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PRICE MOVEMENTS IN THE SAN FRANCISCO/ OAKLAND SMSA RENTAL HOUSING MARKET 1975-1985

By

MICHAEL SMITH-HEIMER

WALTER A. HAAS SCHOOL OF BUSINESS

FISHER CENTER FOR REAL ESTATE AND URBAN ECONOMICS
UNIVERSITY OF CALIFORNIA AT BERKELEY
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INTRODUCTION

In any survey of attitudes about problems in the San Francisco Bay Area, housing affordability inevitably surfaces as a major issue.[2] Problems of housing affordability are pervasive in both the owner and rental market. With Bay Area house prices and rents among the most expensive in the nation, this is understandable. In 1980, Bay Area rents and house prices were the fourth highest in the nation,[3] and these levels continued to rise throughout the 1980's.

While research and the popular press have focused on the housing affordability gap for homeowners, there has been little systematic exploration of the San Francisco/Oakland rental housing market over time. For lower income households, understanding price movements in the rental market are particularly important; since lower income households are primarily renters, changing rent levels directly impact the levels of income available for other consumption, and exacerbate income disparities.

Further, tracing submarket real price movements for constant quality units over time offers researchers a method for directly assessing unit filtering in submarkets, a key ingredient of American housing policy for the poor [Aaron (1972)]. Although Federal policy implicitly assumes that, by offering indirect subsidies to upper income households (including mortgage interest and property tax deductions, deferred capital gains on personal home sales and secondary market subsidization), the existing housing stock will filter to lower income households (presumably increasing the quantity and quality of housing for all income groups), there have been few definitive filtering studies.

This paper examines changes in real prices for a cohort of rental housing units in the San Francisco-Oakland SMSA for the 1975 - 1985 period. In doing so, the paper outlines and tests a method for assessing the filtering of rental units in submarkets of the San Francisco-Oakland

area. By measuring movements in the constant quality price for units in housing submarkets over time, the research directly assesses the relative unit price changes in rental submarkets, indirectly assessing the level of unit price filtering evident in the rental housing market.

The remainder of this paper is divided into four sections. In the following section, a discussion of filtering definitions and the methodological issues inherent in measuring rental price movements is presented. Next follows an overview of the San Francisco-Oakland housing market during the 1975 - 1985 period. In the third section, the paper reports on the constant quality rental price movements in specific rent-based housing submarkets, based on a panel of housing units[4]. Finally, a discussion of the policy implications of the results is presented.

BACKGROUND

The concept of filtering has long been a key ingredient of American housing policy for the poor, and during the past decade, the concept has become a central feature of public policy. While researchers continue to debate the validity of the proposition [see Weicher (1987); Apgar (1987); Fossett and Orfield (1987); and Gilderbloom and Appelbaum (1988) for recent discussions], federal policy has espoused filtering as one of the major vehicles for meeting federal housing goals [see President's Commission on Housing (1982), page 35].

There is agreement on the general concept of filtering. In essence, filtering reflects the dynamics of an exogenous shift rippling through the housing economy through a series of moves by affected populations resulting in a theoretical change in housing quality for low income households as higher income households adjust housing consumption. Filtering dynamics incorporate the price, quantity, quality and investment decisions created by the exogenous shift.

While there is general agreement on the concept of filtering, operational definitions have varied in the literature, reflecting alternative directions for research investigations. These definitions have focused on specific aspects of the housing adjustment process, including changes in occu-

pancy [Ratcliff (1949); Lansing, et. al. (1969); White (1971)], changes in the desirability of aging stock [Grebler (1953); Muth (1973)], changes in unit values [Lowry (1960); Grigsby (1963); Olsen (1969)], or price changes for constant quality units [Weicher and Thibodeau (1988); Sweeney (1974); Ohls (1975)].

While each of these definitions reflects a method for measuring housing market movements, the final definition offers a direct method for assessing the potential of filtering to further public policy goals. If an indirect goal of public housing policies (including tax subsidy expenditures) is to upgrade the quality of units affordable to all households (including lower income households), it is not sufficient that housing units be occupied by successive lower income groups, regardless of price effects, nor to ascertain that unit occupants vary based on unit age or value. To be effective in a public policy perspective, the constant quality price of a unit should remain constant or decline over time, reflecting real gains to successive occupants. It is not enough that a lower income household occupy better housing, if filtering is to offer a viable policy approach to expanding lower income housing opportunities, unit prices should remain constant, or decline over time.

Constant quality price movements for housing units can be assessed using hedonic price estimation techniques. Measuring movements in housing markets using hedonic estimation techniques is not a new research direction. Since the pioneering theoretical work of Rosen (1974), hedonic estimation techniques have been widely used to assess housing price movements in local markets [see for instance, Kain and Quigley (1975), Goodman (1978), Linneman (1980)]. In general, these studies assume that housing units are composed of distinct bundles of attributes. By using hedonic price regression models, a researcher can measure the implicit prices of housing attributes, assuming that these attribute prices reflect the short-run supply and demand conditions of the market at any point in time. Extensions of this basic methodology have been

used to test the effect of key externalities on the price structure of housing markets [see for instance, Mieskowski and Saper (1976), Bajic (1985), Shafer (1979)].

The components to be modelled and the specific mathematical relationships for estimations are key assumptions in hedonic estimations. However, in addition, price estimation techniques in previous studies have rested on several additional key assumptions. Specifically, both the choice of data for the modelling effort, and the requirement that participants can move fluidly between housing submarkets may significantly influence the results of the analysis.

The choice of data for modelling the hedonic relationships is integral to final hedonic regression estimates. With some notable exceptions [Goodman and Kawai (1985)], hedonic price estimates in the rental market have been based on rent levels paid by all renters, both recent and longer term occupants. While these studies often incorporate variables to adjust for variations in price by length of occupancy, they implicitly assume short-term equilibrium throughout the rental market [Follain and Malpezzi (1980), Marshall and Guasch (1983)]. However, as several authors have noted [Downs (1981), Lowry (1981)], the economic calculus of both suppliers and demanders is far more complicated than the traditional rational economic actor, seeking to maximize profits. Decisions to reduce risk and uncertainty (including minimizing unit turnover, rent adjustments based on retaining a "good" tenant, and other actions based on personal relationships), and rent setting based on profit "satisficing," may temper the rent adjustment process for standing tenants in the housing market, dramatically affecting short-term market equilibrium estimates; while the renewal of a rental contract to a standing tenant reflects a completed housing transaction, it may not reflect the true marginal cost of a housing unit transacted at an arms-length transaction. Thus, it is not clear that price estimates based on hedonic equations incorporating data from all renters will reveal marginal demand/supply equilibrium, even in the short term. Research by Goodman and Kawai (1985) reinforces this conclusion.

Price estimates based on recent mover data reveal market signals that more closely approximate the "arms-length" transactions. In the case of recent movers, both building owners and prospective renters have entered the marketplace for rental housing services. Since the unit is vacant, the actions of suppliers should most approximate a rational economic actor, and prospective tenants will seek to maximize housing consumption subject to search and income constraints. Thus, estimates of price movements based on recent movers should provide a more reliable reflection of market dynamics.

A second assumption of most rental price index research is that housing transactions occur in a single unified market. Several authors have conceptualized and tested for the presence of housing submarkets, with segmentation reflecting city/suburb location [Goodman (1978)], income [Schnare and Struyk (1976)], race [Galster (1987)], unit size or location [Bajic (1985)], and tenure [Linneman (1980)]. However, with few notable exceptions, this research has generally focused on the home ownership market.

There are several reasons to posit and test for market segmentation in the rental market. Discontinuities in the rental housing market may significantly influence rental prices in housing submarkets. While several authors acknowledge that segmentation permeates real estate markets, past research has generally assumed market segmentation does not systematically influence price movements in housing markets. However, if households attempt to locate spatially into neighborhoods with households exhibiting similar socio-economic characteristics, market segmentation may reduce the willingness of households to substitute alternative locations. If individuals select locations based on preferences for neighborhoods, and only then select units based on available price/quality relationships, price estimates based on a unified market assumption will not reflect unit supply/demand relationships within given locations. Under an assumption of market segmentation, the short run marginal prices of unit attributes will be sub-

ject to quasi-rents for specific locations, with different price structures characterizing different housing submarkets.

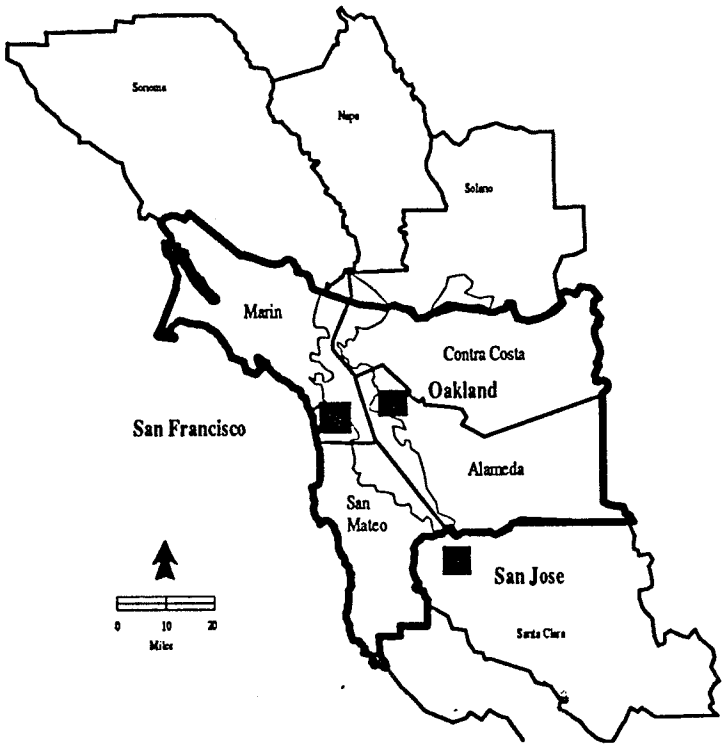
Further, as income declines, the ability to substitute tenure in the consumption of housing decreases. For a low income household occupying a unit at the bottom of the housing market, there are limited available substitutes, leading to potential asymmetrical reactions to shifts in the supply/demand for housing occupied by various income groups.

In summary, while past research on housing markets has developed a strong literature on tracing constant quality price movements, the role of housing market segmentation in assessing price movements has not been well explored. Market segmentation by rental unit class may significantly influence price levels in various rental submarkets. Further, while ownership literature consistently employs housing purchase data (reflecting recently completed transactions in an open housing market), research on rental housing markets has generally assumed that all current rents reflect arms-length transactions. Several researchers have noted the need to account for length-of-occupancy discounts, and highlighted alternative motivations for rent movements for standing tenants. In assessing the marginal price movements within a housing market, rental transactions limited to recent movers will more closely approximate actual marginal supply/demand relationships in the short run.

THE SAN FRANCISCO - OAKLAND SMSA: A SUPPLY CONSTRAINED MARKET

The San Francisco-Oakland SMSA is part of the San Francisco Bay Area, which extends from Sonoma County (Santa Rosa PMSA) to Santa Clara (San Jose PMSA) and includes Napa and Solano Counties (Fairfield-Vallejo PMSA) (see Figure 1). While an analysis of the entire San Francisco Bay Area would offer additional insights into the the metropolitan housing market, comparable data for the other PMSA's in the Bay Area is not available[5]. It is assumed that market relationships in this larger area reinforce the trends evident in the San Francisco-Oakland SMSA.

Figure 1
Location of San Francisco-Oakland SMSA in San Francisco Bay Area



Growth in the San Francisco-Oakland SMSA housing market has been fueled by economic growth in the San Francisco Bay Area. The San Francisco-Oakland SMSA economy generally performed better than the national average, with total employment increasing nearly 40 percent in the 1975-1985 period, outpacing national employment growth by over 16 percent. This growth was concentrated in transactional employment sectors (including communications,

FIRE, and business services), where growth was more than 20 percent greater than national average rates.

Income growth for families and primary individuals was also strong. Median income levels (adjusted for changes in the consumer price index, excluding shelter costs[6]) increased eight percent during the decade, rising from about $24,860 to $26,680 (Figure 2). Families with real incomes below $10,000 decreased by over 27 percent during the period, while families earning in excess of $50,000 increased by over 50 percent.

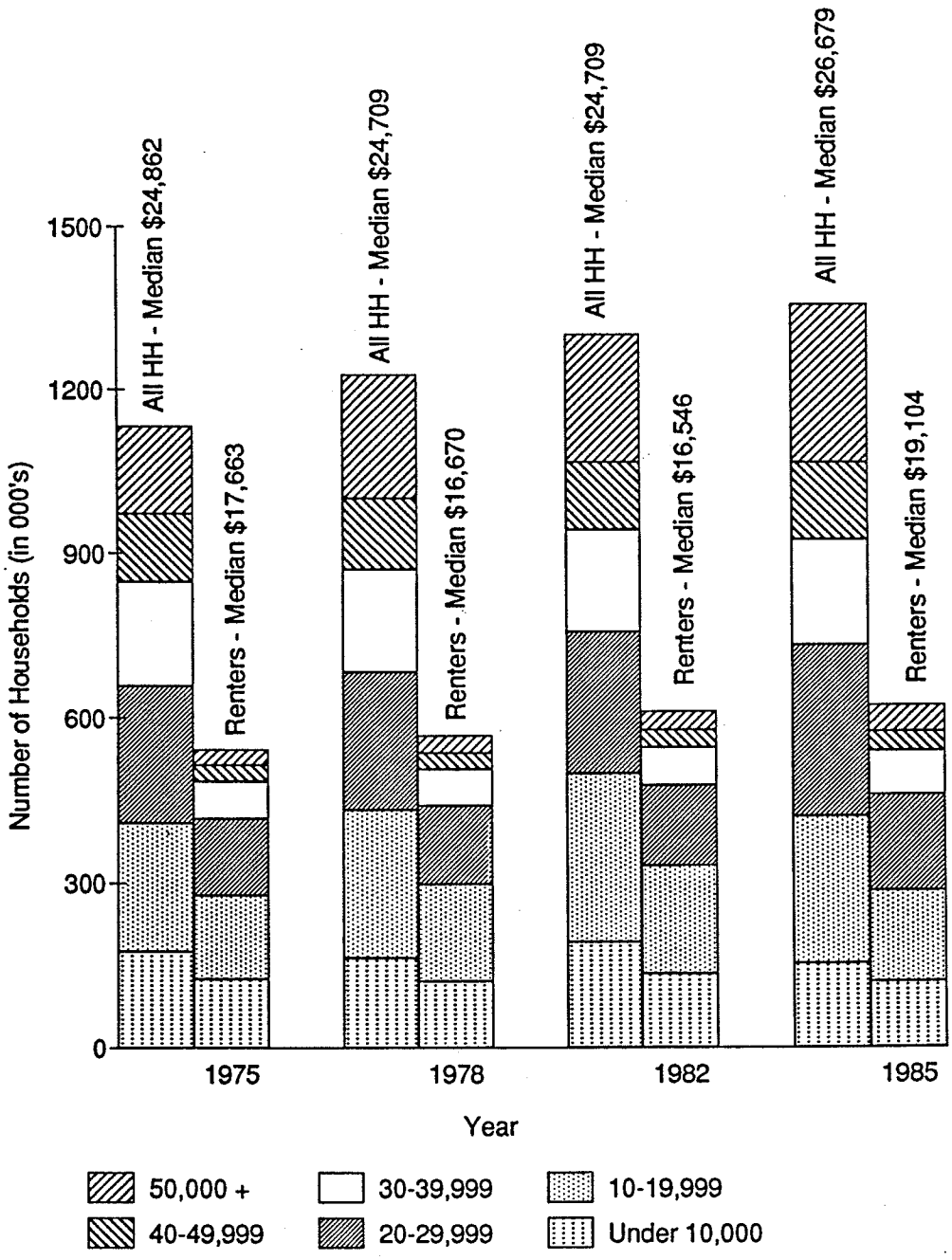
Income growth for renters paralleled overall income growth, with median income levels for renters increasing 8 percent during the decade, rising from about $17,660 to $19,100. Nonetheless, rates of poverty for renters remained higher than overall rates, reflecting income disparities between owners and renters.

While employment and income growth continued to spur housing demand, various factors combined to limit the growth of housing supply during the decade. High construction costs, rapid price inflation, and limited land supplies all contributed to a constrained supply response. In addition, as several researchers have noted, the influence of widespread growth control efforts on the housing market in the San Francisco-Oakland area may have significantly tempered potential supply responses [see Dowall and Landis (1981); Katz and Rosen (1987)].

