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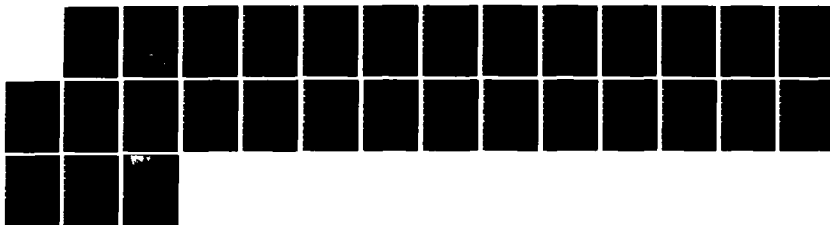
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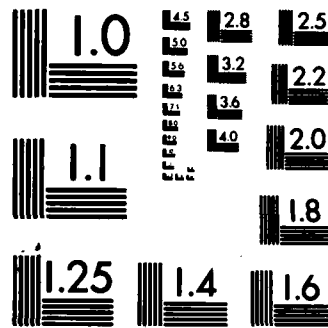
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**HOUSING COSTS
IN
NORTHERN SANTA BARBARA COUNTY,
CALIFORNIA**

**MAJOR FRANKLIN L. GERTCHER
DEPARTMENT OF ECONOMICS**

JULY 1982

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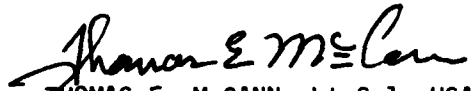
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Editorial Review by Captain Rodney P. Rice
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U.S. Air Force Academy
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This research report is presented as a competent treatment of the subject, worthy of publication. The United States Air Force Academy vouches for the quality of the research, without necessarily endorsing the opinions and conclusions of the author.

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19. ABSTRACT (Continue on reverse if necessary and identify by block number) Vandenberg Space Shuttle contractor costs exceeded Air Force budget expectations by approximately 100 million dollars in Fiscal Year 1982. This paper presents the results of an investigation of this cost overrun. The primary cause was discovered to be Air Force underestimates of contractor labor costs. Space shuttle contractors were paying out higher than expected salaries and wages to attract scientists, engineers, and technicians to the Vandenberg area. A major cause of increased salaries and wages was discovered to be the need to compensate employees for the relatively high cost of housing in Northern Santa Barbara County, California. The influx of contractor employees and their families and the multiplier effect of the Vandenberg Space Shuttle Program are major causes of the increase in housing costs in the area. The problem of high housing costs and subsequent increased labor costs will continue until the peak of contractor personnel influx, which will occur some time in Calendar Year 1984.				
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Housing Costs
in
Northern Santa Barbara County, California

ABSTRACT

Vandenberg space shuttle contractor costs exceeded budget expectations by approximately \$100 million in FY 1982. The primary cause was discovered to be underestimates by the Air Force of contractor labor costs. Contractors were paying out higher than expected salaries and wages to attract scientists, engineers, and technicians to the Vandenberg area. A major cause of increased salaries was discovered to be the need to compensate employees for the relatively high cost of housing in Northern Santa Barbara County, California. The influx of contractor employees and their families and the multiplier effect of the Vandenberg Space Shuttle Program are major causes of the increase in housing costs in the area. The problem of housing costs and subsequent increased labor costs will continue until the peak of contractor personnel occurs sometime in 1984.



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Introduction

Vandenberg Air Force Base is located in northern Santa Barbara County, California, on the Pacific coast, approximately 140 air miles north of Los Angeles. A number of new facilities are being built at Vandenberg to accommodate the Space Shuttle Program, including launch, landing, maintenance, and processing facilities.¹ The prime contractors for the Air Force are Martin Marietta, Rockwell International, and United Technologies. Other contractors are employed by the Army Corps of Engineers for heavy construction of buildings, pads, and runways.

The build-up of contractor personnel began in calendar year 1980 and will continue through 1984. The number of employees will taper off after 1985, eventually resulting in a cadre of contractor personnel needed to operate and maintain the space shuttle facilities. At the peak in 1984-85, over 3,550 contractor personnel and their families will be stationed in the Vandenberg area.²

¹ U.S., Department of the Air Force, Environmental Impact Analysis Process, Final Environmental Impact Statement, Space Shuttle Program, (Vandenberg AFB, California, January 1978).

