vært å undersøke hvordan de optimale planene hadde blitt påvirket om sjokken ikke bare var noe som skjedde helt overraskende, men var mulige hendelser med en sannsynlighetsfordeling som var kjent da planene ble lagt. Dette gjøres i analysene av eksogen utkastelsesrisiko.
I *Cost Dispersion, Reentry Costs and Rental Housing Markets* settes fokuset på hvilken rolle muligheten til å velge mellom eide og leid bolig spiller for konsumentenes valg av boligkarriere. Dette gjøres innenfor rammen av en likevektsmodell hvor tilbudet av eide og leide boliger bestemmes av atferden til de tilbydende. I tråd med den analytiske strategien for hele prosjektet er den modellen som analyseres formulert så enkelt som mulig. Den er formulert for å få fram effekten på boligmarkedet av at konsumenter har et valg mellom eide og leie av bolig og at boliger kan flyttes mellom eide og leiesegmentene av boligmarkedet. Likevekten på boligkapitalmarkedet bestemmes altså av konkurransen mellom selveiere og uteiere.


Husholdenes valg av disposisjonsform antas å være bestemt av en kostnadsminimering. Papiret viser at det er en kvalitativ forskjell mellom å minimere kostnadene periode og å minimere kostnadene over livsløpet. Kostnadene ved å velge en eide bolig kan skrives som summen av forventede bokostnader (se Smith m.fl., 1988) over livsløpet minus verdien av å gå over til en leid bolig om det lønner seg. Kostnadene ved å velge en leid bolig blir på samme måte lik nåverdien av de forventede leiebetalingerne minus verdien av å kunne gå over til en eide bolig om dette senere viser seg å være lønnsmat.

Verdien av å endre disposisjonsform 'når det skulle lønne seg' kan betraktes som en realopsjon. Tidligere forskning om priser på boligkonsumet har ikke identifisert disse realopsjonene. Dette innebærer at mye empirisk arbeid om boligmarkedstatferd har tatt utgangspunkt i en feilspeisering av de sanne prisene på boligkonsumet. Årsaken til at en i dette papiret får identifisert disse opsjonsverdiene ligger i det eksplosivt dynamiske perspektivet i analysene. De teoretiske analyserne som identifiserer en slik realopsjon bør derfor ha konsekvenser for formuleringen av empiriske boligmarkedsmodeller.

Når konsumentene velger en bolig tar de altså hensyn til at valgene kan revurderes på et senere tidspunkt. Den potensielle revisjonen av planen gjøres i lys av informasjon, om priser og husleie, konsumenten vet at hun får tilgang på senere. Disse resultatene er nok en demonstrasjon av når en analyserer boligetryckspersølen på et punkt i tiden må en se på etter-
sporselen som et punkt i en dynamisk plan for boligkonsumet. Sagt på en annen måte en må anlegge et tidsutstrakt boligkarriereksperspektiv.

Konsumentenes valg av disposisjonsform bestemmes av kostnadsforskjellen mellom eide og leide boliger i likevekt. Skattefordelen ved eie av bolig presser kostnaden ved eie nedover. Verdien av utleierens tenure fleksibility opsjon vil presse leiene nedover. Størrelsen på leiemarkedet vil avhenge av spredningen i kostnadsfordelingene, av skattefordelen ved eie og av størrelsen på tenure-fleksibilitets opsjonen. Verdien av opsjonen vil være større jo større volatiliteten i boligprisene er. Resonnementet predikker altså at leieboligenes andel av boligmassen er større jo større spredningen i fordelingen til forventede boligpriser er. I en likevekt med både eide og leide boliger vil de konsumentene med høyest driftskostnader leie, og de med lavest driftskostnader vil eie.

I likevekt kan en på tross av selveiernes skattefordel finne effektive hushold som leier bolig av ineffektive utleier. Med dette menes det at en i likevekt kan finne et eier-utleierpar hvor eieren kunne ha drevet boligen med lavere driftskostnader enn det utleieren kan. For at dette skal være tilfelle må verdien av utleieren 'tenure flexibility' opsjon være større enn skattefordelen for en eier. Så langt vi har kunnet se det er dette arbeidet sammen med Nordvik (2000) de eneste arbeidene i den boligøkonomiske litteraturen som tar opp sammenhengen mellom stokastikken i boligpriser og den dynamiske utviklingen av boligmassen fordelt etter disposisjonsform.

I dette papiret fokuseres det altså på at konsumenter får ny (kostnads)informasjon underveis i en boligkarriere. Det vises at konsumenten kan redusere sine forventede boligkostnader ved å ta hensyn til at dagens valg påvirker de framtidige valgmuligheten. Denne typen dynamiske optimieringsproblemer analyseres ved hjelp av dynamisk stokastiske programmerings-teknikker, dette analytiske grepet kalles også 'backward induction'. Modeller av denne typen blir fort relativt komplekse. For å få en analytisk håndterbar modell som skarpskiler nettopp den mekanismen vi var ute etter å kaste lys over ble derfor en god del forenklinger gjort. Blant annet ble det antatt at alle aktører er risikonyttrale. Denne antakselen ble i A Housing Career Perspective on Risk erstattet med en antaksel om at konsumentene er risikoavser. I dette papiret forenklet vi ved å se bort fra muligheten til å velge en leid bolig, videre gjøres en partiell etterspørselsanalyse hvor likevekten i boligmarkedet ikke diskuteres.

Utgangspunktet for A Housing Career Perspective on Risk er dels den dominerende posisjonen boligkapital har i portefølgene til hushold i både Norge og andre land. Dels er det også det forhold at med stor variasjon i boligprisene vil de valgene som gjøres på boligmarkedet på et punkt i tiden legger sterke føringer på et husholds valgmuligheter i framtiden. Når kapital plasseres i et objekt med så pass mye usikkerhet knyttet til seg som bolig vil utviklingen av formue være usikker. Dermed blir holdning til risiko en av faktorene som er med og bestemmer boligutviklingen.

I papæret A Housing Career Perspective on Risk kommer jeg fram til motsatt resultat: For mange risikoaverse hushold vil boliggetterspørselen være stigende og risikopremiene fallende i usikkerheten i boligpriser! For å forklare hvorfor dette, ved første blikk noe merkelige, resultatet framkommer, skal vi først gå tilbake til utsagnet om at tidligere analyser ikke bruker en fullstendig dynamisk ramme.

Tidligere studier har analysert valget til et hushold som kjøper en bolig. Boligen gir husholdet 'nytte' gjennom én periode og formuen i starten neste periode er bestemt av realiseringen av den stokastiske boligprisen og av hvor mye som ble investert i bolig i første periode. Formuen vil samvarieres med utviklingen i boligprisene, jo mer som er investert i bolig jo sterkere vil samvariasjonen være. Risikoaversion impliserer at konsumenten setter større pris på inntekt (eller formue) i tilstander hvor formuen er lav enn i tilstander hvor formuen er høy. Dette igjen betyr at høy boligpriser gir inntekter når formuen er høy og vice versa. For å justere for dette legger konsumenten en positiv risikopremie til den forventede bokostnaden. Jo større usikkerheten i boligprisene er jo større må risikopremien være. Som allerede sagt resonnementet virker intuitivt klart plausibelt.

Når jeg i papæret argumenterer for at det ovenstående resonnamentet ikke fullt ut tar dynamikken bak boligkarriereinn over seg er det fordi det bare behandler bolig som et konsumgode i dag og som et kapitalobjekt. Det tar ikke hensyn til at bolig er en viktig komponent også i framtidige konsumvektorer.

I stedet for å diskutere hvorvidt det å holde en del formuen i boligkapital genererer volatilitet i framtidig formue kan en spørre seg det mer fundamentale spørsmålet om hvorvidt det genererer volatilitet i framtidige konsummuligheter. En antakelse om risikoaversion er ikke tilstrekkelig til å besvare dette spørsmålet.

Ved å karakterisere husholdenes (forventede) boligkarrierer kan en imidlertid vise hvordan risikopremiene og boliggetterspørselens avhengighet av prisusikkerheten er i ulike tilfeller. Betrakt først et hushold som flytter inn i en bolig de kommer til å bo i resten av livet. Om dette husholdet har mulighet til å 'spise av boligformuen' gjennom reverse mortgages eller på annen måte eller har preferanser for å etterlate seg av vil konsummulighetene korrelere med prisen og deres boliggetterspørsel vil være fallende i prisvolatiliteten. På samme måte som i konvensjonelle analyser vil de ha en positiv risikopremie i sin bokostnad. For hushold som vil redusere sitt boligkonsum i neste skritt i sin boligkarriere vil resultatet bli det samme. Risikopremien vil altså for hushold i denne situasjonen være positiv.

Det mest overraskende resultatet framkommer når hushold som planlegger å øke sitt boligkonsum tilstrekkelig mye i neste skritt i boligkarrieren betraktes. Vi kaller dette ofte for hushold i en stigende boligkarriere. De vil bruke en stor del av formuen til å etterspørre bolig. Verdien av boligformuen korrelerer positivt med deres kapitalbehov ved kjøp av neste bolig. Ja, en kan faktisk si at ved å overinvestere i bolig forsikrer hushold i en stigende boligkarriere seg mot svingninger i boligprisene. Formuen er høy når prisen på det de etterspør er høy og lav når prisen på den boligen de etterspør er lav. Implikasjonen av dette er at risikoaverse hushold i denne situasjonen vil legge en negativ risikopremie til den forventede bokostnadene.

\[\text{1 Med begrepene fra teorien for valg under usikkerhet kan en si at høy boligpriser gir høy formue når grensenytten av inntekt er lav og lave priser gir lav formue når grensenytten er høy. Den sikkerhetsekvivalente boligprisen vil derfor være lavere enn den forventede boligprisen.}\]
De vil også ettersporre mer selveid boligkapital jo høyere volatilитетen til framtidige bolig-
priser er.

I utgangspunktet sa vi at de negative risikopremiene i dette papiret var et overraskende resultat.
I lys av diskusjonen av mekanismene bak den negative risikopremien framstår det som et
intuitivt rimelig og plausibelt resultat. En kan si at for en økonomisk analytiker er det
hyggelig når en stringent formell analyse bidrar til å reformulere intuitasjonen.

Merk at valgene mellom de ulike typene boligkarrriere bestemmes simultant med etterspørsels-
beslutningen. Videre vil de nøyeaktige resultatene om hva som er en tilstrekkelig stor økning i
boligkonsumet avhenge av graden av 'treghet' i de dynamiske prisprosessene. Begge disse to
forholdene er abstrahert bort i framstillingen her.

Til slutt i papiret argumenteres det for at den analytiske rammen som er brukt er langt fra ut-
fyllende analysert. F.eks kan dette analytiske grepet utnyttes til å analysere hvordan usikker-
het om framtidig boligbehov (eller om en heller vil: om egne preferanser) påvirker etter-
spørselen. Konsumenter som enda ikke er etablert i en familiesituasjon vil typisk oppleve det
som om det er usikkerhet om framtidig boligbehov.

### 0.2 Empiriske studier

De teoretiske studiene vi har gått gjennom foran gir i seg selv en god del insikt i bolig-
markedenes funksjonsmåte. Utav dette gir de selvfølgelig også en del retningslinjer for
hvordan en bør utforme empiriske analyser av boligmarkedssater. I begge de empiriske
papirene *Children, Tenure Choice and Residential Mobility* og *Boligkarriere, ettersporsel,
flytting og flyttekostnader* finnes det gjennomganger av annen empirisk litteratur på feltet. Her
i innledningen gis derfor ingen systematisk gjennomgang.

De teoretiske studiene av dynamikken i boligmarkedssaterden gir et svært åpent teoretisk
univers. Når en skal starte empiriske arbeider på feltet betyr dette at teorien gir uvanlig få
skranker å bygge en økonometrisk modell rundt. Henderson og Ioannides (1989) forholder
seg til denne situasjonen ved å si at de heller enn å utlede en empirisk (økonometrisk) modell
fra de teoretiske analyserne, velger å ’’*design a number of econometric experiments by
expressing essential features of the...maximisation problem, such as the simultaneity of
various decisions and their dynamic structure’*. Dette er også strategien for de empiriske
studiene i dette prosjektet

I begge de empiriske arbeidene i denne rapporten analyseres atferdsrelasjoner for gruppen
grunnleggende parametrene bak boligmarkedssateren (typisk: nyttetfunksjonens parametere)
varierer nok betydelig over demografiske strata, og kan derfor vanskelig identifiseres i
analyser av svært ulike hushold. Valget av hvordan strata avgrenses blir naturligvis en
pragmatisk avveining mellom teoretisk puritanisme og ønske om at stort datasett som grunn-
lag for estimeringer.

Temaet for *Children, Tenure Choice and Residential Mobility* er den simultane sammen-
hengen mellom valg av disposisjonsform og planlagt botid. Et spesielt fokus settes på hvordan
husholdenes atferd påvirkes av forekomst av barn. Tankegangen bak formuleringen av
modellen er at et husholds flyttekostnader er sammensatt av monetære flyttekostnader og
individuelle ikke-monetære (oftet kalt emosjonelle) flyttekostnader. Barns emosjonelle flytte-
kostnader har sannsynligvis sammenheng med barnas alder. Ved hjelp av en totinns-
prosedyre foreslått av Maddala (1983) estimeres en simultan to-ligningsmodell for valg av
 disposisjonsform og planlagt botid. Denne prosedyren brukes for å ta hensyn til den gjen-
sidige avhengigheten i systemet. Planlagt botid påvirker valg av disposisjonsform og valg av
disposisjonsform påvirker planlagt botid.

Det viser seg at de resultatene som denne simultane tilnærmingen gir på mange måter skiller
seg fra resultatene i tradisjonelle 'en-ligningsmodeller'. Det simultane systemet som estimeres
i papiret brukes som en ramme for formelle statistiske tester av et sett med hypoteser om
afferdens. Vi går her kort gjennom noen av disse.

Sammenhengen mellom planlagt botid og alder er forskjellig for kvinner og menn. Planlagt
botid er monotonst stigende i alder for menn. For kvinner ser det ut som om planlagt botid
faller rundt 40-årsalderen. Enslige menn rundt 40 år har videre lavere sannsynlighet for å eie
bolig enn det enslige kvinner i samme alder med samme innenhet har. Det er mulig at for-
klaringen ligger i at (den subjektive) sammenhengen mellom sannsynlighet for pardannelse og
alder er ulik for kvinner og menn. Dette er et spennende tema for videre empirisk forskning på
feltet.

Innenfor rammen av den empiriske modellen er det ikke mulig å forkaste en hypotese om at
tilbøyeligheten til å velge en leid bolig er partielt uavhengig av alder! Planlagt botid påvirkes
derimot klart positivt av alder (unntatt for middelaldrende kvinner). I en-ligningsmodeller for
valg av disposisjonsform finner en typisk en klart signifikant fallende alderseffekt på
sannsynligheten for å leie bolig. Den simultane strukturen gjør altså at vi kommer nærmere en
årsaksforklaring til hvorfor unge i stor grad leier bolig.

Hushold med barn har lavere tilbøyelighet til å leie bolig og lengre planlagt botid enn det hush-
hold uten barn har. En lignende forskjell finner en mellom dem med ett og dem med to barn.
Det er imidlertid ingen signifikante forskjeller å spore mellom hushold med to og de med flere
barn. En kan oppsummerre dette ved å si at antall barn påvirker boligmarkedsafferdens, men på
en ikke-lineær måte. Dette kan en se som en klar advarsel mot den vanlige praksisen med å
bruke antall barn eller antall familiemedlemmer som forklaringsvariable i økometriske
boligmarkedsrelasjoner.

Litt overraskende fant en i papiret ingen klar generell sammenheng mellom alder på barn og
boligmarkedsafferd. Selv om ikke generell effekt ble identifisert fant vi en signifikant forskjell
mellom afferdene til hushold med barn som har begynt på skolen og hushold hvor alle barn er
under skolealderen. Som for mange av de andre demografiske variablene finner en signifikant
effekt på planlagt botid, men ikke på valg av disposisjonsform. Dette tyder på at mange hush-
hold legger vekt på å gjennomføre eventuelle planlagte flyttinger før barna begynner på
skolen. Bytte av skole er sannsynligvis en betydelig komponent i de emosjonelle flytte-
kostnadene til barn. Dette er et resultat som tidligere ikke er identifisert i den bolig-
økonomiske litteraturen.

Et gjennomgående trekk i studier av valg av disposisjonsform er at par har klart større tilbøyel-
lighet til å leie bolig enn det enslige har. Det er ingen signifikant forskjell i leiekjendelene til helt
nydannede par og enslige på samme alderstrinn. Eiersannsynligheten er imidlertid klart
stigende i antall år en har levd som par. Mine resultater kan være generert av en struktur der
sannsynligheten for transformasjon av disposisjonsform fra leie til eie er høyere for par en for
enslige. Hvis dette er tilfelle vil en forskjell i leiesannsynligheter utvikle seg etter hvert som et par har bestått en stund. Nettopp denne strukturen framkommer i den empiriske modellen.

Mange av testene viser altså at utvalgte demografiske kjennetegn ved et hushold ikke påvirker valg av disposisjonssform direkte, men at virkningen kommer indirekte ved at planlagt botid påvirkes av de demografiske kjennetegnene. Paperet avsluttes derfor med en test av en hypotese om at valg av disposisjonssform er partisk uavhengig av demografiske kjennetegn som alder (på både barn og voksne), par-status, kjonn og antall barn. En slik hypotese vil være konsistent med en hypotese om at valg av disposisjonssform kun bestemmes ut fra rene kostnadsvurderinger. Denne hypotesen forkastes klart.


Analysene i papiret begrenser seg til atferden til personer som i 1997 var enslige og mellom 25 og 45 år. Vi estimerer etterspørsefunktjoner for boligareal. Separate ligninger for eiere og leietakere estimeres. I disse inkorporeres så informasjon som brukes til å estimer dynamiske strukturer i atferden. Modellene er videre testet for hvorvidt mekanismene bak seleksjonen inn i boligmarkedets eie- og leiesegmenteder gir seleksjonskjevhet i estimatene og for hetskedestisitet. Empirien tyder ikke på at noen av disse to forholdene skaper problemer for tolkningene av de estimerte koeffisientene.


For eiere finner vi en inntektselastisitet på litt i underkant av 0,2. Inntektselastisiteten for leiere ligger på 0,6. Det er vanskelig å gi noen intuitiv forklaring på denne forskjellen. Målet for inntektsstilen påvirker i liten grad den estimerte ettersporselen etter boligareal.

For de yngste eierne viser resultatene at boligettersporselen er fallende i botid. Dette er konsistent med resultatene fra Moving Costs and the Dynamics of Housing Demand som viste at hushold på en stigende boligkarriere vel 'overkonsumere' bolig mens en rett før flytting vil ha et relativt lavt konsum. For enslige mellom 35 og 45 år er effekten motsatt, forklaringen på dette er nok at en del nyskilt have flyttet relativt nylig til en liten bolig. Andre av de nylig skilt har blitt boende i parets tidligere bolig. Dette peker i retning av at skilte med kort botid har små boliger og at skilte med lang botid har større boliger. Også blant leietakerne finner vi en positiv koeffisient for botid. Igjen regner vi med at dette har sammenheng med at en del nyskilde har flyttet ut i en liten leiebolig.
En rimelig hypotese er at stigende (ikke nødvendigvis strenget stigende) planlagte boligkarrierer er relativt vanlig i de aldersgruppene som analyseres her. Ut fra denne hypotesen og resultatene fra *Moving Costs and the Dynamics of Housing Demand* vil en forvente at folk ved flytting justerer boligkonsumet oppover. I estimeringene av boligettersporselen i 1997 inkluderer vi derfor indikatorer for hvorvidt husholdet flyttet året etter. I tråd med forventningene komme denne i alle modellvarianten for både eiere og leiere ut med en negativ koeffisient. Dette gjaldt for begge de flytteindikatorene vi brukte.

Presisjonen i de estimerte effektene er relativt lav. En kan forovrig merke seg at også den samlede forklaringskraften i de estimerte modellene er relativt lav. I eiermodellene ligger $R^2$ korrigert for antall frihetsgrader på noe i overkant av 25%, i leiermodellene ligger $R^2$ stort sett noe lavere. Dette er ikke uvanlig i tverrsnittsstudier av boligmarkedssatsen. Årsaken er naturligvis stor heterogenitet i preferanser og at det alltid i denne typen undersøkelser vil være en god del ikke-observerte, og dermed utelatte, variabler. Det vil sannsynligvis være mulig å estimere mer presise ettersporselsfunksjoner når panelseriene blir lengre. Ikke minst vil noe lengre panelserier gjøre det mulig å behandle dynamikken i sammensetning av husholdene bedre, noe som nok vil bedre kvaliteten på de estimerte ettersporselsfunksjonene.
1. Moving Costs and the Dynamics of Housing Demand

Abstract

It is well established that moving costs make households adjust their housing consumption far less frequent than they would have done in a world in which relocation were costless. This paper adds to our understanding of the dynamics of housing demand by constructing a life-cycle model of housing demand on which several numerical experiments are performed. Among other things it is shown how the sign of price elasticities may be indeterminate because of changes in moving careers induced by price changes. The paper also demonstrates that planned (endogeneous) moving activity and stochastic forced moves should be analysed within a common analytical framework. One simple version of such a common analytical framework is presented and discussed.

1.1 Introduction

Because of high moving costs household will not adjust housing consumption instantaneously to changes in prices, preferences or household composition. Knowledge of this of course affects housing choices made when a move takes place. This paper analyses housing demand as a dynamic plan, which depends on the expected time-path of moving costs and prices, of housing consumption over the life-cycle. One new result that is presented in the paper is that planned moving activity of a household may change as the probability of forced moves changes. The substantial stamp duties, associated with home sales, are also shown to lead to a quite high deadweight loss. The paper is related to two different traditions in the economics of intra-urban mobility. As my baseline model is a discrete time version of the model in Amundsen (1985) my work is a part of the dynamic movement plan approach. The other tradition in economic studies of mobility I will relate my work to is the 'disequilibrium'-approach. In order to illustrate the connections between my work and this approach I will briefly discuss the articles of Venti and Wise (1984) and Loikkanen (1988).

At the start of Venti and Wise (1984) it is stated that 'The basic idea of our model,..., is that families move if the advantages of moving outweigh the transaction costs associated with moving'. Later on when a disequilibrium term is introduced it is inferred that this equals zero just after a move has taken place. This will be true only if the household is planning to stay for only one period in the dwelling into which it moves. The nature of the disequilibrium concept employed by Venti and Wise and others in this tradition is thus somewhat myopic. Even though Venti and Wise offers an econometric framework that facilitates simultaneous analyses of housing demand and moving decisions that take account of moving costs, they fail to take the consequence of housing demand at one point in time being a part of a dynamic plan. Indeed Amundsen (1985), Goodman (1995) and Muth (1974) show that a disequilibrium measure can be at its largest just after a move has taken place. This is supported by the empirical results of Edin and Englund (1991).

Loikkanen (1988) gives a search theoretic analysis of housing demand in which the decision to move can be split up in two steps. First, large discrepancies between actual and desired housing consumption lead a household to start searching for a new dwelling. Second, the
household receives an offer of a suitable dwelling (a dwelling with characteristics inside the acceptance set). A move is the result of households passing through these two steps. Also Loikkanen bases his econometric models on a current, or a myopic, disequilibrium concept.

In short one can say that it seems that even though much of the empirical mobility analyses based on 'the (myopic) disequilibrium approach' have produced important insights it has failed to take full account of the dynamics of housing demand. Analyses that deals explicitly with the dynamics, such as Amundsen (1985), Goodman (1995) and this paper, on the other hand is not yet able to produce a sound basis for empirical analyses. These papers have to rely on simulations on calibrated models in order to give quantitative indications of the dependencies within the models.

The approach of Amundsen (1985) and Goodman (1995) is similar to mine. For an exogenously given path of preferences and prices of housing services and in the presence of moving costs households is assumed to form a dynamic plan of housing consumption. My paper differs from these two in three important ways: Firstly I show how a stochastic process that can generate forced moves can be integrated into a model of endogenously determined moving activity. Secondly I show, through simulations, how a dynamic plan can be revised as exogenous variables changes. I find that the demand reaction towards such changes depend crucial on the date the changes is announced. Thirdly a partial analysis of the welfare effects of a stamp duty within the framework of the calibrated model is given. This analysis indicates that the deadweight-loss of a stamp duty is substantial.

The paper is organised in five sections included the introductory remarks. Section two is denoted a 'Baseline model', this section gives the central theoretical framework of the paper. In section 3 it is showed how stochastic forced moves can be integrated into a model of endogenous (or voluntary) moving activity and which effects it will have. Simulations on a calibrated version of the baseline model are given in part 4. The last section concludes.

1.2 Baseline model

Through an analysis of theoretic structures and some simulations on a calibrated model I will show how demand of housing services at one point in time should be interpreted as a part of an intertemporal plan. In order to focus on aspects I regard as important, the 'Baseline model' is kept quite simple. This means that important aspects of the reality most consumers face is not taken into account. The most important of these are listed below.

i) a perfect capital market in which the market interest rate equals the consumers discount rate. Thus, there is no liquidity constraints.

ii) Housing consumption is measured by a uni-dimensional measure of housing services with a known price.

iii) Time-series of moving costs, prices, interest rates and lifetime wealth is known without any uncertainty.

iv) The planning horizon over which the consumption of housing services and other consumption is allocated is finite equal to T. Furthermore there is assumed to be no bequest motives.

The consumer will choose the consumption vector that maximises the intertemporal utility function U( ), subject to a budget constraint (1). The utility function is both intra- and intertemporally separable.
\[
\begin{align*}
\text{Max} & \quad U = \sum_{t=1}^{T} (1 + \rho)^{-t} u(x(t), h(t), \Gamma(t)) \\
\{x(t), h(t)\} & \\
\text{Subject to} & \quad \sum_{t=1}^{T} (1 + \rho)^{-t} \left[ x(t) + r(t) h(t) + \mu(t) \right] \leq W
\end{align*}
\]

\(\rho\) is the interest rate, which is assumed to be constant over time.

\(x(t)\) is the consumption of the composite good 'other goods and services' in period \(t\).

\(h(t)\) is the consumption of housing services in period \(t\).

\(r(t)\) is the period \(t\) price of housing services.

\(W\) is the life-time wealth measured as a net present value.

\(\Gamma(t)\) is a (set of) parameter(s) that describes the consumers type. By consumers type one can think of whether there is children in the household\(^2\), or whether the taste for housing relative to other goods changes over time. The term \(\mu(t)\) is a potential moving cost. In periods in which the household is not moving \(\mu(t)\) will equal zero, when the household is moving at the start of the period \(\mu(t)\) will equal the exogenously given moving cost \(m(t)\).

Characteristics of the solution to this dynamic optimisation could have been gathered by solving it by backward induction. The last step of the backward induction will be to maximise the sum of the period one utility and an indirect utility function, containing the effects of optimal choices in period 2 to \(T\). Because of the discontinuities caused by the presence of moving costs the indirect utility function will, however, not be very well behaved.

As the baseline model of this paper treats a situation without any uncertainty, using the methods of dynamic programming will not yield any new insights. I therefore proceed in the same way as Goodman (1995) and Amundsen (1985) by postulating a moving career and show how the optimal consumption bundle within this career can be described. To facilitate comparisons of consumption bundles in one period and multiple period stays I will describe the consumption bundles under a career in which the consumer chooses a dwelling at the start of period one, and lives in it for one period. At the start of period two she chooses to move and stay in the period two dwelling throughout the planning horizon. The optimisation will thus be to choose \(\{x(1), \ldots, x(T), h(1), h(2)\}\) so that the Langragian in (2) is maximised.

\[
\begin{align*}
L = \sum_{t=2}^{T} (1 + \rho)^{-t} u(x(t), h(2), \Gamma(t)) + u(x(1), h(1), \Gamma(1)) \\
- \lambda \{x(1) + r(1) h(1) + m(1) + (1 + \rho)^{-1} m(2) + \sum_{t=2}^{T} (1 + \rho)^{-t} \left[ x(t) + r(t) h(2) \right] - W\}
\end{align*}
\]

Some rearranging gives the following first-order conditions:

\(^2\) The terms consumer and household will used synonymously throughout the paper.
\[
\frac{\partial u(x(1), h(1), \Gamma(1))}{\partial x(1)} = \lambda = \frac{\partial u(x(t), h(t), \Gamma(t))}{\partial x(t)} \quad t = 2, 3, \ldots, T
\]

\[MRS_t = r(1)\]

\[\sum_{i=2}^{T} (1 + \rho)^{i-1} \{MRS_t - r(t)\} = 0\]

\[x(1) + r(1)h(1) + m(1) + (1 + \rho)^{i-1} m(2) + \sum_{i=2}^{T} (1 + \rho)^{i-1} [x(t) + r(t)h(2)] = W\]

MRS$_t$ is the period $t$, marginal rate of substitution between housing and other consumption.

The first equation of (3) shows that the path of other consumption is adjusted so that the marginal utility is equalised both within and between stays. This result depends naturally crucially on my assumption of perfect capital markets. Goodman (1995) and Artle and Variya (1978) show that with imperfect access to capital markets the (constrained) optima may imply inter-period variation in the marginal utilities of other consumption. To arrive at conclusions on the form of the time path of 'other consumption' one will have to make more specific assumptions on the time path of $\Gamma(t)$ and prices $r(t)$ and on the cross derivatives of the intra-period utility functions, see proposition 2 in Amundsen (1985).\(^3\)

In a one-period stay the housing consumption is chosen so that MRS is equal to the relative price of housing consumption (the price of the bundle of other consumption goods is set equal to unity). This is exactly what one may denote the traditional first-best allocation rule. For multi-period stays this first-best allocation rule does not apply. From the third equation of (3) one see that the housing consumption within a stay is chosen so that the discounted average difference between MRS and the relative price of housing services is equalised to zero. One can say that within a stay the housing consumption is chosen so that discounted over-consumption is equalised to discounted underconsumption.

If one for one moment assumes that the form of the inter-period utility function and the price path yields a monotone increasing housing consumption had moving cost equalled zero one can within my model show a result that also emerged in Muth (1974). In this case positive moving costs induce the consumer to choose a stay in which overconsumption is at its largest immediately after a move. Thus, under these assumptions there is really no reason to believe that recent movers are in equilibrium. This theoretical point is quite important, as it has been quite common to argue that demand equations preferably should be estimated on samples consisting of recent movers. For a review, see Edin and Englund (1991).

\[^3\] One may note that there is misprint in the text of proposition 2 in Amundsen (1985). The inequalities of part a and b should be reversed. In the proof of the proposition correct inequalities is used.
Some of the empirical results in Edin and Englund (1991) indeed support the claims of Muth (1974) and my model. Firstly they estimated a 'standard housing demand equation' on a cross section of owner-occupiers, then they checked whether the squared residuals correlated with duration of the consumers' incompletely stays. Duration was found to have a significant negative effect on the squared residuals. This result is consistent with results in my model, but certainly not with a 'recent mover hypotheses'. Both for consumers on a decreasing and on an increasing path of housing consumption such a result will appear. In order to take account of this a housing demand equation, which included duration (and its square), was estimated. Here a negative duration effect was found, this indicates increasing housing paths is more frequent than decreasing ones. In the interpretation of this one should bear in mind that increasing paths could be a result of households being liquidity constrained.

It still remains to show how the consumer chooses between the different moving careers. Let $f_1, f_2, \ldots, f_F$ be the possible moving careers and $X(f)$ and $H(f)$ be the optimal paths of other consumption and housing under moving career $f$. The consumer will choose the moving career that yields the highest utility ($U^*$).

\[
U^* = \max \{ U(X(f_1), H(f_1)), U(X(f_2), H(f_2)), \ldots, U(X(f_F), H(f_F)) \}
\]

Thus, the choice of moving career is in this paper modelled as a comparison of utility levels of different careers. The need for such a comparison arises because of the discontinuities of the set of consumption bundles which is a result of the positive moving costs. It is not possible to give any general comparative statics of the structure of the solution of (4). Such comparative statics will at least involve so many expressions and conditions that they will hardly be informative, this is due to the switches of moving careers that may take place as the ordering of the utility levels changes when exogenous variables vary. To illustrate the structure of the solutions results from some numerical experiments is given in the section 'Some simulations'.

### 1.3 Induced moves

Some moves form a part of a planned moving career and should thus be treated as endogenous in the utility maximisation of a consumer. This type of moves are analysed in my baseline model. In addition to this one has moves that is triggered by unforeseen events. Muth (1974) analyses the choice of housing quantity throughout a stay when a stochastic process may generate exogenous moves and length of a stay thus is a stochastic variable. One of the most central conclusions that may be read out of his analysis is that the willingness to accept over- or underconsumption early in a planned stay is decreasing in the probability that a exogenous move should take place. Using a two-period model I shall here show how a planned housing (and moving) career is affected by the presence of stochastic exogenous moves.

As an introduction to this analysis a decision tree may illustrate the decision process:
The large letters describe who is taking the decisions at the node. The consumer (C) takes her decision at the beginning of the first period when she chooses how much housing to consume in this period. Next period is started by 'nature' (N) deciding whether the consumer is allowed to choose a stay or a move. After the decision of the nature the consumer ends her series of decisions by choosing among the available alternatives.

In the baseline model where everything were certain, the consumer made a plan in the form of a time series of moving and staying decisions. In the situation analysed here and illustrated in figure 1 the picture is somewhat different. The strategy stay must be replaced by another strategy, which might be denoted 'attempted stay'. The consumer starts of in the first period and chooses a plan conditioned on her reacting optimal on information arriving later. Thus, the techniques of dynamic programming will be suitable for the analyses of the optimisation of the consumer. That is, I start by analysing the choices of the second (and last) period in two different cases. These two cases correspond to the possible realisations of the nature's draw, which is 'forced move' and 'do as you want'. For each of these cases an indirect utility function is defined, and each of these two indirect utility functions enter the period one optimisation.

If the consumer is forced to move at the start of the second period she will choose the consumption pair \( \{x(2), h(2)\} \) so that:

\[
(5) \quad u(x(2), h(2), \Gamma(2)) - \lambda_{fm}(x(2) + r(2)h(2) + m(2)) - W' 
\]

is maximised. \( W' \) is the period two value of the part of the initial wealth that is not consumed through period 1.

\[
W' = (1 + p)\{W - m(1) - x(1) - r(1)h(1)\} 
\]

This optimisation yields quite standard first order conditions:
(6-1) \( MRS_2 = r(2) \)

(6-2) \( x(2) + r(2)h(2) = W^* - m(2) \)

The solution to (6-1) and (6-2) is denoted \( x^{fm}(2) \) and \( h^{fm}(2) \). Inserting them in the utility function gives the indirect utility function \( V^{fm}(h(1), W^*) \), whose arguments in the language of Kreps (1990) is the links between the past, the present and the future of my model. (6-3) gives the derivatives of the indirect utility function:

\[
\frac{\partial V^{fm}}{\partial h(1)} = 0
\]

(6-3)

\[
\frac{\partial V^{fm}}{\partial W^*} = \lambda_{fm}
\]

The first part of (6-3) is of course due to the fact that variations of the first period housing consumption is not (partially) affecting period two utility as long as you are not allowed to stay in the same dwelling.