These factors all combined to create an extremely tight housing market. While nationwide, new unit construction during the 1976 - 1985 period outpaced household growth (1.07 units for each new household), in the San Francisco-Oakland SMSA, unit construction levels, only .695 units per new household, were among the lowest for areas surveyed in the Annual Housing Survey in both the 1975 and 1985 period (see Figure 3). This unit construction rate was not based on an extraordinary influx of residents; the percentage increase in households in San Francisco was near the national average. While cities such as Portland and Minneapolis more closely approxi-

Figure 2

Family and Primary Household Income
San Francisco-Oakland SMSA
1975 - 1985



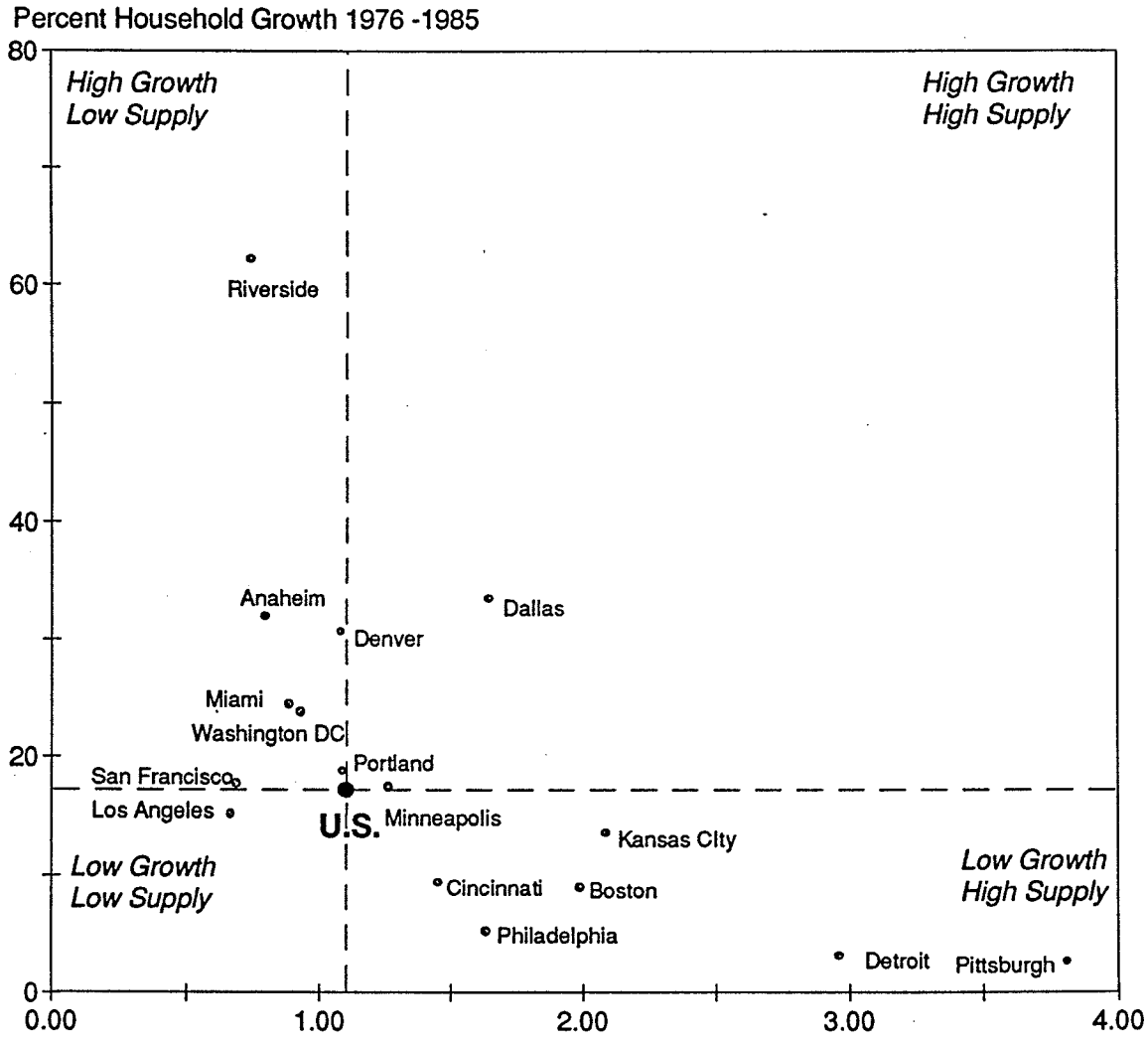
NOTE: All dollars values adjusted by CPI less shelter, 1982-1984=100.

Source: Annual Housing Survey, 1975, 1978, 1982, 1985

Figure 3

Comparison of Household Growth with Ratio of Housing Starts to HH Growth

1976 - 1985



SOURCE: Real Estate and Construction Long-Term State Forecast Tables, Chase Econometrics, Fall 1986, pages N1-N4.

mated national experience, San Francisco lagged Dallas and Denver, for instance, in both growth rates and housing starts per new household. Further, many cities, including Pittsburgh and Detroit, had markets which generated a far greater supply response to new households.

This market tightness is evident in the vacancy rate throughout the decade (see Table 1). Vacancy rates in the SMSA were highest in 1975, with vacancies declining in both the ownership and rental market. In particular, the frictional vacancy rate for renters (units vacant for under two months) decreased significantly during the decade, to nearly one-half of mid-1970's levels. In addition, while the number of rental units vacant for over six months rose in 1978, (accounting

Table 1
Vacancy Rates, San Francisco-Oakland SMSA, 1975 - 1985

(all figures in 000's)	Overall Vacancy Rate	Frictional Rate (<2 mnth)	Long-Term Vacancy (>2 mnth)	Avg Length Vacancy (mnth)
Rental Units				
1975	7.2%	5.5%	1.8%	2.41
1978	5.3%	3.7%	1.6%	2.94
1982	3.7%	2.5%	1.2%	2.82
1985	5.5%	3.6%	1.3%	2.12
For Sale Units				
1975	1.5%	0.6%	0.9%	4.2%
1978	1.7%	0.9%	0.8%	3.5%
1982	1.9%	0.8%	1.1%	4.3%
1985	1.9%	0.6%	0.8%	2.6%
Total Units				
1975	6.1%	3.9%	2.2%	3.1%
1978	5.4%	3.3%	2.1%	3.3%
1982	4.9%	2.5%	2.1%	3.5%
1985	4.9%	2.5%	1.6%	2.7%

SOURCE: Annual Housing Survey 1975, 1978, 182, 1985.

for the increased average vacancy length in 1978), the long range vacancy declined throughout the 1980's. In the ownership market, frictional vacancies declined throughout the period, and with the exception of long term vacancies in the 1982 recession (accounting for the length of vacancy in 1982 ownership units), all indicators reflected an increasingly tight ownership market as well.

With housing demand outpacing supply responses, economic theory would predict rising rents. Indeed, the San Francisco-Oakland SMSA has been characterized by both rising rent levels and increasing rent burdens. During the 1975-1985 period, real rent levels (adjusted for CPI excluding shelter costs) outpaced income growth, rising by 45 percent during the decade, from $348 to $504 (see Table 2). Real rent burdens were exacerbated, with the median rent burden rising by 16.6 percent during this period (see Figure 4). Further, the proportion of households spending in excess of 35 percent of income increased 35 percent during the decade.

Table 2

Trends in Gross Rents, Rent Burdens and House Values

San Francisco-Oakland SMSA, 1975 - 1985

	Renters				Owners
	All Renters		Recent Movers		
Year	Gross Rent	Gross Burden	Gross Rent	Gross Burden	House Value (see Note 1)
1975	$348	24%	$363	25%	$91,150
1978	$362	25%	$394	28%	$130,450
1982	$391	29%	$445	30%	$140,350
1985	$504	28%	$536	30%	$134,350

1. House values reflect recent mover estimates of value.
   Comparable figures not available for gross burden for owners.

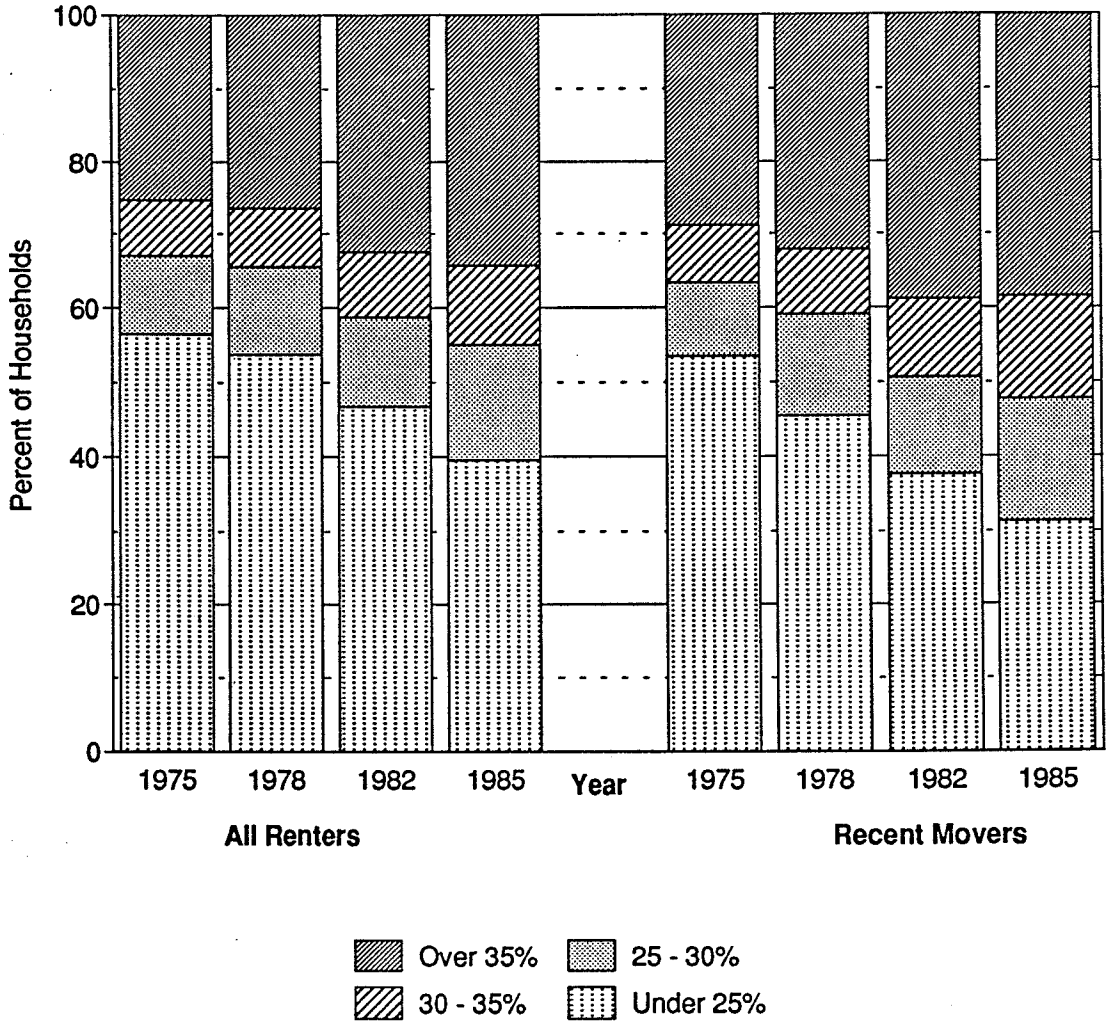
NOTE: All Dollar values adjusted by CPI less shelter, 1982-1984=100.

SOURCE: *Annual Housing Survey 1975, 1978, 1982, 1985.*

Figure 4

Rent Burdens for 1975 - 1985 All Rental Households and Recent Movers

San Francisco-Oakland SMSA



Source: Annual Housing Surveys, 1975, 1978, 1982, 1985

If recent movers are examined separately, the situation has deteriorated more dramatically. Median real rent levels rose 48 percent during the decade. Further, by 1985, over one-half of all recent movers were spending in excess of 30 percent of income on housing, with nearly 40 percent spending in excess of 35 percent of income.

While these figures are stark, they do not fully reveal the extent of problems facing low income households. The availability of rental housing is particularly severe at the bottom of the rental market, and the problem increased throughout the decade. If rental households are matched against available stock, this is evident.

During the past decade, there was a growing disparity between aggregate rent levels and real incomes of renters. Figure 5 highlights this relationship. The 45 degree line represents parity between rents and incomes. Those locations to the left of the line reflect a surplus of units for rental households of a specific income while locations to the right reflect a shortfall of units for a given percentage of households. The figure presents a deteriorating situation for renters in the San Francisco-Oakland SMSA. While real income growth occurred, rental unit costs increased more rapidly, particularly at the bottom of the rental market. The cumulative balance of units shifted from a deficit of affordable units for 50 percent to 75 percent of rental households during the decade, assuming households limited rent expenditures to 25 percent of income, and a deficit for over 45 percent, if a household spent 30 percent of income.

It is evident that the mismatch between rental household income and gross rent levels has increased throughout the decade, especially for the bottom income strata, but it has increasingly impacted renters at all income levels. The pattern of rent burdens throughout the decade indicate an increasing proportion of income is used for rental housing services, and this increasing rent burden is a reflection of an increasing mismatch between income and rent levels at the bottom of the rental market.

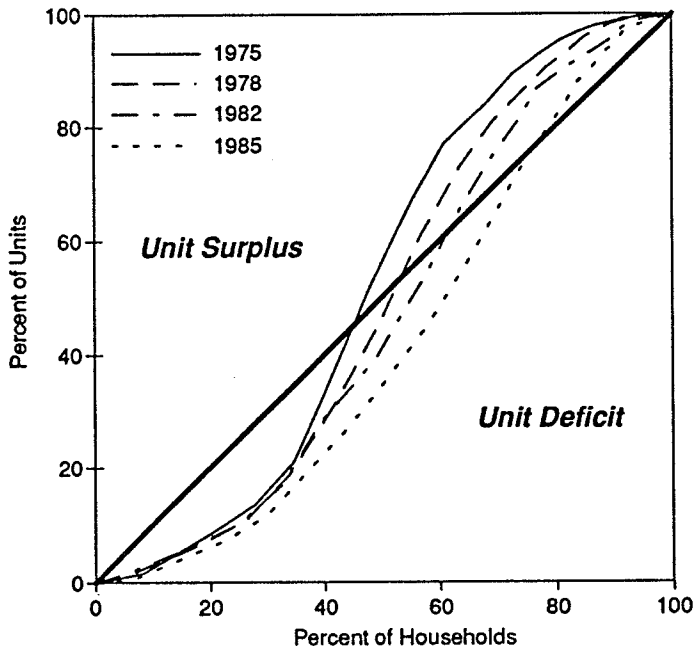
Figure 5

Comparison of Gross Rent Levels with Income of Households and Primary Individuals

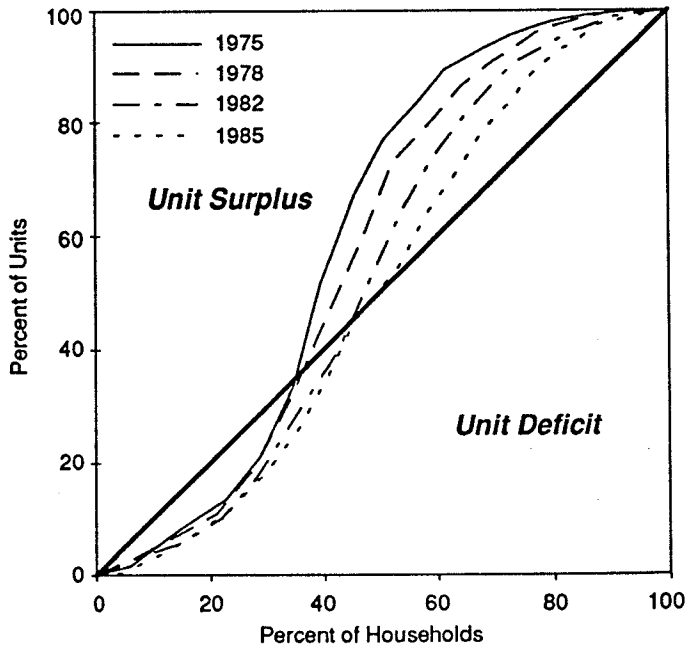
San Francisco-Oakland SMSA

1975 -1985

Gross rent burden limited to 25% of income



Gross rent burden limited to 30% of income



Source: Annual Housing Survey, 1975, 1978, 1982, 1985

Aggregate Shifts in Submarkets

Panel Description

The data for the analysis was developed from the survey sample of renter occupied units present since the inception of the Annual Housing survey in the San Francisco-Oakland SMSA, . While the number of units surveyed in different waves of the Annual Housing Survey has varied dramatically (ranging from in excess of 4,250 units to 16,000 for San Francisco-Oakland), approximately 1,100 rental units were surveyed repeatedly throughout the period (see Table 3). However, since the analysis focuses on recent movers only, the number of units decrease significantly; because mobility rates varied dramatically during the period, recent renter movers accounted for between as little as 22 percent and up to 34 percent of all renters (on an unweighted basis).

