Jobs-Housing Balance, Self-Containment, and Commuting: Evidence from the San Francisco Bay Area, 1980-1990

Kang-Li Wu and Robert Cervero

June 1997

Abstract

The debate over jobs-housing balance as public policy turns on the question of whether market forces, left unobstructed, effectively work to allow people and firms co-locate so as to reduce imbalances. This paper tests the co-location hypothesis by examining changes in ratios of jobs to employed residents in 23 large San Francisco Bay Area cities during the 1980s. Imbalances were found to have generally declined regionwide. This was mainly because dormitory communities in 1980 had attracted businesses by 1990. However, imbalances generally worsened in jobs-surplus cities, particularly those in the Silicon Valley. Little association was found between jobs-housing balance and self-containment. Several Bay Area cities are nearly perfectly balanced, yet fewer than a third of workers reside locally, and even smaller shares of residents work locally. Restricted housing production, especially in fast-growing cities, has in many instances raised housing prices, displacing workers and increasing average commute distances. Eliminating barriers to residential mobility and housing production would allow more housing and jobs to co-locate in the future.

All tables and figures included in this paper appear in Wu's masters thesis and were also partly produced as part of a UCTC research project. The views and opinions expressed are those of the authors, and not necessarily those of the project sponsors.

Jobs-Housing Balance, Self-Containment, and Commuting: Evidence from San Francisco Bay Area, 1980-1990

1. Introduction

The debate over jobs-housing balance as a tool for reducing traffic congestion and improving environmental conditions has heightened over the past decade. Critics doubt whether jobs-housing balance will ever produce significant transportation and air quality benefits for various reasons: workers in two-earner households usually work in different locations; frequent job turnover reduces the ability to locate with reference to one's workplace; residential mobility continues to be hindered by exclusionary zoning policies and housing discrimination; and factors other than job access, such as quality of schools, are increasingly influencing residential location choices (see Giuilano, 1991). Others argue that regional balance is a natural evolutionary process wherein jobs and housing co-locate so as to maintain an equilibrium in average commuting times, consistent with time budget theory (Lowry, 1988; Richardson and Gordon, 1989). An example of co-location , according to Gordon et al. (1991), was the migration of jobs to the suburbs during the past two decades, resulting in polycentric urban structures that reduced commuting times. Using data from the 1980 census and the 1985 Annual Housing Survey, they found that average commuting times fell for 18 of the 20 largest United States metropolitan areas during the first half of the 1980s. Wachs et al. (1993) recently traced changes in journeys-to-work for over 8,000 hospital workers in Southern California, finding that the average commute times remained fairly constant and that average commute distances actually decreased slightly, from 10.0 miles in 1984 to 9.7 miles in 1990. And in the greater Washington, D.C. area, Levinson and Kumar (1994) have shown that while traffic congestion and commuting distances are rising, commuting durations are holding steady.

Other data, however, paint a much different portrait of recent commuting trends. According to the National Personal Transportation Survey (NPTS), the average commute length in the United States increased from 9.2 miles in 1983 to 10.6 miles in 1990 (Hu and Young 1992). And in contrast to the findings of Gordon et al. (1991), Rosetti and Eversole (1993), drawing on census data, show that mean commute times increased from 1980 to 1990 in 35 of

the 39 metropolitan areas with 1990 populations over one million. Moreover, other empirical research suggests jobs-housing balance can produce transportation and environmental benefits. In a study of 1989 travel in the greater Seattle-Tacoma region, Frank and Pivo (1994) found that travel distances and times were generally lower for commutes to balanced areas. The average distance of work trips ending in balanced census tracts (with jobs-to-households ratios of 0.8 to 1.2) was 29 percent shorter (6.9 versus 9.6 miles) than the distance of trips ending in unbalanced tracts. A study by Ewing (1995a), "Before We Write Off Jobs-Housing Balance . . .", used 1990 census data to compute the proportion of work trips that remain within more than 500 cities and towns in Florida. From a regression analysis, Ewing found that the share of "internal," or within-community, commutes significantly increased with greater balance in the numbers of local jobs and working residents.

It is because of conflicting research evidence that the jobs-housing balance debate today continues in earnest. However, we feel that the debate has been miscast. Numerical balances do not guarantee trip reduction. More important is the concept of "commuting self-containment" -- the degree to which journeys-to-work are internalized within a subregion. Only then can reduced trip-making result as regions grow. Additionally, we believe debates over numerical balance have masked what is a more important issue -- lags in housing production that raise median housing prices beyond the reach of most workers, pricing them out of the local housing market. Eliminating market distortions so that healthy housing can emerge is likely to reap greater transportation and environmental benefits than mandating parity in the quantity of housing units and jobs.

To test these propositions, this paper examines 1980 and 1990 data on jobs-to-resident ratios and levels of self-containment for the largest cities in the San Francisco Bay Area. Whether cities have naturally evolved into more balanced and self-contained places, and the implications for commuting, are examined. We also examine whether "jobs-housing balance" or "self-containment" more strongly correlates with commuting patterns. The research also explores whether there were patterns in the kinds of cities that became more balanced during the 1980s or less balanced -- for example, whether bedroom communities or jobs-surplus communities. The research builds upon previous work of Cervero (1986a, 1989) on jobs-housing balance in the Bay

Area and is based on jointly conducted research of the two authors, summarized in Wu (1995) and Cervero (1996). Since the San Francisco region has not embarked on any significant regional programs to balance employment and residential development, it represents a context where market forces alone have largely shaped metropolitan growth; accordingly, the region can provide insights into the degree to which the co-location hypothesis holds. The Bay Area is also a suitable case context because of the rapid rates of suburbanization there during the 1980s. The share of jobs outside of the central cities (San Francisco, Oakland, and San Jose) increased from 59.8 percent in 1980 to 64.7 percent in 1990.

The macro-level study of jobs-housing balance in Bay Area cities is followed by a micro-level investigation of the residential locations and commuting patterns of workers from Pleasanton, a fast-growing suburban community. Particular attention is given to changes in commuting distances and to the influences of housing prices on the residential locational choices of Pleasanton's work force. The paper concludes with a discussion of the policy implications of the research findings.

2. Jobs-Housing Balance Trends in the Bay Area

Using 1980 census data on place of residence and employment for the Bay Area's largest cities, Cervero (1989) reported considerable jobs-housing imbalances and suggested these imbalances were a root cause of worsening suburban traffic congestion. Table 1 updates the index of jobs-to-employed residents to 1990 for the 23 largest cities (in 1990), and shows percentage changes during the 1980s. (Cities have been ordered in Table 1 from the highest to the lowest 1990 J/ER ratios.) Map 1 shows the locations of the 23 Bay Area case cities. Both years of data were obtained from the U.S. Census Population and Housing data files.

Before interpretting these data, several caveats are necessary. One, ratios of jobs-to-employed residents (J/ER) are presented in lieu of jobs-to-housing ratios since the latter index must be adjusted for average number of workers per household, not easily obtainable; a jobs-to-employed-resident ratio requires no such adjustment. Second, the use of cities as geographic units for measuring balance is admittedly suboptimal, since municipal boundaries are political artifacts that do not always capture the spatial dimensions of commute sheds (Cervero 1989;

Table 1. Jobs-Housing Balance Statistics for Large Cities in the San Francisco Bay Area, 1980-1990

