

Modeling firm relocation: identifying significant factors

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UrbanSim 2010

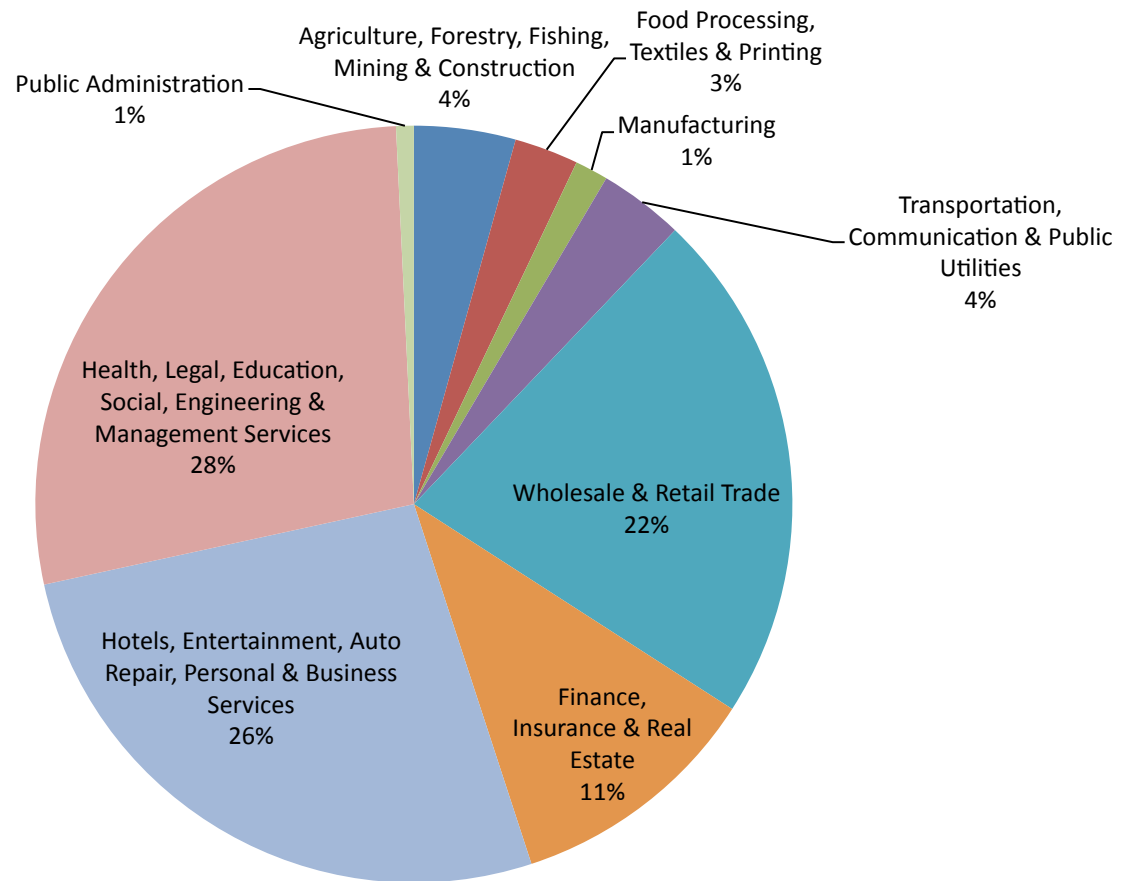
UC Berkeley

The NETS Survey

- National Establishment Time-Series Database, panel data from 1990 - 2005
- Tracks size, type, location, and economic characteristics of firms
- San Francisco has a population of about 40-50,000 firms in any given year

