SHELTER IMPROVEMENT IN LIMA, PERU

Report P - 7

by

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Lima families carry out a vast amount of improvement and expansion work on their dwellings. A drive or walk around any part of the city can prove that. Formal surveys are needed only to show who does how much of what in a way that makes it possible to relate upgrading to the rest of the economy. Such a survey was carried out in a joint effort of the Technical Office for Manpower Studies, General Bureau of Employment, Ministry of Labor and the Housing in Development Unit of Michigan State University. This report gives the principal results.

A Preview

Of course, mainly owner-occupied dwellings, not rented units, are improved by those who live there. Owned dwellings therefore improve with age for about twenty years while rented units deteriorate. The average owner-occupied dwelling aged 16-20 years was worth 156 percent more than the average such dwelling aged 1-5 years. By contrast a comparably older rental would have lost 48 percent of its value. Even if materials, space, sanitary facilities, etc. are held constant, a ten-year-old rental unit will rent for 31 percent less than a five-year-old unit. The effect is partly due to the disincentive of rent control to landlords who might carry out maintenance or improvements.

The average owning household in 1980 consisted of six members: Two or three children under 18 and three or four adults. Two of the adults were workers, and 7.5 percent were unemployed. Their combined monthly income from all sources averaged $71,900 (US $252). Mean age of the head was 47 years, and the family had lived in the dwelling for 11

years. During this period they had expanded its size from 92 to 128 square meters at a 1980 cost of about $770,000 (US $2,700) and thus brought its value to $2.6 million (US $9,100). Two persons per room was typical, but a fifth of households (average size, 6.9 persons) considered themselves too crowded, and two or three people were willing to move out if they could find an affordable separate dwelling.

The expansion organized by the average household took the equivalent of 152 professional workdays. Two-thirds of improvements, however, were carried out by self-help methods that took longer, but for comparability this work should nevertheless be counted at the professional employment rate. In 1980 some 556,500 households out of 897,000 in Lima were owner-occupants, and if each had generated 152 equivalent workdays in improvements, that makes a total of 84.6 million workdays or 338,000 workyears. Spread over 11 years, the improvements therefore created about 31,000 jobs per year, an amount equivalent to 2.2 percent of the labor force. Note that only .7 percent was formal construction labor. As a whole, construction workers were 7.2 percent of the labor force, so that the formal and informal upgrading work on owner-occupied dwellings came to 25 percent of construction labor. An additional 13,000 jobs were created in building materials production and in the inputs into building materials, etc. These statements are estimated orders of magnitude, not precise facts. The following sections will give background, details, and qualifications.

Types and Extent of Improvement

Some kind of improvement or expansion of the dwelling had been made by the vast majority -- 81.6 percent -- of 1980 owner occupants. Half had made more than three types of improvement, and a quarter more than five types.

Types of Improvement	Percentage	Percentage below $50,000 monthly income
None	18.4	17.0
1 - 2	30.2	30.0
3 - 5	25.6	29.1
6 or more	25.8	23.9

The amount of improvement is not easily quantified, but one approach is to count the types of improvement. Thus improved flooring is counted once whether installed a single time in one room or several times throughout a house. This approach is used because it fits what all households can recall accurately. People also remember how many rooms they have added, and that evidence will be analyzed later.

As can be seen in Table 1, seventeen types of improvement have been identified. Only one percent of households reported improvements that did not fit into these categories. The seventeen types are grouped in four categories: site changes, basic changes, utilities, and finishes. The table shows what percentage of occupants have made each type of change, and a further breakdown divides the sample into those below and above the median income level. The average household made 3.8 changes, or, counting only improving households, 4.6 changes.