Because of the discontinuities imposed by moving costs I will have to look at the optimisation in the case where nature chooses 'do as you please' in two steps. First I characterise the optimal consumption pair given that a stay (s) is chosen and then when a move is chosen (cm). Given that a stay is chosen the period two optimisation reduces to spend all remaining money on 'other consumption'.

(7-1) \( h(2) = h(1) \)

(7-2) \( x(2) = W^* - r(2)h(1) \)

Given that a move is chosen the first-order conditions for utility maximum will, in form, resemble the conditions under 'forced move'.

(7-3) \( MRS_2 = r(2) \)

(7-4) \( x(2) + r(2)h(2) = W^* - m(2) \)

However, they are not identical as the amount saved for period two consumption differs in the two cases forced move and chosen move. I will return to this point when the planned housing career under this framework is discussed. The indirect utility function in the case when the consumer is allowed to choose in the second period \( V^C(\cdot) \) will be (8):

\[
V^C(h(1), W^*) = \max \{ u(W^* - r(2)h(1), h(1), \Gamma(2)), u(x^{cm}(2), h^{cm}(2), \Gamma(2)) \}
\]

\[
\max \{ v^s, v^{cm} \}
\]
The derivatives of $V^C(\cdot)$ is of course depending on which of the two arguments of the $\max\{}$-expression is largest.

If $v^s > v^{cm}$ then:

\[
\frac{\partial V^C}{\partial h(1)} = \frac{\partial u(..., \Gamma(2))}{\partial h(1)} - \frac{\partial u(..., \Gamma(2))}{\partial \lambda(2)} r(2)
\]

(9-1)

\[
\frac{\partial V^C}{\partial W^*} = \lambda
\]

If $v^s < v^{cm}$ then:

\[
\frac{\partial V^C}{\partial h(1)} = 0
\]

(9-2)

\[
\frac{\partial V^C}{\partial W^*} = \lambda_{cm}
\]

At the start of period one the consumer must choose a consumption pair \{h(1),x(1)\} and how much to save for the next period $W^*$. Furthermore, this choice must be done before it is known whether the strategy stay is available in period 2. I assume that the choice is done so that the sum of the period one utility and the discounted expected utility of period two is maximised. This leads to the maximisation (10).

(10) \[
\max u(x(1),h(1)) + (1+r)^{-1}[P V^{cm}(h(1),W^*) + (1-P) V^C(h(1),W^*)]
- \mu[x(1)+r(1)h(1)+m(1)+(1+r)^{-1}W^* - W]
\]

The form of $V^C(h(1),W^*)$ differs in the two different cases where the stay-utility exceeds the chosen-move-utility and vice versa. I will therefore start by characterising a planned housing career where the utility of a move in the second period exceeds the potential stay-utility. The results of this analysis are quite standard.

(11-1) \[
MRS_1 = r(1)
\]

(11-2) \[
P\lambda_{cm} + (1-P)\lambda_{fm} = \mu
\]

(11-3) \[
x(1)+r(1)h(1)+m(1)+(1+r)^{-1}W^* = W
\]
A household who has planned to move will not be affected by a message, which says you have to move. This implies that $\lambda_{cm} = \lambda_{dm}$. (11-2) then implies that the marginal utility of money spent in period 1 should equal marginal utility of money spent in period 2. Under this voluntary move scenario the marginal utility of money spent on housing in the first period is equalised to the common marginal utility of other consumption in both the first and the second period. A similar result holds for the housing consumption of period 2. These results hold for any $P$.

In the case in which the household will prefer a stay in period two some more interesting, and maybe even surprising results emerge. The first-order condition for utility maximum, in which some of the characteristics of the indirect utility function $V(\cdot)$ is inserted is given in the equations (12):

$$\frac{\partial h(\ldots, \Gamma(1))}{\partial \lambda(1)} = \mu$$

$$\mu\{MRS_1 - r(1)\} = -(1 + \rho)^{1-P}\lambda(1)\{MRS_2 - r(2)\}$$

$$P\lambda_{dm} + (1 - P)\lambda = \mu$$

$$x(1) + r(1)h(1) + m(1) + (1 + \rho)^{-1} W' = W$$

Using (12) to discuss planned housing careers containing planned stays, in the presence of an exogenous stochastic process that may produce forced moves, it is convenient to start with the third equation of (12). Eq. (12) applies only when the household prefers not to move if this alternative is available. That is, $v^c > v^{dm}$, furthermore, marginal utility of income is decreasing in the utility level - this implies that $\lambda_{dm}$ is greater than $\lambda_c$. Period one consumption of other goods is chosen so that its marginal utility equals the expected marginal utility over the two possible states of the second period.

This result can be used to show how variations of the probability of being forced to move affects the period one consumption of other goods and services of a household who does not intend to move if they are allowed to stay. As the probability of being forced to move is given a positive shift, the weight attached to the marginal utility under 'forced move' also increases. This increases the optimal $\mu$, which in turn leads to a decreased period one consumption of other goods and services. The economic rationale behind this is that 'forced move' is an undesirable event. When the probability of this event increases the period one consumption is decreased in order to be better prepared to meet the moving cost which might be imposed on the household in next period.

In the discussion of equation (3) I showed that with out any exogenous moving processes (that is: $P=0$) the housing consumption will be chosen so that overconsumption in some periods is balanced against underconsumption in other periods. The question is so if (and how) this conclusion is affected by the presence of exogenous stochastic moves. Inspection of the second equation of (12) reveals two differences. First, the mismatch of the first period is
weighted by \( \mu \). As seen in the preceding paragraph, \( \mu \) is increasing in \( P \). This push the size of
the 'first-best' housing consumption downwards. One can say this result is generated by the
same mechanism that pushed down the period one consumption of other goods and services.
Total consumption expenses in period one are decreased in order to increase the utility level if
a move should be imposed upon the household in period two.

The second effect on first period housing consumption is that the first period over-
consumption (under-) is balanced against the product of the probability that stay-strategy is,
available in the last period and underconsumption (over) in the last period. Thus the consumer
is less willing to take a first period mismatch of the housing consumption the more likely it is
that she is not able to avoid paying moving costs in the second period. This effect is exactly
what I denoted the central result of Muth (1974). The last topic of the model of the dynamics
of housing demand in the presence of moving costs and exogenous stochastic moves to be
discussed, is the dependency between planned moves and the probability of being forced to
move.

Within the two-period model analysed here it is possible that a consumer who will plan to
stay in the same dwelling in both periods when \( P \) is low, will plan to move if the probability
of being forced to move if \( P \) is high. To see this give \( P \) a positive shift. As \( P \) increases one see
from (12) that the consumption vector approaches the consumption vector under forced move.
If housing consumption under 'move' differs sufficiently in the two periods there exists a \( P \)
and a corresponding \((h(1), x(1))\) that will lead the consumer to change her mind and move in
the second period even though she is not forced to do so. If the \( P \) that leads her to change her
mind is lower than one there will be a utility loss, which is due to a misfit in the first period.
Thus she will be better off by choosing the move strategy from the start.

The intuition behind this at first look peculiar result is easy to grasp. The gain from a stay is
of course that one does not have to pay moving costs, the price of this gain is some misfit in
the time path of housing consumption. A stochastic process that may generate forced moves
can in this situation lead to households paying the price through a misfit without them
collecting the gain. It is no surprise that increased possibility of not gaining from a strategy
reduces the propensity to paying the price of it.

In his seminal paper of Amundsen (1985) expressed the aim of his the paper to be to 'make a
contribution to the micro-economics of the part of intra-urban mobility that is explained by
long-term planning'. My results indeed show that to understand the part of intra-urban
mobility that is explained by long-term planning, one should analyse planned moving activity
within a framework, which allows for unplanned moves. The analysis of this section should
not be regarded as any completion of an integrated model of induced and planned moves, but
rather as a start of such a work.

1.4 Some simulations

Formulation and calibration of a model

As I argued that comparative statics in my baseline model would yield so messy expression
that they hardly will be informative, I will in this paragraph illustrate some central features of
the model through simulations on a calibrated version of the baseline model. Additive
logarithmic utility functions is used, these functions yield in the absence of moving costs the 'linear expenditure system'. Still, in the presence of moving costs the demand functions will resemble those of the linear expenditure system.

\[(13) \quad U = \sum_{i=1}^{T} (1 + \rho)^{-i} \left( \alpha(t) \ln(h(t) - b(t)) + (1 - \alpha(t)) \ln(x(t) - \beta(t)) \right)\]

Simulations based on the utility function above are done under an eight period long planning horizon. In my simulation I think of each period as consisting of five years. The results of the simulations can thus be thought of as a planned housing career from the age of twenty up to sixty years. An annual discount rate of 4% yields a period discount rate of 21.7%. In the standard simulations it is assumed that both the real price of housing services and moving costs grows at an annual rate of 1.5%, corresponding to a growth rate from one period to the next approximately equal to 7.7%. The price of housing services is set to 10 and moving costs to 40 in the first period. Life-time wealth is set equal to 10,000.

Such simulations on a calibrated model is used by both Goodman (1995) and Amundsen (1985) as a part of the discussion of the dynamics of housing demand in the presence of moving costs. Both stress the fact that planned moves may be triggered by foreseen changes in the composition of the household or by (foreseen) changes in the preference for housing. My simulations differs from both of them in so far as I let the parameters of the utility function vary over time.\(^4\) Of course it seems rather peculiar to formulate a specified time-path of the parameters of the utility function. In my view it is not more peculiar to describe a path where the parameters changes than a path where they are constant over the life-cycle.

The parameters \(b\) and all the \(\beta(t)\)'s, which are sometimes interpreted as some kind of minimum consumption, are given the values 8 and 400. The \(\alpha\)-parameters which may be interpreted as excess-consumption-expenses-shares are set to the quite low value 0.18 in the first period. In each period they are increased by 0.07 up to the fourth period where they equal 0.39, this value is kept also in the fifth period. In period six \(\alpha\) equals 0.32, finally in period seven and eight it is set to 0.25. This time-path is meant to capture a typical life-cycle in which housing is given a quite low priority early in the life of a household and is increasing up to the peak of the nuclear-family-phase. After that the relative preference for housing decreases as children are moving out. In the ageing parts of the life-cycle the relative preference for housing is however assumed to be stronger than in the youngest years.

The reason for capturing the variation of preferences over the life-cycle through varying excess-consumption-expenses-shares instead of the more usual approach by capturing it through time-varying minimum-consumption coefficients is purely pragmatic. It makes it easy to write out closed form housing demand functions also for multiple-period stays.

Table 1 shows the planned housing career under the standard assumptions spelled out in the text. The third column is included in order to facilitate comparison with some kind of first-best solution and contain housing demand when moving costs equal zero. The wealth effect is

\(^4\) In one of the simulations in Ekman and Englund (1997) one parameter of the utility function is allowed to vary.
removed by letting the wealth that generates the demand of column three equal initial wealth minus the net present value of the moving costs associated with the optimal plan.

Table 1 - Simulated path of housing consumption, reference path

<table>
<thead>
<tr>
<th>Period</th>
<th>Reference path with moving costs</th>
<th>'First-best' demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>51.0</td>
<td>39.3</td>
</tr>
<tr>
<td>2</td>
<td>51.0</td>
<td>48.4</td>
</tr>
<tr>
<td>3</td>
<td>51.0</td>
<td>56.0</td>
</tr>
<tr>
<td>4</td>
<td>51.0</td>
<td>62.3</td>
</tr>
<tr>
<td>5</td>
<td>51.0</td>
<td>58.4</td>
</tr>
<tr>
<td>6</td>
<td>51.0</td>
<td>46.4</td>
</tr>
<tr>
<td>7</td>
<td>35.0</td>
<td>35.9</td>
</tr>
<tr>
<td>8</td>
<td>35.0</td>
<td>33.9</td>
</tr>
</tbody>
</table>

Even though I have chosen quite low moving costs, the optimal number of moves, in addition to the first compulsory move in period one, is only equal to one. The simulation results also reveals that given the prices and parameters I am using in the simulations the discrepancies between first-best demand and the simulated demand is substantial. Overconsumption in the first period is 30% of first-best demand, and underconsumption in period 5 is almost 20%.

Some structures are revealed when wealth and moving costs are varied. The number of moves is, not very surprising, decreasing in the size of the moving costs. It is increasing in income. Absolute variation of first-best housing demand is larger the larger life-time wealth is. This implies that the mis-match cost of not adjusting housing consumption between two periods is increasing in life-time wealth. The result that number of moves is increasing in wealth follows from the assumption that moving costs is independent of housing consumption and wealth.

Harrington (1989) analyses the dynamics of housing demand in a framework without any explicit treatment of moving costs. The central idea in Harrington's article is that the time-path of housing and other consumption is affected by changes in the price in one specific period through two different channels. Firstly, one have the direct price effect that pushes down housing consumption in the specific period. This is denoted a intertemporal substitution substitution effect by Harrington. Secondly, one have a wealth effect. That is, the real value of a life-time income decreases as the price of one of the components of the consumption vector is increased. This decrease pushes down the consumption of housing services in all periods.5

In my model where adjustment of housing consumption to variations in the price of housing services might be chosen away because of the moving costs associated with adjustment one may have a third effect. That is that the moving careers might be changed. This will be illustrated in table 2 where the effect of a 50% price increase in period 6 is given. In the table elasticities will be reported in three cases: zero moving costs, moving costs equal to 10 and as

5 Due to a wrong sign (of the \(\theta(t)^{st}\) in equation (10) it seems like the wealth effect of increased price of housing services is positive in Harrington (1989). This again leads to some peculiarities in his 'Interpretation of price parameters'.
in the standard case, moving costs equal to 40. As the price elasticities in table 2 is the sum of three different effects I will denote them gross price elasticities.

Table 2 - Gross price elasticities when the period 6 price is increased

<table>
<thead>
<tr>
<th></th>
<th>m(1)=0</th>
<th>m(1)=10</th>
<th>m(1)=40</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E_{t(6)} h(1)$</td>
<td>-0.004</td>
<td>-0.004</td>
<td>0.019</td>
</tr>
<tr>
<td>$E_{t(6)} h(2)$</td>
<td>-0.005</td>
<td>-0.004</td>
<td>0.019</td>
</tr>
<tr>
<td>$E_{t(6)} h(3)$</td>
<td>-0.005</td>
<td>-0.004</td>
<td>0.019</td>
</tr>
<tr>
<td>$E_{t(6)} h(4)$</td>
<td>-0.005</td>
<td>-0.004</td>
<td>0.019</td>
</tr>
<tr>
<td>$E_{t(6)} h(5)$</td>
<td>-0.005</td>
<td>-0.004</td>
<td>0.019</td>
</tr>
<tr>
<td>$E_{t(6)} h(6)$</td>
<td>-0.556</td>
<td>-0.525</td>
<td>-0.857</td>
</tr>
<tr>
<td>$E_{t(6)} h(7)$</td>
<td>-0.004</td>
<td>-0.039</td>
<td>-0.041</td>
</tr>
<tr>
<td>$E_{t(6)} h(8)$</td>
<td>-0.004</td>
<td>-0.039</td>
<td>-0.041</td>
</tr>
</tbody>
</table>

Over the interval over which I have calculated them the absolute value of the direct price elasticities is between 0.5 and 0.7. The exact figure depends on the magnitude of the moving costs. There does not seem to be any systematic tendencies in the dependencies between moving costs and the intra-period price elasticity. The source of the variations in the intra-period price elasticity lies in the effect the price increase has on the planned moving career. To see this I will discuss the relation between the elasticities in the cases where m(1) equals respectively zero and ten.

Before the price increase period 6 was a one period stay when moving costs equalled 10. Housing consumption in this single period-stay were 33% above housing consumption in the following stay. The price increase did then push 'first-best' consumption in the sixth period slightly below the consumption in the last two periods. The difference between the period six first-best consumption and the consumption of the last periods are however so small that the consumer is better of by moving into a dwelling at the start of period six that she stays in for the last three periods. As long as first-best consumption in period seven and eight is higher than in period six, the stay dwelling chosen so that there will be some overconsumption of housing in period six. This overconsumption is the reason of the, in absolute terms, lower price elasticity in period six when moving costs equal 10. As period six is included in the last stay this pushes down the housing consumption through this stay. This is reflected in the relative high absolute value of the elasticity period eight housing consumption with respect to the price of housing services in period 6. These elasticities are about ten times as large as the 'pure weath effects' that can be seen in the elasticities of housing consumption in the periods prior to period six. These differences are due to the described effects on the planned moving career, that is the cancellation of one move.

When turning to the simulations where the initial moving costs is set equal to 40 one interesting result emerges. The elasticity of period one to five housing consumption is positive, thus in response to a price increase in period six housing consumption is slightly increased in the preceding periods. This is due to the fact that prior to the price increase period six was part of a stay in which the housing consumption was pushed down by the over-consumption in period six. The price increase lead the consumer to move one period earlier, and this increase the consumption of housing services in the preceding stay. One can say that
in this case a positive housing career-effect is dominating the 'conventional' negative wealth effect.

The effects illustrated in table 2 are not very important as they are gathered from a loosely calibrated model. The important insight is that the effect of a price change is composed of three different effects, of which the moving career-effect is even capable of changing the sign of some of the price effects on housing consumption.

Timing of shocks
In this part I will see how the reaction on changes of both prices and some parameters of the utility function depends on when the consumer is informed about the changes. I denote these changes shocks as I perform the analysis under the assumption that prior to a change the consumer has not in any way prepared herself to such changes. In further work it is natural to extend this analysis to see how demand profiles is affected if the consumers expectations on future prices and utility functions is probability distributions rather than point expectations.

Price changes
The price effects that is discussed up to here is the effect of a price increase that is known before the household is making it's plan for the entire planning horizon. I will no turn to see how the response to an increased period six price of housing services is depending on when the price increase is announced. Table 3 shows how the price elasticity is varying with the date of the announcement of the price increase, these figures is reported for two different levels of the initial moving costs.

Table 3 - Gross price elasticities when a period 6 price increase is reported at different dates

<table>
<thead>
<tr>
<th>Message date</th>
<th>m1=10</th>
<th>m1=40</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-0.525</td>
<td>-0.657</td>
</tr>
<tr>
<td>2</td>
<td>-0.526</td>
<td>-0.653</td>
</tr>
<tr>
<td>3</td>
<td>-0.526</td>
<td>-0.653</td>
</tr>
<tr>
<td>4</td>
<td>-0.529</td>
<td>-0.653</td>
</tr>
<tr>
<td>5</td>
<td>-0.531</td>
<td>-0.653</td>
</tr>
<tr>
<td>6</td>
<td>-0.534</td>
<td>-0.653</td>
</tr>
</tbody>
</table>

Intuition tells that the later an increase of a price is announced, the larger intertemporal distortions one should expect. These distortions are due to the consumer spending to much of her resources early in her life span before the price increase is announced. This again implies that the reduction of the period six consumption of housing services is expected to be larger the later it is announced. Even though the variation of the price elasticities is quite small, this intuition is supported by the elasticities calculated for initial moving costs of 10. For initial moving costs of 40 the picture is however different. Here one see that the absolute value of the price elasticity is largest for price increases reported in first period before any part of the initial plan is realised! This somewhat peculiar result origins in the effects on the moving career. As already shown, a price increase in period six announced at the start of period one

---

6 If four or more decimals had been included in the last column of table 4 one would have seen that the decline of the absolute value of the price elasticity is monotone in announcement date!
leads to an earlier move into the last of the two stays, this increases the housing consumption in the first stay. When the price increase is announced after the move into the first stay the consumer prefers to stay in this dwelling for five periods and avoid new moving costs, even though the stay one consumption is lower than what would have been preferred had the prices been known in advance. Loosely speaking, the resources that is not spent on housing early in the life span is then divided on housing consumption in the last stay and other consumption after the announcement. The later the announcement is made the less is spent on other consumption and the more is spent on housing in the last stay.

This last result is again a clear illustration of the fact that once moving costs is introduce some intuitive and standard results might be changed. It does also illustrate the problems associated by giving easy interpretable comparative statics on housing demand in a dynamic framework as long as positive moving costs is present.

Household changes

The time profile of the parameters of the utility function that is employed in the standard simulations may be regarded as the reflection of a plan for household composition. The high values of $\alpha$'s in the middle of the life span can then be seen as reflecting a plan of having children. In one part of the childrens life span very much of the households life is centred around the home and it is natural that housing consumption is given a high weight in the utility function through these years (in my example this is period 4 and 5).

I will perform simulations on two types of deviations from the planned path of household composition. D1 is a situation where for some reason or another, no children arrive in the household. The information on this deviation may arrive at different points in time. The second deviation, D2, is that children arrive, and also leaves, two periods earlier than originally planned. For simplicity I assume that only the $\alpha$-parameters differs between the standard case and the two deviations. These parameters are reported in table 4.

Table 4 - Parameters of the utility function under three different paths of the household composition

<table>
<thead>
<tr>
<th></th>
<th>Standard</th>
<th>D1</th>
<th>D2</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha_1$</td>
<td>0.18</td>
<td>0.18</td>
<td>0.18</td>
</tr>
<tr>
<td>$\alpha_2$</td>
<td>0.25</td>
<td>0.25</td>
<td>0.39</td>
</tr>
<tr>
<td>$\alpha_3$</td>
<td>0.32</td>
<td>0.32</td>
<td>0.39</td>
</tr>
<tr>
<td>$\alpha_4$</td>
<td>0.39</td>
<td>0.32</td>
<td>0.32</td>
</tr>
<tr>
<td>$\alpha_5$</td>
<td>0.39</td>
<td>0.32</td>
<td>0.32</td>
</tr>
<tr>
<td>$\alpha_6$</td>
<td>0.32</td>
<td>0.32</td>
<td>0.32</td>
</tr>
<tr>
<td>$\alpha_7$</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>$\alpha_8$</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
</tr>
</tbody>
</table>

The results of simulations of the demand paths under the household composition paths underlying the parameters of D1 and D2 are reported in table 5. Here it is also shown how the effect of the deviations depends on when the household got to know about the deviations. The headers of each of the columns tell when the household was 'informed' about the changes.
Table 5 - The demand for housing services from a household who is informed at different dates that their plan to have children cannot be fulfilled

<table>
<thead>
<tr>
<th>standard</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>51,0</td>
<td>46,1</td>
<td>51,0</td>
<td>51,0</td>
</tr>
<tr>
<td>2</td>
<td>51,0</td>
<td>46,1</td>
<td>51,0</td>
<td>51,0</td>
</tr>
<tr>
<td>3</td>
<td>51,0</td>
<td>46,1</td>
<td>51,0</td>
<td>51,0</td>
</tr>
<tr>
<td>4</td>
<td>51,0</td>
<td>46,1</td>
<td>51,0</td>
<td>51,0</td>
</tr>
<tr>
<td>5</td>
<td>51,0</td>
<td>46,1</td>
<td>51,0</td>
<td>51,0</td>
</tr>
<tr>
<td>6</td>
<td>51,0</td>
<td>46,1</td>
<td>51,0</td>
<td>51,0</td>
</tr>
<tr>
<td>7</td>
<td>34,9</td>
<td>46,1</td>
<td>34,2</td>
<td>34,0</td>
</tr>
<tr>
<td>8</td>
<td>34,9</td>
<td>46,1</td>
<td>34,2</td>
<td>33,7</td>
</tr>
</tbody>
</table>

If the information arrives before any commitment is made to the original plan the household choose one dwelling in which it stays throughout their planning horizon. Does information arrive later, the household will prefer to avoid moving costs and stay for six periods in the dwelling into which it already has moved, even though this implies an aggregate over-consumption of housing. The over-consumption must be balanced against a lower than desirable-consumption of housing in the last stay and of other goods and services after the information has been revealed. The earlier information arrives the more periods this under-consumption can be divided between. This explains that housing consumption is lower in the last stay the later information on the childlessness arrives.

Table 6 - The demand for housing services from a household where children suddenly appear before planned

<table>
<thead>
<tr>
<th>standard</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>51,0</td>
<td>39,1</td>
</tr>
<tr>
<td>2</td>
<td>51,0</td>
<td>68,5</td>
</tr>
<tr>
<td>3</td>
<td>51,0</td>
<td>68,5</td>
</tr>
<tr>
<td>4</td>
<td>51,0</td>
<td>44,6</td>
</tr>
<tr>
<td>5</td>
<td>51,0</td>
<td>44,6</td>
</tr>
<tr>
<td>6</td>
<td>51,0</td>
<td>44,6</td>
</tr>
<tr>
<td>7</td>
<td>34,9</td>
<td>44,6</td>
</tr>
<tr>
<td>8</td>
<td>34,9</td>
<td>44,6</td>
</tr>
</tbody>
</table>

In table 6 one notice some of the same structure as in table 5. If information on children appearing early arrives before any commitment to the plan is made, then major revisions to the plan is made. If information arrives after the first commitment is made then much smaller revisions takes place. Another point that may be made is that surprises certainly seem to affect moving plans. However one could not infer that a surprise triggers a move that is close in time to the surprise! A comparison of column 1 and 2 in table 6 confirms this. Children arriving at a foreseen point in time generate more moves than surprisingly arriving children!

Welfare effects of a stamp duty

An important part of the monetary moving costs for owner-occupiers is the stamp duty. This tax is in Norway paid by the buyer and amounts to 2.5% of the home price. Loosely estimated
the stamp duty accounts for 75% of the monetary moving costs. For a proper analysis of the welfare effects of the stamp duty one would of course need a equilibrium model in which house prices were endogenously determined. The dynamic framework of this paper may however be used to show the size of the welfare effects conditioned on different assumptions or hypotheses on the dependency between the size of the stamp duty and house prices.

I calculate welfare effects under three different hypotheses and denote them H1, H2 and H3.

H1: Prices of housing capital is not affected by reductions of the stamp duty. This leaves the prices of housing services independent of any changes of the stamp duty.

H2: A reduction of the stamp duty increases the net price of housing capital by the same amount. Assuming that 'real interest after tax' component of the price of housing services is 80% of the total price this implies that the price of housing services is increased by 2% as the stamp duty of 2.5% is removed.

H3: The net price of housing capital is increased by 50% of a reduction of the stamp duty. Implying that a complete removal of the stamp duty increases the prices of housing services by 1%.

The welfare effect of reduced stamp duty consists of two different components. Firstly one has the size of the cash payment needed to the make the consumer considered in my example, indifferent between a package consisting of the prevailing stamp duty and a cash payment and a reduction of the stamp duty. Thus, the welfare measure employed here is a measure of the compensating variation. The second effect is the result of a larger part of the total selling price of a dwelling going to its former owner. As long as the effect on net price is zero, as in H1 also this second effect is zero. In H2 the selling price (or net price) increase by the same amount as a reduction of the stamp duty, in H3 this second effect equals 50% of the direct effect on public income from the tax. The effects on housing consumption and welfare of a removal of the stamp duty under each of the three hypotheses are reported in table 7.

Table 7 - The effect of a complete removal of the stamp duty

<table>
<thead>
<tr>
<th></th>
<th>standard</th>
<th>H1</th>
<th>H2</th>
<th>H3</th>
</tr>
</thead>
<tbody>
<tr>
<td>h1</td>
<td>51.0</td>
<td>43.7</td>
<td>43.0</td>
<td>43.3</td>
</tr>
<tr>
<td>h2</td>
<td>51.0</td>
<td>43.7</td>
<td>43.0</td>
<td>43.3</td>
</tr>
<tr>
<td>h3</td>
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<td>59.0</td>
<td>58.0</td>
<td>58.5</td>
</tr>
<tr>
<td>h4</td>
<td>51.0</td>
<td>59.0</td>
<td>58.0</td>
<td>58.5</td>
</tr>
<tr>
<td>h5</td>
<td>51.0</td>
<td>59.0</td>
<td>58.0</td>
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</tr>
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<td>h6</td>
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<tr>
<td>Transfer</td>
<td></td>
<td>0</td>
<td>44</td>
<td>22</td>
</tr>
</tbody>
</table>

CV is the first component of the welfare-effect of reduced stamp duties, or the welfare gain of the consumer considered in the simulation. The row 'Transfer' gives the size of the transfer from the government to the original owner of the housing capital stemming from increases in net selling prices as the stamp duty is reduced.
The removal of the stamp duties leads the household I am looking at here to increase its number of moves from one to three. This increase of the moving activity is due to the fact that the reduction of the moving costs allows the consumer to reduce intertemporal mismatch in her housing consumption at a 'lower price'. A stamp duty can thus by no means be regarded as any lump-sum tax in so far as the tax leads to adjustments of the composition of the consumption vector in excess of pure income effects.

The interpretation of table 7 can be turned 'upside down' by using them to answer the question of how large is the cost imposed on the private sector when the government is collecting a tax income of 44 through a stamp duty. Under H1 this amounts to 59, under H2 and H3 the sum equals respectively 51.35 and 55.5. My simulations thus indicate that each money unit of tax income collected through a stamp duty imposes a cost on the private sector in the range 1.34 to 1.17. The stamp duty gives a dead-weight loss of somewhere between 17 and 34 percent of the tax income.

My simulations are thus indicating that the stamp duty is an inefficient tax. To conclude whether or not it is an undesirable tax one would of course have to compare it to the other inefficient taxes that are available to governments.

1.5 Conclusions

The paper gives a discrete time version of the model of endogenous moving activity resulting from a dynamic plan of housing demand developed by Amundsen (1985). My model is somewhat more flexible as I explicitly allow prices and parameters of the utility function to vary over time. This larger flexibility does not however give qualitatively new theoretical results. The central result both here and in Amundsen (1985) is that in the presence of moving costs households will move less frequently than without moving costs and that within a stay the household will equate instantaneous marginal substitution rates to instantaneous price ratios. Instead average discounted marginal substitution rates are equated to average discounted price ratios.

The larger flexibility of my approach does however facilitate a richer set of simulations. I show that changes in planned family size are affecting the planned housing career. The effect of such changes is furthermore shown to depend crucial on when the change is announced. That is, changes announced before commitments are made to an original plan generate larger adjustments than changes announced later. Within the framework of my model I replicate the results of Harrington (1989) who showed that demand reaction to changes in the price of housing services can be decomposed into a wealth effect and an intertemporal substitution effect. When moving costs is introduced one gets still another effect, which I denote the moving career effect. That is, as prices in one period change both the number of planned moves and the moving dates may change. This moving career effect might be positive and it might be negative. Indeed it is shown in table 2 that a positive moving career effect can dominate the negative wealth effect of a price increase.

The most interesting theoretical result in my paper arises when a stochastic process that may generate forced moves is introduced into the model of endogenous moving activity. I find that as the probability of being forced to move increases the willingness to accept an early mismatch in housing consumption, in order to avoid moving costs, decreases. This effect can
be so strong that an increase of the probability of a forced move make the consumer change her strategy from 'attempted stay' to be a mover.

A major part of the monetary moving costs for owner-occupiers is a stamp duty. The calibrated model is used to simulate the effects of removing the stamp duty. The simulations reveals that such a removal makes the consumer adjust her housing consumption closer to the first-best consumption of housing through an increased moving activity. Within the calibrated model it is argued that the cost of collecting public income through a stamp duty is somewhere between 17% and 34% of the income from the stamp duty. Thus, the stamp duty can by no means be regarded as any lump-sum tax.

Even though the model of this paper captures many aspects that is important in understanding the dynamics of housing demand it is built on many simplifying assumptions. In further work some of this should be relaxed. The most important of this is firstly to distinguish between different tenures. Moving costs in rental dwelling is probably lower than in owner-occupied housing, at the same time does the tax benefits produce a price of housing services that is lower in owner-occupied housing. This is of course important in an understanding of housing careers. Secondly, real world consumers face liquidity constraints which seriously affects the set of available housing careers, also this should be included in the analysis.
2. Cost Dispersion, Re-entry Costs and Rental Housing Markets

Abstract

The housing stock is in the paper assumed to be tenure flexible. A rental housing unit can be sold at the prevailing market price or let. In the presence of re-entry costs a sale will reduce possible future rental profitability. The return on rental housing consists of rental income and the value of the opportunity to utilise information revealed in the future. The opportunity to utilise future information can be regarded as a real option. The value of this tenure flexibility option may push equilibrium rents below the user cost of a comparable dwelling held by an owner-occupier.

0. Introduction

Units of housing capital can be used by owner-occupiers or tenants. There is no physical reason for some units to be rental units and others to be owner-occupied. Furthermore, there is no reason why a housing unit should stay over time within one particular tenure. This phenomenon may be termed the tenure flexibility of the housing stock (Nordvik, 2000). Together with positive re-entry costs, cost dispersion and stochastic house prices this paper shows that tenure flexibility can be a source of mutually advantageous rental contracts. By mutually advantageous contracts it is simply meant a rent that both yields a normal return on rental housing capital and is lower than the user cost an owner-occupier has in a similar housing unit. I show that such contracts can be found even if there is a tax advantage associated with owner-occupation and the landlord is not more efficient in running a housing unit than the consumer is. Furthermore the paper argues that the frequency of mutually advantageous contracts explain the equilibrium tenure distribution of the housing stock.

To facilitate the analysis a simple model of a housing market is developed. Landlords maximise profit, and a marginal supplier of rental housing is defined as a landlord who earns zero profit in excess of the normal rate of return. An intra-marginal supplier is a landlord with costs below the costs of the marginal supplier. Hence intra-marginal suppliers earn positive profits. Consumers choose tenure so that the cost of their housing consumption is minimised. A necessary and sufficient for a rental market to exist is that there exist a consumer-landlord pair such that the consumer’s user cost as an owner-occupier is higher than the reservation (or no-arbitrage) rent of the landlord.

The central part of the paper is the derivation of an expression for the difference between the reservation rent of a marginal supplier and the user cost of an owner-occupier. In the absence of moving costs the difference consists of three components. The difference between operating costs of a consumer and the marginal landlord, the tax advantage of owner-occupation and a component termed the tenure flexibility option. The difference between operating costs can have any sign. The tax advantage pushes the user cost down relative to the rent, while the tenure flexibility option pushes the rent down relative to the user cost.

The tenure flexibility option component captures the expected value of becoming an intra-marginal supplier next period, given that a supplier continues letting in the present period. In
short the economic intuition behind the value of the tenure flexibility option can be expressed by comparing the distribution of the period t+1 profits made by otherwise identical owners who sells respectively lets in t.

i) For some high asset price realisations non of the two owners will let in t+1, and both make zero profits.

ii) For some low asset price realisations the period t letter continues letting and the t-seller buys a unit and lets it. The profit of the re-entrant is lower than that of the period t letter because of the positive re-entry costs.

iii) For some middle-range price realisations the period t letter becomes intra-marginal and make positive profits. The profit is, however, not sufficiently high to make re-entry profitable.

The value of the tenure flexibility option is simply the value of retaining the possibility to draw advantages of situations such as ii) and iii) above. This value may be large enough to dominate the tax advantage of owner-occupation.