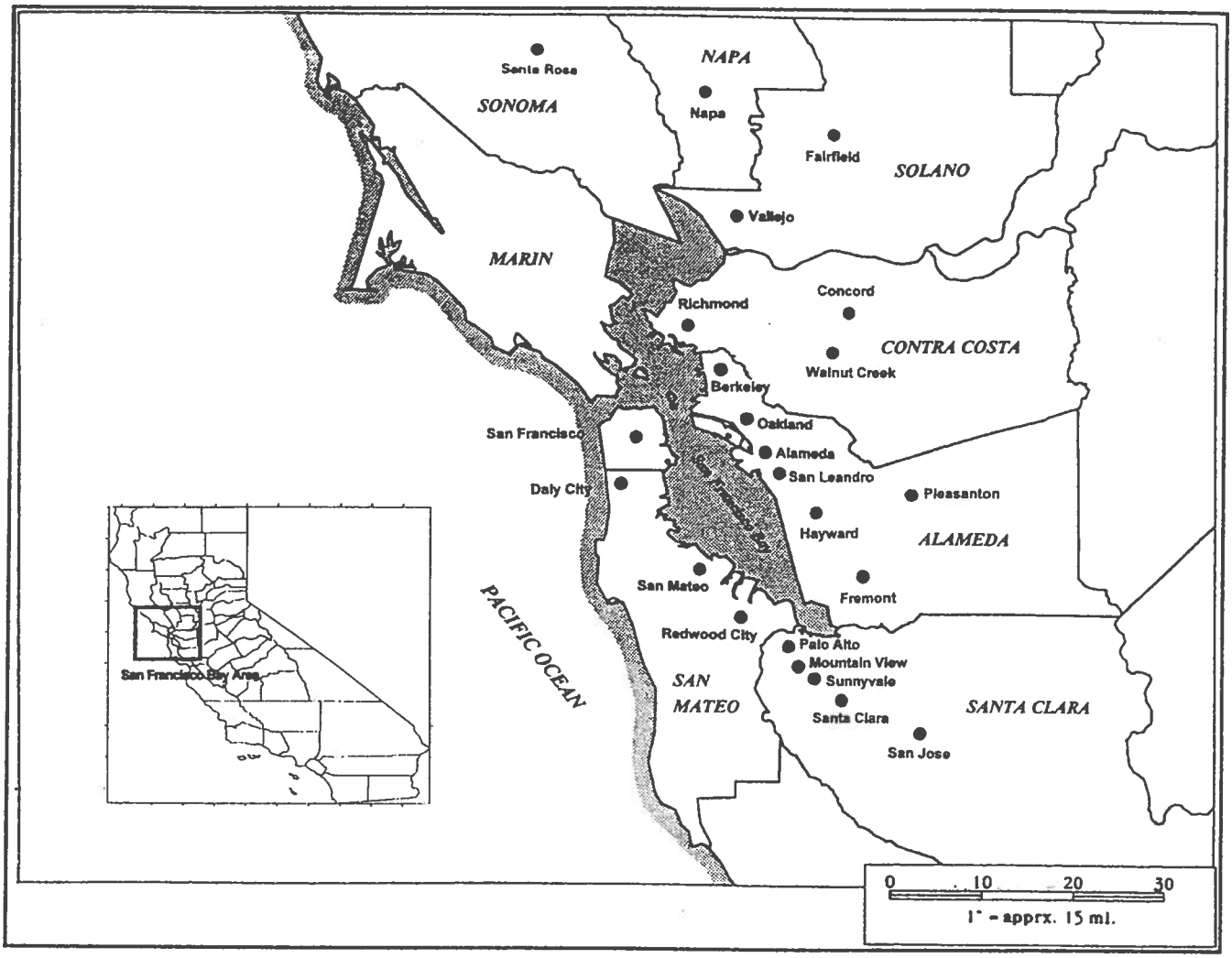
Cities	(1) Employed Residents			(2) Total Workers (Jobs)			(3) Jobs to Employed Residents Ratio		
	1980	1990	% Change	1980	1990	% Change	1980	1990	% Change
Palo Alto	30,550	31,720	3.8	61,912	79,232	28.0	2.03	2.50	7.3
Santa Clara	48,262	53,687	11.2	83,067	108,924	31.1	1.72	2.03	2.8
Sunnyvale	60,526	69,332	14.5	90,603	109,684	21.1	1.50	1.58	1.4
Walnut Creek	25,194	30,645	21.6	29,970	47,965	60.0	1.19	1.57	2.8
San Francisco	333,762	382,309	14.5	458,745	567,112	23.6	1.37	1.48	1.6
Berkeley	49,767	54,590	9.7	58,995	74,859	26.9	1.19	1.37	2.8
Santa Rosa	35,680	54,459	52.6	39,665	69,104	74.2	1.11	1.27	1.4
San Leandro	30,767	33,566	9.1	38,676	42,059	8.7	1.26	1.25	1.0
Hayward	44,608	54,012	21.1	50,238	67,508	34.4	1.13	1.25	1.6
Pleasanton	17,024	29,570	73.7	7,161	33,325	365.4	0.42	1.13	5.0
Oakland	140,114	160,160	14.3	166,102	177,810	7.0	1.19	1.11	0.5
Redwood City	29,267	35,807	22.3	24,568	37,569	52.9	0.84	1.05	2.4
Mountain View	35,732	42,132	17.9	47,160	43,490	-7.8	1.32	1.03	-0.4
Fairfield	25,558	37,015	44.8	23,024	36,903	60.3	0.90	1.00	1.3
Richmond	28,662	37,916	32.3	31,518	36,229	14.9	1.10	0.96	0.5
San Mateo	41,383	47,192	14.0	33,484	45,069	34.6	0.81	0.96	2.5
Napa	23,559	29,013	23.2	17,405	27,649	58.9	0.74	0.95	2.5
Concord	51,260	59,658	16.4	35,071	56,449	61.0	0.68	0.95	3.7
Alameda	33,200	43,668	31.5	22,354	39,992	78.9	0.67	0.92	2.5
San Jose	301,769	400,932	32.9	200,791	334,630	66.7	0.67	0.83	2.0
Vallejo	34,683	49,906	43.9	29,859	39,509	32.3	0.86	0.79	0.7
Fremont	63,879	94,769	48.4	33,982	71,771	111.2	0.53	0.76	2.3
Daly City	38,775	47,420	22.3	13,603	20,666	51.9	0.35	0.44	2.3
Unweighted Average	66,260	81,716	25.9	69,476	94,239	56.4	1.02	1.18	2.2
Standard Deviation	83,133	101,711	16.9	96,774	122,833	72.7	0.41	0.44	1.6

Notes:

(1) Number of residents in the city who are employed

(2) Number of workers in the city

(3) Total workers divided by total employed residents, (2)/(1)



Map 1. Case-Study Cities: Twenty-Three Largest Cities in the San Francisco Bay Area

Downs 1992; Giuliano and Small 1993).[1] As Hamilton et al. (1991) note, however, there is merit in using cities to analyze jobs-housing balance, since they are the entities empowered to regulate land use (mainly through zoning) and are most directly responsible for how metropolitan areas grow. Battles over jobs and housing also are most often waged at the municipal level. Nonetheless, the geographic size of cases for studying jobs-housing balance does matter. The larger the size, the more likely the balance -- at the extreme, planet earth has a perfect balance of jobs and employed residents. For the most part, this study's use of the region's most populous cities as cases produced relatively large geographic units (mean = 32.8 square miles, standard deviation = 34.5 square miles).[2]

Table 1 reveals that most Bay Area cities became more "balanced" during the 1980s, thus lending credence to the co-location hypothesis. Using a ratio of 1 to signify balance, the table shows that 14 of the 23 cities (61 percent) had jobs and housing more aligned in 1990 than in 1980 (i.e., had J/ER ratios closer to 1 in 1990). This is largely because most large Bay Area cities experienced faster employment than housing growth during the 1980s (reflected by higher 1990 J/ER ratios), resulting in traditional "bedroom" communities becoming more balanced. Ten of the eleven bedroom cities with more employed residents than jobs in 1980 saw jobs grow faster than households (Vallejo being the only exception). The most dramatic change was in Pleasanton, which transformed from a dormitory community to a jobs-surplus city in the wake of massive office park development during the 1980s.

The pattern was quite different for the Bay Area's jobs-surplus cities. Of the ten with J/ER ratios over 1.10 in 1980, eight were even less balanced in 1990 -- that is, jobs grew faster than did households. The balance gap widened the most in three of the Bay Area's four cities that were most jobs-rich in 1990 -- Palo Alto, Santa Clara, and Walnut Creek. These three cities recorded tremendous gains in white-collar and high-technology jobs during the 1980s; for example, Walnut Creek's workforce size rose from 30,000 to 48,000 (60 percent) over this period. As noted, market forces largely dictated the amount and type of growth that occurred in these and other large Bay Area cities.

Overall, then, there appears to have been a general trend toward balance in the Bay Area's largest cities during the 1980s, in support of the co-location hypothesis. This occurred mainly in

the form of bedroom communities, as they matured, becoming more balanced. Imbalances in jobs-rich cities generally widened during the 1980s.

3. Trends toward Self-Containment in the Bay Area

Ratios of jobs to employed residents indicate only the potential for balance. The degree to which the potential is realized is reflected by measures of "self-containment" -- notably, the share of jobs in a community actually filled by residents, and the share of workers finding a place to live in that community. Self-containment implies creating a built form that allows people to live, work, shop, and recreate within a community (Burby and Weiss 1976). In a study of British new towns, Thomas (1969) first devised a measure of self-containment. According to Thomas (1969, p. 338), all British new towns were designed to be "self-contained and balanced." For tracking changes in self-containment beween 1951 and 1966, Thomas created an "Independence Index" -- the number of internal (within community) work trips divided by the sum of in and out (external) work trips. The higher the value, the more "independent," or self-contained, the community. Thomas found that early (Mark I) British new towns became more self-contained over the course of the 1960s.

Table 2 presents 1980-1990 changes in Independence Indexes computed for the 23 Bay Area cities, along with two other measures: the percentage of locally residing workers (who reside in the same city where they work) and the percentage of locally working residents (who work in their home city). High values for both percentages signify self-containment. (Cities are ordered in Table 2 as in Table 1 -- according to J/ER ratios.)