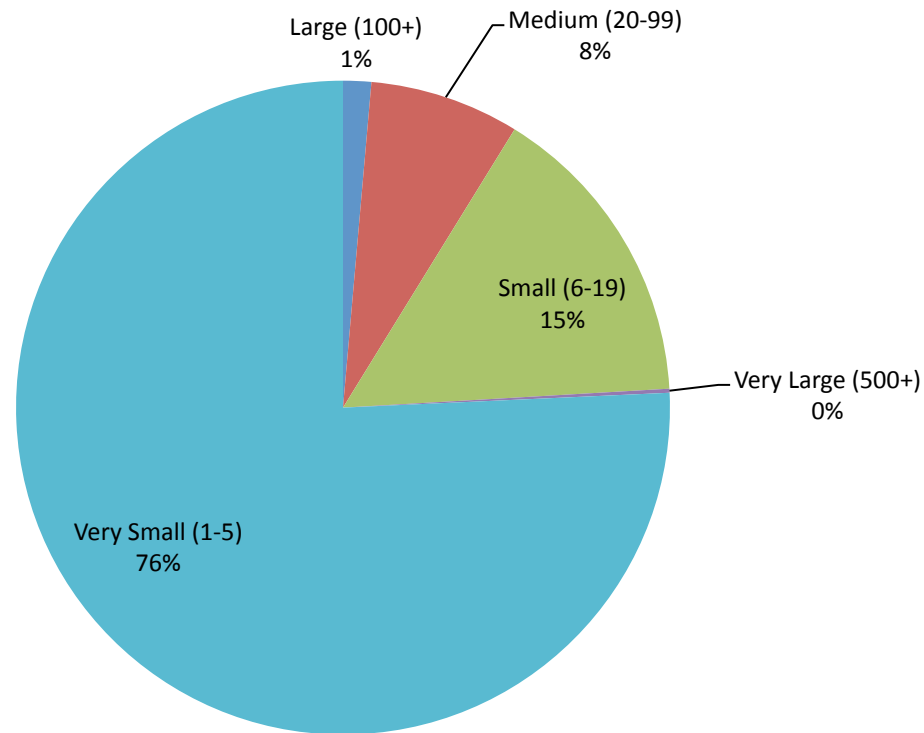
San Francisco's Population of Firms

Firms by Industry, 2005



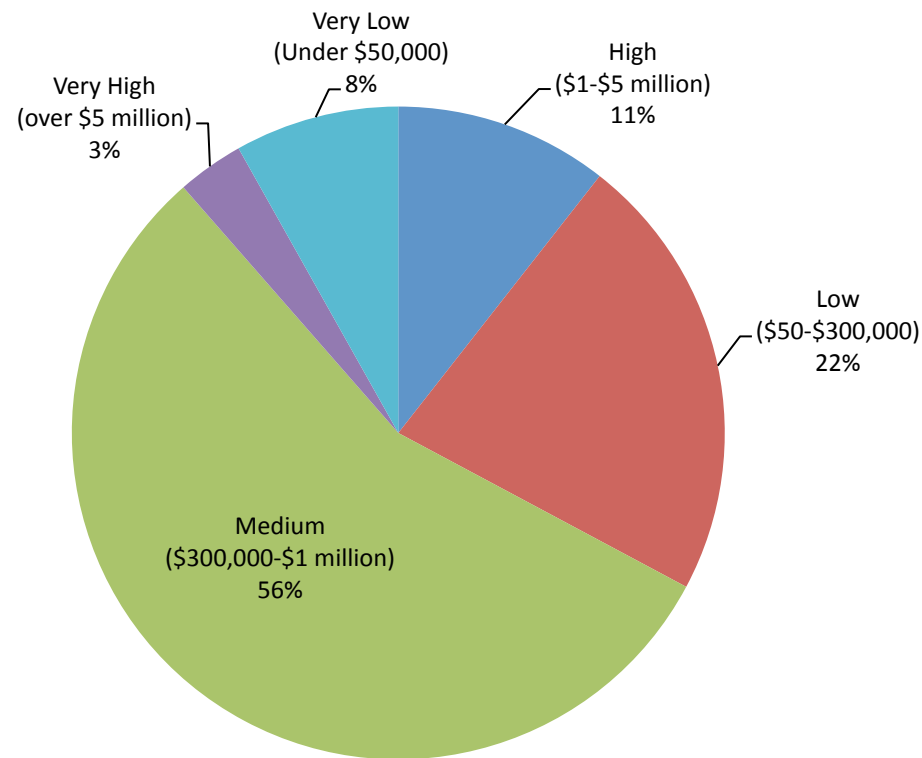
San Francisco's Population of Firms

Firms by Size, 2005



San Francisco's Population of Firms

Firms by Local Sales Volume, 2005



Dependent variable: Firm Relocation

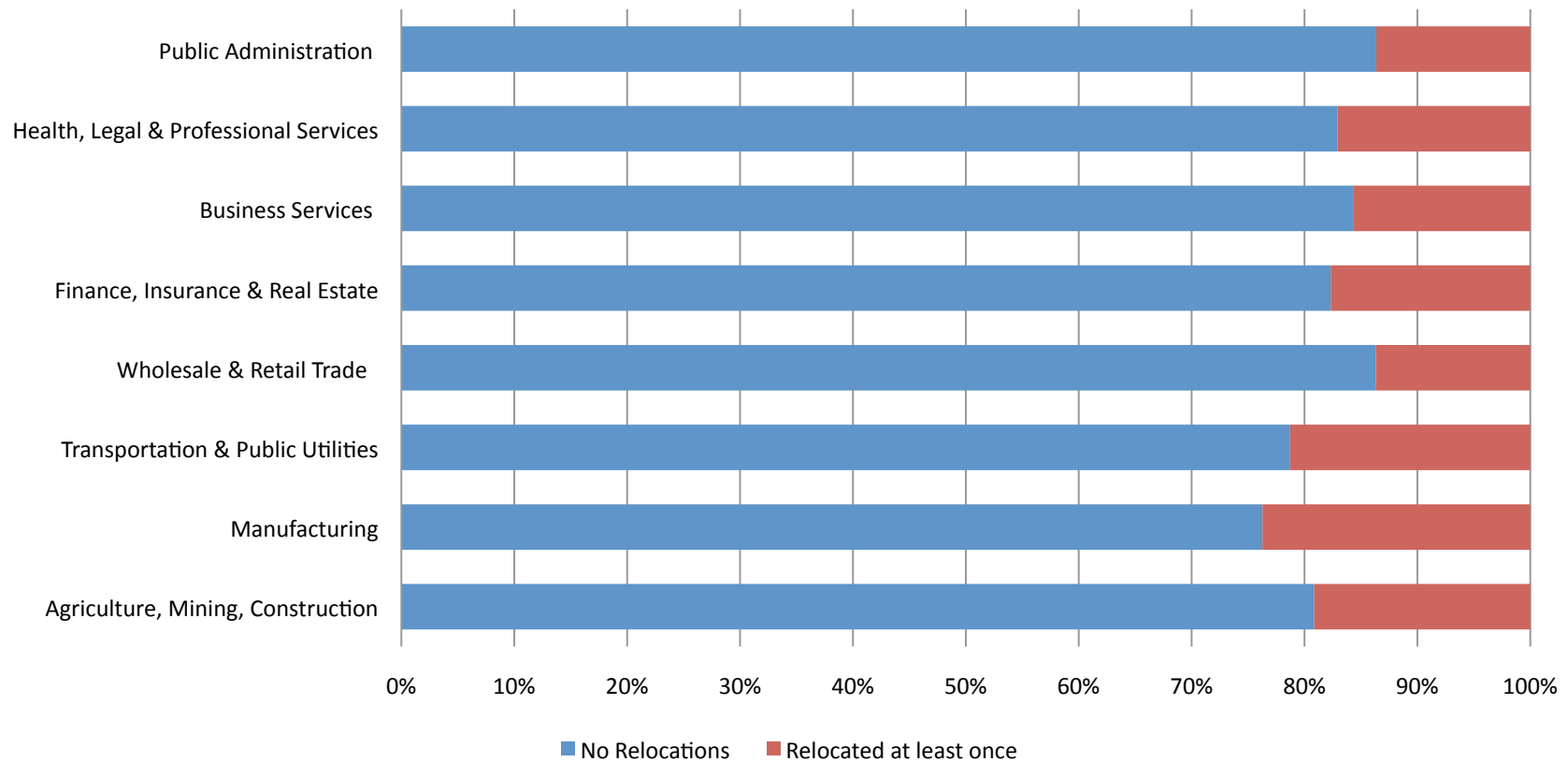
- From 1990 – 2005, there were 124,000 cases in the NETS database, including firms which entered or left San Francisco
- There were 20,000 cases where the firm relocated at least once
- I created variables representing whether the firm relocated
 - Within San Francisco
 - Within the Bay Area region (9 counties)
 - Elsewhere

Characteristics of firms that relocated

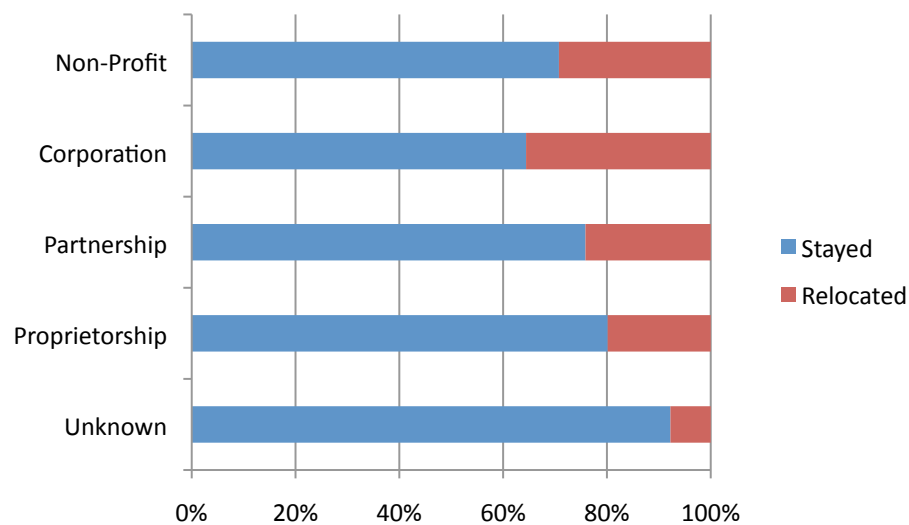
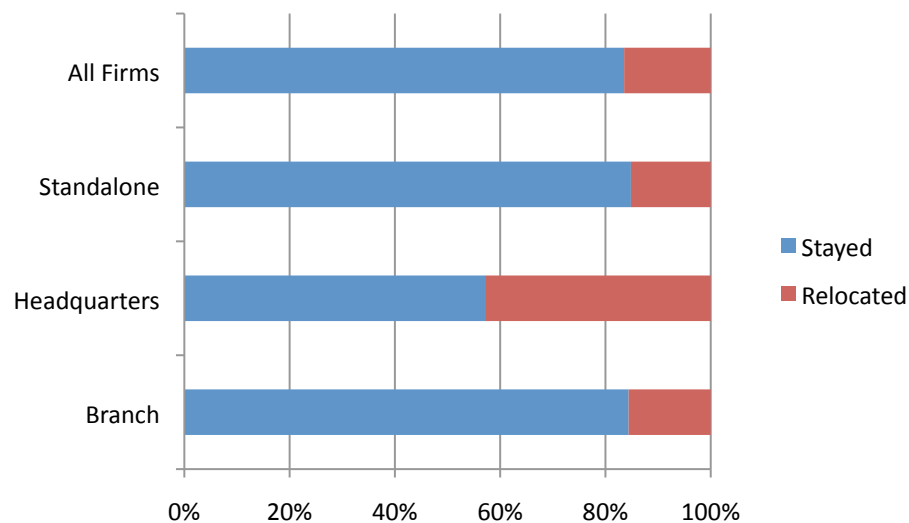
- I added wage data from the BLS and travel data from the Census
- Firms were categorized for analysis by
 - Industry code (SIC2)
 - Size (small, medium, large)
 - Median wage level (high, medium, low)
 - Organizational level (headquarters, branch, standalone)
 - Legal status (corporation, partnership, proprietorship, non-profit)