The strategy of this paper is to formulate a simple model that enable me to focus on tenure flexibility and to abstract from most other difficult aspects of housing markets in general and tenure choice in particular. This can be seen as a formulation of an 'analytic experiment'. Quite a lot of work remains in incorporating the mechanisms of the paper into theoretic models of housing markets that has closer resemblance to real world housing markets. Even more work is needed before these mechanisms can be an integrated part of empirical work on tenure choice. However, the mechanisms analysed give quite strong arguments against ignoring supply-side effects when interpreting empirically estimated tenure choice equations.

Even though there is a tax advantage associated with owner-occupation, it remains a fact that private rental housing amounts to a quite large share of the housing markets in most countries. Explanations of this phenomenon have been sought in interpersonal differences in marginal tax rates, (Swan, 1984), in higher transaction costs for owner-occupiers than for renters. Such cost differences are larger for short than for long expected stays (Rosenthal, 1988 and Henderson and Ioannides, 1989). There also exists some evidence that liquidity constraints bias housing demand towards rental housing (Haurin, 1991). Meyer and Wieand (1996) showed in an equilibrium model of a housing market where housing units are tenure flexible that there might exist mutually advantageous contracts between risk averse landlords and consumers if the ability to diversify risk differs between landlords and consumers. The basic idea is that an owner-occupied dwelling is such a large part of the portfolio of most consumers that owner-occupation prevents them from diversifying.

All these types of explanations are probably parts in a complete description of rental housing markets. Hence, this paper is not searching for explanations of the presence of rental housing markets that replace the reasons analysed in the literature referred above. Rather, in analysing some combined effects of re-entry costs and tenure flexibility of the housing stock, I identify and explore some mechanisms that together with the above mentioned literature contributes to the understanding of private rental housing markets.

Section 1 presents a stochastic process for asset prices of housing capital and some of the simplifying assumptions on which the model is built. Supply decisions of potential landlords
are described in Section 2, while Section 3 explores tenure choices of cost minimising consumers. Equilibrium in the model is analysed in Section 4. Concluding remarks are given in Section 5.

2.1 Background

The markets studied in this paper are in many respects quite simple compared to real world housing markets. The most important deviations, or simplifying assumptions, are presented in this Section. Housing units are homogeneous, and consumers do not have preferences over tenure. Markets of both rental and owner-occupied housing are competitive; neither consumers nor landlords have power to set prices. All agents in the market share expectations over future house prices. All agents on both sides of the market are risk-neutral. Both consumers and landlords face the same after-tax interest rate \( \varphi \) on a perfect capital market.

At any point in time \( t \) the asset price \( P_t \) is observed before any action is taken. The price of period \( t+1 \) is assumed to be a realisation of a stochastic variable with a known expectation \( E(P_{t+1}) \). The distribution of the period \( t+1 \) price is affected by the realisation of \( P_t \). As I throughout the paper deals with the choices made by consumers and landlords after \( P_t \) is revealed I treat \( P_t \) as a predetermined non-stochastic variable. Consequently \( E(P_{t+1}) \) and the density \( f(P_{t+1}) \) is not written as conditional on \( P_t \).

At \( t+1 \) when the realisation of \( P_{t+1} \) is revealed agents revise their expectation of the central moment of the distribution of the price of period \( t+2 \). This expected \( t+2 \) price given information on the realisation of the period \( t+1 \) price is \( E(P_{t+2}|P_{t+1}) \). There may be some serial correlation in the price process. Poterba (1984) showed in a no-arbitrage setting that demand shocks leads to short-run over-shooting in house prices. In the longer run house prices adjust to a new long-run asset market equilibrium. The driving force of this effect is that housing supply (or the size of the housing stock) cannot be adjusted instantaneously to changing demand. One particular specification of a price process consistent with the Poterba-model, i.e. has the desired mean-reversion property, and at the same time is quite simple is given in (1).

\[
E(P_{t+2} | P_{t+1}) = (1 + k)E(P_{t+1}) + \beta(P_{t+1} - E(P_{t+1}))
\]

(1)

\( k \) is the expected growth rate of house prices.\(^7\)

Consider an agent who observes the house price in period \( t \). At \( t \) he expects the period \( t+1 \) price to be \( E(P_{t+1}) \) and the \( t+2 \) price to be \( (1-k)E(P_{t+1}) \). At \( t+1 \) he revises his expectation over the period \( t+2 \) price. The information that can be inferred from the price realisation \( P_{t+1} \) is used in this revision. A \( P_{t+1} \) above what was expected leads to an upwards adjustment of \( E(P_{t+2}) \), while an unexpectedly low realisation leads to a downwards adjustment. As long as \( \beta < (1+k) \) the absolute revision is lower than the forecasting error of the \( t+1 \) price. This is necessary for the process to be mean-reverting. A \( \beta > 0 \) will emerge as long as forecasting

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\(^7\) As pointed out by one referee: the assumption of risk neutrality is not so restrictive as it at first instant seems. The operating costs of landlords and owner-occupiers can be interpreted as certainty equivalent values of agents who exhibit different tolerance towards risk.

\(^8\) No-arbitrage in house price implies that \( k < \varphi \).
errors are results of demand shocks that, at least to some extent, affects demand also in future periods, and there is some inertia in the adjustment of housing supply.

In addition to the theoretical arguments for house prices being mean reverting, estimated error correction models of house prices also support this hypothesis. A majority of these models finds that the growth of house prices correlates significantly and negatively with the forecasting error of the preceding period. Hort (1998) reviews some of these results. A negative correlation implies that the value of the parameter $\beta$ is less than $(1+k)$. Further discussions of properties of a process like (1), for different values of $\beta$, are given in Nordvik (2000).

The information that can be inferred from a price realisation varies with the value of the parameter $\beta$. A parameter value equal to zero implies that a price realisation $P_{t+1}$ does not give any information relevant for a revision of expected future prices. However, in this case the price realisation leads to a one-to-one revision of the difference between the $(t+1)$ price and the discounted $(t+2)$ price. Later in the paper this difference will be showed to play an important role. At a $\beta$-value equal to $(1+k)$ the price process will be a random walk with a trend. In this case $P_{t+1}$ can really be said to contain information on $E(P_{t+2})$ as it is the only information needed to make a prediction. Consequently there is no inertia in the price process and realisations of $P_{t+1}$ will not contain any information relevant for a revision of the expected difference between the $(t+1)$ price and the discounted $(t+2)$ price.

In the same way as house prices the period $t$ rent ($r_t$) is observed at the start of period $t$. Both demanders and suppliers are assumed to have perfect foresight and know which $r_{t+1}$ each realisation $P_{t+1}$ yield. This assumption makes the analysis considerably less complex than it otherwise would have been. The main mechanism behind the result of the paper is that a part of the return on rental housing is the value of the tenure flexibility option. If a stochastic process for rents is introduced the value of this option increases. The economic intuition behind this claim is that the value of the tenure flexibility option is essentially the expected value of revising choices as new information arrives in the future. This value increases as the amount of relevant information revealed at $t+1$ increases. In the concluding remarks this is further discussed.

The theme of this paper is how a tenure flexible housing stock is divided between landlords and owner-occupiers for any given market prices. Therefore I will not close the model by going into how these prices are arrived at. One possibility is to think of the asset prices of housing capital as determined by a stochastically generated number of new consumers.

### 2.2 Supply of Rental Housing

Supply of rental housing is essentially treated in the same way as in the partial supply analysis of Nordvik (2000). Landlords compete with owner-occupiers and must sell or buy housing units at the prevailing market price. The planning horizon of landlords, who are maximising the net present value of their stream of income, is taken to be three periods long. That is, at every period, $t$, no landlords consider letting in period $t+2$. The assumption of a finite planning horizon is made because it makes the calculus less messy, as it implies, as shown in Nordvik (2000), that the optimisation of the landlords can be described by a straightforward application of Bellmans principle.
In the three-period economy analysed in this paper I start by analysing the let decisions in period t+1. Two strategies are open to a potential landlord, either to let or to sell (or not to buy). Those who get an expected pay-off from the letting strategy at least as high as the market price of the housing unit will let. The period t decisions are a little bit more complex. For letting to be profitable the expected pay-off from the letting strategy must be at least as high as the sum of the market price of the housing unit and the value of the possibility (or option) to re-enter the rental market next period. It should be noted that the purpose of the paper is to analyse how letting decisions are affected by the fact that housing units in the future can be moved from one tenure to another.

Each landlord is characterised by a cost of being in the rental market, \((c^1_t, c^{t+1}_t)\). The cost of being in the rental market is continuously distributed on the interval \((c^1_t, c^2_t)\) according to the density \(h_c(c_t)\). These densities are known by all potential landlords and demanders. The main component is operating costs. One can think of the costs to be affected by capital gains taxes. Most countries tax nominal capital gains on realisation rather than on an accrual basis. Housing units that have been let for a long time can consequently have a quite large tax credit. The value of this pushes down the cost of staying a landlord, \(c^1_t\). Different buying dates of the rental stock provides under this interpretation an explanation of the spread in the distribution of the landlord costs.

If landlord \(i\) withdraws from the rental market by selling her unit in period \(t\), she can of course re-enter the rental market by buying a unit when she observes a new house price at the start of period \(t+1\). However, her period \(t+1\) operating costs when re-entering the rental market \(c^{t+1}_{r,i}\) may be higher than they would have been had she not left the market in period \(t\). If \(\delta^i_{t+1}\) is the cost disadvantage of leaving and re-entering the market, the operating cost upon re-entering can be written as \(c^r_{t+1} = c^i_{t+1} + \delta^i_{t+1}\). A positive shift in the operating costs when re-entering the rental market can be traced back to many different sources. The shift can be caused by transaction costs or by reduced efficiency in running rental housing during the time the landlord are 'out of business'. Finally, and may be most important, when a dwelling is sold the tax credits must be paid. When re-entering the rental market a landlord starts off with zero tax credit. These causes and their relative importance will not be further explored in this paper.

The profitability of letting depends on the developments of rents and house prices. A landlord who buys or keeps a housing unit in \(t\) will in this period collect the market rent \(r_t\). After the market price of next period is revealed she will choose whether to let or sell. She will let if:

\[
P_{t+1} < (r_{t+1} - c^{t+1}_t)(1-\tau) + (1+\varphi)^{-1}E(P_{t+2}\mid P_{t+1})
\]

(2)

\(\tau\) is the tax rate employed on net rents that the landlord is facing. The tax rate is assumed to be equal for all potential landlords. One can think of (2) as a 'landlord participation constraint'. If (2) applies for a potential landlord she will be an 'active landlord'; otherwise she will step out of the rental market by selling the housing unit. In short the landlord participation constraint will be termed the participation constraint in the rest of the paper. A marginal supplier is a landlord who earns zero profit (in excess of the normal rate of return). The operating cost of the marginal supplier, \(c^M_{t+1}\), is defined by (3):

\[
r_{t+1} = c^M_{t+1} + \{P_{t+1} - (1+\varphi)^{-1}E(P_{t+2}\mid P_{t+1})\}(1-\tau)^{-1}
\]

(3)
By inserting (3) into (2) and rearranging, one sees that landlord \( i \) will let in period \( t+1 \) if she is more cost efficient than the marginal supplier. Hence, the participation constraint reduces to \( c^M_{t+1} - c^i_{t+1} > 0 \). By definition \( c^M_{t+1} \) is a function of the price realisation of period \( t+1 \). Equation (3b) offers another way of expressing the competitive period \( t+1 \) rent, where the expected price process (1) is inserted.

\[
r_{t+1} = c^M_{t+1} + \frac{P_{t+1}(1 + \varphi - \beta) - E(P_{t+1})(1 + k - \beta)}{(1 + \varphi)(1 - \tau)} \tag{3b}
\]

As \( P_{t+1} \) increases, letting (and renting) becomes relatively less attractive. A positive shift in \( P_{t+1} \) will thus reduce the number of potential landlords who actually chooses to let. The most inefficient landlords (i.e. with the highest operating costs) will leave the rental market first. Thus, the operating costs of the marginal supplier of rental housing will be decreasing in \( P_{t+1} \).

For any specific landlord \( i \) an indifference price \( D^i_{t+1} \), at which she is indifferent between letting and selling, can be defined. This particular value \( D^i_{t+1} \) is the unique solution to the equation \( c^M_{t+1} - D^i_{t+1} = 0 \). If the price is higher than \( D^i_{t+1} \) she sells, if it is lower she lets. This definition of \( D^i_{t+1} \) can be used to write an expression for landlord \( i \)'s expected value of letting a dwelling in \( t \) period:

\[
\Pi'(r_t) = (r_t - c^i_t) (1 - \tau) + (1 + \varphi)^{-1} \int_{-\infty}^{r_t} (r_{t+1} - c^i_{t+1})(1 - \tau) + (1 + \varphi)^{-1} E(P_{t+1} \mid P_{t+1}) f(P_{t+1}) dP_{t+1}
\]

\[
+ (1 + \varphi)^{-1} \int_{P_{t+1}}^\infty P_{t+1} f(P_{t+1}) dP_{t+1}
\]

Then \( 0 = \int_{-\infty}^{r_t} P_{t+1} f(P_{t+1}) dP_{t+1} - \int_{-\infty}^{r_t} P_{t+1} f(P_{t+1}) dP_{t+1} \) is added to (4) and the equilibrium rent from (3) is inserted and one gets after some rearranging (4b).

\[
\Pi'(r_t) = (r_t - c^i_t)(1 - \tau) + (1 + \varphi)^{-1} \int_{-\infty}^{r_t} (c^M_{t+1} - c^i_{t+1})(1 - \tau) f(P_{t+1}) dP_{t+1}
\]

\[
+ (1 + \varphi)^{-1} \int_{-\infty}^{r_t} P_{t+1} f(P_{t+1}) dP_{t+1}
\]

\]

\[
\tag{4b}
\]

40
The expected value of selling in period $t$ ($S^t$) equals the sum of the market price and the value of the option of re-entering the market by buying and letting in period $t+1$. A landlord $i$ who sold in $t$ will re-enter the market in $t+1$ at prices below $Q^t_{i+1}$. This indifference price is defined by (5):

$$Q^t_{i+1} = (r_{i+1} - (c^t_{i+1} + \delta^t_{i+1}))(1 - \tau) + (1 - \phi)^{-1} E(P_{i+1} | Q^t_{i+1})$$

By comparing (2) and (5) one sees that as long as the cost disadvantage of leaving and re-entering the market is positive the price that leaves an individual who has stopped letting indifferent between re-entering and staying out is strictly lower than the indifference price of an active landlord. Using (5) and (3) one sees that it will be profitable to re-enter the supply side of the rental market as long as $c^{M+1}_{i}(P_{i+1}) > c^t_{i+1} + \delta^t_{i+1}$.

The expected value of selling the dwelling in period $t$ ($S^t_i$) is:

$$S^t_i = P_i + (1 + \phi)^{-1} (1 - \tau) \int_{-\infty}^{Q^t_i} [c^M_i(P_{i+1}) - c^t_i - \delta^t_i] f(P_{i+1}) dP_{i+1}$$

Like in period $t+1$ there is also a marginal supplier in period $t$, i.e. an owner whose expected pay-off from letting equals the expected pay-off from selling. Her cost $c^u_i$ can be read out of a rearranging of the condition $\Pi^u_i(t_i) = S^t_i$. The relation between the operating costs of a marginal supplier and the market rent must therefore be as in (7):

$$r_{i} = c^u_i + P_i - (1 + \phi)^{1} E(P_{i+1})$$

$$- (1 + \phi)^{-1} \left\{ \int_{-\infty}^{Q^u_i} \delta^u_i f(P_{i+1}) dP_{i+1} + \int_{Q^u_i}^{Q^t_i} [c^M_i - c^t_i] f(P_{i+1}) dP_{i+1} \right\}$$

The value of the tenure flexibility option in equation (7) has two components. For any period $t+1$ house price below $Q^u_{t+1}$, the marginal supplier will be an active landlord (i.e. she will let) even if she sold in the preceding period. Did she sell; she will earn a positive profit by buying a unit and let it. However, for such low price realisations the profit made by a re-entering landlord will, because of the positive re-entering costs, be lower than the profit made by a landlord who stayed in the market. This is captured by the first component in (7). At prices in between the two indifference prices the marginal supplier in period $t$ earns a positive profit because she is more cost efficient than the marginal supplier in period $t+1$. For all prices in this interval the excess profit will be lower than the re-entering cost $\delta^u_{t+1}$.

Hence, the economic explanation of the existence of a positively valued real option connected to ownership to rental housing unit can in the particular model of this paper be traced back to three causes. Firstly, it is the stochastic nature of house prices. Secondly, it is the
heterogeneity of landlords with regard to their operating costs. Thirdly, the fact that there is some kind of irreversibility in the choice of selling the dwelling. By this I am referring to the fact that there is a cost disadvantage associated with re-entering the market. It should be noted that if the re-entering cost disadvantage δ_{t+1} for all potential landlords, equals zero the two indifference prices will coincide, i.e. \( Q_{t+1}^{1} = D_{t+1}^{1} \), and the option in (7) vanishes.

Equilibrium rents developed in other theoretical work on rental housing markets and tenure choice differs from my expression. The equilibrium rent described by others equals the first two terms of the right hand side of (7).\(^9\) If there is some cost disadvantage associated with re-entry on the supply side of a rental housing market, ignorance of the (real option) value of optimal utilisation of information arriving later leads to a systematic overestimation of no-arbitrage, or equilibrium, rents.

Aggregate supply of rental housing in period \( t \), is of course equal to the size of the set of potential landlords who has an operating cost below the operating cost of a marginal supplier \( c_{t}^{a} \). Hence aggregate supply is decreasing in the period \( t \) house price.

One minor technical point is worth noting. The expression (7) was derived under the condition that the ordering of the \( c_{t}^{1} \)'s is the same as the ordering of the \( c_{t+1}^{1} \)'s. This condition ensures that no landlord with a \( c_{t}^{1} > c_{t}^{a} \) is able to make zero profit on a rent below what is given in (7). Had this condition not been fulfilled it is possible that some landlords with higher period \( t \) costs than the cost of the marginal supplier, had been able to make zero profit at a lower rent because of them having a high value of the real option.

### 2.3 Tenure Choice of Consumers

Consumers live for two periods. In short I term consumers in the first period of their life as young, consumers in their second period are termed old. Analysis of tenure choice within a single period must consequently deal with three different types of consumers: old tenants, old owner-occupiers and young consumers entering the housing market. Under the assumptions given in Section 1, housing choice is a choice of tenure and a consumer chooses the tenure that gives him the lowest net present value of the housing costs.

First period housing choices of young consumers will affect the costs of housing consumption of the second period. The dependency between first period housing choice and second period cost works through two different channels. Firstly, if part of a consumer's wealth is held in the form of owner-occupied housing, he is of course exposed to changes in the asset price of housing. Secondly, if a consumer wants to change tenure in the second period he would face moving costs. Consequently, first period choices should be regarded as the first steps of a dynamic plan for the consumers' housing consumption. At first instant it seems like a young household who is about to enter the housing market has four possible strategies, or combinations of renting (R) and owner occupying (O) over its two period long lifecycle:

\[(R, R), (R, O), (O, R) \text{ or } (O, O)\]

\(^9\) This applies to among others Henderson and Ioannides (1983) and Rosenthal (1988).
I will claim that it makes more sense to reduce this set of possible plans to two. Rent (or buy) a housing unit for the present period, and do whatever is advantageous at the start of next period. 'Whatever is advantageous at the start of next period' depends on the realisation of the stochastic market price, which will be revealed at the start of next period. This Section will give a thorough discussion of the costs of each of the two tenures. Some of the results may be interesting in its own right. However, the main purpose is to shed light on the determinants of cost differences between tenures, because the sign of this difference determines tenure choice.

Before turning to the costs under each of the strategies, the phrase 'Whatever is advantageous at the start of next period' must be discussed a little bit closer. In the last period a consumer chooses the tenure yielding the lowest discounted housing expenses. Before turning to a more formal discussion of the choices, some symbols will have to be defined (all subscripts refer to period):

\[ m_{t+1} \] is the cost of moving into a rental housing unit
\[ M_{t+1} \] is the cost of moving into an owner-occupied housing unit
\[ \theta_{i} \] is household i's operating costs
\[ f(P_{t+1}) \] is the density of the period t+1 price

Did the household owner-occupy in its its first period, they will continue as owner-occupiers if:

\[ r_{t+1} + m_{t+1} - P_{t+1} > \theta_{i} - (1+\phi)^{-1} E(P_{t+2}| P_{t+1}) \]  \hspace{1cm} (8)

If the inequality is reversed the household will move on to a rental unit. By replacing the 'larger than' in (8) with equality, equation (9) which defines the price at which a sitting owner-occupier, i, will be tenure indifferent in the last period \( (V^i_{t+1}) \), is obtained.

\[ r_{t+1} + m_{t+1} - V^i_{t+1} = \theta_{i} - (1+\phi)^{-1} E(P_{t+2}| P_{t+1}) \]  \hspace{1cm} (9)

In interpreting (8) and (9) it should be remembered that the rent \( r_{t+1} \), depends on the price realisation \( P_{t+1} \) and the expected period t+2 price \( E(P_{t+2}| P_{t+1}) \).

If the indifference price \( V^i_{t+1} \) exists for a particular consumer i, it will also exist for all consumers with higher operating costs. At prices above (below) the indifference price consumer i will prefer to continue as owner-occupier (switching over to tenancy). To see this, think about a price equal to the indifference price plus some small amount \( \Delta \). This increases the cost of ownership for both owner-occupiers and landlords by the same amount. For a tenant to compensate the landlord for the increased cost, a rent increase has to cover both \( \Delta \) and the tax increase for the landlord. For renting to be a sensible choice for a consumer he must have an inefficiency in operating a housing unit larger than the tax disadvantage of renting. When prices increase the tax disadvantage increases while the inefficiency is left unaffected. Hence, the attractiveness of renting is decreasing in the price of housing capital.

\[ \text{10 It may be noted that the results in this paper is depending on the existence of some } V^i_{t+1} \text{'}s, but not on this indifference price existing for all } i. \]
The discussion of period \( t+1 \) choices of sitting owner-occupiers is done because optimal reactions towards information arriving in \( t+1 \) is embedded within the cost of choosing owner-occupation in \( t \). The expected discounted cost of choosing an owner-occupied dwelling in the first period \( t \), \( B'(O_t) \), can be written as (10):

\[
B'(O_t) = M_t + \{P_t + o'_t\} + (1 + \varphi)^{-1} \left\{ \int_{r_{t-1}}^{r'_{t-2}} \left[ (o'_{t+1} - (1 + \varphi)^{-1} E(P_{t+2} | P_{t+1}) \right] f(P_{t+1}) dP_{t+1} \right\} \]

\[-(1 + \varphi)^{-1} \left\{ \int_{-\infty}^{r_{t-1}} \left[ r_{t-1} + m_{t+1} - P_{t+1} \right] f(P_{t+1}) dP_{t+1} \right\} \]  

(10)

Some straightforward manipulations allow me to rewrite this as (11).

\[
B'(O_t) = M_t + \{(P_t - (1 + \varphi)^{-1} E(P_{t+1}) + o'_t\}

+ (1 + \varphi)^{-1} \left\{ \int_{-\infty}^{r_{t-1}} \left[ o'_{t+1} + P_{t+1} - (1 + \varphi)^{-1} E(P_{t+2} | P_{t+1}) \right] f(P_{t+1}) dP_{t+1} \right\} \]

\[-(1 + \varphi)^{-1} \left\{ \int_{-\infty}^{r_{t-1}} \left[ (o'_{t+1} - (1 + \varphi)^{-1} E(P_{t+2} | P_{t+1}) \right] - (r_{t-1} + m_{t+1} - P_{t+1}) \right\} f(P_{t+1}) dP_{t+1} \} \]

(11)

One may note that the first two bracketed terms of (11) equal the user cost of housing capital, for period \( t \) and \( t+1 \), as it is usually expressed (see Smith et al., 1988 and Poterba, 1984). The last term of (11), which is not present in traditional expressions of the user costs, is the value of the real option to move over to a rental dwelling later on. The value of this option is always positive. Thus, traditional measures of the user costs of owner-occupiers are biased upwards! At least this statement is valid as long as the user cost concept is intended to capture the cost of owner-occupancy of one period. If the user cost is meant to be a measure of the housing costs of households who have entered owner-occupation and stay within this tenure throughout its life, then my critique is irrelevant. The positive bias is due to a neglect of the value of stepping out of owner-occupation whenever it is advantageous.

A similar expression of the discounted stream of housing expenses given that the household is renting in period \( t \), \( B'(R_t) \), and plan to revise its tenure choice at the start of period \( t+1 \) when new price information is revealed, is given in (12). Also this is written as the discounted sum of expected rental costs over the two periods minus the value of being able to switch over to be an owner-occupier in period \( t+1 \) if that is advantageous.

\[
B'(R_t) = m_t + r_t + (1 + \varphi)^{-1} \int_{-\infty}^{r_{t-1}} f(P_{t+1}) dP_{t+1}

-(1 + \varphi)^{-1} \int_{-\infty}^{r_{t-1}} \left[ r_{t-1} - (M_{t+1} + o'_{t+1} + P_{t+1} - (1 + \varphi)^{-1} E(P_{t+2} | P_{t+1}) \right] f(P_{t+1}) dP_{t+1}
\]

(12)
The indifference price of a sitting tenant $W_{i,t+1}$ is a house price such that a period $t$ renter $i$, is switching over to owner-occupation for all $P_{i,t+1}$ above $W_{i,t+1}$ and continues renting for all $P_{i,t+1}$ lower than $W_{i,t+1}$. $W_{i,t+1}$ is defined equivalently to how $V_{i,t+1}$ is defined as the solution to (8).

Tenure choice in my model is intuitively appealing. The consumer is simply choosing the (expectedly) most inexpensive way of buying the housing services he needs. If the difference $B'(R_i)-B'(O_i)$ is positive (negative) then he buys (rents) a dwelling in period $t$.

I assume that the households differ by the operating costs they will experience as owner-occupiers. Operating costs are distributed with a density $g_o(o_i)$ on an interval $(o_i^*, o_i^-)$. Differences in operating costs can originate in different consumers imposing different need for maintenance on a dwelling, and its sources may be differences in the efficiency of operating a housing unit. My model treats differences in operating costs as stemming from the latter source. The operating cost of a landlord is assumed not to depend on any of the characteristics of a particular tenant. If households differ in the operating costs they impose upon a rental dwelling there will be an adverse selection of households into the rental sector. It may be that there would not exist any rental market in equilibrium under adverse selection (see Akerlof, 1970).

Defining $o_i^*$ as a solution to $B'(R_i)-B'(O_i)=0$, every young household with an $o_i^*>o_i^*$ will be tenants and every household with an $o_i^*<o_i^*$ will be owner-occupiers. Aggregate demand consists of the demand for rental housing from old tenants, old renters and young renters.

### 2.4 Tenure Distribution in Equilibrium

If there exists a rental market in period $t$, landlords must not be better off withdrawing from the market. Hence equilibrium rent must be as given in (7). This section discusses conditions under which there will exist a rental market in my model. I start from the assumption that the participation constraint is fulfilled for some landlords and investigate conditions that must be fulfilled for some consumers to choose to rent their housing unit. Because of the problems caused by the use of a terminal period, the discussion in this Section is focused upon the equilibrium tenure distribution of period $t$, i.e., two periods before the terminal period.

First the young generation is considered. The main strategy of the paper is to show that there might exist a rental market in my model. For this purpose it suffices to show conditions under which the young generation's demand for rental housing is strictly positive. Equilibrium rents of periods $t$ and $(t+1)$ are inserted into an expression for the cost-difference $B'(R_i)-B'(O_i)$. Equation (13) is a slightly rearranged version of the cost difference in equilibrium. If there exists values of $o_i^*$ inside the interval $(o_i^*, o_i^-)$ that yields a negative cost difference, there exist young tenants in equilibrium.
\[ B'(R_t) - B'(O_t) = (m_t - M_t) \]
\[ + \left( (c_t^n - a_t') + \frac{\tau}{1 - \tau} \{ P_t - (1 + \phi)^{-1} E(P_{t+1}) \} \right) \]
\[ - \frac{1}{1 + \phi} \int_{-\infty}^{\infty} \delta_{x_t} \, f(P_{t+1}) \, dP_{t+1} + \int_{-\infty}^{\infty} \left( [c_{x_t} - \tilde{c}_{x_t}] f(P_{t+1}) \, dP_{t+1} \right) \]
\[ + (1 + \phi)^{-1} \int_{-\infty}^{\infty} \left( (c_{x_{t+1}} - a_{x_{t+1}}) + \frac{\tau}{1 - \tau} \{ P_{t+1} - (1 + \phi)^{-1} E(P_{t+2} | P_{t+1}) \} \right) f(P_{t+1}) \, dP_{t+1} \]
\[ + (1 + \phi)^{-1} \int_{-\infty}^{\infty} \left( [m_{x_{t+1}} - (c_{x_{t+1}} - a_{x_{t+1}}) - \frac{\tau}{1 - \tau} \{ P_{t+1} - (1 + \phi)^{-1} E(P_{t+2} | P_{t+1}) \} \right) f(P_{t+1}) \, dP_{t+1} \]
\[ - (1 + \phi)^{-1} \int_{-\infty}^{\infty} \left( [m_{x_{t+1}} + (c_{x_{t+1}} - a_{x_{t+1}}) + \frac{\tau}{1 - \tau} \{ P_{t+1} - (1 + \phi)^{-1} E(P_{t+2} | P_{t+1}) \} \right) f(P_{t+1}) \, dP_{t+1} \]

It is not a straightforward exercise to interpret the equation determining tenure choice in equilibrium in its form (13). I will therefore show how the cost difference can be interpreted in the special case where moving costs equal zero. This is done in order to focus on effects of tenure flexibility at the supply side of the rental housing market. The first fact to be noted is that both indifference prices of a consumer will coincide when moving costs equal zero, i.e. \( W_t = V_t \). The cost difference between choosing tenancy and owner-occupation at \( t \) is then reduced to (14). The main reason for the tenure equation being so much simpler when moving costs equal zero is that all lock-in effects on the demand side disappear. \(^{11}\)

\[ B'(R_t) - B'(O_t) = (c_t^n - a_t') + \frac{\tau}{1 - \tau} \{ P_t - (1 + \phi)^{-1} E(P_{t+1}) \} \]
\[ - \frac{1}{1 + \phi} \int_{-\infty}^{\infty} \delta_{x_t} \, f(P_{t+1}) \, dP_{t+1} + \int_{-\infty}^{\infty} \left( [c_{x_t} - \tilde{c}_{x_t}] f(P_{t+1}) \, dP_{t+1} \right) \]

The last term, the 'the real option value of tenure flexibility', is by necessity positive and when it appears with a minus in (14) it contributes towards a reduction of the cost advantage of owner-occupation over tenancy. As is assumed in this model, and indeed observed in most countries, there is a tax advantage of owner-occupancy over tenancy. This is captured by the second term in (14) and contributes towards an increase in the cost advantage of owner-occupancy. Without specifying the probability distributions of period \( t+1 \) price and operating costs more it is not possible to conclude on the sign of the sum of the two last terms.

The surprising result that can be read out of equation (14) is that one, in equilibrium, can find cost minimising consumers renting from landlords who are less efficient in operating a housing unit than the consumer would have been as an owner-occupier. Hence even though there is a tax advantage associated with owner-occupancy one cannot on theoretical basis rule out the possibility that a landlord will offer a rental contract that is accepted by a consumer.

\(^{11}\) A sketch of an interpretation of the equilibrium tenure choice equation is given in appendix 1.
The reason of this is that the positively valued tenure flexibility option pushes the reservation rent downwards.

Consider the special case where the operating costs are interpreted as certainty equivalent values (see note 1) and different attitude towards risk are the only source of the spread in the distribution of the operating costs. Then the result above means that more risk averse landlords lets to less risk averse consumers.

Next question to be addressed is how positive moving costs affects the conclusion that mutually advantageous rental contracts can exist even between a consumer-landlord pair where the consumer is most efficient in operating a housing unit. The discussion of this will be done under the assumption that for all the cost of moving into owner-occupancy (M_i) is higher than the corresponding cost on rental dwellings (m_i). The total effect of such tenure-asymmetric moving costs can be described as consisting of three types of partial effects:

a) The cost difference in favour of owning is pushed downwards by the immediate effect that the cost of moving into an owner-occupied dwelling is higher than the cost of moving into tenancy.

b) The cost of choosing tenancy in the first period increases because the direct cost of moving over to owner-occupancy next period increases. In addition the interval on the price distribution at which a sitting tenant is locked in by his historical tenure choice is increased, i.e. the cost of moving over to owner-occupancy constrains the possibility to take advantage of lower housing costs in owner-occupancy as compared to tenancy. The total effect is that the cost difference is pushed upwards.

c) An effect similar to b) applies to the cost of owner-occupancy. It is increased because of the increased cost of moving over to tenancy. The total effect is that the cost difference is pushed downwards.

The question of how the cost difference of a particular consumer is affected by the introduction of tenure-asymmetric moving costs, or what is the sign of the sum of the three effects above, can not be given unless more specified functional forms is used. As it is assumed that operating costs is continuously distributed this non-result concerning the effects of tenure-asymmetric moving costs also applies to the size of the rental sector in equilibrium. This inability to draw conclusions on how the existence of moving costs affects rental demand in equilibrium stands in contrast to results in Rosenthal (1988) among others. The difference arises because the model of this paper abstracts from many features of real world rental housing markets. An example is that length of stay in my model is determined by realisations of the stochastic asset price of housing capital and not by demographics and job opportunities.

As shown in the discussion of tenure choice of consumers, tenure choice of the old consumers resembles that of the young consumers. It resembles, but it is somewhat simpler as old consumers do not have to take account of how present tenure choice affects the choice of next period. On the other hand the choices of the old generation are strongly affected by their historic choices.

2.5 Concluding remarks

The analytic experiment performed in this paper gave two important results. The first is that the equilibrium rent in a competitive market can be written as a sum of three components. These are the operating costs of a marginal supplier, the alternative cost of capital held as
rental housing (corrected for expected appreciation of house values) and the negative of a positively valued real option. Earlier work on rental housing markets has only identified the first two of these three components. Hence, no-arbitrage rents have been over-estimated. The ignored component, i.e. the real option value, captures the expected value of becoming an intra-marginal supplier in next period, and hence to earn an extra-normal profit in this period. The second result is that when equilibrium rents is pushed down by a tenure flexibility option one might, in equilibrium, find inefficient landlords letting to efficient owner-occupiers. The value of the tenure flexibility can hence be large enough to overcome both the tax advantages associated with owner-occupation and an owner-occupier's cost efficiency in operating a housing unit. The second 'result' is a direct consequence of the first one.

These results are identified within a theoretical model that in one sense is not closed. It is not closed in so far as it does not explain how equilibrium asset prices are determined. This was done because my ambition was to show how tenure distribution in equilibrium is determined, and in order to keep the model as simple as possible. However, as the central results of the paper apply for all prices, I do not see this as being any major weakness of the paper!