3.1 Trends in Independence Indices

Consistent with the finding of trends toward jobs-housing balance, the Bay Area's largest cities also became more self-contained during the 1980s -- i.e., by 1990, they had higher Independence Indices. The average increase in the Independence Index among the 23 cities, however, was fairly modest -- around 7 percent. Jobs-rich cities tended to become relatively more self-contained during the 1980s; 7 of the 9 cities with J/ERs above 1.25 had higher Independence Indexes in 1990. The East Bay city of Alameda had the fastest growth in internal commutes (owing to the expansion of its military base in the 1980s), followed by two

Table 2. Self-Containment Statistics for Large Cities in the San Francisco Bay Area, 1980-1990

Cities	(1) Percent Locally Residing Workers			(2) Percent Locally Working Residents			(3) Independence Index		
	1980	1990	% Change	1980	1990	% Change	1980	1990	% Change
Palo Alto	19.7	17.6	-10.7	39.9	43.9	10.1	0.28	0.32	11.7
Santa Clara	16.8	14.5	-13.9	28.9	29.3	1.5	0.19	0.19	0.3
Sunnyvale	22.6	20.0	-11.6	33.8	31.6	-6.6	0.24	0.21	-9.7
Walnut Creek	20.6	18.5	-10.4	24.5	28.9	17.9	0.16	0.19	19.7
San Francisco	55.0	54.2	-1.5	75.6	80.4	6.3	1.09	1.23	12.8
Berkeley	37.6	36.2	-3.7	44.6	49.7	11.4	0.38	0.44	15.0
Santa Rosa	53.5	50.3	-6.0	59.5	63.8	7.3	0.68	0.74	8.8
San Leandro	23.9	22.4	-5.9	30.0	28.1	-6.2	0.21	0.19	-8.3
Hayward	28.9	26.8	-7.2	32.5	33.5	3.0	0.23	0.24	2.1
Pleasanton	50.9	29.0	-42.9	21.4	32.7	52.9	0.17	0.24	41.2
Oakland	39.4	42.2	7.2	46.7	46.8	0.4	0.41	0.42	3.0
Redwood City	33.5	26.2	-21.9	28.1	27.4	-2.4	0.20	0.19	-7.7
Mountain View	20.4	20.1	-1.8	27.0	20.7	-23.2	0.18	0.13	-26.4
Fairfield	59.5	49.3	-17.1	53.6	49.2	-8.3	0.62	0.48	-21.5
Richmond	28.4	27.6	-2.8	31.2	26.3	-15.5	0.22	0.18	-18.8
San Mateo	33.4	30.4	-9.1	27.1	29.0	7.3	0.19	0.21	6.5
Napa	62.9	60.2	-4.3	46.5	57.4	23.4	0.51	0.70	35.6
Concord	42.0	33.8	-19.5	28.8	32.0	11.4	0.22	0.24	7.3
Alameda	40.3	45.8	13.6	27.1	41.9	54.6	0.20	0.37	82.5
San Jose	64.0	62.0	-3.2	42.6	51.8	21.5	0.46	0.60	31.5
Vallejo	57.5	53.3	-7.4	49.5	42.2	-14.8	0.53	0.40	-24.2
Fremont	57.7	43.3	-25.0	30.7	32.8	6.8	0.28	0.26	-3.9
Daly City	32.3	27.1	-16.1	11.3	11.8	4.2	0.07	0.07	1.2
Unweighted Average	39.2	35.2	-9.6	36.6	38.8	7.1	0.34	0.36	6.9
Standard Deviation	15.5	14.6	11.4	14.2	15.3	18.7	0.23	0.26	24.4

Notes:
(1) Percent of workers who reside locally
(2) Percent of employed residents who work locally
(3) Percent of residents working locally divided by the sum of the percent of residents working outside a city plus the percent of employees living outside a city

suburban/exurban communities, Pleasanton and Napa. External commuting grew the fastest in Mountain View and Vallejo (the only bedroom community that had faster job growth than housing growth in the 1980s).

Notwithstanding the progress made toward self-containment, most Bay Area cities still had fairly low Independence Indices in 1980 and 1990; on average, around twice as many people commuted in and out as within the region's 23 largest cities. The only Bay Area city that can lay bonafide claim to being self-contained is San Francisco -- four out of five of its employed residents worked in the city in 1990. The least self-contained city is Daly City, on San Francisco's southern border and until recently the western terminus of the region's BART rail system. The absence of many self-contained cities and the extensive cross-haul commuting that occurs each workday between Bay Area cities underscores the high degree of economic interdependence within the region.

3.2 Trends in Residing and Working Locally

While Bay Area cities generally became more self-contained during the eighties, this was mainly due to businesses locating near labor pools, enabling residents to find jobs within their communities or nearby. Table 2 shows that while the share of locally working residents rose in 16 of the 23 cities, the share of locally residing workers fell in 16 cases. Pleasanton, which registered the fastest employment growth during the 1980s, saw the share of the workforce residing locally drop the fastest. Pleasanton, however, also witnessed one of the fastest growth rates in residents with local jobs (52.9 percent). These opposite trends suggest a strong desire of Pleasantan workers to reside locally.

Bay Area cities with the greatest job surpluses in 1990, namely the Silicon Valley cities of Santa Clara, Palo Alto, and Sunnyvale, and Walnut Creek in the East Bay, also had the lowest shares of workers living locally. Cities with the highest shares of residents commuting to jobs elsewhere were the predominantly bedroom communities, like Daly City and Mountain View. In Mountain View, just one of five employed residents worked locally and one of five workers lived locally in 1990. Thus, while Mountain View became fairly balanced during the 1980s by adding more housing, most of its new residents worked elsewhere.

4. Associations between Balance and Self-Containment

As noted, numerical balance in jobs and housing provides little guarantee that commuting will become spatially self-contained within a relatively small, definable geographical area. Among the Bay Area's largest cities, the association between balance and self-containment was fairly weak in both 1980 and 1990. Table 3 shows the Pearson Product-Moment correlation between the "Balance" and "Independence Indexes" was -.250 for 1980 and -.045 for 1990. (The "Balance Index" was constructed as the absolute difference between the jobs-to-employed-residents ratio and 1; the smaller the value, the greater the balance -- for example, a zero value signifies that jobs equal employed residents.[3]) Thus, while balanced communities tended to have higher shares of internal (presumably shorter) commutes in 1980, by 1990 the relationship was almost non-existent.

These weak correlations clearly show that numerical balance does not necessarily translate into commuting efficiencies. Descriptive statistics further underscore this point. Cities like Redwood City, San Mateo, and Mountain View were fairly balanced in 1990, with J/ER ratios between 0.96 and 1.05, yet in all three communities, fewer than 30 percent of workers resided locally and fewer than 30 percent of employed residents worked locally. While these communities generally provided ample housing for local workers, most workers in-commuted. Thus, setting jobs-housing balance targets as means toward mitigating traffic congestion and air pollution clearly makes little sense, at least in the San Francisco Bay Area. If reducing VMT and encouraging more walking, biking, and transit riding are explicit public policy objectives, then working with the marketplace to produce housing suitable the earnings and taste preferences of local workers will likely be more effective than mandating jobs-housing balance targets.

Table 3 shows that the strongest correlations were between balance indicators and shares of workers residing locally. Thus, balance seems to work mostly in favor of allowing a community's workers to reside locally. In the cases of the exurban communities of Fairfield and Napa, for example, both were balanced in 1990 and also had over half of their workers living in the community. In contrast, the association between balance and locally working residents was fairly weak. Together, these associations suggest that the stronger dynamic is for balance to work in favor of workers residing locally rather than residents working locally.

Table 3. Correlations of Jobs-Housing Balance and Self Containment Indicators, 1980 and 1990

	Independence Index	Locally Residing Workers	Locally Working Residents
1980			
Balance Index[a]	-.250	-.299	-.136
Jobs/Employed Residents	.130	-.587**	.140
1990			
Balance Index[a]	-.045	-.448*	.006
Jobs/Employed Residents	.071	-.469*	.189

Notes

[a] Balance Index = | (Jobs/Employed Residents) - 1 |

** Significant at .01 level

* Significant at .05 level

The relatively strong negative correlation between balance and locally residing workers is illustrated in Figures 1 and 2 for 1980 and 1990, respectively. The horizontal axes of the two figures organize Bay Area cities into three groups: (1) housing-rich communities (J/ER ratios below 0.80); (2) balanced communities (J/ER ratios between 0.80 and 1.25); and (3) jobs-rich communities (J/ER ratios above 1.25).[4] In general, housing-rich cities had large shares of workers living locally, whereas job-rich cities had low shares.