Relocation rate varied by industry, with land-intensive firms most likely to move

Firm Relocation Rate by Industry

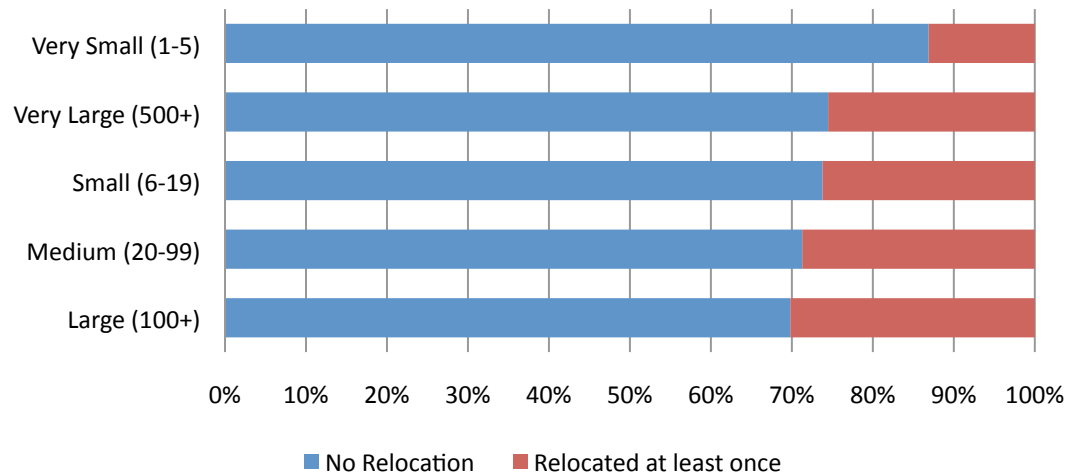


Corporations and headquarters were more likely to relocate

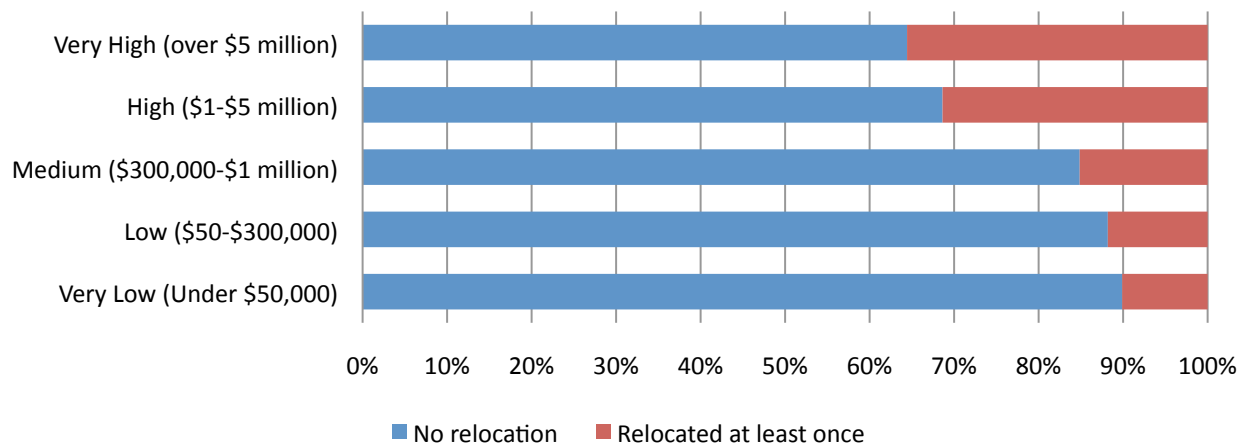


Larger and higher sales volume firms were more likely to relocate

Firm relocation rate by firm size

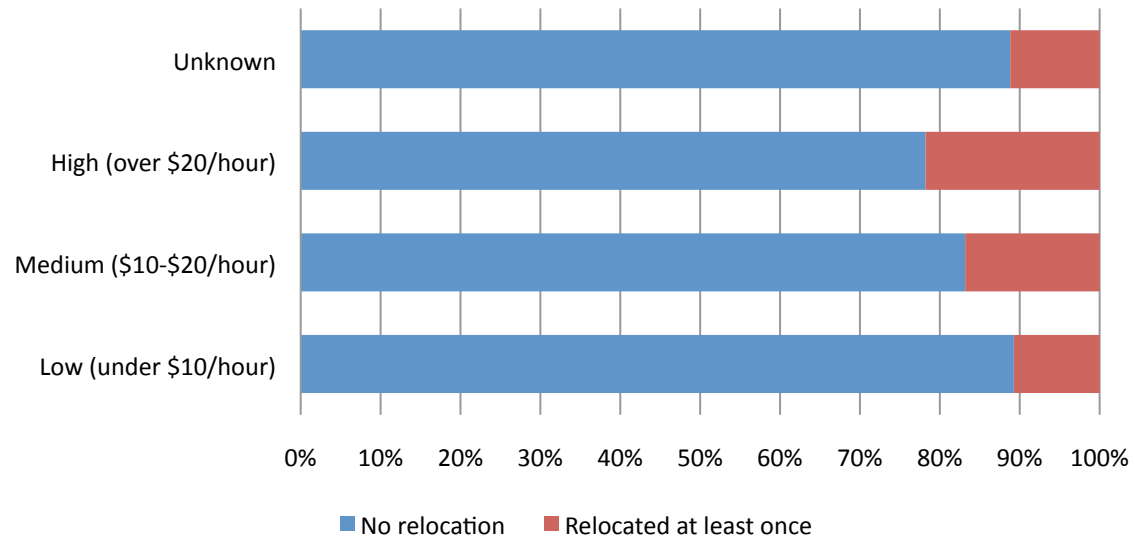


Firm relocation by sales volume



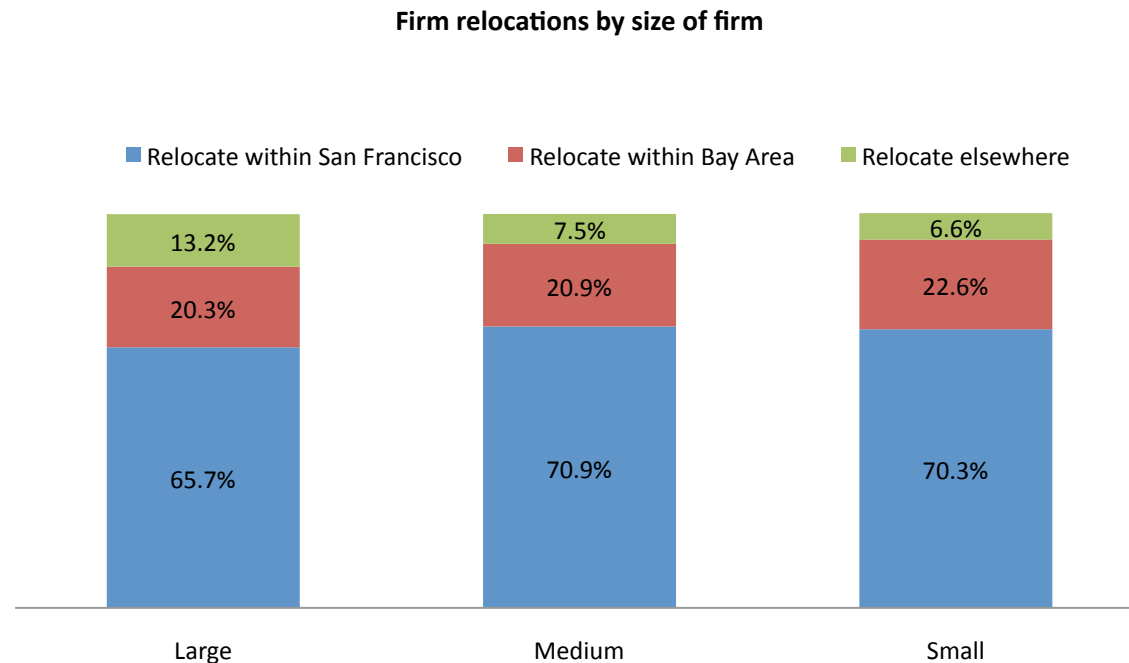
Higher wage firms were more likely to relocate

Firm relocation rate by wage level (2000)