² This figure represents the total in-migration work-force by all space shuttle contractors at Vandenberg. Of this 3,550, Air Force contractors will employ 2,250, and 1,300 will be employed by contractors reporting to the Army Corps of Engineers. These numbers were taken from the USAF Environmental Impact Statement Supplement, February 1982, and are approximations based on the best data available.

This paper provides the results of an empirical study of owner-occupied housing prices in Santa Barbara County from January 1970 through the first quarter of calendar year 1982. The results presented provide a basis for forecasting the mean price of owner-occupied homes within reasonable commuting distance (Northern Santa Barbara County) of Vandenberg Air Force Base. As explained later, more than 66 percent of incoming families are expected to compete for owner-occupied homes. However, owner-occupied and private rental housing markets are related in terms of the appreciation of imputed rents.³

This paper also explains a substantial portion of the inflation in labor costs experienced by contractors at Vandenberg Air Force Base. Consider the following example: suppose an engineer and his family currently live and work near the Kennedy Space Center in Florida. Suppose also that in 1978 the engineer bought a home in Florida with a \$60,000 mortgage at a 10 percent interest rate. His total monthly payment, including principle, interest, taxes, insurance, utilities, and maintenance, would be approximately \$750 per month. At current market prices a comparable home in Santa Barbara County would sell for \$155,000. Suppose this engineer made a profit by selling his home in Florida,

³See Gertcher, F.L., An Economic Evaluation of Military Family Response to the Current Department of Defense Housing Program. (Ph.D. dissertation, University of Hawaii, 1981).

applied the profit to a home in Santa Barbara County, and ended up with a mortgage of \$115,000 at 15.5 percent. His total payments would be approximately \$1700 per month. Even if his new employer at Vandenberg picked up all moving costs, and all other costs of living remained constant, the engineer would still need a salary increase of \$950 per month just to cover the increase in housing costs. Thus he would need at least \$11,400 per year increase in salary and/or benefits to induce him to accept a position with a contractor at Vandenberg.

As indicated by the above example, labor cost inflation for the Space Shuttle Program at Vandenberg is likely to be strongly related to the inflation rate for housing in northern Santa Barbara County. The remainder of this paper provides empirical evidence and analysis to support this hypothesis. In addition, this paper touches upon some other sources of labor cost inflation in the aerospace industry. For example, the current and programmed increases in aerospace procurement spending by the Department of Defense has also affected aerospace labor markets on a macro scale, with defense contractors bidding up the price of critical skills. Details are presented in a companion paper (also see the Department of Defense Annual Report, 1982).

Santa Barbara County: A Housing Profile

Vandenberg Air Force Base has been instrumental in the development of northern Santa Barbara County since the 1960s. The expansion of Vandenberg as a center of aerospace activity continues to be substantially responsible for the resulting population boom in the cities of Lompoc and Santa Maria. Vandenberg currently employs a total work force of 9,600. Of these, 5,500 are permanent military and civilian workers and 4,100 are contract workers. Through the multiplier effect, it is estimated that an additional 11,600 civilian jobs have been created in the surrounding area as a result of the growth in Vandenberg activities.⁴

The space shuttle contractor work force at Vandenberg is expected to grow continuously through 1984. The overwhelming majority of these workers will be middle income engineers, scientists, technicians, and administrators.⁵

In 1979, about three-fourths of Santa Barbara County's building permit valuations were concentrated in the residential

⁴The estimate of the multiplier effect on civilian employment was provided by Security Pacific Bank, Los Angeles, March 1982.

⁵The peak Vandenberg Space Shuttle contractor work force will be approximately 3,550 workers in 1984. For the purpose of this study, middle incomes are defined at those between \$25,000 and \$100,000 annually.

sector. Valuations rose about 40 percent - to \$150 million - between 1978 and 1979. For the county as a whole, building permits issued during 1979 authorized the construction of 1,639 single family dwelling units, up over 42 percent from the previous year. Permits were also issued for 753 multiple family units which represented a decline of almost 20 percent from 1978.