As argued above, my paper establishes theoretical results not identified for rental housing markets before. What remains are to find out whether this point is empirical relevant for real world rental housing markets or not and if relevant: what is the quantitative significance of it. Can the value of tenure flexibility option be estimated and can it be established how it affects rents in real world rental housing markets? No attempt to address this empirical question will be made here. However, it may be noted that Crook and Kemp (1996) find some evidence, which can be used as indications of equilibrium rents being pushed down by a real option value. In a nationally representative sample of lettings from Britain, 1993, they find that 'the discounted net rental stream and expected capital gain from letting residential property is still significantly less than the price owner occupiers are prepared to pay for properties' (p.59). Here one should also note that the size of the private rental sector had been growing in the years prior to 1993, indicating that the 'low' return was not a temporary phenomenon occurring while the size of the private rental stock was adjusting downwards.

The model employed in this paper is quite simple. Further research is needed to show whether the results are robust to changes in the simple model. One important feature would be to allow for imperfect competition. In reality, housing units are highly heterogeneous, yielding thin housing markets in which landlords have some sort of market power (see Arnott, 1989).

Option values may be under-estimated by the model I have been employing. The only source of stochastics in the return of rental housing in the model is a stochastic process for the asset price of housing capital. In addition to this it is also possible that there is a stochastic element in aggregate rental demand which is independent of the house prices. Such stochastics in the rental demand is probably important empirically. It can, among other things, be a result of variations in credit availability among 'marginal home-buyers' and/or stochastic elements in the processes behind formation of new households (moving out from parents).

User costs of owner occupied housing are also showed to be pushed down by the value of an option to step out of owner-occupation at a desirable point in time. Using this result and the corresponding results for housing costs for tenant may extend our knowledge of 'the path of tenure choices' of newly formed households. This finding is however not thoroughly discussed in the paper.
Appendix 1

This appendix shows how the tenure choice equation can be decomposed when moving costs are positive. The decomposition is done so that each of the components can be given a partial economic interpretation. Then a brief discussion of how each of these components contributes to the cost difference is given.

First it should be noted that the indifference price a consumer i will hold as a sitting tenant is greater than (but not necessarily strictly greater than) the indifference price i will hold as a sitting owner-occupier. To be used in the discussion still another 'indifference price' is defined. Let $\Omega'_{t+1}$ be a price so that a consumer will not regret her period t tenure choice no matter what her tenure choice were! Such no regret will only occur at the price realisation where the user cost and rent are equal, and is defined by equation (§1).

$$
(c_{t+1}(\Omega'_{t+1}) - o'_{t+1}) \frac{r}{(1 - r)} \frac{\Omega'_{t+1} - (1 + \varphi)^{-1} E(P_{t+2} | \Omega'_{t+1})}{(1 + \varphi)^{-1} E(P_{t+2} | \Omega'_{t+1})} = 0 \quad (§1)
$$

An alternative, and equivalent, way of introducing $\Omega'_{t+1}$ had been to say that it is the indifference price in a hypothetical situation where both moving costs equal zero. Indifference prices of sitting tenants and owner-occupiers would in this hypothetical situation be identical. The purpose of introducing this variable will be become evident as it is employed in the discussion of (§2).
\[ B'(R_t) - B'(O_t) = (m_t - M_t) \]
\[ + (c_t'' - a_t') + \frac{\tau}{(1-\tau)} \{ (P_t - (1+\phi)^{-1} E(P_{t+1})) \} \]
\[ - \frac{1}{(1+\phi)} \int_{\omega_{R_t}}^{\omega_{O_t}} \{ \delta_t^{\mu} f(P_{t+1}) dP_{t+1} \int_{\omega_{R_t}}^{\omega_{O_t}} (c_t^{\mu} - c_t') f(P_{t+1}) dP_{t+1} \} \]
\[ + (1+\phi)^{-1} \int_{\Omega_t}^{\omega_{O_t}} (c_t^{\mu} - a_t') + \frac{\tau}{(1-\tau)} \{ P_{t+1} - (1+\phi)^{-1} E(P_{t+2} | P_{t+1}) f(P_{t+1}) dP_{t+1} \}
\[ + (1+\phi)^{-1} \int_{\Omega_t}^{\omega_{O_t}} (c_t^{\mu} - a_t') + \frac{\tau}{(1-\tau)} \{ P_{t+1} - (1+\phi)^{-1} E(P_{t+2} | P_{t+1}) f(P_{t+1}) dP_{t+1} \}
\[ + (1+\phi)^{-1} \int_{\Omega_t}^{\omega_{O_t}} M_{t+1} f(P_{t+1}) dP_{t+1} \]
\[ - (1+\phi)^{-1} \int_{\omega_{R_t}}^{\omega_{O_t}} m_{t+1} f(P_{t+1}) dP_{t+1} \]  

(§2)

Each of these eight components can be interpreted as in the list below. For most of the component I am also indicating which sign it is expected to have.

i) The first component measures the higher moving costs when moving into owner-occupation at the start of t.

ii) The second component is a measure of the period t inefficiency of the marginal landlord as compared to the particular consumer i.

iii) The third component is the tax disadvantage of renting over owner-occupancy, in period t.

iv) The fourth component is the discounted after-tax value for the marginal supplier of period t of being able to collect a gain because of her being more efficient than the marginal supplier of period t+1. Is she less efficient than the marginal supplier in t+1, she just sells of the housing unit. This is what I in this paper term the value of the tenure flexibility option of a landlord.

v) Is a kind of expected regret of choosing owner-occupancy, measured in money terms. To be more concise, at price realisations above V^{t+1} and below \Omega^{t+1} tenancy there is a regret cost associated with the choice of owner-occupancy in period t. At all prices below \Omega^{t+1} tenancy will be less expensive than owner-occupancy, but as long as the price is above V^{t+1} the cost advantage of renting housing is smaller than the cost of stepping over to tenancy. This component is a part of the cost of owner-occupancy and is thus negative in (13).
vi) This component resembles component v), it is expected regret of choosing tenancy, measured in money terms. As this is a component in the cost of choosing tenancy in period t, it is pushing up the cost disadvantage of renting.

vii) Is the discounted cost of moving over to owner-occupancy at price realisations above the indifference price of sitting tenants, weighted by the probability of such moves. This of course increases the cost difference between tenancy and owner-occupation.

viii) Is the discounted cost of moving over to tenancy at price realisations below the indifference price of sitting owner-occupiers, weighted by the probability of such moves. This of course decreases the cost difference between tenancy and owner-occupation.

Appendix 2, List of symbols:

\( \text{P}_t \) \quad House price at t

\( E(\text{P}_{t-2} | \text{P}_{t-1}) \) \quad Expected house price period t+2, conditional on realised t+1 price

\( k \) \quad Expected growth rate of expected house price

\( \beta \) \quad Parameter in the price process

\( r_t \) \quad Period t rent

\( c_i^t \) \quad Landlord i’s operating cost at t

\( c_{i+1}^{\text{rc}, t+1} \) \quad Landlord i’s operating cost upon re-entry at t+1

\( c_i^t \) \quad Landlord i’s operating cost at t

\( c_i^M \) \quad Operating cost of the marginal supplier at t

\( c_{i+1}^{M, t+1} \) \quad Operating cost of the marginal supplier at t+1

\( \delta_{i+1} \) \quad Cost disadvantage of leaving and re-entering the market

\( \tau \) \quad Tax-rate applied to net rental income

\( \phi \) \quad After-tax interest rate

\( \Pi^t \) \quad Expected value of letting at t

\( S_i^t \) \quad Expected value of selling at t

\( D_i^{t+1} \) \quad The (t+1)-price that leaves landlord i indifferent between selling and letting in t+1.
$Q^i_{t+1}$ The (t+1)-price that leaves landlord $i$ indifferent between re-entering the rental market at t+1 and staying out

$m^i_{t+1}$ The cost of moving into a rental housing unit

$M^i_{t+1}$ The cost of moving into an owner-occupied housing unit

$o^i_t$ Household $i$'s operating costs

$B^i(O_t)$ The expected discounted cost of choosing owner-occupancy

$B^i(R_t)$ The expected discounted cost of choosing owner-occupancy

$V^i_{t+1}$ The (t+1)-price that leaves consumer $i$ indifferent between staying an owner-occupier and moving over to a rental unit

$W^i_{t+1}$ The (t+1)-price that leaves consumer $i$ indifferent between staying a tenant and moving over to an owner-occupied unit

$Q^t_{t+1}$ The (t+1)-price at which a consumer will not regret his period t tenure choice, irrespective of what choice he made.
3. A Housing Career Perspective on Risk

Abstract

The main question analysed in the paper is how uncertainty in the asset price of owner-occupied housing capital affects user costs and consequently housing demand. The analysis is performed within the framework of a dynamic model of planned housing careers. Owner-occupied housing has a dual role as both an asset and a consumption good; a consumption good both now and in the future. By holding owner-occupied housing capital the risk associated with future purchase of housing, can be reduced. Taking account of this it is shown that the risk premium in the user cost is negative for consumers on a sufficient increasing path of future housing consumption. Hence the demand for owner-occupied housing of a risk averse consumer can be increasing in asset price volatility. This result is contrary to the ‘conventional wisdom’ in housing economics, and can only be identified within an analytical framework that takes account of the dynamic aspects of housing market behaviour.

3.1 Introduction

The decision of how much owner-occupied housing capital to purchase, or to keep, is both a consumption decision and an investment decision. The concept of the expected cost of using and owning one unit of housing capital throughout a period has provided a fruitful basis for theoretical and empirical studies of the market for owner-occupied housing. See for example Smith, et.al. (1988) and Poterba (1984). The user cost of housing capital is defined in a way similar to the user cost of capital familiar from the neo-classical theory of investment.

A commonly held view is that risk averse consumers adjust their user costs upwards as a response to volatility in future prices of housing capital. I show in that even under risk aversion, risk premiums in the user cost of owner-occupied housing capital can be negative. Consequently, housing demand of risk averse consumers may be increasing in uncertainty in house prices! This result arises because housing is not only both a current consumption good and an asset; it is also an important part of future consumption vectors. Hence ‘risky’ investments in owner-occupied housing capital can reduce the risk of future purchases of housing. The result is shown within the framework of a two-period long life-cycle. The paper abstracts from bequest motives and assumes that all available resources, included housing capital, are spent on housing and other consumption during the two periods.

The model employed in the paper contains only two assets: risky owner-occupied housing and a possibility to hold, negative or positive amounts of, an asset yielding a risk-free rate of return r. Introducing other risky assets that correlate with asset prices of housing will modify, but not alter, the conclusions of the paper. REITs can typically be one such alternative asset. As noted by Ben-Shahar (1998), REITs only provides imperfect hedges and also is not available in every market.\(^\text{12}\)

Sign and magnitude of risk premiums in the user cost does not only depend on attitudes towards risk and uncertainty in the variables of relevance for the consumer. It depends also on

\(^{12}\) This argument was suggested by one of the referees.
the (expected) path of future housing choices. I see this as one more demonstration of the fact that housing market behaviour, because of the durability and other types of intertemporal dependencies in the housing market, preferably should be analysed within a dynamic setting.

Hence future house prices are uncertain and holding part of the wealth as owner-occupied housing capital creates volatility in future consumption possibilities. This can be reflected by a risk premium being introduced in the user cost. Miles (1994) and Nordvik (1995) derive a user cost for the case where the price of housing capital is stochastic. Both start from a description of the maximisation of a utility function formulated as the sum of a 'present period direct utility function' and a future indirect utility function. The risk adjustment component equals the negative of the covariance between the marginal utility of future income and house prices, normalised by the marginal utility of present income. Both authors conclude that a concave indirect utility function suffices for the risk premium to be positive.13

Within the framework of a 'Portfolio-based general equilibrium model' Hendershot and Won (1992) find that 'the investment demand' of owner-occupied housing is decreasing in the volatility of the return to owner-occupied housing. In a somewhat similar manner Chinloy (1991) derives a CAPM-like risk-premium component in the user cost of a consumer who can invest in also other risky assets than owner-occupied housing. Also in his model, a negative risk-premium will only arise if the return on 'a market portfolio' and on owner-occupied housing correlates negatively.

Housing market models applying the user cost-concept are often referred to as life-cycle models (Meen, 1999). I will claim that risk-adjustment of the type referred to above lacks a thorough understanding of the dynamics of housing demand, or of the inter-temporal aspects of the housing choices made over the life-cycle. Housing is for most households an important part of the consumption vector in all periods. A thorough understanding of how uncertainty in house prices affects housing choices should take account of the dependency between prices of future and present housing consumption.

Bercovec and Fullerton (1992) note that risk premiums calculated on the basis of variance-covariance matrices may overstate the relevant risk premium on owner-occupied housing for households with long planned stays. 'If the homeowner plans to live in the current house for a long time, then variations in its value help insure against correlated variations in the future cost of housing'. For households who plan for long stays this effect is identified within the formal model of the paper. Such an effect is identified also for owners who plan to move on to another unit whose price correlates with the price of the present unit. This effect is stronger the larger increase in housing consumption the household plans to undertake in 'the next step in their housing career'. Furthermore, the effect may be strong enough to produce negative risk premiums in the user cost of owner-occupied housing for a risk averse consumer.

The life-cycle/user cost approach to analysis of housing demand is here combined with the economics of planned housing careers (see Amundsen, 1985 and Nordvik, 2001). For the purpose of this paper one can say that the most important insight is that a choice of a housing unit today affects tomorrows opportunities, and that households takes account of this when making their choices. The value of optimally utilised future opportunities is measured by an indirect utility function.

13 Miles notes that this conclusion does not hold if there is a sufficient strong negative correlation between income from other sources and house prices. At least in aggregate this is a quite unlikely situation.
Two other papers discuss a positive relation between housing market risk and the demand for owner-occupied housing. For consumers with long expected stays owner-occupation can serve as an insurance against rent risk. This mechanism is studied by Sinai and Souleles (2001). They show that homeownership rates and house prices correlate positively with rent risk. In Ben-Shahar (1998) tenure choice may vary continuously, i.e. consumers can choose to own a fraction of their housing unit. Demand for owner-occupation is in this model the result of a trade-off between transaction costs and risk avoidance. Ben-Shahar shows that if the third derivative of the utility function is positive the demand for owner-occupation is increasing in rent risk. However the mechanisms producing a positive feedback from housing market risk to the demand for owner-occupation are different from the mechanisms explored in this paper.

In Section 2 I describe the environment in which a consumer makes her choice. The indirect utility functions that links period one choices and period two opportunities, and their properties are investigated in Section 3. First-order conditions for utility maximum is given in Section 4, while in Section 5 the central results on the dependency between the sign of risk premiums and the expected future path of future housing consumption is discussed. Section 6 concludes.

### 3.2 The consumer's choices

In order to analyse the housing choices of owner-occupiers in a stochastic environment, a quite simple model is formulated. The quantity of both housing consumption and investment are measured by a uni-dimensional measure - h. At the start of the first period the consumer chooses an owner-occupied unit, period 1 consumption of other goods and services and savings. The stochastic environment is formulated as a set of possible states \( \Omega \) and probabilities for each of them to occur \( \pi_x \). Hence the consumer make her choices so that, within the limits set by her economic resources, the utility function (1) reaches its maximum.

\[
U = u_i(x_i, h_i) + (1 + \rho)^{-1} \left\{ \sum_{x \in \Omega} \pi_x u_2(x_i, h_x) \right\}
\]

where:
- \( x_i \) is the consumption of 'other goods and services' in period i
- \( h_i \) is the consumption of owner-occupied housing in period i
- \( \rho \) is the discount rate, assumed to equal the market interest after tax

Even though the asset price of housing in period 1 is known, the user cost of owner-occupied housing capital in period one is uncertain. Future asset prices of housing vary over states, and their distributions are captured by the probability distribution over states. In period 2 the consumer can either stay in the period one unit and avoid moving costs or she can move on to another unit. Furthermore, there is no uncertainty concerning consumer type in period 2, and the period 2 direct utility function is state independent.

Because of the moving costs and the stochastics in the price of housing capital and income in the second period, the budget constraint becomes quite messy if it is written out in one expression. It is therefore split up in its different parts in the presentation. Equation (2) gives the period 1 budget constraint.

\[
x_i + P_1 h_i (1 + m_1 + c_1 + \alpha) + S \leq W + y_i
\]
where:
- $P_i$ is the period $i$ price of one unit of housing capital\(^{14}\)
- $c_i$ is the period $i$ operating costs as a fraction of the value of a housing unit
- $\alpha$ is the sum of the imputed rental income tax and property tax as a fraction of the value of a housing unit
- $S$ is the period one savings
- $W$ is initial wealth
- $y_i$ is period $i$ income
- $m_i$ is the period $i$ moving costs as a fraction of the value of a housing unit

Note that all the components of the period one budget constraint are known with certainty at the start of period one. Moving costs are formulated as proportional to the value of the housing unit. This is meant to capture transaction taxes and broker fees. The main reason for the disaggregated presentation becomes apparent when the period two budget constraints are discussed. In addition to them being state-dependent, they are also discontinuous along the move-stay dimension. The inequalities (3-1) and (3-2) give the period 2 budget constraints. The constraint (3-1) applies to owner-occupiers who stay in their period one dwelling also in period 2, (3-2) is the constraint facing those who move to another dwelling.

\[
(3-1) \quad x_2 + P_2 h_1 (c_2 + \alpha) \leq (1 + \rho) S + y_2 + (1 + \rho)^{-1} h_1 P_2,
\]

\[
(3-2) \quad x_2 + P_2 h_2 (1 + m_2 + c_2 + \alpha) \leq (1 + \rho) S + y_2 + \left( \frac{h_2 P_2}{1 + \rho} \right) + h_1 P_2,
\]

Some comments should be made on how the terminal, or period three, price enters the budget constraints. In a non-stochastic world without any constraints on credit availability, the properly discounted value of housing owned at the end of the planning horizon is a part of the life-time wealth in the same way as income and initial wealth. Harman and Ioannides (1995) and Ekman and Englund (1997) analyse a housing market where adjustment of housing consumption is costly in an overlapping generation framework. The models in both papers are deterministic, and the terminal prices of a generation are treated as a liquid constant\(^{15}\). It is, however, not evident how the terminal value of housing assets should be treated in an analysis of planned housing careers in a stochastic framework. In such an analysis three crucial questions should be considered:

i) How liquid is the expected period three value of housing capital at the start of period two?

\(^{14}\) The price of the composite ‘other consumption goods’ is normalised to equal unity in any period. Hence $P_1$ can be thought of as the price of housing capital relative to the price of the composite consumption good.

\(^{15}\) Within their deterministic model Ekman and Englund analyse the effects, on housing demand of young and old consumers, of different kinds of shocks. Some of these shocks push house prices downwards. One effect of this is that ‘departing’ consumers leave the housing market with negative equity. This problem is recognised by Ekman and Englund (in their note 8). One can regard this as a general problem in housing market models where housing choices are assumed to be based on user costs, and consumers have finite lives.
ii) (How) is the expected period three price affected by information arriving at the start of period two? One example of such information can be the realisation of the period two price of housing assets.

iii) If period two information leads to revision of the expected period three price: Does the consumer, at the start of period one, know which revisions different pieces of information will make her do?

Throughout this paper it is assumed that the discounted expected period three is liquid at the start of period 2. This assumption is equivalent to assuming that at the start of period 2 the period three price is non-stochastic. This is only a simplification done because the focus of the paper is on risk-adjusted user costs for period one housing. Period 2 realisations of the asset price of housing may affect the expected period three price. Hence question iii) is by definition answered in the affirmative. This paper deals with rationally formed planned housing careers in a stochastic environment. Optimal utilisation of information arriving at different points in time is of course a part such a rationally formed plan.

Amundsen (1985) analyses how an optimal housing career should be chosen in the presence of moving costs in a 'single-tenure' non-stochastic world. His analysis is done in two steps. First he shows which level of housing consumption would be chosen, by a utility maximising consumer, under different moving careers (i.e. different combinations of moves and stays). Then the household is assumed to chose the housing career that yields the highest level of utility. In a stochastic setting, Amundsen’s procedure would be less appropriate. At the start of period one the consumer is choosing her housing and other consumption and savings. This can be said to be a simultaneous choice of both a first period consumption vector and of the choice opportunities for the second period. For optimisation problems of this type dynamic programming is a more appropriate tool.

### 3.3 Period one choices and period two opportunities - the indirect utility functions

The first period choices are described under the assumption that the choice opportunities of period two are optimally utilised. Under this, quite weak, assumption the period two part of the direct utility function of (1) can be written as the probability weighted sum of indirect utility functions. The indirect utility functions express the maximum utility attainable in a specific situation as a function of the variables determining the feasible set of consumption vectors. The indirect utility functions do consequently contain the budget constraints of each of the states of period two. Savings, income and period two prices are of course arguments in the indirect utility functions. Because of the lock-in effects created by the moving costs, period one housing consumption is also one of the arguments of the indirect utility functions.

These indirect utility functions will play a central role in the rest of the paper: some characteristics of them are given before the period one optimisation is formally handled. The derivatives of the indirect utility functions differ over states. Define $\Gamma(h_1)$ as the subset of the state-space $\Omega$ where the consumer chooses to stay in her period one dwelling. The set $\Psi(h_1)$ is the subset where she chooses to move.

For all $s \in \Gamma(h_1)$ the indirect utility functions can be written as (4), and their characteristics are found by straightforward differentiation.
(4) \( V(P_2, h_1, S) = u_2((1 + \rho)S + y_2 + \frac{P_3, h_1}{1 + \rho} - P_2, h_1(\alpha + c_2), h_1) \)

The indirect utility function for the states where the consumer stays in her period one housing unit is particularly simple. It is the utility of the consumption vector consisting of the period one dwelling and all available resources spent on other consumption. The derivatives of the indirect utility function play a crucial role in the optimisation later in the paper. In equations (5-1)-(5-4) the relevant derivatives is therefore given:

\[
(5-1) \quad \frac{\partial V_s}{\partial h_1} = \frac{\partial u_2}{\partial x_2s}
\left( \frac{1 + k}{1 + \rho} - (\alpha + c_2) \right) + \frac{\partial u_2}{\partial h_1}
\]

\[
(5-2) \quad \frac{\partial V_s}{\partial S} = \frac{\partial u_2}{\partial x_2s} (1 + \rho)
\]

\[
(5-3) \quad \frac{\partial V_s}{\partial P_2} = -\frac{\partial u_2}{\partial x_2s} h_1(\alpha + c_2) - \frac{\partial P_1}{\partial P_2} (1 + \rho)^{-1}
\]

The term \( \frac{\partial u_2}{\partial x_2s} \) equals the marginal utility of income (or wealth) in state \( s \) in period 2, for this variable the symbol \( \mu_2 \) will also be used in the remainder of the paper. The variable \( k_2 \) is the growth rate of house prices from period two to three. This growth rate may differ over states. The indirect utility function gives the maximum utility attainable given the budget constraint. This maximum coincides with a stationary point for the Lagrangian in (6). Hence for all \( s \in \Psi(h_1) \) the indirect utility functions are implicitly defined by (6).

\[
(6) \quad u_2(x_2, h_2) - \mu_2 x_2 + P_2, h_2(1 + c_2 + \alpha + m_2) - \frac{P_3, h_2}{1 + \rho} - ((1 + \rho)S + y_2 + h_1 P_2)
\]

When the choices in period two is done; prices are exogenous to each consumer and savings and quantity of owned housing are predetermined variables. The effect on maximum utility of variations in these exogenous and predetermined variables can be derived using the envelope theorem. Hence the characteristics of the indirect utility functions can be found by differentiating the Lagrangian (6) even though the indirect utility function is not explicitly defined. These characteristics are given in (7-1) to (7-3).

\[
(7-1) \quad \frac{\partial V_s}{\partial h_1} = \frac{\partial u_2}{\partial x_2s} P_2 = \mu_2 P_2
\]
\[
\frac{\partial V_1}{\partial S} = \frac{\partial u_1}{\partial x_2},
\]
\[1 + \rho = \mu_1(1 + \rho)\]  

\[
\frac{\partial V_1}{\partial P_2} = -\mu_1\{h_2(1 + \alpha + c_2 + m_2 - \frac{\partial P_1}{\partial P_2}(1 + \rho)^{-1}) - h_1\}
\]

The properties of the indirect utility functions given above will not, in isolation, be further discussed. Their prime function in this paper are as building blocks of the analysis of the period one choice of level of consumption of owner-occupied housing.

3.4 The consumer's choices - a formal analysis

The analysis of the choice of housing consumption in the presence of moving costs is done by replacing the period two direct utility function in equation (1) by its indirect counterpart. As a means to describe the optimal owner-occupied housing unit in period one the Lagrangian (8) is formed.

\[
u_1(x_1, h_1) + (1 + \rho)^{-1} \sum_{i=1}^{p} \pi_i \frac{\partial V^i}{\partial P_2, h_1, S}
\]

\[\lambda[x_1 + S + \{P_1 h_1(1 + \alpha + c_1 + m_1)\} - (W + y_1)]
\]

The maximum of the utility function within the limits set by the budget constraint (see eq. (2)) coincides with a stationary point for the Lagrangian. Note that the budget constraints of each of the states of period two are embedded in the indirect utility functions \(V^i\). Consequently utility maximum is attained for the set \((x_1, h_1, S, \lambda)\) that satisfies equations (9-1)-(9-4).

\[
\frac{\partial u_1}{\partial x_1} = \lambda
\]

\[
\frac{\partial u_1}{\partial h_1} + (1 + \rho)^{-1} \sum_{i=1}^{p} \pi_i \frac{\partial V^i}{\partial h_1} = \lambda P_1(1 + \alpha + c_1 + m_1)
\]

\[
(1 + \rho)^{-1} \sum_{i=1}^{p} \pi_i \frac{\partial V^i}{\partial S} = \lambda
\]

\[
x_1 + S + \{P_1 h_1(1 + \alpha + c_1 + m_1)\} = (W + y_1)
\]
These are re-written using the properties of the indirect utility function given in (5-1), (5-2), (7-1), (7-2) and the definition of the covariance to produce the 'final' set of first-order conditions for the choice of period one owner-occupied housing unit.

\[
\frac{\partial u_t}{\partial x} = \lambda
\]

\[
\frac{\partial u_t}{\partial h_t} + (1 + \rho)^{-1} \sum_{s \in I} \pi_s \frac{\partial h_s}{\lambda} = E(\varphi_t)
\]

\[
+ (1 + \rho)^{-1} \sum_{s \in I} \pi_s \frac{E(\mu_s | \Gamma)}{\lambda} E(\varphi_t | \Gamma)
\]

\[+(1 + \rho)^{-1} \sum_{s \in I} \pi_s \frac{\text{Cov}(\mu_s, \varphi_t | \Gamma)}{\lambda}
\]

\[-(1 + \rho)^{-1} \frac{\text{Cov}(\mu_s, P_t)}{\lambda}
\]

\[
\sum_{s \in I} \pi_s \mu_s + \sum_{s \in I} \pi_s \mu_t = \lambda
\]

\[
x_t + S + \{P_t h_t (1 + \alpha + c_t + m_t)\} = (W_{0} + y_t)
\]

In (10-2) the traditional definition of the expected user cost of one unit of owner-occupied housing capital, included moving costs, \( E(\varphi_t) = P_t (\frac{\rho - k_t}{1 + \rho} + \alpha + c_t + m_t) \) is inserted. In the set up of the model here volatility in the asset price of housing is the only source of volatility in the user cost – this is of course a simplification rather than an empirical claim. Furthermore, if the expected growth rate of house prices is independent of the level of a price realisation the expected user cost and the asset price will be perfectly correlated. The specific specification of the user cost is chosen out of convenience and is not crucial for the results obtained. However, the results of the analysis depend on some correlation between user costs and asset prices.
\( \Pi_{\Gamma} \) is the probability that a stay is chosen in period two. \( E(\mu_1 | \Gamma), E(\varphi_{2s} | \Gamma) \) and \( \text{Cov}(\mu_1, \varphi_{2s} | \Gamma) \) are expectations and the covariance measured over the subset of the state-space where the consumer stays in her period one unit. These are of course not constants but functions of the chosen level of housing consumption in period 1.

### 3.5 The demand for owner-occupied housing and price volatility

The remainder of the paper will be centred on the question of what is the relevant (marginal) user cost\(^{16}\) concept for consumers in different situations. Consider the left-hand side of (10-2): It gives the marginal utility of a housing unit chosen at the start of period one, and consists of the certain period one marginal utility and the discounted expected marginal utility over the states where a consumer stays in the period one dwelling also in the second period. By dividing both sides of the equation by \( \lambda \), the left-hand side can be interpreted as the marginal rate of substitution between housing and other consumption. Consequently equation (10-2) as says that housing consumption in period one should be chosen so that the marginal utility of the housing unit, measured over the period-state space the unit is preferred, equals the risk adjusted marginal user cost over the same period-state space. This is hardly surprising.

Remarks 1 to 3 show the relevant risk adjustment for consumers in different situations. I start by looking into two special cases. First user costs and risk adjustment for a consumer who is certain to stay in the period one dwelling for only one period is considered. Then the behaviour of a consumer who plans to stay for two periods is analysed. The discussion of the special cases in remark 1 and 2 in this paper serves two purposes. Firstly it might be that for some consumers the stay strategy dominates the strategy in all states or vice versa.\(^{17}\) Hence the situation described in remark 1 and 2 might be empirically relevant. Secondly, inspection of the remarks 1 and 2 may make the intuition behind the more complex situation described in remark 3 easier to grasp. After these two limiting cases are considered I analyse the more general case where the consumer plans to move in some states and to stay in other states.

**Remark 1:** Consider a consumer who for any \( s \) will move in the second period. On a sufficient increasing path of housing consumption, the risk-adjusted user cost is lower than the expected user cost. For consumers on a decreasing path the opposite is the case.

By assumption \( \Gamma \) is empty (i.e. \( \Pi_{\Gamma}=0 \)), and the first-order condition (10-2) reduces to (11):

\[
\frac{\partial h_1}{\partial \mu_1} = E(\varphi_1) - (1 + \rho)^{-1} \frac{\text{Cov}(P_2, \mu_s)}{\lambda}
\]

The right-hand side of (11) can be interpreted as a risk adjusted user cost of housing capital. Nordvik (1995) analysed a similar expression and concluded that: Period two wealth of a household, in the particular situation analysed in remark 1, is increasing in \( P_2 \). Hence, under the plausible assumption of decreasing marginal utility of wealth, \( \text{Cov}(P_2, \mu_s) \) is negative.

\(^{16}\) Note that I in the rest of the paper use the phrase ‘user cost’ for the marginal cost of owning and using one unit of housing capital through one period.

\(^{17}\) The phrase ‘dominates’ should here be understood as first-order stochastic dominance.
Using (7.3) it can be shown that in some cases this is indeed true. However, it cannot be generally claimed that the covariance-term is negative, even if an assumption of decreasing marginal utility of wealth (i.e. assuming consumers to be risk averse) holds.

Inspection of (7.3) reveals that the derivative of the indirect utility function with regard to the realised \( P_2 \) in the case where a consumer moves on to another housing unit, has the same sign as the expression: \(-\left\{ h_2 (1 + \alpha + \epsilon_2 + m_2 - \frac{\partial P_2}{\partial P_2} (1 + \rho)^{-1}) - h_1 \right\} \). This can be written as:

\[
h_1 - h_2 \frac{\partial \phi_2}{\partial P_2}
\]

\( P_2 \) realisations affect the utility of consumers moving from one owner-occupied unit to another in two different ways. Assume that the user cost of period two is increasing in \( P_2 \). Then the amount of housing services that can be paid for by a given nominal wealth is decreasing in \( P_2 \). In isolation this price effect gives \( \text{Cov}(P_2, \mu_e) > 0 \). On the other hand, nominal wealth is increasing in \( P_2 \). In isolation this nominal wealth effect gives \( \text{Cov}(P_2, \mu_e) < 0 \). Equation (7.3) reveals that the sign of the aggregate effect of these two countervailing forces depends on the difference between period one and period two housing consumption and of the user cost’s responsiveness towards variations in the asset price of housing.

i) For sufficient low owner-occupied housing consumption in period two relative to consumption in period one, the nominal wealth effect will dominate the price effect and \( \text{Cov}(P_2, \mu_e) < 0 \). The owner-occupied housing consumption will be ‘sufficiently low’, when a marginal increase in \( P_2 \) affect wealth stronger than it affects housing expenses over the life cycle. Risk-averse owner-occupiers will in this situation add a positive risk premium to the expected user cost, and will consequently demand less housing in period one than risk neutral consumers in a similar situation will.

ii) For sufficient high owner-occupied housing consumption in period two relative to consumption in period one, the price effect will dominate the nominal wealth effect and \( \text{Cov}(P_2, \mu_e) > 0 \)! The risk premium will be negative and period one demand of housing will consequently be increasing in the volatility of \( P_2 \). The economic mechanism behind this is that over investing in the seemingly risky (housing) asset reduces the uncertainty of period two consumption. Investments in the risky asset, housing, works as a hedge against the risky price of future housing consumption.

Sign and magnitude of \( \text{Cov}(P_2, \mu_e) \) consequently depends strongly on the responsiveness of user costs to asset prices. For any ordinary asset the covariance between the value of the asset and the marginal utility of wealth of a risk averse consumer will be negative. The indeterminacy of the sign of \( \text{Cov}(P_2, \mu_e) \) in my analysis is due to owner-occupied housing’s dual role as both an asset and as a consumption good. To be more explicit: the indeterminacy of the sign of the covariance, and consequently the sign of the risk premium, is due to the fact that housing is a part of future consumption vectors. When Nordvik (1995) concluded that risk aversion implies \( \text{Cov}(P_2, \mu_e) < 0 \), he failed to take account of the price effect and the consequences of housing being part of future consumption vectors.
Remark 2: Assume that a consumer chooses owner-occupation in the first period and that she for any s will choose not to move in the second period. As the user cost of this consumer is uncertain, so is also her consumption of other goods and services in period 2. Risk adjusting is consequently pushing the relevant user cost above the expected user cost.

Imposing the assumptions made in remark 2 on (10-2) give equation (12).

\[
\frac{\partial u_1}{\partial h_{1n}} \frac{1}{\lambda} + (1 + \rho)^{-1} \sum_{s \in \Omega} \frac{\partial u_{2s}}{\partial h_{2n}} \frac{1}{\lambda} = E(\phi_1)
\]

\[
+ (1 + \rho)^{-1} \frac{E(\mu_1 | \Omega)}{\lambda} E(\phi_2)
\]

\[+ (1 + \rho)^{-1} \frac{\text{Cov}(\mu_1, \phi_2)}{\lambda}
\]

\[= -(1 + \rho)^{-1} \frac{\text{Cov}(\mu_1, \phi_2)}{\lambda}
\]

From (10-3) it is seen that \(\frac{E(\mu_1 | \Omega)}{\lambda} = 1\). The user cost in this context can be written as the sum of expected user costs over the two periods and two components that adjust for risk. Direct inspection of the indirect utility function of consumers choosing to stay, (5), reveals that period two utility is decreasing in the period two user cost\(^{18}\). As the user cost is the price of the consumption good ‘owner-occupied housing’ the sign of the derivative of the indirect utility function corresponds to what can be found in any textbook on microeconomics. Hence \(\text{Cov}(\mu_1, \phi_2)\) is positive and uncertainty in the user cost creates a positive risk premium in the period one user cost.