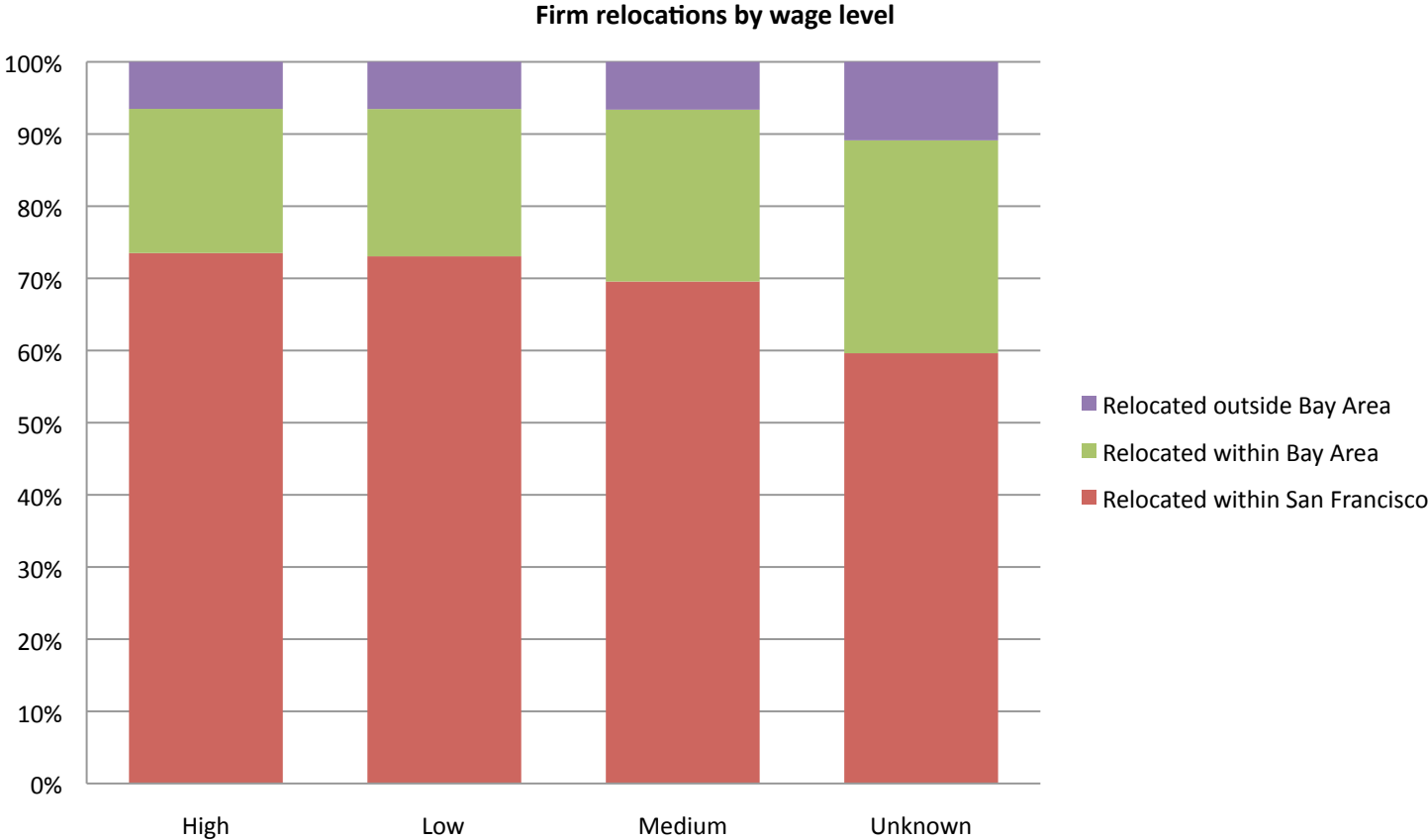


Among firms that relocated, large firms were more likely to leave the Bay Area

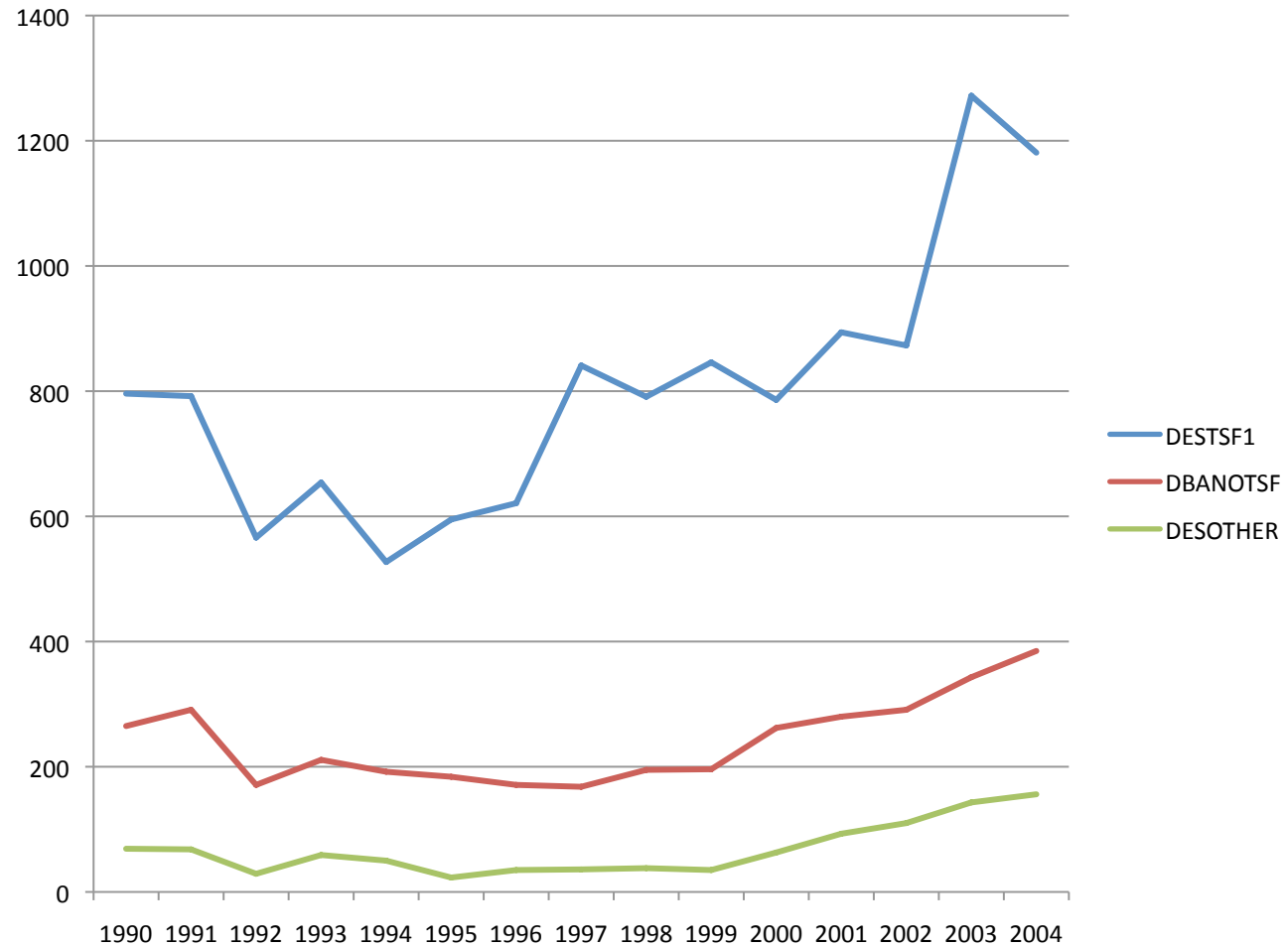
- In general, about 70% of firm relocations were within San Francisco, and Large and Medium firms relocated within the Bay Area at the same rate