The county's most active single family areas during 1979 were the city of Santa Maria and the unincorporated areas, which registered year-to-year increases of 266 units and 255 units, respectively. Further south the single family authorizations for the city of Santa Barbara slipped 52 percent below the level of 1978.

The number of new multiple-unit authorizations in Santa Maria rose 227 units above the total recorded in 1978 but declines in Lompoc (down 202 units) and Carpinteria (down 157 units) significantly depressed activity in the county's multiple-unit sector.

For the future, Santa Barbara County authorities have indicated that in Lompoc and Santa Maria, local builders will provide housing units consistent with long-term population growth trends. They will not build for the short-term, largely transient Vandenberg Space Shuttle contractor work force.⁶ For example, the

⁶Based on interviews with research officers of Security Pacific Bank, Los Angeles, in March 1982, and Mr. Earle Sweetland, Executive Vice-President, Lompoc Chamber of Commerce, March 1982.

Lompoc Chamber of Commerce expects that 1,241 new housing units will be built in the Lompoc area during the period 1982-85. Some workers must find homes in Santa Maria or other towns with greater commuting distances from Vandenberg compared to Lompoc. Owner-occupied housing prices and private rents will continue to be bid up between now and 1984-85 with the greatest increases occurring in towns with the least commuting distance from Vandenberg.

Table 1 provides a historical profile of mean single family home selling prices in Santa Barbara County since 1970. The mean selling prices in California for 1970-82, and the median prices for the western states and the United States as a whole, are also provided for comparison.

Table 1: Sales Prices of Single
Family Homes: 1970 - 1982

Year	Mean Price Santa Barbara County*	Mean Price California**	Median Price Western States***	Median Price U.S. Total****
1970	24,300	35,000	24,000	23,400
1971	24,786	36,000	25,500	25,200
1972	24,459	37,000	27,500	27,600
1973	30,618	38,000	32,400	32,500
1974	33,584	43,000	35,800	35,900
1975	37,908	48,000	50,600	39,300
1976	46,656	55,000	47,200	44,200
1977	57,105	63,000	53,500	48,800
1978	73,386	76,000	61,300	55,700
1979	84,078	80,000	69,600	62,900
1980	103,700	84,000	-	-
1981	109,350	108,000	-	-
1982	155,000	120,000	-	86,700

(1st Qtr)

*Source: Real Estate Research Council of Southern California, California Economic Research, Inc., Torrance, CA.

**Source: Interpolated from data provided by the Economic Research Department, Security Pacific Bank, Los Angeles, CA.

***Source: Statistical Abstract of the United States, 1980, Bureau of the Census. Also see Construction Reports Series C25, Bureau of the Census, 1980. Unfortunately mean selling prices were not available. However, it is reasonable to assume approximately normal distributions of selling prices, and the mean and median for a given distribution are therefore approximately the same. Data not available for 1980, 1981, and 1982.

****Source: Same as above. Data not available for 1980 and 1982.

The mean selling prices of single family homes in Santa Barbara County have clearly escalated past the comparable California prices since 1979. For the most part this escalation was driven

by the increased demand for housing in the northern part of the county. This statement is supported by an analysis of the mean asking prices of homes in Lompoc and Santa Maria during March 1982. In the following table the mean asking prices are broken down by condominiums/townhouses, mobile homes, two bedroom detached, three-four bedroom detached, and five bedrooms or greater categories. Again, it should be noted that these means are based on asking prices, not selling prices. Based on national averages, the mean selling prices are expected to be 10 to 15 percent lower.⁷

⁷The percent difference between the mean asking price and mean selling price was determined by comparing regional selling price data from the U.S. Department of Commerce, Statistical Abstract of the U.S., 1981, (Washington, D.C.: Government Printing Office, 1981), and data on asking prices from various real estate publications, including Christian, J.W., et al, Home Ownership: The American Dream Adrift, Economics Department, (Washington, D.C.: American League of Savings Association, 1982).