From (5-3) it is seen that the sign of \(\frac{\partial V}{\partial P_2}\) and consequently of the last covariance term on the right-hand (12) can not be determined without making additional assumptions on the relative size of the components of the user costs. However, (12) can be rewritten to find a more intuitive expression for the risk adjustment component of the user cost.

\[
\frac{\partial u_1}{\partial h_{1n}} \frac{1}{\lambda} + (1 + \rho)^{-1} \sum_{s \in \Omega} \frac{\partial u_{2s}}{\partial h_{2n}} \frac{1}{\lambda} = E(\phi_{1,2}) + \frac{\text{Cov}(\mu_1, \phi_{1,2})}{\lambda}
\]

\(^{18}\) Note that in the model of this paper the user cost of period two is revealed when the period two state is revealed.
\( E(\varphi_{1,2}) \) is the expected user cost of owner-occupied housing capital held over both first and second period, properly discounted to a period 1 present value. In the same way as when the covariance between \( \mu \), and the period two user cost was considered, one can conclude that the risk premium in (13) is positive. Hence even though the sum of the two components of the risk premium as described in (12) could not be uniquely signed (without having to make 'reasonable assumptions'), (13) show that their sum is positive.

Note that the similarity between (13) and the first-order condition for a consumer choosing to stay found by Amundsen (1985) in a non-stochastic setting. Amundsen showed that the presence of moving costs may induce a consumer to choose a housing unit that serves her needs fairly well over the holding period rather than adjusting consumption in each period. A stay dwelling is chosen so that the discounted marginal rate of substitution (MRS) is equalised to a properly discounted sum of the price of the housing services over the holding period. In my analysis it turns out that by adding a positive risk premium a similar relation between expected MRS's and expected user costs under uncertainty exists in the special case where no realisation of the period state induces the consumer to revise her planned housing career.

\textit{Remark 3: Consider a consumer about to choose an owner-occupied dwelling. Assume that she will stay in this dwelling for two periods with a probability of \( \Pi_{P} \), and move after one period with a probability of \( \Pi_{P} \). The sign of the risk premium in the relevant user cost depends on the distribution of optimal housing choices in the future.}

Period one housing unit is chosen so that the first order-condition (10-2) is met. At the right hand side of (10-2) \( \text{Cov}(\mu_{2}, \mu) \) appears. As the discussion so far in the paper has showed, the sign of this component depends on the path of future housing consumption. For any given level of first period consumption of owner-occupied housing the 'moving space' \( \Psi(h_{1}) \) can be split in two subsets:

i) \( \Psi'(h_{1}) \) consists of the part of the state-space where a consumer chooses to move over to a larger owner-occupied dwelling. This can be thought of as states where realised \( P_{2} \) is low.

ii) \( \Psi''(h_{1}) \) consists of the part of the state-space where a consumer chooses to move over to a smaller owner-occupied dwelling. This can be thought of as states where realised \( P_{2} \) is high.

The last covariance-expression in (10-2) can be written:

\begin{equation}
(14) \quad \text{Cov}(\mu_{2}, \mu) = \Pi_{P} \cdot \text{Cov}(\mu_{2}, \mu \mid \Gamma) + \Pi_{P} \cdot \text{Cov}(\mu_{2}, \mu \mid \Psi') + \Pi_{P} \cdot \text{Cov}(\mu_{2}, \mu \mid \Psi'')
\end{equation}

In i) 'a larger owner-occupied dwelling' is defined as a housing unit large enough for \( \Pi_{P} \cdot \text{Cov}(\mu_{2}, \mu \mid \Psi') \) to be positive. I.e. a level of housing consumption in period two high enough for the price effect to dominate the nominal wealth effect. Equivalently a smaller dwelling is defined so that the corresponding covariance term is negative.

Inserting (14) and a definition of \( \text{Cov}(\mu, \varphi_{1,2} \mid \Gamma) \) into (10-2) gives:
\[
\begin{align*}
\frac{\partial u_1}{\lambda} + (1 + \rho)^{-1} \sum_{s \in T} \frac{\partial h_i}{\lambda} &= E(\varphi_1) + (1 + \rho)^{-1} \Pi_{\varphi} \frac{E(\mu_1 | \Gamma)}{\lambda} E(\varphi_1 | \Gamma) \\
+ (1 + \rho)^{-1} \Pi_{\varphi} \frac{\text{Cov}(\mu_1, \varphi_1 | \Gamma)}{\lambda} - (1 + \rho)^{-1} \Pi_{\psi} \frac{\text{Cov}(\mu_2, P_2 | \Psi^+)}{\lambda} \\
- (1 + \rho)^{-1} \Pi_{\psi} \frac{\text{Cov}(\mu_2, P_2 | \Psi^-)}{\lambda}
\end{align*}
\]

The expected user cost in period two is scaled with the ratio of the expectation of the marginal utility of wealth in period two measured over the part of the state space where the consumer stays in her period one dwelling, and the period one marginal utility of wealth. Somewhat loosely one can say that if revelation of a state in period two in which the consumer prefers to stay in her period one dwelling is 'good' news the ratio is below one. The user cost is scaled down. If the state is bad news it is scaled upwards. Good and bad news are defined in terms of utility levels! The economic intuition behind this adjustment is that the cost of maintaining housing consumption at a fixed level, measured in the utility of other consumption forgone, at a given level is higher in bad than in good times.

Uncertainty in the period two user cost of the owner-occupied dwelling chosen in period one increase the user cost for consumers who intend to stay in the dwelling also in period 2. This is captured by the last covariance at the right-hand side of (15). From the discussion of remark 2 one see that this is positive. This component of the user cost is naturally weighted by the probability that the consumer chooses to stay.

Hence, even though the sign of \(\text{Cov}(P_2, \mu | \Psi)\) does not a priori follow from the assumptions on the form of the utility function, each of the components at the right hand side of (15) can be 'signed'. The sign of the sum of these effects is an empirical question. The relevant risk adjustment of the user cost of an owner-occupied dwelling depends on the distribution of future (optimal) choices in the housing market.

The interdependencies between the period one housing choice and the probabilities of respectively staying, moving upwards and moving downwards are an interesting topic. Each possible choice of a period one housing unit gives a partition of the state space in a move upward space, move downwards space and stay space— and corresponding probabilities for each of the three strategies to be optimal. To investigate these topics more explicit assumptions on the price distribution over states must be formulated. In the present paper, however, the focus remains on risk premiums in the user cost.

### 3.6 Concluding Remarks

This paper incorporates housing choices in a stochastic environment into a dynamic life-cycle model of housing demand. The level of owner-occupied housing consumption is shown to be chosen so that the marginal rate of substitution between housing and other consumption is equalised to the marginal risk adjusted user cost of housing capital. In a stochastic
environment where adjusting housing consumption is costly this simple decision rule turns out to differ over different strategies. However the basic interpretation remains the same, expected MRS’s are equalised to expected risk adjusted user costs.

The main contribution of the paper is the finding that even for risk averse consumers the risk premium in the user cost of owner-occupied housing can be negative. In a way one can say that my results are somewhat discomforting. The knowledge of a uniquely signed risk premium is replaced by a risk premium whose sign cannot be determined without additional assumptions. A more positive reading of my results is that they provide sufficient conditions for risk premiums to be positive. The general form of such conditions is that risk premiums are positive unless the expected path of future housing consumption is sufficient increasing.

The indeterminacy of the sign of the risk premium may have consequences for microeconometric studies of housing demand. The main problem is that the relevant user cost differs systematically between consumers. It differs because of the risk premiums dependency on the expected future path of housing consumption. The shape of the future path probably depends to a quite large extent on a household’s demographic characteristic, and the coefficients of these variables can pick up some of the systematic variation in risk premiums. Unfortunately the demographic coefficients also ‘pick up’ a number of other effects. As Kan (1999) pointed out they proxy for moving costs. It is also probable that the frequency of households being constrained in the credit marked also depends on household characteristics. Consequently demographic household characteristics in estimated demand equations probably capture a lot more than taste dispersion, and it can be hard to provide sound economic interpretations of these coefficients.

The paper is destructive in so far as I point towards a problem but not towards any solutions to it. Hence the question of how to handle such systematic differences in risk premiums in empirical studies of housing demand is an obvious theme for future research on this topic.

The reason of the deviations between the results of this paper and what is given previously in the literature is that I within my model account for the fact that owner-occupied housing not only is both an investment and a current consumption good, but also a quantitatively important part of future consumption vectors. I have not seen this point, and its consequences, been analysed in the literature on housing economics before. The use of a dynamic housing career framework in the analysis is crucial for the revelation of these mechanisms.
4. Children, Tenure Choice and Residential Mobility

Abstract

Planned housing market behaviour of households is strongly affected by presence and magnitude of moving costs. The size of non-monetary or as it is sometimes termed: emotional, moving costs is depending of the composition of a household. This paper presents and estimates an econometric model of the joint decisions of tenure and (planned) residential mobility. The estimated model is used as a framework for tests of various hypotheses of determinants of housing market behaviour. Within the simultaneous two-equation model of this paper it is found that sex and age of household head variables affect planned lengths of stay they have no direct effect on tenure choice. It is also shown that expected residential mobility shifts downwards as children of a family starts their schooling.

4.1 Introduction

It is well known that moving costs leads to inertia in the dynamic adjustment of housing consumption to changes in the determinants of housing demand. Furthermore, when a household chooses a housing unit it is aware of the costs associated with consumption adjustments. Hence, households take this into account when choosing their housing unit, and buy or rent a housing unit that is expected to serve the needs of the household fairly well over a period of time.

Under such circumstances housing consumption at any particular point in time should be regarded as part of a dynamic plan for housing consumption. Housing demand should be regarded as part of a planned housing career. Arguments in favour of this and consequences of it are put forward in the next section 'The Economics of Planned Housing Careers'.

This paper develops and estimates an econometric model of tenure choice and planned future stay in the present dwelling of a household. Ideally, models of this type should be estimated on a panel. However, as such data is not available, a cross-section has been used instead. Most of the results conform to what is usually found in models of this type. My model differs from others in that it contains more detailed description of household composition. This has been done for two main reasons: firstly, moving costs may affect planned housing careers and housing market behaviour strongly; and secondly, non-monetary moving costs probably differ between different types of household members. I hope to capture some of these effects, by using the variables describing household composition. Hence, demographic explanatory variables in mobility and tenure models are capturing the effect of moving costs.

The dynamic stochastic decision problem of choosing and revising an optimal housing career is so complex, involves so many discontinuities and has so many dimensions that one should be reluctant to interpret empirical models as complete structural forms. Rather, empirical models should be interpreted as econometric experiments and as a framework for statistical testing of specific hypotheses of determinants of the dynamics of housing market behaviour. A number of such tests are undertaken in this paper. I would claim that some of the test results should have consequences for formulation of empirical housing market models in general, and more specifically, in formulation of models of tenure choice.
The empirical analysis reveals some very interesting results. Presence of school children in a family reduces expected residential mobility. In most single-equation models, age and sex of household head affect tenure choice. In the two-equation model presented in this paper it is found that even though these two explanatory variables affect planned lengths of stay they have no direct effect on tenure choice.

Section 2 of the paper provides a brief overview of theoretic structures and literature on what, in this paper, is termed the economics of planned housing careers. Section 3 discusses the econometric models, and data is presented in Section 4. In Section 5 model estimates are given and their properties are discussed. Concluding remarks are presented in Section 6.

4.2 The Economics of Planned Housing Careers

One basic assumption is that households' housing choices are the outcome of a utility maximisation. In the absence of moving costs this implies that housing consumption is chosen so that at any given point in time, the marginal rate of substitution is equal to the ratio of the prices of housing and other consumption. Tenure choice will partly be determined by the relative price of housing services in each of the tenures and partly by a household's ability to finance the purchase of owner-occupied housing. Planned length of stay in a dwelling will affect neither the quantity nor the tenure decision, as no consumer is locked in by former choices and no one expects to be locked in in the future by present decisions. The reason for this is that as long as moving costs equal zero, any mismatch between actual and desired housing consumption leads the household to move on to a more suitable housing unit.

In isolation, the conclusions above are not very interesting. Households do face positive moving costs. These consist of both monetary transaction costs, search costs, costs associated with the physical act of moving and non-monetary costs associated with relocating. As shown by Amundsen (1985) and Englund (1986): when taking account of moving costs, housing demand, at any point in time, should be regarded as a part of a dynamic plan of a housing career. The theoretic literature on the dynamics of housing demand is reviewed in Nordvik (2001).

The main results which are found in the literature on the dynamics of housing demand is that housing demand is not determined by a single marginal condition. Ignoring tenure choice, an optimal housing career must fulfil two conditions.

i) Within each stay the average discounted marginal rate of substitution should be equal to the discounted average price ratio.

ii) In addition to i) the chosen number of planned moves and their timing should yield higher utility than the highest attainable utility (i.e. the utility when condition i is fulfilled) under any other possible combination of moves and moving dates.

The latter condition implies that the analytic description of an optimal housing career consists of a global comparison of utility levels over a discontinuous set of housing careers that satisfy the marginal condition i). These discontinuities arise because of the moving costs.

A brief description of an algorithm needed to find an optimal housing career illustrates the complexity of the situation facing both households about to choose a housing career and analysts trying to describe the choices. Firstly, optimal levels of both housing consumption
and the profile of other consumption must be calculated under each of the \((T(T-1))^2\) possible housing careers. The one with the highest utility level is then chosen.

The complexities can be further illustrated by considering the effects changes of 'exogenous' factors have on demand profiles or planned housing careers. Given the reasonable assumption of housing being a normal good, an increase in permanent income will lead to increased housing consumption in any given stay. However, the growth of income may alter the ranking of housing careers. The gross effect of a positive shift in permanent income may be that housing demand in some periods decrease! Examples of combinations of coefficients of the utility function that yield such counter-intuitive 'gross effects' are given in Nordvik (2001). I do not regard these counter-intuitive results as mere theoretical peculiarities. Rather, I regard them as plausible structures that correspond to observable phenomena.

The complexities caused by the discontinuous set of housing careers produce severe problems for applied analysis of the demand side of the housing market. If moving costs and the discontinuities they produce are ignored, it will be difficult to give sound interpretations of estimated demand and tenure choice equations (see Edin and Englund, 1991). On the other hand, when the discontinuities and moving costs are taken account of, an applied analyst faces another difficulty. The theoretical analysis of the dynamics of housing demand in the presence of moving costs is very open. Hence, theory does not give an analyst many constraints around which an empirical model may be constructed.

In their analysis of 'Dynamic Aspects of Consumer Decisions in Housing Markets’, Henderson and Ioannides (1989) note that it is hardly possible to formulate a closed form model of housing market behaviour that is at the same time theoretically plausible and empirically estimable. Rather, they formulated their strategy to be to ‘...design a number of econometric experiments by expressing essential features of the ... maximization problem, such as the simultaneity of various decisions and their dynamic structure’. This will also form the empirical strategy of this paper.

In spite of these problems, the first main theme of this paper is to show how one, within a dynamic housing career framework, can carry out an empirical investigation of the determinants of the simultaneous choice of tenure and planned length of stay. As both choice of tenure and planned length of stay are dimensions of the choice of a dynamic plan of the housing consumption, their simultaneity can be inferred directly from the discussion of optimally chosen housing careers. Intuitively, it is obvious that tenure choice depends on planned length of stay as the (expected) price ratio of rented to owner-occupied housing is increasing in planned length of stay. Rosenthal (1988).

The idea of analysing planned length of stay and tenure choice as a sequence of decisions, have been utilised by Rosenthal (1988) among others. Henderson and Ioannides (1989) allow tenure to affect planned length of stay insofar as they estimate separate planned length of stay equations for owner-occupiers and tenants. As well as random variations, such differences in estimated planned length-of-stay equations can be traced back to two different causes. Firstly, differences can be caused by selection mechanisms and can thus be consistent with length of stay and tenure being sequential choices. Secondly, there may be a structural causal link via which tenure affects planned length of stay.

Quite a lot of households plan to become owner-occupiers sooner or later. The tendency to settle down in the present dwelling, rather than looking forward to the next stay, is
consequently stronger in an owner-occupied than in a rented unit. Reasons for a preference for
owner-occupied housing can, among other things, be tax advantages associated with owner-
occupancy, security of tenure being stronger in owner-occupancy and property rights giving
more freedom as to the choice of physical conversions of a housing unit. These forces can
produce a structural causal link via which tenure affects planned length of stay.

Muth (1974) showed that households facing a high probability of being forced to move in the
near future are less inclined to give weight to future preferences when choosing a housing
unit, than households facing low probabilities of being forced to move are. Hence, lowering
the probability of being forced to move will, ceteris paribus, increase the planned length of
stay. As long as the probability of being forced to moved is larger in rental than in owner-
occupied housing it follows that any given household will be expected to have a lower
expected stay as tenants than as owner-occupiers. Hence, Muth's argument provides a
mechanism by means of which planned length of stay is directly affected by tenure.

The number of moves in a planned housing career is decreasing in the size of the moving
costs (Amundsen, 1985). This implies that the average length of planned stays is increasing in
moving costs. The size of the moving costs of a household depends on household
composition. Pure transaction costs such as taxes and brokers fees are, for a given housing
unit, probably independent of household composition. Approximately this will also hold for
the physical moving cost. Non-monetary (sometimes termed emotional) moving costs on the
other hand, are strongly affected household composition. The non-monetary/emotional
component of the moving cost of a household can be said to be a sum of these cost for each of
the household members. The effect on planned housing careers of the non-monetary moving
costs of each of the household members depends on how individual preferences of household
members are aggregated to a 'utility function' of the household. Throughout the paper it will
be assumed that such an aggregate utility function of a household exists.

The second main theme of the paper is to gain insight into the role of non-monetary moving
costs of children. This investigation is based upon a hypothesis of how the non-monetary
moving costs of children depend on their age. The hypothesis consists of two parts:

i) Non-monetary moving costs of children starts from a fairly low level (probably around
zero) at the birth, and is increasing thereafter. When a child reaches a certain age it
will be strongly increasing in age.

ii) At a certain point in time there will be a positive shift in the moving cost of a child.
This takes place when the child has become established in the area on a social level. I
assume that this takes place at around the same time as the child starts school.

If this hypothesis holds and if children's moving costs affect the preferences of a household,
age and presence of children in a household will affect planned housing careers. The greater
the number of children in the household, the longer the planned lengths of stay should be
expected to be. As far as the youngest children are concerned, this effect is expected to be
quite weak. Moreover, as the children in the household approach school age, there is expected
to be a positive increase in the planned length of stay of the household. Most Norwegian
households plan to enter owner-occupied housing at some point during their lifespan. If this
step is taken prior to the children of the household starting school, high moving costs are
avoided. Hence, the likelihood of households living in rented housing is expected to shift
negatively as the children reach the age of five or six.
The question of how children of a household influence the household's mobility plans and behaviour in the housing market in general has been attracting little attention from housing economists. The quite rudimentary description of children in demand, tenure and length of stay equations may have resulted in some important structures not being revealed.

Kan (1999) points out that the effects of demographic explanatory variables in empirical models of mobility behaviour can be traced back to their effect on moving costs. He finds that the larger the household is the less likely it is that the household plans to move: this effect is significantly different from zero. This is clearly compatible with moving costs being increasing in number of family members. It may be noted that Kan in his analysis constrains the effect on moving costs of the household of presence of children at different ages and adults to be identical. Within the empirical analysis of this paper this is a testable hypothesis, rather than an assumption.

In Henderson and Ioannides (1989), the pattern found in the expected length of stay equations, estimated jointly with a tenure choice equation, differs somewhat from Kan's results. Neither family size nor marital status significantly affects expected length of stay in either rental or owner-occupied housing. However, both being married and a large family increases expected length of stay as these characteristics have a significantly depressing effect on the probability of renting. This increases expected length of stay as expected stays of tenants are clearly shorter than those of owner-occupiers.

Haurin and Chung (1998) estimate a hazard model of households' length of stay. They distinguish between an expected path for the demographic variables and deviations from this expected path. Their hazard function is linear in predicted number of children. Somewhat surprisingly they find that the coefficient of ‘predicted number of children’ is negative, but not significantly different from zero. Unexpected changes in the number of children in the household significantly shorten expected stays. In the results of Haurin and Chung it is difficult to see moving costs of children affecting expected mobility behaviour of households.

Loikkanen (1992) uses a quite large set of dummies describing the households in his analysis of tenure choice and the demand for housing. His study allows for cross-effects by using dummies that combine the number of adults, number of children and age of the head. Inspection of the estimated probit equation for tenure choice clearly indicates that number of children affects the propensity to owner-occupy in a non-linear fashion.

4.3 Econometric model

The discussion of Section 2 showed that the decisions on tenure and planned length of stay or mobility should be regarded as simultaneous, and as part of a dynamic plan. To describe these dynamic plans empirically, ideally a panel of households should be used. However, as I do not have access to suitable panel data, I will base my estimations on a cross-section, which is further described in the next section.

Edin and Englund (1991) argue that the potential bias of the coefficients of well-specified models estimated on cross-sections is probably not quantitatively serious. Even though a panel would have been preferable, it should be born in mind that cross-sections also contain information on the dynamics behind the plans made by households and their behaviour in the housing market. Hence even though the data used are taken from a cross-section they can reflect both historic information and (rationally formed) expectations over paths of future
values of the relevant variables. Such information should be utilised when a cross-section is used to estimate housing demand.

An important lesson to be learned from the discussion of Section 2 is that a theoretic discussion of the dynamics of housing demand does not give any single answer to the question of how an econometric model should be specified. The paper presents and estimates one model described in Section 3.1. of tenure choice and planned length of future stay. Alternative specifications are also loosely discussed. One problem is that individual information on planned mobility is not continuously observed. This will be the subject of further discussion in section 4.

Tenure choice and planned length of stay

Any single household will choose tenure according to the sign of the difference between the utility in each of the tenures owner-occupation, $\Omega_O$, and renting, $\Omega_R$. Hence, my econometric specification does not explicitly deal with the possibility of liquidity constraints affecting tenure choice. It should be noted that in the 1995 Norwegian Survey of Housing Conditions more than 95% of the renters state that for them, renting was not a response to problems of financing a home purchase. The indirect utility function of a household $i$ is given in (1).

$$\Omega_{ij}=v_j(X_i,D_i,F_i)+\varepsilon_{ij} \quad j=O,R$$

where:
- $v(\cdot)$ is a common component of the utility functions of all households.
- $X_i$ is a vector of explanatory variables.
- $D_i$ is a vector of demographic characteristics of household $i$ that among other things proxy for moving costs.
- $F_i$ is the expected future stay in the present dwelling.
- $\varepsilon_{ij}$ is a household specific component, which is unobservable. From an analytical point of view these components are regarded as realisations of stochastic variables with a known common distribution.

The probability of household $i$ being found renting is:

$$P_i(\text{rent})=P(\Omega_R>\Omega_O)=P(v_R(X_i,D_i,F_i)-v_O(X_i,D_i,F_i)>\varepsilon_{iO}-\varepsilon_{iR})$$

Assume that the individual components are independently normally distributed among households, with expectation equal to zero and a variance that does not vary between households. The parameters of the utility difference function can then be estimated using a standard probit procedure. Equivalently, tenure choice can be described by introducing a latent variable $R^*_i$. If this latent 'tendency to rent' is positive the household will choose to rent. The latent variable is a linear function of the arguments of the indirect utility function:

$$R^*_i=aX_i+dD_i+bF_i+v_i$$

Assuming that the residual $v_i$ is standard normal distributed, the coefficients $a$, $d$ and $f$ can be estimated by the standard probit procedure.

The length of the expected future stay in the present dwelling is specified as a linear function of a set of explanatory variables where the latent 'tendency to rent', $R^*_i$, is included. The variance of expected future stay is assumed to be increasing in its level so that the variance
approaches zero as the level approaches zero. These assumptions ensure that confidence and prediction intervals of any positive expected future stay do not include negative stays. A statistical model that satisfies these conditions is the lognormal regression model:

\[(3) \quad F_i = \alpha X_i + \delta D_i + \beta R_i^* + \gamma S_i + u_i\]

Where \(S_i\) is the length of incomplete spell in the present housing unit and \(\alpha, \delta, \beta\) and \(\gamma\) are vectors of coefficients that are to be estimated. The parameters of the lognormal regression equation (3) can be directly estimated using ML-methods. Equation (2b) and (3) are a simultaneous system and hence single-equation ML-estimation of the two equations is inappropriate. The system is therefore estimated using a two-stage procedure proposed by Maddala (1983). In the first step \(R_i^*\) and \(F_i\) is estimated as a function of all the explanatory variables in the system except \(R_i^*\) and \(F_i\). Then, in the final step, the predicted values of the simultaneous determined variables are inserted into equation (2b) and (3), and each of them is re-estimated. This two-stage procedure, when applied to a cross-section, ignores possible fixed, or individual specific, effects on the planned future stay. Future research on tenure choice and residential mobility, based on panel data, should test for the importance of fixed effects.

The coefficient estimates from the second step are consistent estimates of the structural parameters. However, the standard errors estimated in the second step are not correct. In the user’s manual for LIMDEP 7.0 it is noted that correction of the asymptotic covariance matrix of the structural parameters of simultaneous equation models of mixtures of continuous and dichotomous variables can be both a complex and a complicated task. In this paper this problem is handled by not handling it! The estimated model is primarily used as a framework for tests of various hypotheses of the determinants of the dynamics of housing market behaviour. These tests are based on comparisons of the values of the loglikelihood functions. Hence the standard errors of single coefficients are not used in the main interpretation of the results of the estimations. This is my pragmatic argument for not putting any effort into correction of the standard errors.

4.4 Data
The data is from the 1995 Norwegian Survey of Housing Conditions. This contains a broad range of information about households, their income and their housing condition. The observations of the sample cover all parts of Norway. Both answers from a questionnaire and information from official registers are included. I focus on tenure and mobility decisions of relatively young adults. That is to say, I analyse the choices of households with heads aged between 20 and 45. Using only those observations without 'missing' values on any of the relevant variables and in which a household head or his/her partner has been interviewed leaves me with 2,128 observations. Of these 622 (or close to 30%) are tenants.

In the questionnaire, the households were asked to respond to the question 'For how long will Your household stay in Your present dwelling?'. The respondents were asked only about their moving plans. Consequently it is not possible to distinguish between planned inter- and intra-urban mobility. The answers to this question are used to construct the mobility and planned future stay variable used in the empirical analysis. Rather than giving an 'exact' answer to the question the respondents were asked to choose among a number of categories. These categories and their distribution are given in table 1.
Table 1 - Moving and staying plans among renters and owners, head 20-45 years old (percent)

<table>
<thead>
<tr>
<th></th>
<th>Owners</th>
<th>Renters</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate moving plans</td>
<td>6.8</td>
<td>31.9</td>
<td>14.2</td>
</tr>
<tr>
<td>Will move within the next three years</td>
<td>9.6</td>
<td>33.5</td>
<td>16.6</td>
</tr>
<tr>
<td>Not within the next three years/No plans</td>
<td>56.4</td>
<td>30.9</td>
<td>49.0</td>
</tr>
<tr>
<td>Stay here the rest of our life</td>
<td>27.1</td>
<td>3.7</td>
<td>20.2</td>
</tr>
<tr>
<td>Number of observations</td>
<td>1,504</td>
<td>621</td>
<td>2,125</td>
</tr>
</tbody>
</table>

Table 1 reveals that tenants have moving plans to a larger extent than owner-occupiers do. Duration of present incomplete spell also differs significantly between the two tenures. Mean duration of incomplete spell among the owners is 15.8 years, with a standard deviation of 12.8 years. The corresponding figures for tenants are a mean of 4.8 years with a standard deviation of 8.5. Around 8% of the owner-occupiers and 39.6% of the tenants moved into their present housing unit within the last year.

Planned future stay in present dwelling is essentially a continuous variable even though it is unfortunately categorically observed in my data set. Therefore, I have translated the data over to a continuous scale. Of course it is not ideal to put information into a data set by using such a translation procedure. The results from the analysis of the 'translated' data should therefore be interpreted together with the results obtained through the use of alternative translation procedures. Partly because of such translated data is used, the interpretation of the empirical results are focused on signs and significance levels of (sets of) coefficients.

For those who state that they will probably move quite soon, the planned future stay is set to one half of a year, for those who states that they will be moving within the next three years the future stay is set to 1.5 years. Future stay is set to five years for both those who answers that they will stay in their present housing unit for at least three years more and those who answers 'No plans at all'. If a household has answered 'Want to live here for the rest of our life' planned future stay is, again somewhat arbitrary, set to nine years. Alternative translation procedures and estimates based on them, are given in an appendix.

A fairly detailed description of marital status and of other characteristics of households is an important part of the empirical models. Couples are divided into three age groups according to age of head. The specific age cuts can be seen from table 2. Furthermore, the number of years over which a couple has been living together is included as an explanatory variable. Couples who has been living together for more than ten years is given a value of 10 for this variable. The purpose of combining couple-dummies, and the time spent as a couple in the empirical models is to see whether the housing careers are mostly influenced by a the 'couple-or-not' state, or whether the time actually spent as a couple is more important.

Single person households are described in the same way as the couples: i.e. they are divided into three age groups, and number of years, truncated at ten, spent as singles is part of the set of explanatory variables. A single-person household is defined as a household in which the head is not living with a partner. Therefore there may be children present in a single-person household. There may also be other adults living in the same housing units, such as adult children, friends, parents and so on. The definition of single person households follows Börsch-Supan (1986) in being based upon the assumption that housing decisions are taken at a nucleus-level rather than on an extended household level.
Each sex is given its own set of age dummies in order to check whether age affects tenure choice and mobility differently for single males and females. Such differences may be caused by expected changes of marital status depending differently upon age for males and females (see Haurin and Kamara, 1992). Alternatively their cause may simply be that the central tendency in the distributions of preferences really does differ between the sexes.

One of the objectives of this paper is to acquire new empirical knowledge of how children affect the housing career of a household. On account of this children of a household is described in more detail than is usually done in this kind of models. This is done by the way number of children is handled and by entering indicators of age of the oldest child. Instead of using number of children in the household as an explanatory variable; dummies for one or more children, two or more children and three or more children being present are used. Hence, I allow for the fact that the effect of children may be non-linear in their number. Such non-linearities may arise from some kind of economics of scale in the family economy.

In Section 2, it was argued that the moving costs of a child probably are increasing in its age, and that this age dependency probably is not linear and may not even be continuous. My hypothesis is that the moving costs shifts positively around the 6-8 year age of a child. The first such shift experienced by a family occurs when the eldest child reaches this age. Therefore, dummies are used to classify households according to the age of the eldest child in the household. The specific categories used can be seen from table 2. Table 2 gives the frequencies, measured in percent, of the dummy variables used to describe the demographic characteristics of the households in the sample used to estimate the structural models.

<table>
<thead>
<tr>
<th></th>
<th>Owners</th>
<th>Renters</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single male less than 30 years old</td>
<td>2.4</td>
<td>17.0</td>
<td>6.9</td>
</tr>
<tr>
<td>Single male 31-40 years old</td>
<td>3.9</td>
<td>5.9</td>
<td>4.5</td>
</tr>
<tr>
<td>Single male 41-45 years old</td>
<td>2.9</td>
<td>2.4</td>
<td>2.5</td>
</tr>
<tr>
<td>Single female less than 30 years old</td>
<td>2.3</td>
<td>14.1</td>
<td>5.7</td>
</tr>
<tr>
<td>Single female 31-40 years old</td>
<td>5.3</td>
<td>7.7</td>
<td>6.0</td>
</tr>
<tr>
<td>Single female 41-45 years old</td>
<td>2.1</td>
<td>2.6</td>
<td>2.3</td>
</tr>
<tr>
<td>Couple, head less than 30 years old</td>
<td>16.0</td>
<td>28.1</td>
<td>19.5</td>
</tr>
<tr>
<td>Couple, head 31-40 years old</td>
<td>43.3</td>
<td>18.0</td>
<td>35.9</td>
</tr>
<tr>
<td>Couple, head 41-45 years old</td>
<td>21.8</td>
<td>4.2</td>
<td>16.7</td>
</tr>
<tr>
<td>Eldest child 0-3</td>
<td>12.5</td>
<td>13.1</td>
<td>12.7</td>
</tr>
<tr>
<td>Eldest child 4-5</td>
<td>7.5</td>
<td>5.6</td>
<td>7.0</td>
</tr>
<tr>
<td>Eldest child 6-8</td>
<td>12.1</td>
<td>5.6</td>
<td>10.2</td>
</tr>
<tr>
<td>Eldest child 8-18</td>
<td>36.7</td>
<td>10.6</td>
<td>29.0</td>
</tr>
<tr>
<td>One or more child(ren) present</td>
<td>68.8</td>
<td>34.9</td>
<td>58.9</td>
</tr>
<tr>
<td>Two or more children present</td>
<td>46.1</td>
<td>14.1</td>
<td>36.8</td>
</tr>
<tr>
<td>Three or more children present</td>
<td>12.8</td>
<td>3.9</td>
<td>10.2</td>
</tr>
<tr>
<td>Number of observations</td>
<td>1,506</td>
<td>622</td>
<td>2,128</td>
</tr>
</tbody>
</table>

One important determinant of housing consumption is income. However, it is not obvious how income should be entered into empirical models of housing careers. In this paper, I have emphasised that housing demand should be considered within a dynamic perspective, where the present situation of a household should be considered as a part of a rationally formed plan where information is utilised efficiently. It should, then, be obvious that future, and also past,
income is part of the set of variables that explain the present housing situation. This is captured by the concept of permanent income. However, permanent income is not observable. A procedure proposed by Goodman and Kawai (1982) has been extensively used in housing studies. Current income is regressed on a battery of explanatory variables and the estimated regression equation is used to make a prediction. Permanent income is then set equal to the income prediction. Even though the use of the Goodman-Kawai procedure has been quite successful in empirical studies, Cameron (1986) shows that this way of assessing permanent and transitory income is not without its problems.

Income can be decomposed into the product of an hourly wage and labour supply. The choice of individual labour supply and consumption are determined simultaneously. This observation is the argument for an alternative procedure proposed by Haurin (1991). He argues that, because of the simultaneity, neither current income nor the Goodman-Kawai measure of permanent income should be used in housing demand equations. Haurin's alternative is termed 'Full income'. He proposes to regress wage, rather than income, on the explanatory variables. The estimated equation is then used to predict a permanent wage profile over a number of years into the future. The discounted sum of wage times full time work hours is then a measure of human capital, which easily can be transformed to a permanent full income. The permanent full income can be used to purchase housing, other consumption and leisure.