Table 3
Comparison of Original Annual Housing Survey and Panel
1975 - 1985

	1975	1978	1982	1985
Number of Interviews in AHS survey waves	15,458	16,169	4,251	6,600
TOTAL UNITS IN PANEL				
Low Rental Submarket	409	358	356	363
Other Rental Submarkets	606	641	682	729
Homeowners	1,554	1,570	1,531	1,477
Total Units (in Panel)	2,569	2,569	2,569	2,569
RECENT MOVERS IN PANEL				
Low Rental Submarket	124	92	77	94
Other Rental Submarkets	283	250	185	212
Total Recent Movers (in Panel)	407	342	262	306

Source: Annual Housing Survey 1975, 1978, 1982, 1985

The rental stock was stratified by submarket based on median real rent levels for the San Francisco-Oakland area in 1975. Low rent units included those units at 40 percent of median rents or less in 1975, based on bedroom sizes (see Table 4).

Table 4
Differentiation of Submarkets by Price and Size
San Francisco-Oakland SMSA
(Based on 1975 nominal rents)

	Maximum Low Rent Level
Studio	$110
1 bedroom	$150
2 bedroom	$185
3 bedroom +	$160

SOURCE: Annual Housing Survey, 1975

Rent Shifts

Changes in gross rent levels in the San Francisco panel exceeded inflation throughout the survey period (Table 5). While median gross rent levels do not capture differences in quality or unit variations, real gross rent levels in the panel (unadjusted for unit size or quality) increased by over 34 percent during the ten year period, with significant rates of increase evident from the latter 1970's to 1985. In particular, the 1982 - 1985 period witnessed major increases, with rents rising by over 22 percent. Median rent increases of all units within the low rent housing submarket were more modest than the higher rent submarket. In particular, the change in median rent during the 1982 - 1985 period was significantly higher in the higher rent submarket.

However, the picture for recent movers is strikingly different. Recent movers consistently faced significant higher gross rent increases than marketwide medians, with the decade in-

Table 5

Trends in Real Gross Rents

San Francisco-Oakland SMSA Panel

1975 1985

		ALL RENTERS		RECENT MOVERS	
	Panel	Low Rent Submarket	Higher Rent Submarket	Low Rent Submarket	Higher Rent Submarket
1975	349	267	398	277	403
1978	359	276	408	320	421
1982	383	295	429	343	486
1985	469	345	534	399	563
Change in Median Rent					
1975 - 78	3%	3%	3%	16%	4%
1978 - 82	7%	7%	5%	7%	15%
1982 - 85	22%	17%	24%	16%	16%
1975 - 1985	34%	29%	34%	44%	40%

SOURCE: Annual Housing Survey Panel of units present in 1975, 1978, 1982, 1985, obtained from Annual Housing Survey, 1975, 1978, 1982, 1985.

NOTE: All dollar values adjusted by CPI less shelter, 1982-1984=100.

creases averaging one-third more than overall rent level changes. Gross rent levels for recent movers thus not only remained significantly above those of standing tenants, moderating only in the 1982-1985 period (particularly in the higher rent submarket).

Further, rent increases for recent movers in the low and high submarkets did not always coincide. While increases for all recent movers echoed marketwide trends in the 1982-1985 period, gross rents for recent movers in the lower rent submarket experienced significant increases in

the 1975-1978 period, while higher rent recent mover costs lagged, increasing significantly in the 1978-1982 period.

Finally, if rent movements are segmented by direction of real changes, the pattern reveals more detail on the relative movements in rents by submarket (Table 6). While rent movements have varied during the decade, the percent of units with real increases expanded dramatically throughout the period. Between 1975 and 1978 approximately 50 percent of units experienced

Table 6

Movements in Real Rent Levels - Segmented by Direction of Change

San Francisco-Oakland SMSA, 1975-1985

	All Units		Lower Rent		Higher Rent	
	All	Recent Mover	All	Recent Mover	All	Recent Mover
Rent Increased						
1975 - 1978						
Median Change	10%	11%	12%	14%	7%	10%
	49.42%	70.04%	52.36%	79.75%	47.58%	65.73%
1978 - 1982						
Median Change	15%	17%	18%	20%	14%	17%
	57.46%	73.17%	59.19%	80.33%	56.51%	74.19%
1982 - 1985						
Median Change	21%	31%	21%	32%	21%	31%
	76.12%	90.78%	76.78%	87.32%	83.43%	92.47%
Rent Decreased						
1975 - 1978						
Median Change	-7%	-7%	-8%	-7%	-7%	-7%
	50.58%	29.96%	47.64%	20.25%	52.42%	34.27%
1978 - 1982						
Median Change	-10%	-6%	-10%	-7%	-10%	-6.0%
	42.54%	26.83%	40.81%	19.67%	43.49%	25.81%
1982 - 1985						
Median Change	-6%	-6%	-7%	-9%	-6%	-3%
	23.88%	9.22%	23.22%	12.68%	16.57%	7.53%
Number of valid cases 1975-1978	771	257	296	79	475	178
Number of valid cases 1978-1982	771	185	272	61	499	124
Number of valid cases 1982-1985	774	217	267	71	507	146

Source: Annual Housing Survey Panel of units present in 1975, 1978, 1982, 1985.

downward real price movements. However, by the 1982-1985 period, the percentage of units with declining real rents had decreased to one-quarter of the rental housing stock. This trend was generally evident in both high and low cost submarkets.

This same pattern is exentuated for recent movers. When a unit entered the market, an overwhelming majority had real rent increases in each period; 80 - 88 percent in the low rent market, and 65 - 90 percent in the higher rent market. Moreover, median rent increases for recent movers were significantly higher than marketwide rent movements, ranging from 30 to 50 percent greater than general market movement. Even in units with declining real rents, the rates tended to modest in comparison to general market level reductions.

In sum, during the 1975 - 1985 period, the San Francisco housing market has been subject to a constant upward bias in real rents. Further, while price increases were prevalent for units throughout the period, the proportion of units with real increases between survey periods rose by over 50 percent through the decade, comprising over three quarters of units survey in the panel by 1985. Further, these increases were extenuated for recent movers, with almost 90 percent of recent mover units witnessing increases during the 1982-1985 period.

CONSTANT QUALITY HOUSING PRICES IN SUBMARKETS

Overview of Analytical Approach

While household gross rent levels and rent burdens reveal a pattern of increasing strain for renters throughout the San Francisco rental market, the figures do not reveal the quantitative or qualitative adjustments which could account for these changing indicators. Hedonic regression estimates can be constructed to probe the underlying price structure for various components of rental units, adjusting rent levels to reflect the various qualitative and quantitative adjustments made by rental households. By regressing unit prices with key components of the housing bundle, the relative importance of individual housing unit components can assessed.

The hedonic estimation assumes unit component prices are based on several key components of the housing bundle. Formally:

$$P_t = f(b_{tj} z_{tj}) \text{ for } m=1,2$$

where

P is the real price for a housing unit[7]
j reflects an attribute in a vector of housing characteristics (including unit amenities, neighborhood amenity, and accessibility vectors),
t reflects the time period, and
m reflects the respective submarket

A summary of variables used in the analysis are outlined in Table 7.

A note is required regarding the construction of the neighborhood variable(s). While, it is hypothesized that a household values neighborhood location based on a constellation of characteristics, including perceptions of neighborhood quality, safety, and nuisances impacting neighborhood enjoyment, extreme multicollinearity precludes directly entering individual neighborhood variables into regression equations. Principal components analysis was employed to extract overall neighborhood factors that reflected rent variations within the panel[8]. Since individual responses lack consistency, the analysis employed tractwide averages for the variables, constructing an "overall" resident neighborhood perception, more closely approximating a market valuation of neighborhood attributes.[9]

A summary of principal components analysis for the neighborhood characteristics are included in the Appendices. In 1975, factor loadings reflect two factors; neighborhood safety/nuisances and neighborhood externalities best account for the constellation of neighborhood variables. For the remaining periods, a single factor best captured neighborhood variations. The pattern of cumulative variance explained weakened over time, possibly reflecting a decreasing relationship between neighborhood and rent levels or the effect of other factors on neighborhood opinions.

Table 7

Hypothesized Explanatory Variables for San Francisco-Oakland SMSA Regressions

Variable (expected sign)	Description
UNIT AMENITIES	
INT1 (-)	Unit interior condition - sum of occurrence of interior deficiencies -- cracks, poor paster or paint, rats, or holes.
INT2 (-)	Common area maintenance - sum of occurrence of common area maintenance problems -- bad steps or railing deficiencies.
INT3 (-)	Mechanical equipment problems - sum of occurrence of mechanical maintenance problems -- heating system breakdowns and plumbing problems.
INT4 (-)	Unit configuration - sum of occurrence of unit configuration problems -- separate access to baths or bedrooms.
BR1 (+)	Unit is one bedroom
BR2 (+)	Unit is two bedroom
BR3 (+)	Unit is three bedrooms or more
SMALL (+)	Unit is in building with 2 or less units
BATHBIG (+)	Unit has more than one bath
NEIGHBORHOOD AMENITIES	
TGRAD (-)	Percent heads of households in tract without college education
ZBLK (-)	Percent of zone with black heads of household
NGH (-)	Neighborhood characteristics (see factor analysis)
LOCATIONAL CHARACTERISTICS	
CC1 (+)	Unit is located in the City of San Francisco
TDIST (-)	Average distance to work for all respondents in a tract.

While the specific functional form of hedonic equation specification remains a subject of research debate [Edmonds (1984), Halvorsen and Pollakowski (1981); Cassel and Mendelsohn (1985)], theory provides little information on the exact functional form. While researchers have employed a variety of functional forms, the analysis which follows will report both linear and log-linear equation functional forms.

Formal tests for analyzing the relative importance of submarkets in price movements has been outlined by several researchers [Bajic (1985), Schnare and Struyk (1976)]. As indicated previously, the following analysis hypothesizes that submarkets for housing units are based on initial price differences in the housing market, with low cost units (40 percent of median or below), reflecting market divisions. A Chow Test will be employed to assess the presence of market segmentation. This test evaluates the reduction in standard error levels provided by an unconstrained model specification (separate hedonic equations) in relation to the constrained model specification (pooled submarket data).

To assess movements in unit prices over time, hedonic equation estimates are estimated for separate time periods, assessing individual housing bundle component parameter estimate movements. By substituting mean characteristics for a single time period (1975, the base year), constant quality unit prices can be assessed over time.

Formally:

$$CP_t = f(b_{tj}, z_{0j}) \text{ for } m=1,2$$

where

CP_t is the price estimate of a constant quality unit in each submarket at time t,
b_{tj} is the parameter estimate for a unit attribute characteristic in each submarket during each time period,
z_{0j} is the mean value of each housing characteristic attribute in each submarket at time 0, and
m is a submarket

Hedonic Regressions

Three sets of regressions were developed for each panel during each time period. One set, based on rent movers, included a linear estimation of a constrained model specification and an unconstrained model specification (assuming separate estimations for each hypothesized housing submarket). A second series of regressions specified a log-linear functional form. A final set of estimates used traditional hedonic estimations incorporating all renters in the panel during each period (again including separate estimates for each hypothesized submarket.) In the following discussion, data are presented on the log-linear functional form - based on estimates from data limited to recent movers. The remaining model specifications are presented in the Appendices.

Means for regression variables for each period are presented in the Appendices. In general, there is systematic variation between the variables by housing submarket segment, and the pattern of movements in the means over time appears reasonable.

Results of the hedonic regression estimates based on recent mover real gross rents in the panel and recent movers in each submarket for each period are presented in Tables 8, 9, 10, and 11.[10] In general, the equations reflect a reasonable fit to the data. During the recession of 1982, overall fits are more marginal, but in all cases the equations are significant at the .01 level. Over time, fitted equations based on submarket data lose explanatory power. Since the submarkets were fixed using 1975 data, this is understandable; unit movements within and between submarkets will introduce noise into the equations.

While equation fits for individual submarkets do not always indicate a significant gain in explanatory power, a separate Chow Test was employed to assess the relative gain of market segmentation.[11] The tests provide mixed results. In 1975, the unconstrained regressions offered a significant improvement in fit (with a weighted standard error approximately 25 percent lower

Table 8

ESTIMATION OF REGRESSIONS FOR SAN FRANCISCO RECENT MOVERS, 1975

UNIT CHARACTERISTICS	*All Units (Recent Movers)*		*Low Rent Units (Recent Movers)*		*High Rent Units (Recent Movers)*	
Dependent Variable= Log of Real Rent	*B*	*Beta*	*B*	*Beta*	*B*	*Beta*
(CPI less shelter, 1982-1984=100)	(S Error)	t stat	(S Error)	t stat	(SE)	t stat
1 Bedroom	0.2465 ***	0.3228	0.4653 ***	0.7312	0.2870 ***	0.4552
	(0.0567)	t= 4.35	(0.1172)	t= 3.97	(0.0488)	t= 5.89
2 Bedroom	0.4256 ***	0.5491	0.7170 ***	1.1085	0.4669 ***	0.7302
	(0.0570)	t= 7.47	(0.1193)	t= 6.01	(0.0490)	t= 9.53
3 Bedroom	0.5165 ***	0.4789	0.7884 ***	0.8906	0.6044 ***	0.6747
	(0.0748)	t= 6.90	(0.1313)	t= 6.01	(0.0684)	t= 8.84
Extra Baths	0.1625 ***	0.1541	0.0197	0.0173	0.1318 ***	0.1619
	(0.0492)	t= 3.30	(0.0854)	t= 0.23	(0.0445)	t= 2.96
Single Family Unit	0.1109 ***	0.1155	0.0156	0.0200	0.1563 ***	0.1951
	(0.0419)	t= 2.65	(0.0551)	t= 0.28	(0.0402)	t= 3.89
Unit Amenities (Unit Interior)	(0.0524) *	-0.0724	(0.0260)	-0.0563	(0.0504) *	-0.0705
	(0.0283)	t= -1.85	(0.0306)	t= -0.85	(0.0308)	t= -1.63
Unit Amenities (Common Area)	-0.0389	-0.0380	-0.0291	-0.0457	-0.0195	-0.0187
	(0.0400)	t= -0.97	(0.0427)	t= -0.68	(0.0439)	t= -0.44
Unit Amenities (Mechanical Equipment)	-0.4967 ***	-0.2209	-0.1718 *	-0.1509	-0.2539 *	-0.0698
	(0.0899)	t= -5.52	(0.1050)	t= -1.64	(0.1536)	t= -1.65
Unit Amenities (Unit Configuration)	-0.1286 **	-0.0990	-0.0802	-0.0933	-0.0483	-0.0388
	(0.0507)	t= -2.53	(0.0570)	t= -1.41	(0.0546)	t= -0.89
NEIGHBORHOOD CHARACTERISTICS						
Neighborhood Amenity (Nuisances)	-0.0563 ***	-0.1312	0.0304	0.0880	-0.0566 ***	-0.1540
	(0.0171)	t= -3.28	(0.0218)	t= 1.39	(0.0170)	t= -3.34
Neighborhood Amenity (Crime/Aban)	-0.0459 ***	-0.1140	-0.0386	-0.1634	-0.0197	-0.0426
	(0.0166)	t= -2.77	(0.0167)	t= -2.31	(0.0198)	t= -0.99
Percent Zone Black	-0.0035 ***	-0.1082	-0.0019	-0.0831	0.0002	0.0064
	(0.0013)	t= -2.72	(0.0016)	t= -1.22	(0.0013)	t= 0.15
Percent HH without College Ed.	-0.0019 ***	-0.1458	-0.0012 *	-0.1072	-0.0014 ***	-0.1234
	(0.0005)	t= -3.90	(0.0007)	t= -1.73	(0.0005)	t= -2.93
LOCATION CHARACTERISTICS						
San Francisco CC	0.0594 *	0.0655	-0.0760	-0.0938	0.0656 **	0.0897
	(0.0358)	t= 1.66	(0.0515)	t= -1.48	(0.0332)	t= 1.97
Distance to Work	0.0008	0.0159	-0.0023	-0.0618	0.0015	0.0325
	(0.0021)	t= 0.39	(0.0025)	t= -0.91	(0.0021)	t= 0.71
Constant	5.6792 ***		5.1771 ***		5.6528 ***	
	(0.0644)	t= 88.12	(0.1232)	t= 42.02	(0.0576)	t= 98.14
R Squared	0.5348		0.7314		0.5754	
Adjusted R Squared	0.5144		0.6804		0.5497	
Standard Error	0.2613		0.1779		0.2075	
MSE REGRESSION	1.7949		0.4541		0.9645	
MSE RESIDUAL	0.0683		0.0317		0.0431	
SSE REGRESSION	26.9237		6.8110		14.4669	
SSE RESIDUAL	23.4223		2.5014		10.6775	
DF REGRESSION	15		15		15	
DF RESIDUAL	343		79		248	
F	26.2850		14.3403		22.4009	
Sign. F	0.0000		0.0000		0.0000	
N	359		95		264	
CHOW TEST F			2.534427 **		3.12853 **	
CRITICAL F FOR CHOW TEST			1.25		1.3	