Figure 1 shows that in 1980, 6 of the 7 housing-rich communities had above-average shares of locally residing workers. And 5 of the 6 jobs-rich cities had below-average shares of locally residing workers. Superimposing the two graphs on top of each other reveals that most data points shifted to the right between 1980 and 1990. That is, during the 1980s most bedroom communities became balanced as new employers moved in, while most corporate communities suffered worsening housing deficits, as job growth continued to outpace housing construction. Overall, more communities fell in the balance range in 1990: 13 of the 23 had J/ER ratios between 0.80 and 1.25, versus 10 in 1980. Thus, while the co-location hypothesis appears to generally hold, this was only so for historically housing-rich cities. We see, then, that under free market conditions, Bay Area businesses seem to have adjusted well to available labor markets, however housing development has not adjusted to job surpluses.

5. External Commuting and Housing Prices

Other researchers (Dowall, 1984; Landis, 1986) have found that constraints on housing supplies in the Bay Area have inflated housing prices, forcing modest-income workers and first-time home-buyers to reside on the fringes of the metropolitan area and beyond. If such displacement still occurs, it should be reflected by a strong association between external commuting and relative housing prices across our 23 case-study cities. To explore this, we ran a regression of the Independence Index on relative housing prices and two other significant explanatory variables. The resulting model, summarized in Table 4, shows that relatively high housing prices are associated with relatively high shares of external commuting. The model controls for size of the community, which generally increases the share of internal commutes, and vehicle ownership levels (a proxy for income as well as automobility), which generally

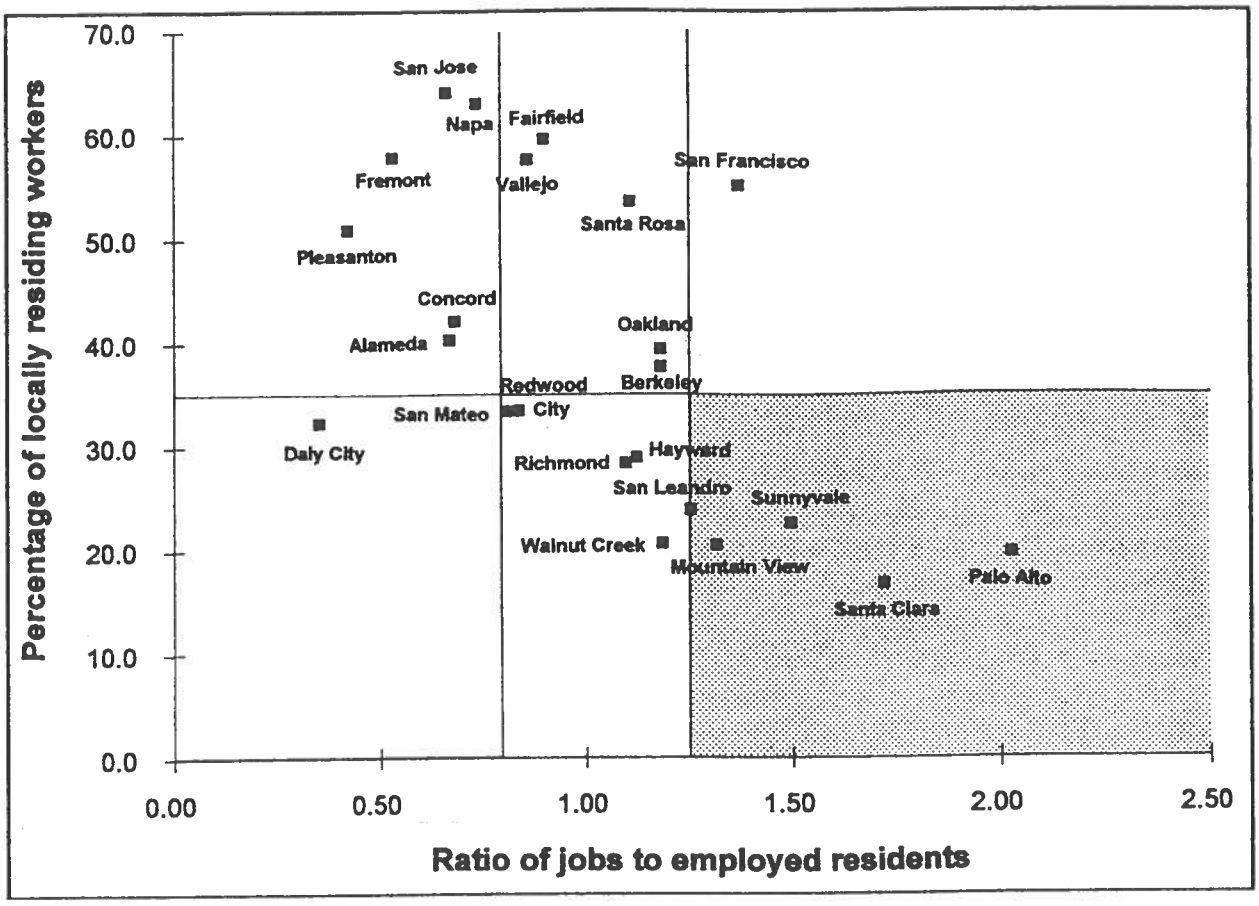


Figure 1. **Jobs-to-Employed Residents versus Percent Locally Residing Workers, Large Bay Area Cities, 1980**

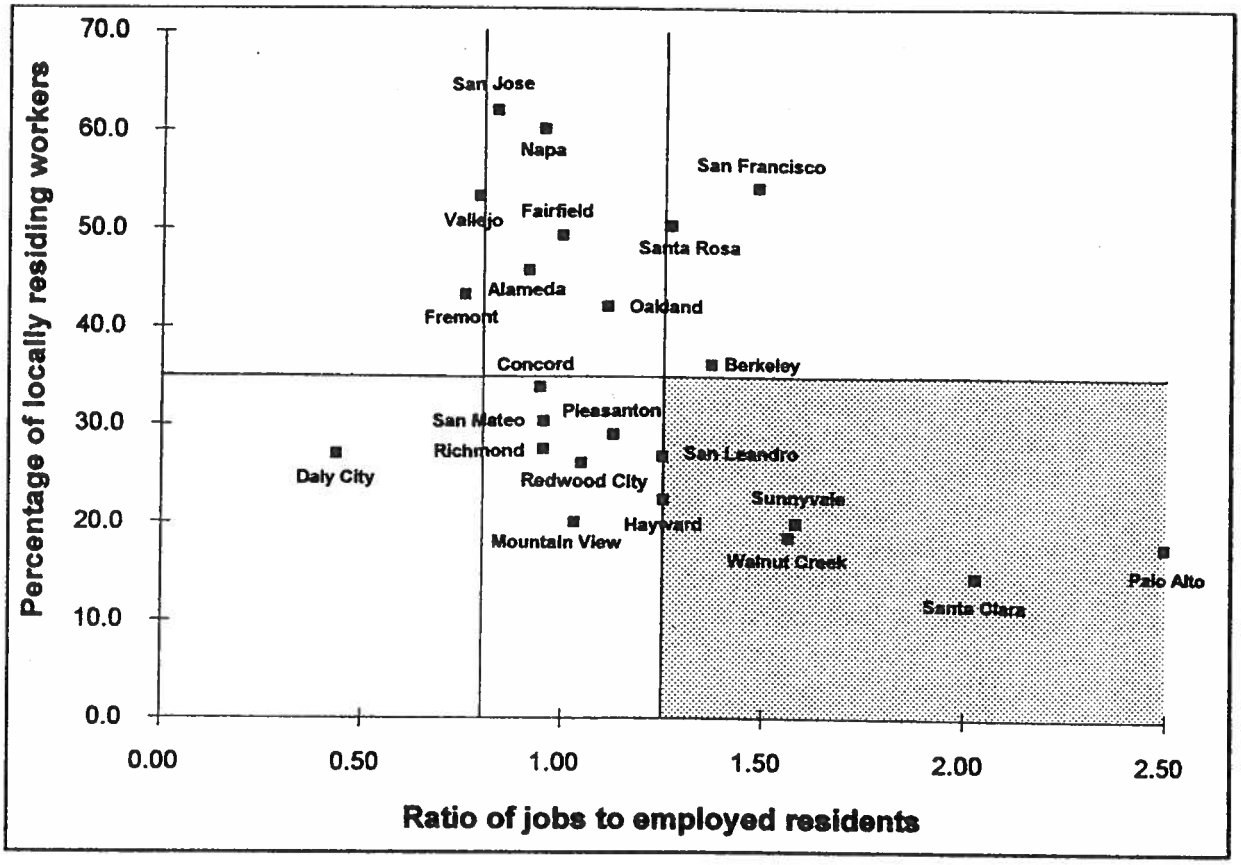


Figure 2. **Jobs-to-Employed Residents versus Percent Locally Residing Workers, Large Bay Area Cities, 1990**

Table 4. Model for Predicting Independence Indices for Large Bay Area Cities, 1990

Dependent Variable: Independence Index (internal commutes/external commutes)

	Coefficient	Standard Error	Significance
Housing price index (median single-family home value/ median household income)	-0.0573	0.0403	0.119
No. of employed residents in city	0.0015	0.0004	0.002
No. of vehicles per household	-0.3681	0.1853	0.062
Constant	1.1633	0.4291	0.014

No. of cases = 23. $R^2 = .549$. F = 7.305; prob. = 0.002.

increases the share of external commutes. Overall, this model corroborates the findings of other researchers that high housing prices near major employment centers have had a displacing effect on residential location in the San Francisco Bay Area. It further reinforces the inference that what matters most from a transportation and environmental point-of-view is housing performance over time within and near jobs-surplus cities, not subregional jobs-housing balance *per se*, a topic addressed in the next section.