High wage firms were more likely to relocate, but just as likely to remain in SF



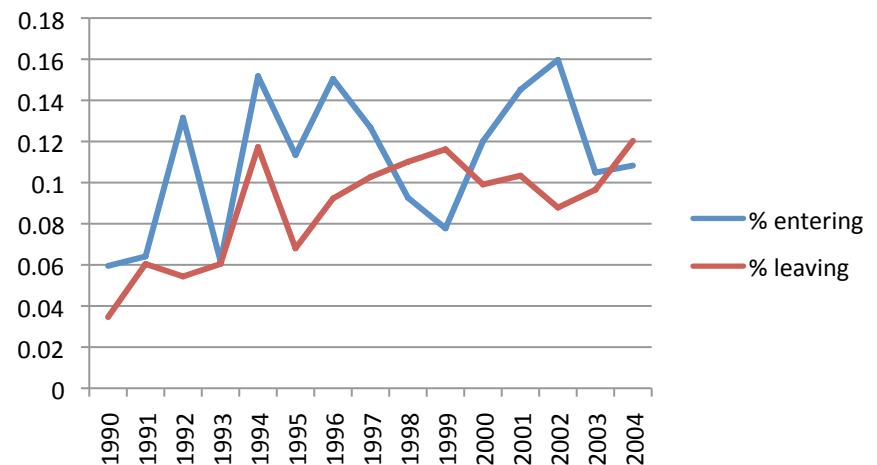
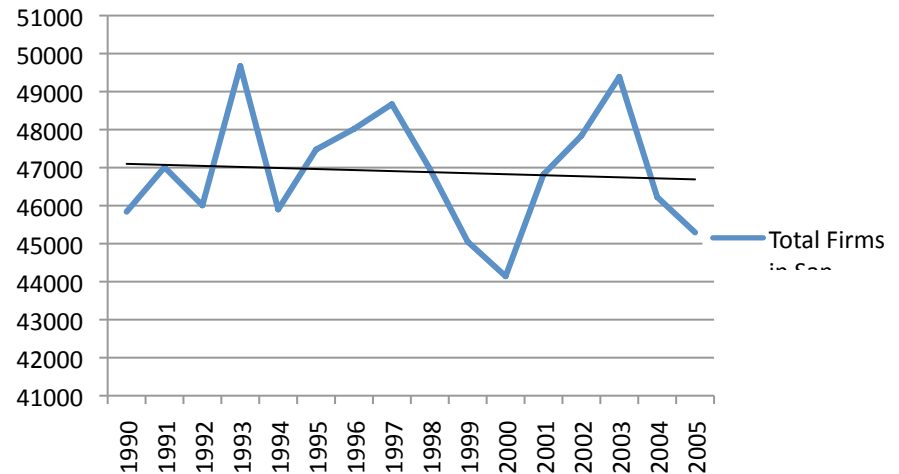
The rate of firm relocation increased during this timeframe



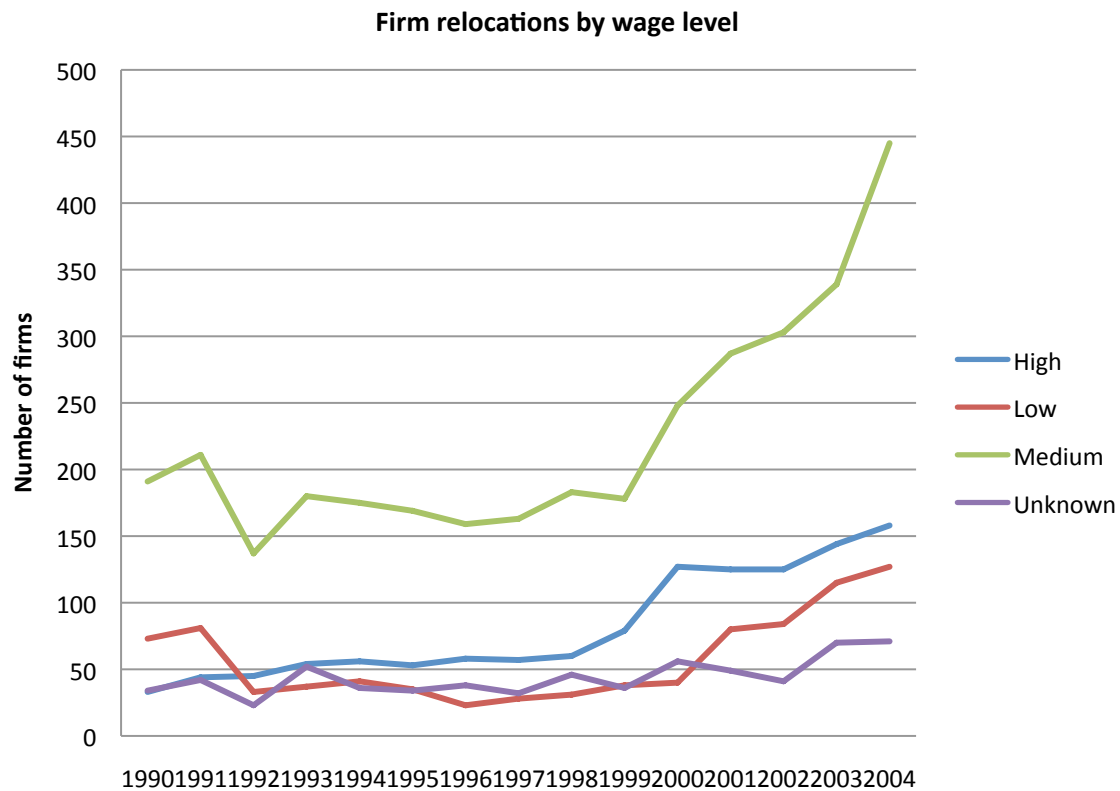
SF experienced a net loss of firms from 1990 - 2005