NOTE: *** Significant at the .01 level ** Significant at .05 level * Significant at .1 level

Table 9

ESTIMATION OF REGRESSIONS FOR SAN FRANCISCO RECENT MOVERS, 1978

	All Units (Recent Movers)		*Low Rent Units (Recent Movers)*		*High Rent Units (Recent Movers)*	
Dependent Variable= Log of Real Rent	*B*	*Beta*	*B*	*Beta*	*B*	*Beta*
(CPI less shelter, 1982-1984=100)	(S Error)	t stat	(S Error)	t stat	(S Error)	t stat
UNIT CHARACTERISTICS						
1 Bedroom	0.2613 ***	0.3515	0.1962 *	0.3257	0.3038 ***	0.4283
	(0.0467)	t= 5.60	(0.1082)	t= 1.81	(0.0473)	t= 6.43
2 Bedroom	0.4517 ***	0.6179	0.4140 ***	0.7596	0.5407 ***	0.7513
	(0.0479)	t= 9.43	(0.1104)	t= 3.75	(0.0502)	t= 10.77
3 Bedroom	0.6155 ***	0.6812	0.5643 ***	0.7610	0.7179 ***	0.8398
	(0.0575)	t= 10.70	(0.1154)	t= 4.89	(0.0659)	t= 10.90
Extra Baths	0.1114 ***	0.1163	0.0145	0.0103	0.0512	0.0604
	(0.0407)	t= 2.73	(0.1339)	t= 0.11	(0.0422)	t= 1.21
Single Family Unit	0.1491 ***	0.1759	0.0832	0.1069	0.1156 ***	0.1467
	(0.0359)	t= 4.15	(0.0799)	t= 1.04	(0.0406)	t= 2.85
Unit Amenities (Unit Interior)	0.0012	0.0019	(0.0035)	-0.0076	(0.0151)	-0.0255
	(0.0232)	t= 0.05	(0.0594)	-0.06	(0.0243)	t= -0.62
Unit Amenities (Common Area)	-0.0385	-0.0295	-0.0020 *	-0.0022	-0.0835 *	-0.0632
	(0.0494)	t= -0.78	(0.1052)	t= -0.02	(0.0535)	t= -1.56
Unit Amenities (Mechanical Equipment)	-0.2284 ***	-0.1480	-0.0975	-0.1493	-0.4037 ***	-0.1082
	(0.0598)	t= -3.82	(0.0775)	t= -1.26	(0.1508)	t= -2.68
Unit Amenities (Unit Configuration)	0.0532	0.0515	0.0242	0.0338	0.0389	0.0375
	(0.0392)	t= 1.36	(0.0772)	t= 0.31	(0.0431)	t= 0.90
NEIGHBORHOOD CHARACTERISTICS						
Neighborhood Amenities	-0.0607 ***	-0.1737	-0.0323	-0.1527	-0.0623 ***	-0.1602
	(0.0143)	t= -4.24	(0.0236)	t= -1.37	(0.0173)	t= -3.59
Percent Zone Black	-0.0045 ***	-0.1376	-0.0008	-0.0375	-0.0053 ***	-0.1486
	(0.0013)	t= -3.57	(0.0022)	t= -0.35	(0.0015)	t= -3.52
Percent HH without College Ed.	-0.0025 ***	-0.2234	-0.0017 *	-0.1917	-0.0023 ***	-0.2045
	(0.0004)	t= -5.86	(0.0009)	t= -1.85	(0.0005)	t= -4.95
LOCATION CHARACTERISTICS						
San Francisco CC	0.1611 ***	0.1900	0.1422 *	0.1892	0.1165 ***	0.1471
	(0.0351)	t= 4.58	(0.0857)	t= 1.66	(0.0363)	t= 3.21
Distance to Work	-0.0023	-0.0437	0.0052	0.1007	-0.0059 ***	-0.1215
	(0.0021)	t= -1.08	(0.0054)	t= 0.96	(0.0022)	t= -2.73
Constant	5.7413 ***		5.4934 ***		5.7897 ***	
	(0.0554)	t= 103.58	(0.1284)	t= 42.77	(0.0573)	t= 101.11
R Squared	0.6270		0.5349		0.6696	
Adjusted R Squared	0.6088		0.4206		0.6482	
Standard Error	0.2200		0.2077		0.2017	
MSE REGRESSION	1.6737		0.2020		1.2714	
MSE RESIDUAL	0.0484		0.0431		0.0407	
SSE REGRESSION	23.4318		2.8273		17.8000	
SSE RESIDUAL	13.9422		2.4587		8.7828	
DF REGRESSION	14		14		14	
DF RESIDUAL	288		57		216	
F	34.5733		4.6818		31.2689	
Sign. F	0.0000		0.0000		0.0000	
N	303		72		231	
			1.172702637		1.77048501 **	
			1.25		1.3	

NOTE: *** Significant at the .01 level ** Significant at .05 level * Significant at .1 level

Table 10

ESTIMATION OF REGRESSIONS FOR SAN FRANCISCO RECENT MOVERS, 1982

	All Units (Recent Movers)		*Low Rent Units (Recent Movers)*		*High Rent Units (Recent Movers)*	
Dependent Variable= Log of Real Rent	*B*	*Beta*	*B*	*Beta*	*B*	*Beta*
(CPI less shelter, 1982-1984=100)	(S Error)	t Stat	(S Error)	t Stat	(S Error)	t Stat
UNIT CHARACTERISTICS						
1 Bedroom	0.2684 ***	0.3285	0.2138	0.2934	0.2781 ***	0.3858
	(0.0756)	t= 3.55	(0.1428)	t= 1.50	(0.0836)	t= 3.33
2 Bedroom	0.4062 ***	0.4984	0.4306 ***	0.6013	0.4224 ***	0.5819
	(0.0785)	t= 5.17	(0.1596)	t= 2.70	(0.0845)	t= 5.00
3 Bedroom	0.4633 ***	0.4435	0.3073	0.2042	0.4678 ***	0.5533
	(0.0979)	t= 4.73	(0.2157)	t= 1.42	(0.1017)	t= 4.60
Extra Baths	0.2480 ***	0.2329	-0.0658	-0.0314	0.1989 ***	0.2353
	(0.0631)	t= 3.93	(0.2567)	t= -0.26	(0.0602)	t= 3.31
Single Family Unit	0.1335 **	0.1500	-0.0305	-0.0292	0.1662 ***	0.2233
	(0.0546)	t= 2.44	(0.1336)	t= -0.23	(0.0565)	t= 2.94
Unit Amenities (Unit Interior)	-0.0458	-0.0720	0.0139	0.0345	-0.0613	-0.0832
	(0.0316)	t= -1.45	(0.0474)	0.29	(0.0425)	t= -1.44
Unit Amenities (Common Area)	-0.0095	-0.0055	-0.0406	-0.0300	-0.0034	-0.0021
	(0.0837)	t= -0.11	(0.1566)	t= -0.26	(0.0917)	t= -0.04
Unit Amenities (Mechanical Equipment)	-0.2917 ***	-0.2003	-0.3006 ***	-0.3923	-0.2056	-0.0754
	(0.0773)	t= -3.77	(0.1072)	t= -2.80	(0.1569)	t= -1.31
Unit Amenities (Unit Configuration)	-0.0950 *	-0.0949	-0.1864 **	-0.2450	-0.0476	-0.0499
	(0.0489)	t= -1.94	(0.0916)	t= -2.03	(0.0545)	t= -0.87
NEIGHBORHOOD CHARACTERISTICS						
Neighborhood Amenities	-0.0698 ***	-0.1525	-0.0225	-0.0661	-0.0557 *	-0.1168
	(0.0251)	t= -2.78	(0.0439)	t= -0.51	(0.0304)	t= -1.83
Percent Zone Black	-0.0026	-0.0706	0.0042	0.1414	-0.0055 **	-0.1545
	(0.0019)	t= -1.37	(0.0037)	t= 1.13	(0.0022)	t= -2.55
Percent HH without College Ed.	-0.0012 *	-0.0963	0.0012	0.1157	-0.0021 ***	-0.1787
	(0.0006)	t= -1.91	(0.0013)	t= 0.92	(0.0007)	t= -2.99
LOCATION CHARACTERISTICS						
San Francisco CC	0.1864 ***	0.1984	0.2604 **	0.3184	0.1760 ***	0.2101
	0.0549	t= -3.39	(0.1162)	t= 2.24	(0.0594)	t= 2.97
Distance to Work	-0.0005	-0.0095	0.0028	0.0602	-0.0005	-0.0109
	(0.0030)	t= -0.18	(0.0058)	t= 0.49	(0.0033)	t= -0.17
Constant	5.7774 ***		5.4069 ***		5.8760 ***	
	(0.0855)	t= 67.60	(0.1632)	t= 33.13	(0.0974)	t= 60.32
R Squared	0.5002		0.4892		0.5080	
Adjusted R Squared	0.4691		0.3371		0.4657	
Standard Error	0.2874		0.2905		0.2537	
MSE REGRESSION	1.3284		0.2713		0.7739	
MSE RESIDUAL	0.0826		0.0844		0.0644	
SSE REGRESSION	18.5980		3.7984		10.8344	
SSE RESIDUAL	18.5815		3.9655		10.4938	
DF REGRESSION	14		14		14	
DF RESIDUAL	225		47		163	
F	16.0858		3.2157		12.0207	
Sign. F	0.0000		0.0013		0.0000	
N	240		62		178	
CHOW TEST F			0.9939252		2.038664 **	
CRITICAL F (CHOW TEST)			1.25		1.3	

NOTE: *** Significant at the .01 level ** Significant at .05 level * Significant at .1 level

Table 11

ESTIMATION OF REGRESSIONS FOR SAN FRANCISCO RECENT MOVERS, 1985

	All Units (Recent Movers)		*Low Rent Units (Recent Movers)*		*High Rent Units (Recent Movers)*	
Dependent Variable= Log of Real Rent	*B*	*Beta*	*B*	*Beta*	*B*	*Beta*
(CPI less Shelter, 1982-1984=100)	(S Error)	t Stat	(S Error)	t Stat	(S Error)	t Stat
UNIT CHARACTERISTICS						
1 Bedroom	0.2264 ***	0.2871	0.3938 **	0.5028	0.2412 ***	0.3577
	(0.0601)	t= 3.77	(0.1503)	t= 2.62	(0.0605)	t= 3.99
2 Bedroom	0.4778 ***	0.5871	0.7572 ***	0.9468	0.4743 ***	0.6777
	(0.0642)	t= 7.44	(0.1569)	t= 4.83	(0.0655)	t= 7.24
3 Bedroom	0.6413 ***	0.5866	0.7346 ***	0.4518	0.6335 ***	0.7417
	(0.0820)	t= 7.82	(0.2181)	t= 3.37	(0.0826)	t= 7.67
Extra Baths	0.0619	0.0443	0.1566	0.0867	0.0439	0.0397
	(0.0614)	t= 1.01	(0.1823)	t= 0.86	(0.0592)	t= 0.74
Single Family Unit	0.0335	0.0367	-0.0392	-0.0344	0.0387	0.0525
	(0.0482)	t= 0.70	(0.1070)	t= -0.37	(0.0503)	t= 0.77
Unit Amenities (Unit Interior)	-0.0217	-0.0295	-0.0383	-0.0497	-0.0349	-0.0567
	(0.0320)	t= -0.68	(0.0791)	-0.48	(0.0323)	t= -1.08
Unit Amenities (Common Area)	-0.1177	-0.0398	-0.2804	-0.1353	0.0801	0.0240
	(0.1293)	t= -0.91	(0.2328)	t= -1.20	(0.1696)	t= 0.47
Unit Amenities (Mechanical Equipment)	-0.4210 ***	-0.1898	-0.0417	-0.0335	0.0000	0.0000
	(0.1045)	t= -4.03	(0.1782)	t= -0.23	0.0000	t= 0.00
Unit Amenities (Unit Configuration)	-0.1343 ***	-0.1429	-0.0913	-0.1246	-0.1477 ***	-0.1568
	(0.0408)	t= -3.29	(0.0705)	t= -1.29	(0.0485)	t= -3.05
NEIGHBORHOOD CHARACTERISTICS						
Neighborhood Amenities	n/a	n/a	n/a	n/a	n/a	n/a
	n/a	n/a	n/a	n/a	n/a	n/a
Percent Zone Black	-0.0072 ***	-0.2234	-0.0006	-0.0216	-0.0076 ***	-0.2483
	(0.0014)	t= -5.07	(0.0029)	t= -0.21	(0.0016)	t= -4.76
Percent HH without College Ed.	-0.0023 ***	-0.2001	-0.0010	-0.0901	-0.0020 ***	-0.1921
	(0.0005)	t= -4.66	(0.0011)	t= -0.97	(0.0005)	t= -3.71
LOCATION CHARACTERISTICS						
San Francisco CC	0.2256 ***	0.2532	0.2660 **	0.2941	0.2000 ***	0.2649
	(0.0441)	t= 5.11	(0.1105)	t= 2.41	(0.0444)	t= 4.51
Distance to Work	0.0057 **	0.1095	0.0090	0.1580	0.0028	0.0064
	(0.0024)	t= 2.36	(0.0059)	t= 1.51	(0.0024)	t= 1.15
Constant	6.0913 ***		5.7013 ***		5.9756 ***	
	(0.1417)	t= 43.00	(0.2547)	t= 22.38	(0.1858)	t= 32.16
R Squared	0.5355		0.5061		0.5258	
Adjusted R Squared	0.5131		0.4103		0.4958	
Standard Error	0.2693		0.2989		0.2334	
MSE REGRESSION	1.7367		0.4718		0.9562	
MSE RESIDUAL	0.0725		0.0893		0.0545	
SSE REGRESSION	22.5766		6.1338		11.4739	
SSE RESIDUAL	19.5834		5.9850		10.3494	
DF REGRESSION	13		13		12	
DF RESIDUAL	270		67		190	
F	23.9437		5.2819		17.5537	
Sign. F	0.0000		0.0000		0.0000	
N	284		81		203	
CHOW TEST F			0.76109		2.092877 **	
CRITICAL F (CHOW TEST)			1.25		1.3	

NOTE: *** Significant at the .01 level ** Significant at .05 level * Significant at .1 level

than the constrained equation), significant at the .05 percent level. This suggests that the submarket equations (unconstrained regressions) were superior in capturing variations within the housing market. However, during subsequent periods, while the weighted standard error for the unconstrained equations was lower (in the range of 7 to 10 percent) than the constrained equation, the use of unconstrained equations did not significantly improve predictability. Thus, while the 1975 data implies significant improvements from using an unconstrained model, results from the unconstrained models in later years do not offer significant improvements over the simple constrained equation estimation.

The relative importance of individual housing characteristic parameter estimates varies significantly. In all cases, several unit characteristics tend to remain highly significant across time and across submarkets.. As expected, unit size is consistently significant throughout the regression (with the single exception of the low rent submarket in 1982). Further, the expected signs of the variables are generally in the expected direction.

For all recent movers (not segmented by submarket), with the exception of unit amenities and unit configuration in 1978, and a varying distance-to-work sign, all signs are in the predicted direction. While the unit interior and common area variables are generally insignificant, all unit amenity variables are correctly signed, and the unit configuration/mechanical equipment variables are generally significant. In all, of the 58 parameter estimates in the four time periods, about 75 percent (43) are significant. Unit size, selected unit amenities, neighborhood amenities, average educational levels, and location are significant throughout the period.