Adding a room or two was the most popular change, followed by interior painting and plastering. Below the median income level, nearly

Table 1 -- Percentage of Owner-Occupants Making Different Types of Improvements

Type of Improvement	Total Sample n = 724	Monthly Income 50,000 soles or less n = 377	Monthly Income Over 50,000 soles n = 347
A. Basic			
1. Reconstruct the house	30.2	40.1	19.6
2. Room(s) added	41.9	46.7	36.6
3. Wall materials changed	25.3	30.5	19.6
4. Roof materials better	17.0	16.4	17.6
B. Utilities			
1. Water facilities better	25.4	27.1	44.6
2. Toilet better	26.7	22.5	56.0
3. Kitchen improvements	26.0	21.5	30.8
C. Finishes			
1. Interior plastering and painting	39.4	27.6	52.2
2. Floor improvements	30.1	28.4	32.0
3. Windows and doors improved	29.4	23.6	35.7
4. Outside plastering	19.6	18.3	21.0
5. Interior ceiling finished	11.5	8.5	14.7
D. Site Changes			
1. Grading	20.2	29.2	10.4
2. Adding fill	12.2	18.0	6.6
3. Fence or wall	10.4	6.9	14.1
4. Garden	9.9	6.1	14.1
E. Other	1.2	1.1	1.4

half added rooms, and more than half did interior painting and plastering above that income level. The most popular improvement or addition at the higher level, however, was improving the toilet or adding another. Fifty-six percent of households did that, and 44.6 percent improved water facilities in other ways.

Below the median income level, 40.1 percent reconstructed their house in its entirety -- usually going from estera mats or wood to bricks and concrete. Grading the site and adding fill was also important at the lower, but not the higher level. Improving plumbing facilities, finishing an interior ceiling, inside decoration, or planting a garden was substantially less important at the low compared with the high level. About equally important was outside plastering, improving floors, and bettering windows and doors. (See Table 1). Poor households often had to improve the site and rebuild and expand a simple shack with basic changes. Higher quality finishes and better utilities became priorities after middle income and middle age had been reached.

The longer a household has occupied a dwelling, the more types of improvement it will have made. The last two lines of Table 2 show that households that had been in place only 1-2 years had averaged two types of improvement, while those who had been there over a decade had averaged 4.7 types of improvements. The new occupants were most likely to have plastered and painted the inside, installed better (often safer) windows and doors, and added a room. Better plumbing facilities and flooring were the main changes that long-time occupants will have made in addition, apart from entirely rebuilding the house.

Table 2 -- Percentage of Owners Making Specific Changes

Type of Improvement	Percentage of Owner-occupants who had made that type, total and by years of occupancy					
	(1) All	(2) 1-2	(3) 3-5	(4) 6-10	(5) Over 10	(6) 5/2
A. Basic						
1. Reconstruct the house	30.2	10.0	18.3	32.4	37.7	3.8
2. Room(s) added	41.9	23.3	37.3	36.9	51.5	2.2
3. Wall materials changed	25.3	10.0	17.5	24.1	32.7	3.3
4. Roof materials better	17.0	10.0	12.7	15.4	21.5	2.2
B. Utilities						
1. Water facilities	25.4	11.7	15.1	26.1	32.0	2.7
2. Toilet better	26.7	13.3	15.1	21.6	38.4	2.9
3. Kitchen improvements	26.0	16.7	20.6	20.7	34.3	2.1
C. Finishes						
1. Interior plastering and painting	39.4	30.0	34.9	33.6	47.8	1.6
2. Floor improvements	30.1	16.7	22.2	25.3	40.1	2.4
3. Windows and doors improved	29.4	20.0	27.0	25.3	35.7	1.8
4. Outside plastering	19.6	8.3	13.5	19.9	24.2	2.9
5. Interior ceiling finished	11.5	8.3	11.1	8.3	14.8	1.8
D. Site Changes						
1. Grading	20.2	10.0	15.1	22.0	22.9	2.3
2. Adding fill	12.2	5.0	11.1	13.3	14.1	2.8
3. Fence or wall	10.4	8.3	11.9	12.9	8.1	1.0
4. Garden	9.9	5.0	8.7	11.2	10.4	2.1
E. Others	1.2	1.7	0	.8	2.0	1.7
Average Number of changes (Standard deviation)	3.77 (3.66)	2.08 (3.01)	2.92 (3.03)	3.50 (3.48)	4.68 (3.94)	2.3