I use a full income measure calculated on basis of my cross-section data. Explanatory variables used are type and level of education, age, type of occupation, marital status and regional dummies. The wage equation was estimated as a pooled regression where the coefficients of males and females in different educational groups were allowed to differ. It may be noted that the wage equation showed considerable weaker age-related growth for females than was the case for males. The wage equation is presented in appendix 3. The same age-gender structure was revealed in Longva and Strom (1996). To check whether the shape of the expected wage profile matters for the housing choices and plans I have calculated the difference between the predicted wage ten years ahead and predicted wage of today. The difference is termed the income tilt.

Before concluding this section on data and explanatory variables, it is pertinent to make a few comments on two variables, which are not included in the set of explanatory variables of my model. The only wealth variable I use is the full income that can be interpreted as a measure of human capital. Housing capital is the major part of the wealth of Norwegian households. Current wealth is, probably to a quite large extent, the result of capital gains made on owner-occupied housing, and ‘forced’ down-payments made on loans for housing purposes. Hence, it is even more likely that wealth is determined by past tenure choices than is that present tenure choice depends on wealth. Some of the results in described by Edin and Englund (1991) indicate that this also might be the case in Sweden. Another pragmatic reason for the omission of wealth from the empirical models is that this would have reduced the size of the sample by more than 15% due to missing information on wealth.

Nor does the tenure choice equation include any direct measure of the ratio between the cost of owner-occupancy and tenancy. If it is assumed that rental housing is priced according to some no-arbitrage condition there will be no cross-section variation in rents, nor will there be any variation between households in the user cost of owner-occupancy as every household are facing the same marginal tax rates on capital income. Even though the empirical models do not include any direct measure of the ratio between the user cost of owner-occupancy to that of tenancy, the effect of expected length of stay capture some price effects. As already argued
the price ratio correlates positively with expected length of stay. This is due to the differences in moving costs in the two tenures.

### 4.5 Empirical results

As argued in Section 2, empirical models such as the one used in this paper should not be interpreted as fully specified empirical counterparts of theoretical models of the dynamics of housing demand. Rather, they should be considered as econometric experiments that take account of essential features of the theoretical results, and to be a framework for discussing and testing of different hypothesis of housing market behaviour. Discussions of hypothesis and possible mechanisms will consequently form the central part of the presentation of empirical results.

**Tenure choice and planned length of stay**

The ML-estimates of the coefficients of the two-equation model outlined in Section 3 are given in Table 3.

Table 3 – Estimated model of planned future length of present stay and tenure, (t-values)

<table>
<thead>
<tr>
<th></th>
<th>Probit model of renting</th>
<th>Lognormal model of length of future stay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>5.049 (7.78)</td>
<td>3.334 (6.39)</td>
</tr>
<tr>
<td>Latent tendency to rent(a)</td>
<td>-0.937 (11.52)</td>
<td>-0.793 (1.79)</td>
</tr>
<tr>
<td>Log (E[\text{stay}])</td>
<td>-0.393 (4.96)</td>
<td>-0.003 (3.46)</td>
</tr>
<tr>
<td>Tilt income</td>
<td></td>
<td>-0.050 (0.54)</td>
</tr>
<tr>
<td>Duration of incomplete spell</td>
<td></td>
<td>0.005 (1.42)</td>
</tr>
<tr>
<td>Duration squared</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single male 31-40 years old</td>
<td>-0.273 (1.46)</td>
<td>0.835 (1.78)</td>
</tr>
<tr>
<td>Single male 41-45 years old</td>
<td>-0.288 (1.19)</td>
<td>1.339 (1.89)</td>
</tr>
<tr>
<td>Single female less than 30 years old</td>
<td>-0.051 (0.29)</td>
<td>0.180 (0.64)</td>
</tr>
<tr>
<td>Single female 31-40 years old</td>
<td>-0.329 (1.83)</td>
<td>0.426 (0.94)</td>
</tr>
<tr>
<td>Single female 41-45 years old</td>
<td>-0.403 (1.61)</td>
<td>-0.533 (1.05)</td>
</tr>
<tr>
<td>Years as single</td>
<td>-0.008 (0.36)</td>
<td>0.058 (1.16)</td>
</tr>
<tr>
<td>Couple, head less than 30 years old</td>
<td>-0.123 (0.81)</td>
<td>0.291 (0.86)</td>
</tr>
<tr>
<td>Couple, head 31-40 years old</td>
<td>-0.243 (1.40)</td>
<td>0.934 (1.96)</td>
</tr>
<tr>
<td>Couple, head 41-45 years old</td>
<td>-0.318 (1.53)</td>
<td>1.092 (1.68)</td>
</tr>
<tr>
<td>Years as couple</td>
<td>-0.033 (2.16)</td>
<td>0.098 (2.10)</td>
</tr>
<tr>
<td>Oldest child 4-5</td>
<td>0.159 (0.98)</td>
<td>-0.083 (0.21)</td>
</tr>
<tr>
<td>Oldest child 6-8</td>
<td>0.224 (1.41)</td>
<td>0.408 (0.90)</td>
</tr>
<tr>
<td>Oldest child 8-18</td>
<td>0.238 (1.58)</td>
<td>0.974 (2.12)</td>
</tr>
<tr>
<td>One or more child(ren) present</td>
<td>-0.229 (2.15)</td>
<td>-0.138 (0.54)</td>
</tr>
<tr>
<td>Two or more children present</td>
<td>-0.260 (2.20)</td>
<td>0.532 (1.33)</td>
</tr>
<tr>
<td>Three or more children present</td>
<td>0.083 (0.55)</td>
<td>-0.583 (1.18)</td>
</tr>
<tr>
<td>(\sigma^2)</td>
<td></td>
<td>1.065 (32.29)</td>
</tr>
<tr>
<td>( \log L )</td>
<td>-935.03</td>
<td>-2,720.85</td>
</tr>
<tr>
<td>Restricted ( \log L )</td>
<td>-1,283.80</td>
<td>-2,898.43</td>
</tr>
<tr>
<td>Number of observations</td>
<td>2,125</td>
<td>2,125</td>
</tr>
</tbody>
</table>

\(a\) These two variables are calculated in the first step of the two stage estimation procedure.
The differences between the restricted loglikelihood values and those of the model are clearly satisfactory. Tenure is correctly predicted for 53.1% of the tenants and for 89.4% of the owner-occupiers. This gives a total share of correct predictions of 78.8%. The signs of the estimated coefficients do not contradict expectations based on theoretical considerations and previous studies. Apart from noting these desirable properties of the estimated model, the estimation results as presented in table 3, will not be further discussed in the paper! Instead, I will use the model as a framework for tests of various hypotheses on the determinants of the dynamics of housing market behaviour. These tests are presented in Section 5.2.

The dynamics of housing market behaviour - some tests

I regard the estimations of this paper as a contribution to an empirical based understanding of the dynamics of housing market behaviour rather than as an empirical counterpart of a closed structural model of the demand side of a housing market. In view of this, I find it more appropriate to use the estimated model as a framework for statistical testing of simple statements rather than to give any full interpretation of the results. Tests of the statements are meant both to give new insight in the determinants of housing choices and to provide guidelines for specifications of empirical housing market models. In this section, the hypotheses are presented and the results of the tests are given and discussed in a verbal and informal way. In appendix 2 the test results are described somewhat more formally.

Only hypotheses that are nested within the full model given in table 3 is tested. A model nested within the full model consists of the full model and a set of linear constraints. Twice the difference between the loglikelihood function of the full model and of the restricted model is kji-square distributed with a number of degrees of freedom equal to the number of linearly independent restrictions (Ben-Akiva and Lerman, 1985 p.28). The uncorrect(ed) standard errors reported in table 3, are hence not used. There is probably also some structural multicollinearity between some of the demographic explanatory variables. It should be sufficient to mention age of household head, years spent as a couple and age of the eldest child. Also this tends to bias estimates of standard errors. Hence the global loglikelihood test seems to be an appropriate tool in this analysis.

Statement 1: Sex matters

If sex of singles does not matter for the dynamics of housing market behaviour, my model is unnecessary complicated. To test for this, the set of age dummies crossed with sex dummies is replaced with pure age dummies for the singles. According to these tests it is not possible to reject the hypothesis that tenure choice is independent of sex. The hypothesis that planned length of future stay is independent of sex is clearly rejected, at a 5%-level of significance.

Hence sex seems to matter for the dynamic choices of housing careers for singles. Inspection of the ML-estimates in table 3 indicates that the expected stay in present dwelling increases monotonically as single men gets older. The increase in expected future stay in age is weaker for the females and is turned towards a drop as the females gets forty years old. Without further research it is not possible to conclude on the reason of this results. One possible explanation is that the correlation between age and expected change of marital status differ between single males and females.
Statement 2: Age strongly affects planned length of stay, but may have no direct effect on tenure choice

Most empirical models of tenure choice reveal quite a strong age dependency. At least, this is true in the case of single equation models. Within the framework of the model of this paper it is possible test whether this age dependency is a direct effect on tenure choice or whether it works indirectly through the effect age has on planned length of future stay. An effect on planned length of stay will affect tenure choice through its effect on the relative price of tenancy as compared to owner occupation. It may be noted that Henderson and Ioannides (1989), in their simultaneous model of tenure and length of residential spell, found that age has a positive but insignificant partial effect on ownership probabilities.

It turns out that the model that containing age effects in the tenure choice equation does not perform significantly better than an equation without such effects. Hence the null hypothesis of no age effect in the tenure choice equation cannot be rejected at any sensible level. This result holds both for couples and singles. A null hypothesis of length of planned future stay in present dwelling being independent of age of the head of the household, on the other hand, is rejected at a 1-percent level of significance. This result applies both for singles and couples. A significant negative dependency between length of residential stays and age is also found in Henderson and Ioannides (1989). These results can be taken as a strong indication of the desirability to use simultaneous models of the different dimensions of housing careers when formulating empirical models of the dynamics of housing market behaviour.

Statement 3: Marital history more important than marital status

The statement investigated in this subsection is that the choice of tenure and planned length of stay is quite similar for newly formed couples and singles at the same age. If a couple stays together, a difference between the couples and singles will evolve over time.

The first two tests carried out in order to shed light on Statement 3 were to omit the 'years spent as a couple'-variable from respectively the tenure choice equation and the length of future stay-equation. Both these omissions yielded a significantly poorer fit, as measured by the loglikelihood, than the models that include years spent as a couple. The coefficients of the marital status-variables increased in magnitude and were clearly significant different from zero in the model without the 'years spent as a couple'-variable. This is the same as what is found in empirical models of tenure choice that do not include years spent as couple.

Above it is established that length of marital history matters for actual tenure and planned housing careers. This is hardly surprising. Far more surprising results emerge when the hypothesis that, when controlling for length of marital history, marital status does not have any effect on neither tenure choice nor planned length of future stay. Somewhat ad-hoc this hypothesis is tested by constraining the age effect of couples to be equal to those of single males. It is then checked whether the corresponding reduction of the value of loglikelihood functions are significantly greater than zero. The estimations show that the reductions in the value of the log-likelihoods are far from being significantly different from zero. This applies to both the tenure choice and planned length of future stay equations. Hence, the hypothesis that planned housing careers are independent of marital status can not be rejected at any sensible level of significance.
The results in this subsection are consistent with a hypothesis of transition rates from rental to owner-occupied rather than tenure-state, depends on marital status. It might also be that years spent as a couple affects the couples' faith in their relation to last and through this affect their housing market behaviour.

**Statement 4: Age of the children affects the families' housing choices**

In the theoretical discussion in Section 2, I hypothesised that the non-monetary moving costs of children is increasing in their age, and that these costs makes a positive jump around the time the children go to school. This is expected to make planned length of stay an increasing function of the age of children in the household. In this paper, I have described the age of children in a household by the age of the eldest child.

The full model, presented in table 3, is tested against models without any effect from the age of children to the housing choices. It so turns out that the model which includes children's-age-dummies is not describing tenure choice significantly better than a model which does not contain such explanatory variables. The model describes planned length of future stay better with children's-age-dummies than without them. However, the loglikelihood in the former model is higher than that of the latter only at a 10% level of significance. Therefore, these tests can not really be said to establish my hypothesis.

The reason for the failure to identify a children's-age-effect may, of course, be that it does not exist. It may also be that there is little difference between moving costs of very young children, but that there still is a positive jump in the moving costs around the age a child starts school. In order to test for this, I have formulated a 'full model' where the only children's-age-dummy included is 'presence of school kids'. This revised full model is then tested against models where the 'presence of school kids'-dummy is omitted. Also within this test framework I find that a null hypothesis of tenure choice being independent of presence of school kids cannot be rejected. Planned length of future stay in present dwelling, on the other hand, is significantly better described when the dummy for school kids present is included. Hence, my model indicates that presence of school children in a family significantly reduces a family's expected mobility. As far I am aware of this effect has not been identified previously in the literature on residential mobility. Sarmiento (1995) reports that she tested for this effect, but that she was not able to identify any significant effect.

**Statement 5: Number of children affects housing market behaviour - in a non-linear fashion**

It seems a little bit unnatural to formulate a model that includes dummies for age of children but not number of children. Therefore I use the same strategy as in the former subsection when formulating the tests. Firstly, a full model without age of children dummies is estimated, then this model is tested against a model without dummy indicators of number of children. Within this framework the null hypothesis that tenure choice is independent of number of children is rejected at a 2%-level of significance. The corresponding hypothesis for planned length of stay can only be rejected at a level of significance a little bit above 5%.

Both common sense and the tests above indicate that the number of children in a household affect tenure choice and planned length of stay. The next question to be addressed is whether these effects are linear or not. The common practice is to use family size or number of children as explanatory variables in empirical models of tenure choice and residential mobility. Furthermore, the ML-estimates of the coefficients of the dummies for respectively
one or more, two or more and three or more children present in the household do not seem to be consistent with a linear effect. The estimates indicate that housing market behaviour of household with two or more children does not differ much from the behaviour of households with two children. These features make it interesting to perform a formal test of whether the effects are linear or not. The impression that inspection of the ML-estimates of the coefficients gives is confirmed by the statistical test. The hypothesis of linear effects in the two equations is rejected at a 2%-level.

The non-linear relations between number of children and planned length of stay and the 'latent propensity to chose a rental dwelling' are probably caused by some economies of scale in a family's housing consumption technology'. This results together with the results on the effects of age of the children, implies that one should think thoroughly through how one describe family structure when disaggregated models of housing choice are formulated.

Statement 6: Tenure choice is affected by demographic characteristics

After performing several partial tests and finding that sex, age, marital status and age of children primarily affects tenure choice through their effect on planned lengths of stay, it is tempting to conclude that apart from the effect on planned length of stay, tenure is independent of demographics. This strong hypothesis can be tested within the framework of the empirical model of the paper. This can really be said to be a strong hypothesis in light of the consistent agreement in the literature on tenure choice of the importance of demographic variables.

However, the hypothesis that all the coefficients of all dummies that characterise the demographic status of the household are simultaneously equal to zero in the tenure choice equation is rejected at level of significance well below 1%.

4.6 Concluding Remarks

An important thesis upon which this paper is based is that tenure and planned mobility, or planned length of stay, are simultaneously determined dimensions of the planned housing career of a household. Estimation of an empirical model that takes account of the simultaneity proved to yield a suitable framework for statistical tests of important hypothesis regarding the determinants of the dynamics of housing market behaviour.

Among other things, it is shown that expected mobility is reduced significantly by the presence of schoolchildren in the household. Many countries encourage home-ownership. I take the empirical results in this paper as indicating that the welfare effects of such policies may be greatest if families with pre-school children are given priority when support of this kind is allocated. This may enable some families to make the transition to owner-occupation at a point when the moving costs of their children are at their lowest.

This paper has demonstrated the need for care when choosing how to describe household composition in models of housing market behaviour. It is particular important to exercise caution regarding how to describe number of children. In models in which the dynamics of the behaviour are important one should also consider using age of the children among the explanatory variable. Furthermore I hope that I in this paper have lent support to the claim of Edin and Englund (1991), that it is possible to gain insight into the dynamics of housing demand, even on the basis of cross-section data.
The simultaneous two-equation structure used in the paper makes it possible to check whether some of the explanatory variables frequently used in empirical models of tenure choice have a direct effect on tenure or affects tenure choice indirectly via planned length of stay. Tests reveals that neither sex nor age of household head has any significant direct effect on tenure choice. However, both these variables affect planned length of stay significantly.

The strong effect of the 'years spent as a couple' variable verifies that knowledge of the demographic history of a household is important when it comes to understanding of its housing market behaviour. Knowledge of whether past changes in household composition were expected or not and of the expected future development is probably also important. The significant differences in the age pattern of expected future stays between single males and females may be due to such differences in expected future household composition. Haurin and Chung (1998) have modelled housing demand using, at least to some extent, the type of demographic household history described here. However, they do not place their emphasis on tenure choice. To capture the effects on planned housing careers of expected and unexpected changes of the household composition empirically, the analysis should probably be based on panel data.
### Appendix 1

The data for the simultaneous model of tenure and planned length of future stay are categorical data translated over to a continuous scale. The categorical data are taken from the answer to a question of how long to plan to stay in your present housing unit. In A1 the predefined categories are given. In the column Translation 1, the translation procedure used in the paper is given. Translation 2 and 3 gives some alternative translation procedures. In tables A2 and A3 it is shown which results emerged under each of the three translation procedures.

<table>
<thead>
<tr>
<th></th>
<th>Translation 1</th>
<th>Translation 2</th>
<th>Translation 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate moving plans</td>
<td>0.5</td>
<td>0.5</td>
<td>1</td>
</tr>
<tr>
<td>Will move within the next three years</td>
<td>1.5</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Not within the next three years/No plans</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Stay here the rest of our life</td>
<td>9</td>
<td>11</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Translation 1 (0.5;1.5;5;9)</th>
<th>Translation 2 (0.5;2;6;11)</th>
<th>Translation 3 (1;2;7;15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>5.049 (7.78)</td>
<td>5.362 (8.14)</td>
<td>5.780 (8.61)</td>
</tr>
<tr>
<td>Log E[stay]</td>
<td>-0.937 (11.52)</td>
<td>-1.030 (11.53)</td>
<td>-1.133 (11.55)</td>
</tr>
<tr>
<td>Log Full income</td>
<td>-0.399 (5.03)</td>
<td>-0.399 (5.03)</td>
<td>-0.415 (5.21)</td>
</tr>
<tr>
<td>Single male 31-40 years old</td>
<td>-0.273 (1.46)</td>
<td>-0.222 (1.18)</td>
<td>-0.204 (1.08)</td>
</tr>
<tr>
<td>Single male 41-45 years old</td>
<td>-0.288 (1.19)</td>
<td>-0.223 (0.91)</td>
<td>-0.163 (0.67)</td>
</tr>
<tr>
<td>Single female less than 30 years</td>
<td>-0.051 (0.29)</td>
<td>-0.019 (0.11)</td>
<td>-0.056 (0.32)</td>
</tr>
<tr>
<td>Single female 31-40 years old</td>
<td>-0.329 (1.83)</td>
<td>-0.283 (1.56)</td>
<td>-0.278 (1.53)</td>
</tr>
<tr>
<td>Single female 41-45 years old</td>
<td>-0.403 (1.61)</td>
<td>-0.392 (1.56)</td>
<td>-0.363 (1.44)</td>
</tr>
<tr>
<td>Years as single</td>
<td>-0.008 (0.36)</td>
<td>-0.006 (0.28)</td>
<td>-0.006 (0.27)</td>
</tr>
<tr>
<td>Couple, head less than 30 years</td>
<td>-0.123 (0.81)</td>
<td>-0.085 (0.56)</td>
<td>-0.079 (0.52)</td>
</tr>
<tr>
<td>Couple, head 31-40 years old</td>
<td>-0.243 (1.40)</td>
<td>-0.181 (1.04)</td>
<td>-0.162 (0.93)</td>
</tr>
<tr>
<td>Couple, head 41-45 years old</td>
<td>-0.318 (1.53)</td>
<td>-0.253 (1.21)</td>
<td>-0.226 (1.07)</td>
</tr>
<tr>
<td>Years as couple</td>
<td>-0.033 (2.16)</td>
<td>-0.029 (1.90)</td>
<td>-0.027 (1.75)</td>
</tr>
<tr>
<td>Oldest child 4-5</td>
<td>0.159 (0.98)</td>
<td>0.155 (0.96)</td>
<td>0.142 (0.88)</td>
</tr>
<tr>
<td>Oldest child 6-8</td>
<td>0.224 (1.41)</td>
<td>0.225 (1.41)</td>
<td>0.235 (1.48)</td>
</tr>
<tr>
<td>Oldest child 8-18</td>
<td>0.238 (1.58)</td>
<td>0.250 (1.66)</td>
<td>0.273 (1.81)</td>
</tr>
<tr>
<td>One or more child(ren) present</td>
<td>-0.229 (2.15)</td>
<td>-0.231 (2.17)</td>
<td>-0.218 (2.05)</td>
</tr>
<tr>
<td>Two or more children present</td>
<td>-0.260 (2.20)</td>
<td>-0.241 (2.04)</td>
<td>-0.235 (1.99)</td>
</tr>
<tr>
<td>Three or more children present</td>
<td>0.083 (0.55)</td>
<td>0.064 (0.42)</td>
<td>0.058 (0.38)</td>
</tr>
<tr>
<td>LogL</td>
<td>935.03</td>
<td>934.41</td>
<td>933.58</td>
</tr>
<tr>
<td>Restricted LogL</td>
<td>1,283.80</td>
<td>1,283.80</td>
<td>1,283.80</td>
</tr>
<tr>
<td>Share correct predicted tenants</td>
<td>53.1%</td>
<td>53.6%</td>
<td>53.1%</td>
</tr>
<tr>
<td>Share correct predicted owners</td>
<td>89.4%</td>
<td>89.4%</td>
<td>89.0%</td>
</tr>
<tr>
<td>Total correct predictions</td>
<td>77.8%</td>
<td>78.9%</td>
<td>78.7%</td>
</tr>
<tr>
<td>Number of observations</td>
<td>2,125</td>
<td>2,125</td>
<td>2,125</td>
</tr>
</tbody>
</table>

*These two variables are calculated in the first step of the two stage estimation procedure.*
### Table A3 – Planned length of future stay alternative translation procedures

<table>
<thead>
<tr>
<th></th>
<th>Translation 1 (0.5;1.5;5;9)</th>
<th>Translation 2 (0.5;2.6;11)</th>
<th>Translation 3 (1;2;7;15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>3.334 (6.39)</td>
<td>4.007 (5.93)</td>
<td>5.086 (7.01)</td>
</tr>
<tr>
<td>Latent tendency to rent*</td>
<td>-0.793 (1.79)</td>
<td>-0.939 (1.63)</td>
<td>-1.230 (1.99)</td>
</tr>
<tr>
<td>Tilt income</td>
<td>-0.003 (3.46)</td>
<td>-0.004 (3.22)</td>
<td>-0.005 (4.05)</td>
</tr>
<tr>
<td>Duration of incomplete spell</td>
<td>-0.050 (0.54)</td>
<td>-0.048 (0.41)</td>
<td>-0.106 (0.85)</td>
</tr>
<tr>
<td>Duration squared</td>
<td>0.005 (1.42)</td>
<td>0.006 (1.29)</td>
<td>0.008 (1.75)</td>
</tr>
<tr>
<td>Single male 31-40 years old</td>
<td>0.835 (1.78)</td>
<td>1.068 (1.77)</td>
<td>1.041 (1.58)</td>
</tr>
<tr>
<td>Single male 41-45 years old</td>
<td>1.339 (1.89)</td>
<td>1.626 (1.79)</td>
<td>1.885 (1.90)</td>
</tr>
<tr>
<td>Single female less than 30 years</td>
<td>0.180 (0.64)</td>
<td>0.322 (0.91)</td>
<td>0.090 (0.23)</td>
</tr>
<tr>
<td>Single female 31-40 years old</td>
<td>0.426 (0.94)</td>
<td>0.594 (1.01)</td>
<td>0.445 (0.70)</td>
</tr>
<tr>
<td>Single female 41-45 years old</td>
<td>-0.533 (1.05)</td>
<td>-0.721 (1.13)</td>
<td>-0.738 (0.99)</td>
</tr>
<tr>
<td>Years as single</td>
<td>0.058 (1.16)</td>
<td>0.073 (1.15)</td>
<td>0.076 (1.09)</td>
</tr>
<tr>
<td>Couple, head less than 30 years</td>
<td>0.291 (0.86)</td>
<td>0.414 (0.96)</td>
<td>0.300 (0.63)</td>
</tr>
<tr>
<td>Couple, head 31-40 years old</td>
<td>0.934 (1.96)</td>
<td>1.250 (2.03)</td>
<td>1.181 (1.78)</td>
</tr>
<tr>
<td>Couple, head 41-45 years old</td>
<td>1.092 (1.68)</td>
<td>1.433 (1.68)</td>
<td>1.385 (1.58)</td>
</tr>
<tr>
<td>Years as couple</td>
<td>0.098 (2.10)</td>
<td>0.132 (2.16)</td>
<td>0.139 (2.19)</td>
</tr>
<tr>
<td>Oldest child 4-5</td>
<td>-0.083 (0.21)</td>
<td>0.098 (0.19)</td>
<td>-0.135 (0.25)</td>
</tr>
<tr>
<td>Oldest child 6-8</td>
<td>0.408 (0.90)</td>
<td>0.467 (0.79)</td>
<td>0.623 (1.03)</td>
</tr>
<tr>
<td>Oldest child 8-18</td>
<td>0.974 (2.12)</td>
<td>1.199 (1.99)</td>
<td>1.535 (2.49)</td>
</tr>
<tr>
<td>One or more child(ren) present</td>
<td>-0.138 (0.54)</td>
<td>-0.194 (0.59)</td>
<td>-0.167 (0.47)</td>
</tr>
<tr>
<td>Two or more children present</td>
<td>0.532 (1.33)</td>
<td>0.701 (1.34)</td>
<td>0.659 (1.22)</td>
</tr>
<tr>
<td>Three or more children present</td>
<td>-0.583 (1.18)</td>
<td>-0.783 (1.22)</td>
<td>-0.805 (1.21)</td>
</tr>
<tr>
<td>$\sigma^2$</td>
<td>1.065 (32.29)</td>
<td>1.144 (34.14)</td>
<td>0.977 (32.46)</td>
</tr>
</tbody>
</table>

LogL                      -2,720.85       2,825.41       2,590.45
Restricted LogL            2,898.43
Number of observations    2,125

*These two variables are calculated in the first step of the two stage estimation procedure*

Tables reveals that the results are not very sensitive to the choice of translation procedure.
Appendix 2 - Some tests of determinants of the dynamics of housing market behaviour

The tests described in Section 5.2 are described in more detail in this appendix. The test static referred to in the tables equals twice the difference between the loglikelihood (LL) under H1 and H0.

Statement 1: Sex matters

Test 1.1:

<table>
<thead>
<tr>
<th></th>
<th>Degrees of freedom</th>
<th>LL Tenure choice</th>
<th>LL Planned length of stay</th>
<th>Σ LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0: Tenure independent of sex of singles</td>
<td>2</td>
<td>-935.18</td>
<td>-2720.85</td>
<td>-3656.03</td>
</tr>
<tr>
<td>H1: Full model</td>
<td></td>
<td>-935.03</td>
<td>-2720.85</td>
<td>-3655.88</td>
</tr>
<tr>
<td>Test static</td>
<td>0.3</td>
<td>0.0</td>
<td></td>
<td>0.3</td>
</tr>
<tr>
<td>Critical value 10%-level</td>
<td>4.61</td>
<td>4.61</td>
<td></td>
<td>4.61</td>
</tr>
<tr>
<td>Critical value 5%-level</td>
<td>5.99</td>
<td>5.99</td>
<td></td>
<td>5.99</td>
</tr>
<tr>
<td>Critical value 2%-level</td>
<td>7.82</td>
<td>7.82</td>
<td></td>
<td>7.82</td>
</tr>
</tbody>
</table>

Hence, the null hypothesis cannot be rejected at any sensible level.

Test 1.2:

<table>
<thead>
<tr>
<th></th>
<th>Degrees of freedom</th>
<th>LL Tenure choice</th>
<th>LL Planned length of stay</th>
<th>Σ LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0: Planned length of future stay independent of sex of singles</td>
<td>2</td>
<td>-934.86</td>
<td>-2724.92</td>
<td>-3659.78</td>
</tr>
<tr>
<td>H1: Tenure independent of sex of singles</td>
<td></td>
<td>-935.18</td>
<td>-2720.85</td>
<td>-3656.03</td>
</tr>
<tr>
<td>Test static</td>
<td>-0.64</td>
<td>8.14</td>
<td></td>
<td>7.5</td>
</tr>
<tr>
<td>Critical value 10%-level</td>
<td>4.61</td>
<td>4.61</td>
<td></td>
<td>4.61</td>
</tr>
<tr>
<td>Critical value 5%-level</td>
<td>5.99</td>
<td>5.99</td>
<td></td>
<td>5.99</td>
</tr>
<tr>
<td>Critical value 2%-level</td>
<td>7.82</td>
<td>7.82</td>
<td></td>
<td>7.82</td>
</tr>
</tbody>
</table>

The hypothesis that 'Planned length of future stay is independent of sex of singles' is rejected at a level of significance close 2%.
**Statement 2:** Even though age strongly affects planned length of stay it has no direct effect on tenure choice.

**Test 2.1:**

<table>
<thead>
<tr>
<th>Degrees of freedom</th>
<th>LL Tenure choice</th>
<th>LL Planned length of stay</th>
<th>Σ LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0: Tenure independent of age of head of household - singles</td>
<td>4</td>
<td>-937.49</td>
<td>-2720.85</td>
</tr>
<tr>
<td>H1: Full model</td>
<td></td>
<td>-935.03</td>
<td>-2720.85</td>
</tr>
<tr>
<td>Test static</td>
<td></td>
<td>4.92</td>
<td>0</td>
</tr>
<tr>
<td>Critical value 10%-level</td>
<td></td>
<td>7.78</td>
<td>7.78</td>
</tr>
<tr>
<td>Critical value 5%-level</td>
<td></td>
<td>9.49</td>
<td>9.49</td>
</tr>
<tr>
<td>Critical value 2%-level</td>
<td></td>
<td>11.67</td>
<td>11.67</td>
</tr>
</tbody>
</table>

Hence, the null hypothesis can not be rejected at any sensible level.

**Test 2.2:**

<table>
<thead>
<tr>
<th>Degrees of freedom</th>
<th>LL Tenure choice</th>
<th>LL Planned length of stay</th>
<th>Σ LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0: Planned length of future stay independent of age of head of household - singles</td>
<td>4</td>
<td>-940.80</td>
<td>-2730.70</td>
</tr>
<tr>
<td>H1: Tenure independent of age of head of household - singles</td>
<td></td>
<td>-937.49</td>
<td>-2720.85</td>
</tr>
<tr>
<td>Test static</td>
<td></td>
<td>6.62</td>
<td>19.70</td>
</tr>
<tr>
<td>Critical value 10%-level</td>
<td></td>
<td>7.78</td>
<td>7.78</td>
</tr>
<tr>
<td>Critical value 5%-level</td>
<td></td>
<td>9.49</td>
<td>9.49</td>
</tr>
<tr>
<td>Critical value 2%-level</td>
<td></td>
<td>11.67</td>
<td>11.67</td>
</tr>
</tbody>
</table>

The hypothesis that 'Planned length of future stay is independent of age of head of household - singles' is hence rejected at a level of significance below 2%.
Test 2.3:

<table>
<thead>
<tr>
<th></th>
<th>Degrees of freedom</th>
<th>LL Tenure choice</th>
<th>LL Planned length of stay</th>
<th>Σ LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0: Tenure independent of age of head of household - couples</td>
<td>2</td>
<td>-936.04</td>
<td>-2720.85</td>
<td>-3656.89</td>
</tr>
<tr>
<td>H1: Full model</td>
<td></td>
<td>-935.03</td>
<td>-2720.85</td>
<td>-3655.88</td>
</tr>
<tr>
<td>Test static</td>
<td></td>
<td>2.02</td>
<td>0</td>
<td>2.02</td>
</tr>
<tr>
<td>Critical value 10%-level</td>
<td>4.61</td>
<td>4.61</td>
<td></td>
<td>4.61</td>
</tr>
<tr>
<td>Critical value 5%-level</td>
<td>5.99</td>
<td>5.99</td>
<td></td>
<td>5.99</td>
</tr>
<tr>
<td>Critical value 2%-level</td>
<td>7.82</td>
<td>7.82</td>
<td></td>
<td>7.82</td>
</tr>
</tbody>
</table>

Hence, the null hypothesis cannot be rejected at any sensible level.

Test 2.4:

<table>
<thead>
<tr>
<th></th>
<th>Degrees of freedom</th>
<th>LL Tenure choice</th>
<th>LL Planned length of stay</th>
<th>Σ LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0: Planned length of future stay independent of age of head of household - couples</td>
<td>2</td>
<td>-938.42</td>
<td>-2726.06</td>
<td>-3664.48</td>
</tr>
<tr>
<td>H1: Tenure independent of age of head of household - couples</td>
<td></td>
<td>-936.04</td>
<td>-2720.85</td>
<td>-3656.89</td>
</tr>
<tr>
<td>Test static</td>
<td></td>
<td>4.76</td>
<td>10.42</td>
<td>15.18</td>
</tr>
<tr>
<td>Critical value 10%-level</td>
<td>4.61</td>
<td>4.61</td>
<td></td>
<td>4.61</td>
</tr>
<tr>
<td>Critical value 5%-level</td>
<td>5.99</td>
<td>5.99</td>
<td></td>
<td>5.99</td>
</tr>
<tr>
<td>Critical value 2%-level</td>
<td>7.82</td>
<td>7.82</td>
<td></td>
<td>7.82</td>
</tr>
</tbody>
</table>

The hypothesis that 'Planned length of future stay is independent of age of head of household - couples' is hence rejected at a level of significance below 2%.
Test 2.5:

<table>
<thead>
<tr>
<th>Degrees of freedom</th>
<th>LL Tenure choice</th>
<th>LL Planned length of stay</th>
<th>Σ LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0: Tenure independent of age of head of household - all</td>
<td>6</td>
<td>-938.17</td>
<td>-2720.85</td>
</tr>
<tr>
<td>H1: Full model</td>
<td>-935.03</td>
<td>-2720.85</td>
<td>-3655.88</td>
</tr>
<tr>
<td>Test static</td>
<td>6.28</td>
<td>0</td>
<td>6.28</td>
</tr>
<tr>
<td>Critical value 10%-level</td>
<td>10.65</td>
<td>10.65</td>
<td>10.65</td>
</tr>
<tr>
<td>Critical value 5%-level</td>
<td>12.59</td>
<td>12.59</td>
<td>12.59</td>
</tr>
<tr>
<td>Critical value 2%-level</td>
<td>15.03</td>
<td>15.03</td>
<td>15.03</td>
</tr>
</tbody>
</table>

Hence, the null hypothesis cannot be rejected at any sensible level.