Since the higher rent submarket generally accounts for approximately 80 percent of market transactions in each period, it is not surprising that the equations based on recent movers in the higher rent submarket tend to echo the general recent mover trends. Nonetheless, sign changes and insignificant parameters are more evident in unit amenities, and like the combined sample, distance-to-work is insignificant, with a changing sign. Overall, about 65 percent (39) parame-

ters are significant with correct signs and only 3 parameters have signs not consistent with a-priori hypotheses.

While the overall fit of the lower submarket equation offers significant improvement in 1975, the equations consistently have lower explanatory power in the remaining years than all other equations. In addition, specific parameter estimates for the low rent submarket equations are weaker. In particular, signs on ten parameter estimates (about 15 percent of total parameters) are not in the predicted direction. The fit for 1982 is particularly poor, with several unit parameters and neighborhood "status" characteristics in directions contrary to predictions. Similarly, less than one half of the parameter estimates are significant at the .1 level[12]

Thus, while the overall fit of the lower submarket equation offers significant improvement in 1975, individual parameter estimates are weak. In subsequent years, the unconstrained equations do not offer significant improvements in predictability, and the parameter estimates remain weak.[13]

An examination of beta estimates for the variables reveals some of the underlying market dynamics in the submarkets. In all cases, the most significant beta estimates are those related to underlying unit size characteristics, particularly the unit size variables. Also, except for the lower rent submarket, the unit size beta estimates suggest an increasing importance of unit size over time. Specifically, while the beta estimate for one-bedroom units has declined modestly during the decade, those for larger units have drifted upward, implying an increasing premium for larger unit sizes. The lower rent submarket unit size beta estimates do not follow a consistent pattern.

Additional unit characteristics account for more modest shifts in rent levels, and the beta estimates are much less stable over time. While unit measures of mechanical equipment quality have modest importance, the remaining unit quality variables tend to have an insignificant level

of impact on price levels. Further, the premium for additional baths or presence in a small building are not consistent over time (although except for 1985, the value of units in single family houses increased modestly over time).

Neighborhood characteristics have a moderate impact on rental unit prices. While these impacts are small, the beta estimates have remained relatively consistent over time across submarkets. The influence of racial and educational variables, however, varies across the market segments. In the constrained market and higher rent submarket estimates, the beta estimates remain relatively stable over time (excepting 1982). But, in the low rent submarket, the beta estimates tend to vary over time. This pattern was consistent in several alternative equation specifications (as well as in an estimate expanded to include all lower submarket renters, including non-movers). It appears that in lower rent submarket, neighborhood characteristics do not significantly influence the rent levels of recent movers.

Location characteristics vary over time. The movements of the beta estimate for a San Francisco location premium are consistent across time period and submarket; over time, the premium for San Francisco locations has increased dramatically in all submarkets. But, the distance variable has almost no influence on rent levels, a finding again consistent across housing submarkets. While this may lie in the specification of the variable, it may be that the polycentric nature of Bay Area employment may dampen the influence of distance variables.

In summary, regression estimates for 1975 confirm the presence of significant submarket variation in the San Francisco-Oakland SMSA. While individual parameter estimates in the lower rent market are disappointing, the weighted standard error for the unconstrained equations is approximately 25 percent below the constrained equation estimation. Over time, this segmentation is less evident, with increasing heterogeneity of lower rent units limiting the utility of an unconstrained equation system. Further, while overall equation fits in both the constrained and unconstrained higher rent submarket equations falls modestly, overall equation and parameter

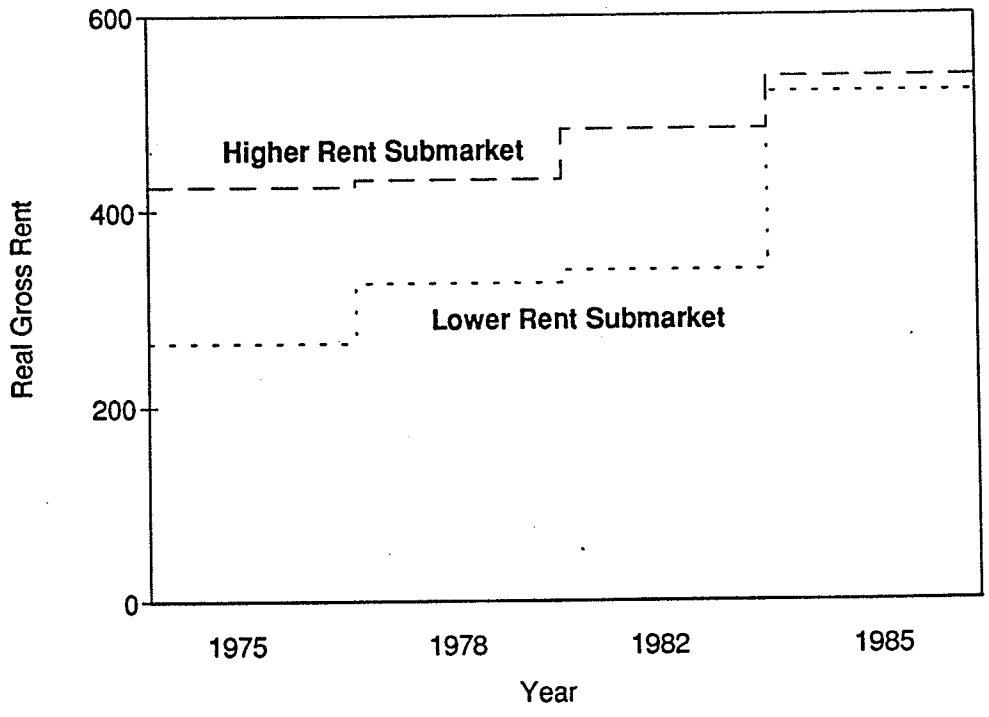
estimate fits in the lower submarket equation decrease significantly after 1975.[14] This is likely caused by a combination of limited cases, and an increasing heterogeneity of units within the submarket.

Constant quality price movements

The mean unit attributes for the unconstrained equations from 1975 were repriced throughout the period, substituting mean values in the various equations (see Figure 6). While real rent levels were rising throughout the rental market, there is a strong shift in the relative price of lower rent units in relation to higher rent units. While initial differences in constant quality prices were highly significant in 1975, the price disparities in constant quality units have generally de-

Figure 6

Constant Quality Price Movements by Rental Submarket
San Francisco-Oakland SMSA
1975 - 1985



NOTE: All dollar values adjusted by CPI less shelter, 1982-1984=100.

creased over time, only in the recessionary period of 1982 did lower submarket rent movements lag the higher rent submarket. By 1985, the difference between rental submarkets had all but disappeared. This shift reflects a marketwide movement; when unit prices for standing tenants are repriced, the results are consistent with recent movers.

This finding was consistent with the results of regression equations based on all renters, and with several other function form specifications. Even accounting for the greater standard errors, constant quality prices in the lower rent submarket rose at a significantly greater rate than overall rent levels (and higher rent submarket prices).

SUMMARY

The previous results paint a stark picture for lower income tenants. During the past decade, lower income renters have faced dramatically increasing rents, with rates for constant quality units outpacing high rent submarket rent increases. While standing tenants consistently have rents below those for recent movers, when units become vacant, the disparity disappears; at vacancy, units have increases which align the units with the submarket price structure. By the mid 1980's, lower rent submarket units, when adjusted for unit quality and location, were approaching an equivalence with higher unit submarkets. The exact source of this increase remains illusive; sample size and other factors in the lower rent submarket do not offer convincing evidence regarding the qualitative or quantitative shifts in the low rent submarket.

Thus, while real rent levels in both submarkets increased during the decade, lower rent submarket tenants faced a continuing erosion of housing purchasing power relative to the overall rental market. While real incomes grew throughout the decade, price increases outpaced income growth and rent burdens for tenants in lower rent units increased significantly during the period. In short, income growth did not keep pace with rent increases, and while all renters faced decreased non-housing consumption, occupants of lower rent units were hit harder than other rental occupants.

This research implies that in the supply constrained San Francisco-Oakland housing markets, the current federal laissez-faire approach to housing policy is particularly anemic. Over the long run, the demand augmenting approach of vouchers will not improve the plight of the bulk of low income tenants. Moreover, given the rent movements of the past decade, it is not clear that exclusive reliance on demand subsidies offer a cost effective solution, since the relative cost of demand subsidies should rise to meet market changes if tenant purchasing power is to remain comparable to higher income renters. While new supply additions or acquisition of existing projects is costly, it would more effectively limit the increase in rents for lower income households, and could act to temper the rate of rent increases at the bottom of the market. However, given the level of new supply construction (both owner and renter), it will be difficult to counter prevailing rental housing price inflation.

From a methodological perspective, the results offer mixed results. The complexities and data requirements introduced in estimating equations based recent movers of housing submarkets are extensive. Moreover, the general procedure for analyzing housing submarket movements over time would benefit from additional information on housing units (greater detail on neighborhood characteristics and more detailed information on alternatives open to owners of lower income units). In particular, some method for incorporating information on individual unit gentrification potential would greatly enrich an analysis. Nonetheless, the results suggest that unconstrained equation estimation based on rent-stratified submarkets may offer additional insight into the functioning of a metropolitan submarket.

Further, this research is part of a larger research effort to explore the potential for this methodological approach to measure the presence of filtering in various regional housing markets. It is evident that unit filtering has not occurred for recent movers in the San Francisco-Oakland SMSA. In essence, the short term market equilibrium of the San Francisco-Oakland housing market has not generated constant quality price filtering during the decade. Given the tightness

of the San Francisco-Oakland SMSA rental housing market, this is not an unexpected result. In future research, this same methodology will be applied to a variety of housing markets exhibiting differing demand levels and supply responses.

[1] The data utilized in this study were made available in part by the Inter-university Consortium for Political and Social Research. The data for American Housing Survey, 1985, Annual Housing Survey, 1982, 1978, 1975: MSA files were originally collected and prepared by the U.S. Department of Commerce, Bureau of the Census. Neither the collector of the original data nor the Consortium bears any responsibility for the analyses or interpretations presented here.

[2] In a survey of government and businesses, for instance, 98 percent of business leaders and 91 percent of government officials indicated that cost/availability of housing. Bay Area Economic Forum, "The Bay Area Economy: A Region at Risk", March, 1989.

[3] Median rents in the Bay Area were $297 in 1980, with only Santa Barbara ($300), Honolulu ($315), and Anchorage ($374) exceeding these levels.

[4] The panel is composed of housing units surveyed in each year of the Annual Housing Survey, San Francisco-Oakland Metropolitan data.

[5] Data for the study is obtained from the Metropolitan Series of the Annual Housing Survey. Neither Santa Rosa nor the Vallejo-Fairfield PMSA's are included within the Survey. San Jose was added to the survey in 1984, but a comparable time series is not available.

[6] Throughout this paper, all dollar values are adjusted using Consumer Price Index for Urban Wage Earners and Clerical Workers Less Shelter (1982-1984=100), published by US Department of Labor, Bureau of Labor Statistics.

[7] Since publicly subsidized units have administrative rent setting procedures, these units will be excluded from analysis.

[8] Neighborhood variables are reported in a supplement to the Annual Housing Survey; the data is not currently available for the 1985-1986 period.

[9] The data for the analysis reflects the opinions of all residents of a tract, including both homeowners and renters. While there may be systematic variation in the importance of various factors by tenure, limited cases precluded such separation.

[10] The equations presented reflect a log linear specification. A linear specification is presented in the Appendices. In addition, a series of regressions were run based on all renters, with similar panel-wide results. These are also presented in the Appendices.

[11] Chow tests were undertaken to measure the qualitative gain in explanatory power offered by segmenting data. For a fuller discussion of the rationale for the Chow Test, see Schnare and Struyk (1975), or Bajic (1983).

[12] This pattern of fit did not vary based on specification, nor did the pattern vary in an alternative specification incorporating all low rent units.

[13] This may be due to the limited sample size in this submarket, but may also reflect gentrification of units throughout the lower income submarket.

[14] Alternative submarket segmentation schemes based on location (central city vs. suburb) offered similar results. Data was not sufficient to establish race or neighborhood quality schemes.

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APPENDICES

Employment in San Francisco/Oakland SMSA and U.S.
1975 - 1985

	San Francisco/Oakland SMSA				United States			
	1975	1978	1982	1985	1975	1978	1982	1985
NATURAL RESOURCES	6	8	10	17	912	1,091	1,508	1,325
CONSTRUCTION	72	83	94	94	3,321	4,130	3,941	4,480
MANUFACTURING	178	206	204	196	18,374	20,611	19,572	19,434
Low Wage	24	29	31	35	4,180	4,899	4,236	4,255
Medium Wage	82	90	96	100	7,793	8,709	8,863	8,970
High Wage	58	59	48	42	5,266	5,744	5,201	4,922
Administrative Support	15	28	29	19	1,135	1,260	1,273	1,286
TRANSPORTATION AND TRADE	398	447	452	505	19,402	22,440	23,792	26,010
Transport	115	121	91	101	2,798	3,122	3,277	3,533
Wholesale Trade	84	89	95	110	4,333	4,837	5,235	5,625
Retail Trade	198	237	266	294	12,271	14,481	15,280	16,852
TRANSACTIONAL ACTIVITIES	220	273	329	383	8,441	10,043	11,896	13,686
Communications	28	29	37	38	1,137	1,223	1,350	1,283
FIRE	115	142	155	174	4,263	4,872	5,447	6,004
Business Services	78	101	137	171	3,041	3,948	5,099	6,399
PERSONAL SERVICES	57	65	70	83	2,927	3,444	3,780	4,170
SOCIAL SERVICES (exc. govt)	113	131	155	177	6,689	8,177	9,703	10,974
MISC	14	8	2	23	496	355	105	1,041
TOTAL	1,059	1,221	1,316	1,478	60,564	70,289	74,297	81,119

Source: County Business Patterns, 1975, 1978, 1982, 1985.

San Francisco Construction and Household Growth, 1976-1985

NOTE: All figures are in thousands

Year	Total Households	New Construction	Single Family	Multi-Family	Total Units
1976	1,194	16	715	546	1,261
1977	1,217	24	724	561	1,285
1978	1,256	20	730	578	1,308
1979	1,279	20	741	597	1,338
1980	1,308	14	757	601	1,358
1981	1,331	10	769	605	1,374
1982	1,334	8	776	608	1,384
1983	1,358	16	784	613	1,397
1984	1,385	18	799	619	1,418
1985	1,406	18	811	625	1,436
Change During Period	212	163	96	79	175
Percent Change	17.8%		13.4%	14.5%	13.9%
Ratio of Starts to HH Growth				69.5%	

Source: U.S. Regional Forecasts: Metro Area Long-Term Tables, Chase Econometrics, Fall 1986, page 50.