6. Balance, Containment, and Commuting

To probe how balance and self-containment were associated with characteristics of workers' commutes, Analyses of Variance (ANOVAs) were carried out. Three features of journeys-to-work were examined: durations, distances, and modal splits. Data were compiled from the 1990 Census Transportation Planning Package (CTPP) for the San Francisco-Oakland-San Jose CMSA, Part 1 (place of residence) and Part 2 (place of work). Average straightline commute distances among workers were estimated for each of the 23 cities.[5] The average commute VMT per worker was then estimated by combining commute distance and modal occupancy data.[6]

Two statistical comparisons, summarized in Table 5, were produced to explore these relationships. The first contrasts commuting statistics between high job-surplus cities (where J/ER > 1.55) and all remaining Bay Area cities.[7] The second comparison is with reference to levels of internal commuting -- low, medium, or high. (See Tables 1 and 2 for the cities in each class.)

Workers in high job-surplus cities averaged one-way commutes that were 2 minutes and 40 seconds longer than those in other (i.e., balanced and housing-surplus) Bay Area cities.[8] The biggest difference was in the average one-way commute times of those working in job-surplus cities versus times for those in housing-surplus cities -- a 3-minute differential.

A useful way to gain insight into the *relative* commute times of workers in a city is to compare them to the commute times of employed residents from the same city. Table 5 reveals appreciable differences according to the levels of jobs-housing balance. In the high job-surplus cities, workers averaged commutes that were 28 percent longer than those of employed residents.

Table 5. Comparisons of Commuting Characteristics Among Classes of Bay Area Cities, 1990

	Number	Mean Worker Commute Times (Minutes)	Mean Ratio of Commute Times[a]	Mean Drive-Alone Commutes (%)	Mean CommuteVMT Per Employee
Balance Comparison:					
High Job Surplus Cities[b]	4	26.5	1.28	78.3	8.41
Other Cities	18	23.8	0.97	74.3	7.90
		(F=3.04)*	(F=10.44)**	(F=1.11)	(F=1.02)
Self-Containment Comparison:					
Low Internal Commutes[c]	12	25.4	1.07	77.9	8.43
Moderate Internal Commutes[c]	7	24.0	1.00	69.1	7.61
High Internal Commutes[c]	4	23.8	0.98	68.5	6.55
		(F=0.79)	(F=0.83)	(F=2.43)*	(F=6.17)**

* Significant at 0.10 probability level
** Significant at 0.05 probability level

[a] Mean commute time of workers divided by mean commute time of employed residents

[b] Job-to-Employed Resident ratio exceeds 1.55: Palo Alto, Santa Clara, Sunnyvale, and Walnut Creek.

[c] Low Internal Commutes: Independence Index < 0.25; Moderate Internal Commutes: 0.25 ≤ Independence Index ≤ 0.50; High Internal Commute: Independence Index > 0.50.

For the remaining Bay Area cities, commute durations were, on average, fairly similar among workers and employed residents.

While workers in jobs-surplus cities relied more on drive-alone commuting, differences were not large or statistically significant.[9] The greatest differences were according to levels of self-containment. Cities with high rates of external commuting (independence index < 0.25) averaged well over three-quarters of workers who solo-commuted. In more self-contained cities, workers were less inclined to drive alone. Public transit commuting made up much of the difference.

Combining statistics on commuting distances and occupancy levels (according to mode) produced estimates of commute VMT per employee, the last column in Table 5. According to Ewing (1995b), per capita measures of VMT are the best overall indicators of performance from both a transportation and environmental standpoint. This statistic, more than any, best expresses the mobility and environmental implications of jobs-housing mismatches.

Table 5 shows that jobs-surplus cities generally averaged more commute VMT per worker, however differences were not statistically significant. More relevant was the association between VMT per worker and self-containment. On any given workday, cities with Independence Indexes under 0.25 (low internal commuting) averaged nearly two more vehicle miles per worker (in one direction) than did cities with Indexes above 0.50 (high internal commuting). Summed over all workers and assuming 300 work days per year, this difference amounts to over 800 million more vehicle miles of commuting annually in these noncontained cities than the self-contained ones.[10] Clearly, any movement toward self-containment would improve regional transportation and environmental conditions.

In sum, imbalances and noncontainment did significantly affect commuting in the Bay Area in 1990. Longer durations, solo-occupancies, and more VMT per employee characterized the commutes of workers in both jobs-surplus cities and cities with high external commuting. In most cases, these cities were one and the same, since the most jobs-rich cities were also the least self-contained.

7. Pleasanton: Job Growth Outstripping Housing Growth

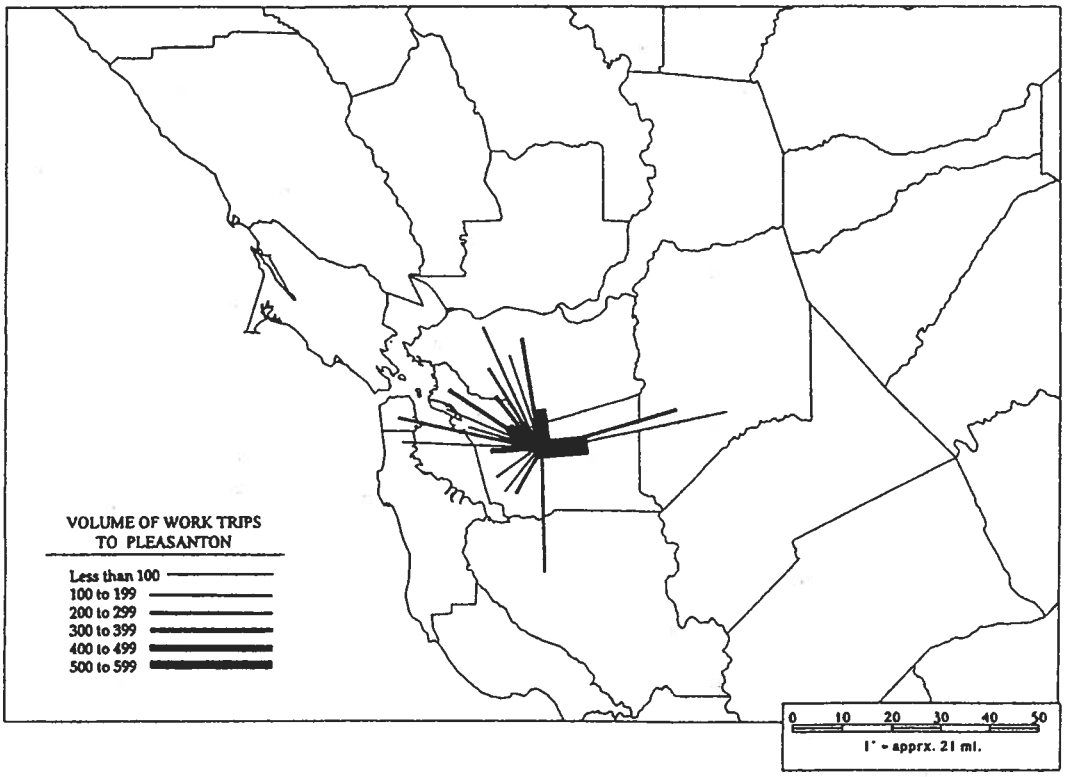
The relationships among employment growth, jobs-housing balance, housing prices, and commuting were further examined for Pleasanton, the Bay Area city that experienced the fastest rate of employment growth during the 1980s. If the transportation implications of lags in housing production are to stand out for any one city, we felt, it would be in Pleasanton. During the 1980s, Pleasanton received a tremendous in-flow of back offices that relocated out of downtown San Francisco and Oakland. A significant share of Pleasanton's growth has taken place in the Hacienda Business Park, a 860-acre master-planned complex with over 4 million square feet of mixed use (though predominantly office) development and over 12,000 workers. Among all of the Bay Area cities studied, moreover, Pleasanton has made the greatest strides toward balance, having changed from a predominantly bedroom community in 1980 (J/ER ratio of .42) to a fairly balanced community in 1990 (J/ER ratio of 1.13). As noted, however, most new workers have taken up residence outside the city, which has resulted in fairly low levels of self-containment; four times as many people commute in and out of the city each day as within.