The replacement rate of new firms that either moved into San Francisco or were “born” there was exceeded by the rate they moved out of the city or “died” there

Total Firms in San Francisco



Firms with mid-level median wages relocated at a faster rate

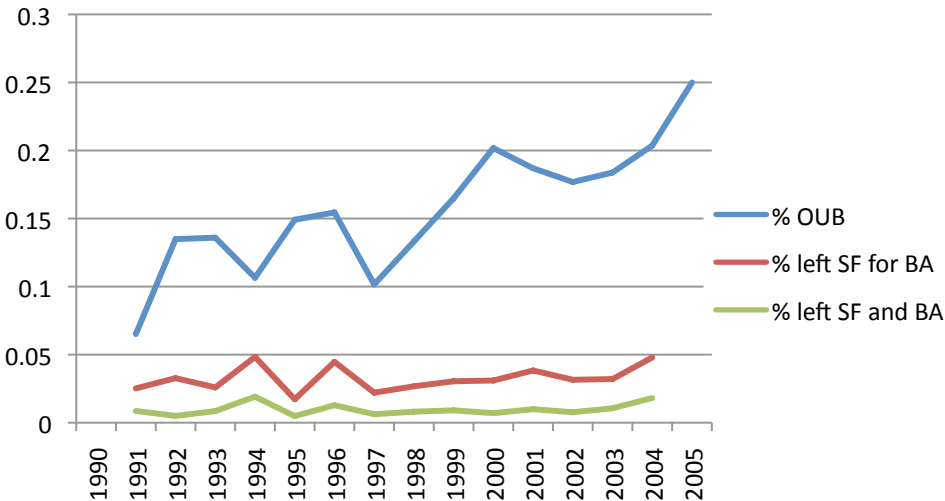
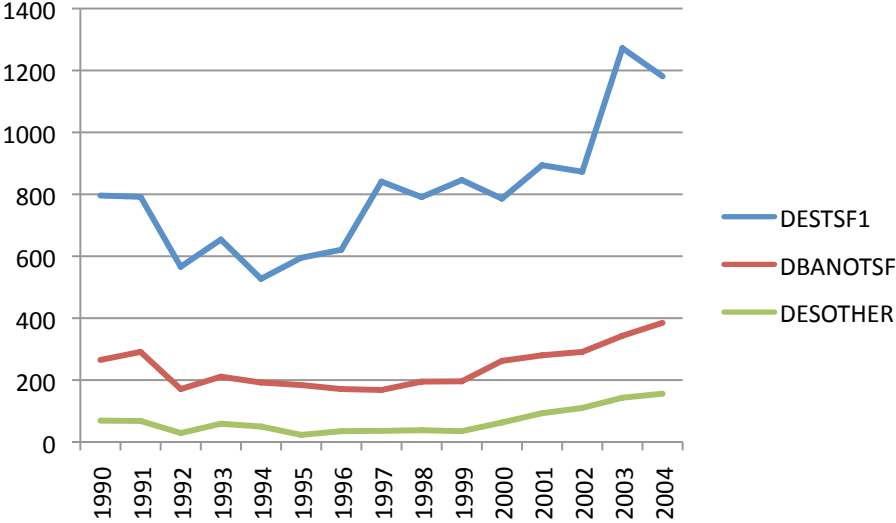


Firms were more generally more likely to relocate within SF than outside

Firms that left SF were more likely to relocate within the Bay Area (BA) than to leave it

The rates of firm relocations and going out of business (OUB) roughly track each other

This reflects the bust of the dot com bubble after the year 2000



Bay Area cities that were the destination of more than 50 SF firms

It appeared that most firm relocations within the Bay Area were to cities with excellent transit, and good proximity to airports, especially international airports

Destination City	Number of Firms	BA County	Near Intl Airport	Near Small Airport	Near BART
OAKLAND	534	Alameda	1		1
SOUTH SF	341	San Mateo	1		1
SAN RAFAEL	259	Marin			
BURLINGAME	204	San Mateo	1		1
DALY CITY	203	San Mateo			1
MILL VALLEY	172	Marin			
SAUSALITO	171	Marin			
SAN MATEO	168	San Mateo	1		1
BERKELEY	155	Alameda			1
WALNUT CREEK	151	Contra Costa		1	
NOVATO	106	Marin			
LOS ANGELES	90		1		
EMERYVILLE	90	Alameda			
HAYWARD	85	Alameda		1	1
SAN JOSE	82	Santa Clara		1	
SAN BRUNO	81	San Mateo	1		1
SAN LEANDRO	80	Alameda	1		1
CORTE MADERA	75	Marin			
BRISBANE	74	San Mateo	1		1
		Total	8	3	10

A binary logit model was estimated to predict firm relocation

- Dependent variable: relocate or not

Predictors:

- SIC4 code
- Median wage by SIC2 industry code in 2000
- Number of employees
- Sales in most recent year on record

Model results

- Dependent variable RELO123: 1 = at least 1 relocation, 0 = no relocations (in 15 year timeframe)
- Significant predictors represented with dummy variables included
 - Corporation
 - Headquarters
 - Small firm
 - High and medium wage level

Ongoing Research Question

- Which types of firms more sensitive to travel cost (time and direct cost), such that it may affect their relocation decision?
- More detailed analysis of the set of firms that relocated and where they went
- Several variables representing accessibility and travel time cost tested

Conclusions

- There is a trend of an increasing number of firms relocating out of San Francisco
- A firm that relocates is more likely to be a corporation, a headquarters, a small firm (less than 25 employees) and to belong to an industry that pays medium to high wages (at or above the median wage level)
- Transportation accessibility in the destination county is a significant factor for firms that relocate within the Bay Area

How to measure the sensitivity of firms to increasing costs?