Summary of Neighborhood Factors -

1975, 1978, 1982, 1985

NEIGHBORHOOD FACTORS, 1975 SAN FRANCISCO S/

DESCRIPTIVE STATISTICS	MEAN	STD DEV
TSTRN -street noise	0.73141	0.54153
TCRIME - crime	0.57103	0.59429
TJUNK - litter or junk	0.38435	0.51299
TABAN - rundown buildings	0.10684	0.32198
TODOR - offensive odors	0.16845	0.36069
THOWN - resident perception	1.96845	0.55530
TNONRES - nonresidential uses	0.33040	0.38770

FACTOR MATRIX

TSTRN -street noise	0.83754	-0.23872
TCRIME - crime	0.69879	0.31764
TJUNK - litter or junk	0.57290	0.53367
TABAN - rundown buildings	0.05151	0.82979
TODOR - offensive odors	0.14891	0.56445
THOWN - resident perception	0.60280	0.42698
TNONRES - nonresidential uses	0.46443	0.31692
Variance Explained	55.10%	

FACTOR SCORE COEFFICIENT MATRIX

TSTRN -street noise	0.56366	-0.41729
TCRIME - crime	0.31917	0.02508
TJUNK - litter or junk	0.18180	0.21783
TABAN - rundown buildings	-0.21225	0.53421
TODOR - offensive odors	-0.07723	0.36410
THOWN - resident perception	0.23060	0.13211
TNONRES - nonresidential uses	0.18119	0.09308

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.80346
Bartlett test of Sphericity		1285.68700
	F=	0.00000

NEIGHBORHOOD FACTORS, 1978 SAN FRANCISCO SAMPLE

DESCRIPTIVE STATISTICS	MEAN	STD DEV
TSTRN -street noise	0.89506	0.56316
TCRIME - crime	0.67229	0.58209
TJUNK - litter or junk	0.42171	0.49208
TABAN - rundown buildings	0.12799	0.31732
TODOR - offensive odors	0.17885	0.36745
THOWN - resident perception	2.04252	0.57147
TNONRES - nonresidential uses	0.38363	0.36259

FACTOR MATRIX

TSTRN -street noise	0.61474
TCRIME - crime	0.61126
TJUNK - litter or junk	0.71577
TABAN - rundown buildings	0.60277
TODOR - offensive odors	0.63898
THOWN - resident perception	0.70678
TNONRES - nonresidential uses	0.54316
Variance Explained	40.40%

FACTOR SCORE COEFFICIENT MATRIX

TSTRN -street noise	0.21722
TCRIME - crime	0.21599
TJUNK - litter or junk	0.25292
TABAN - rundown buildings	0.21299
TODOR - offensive odors	0.22578
THOWN - resident perception	0.24974
TNONRES - nonresidential uses	0.19193

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.82714
Bartlett test of Sphericity		1329.99840
	F=	0.00000

NEIGHBORHOOD FACTORS, 1982 SAN FRANCISCO SAMPLE

DESCRIPTIVE STATISTICS	MEAN	STD DEV
TSTRN -street noise	0.71780	0.53443
TCRIME - crime	0.68655	0.62563
TJUNK - litter or junk	0.42359	0.55527
TABAN - rundown buildings	0.08623	0.24740
TODOR - offensive odors	0.17851	0.37188
THOWN - resident perception	1.98702	0.57459
TNONRES - nonresidential uses	0.39896	0.39753

FACTOR MATRIX

TSTRN -street noise	0.70431
TCRIME - crime	0.66626
TJUNK - litter or junk	0.73850
TABAN - rundown buildings	0.43378
TODOR - offensive odors	0.55275
THOWN - resident perception	0.70378
TNONRES - nonresidential uses	0.56670
Variance Explained	39.90%

FACTOR SCORE COEFFICIENT MATRIX

TSTRN -street noise	0.25195
TCRIME - crime	0.23833
TJUNK - litter or junk	0.26418
TABAN - rundown buildings	0.15517
TODOR - offensive odors	0.19773
THOWN - resident perception	0.25175
TNONRES - nonresidential uses	0.20272

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.80548
Bartlett test of Sphericity		1404.90920
	F=	0.00000

Means for Key Variables-

1975, 1978, 1982, 1985

MEANS FOR KEY VARIABLES, SAN FRANCISCO
1975

	1975 RECENT MOVERS			1975 ALL RENTERS		
	ALL	LOWRENT	HIRENT	ALL	LOWRENT	HIRENT
REAL RENT	396.833	277.358	444.017			
I3	0.052	0.101	0.033	0.055	0.080	0.041
I4	0.044	0.064	0.036	0.057	0.068	0.049
I5	0.057	0.064	0.054	0.067	0.088	0.055
I6	0.029	0.055	0.018	0.026	0.037	0.019
M3	0.042	0.064	0.033	0.041	0.051	0.034
M4	0.068	0.119	0.047	0.053	0.077	0.039
COLD	0.010	0.028	0.004	0.018	0.034	0.009
SIN	0.018	0.055	0.004	0.025	0.063	0.002
PRIVN	0.052	0.110	0.029	0.049	0.091	0.024
PRIVB	0.039	0.046	0.036	0.040	0.046	0.036
TSTRN	0.684	0.811	0.634	0.731	0.757	0.716
TCRIME	0.535	0.634	0.496	0.571	0.594	0.558
TJUNK	0.350	0.453	0.310	0.384	0.470	0.333
TABAN	0.113	0.243	0.062	0.107	0.205	0.048
TODOR	0.181	0.273	0.145	0.168	0.230	0.132
THOWN	1.945	2.196	1.846	1.968	2.159	1.854
TNONRES	0.302	0.375	0.273	0.330	0.380	0.301
BR1	0.403	0.413	0.399	0.390	0.396	0.386
BR2	0.371	0.376	0.370	0.379	0.382	0.377
BR3	0.140	0.147	0.138	0.142	0.151	0.137
ZBLK	10.105	15.239	8.077	11.091	15.532	8.431
TGRAD	46.886	53.373	44.324	48.863	58.756	42.938
SMALL	0.187	0.202	0.181	0.208	0.219	0.201
INT1	0.182	0.284	0.141	0.205	0.274	0.164
INT2	0.109	0.183	0.080	0.094	0.128	0.073
INT3	0.029	0.083	0.007	0.043	0.097	0.010
INT4	0.092	0.157	0.066	0.089	0.137	0.060
BATHBIG	0.148	0.083	0.174	0.141	0.068	0.184
NGH1	-0.114	0.134	-0.221	-0.001	0.090	-0.056
NGH2	0.031	0.383	-0.107	-0.001	0.314	-0.189
CC1	0.218	0.183	0.232	0.297	0.291	0.300
TDIST	10.797	9.614	11.224	10.343	9.528	10.798
NGH 78	-0.065	0.357	-0.23	-0.002	0.271	-0.164
NGH 82	-0.073	0.335	-0.233	-0.002	0.255	-0.155

MEANS FOR KEY VARIABLES, SAN FRANCISCO
1978

	1978 RECENT MOVER			1978 ALL RENTERS		
	ALL	LOWRENT	HIRENT	ALL	LOWRENT	HIRENT
Real Rent	431.162	330.322	463.908			
I3	0.085	0.103	0.079	0.097	0.142	0.075
I4	0.075	0.064	0.079	0.093	0.115	0.082
I5	0.044	0.013	0.054	0.089	0.122	0.074
I6	0.022	0.026	0.021	0.021	0.030	0.016
M3	0.031	0.038	0.029	0.030	0.034	0.028
M4	0.047	0.064	0.042	0.041	0.057	0.033
COLD	0.019	0.064	0.004	0.020	0.047	0.007
SIN	0.022	0.077	0.004	0.023	0.064	0.003
PRIVN	0.038	0.026	0.042	0.025	0.017	0.029
PRIVB	0.063	0.077	0.058	0.060	0.078	0.051
TSTRN	0.903	0.994	0.874	0.905	0.947	0.884
TCRIME	0.645	0.707	0.625	0.641	0.678	0.623
TJUNK	0.405	0.434	0.395	0.402	0.471	0.368
TABAN	0.113	0.235	0.073	0.114	0.195	0.075
TODOR	0.169	0.234	0.148	0.172	0.248	0.136
THOWN	2.023	2.248	1.950	2.014	2.205	1.921
TNONRES	0.386	0.437	0.370	0.382	0.424	0.362
BR1	0.336	0.282	0.354	0.358	0.341	0.367
BR2	0.362	0.449	0.333	0.369	0.416	0.347
BR3	0.186	0.154	0.196	0.162	0.111	0.187
ZBLK	9.707	13.713	8.405	11.011	15.238	8.963
TGRAD	47.564	58.405	44.041	46.935	56.038	42.524
SMALL	0.220	0.141	0.246	0.214	0.176	0.232
INT1	0.226	0.205	0.233	0.300	0.409	0.247
INT2	0.079	0.103	0.071	0.071	0.091	0.061
INT3	0.041	0.141	0.008	0.043	0.111	0.010
INT4	0.101	0.103	0.100	0.085	0.095	0.080
BATHBIG	0.160	0.038	0.200	0.159	0.044	0.214
NGH1	-0.039	0.281	-0.143	-0.045	0.227	-0.177
CC1	0.220	0.154	0.242	0.282	0.280	0.283
TDIST	9.255	7.515	9.797	8.899	8.028	9.290

MEANS FOR KEY VARIABLES, SAN FRANCISCO
1982

	1982 RECENT MOVERS			1982 ALL RENTERS		
	ALL	LOWRENT	HIRENT	ALL	LOWRENT	HIRENT
Real Rent	489.945	355.435	539.927			
I3	0.088	0.132	0.071	0.090	0.127	0.072
I4	0.092	0.162	0.066	0.120	0.153	0.105
I5	0.048	0.074	0.038	0.101	0.156	0.075
I6	0.016	0.059	0.000	0.021	0.019	0.022
M3	0.040	0.044	0.038	0.034	0.058	0.023
M4	0.016	0.029	0.011	0.033	0.049	0.026
COLD	0.036	88.000	0.016	0.019	0.042	0.008
SIN	0.016	0.059	0.000	0.018	0.052	0.002
PRIVN	0.036	0.044	0.033	0.042	0.058	0.034
PRIVB	0.096	0.104	0.093	0.081	0.091	0.076
TSTRN	0.682	0.770	0.649	0.719	0.768	0.696
TCRIME	0.604	0.723	0.560	0.672	0.717	0.650
TJUNK	0.363	0.549	0.294	0.423	0.559	0.359
TABAN	0.059	0.091	0.047	0.081	0.113	0.065
TODOR	0.178	0.325	0.124	0.181	0.238	0.154
THOWN	1.910	2.125	1.830	1.966	2.153	1.878
TNONRES	0.372	0.451	0.342	0.402	0.475	0.367
BR1	0.367	0.382	0.361	0.354	0.406	0.329
BR2	0.371	0.426	0.350	0.373	0.386	0.366
BR3	0.171	0.059	0.213	0.176	0.097	0.214
ZBLK	9.099	12.769	7.735	10.338	13.945	8.628
TGRAD	39.375	50.622	35.195	43.742	51.741	39.952
SMALL	0.267	0.132	0.317	0.248	0.149	0.295
INT1	0.243	0.426	0.175	0.332	0.455	0.274
INT2	0.056	0.074	0.049	0.068	0.107	0.049
INT3	0.052	0.147	0.016	0.037	0.094	0.009
INT4	0.132	0.149	0.126	0.123	0.150	0.110
BATHBIG	0.163	0.029	0.213	0.169	0.058	0.222
NGH1	-0.142	0.267	-0.294	-0.015	0.259	-0.145
CC1	0.227	0.250	0.219	0.279	0.295	0.271
TDIST	10.078	10.578	9.901	9.605	8.676	10.033

MEANS FOR KEY VARIABLES, SAN FRANCISCO
1985

	1985 RECENT MOVERS			1985 ALL RENTERS		
	ALL	LOWRENT	HIRENT	ALL	LOWRENT	HIRENT
Real Rent	551.538	420.833	604.201			
I3	0.073	0.096	0.063	0.107	0.142	0.091
I4	0.055	0.012	0.073	0.099	0.118	0.090
I5	0.038	0.060	0.029	0.052	0.069	0.045
I6	0.017	0.024	0.015	0.020	0.021	0.020
M3	0.422	0.313	0.466	0.439	0.401	0.456
M4	0.561	0.651	0.524	0.537	0.567	0.524
COLD	0.000	0.000	0.000	0.006	0.010	0.005
SIN	0.031	0.108	0.000	0.019	0.055	0.003
PRIVN	0.035	0.072	0.020	0.035	0.062	0.023
PRIVB	0.094	0.122	0.083	0.079	0.104	0.068
TSTRN	N/A	N/A	N/A	N/A	N/A	N/A
TROAD	N/A	N/A	N/A	N/A	N/A	N/A
TCRIME	N/A	N/A	N/A	N/A	N/A	N/A
TJUNK	N/A	N/A	N/A	N/A	N/A	N/A
TABAN	N/A	N/A	N/A	N/A	N/A	N/A
TODOR	N/A	N/A	N/A	N/A	N/A	N/A
THOWN	N/A	N/A	N/A	N/A	N/A	N/A
TNONRES	N/A	N/A	N/A	N/A	N/A	N/A
BR1	0.394	0.422	0.383	0.369	0.391	0.360
BR2	0.339	0.373	0.325	0.388	0.408	0.378
BR3	0.145	0.060	0.180	0.160	0.087	0.192
ZBLK	10.856	15.193	9.109	10.940	15.129	9.064
TGRAD	40.663	51.766	36.190	42.712	52.630	38.268
SMALL	0.232	0.133	0.272	0.256	0.166	0.296
INT1	0.183	0.193	0.180	0.278	0.349	0.247
INT2	0.983	0.964	0.990	0.976	0.969	0.980
INT3	0.031	0.108	0.000	0.026	0.066	0.008
INT4	0.129	0.195	0.102	0.115	0.167	0.092
BATHBIG	0.083	0.048	0.097	0.079	0.035	0.099
CC1	0.249	0.241	0.252	0.272	0.263	0.276
TDIST	10.599	8.558	11.410	10.015	8.999	10.455

Estimates of Regressions for San Francisco Recent Movers

Linear specification

1975, 1978, 1982, 1985

ESTIMATION OF REGRESSIONS FOR SAN FRANCISCO RECENT MOVERS, 1975

Dependent Variable= Real Rent	All Units (Recent Movers) B (S Error)	Beta t test	Low Rent Units (Recent Movers) B (S Error)	Beta t test	High Rent Units (Recent Movers) B (S Error)	Beta t test
UNIT CHARACTERISTICS						
1 Bedroom	61.0222 **	0.2018	76.0075 **	0.4966	76.9208 ***	0.2626
	(23.95)	t= 2.55	(29.43)	t= 2.58	(28.08)	t= 2.74
2 Bedroom	125.8098 ***	0.4099	142.4227 ***	0.9155	155.6277 ***	0.5107
	(24.05)	t= 5.23	(29.96)	t= 4.75	(23.89)	t= 6.52
3 Bedroom	166.2852 ***	0.3894	164.5466 ***	0.7727	220.6109 ***	0.5300
	(31.60)	t= 5.26	(32.95)	t= 4.99	(33.34)	t= 6.62
Extra Baths	97.1441 ***	0.2327	14.7207	0.0538	82.9687 ***	0.2193
	(20.79)	t= 4.67	(21.44)	t= 0.69	(21.69)	t= 3.83
Single Family Unit	60.1988 ***	0.1583	4.7146	0.0251	84.6071 ***	0.2272
	(17.70)	t= 3.40	(13.84)	t= 0.34	(19.59)	t= 4.32
Unit Amenities (Unit Interior)	-19.2136	-0.0671	-1.9458	-0.0175	-23.6733	-0.0713
	(11.94)	t= -1.61	(7.68)	t= -0.25	(15.03)	t= -1.57
Unit Amenities (Common Area)	-11.7240	-0.0289	-7.9833	-0.0521	-7.9850	-0.0165
	(16.91)	t= -0.69	(10.71)	t= -0.75	(21.42)	t= -0.37
Unit Amenities (Mechanical Equipment)	-109.6228 ***	-0.1232	-43.5282 *	-0.1590	-66.1997	-0.0392
	(37.98)	t= -2.89	(26.37)	t= -1.65	(74.88)	t= -0.88
Unit Amenities (Unit Configuration)	-38.2875	-0.0745	-20.2502	-0.0979	-20.0208	-0.0346
	(54.42)	t= -0.70	(14.30)	t= -1.42	(26.60)	t= -0.75
NEIGHBORHOOD CHARACTERISTICS						
Neighborhood Amenity (Nuisances)	-25.2318 ***	-0.1486	6.6149	0.0797	-25.4775 ***	-0.1492
	(7.24)	t= -3.48	(5.47)	t= 1.21	(8.27)	t= -3.08
Neighborhood Amenity (Crime/Aban)	-13.0485 *	-0.0819	-8.6146 **	-0.1518	-8.2502	-0.0385
	(6.99)	t= -1.87	(4.18)	t= -2.06	(9.67)	t= -0.85
Percent Zone Black	-0.9611 *	-0.0751	-0.5490	-0.0988	0.1965	0.0137
	(0.54)	t= -1.77	(0.39)	t= -1.39	(0.64)	t= 0.31
Percent HH without College Ed.	-0.7097 ***	-0.1364	-0.2471	-0.0936	-0.6236 ***	-0.1221
	(0.21)	t= -3.42	(0.17)	t= -1.45	(0.23)	t= -2.76
LOCATION CHARACTERISTICS						
San Francisco CC	29.9503 **	0.0834	-15.6641	-0.0805	35.3834 **	0.1041
	(15.14)	t= 1.98	(12.92)	t= -1.21	(16.19)	t= 2.19
Distance to Work	0.1958	0.0097	-0.3676	-0.0411	0.6230	0.0298
	(0.87)	t= 0.22	(0.63)	t= -0.58	(1.00)	t= 0.62
Constant	319.8456 ***		205.2658 ***		307.5255 ***	
	(27.21)	t= 11.75	(30.93)	t= 6.64	(28.08)	t= 10.95
R Squared	0.4709		0.7074		0.5326	
Adjusted R Squared	0.4477		0.6518		0.5043	
Standard Error	110.3446		44.6733		101.1575	
MSE REGRESSION	247,763.2683		25,410.2122		192,742.2966	
MSE RESIDUAL	12,175.9369		1,995.7051		10,232.8396	
SSE REGRESSION	3,716,449.0239		371,153.1822		2,891,134.4488	
SSE RESIDUAL	4,176,346.3596		157,660.7044		2,537,744.2090	
DF REGRESSION	15		15		15	
DF RESIDUAL	343		79		248	
F	20.3486		12.7325		18.8357	
Sign. F	0.0000		0.0000		0.0000	
N	359		95		264	
CHOW TEST F			7.724077706 **		1.692393766 **	
CRITICAL F (CHOW TEST)			1.25		1.3	