Test 2.6:

<table>
<thead>
<tr>
<th>Degrees of freedom</th>
<th>LL Tenure choice</th>
<th>LL Planned length of stay</th>
<th>Σ LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0: Planned length of future stay independent of age of head of household - all</td>
<td>6</td>
<td>-943.72</td>
<td>-2735.22</td>
</tr>
<tr>
<td>H1: Tenure independent of age of head of household - all</td>
<td>-938.17</td>
<td>-2720.85</td>
<td>-3659.02</td>
</tr>
<tr>
<td>Test static</td>
<td>11.10</td>
<td>28.74</td>
<td>39.84</td>
</tr>
<tr>
<td>Critical value 10%-level</td>
<td>10.65</td>
<td>10.65</td>
<td>10.65</td>
</tr>
<tr>
<td>Critical value 5%-level</td>
<td>12.59</td>
<td>12.59</td>
<td>12.59</td>
</tr>
<tr>
<td>Critical value 2%-level</td>
<td>15.03</td>
<td>15.03</td>
<td>15.03</td>
</tr>
</tbody>
</table>

The hypothesis that 'Planned length of future stay is independent of age of head of household' for both couples and singles can hence be rejected at any sensible level of significance.

Statement 3: Marital history more important than marital status

Test 3.1:

<table>
<thead>
<tr>
<th>Degrees of freedom</th>
<th>LL Tenure choice</th>
<th>LL Planned length of stay</th>
<th>Σ LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0: Tenure independent of years spent as a couple</td>
<td>1</td>
<td>-937.32</td>
<td>-2720.85</td>
</tr>
<tr>
<td>H1: Full model</td>
<td>-935.03</td>
<td>-2720.85</td>
<td>-3655.88</td>
</tr>
<tr>
<td>Test static</td>
<td>4.46</td>
<td>0</td>
<td>4.46</td>
</tr>
<tr>
<td>Critical value 10%-level</td>
<td>2.71</td>
<td>2.71</td>
<td>2.71</td>
</tr>
<tr>
<td>Critical value 5%-level</td>
<td>3.84</td>
<td>3.84</td>
<td>3.84</td>
</tr>
<tr>
<td>Critical value 2%-level</td>
<td>5.41</td>
<td>5.41</td>
<td>5.41</td>
</tr>
</tbody>
</table>
The null hypothesis is rejected at a 5%-level.

Test 3.2:

<table>
<thead>
<tr>
<th></th>
<th>Degrees of freedom</th>
<th>LL Tenure choice</th>
<th>LL Planned length of stay</th>
<th>Σ LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0: Planned length stay independent of years spent as a couple</td>
<td>1</td>
<td>-935.03</td>
<td>-2722.93</td>
<td>-3657.96</td>
</tr>
<tr>
<td>H1: Full model</td>
<td></td>
<td>-935.03</td>
<td>-2720.85</td>
<td>-3655.88</td>
</tr>
<tr>
<td>Test static</td>
<td>4.16</td>
<td>0</td>
<td>0</td>
<td>4.16</td>
</tr>
<tr>
<td>Critical value 10%-level</td>
<td>2.71</td>
<td>2.71</td>
<td>2.71</td>
<td></td>
</tr>
<tr>
<td>Critical value 5%-level</td>
<td>3.84</td>
<td>3.84</td>
<td>3.84</td>
<td></td>
</tr>
<tr>
<td>Critical value 2%-level</td>
<td>5.41</td>
<td>5.41</td>
<td>5.41</td>
<td></td>
</tr>
</tbody>
</table>

The hypothesis that 'Planned length of future stay is independent of years spent as a couple' is rejected at a level of significance below 5%.

In order to test whether the fact that a household consists of a couple or a single has any consequence for the dynamics of housing market behaviour alternative models are estimated. The coefficients of the couple-dummies in the alternative models are constrained to be equal to the corresponding coefficients of the age dummies for single males. In short this is termed tenure choice/planned length of stay independent of 'marital status'.

Test 3.3:

<table>
<thead>
<tr>
<th></th>
<th>Degrees of freedom</th>
<th>LL Tenure choice</th>
<th>LL Planned length of stay</th>
<th>Σ LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0: Tenure independent of marital status</td>
<td>3</td>
<td>-935.44</td>
<td>-2720.85</td>
<td>-3656.29</td>
</tr>
<tr>
<td>H1: Full model</td>
<td></td>
<td>-935.03</td>
<td>-2720.85</td>
<td>-3655.88</td>
</tr>
<tr>
<td>Test static</td>
<td>0.82</td>
<td>0</td>
<td>0</td>
<td>0.82</td>
</tr>
<tr>
<td>Critical value 10%-level</td>
<td>6.25</td>
<td>6.25</td>
<td>6.25</td>
<td></td>
</tr>
<tr>
<td>Critical value 5%-level</td>
<td>7.82</td>
<td>7.82</td>
<td>7.82</td>
<td></td>
</tr>
<tr>
<td>Critical value 2%-level</td>
<td>9.84</td>
<td>9.84</td>
<td>9.84</td>
<td></td>
</tr>
</tbody>
</table>

The hypothesis that tenure choice is independent of marital status, after controlling for years spent as a couple, can not be rejected.
Test 3.4:

<table>
<thead>
<tr>
<th>Degrees of freedom</th>
<th>LL Tenure choice</th>
<th>LL Planned length of stay</th>
<th>Σ LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0: Planned length stay</td>
<td>3</td>
<td>-935.48</td>
<td>-2722.18</td>
</tr>
<tr>
<td>independent of marital status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H1: Tenure independent of marital status</td>
<td>-935.44</td>
<td>-2720.85</td>
<td>-3656.29</td>
</tr>
<tr>
<td>Test static</td>
<td>0.08</td>
<td>3.26</td>
<td>3.34</td>
</tr>
<tr>
<td>Critical value 10%-level</td>
<td>6.25</td>
<td>6.25</td>
<td>6.25</td>
</tr>
<tr>
<td>Critical value 5%-level</td>
<td>7.82</td>
<td>7.82</td>
<td>7.82</td>
</tr>
<tr>
<td>Critical value 2%-level</td>
<td>9.84</td>
<td>9.84</td>
<td>9.84</td>
</tr>
</tbody>
</table>

The hypothesis that 'Planned length of future stay' is independent of marital status can not be rejected at any sensible level of significance.

Statement 4: Age of the children affects the families' housing choices

Test 4.1:

<table>
<thead>
<tr>
<th>Degrees of freedom</th>
<th>LL Tenure choice</th>
<th>LL Planned length of stay</th>
<th>Σ LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0: Tenure independent of age of the children in the household</td>
<td>3</td>
<td>-936.47</td>
<td>-2720.85</td>
</tr>
<tr>
<td>H1: Full model</td>
<td>-935.03</td>
<td>-2720.85</td>
<td>-3655.88</td>
</tr>
<tr>
<td>Test static</td>
<td>2.88</td>
<td>0</td>
<td>2.88</td>
</tr>
<tr>
<td>Critical value 10%-level</td>
<td>6.25</td>
<td>6.25</td>
<td>6.25</td>
</tr>
<tr>
<td>Critical value 5%-level</td>
<td>7.82</td>
<td>7.82</td>
<td>7.82</td>
</tr>
<tr>
<td>Critical value 2%-level</td>
<td>9.84</td>
<td>9.84</td>
<td>9.84</td>
</tr>
</tbody>
</table>

Hence, the null hypothesis is not rejected.
Test 4.2:

<table>
<thead>
<tr>
<th></th>
<th>Degrees of freedom</th>
<th>LL Tenure choice</th>
<th>LL Planned length of stay</th>
<th>Σ LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0: Planned length of future stay independent of children's age</td>
<td>3</td>
<td>-935.03</td>
<td>-2724.34</td>
<td>-3659.37</td>
</tr>
<tr>
<td>H1: Full model</td>
<td></td>
<td>-935.03</td>
<td>-2720.85</td>
<td>-3655.88</td>
</tr>
<tr>
<td>Test static</td>
<td>0</td>
<td>6.98</td>
<td>6.98</td>
<td>6.98</td>
</tr>
<tr>
<td>Critical value 10%-level</td>
<td></td>
<td>6.25</td>
<td>6.25</td>
<td>6.25</td>
</tr>
<tr>
<td>Critical value 5%-level</td>
<td></td>
<td>7.82</td>
<td>7.82</td>
<td>7.82</td>
</tr>
<tr>
<td>Critical value 2%-level</td>
<td></td>
<td>9.84</td>
<td>9.84</td>
<td>9.84</td>
</tr>
</tbody>
</table>

The null hypothesis can be rejected, but only at a level of significance close to 10%.

In order to single out a possible effect of presence of school kids present in the family a model with a dummy-indicator for only school kids (i.e. no other childrens-age-dummies) is tested against a model with no indicators for children's age.

Test 4.3:

<table>
<thead>
<tr>
<th></th>
<th>Degrees of freedom</th>
<th>LL Tenure choice</th>
<th>LL Planned length of stay</th>
<th>Σ LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0: Tenure independent of presence of school kids</td>
<td>1</td>
<td>-936.49</td>
<td>-2721.35</td>
<td>-3656.84</td>
</tr>
<tr>
<td>H1: Full model, only school kids present</td>
<td></td>
<td>-936.12</td>
<td>-2721.35</td>
<td>-3657.47</td>
</tr>
<tr>
<td>Test static</td>
<td>0.74</td>
<td>0</td>
<td>0</td>
<td>0.74</td>
</tr>
<tr>
<td>Critical value 10%-level</td>
<td></td>
<td>2.71</td>
<td>2.71</td>
<td>2.71</td>
</tr>
<tr>
<td>Critical value 5%-level</td>
<td></td>
<td>3.84</td>
<td>3.84</td>
<td>3.84</td>
</tr>
<tr>
<td>Critical value 2%-level</td>
<td></td>
<td>5.41</td>
<td>5.41</td>
<td>5.41</td>
</tr>
</tbody>
</table>

The null hypothesis can not be rejected at any sensible level.
Test 4.4:

<table>
<thead>
<tr>
<th></th>
<th>Degrees of freedom</th>
<th>LL Tenure choice</th>
<th>LL Planned length of stay</th>
<th>Σ LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0: Planned length stay independent of presence of school kids</td>
<td>1</td>
<td>-935.12</td>
<td>-2724.34</td>
<td>-3659.46</td>
</tr>
<tr>
<td>H1: Full model, only school kids present</td>
<td>-936.12</td>
<td>-2721.35</td>
<td>-3657.47</td>
<td></td>
</tr>
<tr>
<td>Test static</td>
<td>3.98</td>
<td>0</td>
<td>3.98</td>
<td></td>
</tr>
<tr>
<td>Critical value 10%-level</td>
<td>2.71</td>
<td>2.71</td>
<td>2.71</td>
<td></td>
</tr>
<tr>
<td>Critical value 5%-level</td>
<td>3.84</td>
<td>3.84</td>
<td>3.84</td>
<td></td>
</tr>
<tr>
<td>Critical value 2%-level</td>
<td>5.41</td>
<td>5.41</td>
<td>5.41</td>
<td></td>
</tr>
</tbody>
</table>

The hypothesis that 'Planned length stay is independent of presence of school kids in a family' is rejected at a 5%-level of significance.

Statement 5: Number of children affects housing market behaviour, but in a non-linear fashion

Test 5.1:

<table>
<thead>
<tr>
<th></th>
<th>Degrees of freedom</th>
<th>LL Tenure choice</th>
<th>LL Planned length of stay</th>
<th>Σ LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0: Tenure independent number of children</td>
<td>2</td>
<td>-940.06</td>
<td>-2723.70</td>
<td>-3663.76</td>
</tr>
<tr>
<td>H1: Full model - without dummies for age of children</td>
<td>-935.63</td>
<td>-2723.70</td>
<td>-3659.33</td>
<td></td>
</tr>
<tr>
<td>Test static</td>
<td>8.86</td>
<td>0</td>
<td>8.86</td>
<td></td>
</tr>
<tr>
<td>Critical value 10%-level</td>
<td>4.61</td>
<td>4.61</td>
<td>4.61</td>
<td></td>
</tr>
<tr>
<td>Critical value 5%-level</td>
<td>5.99</td>
<td>5.99</td>
<td>5.99</td>
<td></td>
</tr>
<tr>
<td>Critical value 2%-level</td>
<td>7.82</td>
<td>7.82</td>
<td>7.82</td>
<td></td>
</tr>
</tbody>
</table>

The null hypothesis is rejected at a 2%-level of significance.
Test 5.2:

<table>
<thead>
<tr>
<th></th>
<th>Degrees of freedom</th>
<th>LL Tenure choice</th>
<th>LL Planned length of stay</th>
<th>Σ LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0: Planned length of future stay independent of number of children</td>
<td>2</td>
<td>-935.63</td>
<td>-2726.57</td>
<td>-3662.20</td>
</tr>
<tr>
<td>H1: Full model - without dummies for age of children</td>
<td></td>
<td>-935.63</td>
<td>-2723.70</td>
<td>-3659.33</td>
</tr>
</tbody>
</table>

Test static

- Critical value 10%-level: 4.61
- Critical value 5%-level: 5.99
- Critical value 2%-level: 7.82

The hypothesis that 'Planned length of future stay is independent of number of children' is rejected at a level of significance a little bit above 5%.

Test 5.3:

<table>
<thead>
<tr>
<th></th>
<th>LL Tenure choice</th>
<th>LL Planned length of stay</th>
<th>Σ LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0: Planned length of future stay and tenure linear in number of children</td>
<td>-938.04</td>
<td>-2723.77</td>
<td>-3661.81</td>
</tr>
<tr>
<td>H1: Full model</td>
<td>-935.03</td>
<td>-2720.85</td>
<td>-3655.88</td>
</tr>
</tbody>
</table>

Test static

- Degrees of freedom: 2
- Critical value 10%-level: 4.61
- Critical value 5%-level: 5.99
- Critical value 2%-level: 7.82

When each of the two equations is considered in isolation it is possible to reject the null hypothesis of a linear effect of number of children on tenure choice at a 5%-level of significance. A linear effect on length of stay can be rejected at a level slightly above 5%. The joint hypothesis of linear effects in both equations, however, is rejected at a 2%-level.
Statement 6: Demographics determine length of stay, but have no independent effect on tenure choice.

Test 6.1:

<table>
<thead>
<tr>
<th></th>
<th>Degrees of freedom</th>
<th>LL Tenure choice</th>
<th>LL Planned length of stay</th>
<th>Σ LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0: Tenure independent of demographic characteristics of the households</td>
<td>16</td>
<td>-954.12</td>
<td>-2720.85</td>
<td>-3674.97</td>
</tr>
<tr>
<td>H1: Full model</td>
<td></td>
<td>-935.03</td>
<td>-2720.85</td>
<td>-3655.88</td>
</tr>
<tr>
<td>Test static</td>
<td></td>
<td>38.18</td>
<td>0</td>
<td>38.18</td>
</tr>
<tr>
<td>Critical value 10%-level</td>
<td></td>
<td>23.54</td>
<td>23.54</td>
<td>23.54</td>
</tr>
<tr>
<td>Critical value 5%-level</td>
<td></td>
<td>26.30</td>
<td>26.30</td>
<td>26.30</td>
</tr>
<tr>
<td>Critical value 2%-level</td>
<td></td>
<td>29.63</td>
<td>29.63</td>
<td>29.63</td>
</tr>
</tbody>
</table>
Appendix 3 - Wage equation

The estimated wage equation used in the calculation of the full income measure is as reported in the table below.

Table - Wage regression, dependent variable hourly wage

<table>
<thead>
<tr>
<th></th>
<th>Coeff.</th>
<th>Absolute t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERCEP</td>
<td>77.08</td>
<td>2.89</td>
</tr>
<tr>
<td>Male without higher education - dummy (MA)</td>
<td>-65.43</td>
<td>-2.09</td>
</tr>
<tr>
<td>Age*MA</td>
<td>3.66</td>
<td>4.82</td>
</tr>
<tr>
<td>Age squared*MA</td>
<td>-0.03</td>
<td>-3.96</td>
</tr>
<tr>
<td>Smal municipality*MA</td>
<td>5.07</td>
<td>1.44</td>
</tr>
<tr>
<td>Medium sized municipality*MA</td>
<td>1.38</td>
<td>0.42</td>
</tr>
<tr>
<td>Large municipality*MA</td>
<td>4.99</td>
<td>1.65</td>
</tr>
<tr>
<td>Single person*MA</td>
<td>-5.99</td>
<td>-1.53</td>
</tr>
<tr>
<td>Divorced or bewidowed*MA</td>
<td>-1.80</td>
<td>-0.29</td>
</tr>
<tr>
<td>Oslo*MA</td>
<td>10.93</td>
<td>2.95</td>
</tr>
<tr>
<td>Mid-Norway*MA</td>
<td>3.33</td>
<td>0.90</td>
</tr>
<tr>
<td>North-Norway*MA</td>
<td>-1.53</td>
<td>-0.33</td>
</tr>
<tr>
<td>West-Norway*MA</td>
<td>10.74</td>
<td>3.34</td>
</tr>
<tr>
<td>South-Norway*MA</td>
<td>7.27</td>
<td>1.62</td>
</tr>
<tr>
<td>Leader*MA</td>
<td>15.38</td>
<td>4.20</td>
</tr>
<tr>
<td>Low educational level*MA</td>
<td>1.78</td>
<td>0.57</td>
</tr>
<tr>
<td>High educational level*MA</td>
<td>10.70</td>
<td>3.86</td>
</tr>
<tr>
<td>Male with higher education - dummy (MH)</td>
<td>-163.77</td>
<td>-4.46</td>
</tr>
<tr>
<td>Age*MH</td>
<td>9.03</td>
<td>7.94</td>
</tr>
<tr>
<td>Age squared*MH</td>
<td>-0.09</td>
<td>-7.05</td>
</tr>
<tr>
<td>Smal municipality*MH</td>
<td>11.03</td>
<td>1.71</td>
</tr>
<tr>
<td>Medium sized municipality*MH</td>
<td>21.54</td>
<td>3.59</td>
</tr>
<tr>
<td>Large municipality*MH</td>
<td>10.35</td>
<td>1.95</td>
</tr>
<tr>
<td>Single person*MH</td>
<td>-12.25</td>
<td>-1.92</td>
</tr>
<tr>
<td>Divorced or bewidowed*MH</td>
<td>-32.68</td>
<td>-3.20</td>
</tr>
<tr>
<td>Oslo*MH</td>
<td>15.03</td>
<td>2.52</td>
</tr>
<tr>
<td>Mid-Norway*MH</td>
<td>3.66</td>
<td>0.60</td>
</tr>
<tr>
<td>North-Norway*MH</td>
<td>-10.96</td>
<td>-1.34</td>
</tr>
<tr>
<td>West-Norway*MH</td>
<td>10.52</td>
<td>1.81</td>
</tr>
<tr>
<td>South-Norway*MH</td>
<td>5.76</td>
<td>0.74</td>
</tr>
<tr>
<td>Leader*MH</td>
<td>13.73</td>
<td>2.49</td>
</tr>
<tr>
<td>Low degree*MH</td>
<td>-0.96</td>
<td>-0.25</td>
</tr>
<tr>
<td>high degree*MH</td>
<td>14.12</td>
<td>3.79</td>
</tr>
<tr>
<td>Female no higher education - dummy (FA)</td>
<td>-20.28</td>
<td>-0.64</td>
</tr>
<tr>
<td>Age*FA</td>
<td>1.48</td>
<td>1.88</td>
</tr>
<tr>
<td>Age squared*FA</td>
<td>-0.01</td>
<td>-1.46</td>
</tr>
<tr>
<td>Smal municipality*FA</td>
<td>-0.39</td>
<td>-0.10</td>
</tr>
<tr>
<td>Medium sized municipality*FA</td>
<td>-3.66</td>
<td>-1.01</td>
</tr>
<tr>
<td>Variable</td>
<td>Coefficient 1</td>
<td>Coefficient 2</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>---------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Large municipality*FA</td>
<td>-4.18</td>
<td>-1.28</td>
</tr>
<tr>
<td>Single person*FA</td>
<td>-4.11</td>
<td>-0.85</td>
</tr>
<tr>
<td>Divorced or bewidowed*FA</td>
<td>-3.44</td>
<td>-0.77</td>
</tr>
<tr>
<td>Oslo*FA</td>
<td>7.56</td>
<td>1.89</td>
</tr>
<tr>
<td>Mid-Norway*FA</td>
<td>1.91</td>
<td>0.49</td>
</tr>
<tr>
<td>North-Norway*FA</td>
<td>5.85</td>
<td>1.23</td>
</tr>
<tr>
<td>West-Norway*FA</td>
<td>4.20</td>
<td>1.17</td>
</tr>
<tr>
<td>South-Norway*FA</td>
<td>0.56</td>
<td>0.11</td>
</tr>
<tr>
<td>Leader*FA</td>
<td>12.45</td>
<td>1.58</td>
</tr>
<tr>
<td>Low educational level*FA</td>
<td>2.75</td>
<td>0.92</td>
</tr>
<tr>
<td>High educational level*FA</td>
<td>8.75</td>
<td>2.67</td>
</tr>
<tr>
<td>Female with higher education - dummy (FH), reference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age*FH</td>
<td>1.41</td>
<td>1.13</td>
</tr>
<tr>
<td>Age squared*FH</td>
<td>-0.01</td>
<td>-0.85</td>
</tr>
<tr>
<td>Small municipality*FH</td>
<td>-4.90</td>
<td>-0.73</td>
</tr>
<tr>
<td>Medium sized municipality*FH</td>
<td>-6.09</td>
<td>-1.01</td>
</tr>
<tr>
<td>Large municipality*FH</td>
<td>-3.30</td>
<td>-0.63</td>
</tr>
<tr>
<td>Single person*FH</td>
<td>2.10</td>
<td>0.42</td>
</tr>
<tr>
<td>Divorced or bewidowed*FH</td>
<td>10.90</td>
<td>1.24</td>
</tr>
<tr>
<td>Oslo*FH</td>
<td>2.05</td>
<td>0.34</td>
</tr>
<tr>
<td>Mid-Norway*FH</td>
<td>-4.62</td>
<td>-0.74</td>
</tr>
<tr>
<td>North-Norway*FH</td>
<td>-5.00</td>
<td>-0.58</td>
</tr>
<tr>
<td>West-Norway*FH</td>
<td>0.89</td>
<td>0.15</td>
</tr>
<tr>
<td>South-Norway*FH</td>
<td>8.63</td>
<td>1.12</td>
</tr>
<tr>
<td>Leader*FH</td>
<td>3.47</td>
<td>0.37</td>
</tr>
<tr>
<td>Low degree*FH</td>
<td>3.67</td>
<td>1.04</td>
</tr>
<tr>
<td>high degree*FH</td>
<td>24.10</td>
<td>4.83</td>
</tr>
<tr>
<td>R²-adj</td>
<td>0.192</td>
<td></td>
</tr>
<tr>
<td>No. observations</td>
<td>4,480</td>
<td></td>
</tr>
</tbody>
</table>

The estimated wage regression resembles the ones in Longva and Strom (1996). Two major differences may be noted. They used the log of the wage as a dependent variable and they included industry among their set of explanatory variables. Information of industry is of course important in a wage equation. I omitted it because my equation was meant to be used to predict full income also for persons presently outside the working force. The fit of my equation is however not very much poorer with a R² of 19.2% as opposed to 26.7% for females and 36.2% for males in Longva and Strom. The total sample in Longva and Strom was more than a hundred times larger than my sample.
5. BOLIGKARRIERER, ETTERSPØRSEL, FLYTTING OG FLYTTEKOSTNADER

av
Per Medby.

5.1 Bakgrunn

En antar ofte at boligkonsum kan måles langs to dimensjoner, kvantum og disposisjonsform. Beslutninger om kvantum og disposisjonsform tas simultant. Endring i konsumet av boligtjenester kan i de fleste situasjoner bare skje gjennom flytting. Både behov/preferanser, inntekter og pris på boligkonsum varierer sterkt over tid, det er derfor rimelig å anta at også den optimale boligen varierer over tid. Likevel flytter de fleste av oss relativt sjelden. Den viktigste årsaken til dette er nok at bytte av bolig er kostnadskrevende. Kostnadene består både av direkte utgifter i forbindelse med flytting, og kostnader forbundet med søking og oppbrudd fra boligen en bor i.

For en husholdning som bor i en bolig vil disse kostnadene være et argument for at en vil tåle et visst avvik mellom den optimale boligen og den boligen en bor i, også kalt mismatch. Allerede før et hushold flytter inn i en bolig vet de at det er kostnadskrevende å flytte fra den. Denne kunnskapen påvirker i sin tur boligvalget.

I prinsippet kan en tenke seg to ulike måter som kunnskap om flyttekostnadene vil kunne påvirke boligvalgene på. For det første kan det være at personer som enten planlegger å flytte, eller tror at de kommer til å flytte snart, vil velge en bolig der flyttekostnadene er lave. Ofte vil dette være en leid bolig. For det andre kan flyttekostnadene påvirke boligvalget for hushold som faktisk flytter ved at de velger en bolig som de regner med at de ikke vil flytte fra i tiden som kommer. Slike betraktninger kan være bakgrunnen for at mange unge kjøper en bolig som de i utgangspunktet mener er for dyr. Altså, mange kjøper en bolig som gir dem et umiddelbart for høyt boligkonsum. En gør dette fordi en i framtidens skal kunne ha et høyt boligkonsum uten å måtte pådra seg flyttekostnader.

Teoretiske hovedretninger

To teoretiske hovedretninger finnes. Den ene retningen ser på flyttebeslutninger som en respons på mismatch i dagens boligkonsum. Det vil si at mulige konsekvenser for framtidig boligkonsum ikke trekkes inn. Denne tradisjonen kalles for "The Disequilibrium Approach".

Den andre hovedretningen er de som analyserer planlagte boligkanner. Mismatch betraktes her som en kjent eller forventet konsekvens av de valg som gjøres. Husholdenes boligvalg betraktes her som et forsøk på å minimere nåverdien av mismatch over hele boligkanrenen. Denne tradisjonen kalles for "The Economics of the Dynamics of Housing Demand".

Den grunnleggende tanken bak ulikevektstilnærmingen er at det kostet å flytte, kostnaden er dels av monetær og dels av følelsesmessig art. Følelsesmessige flyttekostnader kan komme av at en har utviklet område- og boligspesifikk kunnskap som mister sin verdi når en flytter til et nytt område. En hypotese arbeidene i denne tradisjonen bygger på er at hushold flytter inn en bolig som passer så godt som mulig på innflyttingstidspunktet. Etterhvert skjer det ting i hus-

19 I optimum er grensenytten av boligkonsumet lik (den for husholdet relevante) prisen på boligtjenester.
holdet eller i omgivelsene som gjør at boligen passer stadig dårligere. Når mistilpasningen passerer en viss kritisk grense flytter husholdet. I den nye boligen er mistilpasningen lik null eller lav (Loikkanen, 1988). Fordelen med ulikevektstiltærmningen er at modellene er utformet på en slik måte at de lett kan danne grunnlag for empiriske analyser. Ulempen ved ulikeveks-modellene er at de bygger på en forutsetning om at forventet mistilpasning i boligkonsumet er lik/tiltærmøttet lik null i tiden rett etter flytting, eller at ønsket boligkonsum bare avhenger av størrelser som kan observeres i dag.

Amundsen (1985) var det første arbeidet i den dynamiske boligkarrieretradisjonen. Han viser hvordan boligkarrieren velges i et hushold som har perfekt informasjon i hele sin planleggningshorisont. Han forutsetter at både livstidsinnvikten, forløpet av prisen på boligtjenester, og husholdssammensetningen er kjente størrelser. Hovedresultatet i den teoretiske analysen er at nyttomaksimerende hushold vil velge en bolig som er slik at overkonsum i noen perioder balanseres mot underkonsum i andre perioder, begge størrelsen neddikkert til et beslutningsstidspunkt. Valg mellom ulike boligkarrierer, det vil si hvor mange flyttinger som skal foretas og når de gjøres, avhenger av hvilken karriere som gir den høyeste nytten.

Goodman (1995) formulerer en modell av denne typen i diskret tid med likviditetskranker. Da vises det at innpektens fordeling over tid i den perioden et hushold bor i boligen påvirker den optimale boligstørrelsen. Videre vises det at antall flyttinger i en plan for boligkarrieren vil være høyere med likviditetskranker enn uten slike skranker. En svakhet med Goodmans modell er at de likviditetskrankene han innfører er svært absolutte, og at de kombineres med en antakelse om at hushold ikke i noen perioder kan plassere overskuddslikviditet i noe kapitalobjekt. Faktisk er modellen utformet slik at innpekt i en periode ikke kan brukes til forbruk i seinere perioder.


Figur 1 på neste side illustrerer sammenhengen mellom "first-best" boligkonsum, og faktisk boligkonsum gjennom livsløpet. På den horisontale aksen angis tid (T), mens den vertikale aksen angir kvantum (X). Den stigende kurven i figur 1 på neste side viser "first-best" boligkonsum, mens den horisontale linja mellom punktene A og B viser faktisk boligkonsum. Det

20 Også kalt permanentinnvikten.
21 I "first-best" er individ/husholdet optimalt tilpasset. Følgelig er mismatchen lik null.
er reint tilfeldig at "first-best" kurven er ei rett linje, det skyldes kun måten vi har tegnet figuren på. Figuren illustrerer at faktisk boligkonsum avviker fra "first-best" i store deler av livslopet. Den vertikale linja mellom punktene C og D lenger ute i figuren viser at individet/husholdet flytter når konsumet blir tilstrekkelig mye lavere enn "first-best". Det er viktig å merke seg at i den dynamiske boligkarriereretningen befinner ikke husholdet seg nødvendigvis i "first-best"- punktet (C) etter flytting.

Figuur 1. En enkel illustrasjon av dynamikken i boligkarrieremodellene.

5.2 Noen forhold som har betydning for boligkarrierene

Den skattemessige behandlingen av eide boliger gjør at prisen på boligtjenester er lavere for folk som eier enn for folk som leier bolig. Etterspørselen etter leide boliger må sees i lys av et rasjonelt boligkarriereperspektiv, heller enn som et utslag av irrasjonell atferd hos etterspørreare. De fleste personer vil være både leietakere og eiere gjennom livslopet.

Boligkarrieremodellene slik vi kjenner dem i dag skiller ikke mellom ulike disposisjonsformer. Forskjellen mellom eie og leiemarkedet går langs to dimensjoner. Prisen på boligtjenestene vil være lavere i eiemarkedet enn i leiemarkedet. På den annen side vil flyttekostnadene være høyest i eiemarkedet. Å velge leie som disposisjonsform betyr derfor at en er villig til å betale en noe høyere pris for sitt boligkonsum, siden en da slipper å betale mye for å endre konsumet.

Kreditrestriksjoner påvirker også disposisjonsformen. Noen får overhodet ikke åpne penger, disse personene presses dermed over i leiemarkedet. Andre får ikke åpne nok penger til å
kjøpe den boligen de ønsker seg. De avstår derfor fra å kjøpe en billigere bolig, de velger i stedet å leie bolig. Dermed slipper de å pådra seg høye flyttekostnader.


Forhold som har betydning ved empiriske undersøkelser


---

22 Ikke-monetære eller følelsesmessige flyttekostnader for et hushold må betraktes som kostnaden for alle husholdsmedlemmene summet. Det betyr at følelsesmessige flyttekostnader stiger med antall husholdsmedlemmer.
23 Husholdets "leder" er her definert som den personen i husholdet som har høyest inntekt.
24 Datasettene en har hatt tilgang til er SSB’s boforholdsundersøkelser.
26 Paneldataundersøkelser vil videreføres hvert år, og dataene for 1999 vil foreligger snart.
Oppsummering av resultatene i Nordvik(2001c)


Valg av disposisjonsform er uavhengig av kjønn, mens kjønn klart påvirker den planlagte botiden. Forventet botid i nåværende bolig oker monotont med enslige mens alder, mens tilsvarende effekt er langt svakere blant enslige kvinner. En mulig forklaring er at korrelasjonen mellom alder og forventet endring av ekteskapelig status37 er forskjellig for menn og kvinner.


Nordvik finner videre at ekteskapelig historie er viktigere enn ekteskapelig status. Par som har bodd sammen i kort tid skiller seg ikke fra enslige i samme aldersgruppe når det gjelder valg av disposisjonsform og planlagt botid. Desto lengre paret har bodd sammen, desto lavere er tilbøyeligheten til å leie, og desto lengre er den planlagte botiden. Forskjellen mellom sambøere og enslige utvikler seg altså over tid.


Det kan se ut som om at demografiske variabler i seg selv ikke påvirker valg av disposisjonsform dersom en ser bort fra effekten disposisjonsformen har på planlagt botid. I ligningen for valg av disposisjonsform forskastes imidlertid en hypotese om at koeffisientene foran alle de demografiske dummyvariablene simultant er lik null.

Oppsummering av resultatene i Barlindhaug (2000)

Barlindhaug (2000) har utført en deskriptiv analyse av flytteatferd med bakgrunn i paneldatasett fra SSB. Vi vil her kort oppsummere viktige funn i Barlindhaugs analyse. Resultatene i undersøkelsen tyder på at flytting er en sterkt livsfasebetinget aktivitet. Den første flyttingen

---

37 Med ekteskap mener vi alle par som bor sammen enten de er gift eller ikke.
28 Barnas alder er målt som alderen på det eldste barnet i husholdet.
skjer oftest fra foreldre hjemmet til en egen leid bolig i forbindelse med arbeid eller utdanning. Noen flytter imidlertid direkte fra foreldre hjemmet til en annen bolig der de bor sammen med andre enten i bofelleskap eller i parforhold. Videre kan en merke seg at nær halvparten av dem som flytter på grunn av arbeid eller utdanning krysser en kommunegrense.

Svært mange som bor alene skifter bolig og opprettholder sin status som aleneboere. De øker i liten grad boarealet eller skifter hustype, mens det ser ut som at enslige ofte flytter fra leid til eit bolig. Nesten halvparten av denne gruppen oppgir at arbeid eller utdanning er den viktigste grunn til å skifte bolig.

En større gruppe aleneboere inn går et parforhold gjennom flytting. De yngste øker boligarealet og eierandelen i beskjeden grad gjennom flyttingen, mens de noe eldre øker boligarealet betraktelig. Pardannelse oppgis her selvfølgelig som hovedbegrunnelsen bak flyttingen, men også arbeid/utdanning tillegges betydelig vekt.


Undersøkelsen sammenligner også flyttere og bofaste. Det viser seg da at de bofaste har størst boligareal, høyest eneboligandel og høyest eierandel. Dette forklarer med at de bofaste er betydelig eldre enn dem som har flyttet.