Table 2: Asking Prices of Single Family Homes:
Lompoc-Santa Maria, March 1982

Category*	Mean Asking Price	Sample Size
Condominiums/Townhouses	97,700	5
Mobile Homes	30,238	9
Two Bedroom Detached	106,495	11
Three/Four Bedroom Detached	172,390	42
Five-plus Bedrooms	392,127	11
Total (Weighted)	172,895	78

*Source: Real Estate Guide, California Central Coast, March 1982, Namar Publishing, Ojai, CA, and Homes and Land of Santa Barbara County, March 1982, Homes and Land Publishing Corporation, Santa Barbara, CA. Weights for the total are based on the percentages of each category compared to the total units on the market. Sample sizes approach 20 percent in all cases except condominiums/townhouses and mobile homes. In those two cases, sample sizes are 10 percent and 15 percent, respectively.

Based on historical and current empirical data, the prices of owner-occupied units are expected to continue to escalate in the Vandenberg area at a rate consistent with the in-migration of new families, which exceeds the long-term growth rate of the population of Santa Barbara County. Since this in-migration is primarily driven by the influx of contractor workers at Vandenberg, housing prices in northern Santa Barbara County are expected to level off after 1985 to a rate consistent with the California average rate.

A Monopsony Model of the Vandenberg Labor Market

The relationship between housing cost and labor cost was indicated earlier by the example of the engineer who would move from Florida to Vandenberg. However, a more elegant illustration can be demonstrated by using a standard monopsony model of the aerospace labor market at Vandenberg.

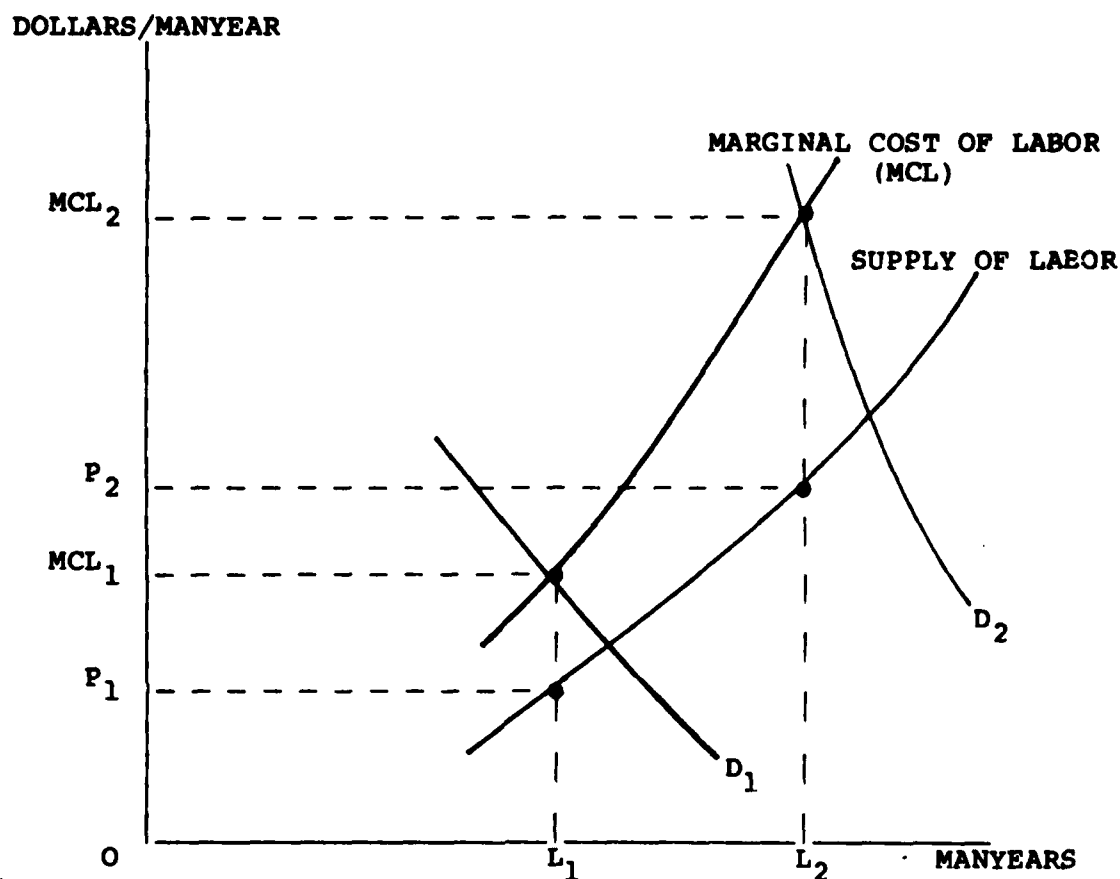
Consider the following assumptions. First, it is assumed that Vandenberg contractors are the sole employers of aerospace engineers, scientists, and certain types of technicians in Santa Barbara County. This assumption is clearly consistent with the available data on employment for Santa Barbara County. Second, assume that the contractors at Vandenberg, for the most part, act as a single, profit maximizing buyer of aerospace labor. This assumption is consistent with the current contract structure between the prime contractors at Vandenberg and Department of Defense Agencies. Finally, assume that aerospace workers are free to move to different locations around the country consistent with economic incentives.