NOTE: *** Significant at the .01 level ** Significant at .05 level * Significant at .1 level

ESTIMATION OF REGRESSIONS FOR SAN FRANCISCO RECENT MOVERS, 1978

Dependent Variable= Real Rent	All Units (Recent Movers) B	Beta	Low Rent Units (Recent Movers) B	Beta	High Rent Units (Recent Movers) B	Beta
UNIT CHARACTERISTICS						
1 Bedroom	84.2374 ***	0.2410	50.7467	0.2616	105.4704 ***	0.2948
	(23.36) t= 3.61		(36.03) t= 1.41		(26.25) t= 4.02	
2 Bedroom	166.4055 ***	0.4842	125.3838 ***	0.7143	215.0767 ***	0.5925
	(23.97) t= 6.94		(36.76) t= 3.41		(27.88) t= 7.72	
3 Bedroom	252.4363 ***	0.5942	186.7552 ***	0.7718	307.3270 ***	0.7128
	(28.81) t= 8.76		(38.43) t= 4.86		(36.56) t= 8.41	
Extra Baths	69.8850 ***	0.1553	-1.3562	-0.0030	42.6079 *	0.0996
	(20.40) t= 3.43		(44.59) t= -0.03		(23.41) t= 1.82	
Single Family Unit	81.5579 ***	0.2046	29.9227	0.1193	66.3438 ***	0.1670
	(17.98) t= 4.54		(26.61) t= 1.12		(22.53) t= 2.94	
Unit Amenities (Unit Interior)	-5.7954	-0.0202	-8.1055	-0.0543	-10.0674	-0.0337
	(11.61) t= -0.50		(19.80) t= -0.41		(13.46) t= -0.75	
Unit Amenities (Common Area)	-9.0743	-0.0148	-0.3073	-0.0011	-27.7489	-0.0416
	(24.73) t= -0.37		(35.01) t= -0.01		(29.72) t= -0.93	
Unit Amenities (Mechanical Equipment)	-64.1767 **	-0.0884	-16.5553	-0.0787	-120.5771	-0.0641
	(29.93) t= -2.14		(25.79) t= -0.64		(83.72) t= -1.44	
Unit Amenities (Unit Configuration)	28.6062	0.0589	14.7269	0.0639	27.5649	0.0526
	(19.60) t= 1.46		(25.71) t= 0.57		(23.92) t= 1.15	
NEIGHBORHOOD CHARACTERISTICS						
Neighborhood Amenities	-24.7975 ***	-0.1510	-9.4617	-0.1390	-26.0709 ***	-0.1330
	(7.17) t= -3.46		(7.85) t= -1.21		(9.62) t= -2.71	
Percent Zone Black	-1.8931 ***	-0.1238	-0.2168	-0.0334	-2.7089 ***	-0.1493
	(0.63) t= -3.02		(0.72) t= -0.30		(0.84) t= -3.22	
Percent HH without College Ed.	-1.2682 ***	-0.2368	-0.6291 **	-0.2224	-1.2332 ***	-0.2162
	(0.22) t= -5.83		(0.30) t= -2.07		(0.26) t= -4.75	
LOCATION CHARACTERISTICS						
San Francisco CC	76.7357 ***	0.1925	51.5104 *	0.2129	62.0595 ***	0.1553
	(17.59) t= 4.36		(28.52) t= 1.81		(20.16) t= 3.08	
Distance to Work	-1.9586 *	-0.0792	1.1436	0.0693	-3.5005 ***	-0.1426
	(1.06) t= -1.84		(1.80) t= 0.64		(1.20) t= -2.91	
Constant	347.3601 ***		255.2263 ***		365.0525 ***	
	(27.75) t= 12.52		(42.76) t= 5.97		(31.79) t= 11.48	
R Squared	0.5769		0.5028		0.5997	
Adjusted R Squared	0.5564		0.3807		0.5738	
Standard Error	110.1612		69.1474		111.9401	
MSE REGRESSION	340,446.4416		19,684.8816		289,674.4661	
MSE RESIDUAL	12,135.4894		4,781.3657		12,530.5871	
SSE REGRESSION	4,766,250.1819		275,588.3429		4,055,442.5257	
SSE RESIDUAL	3,495,020.9358		272,537.8449		2,706,606.8194	
DF REGRESSION	14		14		14	
DF RESIDUAL	288		59		216	
F	28.0538		5.0018		23.1174	
Sign. F	0.0000		0.0000		0.0000	
N	303		74		231	
CHOW TEST F			3.071164651 **		0.854195411	
CRITICAL F (CHOW TEST)			1.25		1.3	

NOTE: *** Significant at the .01 level ** Significant at .05 level * Significant at .1 level

ESTIMATION OF REGRESSIONS FOR SAN FRANCISCO RECENT MOVERS, 1982

Dependent Variable= Real Rent	*All Units (Recent Movers)* B	Beta	*Low Rent Units (Recent Movers)* B	Beta	*High Rent Units (Recent Movers)* B	Beta
UNIT CHARACTERISTICS						
1 Bedroom	111.9213 ***	0.2711	62.6229	0.2753	133.5650 ***	0.3186
	(37.77) t= 2.96		(44.52) t= 1.41		(48.46) t= 2.76	
2 Bedroom	166.8938 ***	0.4052	141.2965 ***	0.6321	191.3149 ***	0.4532
	(39.23) t= 4.25		(49.74) t= 2.84		(49.00) t= 3.90	
3 Bedroom	224.4946 ***	0.4252	164.8063 **	0.3508	232.2084 ***	0.4724
	(48.92) t= 4.59		(67.23) t= 2.45		(58.97) t= 3.94	
Extra Baths	161.7755 ***	0.3006	-30.1023	-0.0460	148.5579 ***	0.3022
	(31.53) t= 5.13		(80.02) t= -0.38		(34.88) t= 4.26	
Single Family Unit	81.1984 ***	0.1806	1.7803	0.0055	104.5805 ***	0.2417
	(27.30) t= 2.97		(41.64) t= 0.04		(32.76) t= 3.19	
Unit Amenities (Unit Interior)	-15.8224	-0.0492	4.4153	0.0351	-21.5520	-0.0503
	(15.79) t= -1.00		(10.54) t= 0.42		(24.66) t= -0.87	
Unit Amenities (Common Area)	-9.9304	-0.0115	-6.0530	-0.0143	-8.0041	-0.0086
	(41.79) t= -0.24		(48.82) t= -0.12		(53.14) t= -0.15	
Unit Amenities (Mechanical Equipment)	-68.6979 *	-0.0933	-80.7885 **	-0.3378	-63.3830	-0.0400
	(38.62) t= -1.78		(33.42) t= -2.42		(90.98) t= -0.70	
Unit Amenities (Unit Configuration)	-35.0758	-0.0693	-61.1126 **	-0.2573	-26.1428	-0.0471
	(24.36) t= -1.44		(28.56) t= -2.14		(31.57) t= -0.83	
NEIGHBORHOOD CHARACTERISTICS						
Neighborhood Amenities	-25.6678 **	-0.1110	-4.8391	-0.0455	-21.4058	-0.0772
	(12.54) t= -2.05		(13.69) t= -0.35		(17.65) t= -1.21	
Percent Zone Black	-1.8846 *	-0.1003	0.7808	0.0846	-3.5193 ***	-0.1692
	(0.96) t= -1.97		(1.15) t= 0.68		(1.25) t= -2.80	
Percent HH without College Ed.	-0.9585 ***	-0.1510	0.2989	0.0944	-1.5360 ***	-0.2198
	(0.32) t= -3.04		(0.40) t= 0.75		(0.42) t= -3.69	
LOCATION CHARACTERISTICS						
San Francisco CC	74.4865 ***	0.1569	90.4562 **	0.3543	82.2536 **	0.1689
	(27.44) t= 2.71		(36.22) t= 2.50		(34.41) t= 2.39	
Distance to Work	-1.6230	-0.0575	0.4398	0.0298	-2.0020	-0.0684
	(1.50) t= -1.08		(1.81) t= 0.24		(1.89) t= -1.06	
Constant	363.7964 ***		230.6757 ***		395.8774 ***	
	(42.70) t= 8.52		(50.87) t= 4.53		(56.48) t= 7.01	
R Squared	0.5116		0.4909		0.5108	
Adjusted R Squared	0.4812		0.3392		0.4688	
Standard Error	143.5769		90.5336		147.1111	
MSE REGRESSION	347,017.9685		26,529.9936		263,120.9218	
MSE RESIDUAL	20,614.3309		8,196.3312		21,641.6875	
SSE REGRESSION	4,858,251.5592		371,419.9101		3,683,692.9049	
SSE RESIDUAL	4,638,224.4594		385,227.5684		3,527,595.0581	
DF REGRESSION	14		14		14	
DF RESIDUAL	225		47		163	
F	16.8338		3.2368		12.1581	
Sign. F	0.0000		0.0013		0.0000	
N	240		62		178	
CHOW TEST F			2.977137828 **		0.83280361	
CRITICAL F			1.25		1.3	

ESTIMATION OF REGRESSIONS FOR SAN FRANCISCO RECENT MOVERS, 1985

Dependent Variable= Real Rent	All Units (Recent Movers) B (S Error)	Beta t stat	Low Rent Units (Recent Movers) B (S Error)	Beta t stat	High Rent Units (Recent Movers) B (S Error)	Beta t stat
UNIT CHARACTERISTICS						
1 Bedroom	106.6277 ***	0.2603	122.4623 **	0.4312	127.3197 ***	0.3149
	(30.89)	t= 3.45	(52.77)	t= 2.32	(35.82)	t= 3.55
2 Bedroom	231.8212 ***	0.5481	267.9198 ***	0.9242	257.4276 ***	0.6134
	(33.03)	t= 7.02	(55.07)	t= 4.86	(38.75)	t= 6.64
3 Bedroom	356.3600 ***	0.6273	274.3699 ***	0.4655	385.8081 ***	0.7532
	(42.18)	t= 8.45	(76.56)	t= 3.58	(48.88)	t= 7.89
Extra Baths	32.3754	0.0446	49.3888	0.0754	25.3199	0.0371
	(31.56)	t= 1.03	(63.98)	t= 0.77	(35.04)	t= 0.72
Single Family Unit	41.8621 *	0.0882	-28.8406	-0.0697	40.6215	0.0919
	(24.80)	t= 1.69	(37.57)	t= -0.77	(29.76)	t= 1.36
Unit Amenities (Unit Interior)	-11.9938	-0.0314	-1.8463	-0.0066	-14.7809	-0.0400
	(16.44)	t= -0.73	(27.76)	t= -0.07	(19.09)	t= -0.77
Unit Amenities (Common Area)	-31.0926	-0.0202	-70.0183	-0.0932	62.8760	0.0314
	(66.52)	t= -0.47	(81.71)	t= -0.86	(100.35)	t= 0.63
Unit Amenities (Mechanical Equipmen	-146.7699 ***	-0.1273	-20.8451	-0.0462	0.0000	0.0000
	(53.77)	t= -2.73	(62.56)	t= -0.33	0.00	t= 0.00
Unit Amenities (Unit Configuration)	-58.4004 ***	-0.1196	-30.2973	-0.1141	-76.1614 ***	-0.1349
	(20.98)	t= -2.78	(24.76)	t= -1.22	(28.69)	t= -2.65
NEIGHBORHOOD CHARACTERISTICS						
Neighborhood Amenities	n/a	n/a	n/a	n/a	n/a	n/a
	n/a	n/a	n/a	n/a	n/a	n/a
Percent Zone Black	-3.2990 ***	-0.1967	-0.5582	-0.0539	-3.7161 ***	-0.2030
	(0.73)	t= -4.51	(1.01)	t= -0.55	(0.94)	t= -3.94
Percent HH without College Ed.	-1.2224 ***	-0.2044	-0.3017	-0.0738	-1.2172 ***	-0.1985
	(0.25)	t= -4.81	(0.37)	t= -0.82	(0.31)	t= -3.89
LOCATION CHARACTERISTICS						
San Francisco CC	123.8308 ***	0.2675	76.7985 *	0.2342	129.1952 ***	0.2854
	(22.69)	t= 5.46	(38.79)	t= 1.98	(26.26)	t= 4.92
Distance to Work	2.7874 **	0.1032	2.3075	0.1122	1.6295	0.0620
	(1.24)	t= 2.24	(2.08)	t= 1.11	(1.44)	t= 1.13
Constant	436.6666 ***		315.8998 ***		363.7355 ***	
	(72.87)	t= 5.99	(89.41)	t= 3.53	(109.96)	t= 3.31
R Squared	0.5449		0.5369		0.5381	
Adjusted R Squared	0.5230		0.4471		0.5089	
Standard Error	138.5149		104.9125		138.1209	
MSE REGRESSION	477,191.6273		65,775.1382		351,839.6112	
MSE RESIDUAL	19,186.3768		11,006.6223		19,077.3894	
SSE REGRESSION	6,203,491.1543		855,076.7968		4,222,075.3344	
SSE RESIDUAL	5,180,321.7343		737,443.6921		3,624,703.9933	
DF REGRESSION	13		13		12	
DF RESIDUAL	270		67		190	
F	24.8714		5.9760		18.4428	
Sign. F	0.0000		0.0000		0.0000	
N	284		81		203	
CHOW TEST F			2.018126577 **		1.006697345	
CRITICAL F			1.25		1.3	

NOTE: *** Significant at the .01 level ** Significant at .05 level * Significant at .1 level