Undersøkelsesopplegget


Planlagt botid er en ubobserverbar størrelse. Ved å betrakte innflyttingsår kan vi imidlertid kikke bakover og på den måten finne lengden på "duration of present incomplete stay". Ved stigende boligkarriærer forventer vi at koeffisienten for "duration of present incomplete stay"

Datasættet inneholder dessverre ikke opplysninger om hvem som i 1997 har planlagt å flytte i den nærmeste perioden. Vi er da ute av stand til å kartlegge forskjeller i flytteatefør mellom de som har planlagt å flytte og de som er nødt til å flytte av ulike årsaker. Vi er heller ikke i stand til å undersøke hvordan flytteplanene fordeler seg på leiere og eiere. Det er mulig at sannsynligheten for endring av husholdssatus bør behandles særskilt, spesielt sannsynligheten for pardannelse og skilsmisse. Det er derfor beklagelig at datasetset ikke inneholder opplysninger om tidligere skilsmisser / opplosning av samboerforhold.

5.3 DESKRIPTIV STATISTIKK

Disposisjonsform
Vi skal først undersøke hvordan gruppen enslige 25-44 år fordeler seg på disposisjonsformer i 1997. Tabell 1 på neste side viser at leieandelen er svært høy i vårt utvalg. Hele 52.4% oppgir at de er leietakere. Til sammenlikning er det bare 17.8% av parane i samme aldersgruppe som er leietakere. Årsaken til dette er nok at enslige med en inntekt har større problemer med å betjene store lån enn par med to inntekter. Vi gjør oppmerksom på at leieandelen i denne analysen ikke er blitt vektet slik at de er representativt på husholdsnivå, andelen er dermed ikke sammenlignbare med dem som oppgis i Boforholdsundersøkelsene. For en undersøkelse av utviklingen i leieandeler for hushold for perioden 1973-98 viser vi til Gulbrandsen (2000).

<table>
<thead>
<tr>
<th>Disposisjonsform</th>
<th>Frekvens</th>
<th>PF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selveier</td>
<td>120</td>
<td>30.5%</td>
</tr>
<tr>
<td>Eier gjennom borettslag ol.</td>
<td>67</td>
<td>17%</td>
</tr>
<tr>
<td>Leietaker</td>
<td>201</td>
<td>52.4%</td>
</tr>
<tr>
<td>Uoppgitt</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>394</td>
<td></td>
</tr>
</tbody>
</table>

Noter: PF er prosentvis fordeling.

Botid
Vi vil nå undersøke hvor lenge personene i utvalget har bodd i sin nåværende bolig. Datasettet inneholder opplysninger om når personene flyttet inn i sin nåværende bolig. Siden undersøkelsen ble foretatt helt i starten av 1997 har vi i bergningene her satt botiden lik 0 år for de personene som flyttet inn i sin nåværende bolig i 1997. Vi vet at leie er mest utbredt blant personer som befinner seg tidlig i en boligkarriere. Det er derfor grunn til å tro at leiere har kortere botid enn eiere.

Vi ser av tabellen at botiden er forskjellig for eiere og leiere, gjennomsnittlig botid er for eiere 6,1 år, mens den for leietakere bare er 3 år. Hele 75% av leietakerne har bodd i boligen sin i 3 år eller mindre. Den høye mobiliteten blant leierne er nok til en viss grad en følge av lavere flyttekostnader for denne gruppen. Videre kan høy mobilitet være en følge av at leierne er personer som befinner seg på et tidlig stadium i boligkarrieren. Blant eiere er det på den
annen side over 20% som har bodd i 10 år eller mer i sin nåværende bolig. Den høye andelen som har bodd så lenge i sin nåværende bolig kan tyde på at disse personene valgte en bolig ut fra langsiktige betraktninger, de valgte altså en bolig som i utgangspunktet ikke var optimal.

Tabell 2: Botid for enslige personer 25-44 år.

<table>
<thead>
<tr>
<th>Botid</th>
<th>Leietakere</th>
<th>Eiere</th>
<th>Alle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 2 år</td>
<td>49,27%</td>
<td>20,65%</td>
<td>35,90%</td>
</tr>
<tr>
<td>2 år</td>
<td>21,95%</td>
<td>11,41%</td>
<td>16,92%</td>
</tr>
<tr>
<td>3-4 år</td>
<td>16,1%</td>
<td>19,57%</td>
<td>17,69%</td>
</tr>
<tr>
<td>5-9 år</td>
<td>8,29%</td>
<td>26,63%</td>
<td>16,43%</td>
</tr>
<tr>
<td>10 år og mer</td>
<td>4,39%</td>
<td>21,74%</td>
<td>12,56%</td>
</tr>
<tr>
<td>Uppgitt</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Gjennomsnitt</td>
<td>3,01</td>
<td>6,10</td>
<td>4,46</td>
</tr>
<tr>
<td>Q3</td>
<td>3</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Median</td>
<td>2</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Q1</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Noter: Q3 er øvre kvartil (75%), mens Q1 er nedre kvartil (25%).

Effekter av pardannelser


<table>
<thead>
<tr>
<th>Disposisjonsform</th>
<th>Frekvens</th>
<th>PF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selveier</td>
<td>18</td>
<td>32,14%</td>
</tr>
<tr>
<td>Eier gjennom borettslag ol.</td>
<td>12</td>
<td>21,43%</td>
</tr>
<tr>
<td>Leietaker</td>
<td>26</td>
<td>46,43%</td>
</tr>
<tr>
<td>N</td>
<td>56</td>
<td></td>
</tr>
</tbody>
</table>

Noter: Se tabell 1.


Tabell 4: Fordeling etter disposisjonsform i 1997 (for flytting).

<table>
<thead>
<tr>
<th>Disposisjonsform</th>
<th>Frekvens</th>
<th>PF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selveier</td>
<td>6</td>
<td>22,22%</td>
</tr>
<tr>
<td>Eier gjennom borettslag ol.</td>
<td>3</td>
<td>11,11%</td>
</tr>
<tr>
<td>Leietaker</td>
<td>18</td>
<td>66,67%</td>
</tr>
<tr>
<td>N</td>
<td>27</td>
<td></td>
</tr>
</tbody>
</table>

Noter: Se tabell 1

<table>
<thead>
<tr>
<th>Disposisjonsform</th>
<th>Frekvens</th>
<th>PF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selveier</td>
<td>15</td>
<td>55.56%</td>
</tr>
<tr>
<td>Eier gjennom borettslag ol.</td>
<td>2</td>
<td>7.41%</td>
</tr>
<tr>
<td>Leietaker</td>
<td>10</td>
<td>37.04%</td>
</tr>
<tr>
<td>N</td>
<td>27</td>
<td></td>
</tr>
</tbody>
</table>

Noter: Se tabell 1.

Flytterne


Tabell 7 viser at leieandelen er hoy blant flytterne. Over 70% av flytterne var leietakere før flytting. Tabell 8 viser at leieandelen etter flytting er redusert med omlag 15 prosentpoeng. Dette tyder at de som flytter i denne aldersgruppen befinner seg i en stigende boligkarriere.

Tabell 6: Svar på spørsmålet: "Har du flyttet i 1997/98"

<table>
<thead>
<tr>
<th>Svar</th>
<th>Frekvens</th>
<th>PF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ja</td>
<td>102</td>
<td>29.31%</td>
</tr>
<tr>
<td>Nei</td>
<td>246</td>
<td>70.69%</td>
</tr>
<tr>
<td>Uoppgitt</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>394</td>
<td></td>
</tr>
</tbody>
</table>

Tabell 7: Fordeling etter disposisjonsform i 1997 (for flytting).

<table>
<thead>
<tr>
<th>Disposisjonsform</th>
<th>Frekvens</th>
<th>PF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selveier</td>
<td>17</td>
<td>16.67%</td>
</tr>
<tr>
<td>Eier gjennom borettslag ol.</td>
<td>8</td>
<td>7.84%</td>
</tr>
<tr>
<td>Leietaker</td>
<td>77</td>
<td>75.49%</td>
</tr>
<tr>
<td>N</td>
<td>102</td>
<td></td>
</tr>
</tbody>
</table>

Noter: Se tabell 1.


<table>
<thead>
<tr>
<th>Disposisjonsform</th>
<th>Frekvens</th>
<th>PF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selveier</td>
<td>32</td>
<td>31.37%</td>
</tr>
<tr>
<td>Eier gjennom borettslag ol.</td>
<td>8</td>
<td>7.84%</td>
</tr>
<tr>
<td>Leietaker</td>
<td>62</td>
<td>60.78%</td>
</tr>
<tr>
<td>N</td>
<td>102</td>
<td></td>
</tr>
</tbody>
</table>

Noter: Se tabell 1.
Tabell 9 viser hvor lenge de som flyttet i 1997/98 hadde bodd i den boligen de flyttet fra. Det viser seg som forventet at leietakerne har bodd relativt kort tid i den boligen de flyttet fra. Mer overraskende er det at hele 36% av eiere som flyttet hadde bodd i boligen i 2 år eller mindre. Dette er overraskende tatt i betraktning de betydelige transaksjonskostnadene som er forbundet med oppbrudd fra en eid bolig. Årsaken til at såpass mange flytter raskt ut igjen av en eid bolig kan være at mange enslige ikke har den likviditetene som er nødvendig for å kunne betjene et stort boliglån. Barlindhaug (2000) påviser at yngre boligkjøpere i stor grad lånefinansierer boligkjøpet. Tabellen viser at over 34% av eiere har bodd i 10 år eller mer i boligen de flyttet fra. Mange ser altså ut til å vente lenge med å endre sitt boligkonsum, de aksepterer i lang tid en viss mismatch mellom den boligen de bor i og den optimale boligen.

### Tabell 9: Botid i 1997 for flyttere.

<table>
<thead>
<tr>
<th>Botid</th>
<th>Leietakere</th>
<th>Eiere</th>
<th>Alle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 2 år</td>
<td>53,25%</td>
<td>36%</td>
<td>49,02%</td>
</tr>
<tr>
<td>2 år</td>
<td>25,97%</td>
<td>4%</td>
<td>20,59%</td>
</tr>
<tr>
<td>3-4 år</td>
<td>12,98%</td>
<td>20%</td>
<td>14,70%</td>
</tr>
<tr>
<td>5-9 år</td>
<td>7,79%</td>
<td>28%</td>
<td>6,73%</td>
</tr>
<tr>
<td>10 år og mer</td>
<td>0</td>
<td>12%</td>
<td>2,94%</td>
</tr>
<tr>
<td>Gjennomsnitt</td>
<td>1,93</td>
<td>4,56</td>
<td>2,58</td>
</tr>
<tr>
<td>Q3</td>
<td>2</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Median</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Q1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Noter: Se tabell 2.


### Tabell 10: Boareal i kvadratmeter for flyttere

<table>
<thead>
<tr>
<th></th>
<th>Gjennomsnitt</th>
<th>Q3</th>
<th>Median</th>
<th>Q1</th>
<th>Frafall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alle for flytting</td>
<td>67,7</td>
<td>80</td>
<td>65</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>Alle etter flytting</td>
<td>85,6</td>
<td>100</td>
<td>75</td>
<td>50</td>
<td>3</td>
</tr>
<tr>
<td>Eiere for flytting</td>
<td>82,3</td>
<td>96</td>
<td>80</td>
<td>60</td>
<td>1</td>
</tr>
<tr>
<td>Eiere etter flytting</td>
<td>110,4</td>
<td>140</td>
<td>85</td>
<td>68,5</td>
<td>0</td>
</tr>
<tr>
<td>Leiere for flytting</td>
<td>62,9</td>
<td>80</td>
<td>60</td>
<td>40</td>
<td>2</td>
</tr>
<tr>
<td>Leiere etter flytting</td>
<td>68,8</td>
<td>87</td>
<td>70</td>
<td>50</td>
<td>3</td>
</tr>
</tbody>
</table>

Noter: Frafall er beregnet i forhold til flytterne i tabellene 6,7 og 8.
5.4 ETTERSPØRSEL ETTER BOLIGAREAL

Modell

Etter at vi i den deskriptive delen ved hjelp av tabeller har beskrevet noen empirisk trekk skal vi i denne delen estimere etterspørselsfunksjoner for henholdsvis eiere og leiere. Den teoretiske diskusjonen av dynamikken bak atferden på boligmarkedet danner bakgrunn både for spesifikasjonen av etterspørselsfunksjonene og tolkningen av resultatene.


For begge gruppene vil utgangspunktet for estimeringene være følgende generelle modell:

\[(1) \ln A = b_0 + b_1 \ln I_1 + b_2 G_1 + b_3 D_1 + b_4 Botid + b_5 Flytting + U \]

\(I_1\) er et mål på inntekt, \(G_1\) er et sett av geografiske dummyvariabler som ivaretar priseffekter, \(D_1\) er demografiske variabler som alder, barn og kjønn. Et av de sentrale målene med dette notatet er å undersøke en del dynamiske faktorers betydning for atferden på boligmarkedet. Slike faktorer trekkes inn i de øvrig modellene. Mål på botid og flytting vil derfor inkluderes i noen av de estimerte modellene. En kan da undersøke om resultatene endres når en trekker dynamikk inn i modellene. U er et stokastisk restledd. Vi estimerer 5 ulike modellvarianter for begge gruppene.


---

31 Formue inngår ikke i de estimerte modellene selv om vi har mål på formuen. Grunnen til at vi ikke trekk formue inn i modellene er at formen ofte er en konsekvens av tidligere boligvalg.
32 Det vil kanskje være mer riktig å benytte begrepet framtidig inntektspotensial. Videre i notatet velger vi likevel å betegne dette som permanentinntekten.
et sett forklaringsvariabler, se appendiks A\textsuperscript{33}. I andre trinn brukes disse resultatene til å predikere en forventet framtidig lønnsprofil. Nåverdien av denne profilen benyttes i ettersporselsfunksjonene. På denne måten tar en hensyn til at arbeidstillbud og boligvalg er beslutninger som henger sammen. Vi trekker også inn en tiltvariabel, som viser den neddiskonteerte trenden i inntekten. Tiltvariabelen er her målt som predikert neddiskontert nåverdi av inntekt i 2006 minus løpende inntekt i 1997. I aldersgruppen som betraktes her er det grunn til å forvente et positivt fortegn på koeffisienten foran tiltvariabelen.


For å kunne sammenligne de ulike modellenes forklaringskraft på en best mulig måte har vi valgt å utelate de observasjonene der vi har "missing" på noen av variablene. Dette medfører at vi står igjen med et utvalg på 177 eiere og 194 leietakere. Regjereingsregningene er utført i programpakken Limdep 7.0. Denne er beskrevet i Greene (1997).

RESULTAT
I denne delen av notatet presenteres resultatene fra den empiriske analysen. På grunn av eie-leie dimensjonen er det mulig at det finnes seleksjonsskjevhet i utvalget vårt fordi valg av disposisjonsform og kvantum er simultane beslutninger. Vi undersøker derfor om vi har en slik skjevhet i utvalget vårt ved hjelp av framgangsmåten beskrevet i Heckman (1977). Metoden går ut på å beregne en såkalt inverse Millsrate ved hjelp av en probitmodell. En signifikant koeffisient for den inverse Millsraten tyder på seleksjonsskjevhet. Koeffisienten viste seg å være liten og uskarpt bestemt\textsuperscript{34}, noe som indikerer at vi ikke har betydelige seleksjonsskjevhet i utvalget vårt.

\textsuperscript{33} I appendiks A redegjør vi for hvordan lønnsrelasjonene er spesifisert. Appendikset viser også resultatene i lønnsregjeringene.

\textsuperscript{34} Ikke rapportert.
Tabell 12: Estimeringsresultat: Eiere

<table>
<thead>
<tr>
<th></th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Konstant</td>
<td>1.39(1.49)</td>
<td>1.81(1.32)</td>
<td>4.50(2.61)</td>
<td>4.38(2.53)</td>
<td>4.98(2.81)</td>
</tr>
<tr>
<td>Ln Alder</td>
<td>0.56(3.03)</td>
<td>0.39(1.59)</td>
<td>-0.36(-0.95)</td>
<td>-0.37(-0.97)</td>
<td>-0.47(-1.21)</td>
</tr>
<tr>
<td>D Storby</td>
<td>-0.26(-3.78)</td>
<td>-0.25(-3.61)</td>
<td>-0.21(-2.94)</td>
<td>-0.21(-2.99)</td>
<td>-0.22(-3.04)</td>
</tr>
<tr>
<td>D Bygde</td>
<td>-0.02(-0.26)</td>
<td>-0.02(-0.22)</td>
<td>0.03(0.46)</td>
<td>0.04(0.50)</td>
<td>0.03(0.38)</td>
</tr>
<tr>
<td>Ln Inntekt</td>
<td>0.21(2.28)</td>
<td>0.19(2.12)</td>
<td>0.24(2.59)</td>
<td>0.22(2.39)</td>
<td>0.24(2.64)</td>
</tr>
<tr>
<td>Ln Nåverdi</td>
<td>0.09(1.35)</td>
<td>0.19(0.85)</td>
<td>0.17(0.79)</td>
<td>0.20(0.90)</td>
<td>0.18(0.80)</td>
</tr>
<tr>
<td>Tilt</td>
<td>0.12(1.76)</td>
<td>0.12(1.66)</td>
<td>0.12(1.68)</td>
<td>0.11(1.68)</td>
<td>0.13(1.87)</td>
</tr>
<tr>
<td>Barn1</td>
<td>0.096(0.71)</td>
<td>0.07(0.84)</td>
<td>0.07(0.82)</td>
<td>0.07(0.82)</td>
<td>0.01(0.77)</td>
</tr>
<tr>
<td>Barn2</td>
<td>0.01(-0.15)</td>
<td>-0.01(-0.21)</td>
<td>-0.00(-1.41)</td>
<td>-0.00(-0.94)</td>
<td>-0.00(-0.94)</td>
</tr>
<tr>
<td>Ln Botid</td>
<td>0.10(2.28)</td>
<td>0.10(2.22)</td>
<td>0.09(2.17)</td>
<td>0.09(2.17)</td>
<td>0.09(2.17)</td>
</tr>
<tr>
<td>Ln Botid_E</td>
<td>-0.10(-1.46)</td>
<td>-0.11(-1.46)</td>
<td>-0.10(-1.36)</td>
<td>-0.10(-1.36)</td>
<td>-0.10(-1.36)</td>
</tr>
<tr>
<td>Ln Botid_U</td>
<td>0.26</td>
<td>0.25</td>
<td>0.27</td>
<td>0.27</td>
<td>0.28</td>
</tr>
<tr>
<td>R²</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Noter:* Avhengig variabel i alle regresjonsmodellene er logaritmen til arealet. R² er den justerte multiple determinasjonskoefisienten, et mål på modellens forklaringskraft. Variablene er definert i hovedteksten.

I M1 ser vi at den estimerte inntektselastisiteten er svært lav og uskarpt bestemt. Dette kan bety at den løpende inntekten ikke betyr så mye for økonom konsum av boligtenester. I de andre modellene benytter vi nåverdien av framtidig inntekt i stedet for løpende inntekt. Den estimerte inntektselastisiteten viser seg å være høyere når permanentinntektsmålet benyttes. T-verdiene viser at effekten av permanent inntekt er mindre signifikant enn effekten av løpende inntekt i M1. I lys av de lave t-verdiene er det overraskende at den estimerte permanente inntektselastisiteten har nesten identisk koefisientverdi i alle modellene der den inngår. Det er også overraskende at koefisienten foran tiltvariabelen er nær null og uskarpt bestemt i alle modellene.

I M3 inkluderer botid som forklaringsvariabel. Vi forsøkte flere funksjonsformer for botidsvariabelen. Resultatene var imidlertid entydige, botid hadde en positiv effekt på konsumet kvantum av boligtenester. Vi hadde på forhånd ventet oss et negativt fortegn. Personer som har bodd lenge i samme bolig kan forventes å være lenger unna den optimale boligen enn personer som nettopp har valgt en bolig. Vi hadde derfor en mistanke om at funnet kunne reflektere ulik effekt av botid i ulike aldersgrupper. Vi valgte derfor å inkludere to nye botidsvariabler, ln Botid_U for personer under 30 år og ln Botid_E for personer over 35 år, i tillegg til den opprinnelige botidsvariabelen ln Botid. Denne modellformuleringen er mer fleksibel siden den tillater effekten av botid å variere med alder. Resultatene viser at effekten av den "samlede" botidsvariabelen forsvinner helt. Videre er effekten av botid klart positiv for de eldste, mens den for de yngste er negativ. Vi merker oss også at de to koefisientene er nesten identiske i absoluttverdi. Utkastelse på grunn av skilsmisser/opplosning av samboerskap kan forklare den positive botidseffekten for de eldste. Den eldste delen av utvalget kan tenkes å bestå av tre ulike grupper. En gruppe har vært lenge enslige, det er grunn til å anta at personene i denne gruppen har bodd lenge i store boliger. Det har også skilte som fortsatt bor
i boligen de bodde i før skilsmissen. Den tredje gruppen er skilte som ikke bor i boligen de bodde i før skilsmissen, en kan anta at disse personene har kort botid i små boliger. Vi er her nødt til å basere oss på antakelser siden datasettet som benyttes ikke inneholder om opplysninger om hvem som er skilte.

Resultatene gir ingen klar støtte for at den dynamiske tilnærmingen er riktig. En hypotese om at koeffisientene foran alle botidsvariblaene er lik null er nær ved å forkastes. F-verdien på 2,60 er ikke signifikant på 5%-nivå, kritisk verdi ligger på 2,65. I M4 inkluderes en dummyvariabel for flytting (D Move). Dummyvariabelen ingår med negativt fortegn, vi ser imidlertid i tabell 12 at effekten ikke er signifikant. I M5 benytter vi en flyttesannsynlighet beregnet i en probitanalyse i stedet for dummyvariabelen uten at resultatet endrer seg nevenueerlig. Vi kan altså ikke forkaste en hypotese om at atferden i 1997 var lik for flyttere og ikke-flyttere.

Resultatene overfor bor ikke tas som en indikasjon på at den dynamiske tilnærmingen nødvendigvis trenger å være gal. Tidsperioden vi undersøker er for kort til å trekke sikre konklusjoner om kompliserede dynamiske sammenhenger. En ytterligere komplikasjon er at vi ikke vet noe om hvorvidt den observerte flyttingen er planlagt eller ikke.

Når det gjelder de øvrige resultatene kan vi nevne at alderseffekten inngår signifikant med fortegn i M1. Effekten er relativt sterk, en økning i alderen med 1% gir en økning i boligkonsumet med 0,56%. Den estimerte alderseffekten er svakere i M2 der den løpende inntekten er erstatte med den permanente inntekten. Alderseffekten endrer seg fundamentalt når botid inkluderes, effekten er nå negativ og ikke signifikant.


Tversnittsanalyser er ofte preget av restledsvariansen ikke er konstant, også kalt heteroskedastisitet. Heteroskedastisitet medfører at standardavvikene feilestimeres, noe som kan være et problem ved signifikantestting. Vi testet dette på en enkel måte i Limdep ved å utføre nye regresjonsberegninger på de samme modellene med korrigerte standardavvik. Det viste seg da at de korrigerte standardavvikene var så godt som identiske med de opprinnelige standardavvikene. Dette indikerer at modellene våre ikke er behøvet med heteroskedastisitet.

Modellene er preget av at forklaringskraften er lav, modellene forklarer bare rundt en fjerdedel av variasjonen i den avhengige variabelen. Den lave forklaringskraften skyldes nok både at utvalget er lite, og at utvalget er preget av stor heterogenitet. Vi testet også en hypotese om at alle koeffisientene unntatt konstantledet er lik null ved hjelp av en F-test. Denne nullhypotesen ble forkastet i samtlige modeller. Forklaringskraften varierer lite mellom de ulike modellene. Vi legger likevel merke til at $R^2$ er litt høyere i de dynamiske modellene.
Estimeringsresultat for leietakere

Tabell 13: Estimeringsresultat: Leiere

<table>
<thead>
<tr>
<th></th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Konstant</td>
<td>-1,00(-1,07)</td>
<td>-2,07(-0,96)</td>
<td>-1,19(-0,47)</td>
<td>-1,05(-0,41)</td>
<td>-0,38(-0,15)</td>
</tr>
<tr>
<td>Ln Alder</td>
<td>0,15(0,58)</td>
<td>0,53(1,30)</td>
<td>0,27(0,54)</td>
<td>0,28(0,54)</td>
<td>-0,01(-0,02)</td>
</tr>
<tr>
<td>D Storby</td>
<td>-0,07(-0,78)</td>
<td>-0,14(-1,48)</td>
<td>-0,14(-1,44)</td>
<td>-0,14(-1,41)</td>
<td>-0,17(-1,74)</td>
</tr>
<tr>
<td>D Bygud</td>
<td>-0,06(-0,50)</td>
<td>-0,17(-1,41)</td>
<td>-0,16(-1,28)</td>
<td>-0,16(-1,26)</td>
<td>-0,16(-1,30)</td>
</tr>
<tr>
<td>Ln Nøverdi</td>
<td>0,26(2,11)</td>
<td>0,17(1,23)</td>
<td>0,21(1,45)</td>
<td>0,21(0,49)</td>
<td>0,18(1,24)</td>
</tr>
<tr>
<td>Tilt</td>
<td>0,37(6,14)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barn1</td>
<td>0,60(1,56)</td>
<td>0,59(1,54)</td>
<td>0,57(1,47)</td>
<td>0,66(1,70)</td>
<td></td>
</tr>
<tr>
<td>Barn2</td>
<td>0,49(4,23)</td>
<td>0,52(4,45)</td>
<td>0,52(4,45)</td>
<td>0,54(4,58)</td>
<td></td>
</tr>
<tr>
<td>Ln Botid</td>
<td>0,01(0,06)</td>
<td>0,03(0,17)</td>
<td>0,03(0,14)</td>
<td>0,03(0,17)</td>
<td></td>
</tr>
<tr>
<td>Ln Botid_U</td>
<td>-0,06(-0,9)</td>
<td>-0,07(-0,95)</td>
<td>-0,07(-0,95)</td>
<td>-0,08(-1,15)</td>
<td></td>
</tr>
<tr>
<td>Ln Botid_E</td>
<td>0,05(0,50)</td>
<td>0,04(0,44)</td>
<td>0,06(0,59)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D Move</td>
<td>0,18(1,96)</td>
<td>0,18(1,96)</td>
<td>0,18(1,96)</td>
<td>0,19(2,06)</td>
<td></td>
</tr>
<tr>
<td>P Move</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-1,04(-1,47)</td>
</tr>
<tr>
<td>R²</td>
<td>0,33</td>
<td>0,21</td>
<td>0,21</td>
<td>0,21</td>
<td>0,22</td>
</tr>
</tbody>
</table>

Noter: Se tabell 12.

Tabellen viser at den løpende inntektselastisiteten er høyest signifikant. En økning i inntekten på 1% gir en økning i boligkonsumet på 0,37%. Overraskende nok viser det seg den estimerte inntektselastisiteten øker i verdi i modellene der permanentinntekten brukes. Funnet må tolkes forsiktig fordi den estimerte nåverdielastisiteten ikke er skarpt bestemt. Vi hadde på forhånd forventet at leietakerne la mest vekt på inntekten i inneværende periode. På grunn av de lave flyttekostnadene i leiemarkedet hadde vi ventet at leietakerne i større grad var motiveret av kortsiktige betraktninger ved valg av bolig. Vi ser også at tiltvariablen ikke ser ut til å ha noen effekt. Effekten av de andre variablene er ganske lik uansett hvilket inntektsmål som benyttes.

Også i leiergresjonen forsøkte vi ulike funksjonsformer og spesifikasjoner for botidsvariablene. Effekten av botid viste seg jevnt over å være svak uansett hvilken spesifikasjon som ble benytet. For sammenligningens skyld valgte vi å benytte samme spesifikasjon som i eiermodellene. For leietakerne viste det seg da at botid ikke så ut til å ha noen effekt bortsett fra for personer i den eldste aldersgruppen. Den mulige forklaringen fra eiermodellene om at den eldste gruppen er svært sammensatt er minst like relevant her. Det kan også tenkes at noen i denne aldersgruppen har bodd lenge i store leide boliger førde de er fornøyd med å være leietakere. En hypotese om at alle botidkoefisientene simultant er like null forkastes ikke\(^{35}\). I M4 og M5 der flytterne trekkes inn ser vi at både D move og P move inngår med det forventede fortegnet, som vi ser av tabell 13 er effekten både svak og uskarpt bestemt.

Aldersvariablen inngår ikke signifikant i noen av modellene, fortegnet er imidlertid "riktig" i samtlig modeller, unntatt M5. Boligkonsumet er videre klart høyere i hushold med barn enn i hushold uten barn. Hushold med 2 eller flere barn skiller seg ikke ut fra hushold med ett barn.

\(^{35}\) F-verdien på 1,40 ligger klart under kritisk verdi.
Effekten av dummyen Barn 2 er tilnærmet lik null. Når det gjelder urbanitetsdummiene hadde vi ventet oss en forskjell mellom storbyer og andre byer.

Basert på samme framgangsmåte som i eiermodellene testet vi for heteroskedastisitet også i leietakermodellene. Det viste seg at det heller ikke her var tegn som tydet på heteroskedastisitet. Når vi betrakter modellene forklaringskraft ser vi at den enkleste modellen, M1, ser ut til fungere best, $R^2$ er her 0,33. En svakhet ved den enkle modellen er at den ikke avdekker at botidseffekten er forskjellig i ulike aldersgrupper. En hypotese om at alle helsingskoeffisienter er like null forkastes for samtlige modeller.

### 5.5 Oppsummering og sammenligning

Vi vil nå sammenligne resultatene for eiere med resultatene for leietakerne. Et resultat som er felles for begge gruppane er at boligkonsumet øker når det er barn i husholdet. Det store skillet går som nevnt mellom hushold med barn og hushold uten barn. En egen dummy-variabel for kjenne viste seg å ikke gi noen utslag i noen av modellene, noe som kan være en følge av at denne variabelen er korreliert med barnevariablene. Ved undersøkelse av datasset viste det seg at nesten alle enslige forsørgere var kvinner.


Helt i strid med det vi hadde forventet ser vi at nåverdielastisiteten er høyere for leiere enn for eiere. Vi finner ingen god forklaring på resultatet, det kan selvfølgelig være en følge av at nåverdien ikke er beregnet på noen god måte. Dette resultatet er så spesielt at det er vanskelig å forklare på en "god" måte.

Urbanitetsdummiene som tenkes å ivareta pris effekter har et klarere mønster i eieregressjonene enn i leieregressjonen. Årsaken kan være at prisene på eide boliger varierer mer enn prisene på leide boliger. Vi vet imidlertid at prisene på leide boliger også varierer, og at det er Oslo som skiller seg ut blant storbyene. Dette kan forklare at koeffisienten foran D Storby og D By er ganske lik i leieregressjonene. Vi er klar over at urbanitetsdummiene er et dårlig prøvemål, særlig med areal som avhengig variabel.

Det ser ut til at de dynamiske faktorene betyr mer for eieres enn for leieres etterspørsel. Vi var nær med å forkaste en hypotese om at alle botidskoeffisientene var lik null for eieres del, mens vi for leieres del klart ikke kunne forkaste en slik hypotese. Bortsett fra i modellen med løpende inntekt var forklaringskraften høyere i eiermodellene enn i leietakermodellene.

Estimeringsresultatene må tas med flere forbehold. For det første kan en regne med at både kvantum, botid og disposisjonsform bestemmes i et simultant ligningssystem. Våre estimatorer kan derfor være forventningsskjeve. Tidsperioden som betraktes er også for kort til å si noe sikkert om dynamikken i modellen. Det vil derfor være interessant å utføre ytterligere analyser når panelet forlenges.
APPENDIKS A


\[ W = \beta_0 + \beta_1 \text{alder} + \beta_2 (\text{alder}^2) + \beta_3 \text{ansennitet} + \beta_4 \text{privat} + \beta_5 D \text{Storby} + \beta_6 D \text{By} + \beta_7 D \text{Tett} + U \]

\( U \) er et stokastisk restledd.

Estimeringsresultatene er gjengitt i tabell 11 på neste side. Et gjennomgående trekk ved alle de estimerte regresjons ligningene er at forklaringskraften målt ved \( R^2 \) er lav. Modellen forklarer best timelønna for menn med høy utdanning. Det ser også ut som modellen passer bedre for menn enn for kvinner. For gruppen med lavest utdanning er imidlertid modellens forklaringskraft like nedslående for både menn og kvinner. Lav forklaringskraft er vanlig i modeller av denne typen. Longva og Strom (1996) oppnådde en \( R^2 \) på 0.36 i ligningen for menn og 0.27 i ligningen for kvinner\(^{36}\).

\(^{36}\) Longva og Strom benyttet et datasett med ca.190000 observasjoner for kvinner og ca. 345000 observasjoner for menn. De benyttet bla., et omfattende sett av bransjedummier som forklaringsvariabler.
Tabell A1: Estimeringsresultat for timelonnssats for enslige personer i aldersgruppen 25-54 år.

<table>
<thead>
<tr>
<th>Gruppe</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>K1</th>
<th>K2</th>
<th>K3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Konstant</td>
<td>-126,45</td>
<td>5,67</td>
<td>-275,66</td>
<td>16,57</td>
<td>37,68</td>
<td>-36,10</td>
</tr>
<tr>
<td></td>
<td>(-0,9)</td>
<td>(0,08)</td>
<td>(-2,21)</td>
<td>(0,15)</td>
<td>(0,42)</td>
<td>(-0,42)</td>
</tr>
<tr>
<td>Alder</td>
<td>13,59</td>
<td>3,44</td>
<td>18,25</td>
<td>4,03</td>
<td>4,32</td>
<td>7,07</td>
</tr>
<tr>
<td></td>
<td>(1,99)</td>
<td>(0,92)</td>
<td>(2,67)</td>
<td>(0,72)</td>
<td>(0,92)</td>
<td>(1,49)</td>
</tr>
<tr>
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Når det gjelder enkeltresultatene i modellen vil vi i liten grad forsøke å tolke disse. Hovedvekten legges på å undersøke om variablene opptrer med forventet fortegn. Fra tabellen legger vi merke til at alderen og den kvadrerte alderen inngår med forventet fortegn i samtatte regresjoner. Videre ser vi at ansennitet inngår med positivt fortegn i de estimerte modellene med ett unntak, modellen for menn med lav utdanning. Privat sektor dummyen inngår med positivt fortegn i samtatte modeller, bortsett fra i modellen for kvinner med middels utdanning. I begge disse tilfellene med uventet fortegn er imidlertid sammenhengen både svak og ikke signifikant. Vi legger videre merke til at menn med høyest utdanning tjener klart bedre i privat sektor enn i offentlig sektor, vi ser også at sammenhengen er skarpt bestemt.

Videre ser vi at det ikke avdekkes noen klar sammenheng mellom timelonn og urbanitetgrad. Her spriker resultatene sterkt mellom de ulike gruppende. En inndeling på basis av landsdeler ble også prøvd uten av det ble avdekket noe klart geografisk monster.
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