Pleasanton was one of the nation's first cities to enact a trip reduction ordinance in response to worsening traffic congestion (Cervero 1986b; Cervero and Griesenbeck 1988). Pleasanton is also unique for having among the richest times series data on commuting patterns of the workforce anywhere. Since 1984, annual travel surveys have been compiled as part of the city's traffic management program. The 1993 survey used in this analysis provided detailed data on travel and place of residence for 14,804 workers, in companies with 10 or more employees, representing 71 percent of the city's workforce.

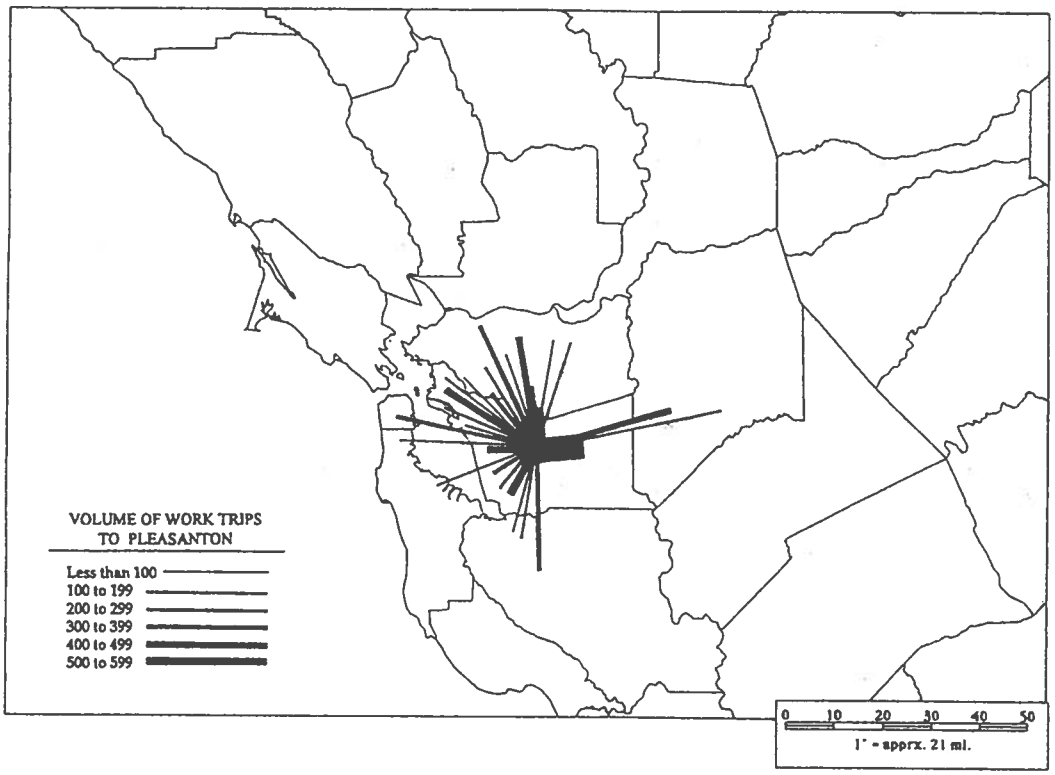
7.1 Trends in Residential Location and Journey-to-Work

The trend toward external commuting among Pleasanton's workforce is illustrated by the desire line maps shown in Maps 2 and 3. Changes in patterns and volumes of work trips to Pleasanton show that the city's commuteshed expanded significantly between 1985 and 1993. Most notable was the growth in reverse commutes from the West Bay (San Francisco and northern San Mateo County) to Pleasanton, as well as a tripling of commutes to and from California's central valley (the farthest east origins).

The expansion of Pleasanton's commuteshed increased the average worker commute



Map 2. **Desire Line Map of External Work Trip Origins and Destinations for Pleasanton Workers, 1985**



Map 3. **Desire Line Map of External Work Trip Origins and Destinations for Pleasanton Workers, 1993**

distance, as shown in Figure 3 for the 1987-1993 period.[11] The share of workers commuting under 5 miles fell by 9 percent over this six-year period, matched by a 7 percent increase in the share commuting over 16 miles. The average commute distance for Pleasanton's workforce was 18.8 miles in 1993, considerably above the Bay Area's average of 14.4 miles (RIDES, Inc. 1994).

7.2 Pleasanton's Jobs-Housing Balance Dilemma

The case of Pleasanton underscores the dilemma posed by using ratios of jobs to housing units to evaluate balance. While it evolved into one of the Bay Area's most balanced communities during the 1980s, today most workers live elsewhere and most residents work elsewhere. According to 1990 journey-to-work statistics, 35 percent of Pleasanton's employed residents worked in San Francisco, the Silicon Valley, or the built-up Oakland-Fremont corridor paralleling Interstate-880.[12] As new jobs formed in Pleasanton, most new workers found that the city's housing stock was already occupied. And not enough housing was added to accommodate many new workers. While Pleasanton's workforce grew from 7,161 in 1980 to 33,325 in 1990, or 365 percent, housing increased from 11,665 to 19,356 units, or only 66 percent, over that decade.

Most of the blame for the lag in housing production can be placed on growth constraints rather than market inertia. Since the mid-1970s, Pleasanton has limited the number of residential building permits issued and new sewer hook-ups allowed because of limited infrastructure capacity and a citizen backlash against growth. Such protectionist actions have become common in many fast-growing California cities in the wake of Proposition 13, California's landmark 1978 law that restricted the ability of local governments to raise property tax rates (Fulton 1991). In the late 1980s, the developers of Hacienda Business Park were prohibited from building several thousand housing units on-site, including moderately dense apartments, because of NIMBY resistance.

There is some anecdotal evidence that the new housing that was built was not within reach of the earnings of many Pleasanton workers. In 1990, 69 percent of Pleasanton's work force had jobs in clerical, data processing, sales, services, labor, and other nonprofessional/nonmanagerial fields. According to the 1990 census, the median annual

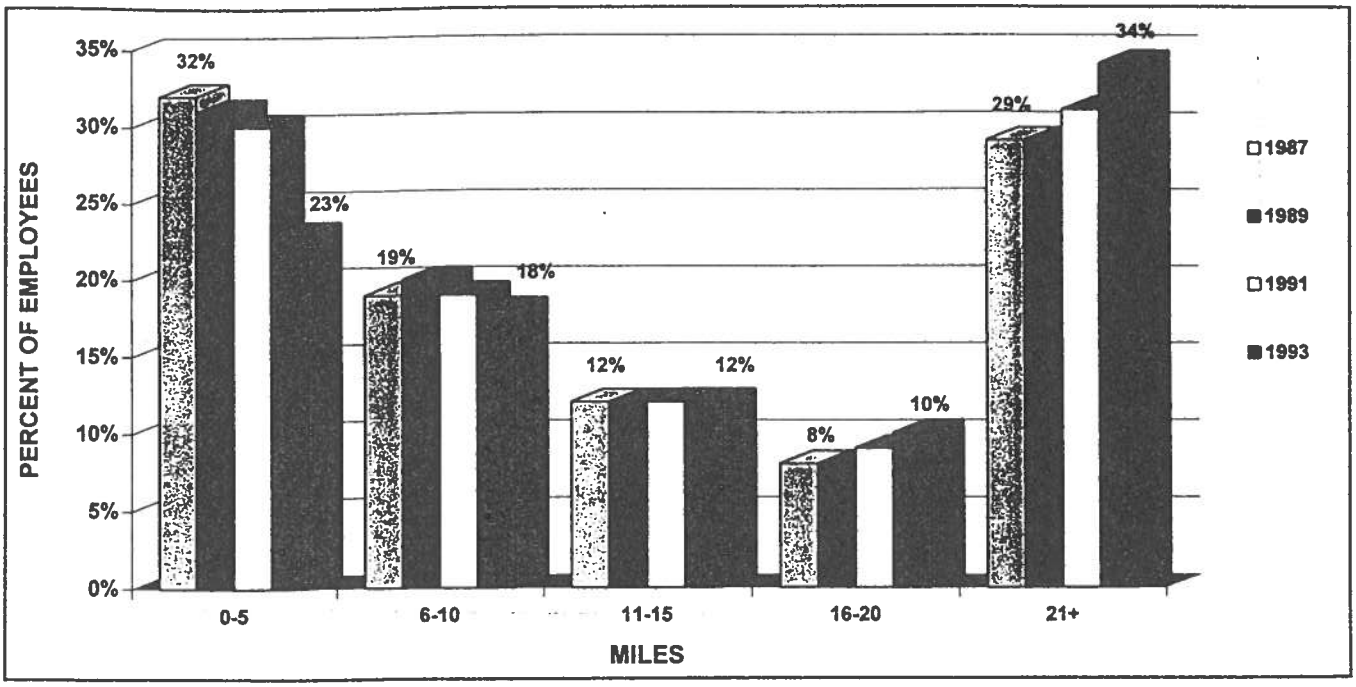


Figure 3. Journey-to-Work Distances Among Pleasanton's Workforce, 1987-1993

earnings for Pleasanton workers was $33,033, with a fair amount of variation around this average (standard deviation = $29,515).[13] Pleasanton's housing stock, however, is among the most expensive in the Bay Area's outer suburbs. The average single-family home in Pleasanton was worth $296,100 in 1990, compared to a median value of $225,300 for Alameda County and $250,1000 for the nine-county Bay Area.[14] Assuming a 10 percent down payment and a fixed 30-year loan at 9 percent, to purchase the typical Pleasanton home would require an annual household income of $73,550 (assuming 35 percent of gross income goes towards mortgage payments), more than twice the earnings of the average worker.[15]