Estimates of Regressions for San Francisco - All units

Linear specification

1975, 1978, 1982, 1985

ESTIMATION OF REGRESSIONS FOR SAN FRANCISCO, ALL UNITS, 1975

Dependent Variable= Real Rent	All Units (Recent Movers) B	Beta	Low Rent Units (Recent Movers) B	Beta	High Rent Units (Recent Movers) B	Beta
UNIT CHARACTERISTICS						
1 Bedroom	72.2083 **	0.2486	72.1178 ***	0.4665	101.7324 ***	0.3659
	(14.65) t= 4.93		(17.00) t= 4.24		(15.20) t= 6.69	
2 Bedroom	134.8194 ***	0.4617	133.8198 ***	0.8598	176.1322 ***	0.6307
	(14.95) t= 9.02		(17.19) t= 7.78		(15.73) t= 11.20	
3 Bedroom	167.2309 ***	0.4120	170.2218 ***	0.8061	239.4928 ***	0.6075
	(18.84) t= 8.88		(18.43) t= 9.24		(22.21) t= 10.78	
Extra Baths	98.8358 ***	0.2427	7.2519	0.0242	73.0314 ***	0.2092
	(12.69) t= 7.79		(13.10) t= 0.55		(13.81) t= 5.29	
Single Family Unit	39.3324 ***	0.1127	-2.5470	-0.0139	59.5092 ***	0.1763
	(10.35) t= 3.80		(7.56) t= -0.34		(12.79) t= 4.65	
Unit Amenities (Unit Interior)	-11.7721 *	-0.0458	-7.3105	-0.0606	-14.4542 *	-0.0530
	(6.91) t= -1.70		(4.85) t= -1.51		(8.78) t= -1.65	
Unit Amenities (Common Area)	-3.9480	-0.0095	-5.9599	-0.0318	4.5902	0.0101
	(10.93) t= -0.36		(7.47) t= -0.80		(14.23) t= 0.32	
Unit Amenities (Mechanical Equipment)	-78.8973 ***	-0.1211	-42.7560 ***	-0.1829	-20.2794	-0.0151
	(18.22) t= -4.33		(13.57) t= -3.15		(41.51) t= -0.49	
Unit Amenities (Unit Configuration)	-42.2818 ***	-0.0850	-16.3629 *	-0.0744	-19.3075	-0.0339
	(13.06) t= -3.24		(8.74) t= -1.87		(17.86) t= -1.08	
NEIGHBORHOOD CHARACTERISTICS						
Neighborhood Amenity (Nuisances)	-8.6378 **	-0.0609	0.4277	0.0056	-10.8766 **	-0.0803
	(3.82) t= -2.26		(2.99) t= 0.14		(4.50) t= -2.42	
Neighborhood Amenity (Crime/Aban)	-12.0906 ***	-0.0853	-2.5679	-0.0458	-3.6022	-0.0172
	(3.90) t= -3.10		(2.32) t= -1.11		(6.71) t= -0.54	
Percent Zone Black	-1.2810 ***	-0.1098	-0.6155 ***	-0.1111	0.1361	0.0103
	(0.32) t= -4.03		(0.23) t= -2.70		(0.42) t= 0.33	
Percent HH without College Ed.	-0.9109 ***	-0.1918	-0.2470 **	-0.0960	-0.6760 ***	-0.1423
	(0.13) t= -7.28		(0.10) t= -2.47		(0.15) t= -4.56	
LOCATION CHARACTERISTICS						
San Francisco CC	18.6778 **	0.0602	-3.9113	-0.0235	27.0076 ***	0.0915
	(8.92) t= 2.09		(7.06) t= -0.55		(10.36) t= 2.61	
Distance to Work	0.0422	0.0022	0.2358	0.0244	-0.3957	-0.0208
	(0.54) t= 0.08		(0.41) t= 0.57		(0.64) t= -0.62	
Recent Movers	33.2705 ***	0.1155	7.9310	0.0485	19.8474 **	0.0732
	(7.51) t= 4.43		(6.31) t= 1.26		(8.55) t= 2.32	
Constant	298.1817 ***		195.4620 ***		289.5337 ***	
	(17.74) t= 16.81		(19.22) t= 10.17		(19.13) t= 15.13	
R Squared	0.4623		0.6007		0.5096	
Adjusted R Squared	0.4520		0.5785		0.4947	
Standard Error	104.9293		49.1594		96.2941	
MSE REGRESSION	491,687.7534		65,223.5030		317,321.4995	
MSE RESIDUAL	11,010.1551		2,416.6461		9,272.5460	
SSE REGRESSION	7,867,004.0542		1,043,576.0483		5,077,143.9912	
SSE RESIDUAL	9,149,438.8943		693,577.4366		4,886,631.7216	
DF REGRESSION	16		16		16	
DF RESIDUAL	831		287		527	
F	44.6577		26.9893		34.2216	
Sign. F	0.0000		0.0000		0.0000	
N	848		304		544	
CHOW TEST F			6.454409126 **		1.515117857 **	
CRITICAL F (CHOW TEST)			1.25		1.3	

NOTE: *** Significant at the .01 level ** Significant at .05 level * Significant at .1 level

ESTIMATION OF REGRESSIONS FOR SAN FRANCISCO, ALL UNITS, 1978

Dependent Variable= Real Rent	All Units (Recent Movers) B	Beta	Low Rent Units (Recent Movers) B	Beta	High Rent Units (Recent Movers) B	Beta
UNIT CHARACTERISTICS						
1 Bedroom	65.2788 ***	0.1841	49.1672 ***	0.2384	81.3708 ***	0.2249
	(16.07) t= 4.06		(17.50) t= 2.81		(20.37) t= 3.99	
2 Bedroom	136.2390 ***	0.3867	104.4323 ***	0.5263	170.9917 ***	0.4669
	(16.37) t= 8.32		(17.72) t= 5.89		(21.06) t= 8.12	
3 Bedroom	212.5229 ***	0.4606	179.0177 ***	0.5762	234.1305 ***	0.5232
	(20.86) t= 10.19		(21.48) t= 8.33		(28.11) t= 8.33	
Extra Baths	98.2746 ***	0.2112	43.6750 *	0.0915	75.3337 ***	0.1774
	(14.50) t= 6.78		(23.48) t= 1.86		(17.30) t= 4.35	
Single Family Unit	38.3721 ***	0.0925	-8.5043	-0.0331	53.1460 ***	0.1288
	(12.45) t= 3.08		(12.75) t= -0.67		(16.87) t= 3.15	
Unit Amenities (Unit Interior)	-12.4231 *	-0.0479	-4.5408	-0.0368	-11.6626	-0.0382
	(7.04) t= -1.77		(6.43) t= -0.71		(10.10) t= -1.15	
Unit Amenities (Common Area)	-17.6102	-0.0291	10.3690	0.0341	-37.1645 *	-0.0551
	(15.95) t= -1.10		(15.26) t= 0.68		(21.94) t= -1.69	
Unit Amenities (Mechanical Equipment)	-73.3345 ***	-0.0943	-46.7941 ***	-0.1653	-56.5137	-0.0320
	(21.11) t= -3.47		(15.93) t= -2.94		(56.74) t= -1.00	
Unit Amenities (Unit Configuration)	0.6501	0.0012	1.2712	0.0042	3.0361	0.0051
	(14.56) t= 0.04		(14.67) t= 0.09		(19.10) t= 0.16	
NEIGHBORHOOD CHARACTERISTICS						
Neighborhood Amenities	-25.5550 ***	-0.1433	-7.2039 *	-0.0839	-31.8303 ***	-0.1491
	(4.97) t= -5.14		(4.34) t= -1.66		(7.34) t= -4.34	
Percent Zone Black	-1.4701 ***	-0.1040	-0.1984	-0.0286	-1.7480 ***	-0.1030
	(0.38) t= -3.90		(0.36) t= -0.56		(0.56) t= -3.14	
Percent HH without College Ed.	-1.1227 ***	-0.2032	-0.4511 ***	-0.1436	-1.0902 ***	-0.1851
	(0.14) t= -7.77		(0.15) t= -3.02		(0.19) t= -5.68	
LOCATION CHARACTERISTICS						
San Francisco CC	47.7750 ***	0.1265	37.0436 ***	0.1702	47.8089 ***	0.1236
	(11.16) t= 4.28		(11.96) t= 3.10		(14.28) t= 3.35	
Distance to Work	-1.2392 *	-0.0483	1.0876	0.0672	-2.5204 ***	-0.0988
	(0.73) t= -1.69		(0.84) t= 1.30		(0.91) t= -2.75	
Recent Mover	52.5715 ***	0.1475	51.7221 ***	0.2330	40.0059 ***	-0.0988
	(9.21) t= 5.71		(11.01) t= 4.70		(11.31) t= 3.54	
Constant	318.4575 ***		213.4205 ***		365.0525 ***	
	(19.78) t= 16.10		(20.80) t= 10.26		(31.79) t= 11.48	
R Squared	0.4623		0.4632		0.4391	
Adjusted R Squared	0.4527		0.4305		0.4244	
Standard Error	125.8541		73.9235		132.3666	
MSE REGRESSION	758,197.6746		77,329.4876		523,972.1468	
MSE RESIDUAL	15,839.2460		5,464.6848		17,520.9249	
SSE REGRESSION	11,372,965.1195		1,159,942.3140		7,859,582.2012	
SSE RESIDUAL	13,225,770.4470		1,344,312.4673		10,039,489.9797	
DF REGRESSION	15		15		15	
DF RESIDUAL	835		246		573	
F	47.8683		14.1508		29.9055	
Sign. F	0.0000		0.0000		0.0000	
N	851		262		589	
CHOW TEST F			3.706390453 **		0.695317167	
CRITICAL F (CHOW TEST)			1.25		1.3	

NOTE: *** Significant at the .01 level ** Significant at .05 level * Significant at .1 level

ESTIMATION OF REGRESSIONS FOR SAN FRANCISCO ALL UNITS, 1982

Dependent Variable= Real Rent	All Units (Recent Movers) B	Beta	Low Rent Units (Recent Movers) B	Beta	High Rent Units (Recent Movers) B	Beta
UNIT CHARACTERISTICS						
1 Bedroom	65.8689 ***	0.1772	57.7698 **	0.2252	86.3281 ***	0.2294
	(16.84) t= 3.91		(25.97) t= 2.22		(20.35) t= 4.24	
2 Bedroom	130.7759 ***	0.3557	129.5958 ***	0.5008	147.6676 ***	0.4022
	(17.40) t= 7.51		(27.52) t= 4.71		(20.88) t= 7.07	
3 Bedroom	194.7092 ***	0.4175	178.9516 ***	0.4211	198.7661 ***	0.4608
	(21.79) t= 8.94		(32.87) t= 5.44		(26.79) t= 7.42	
Extra Baths	130.0604 ***	0.2742	63.5963 **	0.1184	118.3984 ***	0.2780
	(13.93) t= 9.34		(28.92) t= 2.20		(15.61) t= 7.59	
Single Family Unit	42.0189 ***	0.1021	-31.8148 *	-0.0900	60.5275 ***	0.1561
	(12.48) t= 3.37		(19.10) t= -1.67		(15.80) t= 3.83	
Unit Amenities (Unit Interior)	-7.1979	-0.0273	-3.8523	-0.0239	-3.6575	-0.0126
	(6.64) t= -1.08		(8.36) t= -0.46		(8.89) t= -0.41	
Unit Amenities (Common Area)	-7.3908	-0.0113	16.5306	0.0458	-22.2919	-0.0282
	(16.30) t= -0.45		(18.79) t= 0.88		(23.79) t= -0.94	
Unit Amenities (Mechanical Equipment)	-70.9995 ***	-0.0833	-50.8770 **	-0.1347	-33.7164	-0.0182
	(22.53) t= -3.15		(24.76) t= -2.05		(55.08) t= -0.61	
Unit Amenities (Unit Configuration)	-18.0231	-0.0392	1.1019	0.0038	-26.6791 *	-0.0542
	(11.49) t= -1.57		(15.16) t= 0.07		(14.97) t= -1.78	
NEIGHBORHOOD CHARACTERISTICS						
Neighborhood Amenities	-17.6332 ***	-0.0972	-7.3713	-0.0624	-19.8299 ***	-0.1017
	(4.90) t= -3.60		(6.64) t= -1.11		(6.28) t= -3.16	
Percent Zone Black	-1.7144 ***	-0.1048	-0.8566	-0.0834	-1.7345 ***	-0.0949
	(0.42) t= -4.08		(0.58) t= -1.47		(0.56) t= -3.11	
Percent HH without College Ed.	-0.9184 ***	-0.1580	-0.4247 **	-0.1080	-0.9648 ***	-0.1588
	(0.15) t= -6.27		(0.21) t= -2.04		(0.19) t= -5.20	
LOCATION CHARACTERISTICS						
San Francisco CC	42.4671 ***	-0.1071	33.9368 **	0.1229	44.1222 ***	0.1109
	(11.14) t= 3.81		(16.66) t= 2.04		(13.69) t= 3.22	
Distance to Work	-0.4421	-0.0171	0.0017	0.0001	-1.1797	-0.0469
	(0.68) t= -0.65		(1.09) t= 0.00		(0.81) t= -1.46	
Recent Movers	82.5895 ***	0.2043	57.2743 ***	0.1885	81.9544 ***	0.2084
	(9.95) t= 8.30		(15.66) t= 3.66		(11.81) t= 6.94	
Constant	321.2269 ***		246.2642 ***		337.6441 ***	
	(19.19) t= 16.74		(29.75) t= 8.28		(23.23) t= 14.54	
R Squared	0.4773		0.3210		0.4803	
Adjusted R Squared	0.4685		0.2834		0.4674	
Standard Error	129.6722		106.8293		129.1812	
MSE REGRESSION	912,122.5915		97,476.9692		620,940.6005	
MSE RESIDUAL	16,814.8886		11,412.4984		16,687.7790	
SSE REGRESSION	13,681,838.8720		1,462,154.5383		9,314,109.0081	
SSE RESIDUAL	14,982,065.7705		3,092,787.0548		10,079,418.5104	
DF REGRESSION	15		15		15	
DF RESIDUAL	891		271		604	
F	54.2449		8.5413		37.2093	
Sign. F	0.0000		0.0000		0.0000	
N	907		287		620	
CHOW TEST F			1.686485858 **		1.025341764	
CRITICAL F			1.25		1.3	

NOTE: *** Significant at the .01 level ** Significant at .05 level * Significant at .1 level

ESTIMATION OF REGRESSIONS FOR SAN FRANCISCO ALL UNITS, 1985

ependent Variable= Real Rent	All Units (Recent Movers) B	Beta	Low Rent Units (Recent Movers) B	Beta	High Rent Units (Recent Movers) B	Beta
NIT CHARACTERISTICS						
l Bedroom	96.2739 ***	0.2301	59.2362 **	0.1948	116.2116 ***	0.2853
	(22.17) t= 4.34		(32.26) t= 1.84		(27.00) t= 4.30	
2 Bedroom	191.2455 ***	0.4614	156.4600 ***	0.5182	219.4496 ***	0.5444
	(23.20) t= 8.24		(33.71) t= 4.64		(28.25) t= 7.77	
3 Bedroom	300.1958 ***	0.5443	172.7967 ***	0.3273	338.1735 ***	0.6717
	(27.62) t= 10.87		(41.40) t= 4.17		(33.66) t= 10.05	
Extra Baths	48.0269 **	0.0642	57.3632	0.0706	28.8862	0.0442
	(20.19) t= 2.38		(42.44) t= 1.35		(21.85) t= 1.32	
Single Family Unit	41.0949 ***	0.0888	-9.0132	-0.0226	29.2913	0.0684
	(14.66) t= 2.80		(21.69) t= -0.42		(18.24) t= 1.61	
Unit Amenities (Unit Interior)	-0.5572	-0.0019	14.6447	0.0720	-0.6521	-0.0022
	(7.89) t= -0.07		(10.87) t= 1.35		(9.76) t= -0.07	
Unit Amenities (Common Area)	-44.0030	-0.0330	-7.8222	-0.0092	-37.1126	-0.0267
	(35.03) t= -1.26		(45.48) t= -0.17		(45.28) t= -0.82	
Unit Amenities (Mechanical Equipment)	-107.0271 ***	-0.0839	-91.6437 **	-0.1531	-15.8536	-0.0071
	(36.34) t= -2.94		(40.32) t= -2.27		(72.67) t= 0.00	
Unit Amenities (Unit Configuration)	-38.6287 ***	-0.0723	-19.8823	-0.0612	-34.9808 *	-0.0598
	(14.30) t= -2.70		(17.87) t= -1.11		(18.98) t= -1.84	
EIGHBORHOOD CHARACTERISTICS						
leighborhood Amenities	n/a	n/a	n/a	n/a	n/a	n/a
	n/a	n/a	n/a	n/a	n/a	n/a
ercent Zone Black	-3.1507 ***	-0.1855	-1.2662 **	-0.1165	-3.1385 ***	-0.1681
	(0.45) t= -6.99		(0.60) t= -2.12		(0.60) t= -5.21	
ercent HH without College Ed.	-1.4848 ***	-0.2336	-0.5619 **	-0.1188	-1.4720 ***	-0.2330
	(0.17) t= -8.84		(0.25) t= -2.28		(0.21) t= -7.11	
)CATION CHARACTERISTICS						
an Francisco CC	61.5391 ***	0.1356	41.8417 **	0.1241	64.1615 ***	0.1467
	(13.68) t= 4.50		(20.86) t= 2.01		(16.30) t= 3.94	
istance to Work	2.4366 ***	0.0825	1.4012	0.0617	1.9444 *	0.0688
	(0.84) t= 2.88		(1.28) t= 1.09		(1.00) t= 1.95	
ECENT MOVER	83.1252 ***	0.1903	86.6790 ***	0.2643	78.0332 **	0.1861
	(11.50) t= 7.23		(17.18) t= 5.05		(13.69) t= 5.70	
nstant	413.5173 ***		283.5492 ***		422.6527 ***	
	(43.24) t= 9.56		(56.57) t= 5.01		(55.62) t= 7.60	
quared	0.3975		0.3177		0.3694	
justed R Squared	0.3881		0.2813		0.3552	
ndard Error	158.0603		126.0265		157.0946	
E REGRESSION	1,057,038.8745		138,426.4654		641,259.0286	
E RESIDUAL	24,983.0596		15,882.6797		24,678.7252	
E REGRESSION	14,798,544.2424		1,937,970.5161		8,977,626.4006	
E RESIDUAL	22,434,787.5460		4,161,262.0796		15,325,488.3685	
REGRESSION	14		14		14	
RESIDUAL	898		262		621	
	42.3102		8.7156		25.9843	
n. F	0.0000		0.0000		0.0000	
	913		277		636	
OW TEST F			1.815916634 **		1.041653035	
TICAL F			1.25		1.3	

TE: *** Significant at the .01 level ** Significant at .05 level * Significant at .1 level