If, as illustrated in the engineer example, labor costs are directly related to the appreciating cost of housing, the supply curve of aerospace labor will slope up and to the right.⁸ Given the profit-maximizing motives of the contractors and the relative ease experienced by the contractors in passing on additional labor costs to the Department of Defense, it is clear that the contractors will tend to operate at the point where the marginal cost of labor equals the marginal revenue product of labor.⁹

⁸For the purpose of illustration, the model has been simplified by assuming a homogeneous pool of aerospace workers. However, this assumption is not a necessary condition. The same general results would be achieved if we used separate labor markets for various types of engineers, scientists, technicians, etc.

⁹See any standard principles of economics text for details on the rule that the marginal cost of labor equals the marginal revenue product of labor at profit maximization. Also the contracts between Martin Marietta, Rockwell International, and the Air Force are cost plus fixed fee with overruns split decidedly in favor of the contractor. United Technologies is on a fixed price contract with the Air Force; however, they have by far the smaller share of the total Space Shuttle Program. We have no data on the nature of the contracts managed by the Army Corps of Engineers.

Figure 1: The Supply and Demand for Aerospace Labor at Vandenberg. A Monopsony Model



The above figure illustrates the monopsony labor market model. Note that the marginal cost of labor curve rises faster than the supply of labor curve which is consistent with the expectation that, as the marginal worker is hired at a higher salary, workers with similar skills currently employed will demand and receive increases in salary consistent with the salary of the marginal worker.

It can be shown that the current demand for aerospace labor at Vandenberg (D_1) is also the marginal revenue product curve for aerospace labor at Vandenberg. It is expected that D_1 is highly inelastic given the current state of contractor incentives. Given the profit maximization motive, the contractors will collectively buy L_1 amount of labor at a direct cost per manyear of P_1 . As demand shifts from D_1 to D_2 , the cost per manyear will shift from P_1 to P_2 . The incremental change in labor cost passed on to the Department of Defense as the labor force increases from L_1 to L_2 is the area under the MCL curve between L_1 and L_2 .

As stated earlier, a driving force behind labor cost appreciation at Vandenberg is the appreciation of the cost of housing in northern Santa Barbara County. Even if there are no other forces which act upon labor costs, housing cost appreciation is sufficient to cause an upward sloping supply curve for labor which is a necessary condition for the model described above. Sufficient conditions are provided by the relative isolation of Vandenberg from other buyers of aerospace labor (monopsony) and the nature of the cost-plus fixed fee contracts between the prime contractors and Department of Defense agencies (ease of cost transfer to the Department of Defense).

Even though data is not available for precise calculations, the model clearly shows that, in general, the Department of Defense will experience a rate of increase in labor costs that

will exceed the rate of increase in direct cost per manyear for an aerospace worker. The model can be broken down into separate markets for different labor categories. However, similar results would be obtained. If forces other than the cost of housing are acting on the labor market, the cost of labor (MCL) experienced by Department of Defense agencies will increase at an even faster rate.

The Choice Between Home Ownership and Private Rental

The in-migration of contract workers to Vandenberg will impact on both the owner-occupied and the rental housing markets. This impact will be amplified by the net increase in the military and non-contractor civilian work force at Vandenberg and the influx of workers due to the Vandenberg multiplier effect on the local economy.

To assess the magnitude and the direction of this impact it is useful to examine the probability of choice of home ownership compared to private rental for incoming families. If families can be grouped according to certain socioeconomic characteristics, and if the numbers of families in each group are known, a probabilistic model can be used to predict the numbers of owner occupied and private rental housing units necessary to accommodate the newcomers.