7.3 Influences of Housing Supply and Price on Residential Location

To examine the effects of housing prices and supplies on the residential location choices of Pleasanton's workforce, a gravity model was estimated using journey-to-work data from Pleasanton's 1993 employee transportation survey. The model predicted interzonal commute flows from other Bay Area cities (origin i) to Pleasanton (destination j) as a function of three variables: number of housing units in city i; median single-family home price in city i; and straightline distance from city i to Pleasanton. The singly-constrained gravity model was of the form:

$$T_{ij} = k * [HU_i^{\beta 1} * HP_i^{\beta 2}] * \exp(-\theta D_{ij}) * u_{ij} \qquad (1)$$

where:

T_{ij} = Daily one-way commute trips from city i to j (Pleasanton)

HU_i = Housing units in city i

HP_i = Median single-family home price in city i

D_{ij} = Straightline distance from city i to j (Pleasanton)

u_{ij} = Random disturbance term for the i-j interchange

k = Constant

β_1 , β_2 , θ = Parameters, empirically estimated.

In all, 63 city-i-to-Pleasanton commute interchanges were available for the analysis.[16] All housing data were obtained from the 1990 U.S. census, Summary Tape File 3A. The model was estimated using log-linear transformations and ordinary least squares.

Table 6 shows that Pleasanton's workforce was highly sensitive to both housing prices

Table 6. Gravity Model for Predicting Residential Locations of Pleasanton Workers, 1993

Dependent Variable: Tij = Daily one-way commute trips from city i to j (Pleasanton)

	Coefficient	Standard Error	Significance
$\ln(HP_i)$	-0.775	0.243	.002
$\ln(HU_i)$	0.721	0.092	.000
D_{ij}	-0.123	0.011	.000
Constant	9.611	3.272	.005

Where:

HP_i = median single-family home price in city i

HU_i = number of housing units in city i

D_{ij} = straightline distance from city i to j (Pleasanton)

ln = natural logarithm

No. of cases = 63
R^2 = .756
F = 60.03 (probability = .000)

and supplies in choosing residential locations. The model indicates that, controlling for housing supply and commute distance, Pleasanton's largely back-office workforce generally avoided living in cities with high housing prices. From the model's elasticity coefficients, we see that Pleasanton workers were more sensitive to housing prices than to housing supply when choosing residential locations. This is consistent with the finding of Levernier and Cushing (1994) that housing prices and quality are the most important determinants of residential distribution in urbanized parts of the U.S. Although Table 5 is an incomplete model in that other factors, like quality of schools and neighborhoods, contribute to residential location choices (Quigley and Weinberg 1977; Clark and Burt 1980; Giuliano and Small 1993), the relative goodness-of-fit of the model ($R^2 = .836$) suggests that single-family home prices and housing availability were strong determinants of where Pleasanton's workers took up residence over the past decade. Moreover, the model explained 7 percent more of the variation in commute trip interchanges than did a basic single-destination gravity model using only population size of city i and straightline travel distance to Pleasanton as predictors.[17]

8. Summary and Conclusion

During the 1980s, the Bay Area's largest cities generally became more balanced, lending some credence to the co-location hypothesis. However, this was primarily due to jobs moving to labor markets -- that is, dormitory suburban communities attracting more businesses and industries as they matured. In contrast, imbalances generally worsened in jobs-surplus cities, particularly those in the Silicon Valley. While jobs tended to follow labor markets, housing capital generally did not follow jobs. As a consequence, workers in jobs-surplus cities average longer duration commutes, more VMT per person, and higher rates of solo commuting. These outcomes, we conclude, represent planning failures, not market failures. Many of the Bay Area's jobs-surplus communities have been unwilling to plan for and accommodate new housing, especially affordable units, where they are most needed. Left to its own accord, the market would have no doubt given rise to more housing production near job centers than has materialized.

If the consequences of planning failures -- e.g., zoning out affordable housing -- are

viewed as imposing significant regional costs, then a limited set of policy remedies might be considered. One is tax-base sharing, in which job-surplus cities share their local tax receipts with the bedroom communities that end up housing their workers (Cervero 1989; Downs 1994). In theory, this would remove the incentive to zone out apartments and other low-tax-yielding/high-services-demanding activities. Two other options, fair share housing programs and regional control of land uses, have also been introduced in other states and regions as means of increasing the stock of affordable housing and promoting regional balance. Anthony Downs (1992) has criticized such programs on the grounds that the "cures are often worst than the symptoms", noting that extending extraterritorial powers often ends up introducing as many problems as are solved.

Even if jobs-housing balance is attained, this research shows that it does not guarantee self-containment or reduced external commuting. While most Bay Area cities saw internal commutes increase, proportionally, during the 1980s, there was little correlation between balance and self-containment. Several communities were near perfectly balanced, yet fewer than a third of their workers resided locally and even smaller shares of their residents worked locally. Accordingly, we conclude that as public policy, jobs-housing balance targets are wrong-headed. Balance itself often has little bearing on commuting or, by extension, on air quality. More relevant to the reduction of commuting durations and VMT are adding more housing in or near job-surplus cities and reducing rates of external commuting, in part through the production of housing appropriate to the earnings and preferences of workers.

Our research findings further suggest that the jobs-housing balance debate has been miscast. Jobs-housing balance is about breaking down the barriers to residential mobility, not mandating where people live and work. The problem lies with jobs-rich communities excluding categories of housing for fiscal and parochial reasons, to the detriment of their region at large. When developers are prevented from building housing near employment centers that is targeted at the local workforce, as recently happened in Pleasanton, California, there is, we believe, grounds for some degree of policy intervention -- to correct planning, not market, failures.

In closing, experiences in the San Francisco Bay Area suggest that problems of imbalanced growth are fundamentally problems of constraints on housing production in jobs-rich cities and

subregions. Over time, inadequate housing can lead to economic decline and exacerbate regional transportation and environmental problems. Thus, one of the many policy challenges to planners in coming years will be to break down barriers to residential mobility, such as NIMBY resistance, large-lot zoning, and other exclusionary policies. Whether these findings are particular to the San Francisco Bay Area are unknown since little parallel research has been conducted for other metropolitan areas. We believe that they are not peculiar to the Bay Area, but rather represent, to varying degrees, the general outcomes of constraints on regional growth. Testing the generalizability of these findings through empirical studies of other metropolitan areas, we believe, would be a fruitful area of future research.

Acknowledgement

This research was carried out partly through the support of a grant from the University of California Transportation Center (UCTC). We thank Chuck Purvis of the Metropolitan Transportation Commission and Gail Gilpin from the city of Pleasanton for assisting us gather some of the data used in this research. The views and opinions expressed in this paper, however, are those of the authors and not necessarily those of the research sponsors or others.

NOTES

1. The typical one-way commute distance, around 11 miles nationwide in 1990 (Hu and Young 1992) and 14.4 miles in 1993 for the San Francisco Bay Area (RIDES, Inc. 1994), could be viewed as the appropriate radius of a commute shed for studying jobs-housing balance. This, after all, is a radius whose area should, in theory, have equal counts of jobs and employed residents. The typical commute shed around large employment centers has also been suggested as a spatial context for studying jobs-housing balance (Cervero 1986a).

2. Computed from the 1990 U.S. Census, Summary Tape File 3A. Only land areas are included in this calculation; water areas within the boundaries of cities are excluded.

3. J/ER ratios, in and of themselves, are not satisfactory measures of balance in a correlation analysis, since both very low and very high values indicate imbalance. Since a J/ER ratio of 1 signifies balance, a more appropriate measure is to gauge by how much J/ER ratios vary from one in absolute terms (regardless of sign).

4. The boundaries, 0.80 and 1.25, are the values 0.5 standard deviations below and above the mean 1980 J/ER value of 1.02.

5. For each city, average commute distances for employed residents were estimated as the sum of straightline distances from the center of the city to the centroid of all traffic analysis zones (TAZs) for which employed-residents made a commute trip, divided by the total commute trips by these employed residents. (The Bay Area has 1099 TAZs within the 9-county region; conversion tables were used to translate these to census tract geographies.) Average commute distances for workers were similarly estimated, using data from the CTPP Part 2.