Three variables were created as indicators of a firm's sensitivity to rising commute costs

1. Accessibility Factor
2. Dominant commute mode in Bay Area county (drive, transit, carpool)
3. Travel time delay (wage rate x average commute time by income level)

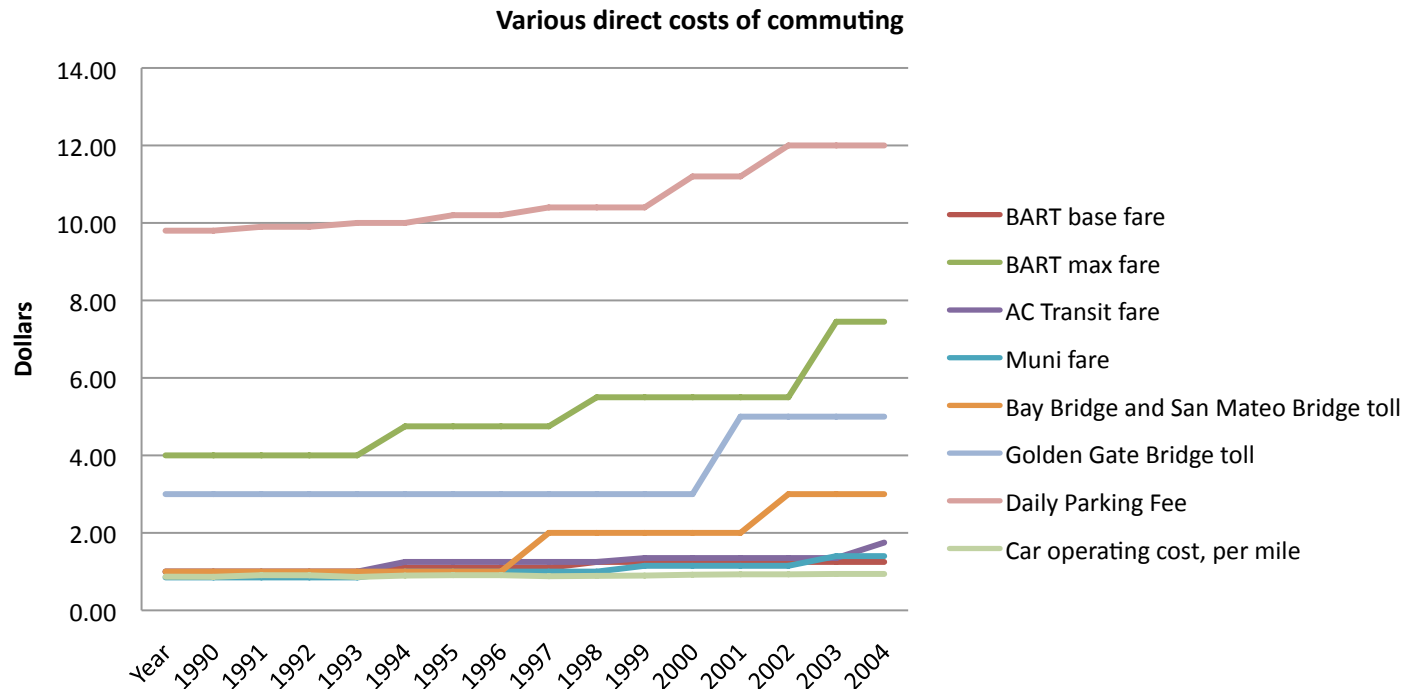
These factors were applied to 20,000 cases where firms relocated

Top 25 industries, by employment

Total Employees	Total Firms	Emp's/ Firm	Relocation Rate	SIC2 (Standard Industry Code, first 2 digits)
157,712	19,122	8	18.9%	73 BUSINESS SERVICES
112,479	10,770	10	22.3%	87 ENGINEERING & MGMT SERVICES
99,852	6,676	15	10.5%	80 HEALTH SERVICES
62,836	4,961	13	9.4%	58 EATING AND DRINKING PLACES
43,711	1,235	35	24.3%	48 COMMUNICATION
42,071	5,043	8	22.0%	81 LEGAL SERVICES
39,974	4,559	9	21.7%	50 WHOLESALE TRADE DURABLE GOODS
37,947	1,273	30	16.5%	82 EDUCATIONAL SERVICES
37,912	8,354	5	11.8%	59 MISCELLANEOUS RETAIL
37,669	797	47	12.3%	60 DEPOSITORY INSTITUTIONS
35,049	3,787	9	19.7%	51 WHOLESALE TRADE NONDURABLE GOODS
34,446	5,249	7	14.7%	65 REAL ESTATE
34,198	1,688	20	22.8%	62 SECURITY AND COMMODITY BROKERS
31,341	695	45	9.1%	70 HOTELS AND OTHER LODGING PLACES
27,840	2,083	13	21.9%	27 PRINTING AND PUBLISHING
26,097	3,483	7	11.1%	86 MEMBERSHIP ORGANIZATIONS
22,916	2,394	10	13.1%	83 SOCIAL SERVICES
21,575	332	4	30.7%	63 INSURANCE CARRIERS
21,070	5,909	4	8.9%	72 PERSONAL SERVICES
19,035	1,536	12	20.8%	64 INSURANCE AGENTS, BROKERS, & SERVICE
18,787	2,983	6	18.8%	15 GENERAL BUILDING CONTRACTORS
14,120	2,239	6	18.6%	17 SPECIAL TRADE CONTRACTORS
978,637	95,168	15	17.3%	

General trend: Commuting costs increased from 1990 - 2005

- Transit fares and bridge tolls rose at a faster rate after the year 2000 than before



1. Accessibility factor

- Each Bay Area county was weighted with an accessibility factor based upon its transportation infrastructure

County Accessibility Characteristics	Intl Airport	Small Airport	BART	Toll bridge	Ferry	Accessibility Factor
Alameda	1	1	1	1	1	5
Contra Costa		1	1	1		3
Marin				1	1	2
San Mateo	1	1	1	1		4
San Francisco			1	1	1	3
Santa Clara		1				1
Sonoma		1				1
Napa		1				1
Solano				1	1	2

2. Commute mode factor

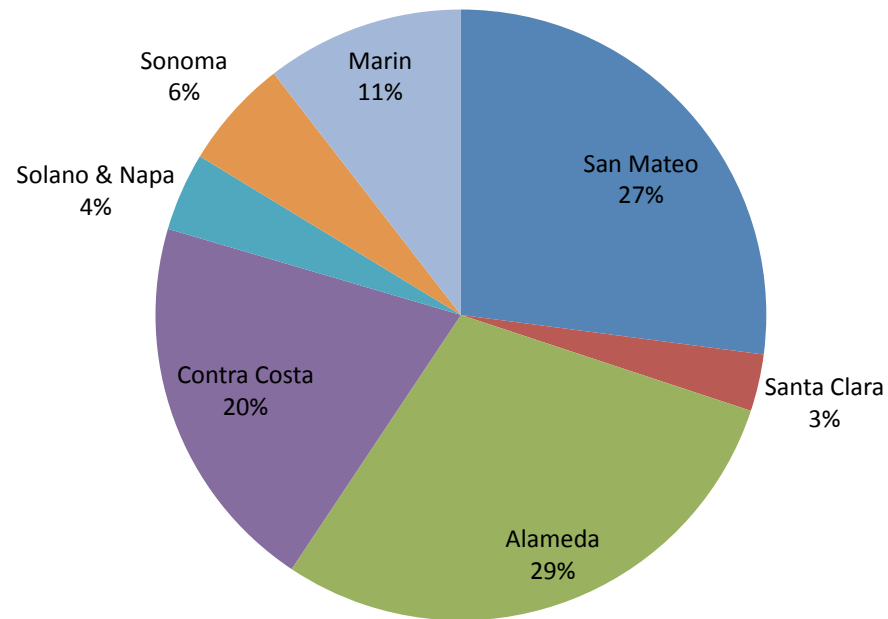
- Firms that relocated were coded by the dominant commute mode in their destination county
- Code represents the dominant mode used by commuters to get to jobs in San Francisco (from MTC 2000 county-to-county worker flow report)