A large number of studies have focused on the explanation of choice between home ownership and private rental. Income, age of head, family size, race of head, and housing characteristics such as monthly imputed rent, distances to work, and number of bedrooms have been generally found to be the primary determinants of the housing choice decision.¹⁰

Mingche M. Li (1977) provided a logit model of choice behavior between home-ownership and private rental.¹¹ He used observations of civilian households to calculate regression coefficients. Essentially he found that the probability of home ownership compared to private rental increased as income and age of head increased. The probability of home ownership also went up as family size increased, but then declined as family size exceeded five persons. This decrease for larger families was primarily due to the budget constraint, e.g., larger families forego housing service consumption to pay for increased amounts

¹⁰See Gertcher, F. L. op. cit., for details on imputed rents. The imputed rent of an owner-occupied home is the uniform monthly cost that is equivalent to all of the cash amounts paid out or received by a given home owner at an appropriate discount rate. It includes the amortized effects of down payment, monthly payments, income tax benefit, and expected net selling price. The discount rate most often used is the mortgage interest rate paid by the home owner. The imputed rent of a rented home includes all monthly payments and the amortized effects of one-time deposits.

¹¹Li, Mingche, M., "A Logit Model of Homeownership," Econometrica, Vol. 45, No. 5 (July 1977).

of non-housing goods. Since owner occupied homes tend to provide larger amounts of housing service per dollar spent in imputed rents, home ownership tends to decline for larger families. Consistent with other studies, Li showed that in 1976-77, the probability of home ownership dropped by over 30 percent for households headed by blacks.

Li's logit model was limited because it did not include characteristics of housing units. F. L. Gertcher (1981) developed a logit model which included imputed rent, distance to work, number of bedrooms, and expected period of occupancy in addition to income and family size.¹² However, Gertcher's model used observations of military, not civilian, families to calculate regression coefficients. In those instances where they are comparable, the two logit models provide remarkably consistent results. Gertcher's model provided the following additional information. For the usual case, the probability of home ownership increased as the difference in imputed rent increased. This relationship was mitigated somewhat for lower income families by the greater monthly cash flow variations experienced by home owners compared to private renters. The distance-to-work coefficient was not significant in the choice between home ownership and private rental. An increase in the number of bedrooms

¹²See Gertcher, op. cit.

resulted in an increase in the probability of home ownership. Finally, the model showed that the longer the expected period of occupancy, the greater the probability of home ownership. This is consistent with the gains over time from the tax benefit and the appreciation of the selling price which accrues to home owners and makes home ownership relatively more attractive. Given the consistency between Li's model and Gertcher's model, it is reasonable to conclude that there are no essential differences between home choices made by civilian and military families with similar income, ages of head, family size, and expected periods of occupancy. Due to equal opportunity attitudes and laws in 1982 compared to 1977, race is assumed not to be a relevant variable in communities surrounding Vandenberg. However, it must be stated that no hard empirical evidence is available to support this assumption. Given the above framework and assumptions, Table 3 provides coefficients and signs which show the direction of change of the probability of home ownership compared to private rental for each independent variable.

The value of the model lies in the signs of the coefficients rather than their magnitudes. The signs, of course, are consistent with the above discussion.

**Table 3: Probability of Home Ownership Compared
to Private Rental**

<u>Independent Variable</u>	<u>Logit Coefficient</u>	<u>T-Ratio</u>
Difference in Mean Imputed Rents	-0.9611	-8.8539
Difference in Mean Distance to Work	0.0161	1.0279
Difference in Mean Number of Bedrooms	1.9618	9.1942
Income	0.7238	3.4139
Family Size	-0.0643	0.8347
Expected Period of Occupancy	0.0325	3.3274
Constant	-0.6850	-1.2597

Pseudo R-Square = .5160

Pseudo R-Square for Model = .7404

Likelihood Ratio Test = 822.12 with 6 D.F.

Table 4 provides mean and standard deviation statistics for the values of the independent variables used to estimate coefficients for the logit model. Of special interest are the mean value for the imputed rent difference (measured in dollars), and the mean value for the distance-to-work difference (measured in

miles).¹³ These statistics should be compared to the statistics associated with Vandenberg observations. If there are significant differences, the predictive power of the model will be reduced.