6. For each origin-destination (O-D) pair, commute VMT per worker was calculated by dividing the number of workers traveling in each mode by an assumed average occupancy of that mode, then multiplying this value by the average straightline distance for the pair, and summing over all modal categories. This value was then accumulated over all O-D pairs and divided by the total number of O-D pairs, to derive an estimate. The modal categories (and assumed occupancy of each mode) were: drive-alone (1 person), carpool (1.5 persons), vanpool (3 to 10 persons depending on census coding), bus transit (35 persons), and rail transit (subway or commuter rail -- 400 persons). These occupancy averages were based on empirical averages from the San Francisco region, using primary data from RIDES, Inc. (1994). For the mass transit modes used for any O-D pair, any fraction of the number of workers commuting by transit divided by the assumed occupancy level was rounded up one digit. This approach sought to estimate the number of motorized vehicles involved in the commute of each O-D pair, as a basis for estimating commute VMT per worker.

7. These high job-surplus cities also tended to have low rates of internal commuting, as shown in Table 2. For this first comparison, San Francisco is omitted as an outlier data case because, despite having a relatively high J/ER (1.48), it had by far the highest rate of internal commuting in 1990 (Independence Index = 1.23).

8. The correlation between J/ER and commute time was 0.345. Also, ANOVA comparisons of commuting times were made between these four high job-surplus cities and a more limited set of "other" cities that were matched in terms of numbers of employed residents and numbers of workers. This more limited set consisted of seven "other cities" (Berkeley, Santa Rosa, Hayward, Mountain View, San Mateo, Concord, and Fremont) that, just like the high job-surplus cities, had between 30,000 and 70,000 employed residents and between 48,000 and 110,000 workers in 1990. Thus, these matches effectively controlled for scale influences. The ANOVA results were comparable.

9. The strongest correlation between J/ER and modal splits was for carpooling: -.21. Thus, job-surplus cities tended to have relatively low rates of workers who shared rides.

10. These 12 noncontained cities (with Independence Indexes < 0.25) had 692,200 workers in 1990. If these workers averaged a commute VMT per employee comparable to that for their counterparts in self-contained cities (with Independence Indexes > 0.50), then they would reduce their annual commute VMT by: (692,200 workers) x (2 one-way work trips per day) x (2 fewer VMT per worker per day) x (300 work days per year) = 830,640,000 vehicle miles.

11. Estimates of commute distances are based on information provided by workers as to their zip code of residence. Straightline distances are used.

12. Silicon Valley cities include San Jose, Santa Clara, Sunnyvale, Palo Alto, Mountain View, and Milpitas. Oakland-Fremont cities include Alameda, Hayward, San Leandro, San Lorenzo, and Union City. (Source: 1990 U.S. Census Transportation Planning Package, Parts I and II, San Francisco-

Oakland-San Jose Consolidated Metropolitan Statistical Area.)

13. Source: 1990 U.S. Census Transportation Planning Package, Part II, San Francisco-Oakland-San Jose Consolidated Metropolitan Statistical Area.

14. Source: 1990 U.S. Census Population and Housing Data, Summary Tape File 3A.

15. The monthly mortgage for the median single-family home, at these terms, would be $2,145. Assuming that 35 percent of gross earnings go toward principal, interest, taxes, and insurance, this would require $6,130 in monthly earnings, or $73,550 per year. This figure does not include additional costs associated with home purchases, such as brokerage and origination fees, and loan points.

16. City-to-city interchanges with fewer than five commute trips were deleted as statistical outliers.

17. The estimated basic model was: T_{ij} (estimated) = $1.128*(\text{Population}_i^{0.798})*\exp(-0.12D_{ij})$, with an $R^2 = 0.765$.

REFERENCES

Burby, Raymond and Shirley Weiss. 1976. *New Communities U.S.A.* Lexington MA: Lexington Books.

Cervero, Robert. 1986a. *Jobs-Housing Imbalances as a Transportation Problem.* Berkeley, CA: Institute of Transportation Studies, University of California, Research Report no. 86-9.

Cervero, Robert. 1986b. *Suburban Gridlock.* New Brunswick, NJ: Center for Urban Policy Research.

Cervero, Robert. 1989. Jobs-Housing Balancing and Regional Mobility. *Journal of the American Planning Association* 55, 2: 136-50.

Cervero, Robert. 1996. Jobs-Housing Balance Revisited: Trends and Impacts in the San Francisco Bay Area. *Journal of the American Planning Association* 62, 4: 492-511.

Cervero, Robert, and Bruce Griesenbeck. 1987. *Commuting Behavior in Suburban Labor Markets: A Case Analysis of Pleasanton, California.* Berkeley: Institute of Transportation Studies, Research Report 86-9.

Cervero, Robert, and Bruce Griesenbeck. 1988. Factors Influencing Commuting Choices in Suburban Labor Markets: A Case Analysis of Pleasanton, California. *Transportation Research* 22A, 3: 151-61.

Clark, William, and James Burt. 1980. The Impact of Workplace on Residential Location. *Annals of the Association of American Geographers* 29: 2-13.

Dowall, David. 1984. *The Suburban Squeeze: Land Conversion and Regulation in the San Francisco Bay Area*. Berkeley, CA: University of California Press.

Downs, Anthony. 1992. *Stuck in Traffic: Coping with Peak-Hour Traffic Congestion*. Washington, DC: The Brookings Institution.

Downs, Anthony. 1994. *New Visions for Metropolitan America*. Washington, DC: The Brookings Institution.

Ewing, Reid. 1995. "Before We Write Off Jobs-Housing Balance . . . .". In *Best Development Practices: Doing the Right Thing and Making Money at the Same Time*. Chicago: American Planning Association.

Ewing, Reid. 1995b. Measuring Transportation Performance. *Transportation Quarterly* 49, 1: 91-104.

Frank, Lawrence, and Gary Pivo. 1994. *Relationships Between Land Use and Travel Behavior in the Puget Sound Region*. Seattle: Washington State Transportation Center.

Fulton, William. 1991. *Guide to California Planning*. Point Arena, CA: Solano Press Books.

Giuliano, Genevieve. 1991. Is Jobs-Housing Balance a Transportation Issue? *Transportation Research Record* 1305: 305-12.

Giuliano, Genevieve, and Kenneth Small. 1993. Is the Journey to Work Explained by Urban Structure? *Urban Studies* 30, 9: 1485-500.

Gordon, Peter, Harry Richardson, and M. Jun. 1991. The Commuting Paradox: Evidence from the Top Twenty. *Journal of the American Planning Association* 57, 4: 416-20.

Hamilton, Edward, Francine F. Rabinovitz, John H. Alschuler, and Paul J. Silvern. 1991. Applying the Jobs/Housing Balance Concept. *Urban Land* 50, 10: 15-18.

Hu, P., and J. Young. 1992. *Summary of Travel Trends: 1990 Nationwide Personal Transportation Survey*. Washington, DC: Federal Highway Administration.

Landis, John. 1986. Land Regulation and the Price of New Housing: Lessons from Three California Cities. *Journal of the American Planning Association* 52, 1: 9-21.

Levernier, William, and Brian Cushing. 1994. A New Look at the Determinants of the

Intrametropolitan Distribution of Population and Employment. *Urban Studies* 31,8: 1391-405.

Levinson, David, and Ajay Kumar. 1994. The Rational Locator: Why Travel Times Have Remained Stable. *Journal of the American Planning Association* 60, 3: 319-332.

Lowry, Ira. 1988. Planning for Urban Sprawl. In *Transportation Research Board Special Report 221: Looking Ahead, the Year 2000.* Washington, DC: Transportation Research Board.

Quigley, John, and D. Weinberg. 1977. Intraurban Residential Mobility: A Review and Synthesis. *International Regional Science Review* 1: 41-66.

Richardson, Harry, and Peter Gordon. 1989. Counting Nonwork Trips: The Missing Link in Transportation, Land Use, and Urban Policy. *Urban Land* 48,9: 6-18.

RIDES, Inc. 1994. Commute Profiles '94. San Francisco: RIDES for Bay Area Commuters.

Rosetti, Michael, and Barbara Eversole. 1993. *Journey to Work Trends in the United States and Its Major Metropolitan Areas.* Cambridge, MA: John A. Volpe National Transportation Systems Center.

Shoup, Donald. 1995. An Opportunity to Reduce Minimum Parking Requirements. *Journal of the American Planning Association* 61, 1: 14-28.

Thomas, Ray. 1969. *London's New Towns: A Study of Self-Contained and Balanced Communities.* London: PEP.

Wachs, Martin, Brian Taylor, Ned Levine, and Paul Ong. 1993. The Changing Commute: A Case-study of the Jobs-Housing Relationship over Time. Urban Studies 30,10: 1711-29.

Wu, Kang-Li. 1995. *A Study of the Spatial Relationship Between Jobs and Housing in the San Francisco Bay Area in 1990: Improving the Jobs-Housing Balance to Improve Regional Mobility.* Berkeley: University of California, Department of City and Regional Planning, Master's Thesis.