Dominant commute mode in destination county

San Francisco	Transit
San Mateo	Drive alone
Santa Clara	Drive alone
Alameda	Transit
Contra Costa	Transit
Solano	Carpool
Napa	Drive alone
Sonoma	Drive alone
Marin	Drive alone

Most workers commute from adjacent counties with good transit connections

Workers commuting to firms in San Francisco



(Data from the from MTC 2000 county-to-county worker flow report)

3. Commute time sensitivity factor

A “commute time sensitivity factor” was calculated for each firm,

= **wage x employees x travel time**

- Median hourly wage for industry (high, medium, low)
- Number of employees in most recent year
- Median commute time for workers by income category (From a 1990 report by the MTC in 2000 which analyzed median commute distance and time by household income quartile)

High income (above \$75,000) = 19 minutes

Medium income (\$25,000 - \$75,000) = 16 minutes

Low income (under \$25,000) = 14 minutes

Note: This is a crude measurement of travel time cost, as it represents an approximation of the one-way travel cost of all employees at a firm by the median industry wage. It does not distinguish wage difference by occupation, or mode split among employees, or home location of employees.

Firms with high sensitivity to travel cost were more likely to relocate

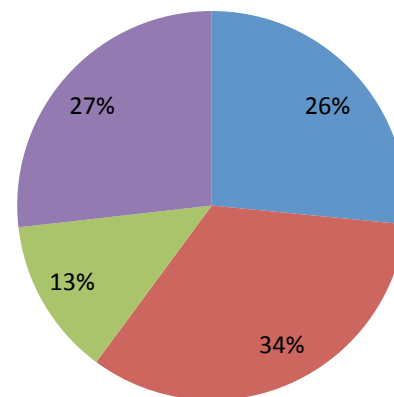
The rate of relocation was highest among firms that had high travel costs

Firms were categorized by the order of magnitude of travel time cost factor

- Extremely high = over \$100,000
- High = \$10,000 - \$100,000
- Medium = \$1,000 - \$10,000
- Low = up to \$1,000

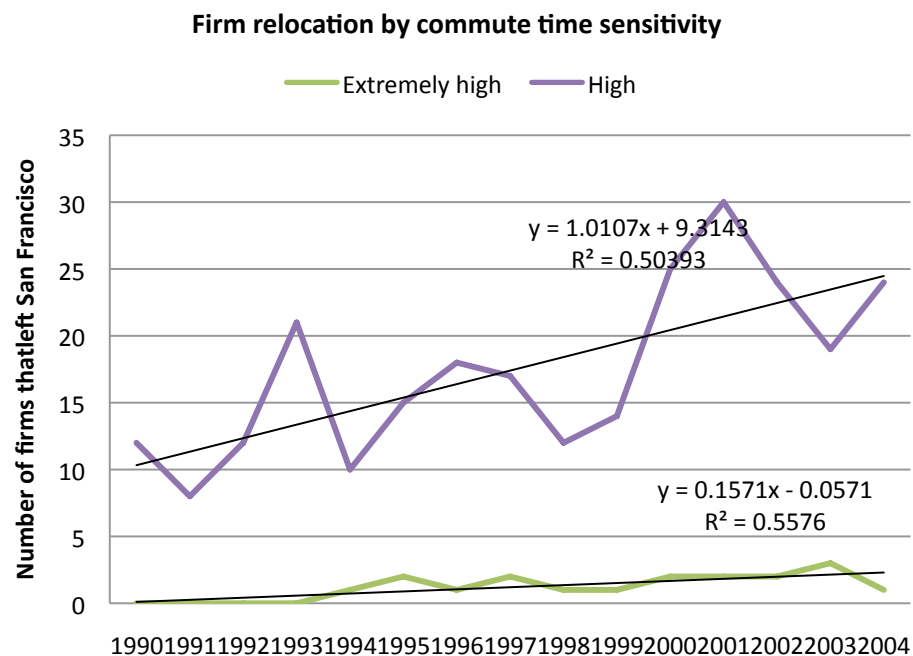
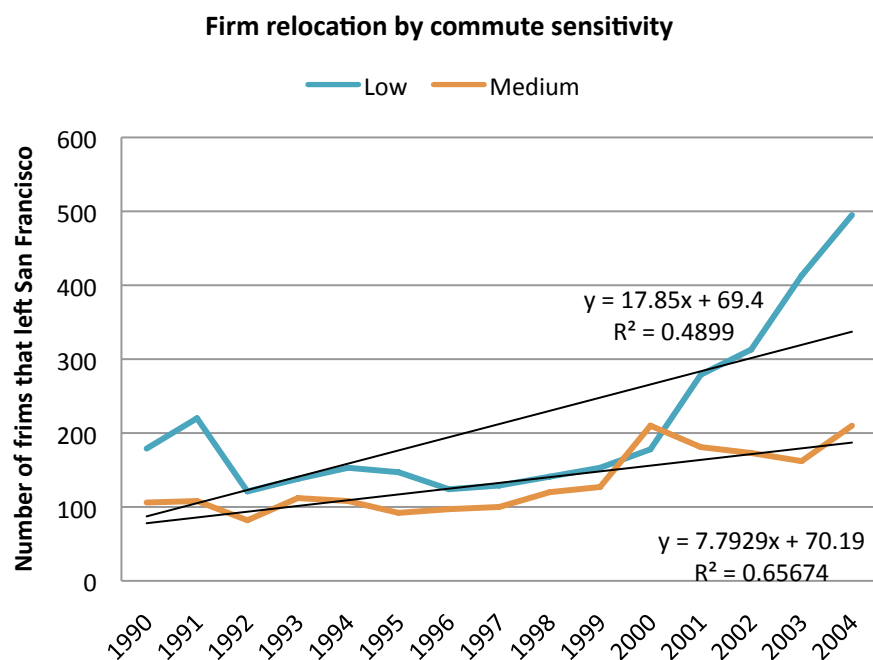
Firm relocation rates by travel cost sensitivity

■ Extremely high ■ High ■ Low ■ Medium



Relocation rates by commute time sensitivity

- Relocations have been increasing among all firms
- Low and medium sensitivity firms have the highest rate of relocation, they are likely less location- or access-dependent industries



Based on this data analysis, predictor variables were identified for binary a logit model

- Dependent variable: Relocate within SF or out
- Predictor variables:
 - Same as before, but with Commute Sensitivity factors:
 - Accessibility by county
 - Dominant commute mode by county
 - Travel time cost by firm

Model 2:

Dependent variable is relocation within Bay Area

- A simple base model did not have great predictive power
- Local sales volume was not a significant predictor

1. Accessibility factor

- This variable made a significant contribution to the model
- It was correlated with the transportation infrastructure in the destination county to which the firm relocated
- Counties with greater transportation access attracted more firms

■■■■■

■■■

2. Commute mode factor

- This variable made the most significant contribution to the model
- Only one category was significant, Transit County
- Counties where transit is the dominant mode used by commuters with jobs in San Francisco were negatively correlated with firm relocations
- This result needs more investigation, as it contradicts the expectation from looking at the data- it should be positive, so something may be wrong with this variable

3. Commute time sensitivity factor

- This variable did not add much to the model
- Firms with a low commute time sensitivity were the most significant factor, and were negatively correlated with relocation
- Firms with an extremely high commute time sensitivity were also a significant predictor, and were positively correlated with relocation

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