Table 4: Variable Statistics for Home Ownership to Private Rental Comparison

Variable	Mean	Standard Deviation
Home owner cost difference	-46.95	113.60
Private rental cost difference	-31.88	73.24
Home owner distance difference	1.43	.73
Private rental distance difference	-.59	3.37
Home owner bedroom difference	.06	.96
Private rental bedroom difference	-.06	.96
Income	18430.00	7949.00
Family size	3.71	2.13
Expected period of occupancy	46.26	17.28

¹³The opportunity cost of time spent in travel was implicitly included as part of travel cost-to-work. Refer to Mills, Edwin S., Urban Economics. (Glenview, IL: Scott, Foresman and Co., 1972), pp. 85-88. Also see the empirical studies references by Mills with regard to the choice of transportation mode for travel-to-work.

In 1981, approximately 66 percent of the housing units in the U.S. were owner-occupied.¹⁴ As the model presented in Table 3 indicates, the percentage of homeowners increases with income and with expected period of occupancy. Given the relatively high incomes of Vandenberg contractor workers compared to the national average, it can easily be shown that the percentage of home owners among these workers will be substantially higher than the national average, approaching 90 percent among higher income classes.

Conclusions and Recommendations

We can conclude by stating that the mean price of owner-occupied homes is a major driving force in escalation of housing costs experienced by newcomers to the Vandenberg area. Further, the escalation in housing costs will continue to force increases in the cost of inducing workers to come to Vandenberg. As stated earlier, this escalation of prices will only level off when the rate of family in-migration levels off in 1984-85.

As indicated by USAF Space Division cost accountants in March 1982, fixed labor cost wrap-rates have been used to forecast labor costs. With a fixed wrap-rate per manyear, the only variable in the forecast is the number of workers. As noted earlier

¹⁴Source: U.S. Department of Commerce, op. cit.

in this paper, labor costs, at the very least, are driven by the "tight" market for certain types of aerospace workers and the appreciation in the cost of housing for northern Santa Barbara County. We therefore recommend that current wrap-rates be abandoned, and that the labor cost per manyear be expressed as a function of certain independent variables. The list of independent variables should include national labor cost indices for appropriate labor categories and a Santa Barbara index for the cost of housing.

In theory, a substantial savings would likely occur if contractors would pay differential housing costs instead of salary increases designed to cover differential housing costs. We argue as follows. First, if the marginal worker is given a salary increase to induce him to move to the Vandenberg area, there is a strong tendency for currently employed workers with similar skills to demand the same salary. Thus, the MCL curve would tend to rise faster than the supply of labor curve. Thus, the increase in labor cost passed on to the Department of Defense is substantially greater than the increase in salaries per manyear. On the other hand, if the contractor paid each worker a differential to offset the cost of housing instead of an increased salary, the MCL curve would not rise as fast, and less cost would be passed on to the Department of Defense. Of course, the exact

methodology of such a model would have to be worked out based on empirical data.

The rise in the mean price of single family homes in northern Santa Barbara County is a function of the total in-migration of new families and the rate of increase in the existing housing stock. It is dangerous to forecast appreciation rates based on the influx of Air Force contractor workers alone. Forecasts should be based on the influx of military and civilian workers for both Air Force and Army Corps of Engineers programs at Vandenberg and the influx of civilians due to the multiplier effect on the civilian economy. It can reasonably be assumed that the increase in housing stock will be based on long-term population growth, not the in-migration of a transient work force. Forecasts for total in-migration can be provided by a number of agencies, including the Security Pacific Bank in Los Angeles, the Real Estate Research Council of Southern California, and various other California-based economic research agencies.

Due to the press of time and the non-availability of certain data, this paper provides only a general solution to a portion of the problem of inaccurate labor cost forecasts for Vandenberg Space Shuttle Program. The framework is limited to the portion of the increase in labor costs that can be attributed to the appreciation in the cost of housing in northern Santa Barbara County. However, as indicated by the example in the introduction

and the references presented, I believe that the impact of housing costs on labor costs is substantial, and perhaps the single most important element.

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