Income and the Improvement of Different Housing Types

The preceding section has implied that improvement depends partly on income. This implication can be misleading. Poor households, it is true, can afford to make fewer improvements; but they can also afford less housing to begin with and must therefore make more improvements. The net result, as was stated, is that the poor make different types of improvement -- those types that bring a rudimentary shack to a minimal level of size and quality. They level the site, bring in fill, change the walls and roof, and plaster the inside.

Table 3 is a cross-tabulation, "stock-user matrix," with 36 cells. The bottom number in each cell is the number of households that have the income characteristics of that row and the type of housing of that column. The top line is the average number of types of improvements made by the households in the cell. Thus the fewest improvements, 1.19 were made by 16 households in the upper left cell, those with the lowest incomes living in the worst housing. From Tables 5, 7, and 19, we can see that these households had 4.4 members, including a head aged 46, and that they had occupied the unit for 14 years. These are the households in the most desperate circumstances.

The 15 percent of households (105), F0 and F1, who received $28,000 (US $98) monthly or less, generally made fewer than three types of improvement, but the income range immediately above, F2, averaged the most improvements, more than four types. These F2's are households just below the median income level. The housing most suited to the F2 income level -- H2 Minimal (2-3 rooms, $45m^2$) -- is also the most improved housing type, typically containing 4.6 improvements.

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Table 3. Average number of types of improvements. Owners, Lima, 1980
(Per dwelling/household)

Households / Dwellings — Monthly income 6/1980 Soles,000	H_0 Temporary	H_1 Sub-standard	H_2 Minimal	H_3 Basic	H_4 Good	H_5 Excellent	Σ_F
F_0 15 or less	1.19 (1.22) 16	3.80 (3.70) 5	3.60 (3.78) 5	C — 1			2.44 (2.90) 27
F_1 15.1 - 28	2.88 (2.43) 48	3.36 (2.87) 11	4.30 (3.50) 10	2.71 (2.21) 7	— 1	9.00 — 1	2.92 (2.83) 78
F_2 28.1 - 50	3.17 (2.42) 93	3.47 (2.78) 45	4.94 (3.70) 52	4.47 (3.27) 37	5.61 (5.11) 33	5.00 (4.65) 11	4.11 (3.55) 272
F_3 50.1 - 90	2.67 (2.00) 27	4.33 (3.14) 21	4.67 (3.38) 21	3.60 (4.16) 45	4.46 (4.41) 46	3.76 (3.97) 35	3.90 (3.29) 193
F_4 90.1 - 162	3.14 (2.70) 7	2.67 (3.06) 3	3.29 (3.26) 9	5.27 (4.48) 15	3.14 (4.25) 29	3.75 (4.19) 40	3.73 (4.06) 112
F_5 Over 162			4.00 — 2	1.00 — 1	3.08 (2.94) 12	3.96 (4.10) 27	3.64 (3.72) 42
Σ_H	2.72 191	3.78 85	4.04 99	4.03 107	4.28 121	3.95 121	3.77 (3.66) 724

Source: Survey of 1,167 households, Lima, June 10-July 3, 1980.

Note: The top row in each cell shows the average number of types of improvements carried out by households of that income level in that type of housing. The second figure is the standard deviation. The bottom number is the total of observations in that cell.

The greatest number of improvements, 5.6, were made by 33 households at the F2 income level that had brought their housing up to the H4 level. Such housing was made of good materials, had 4-5 rooms, about $120m^2$, and all plumbing facilities. These households had 5.3 members, had occupied the premises for the Lima average of 11 years, but their head was aged 52, five years more than the average.

As the last column of Table 3 shows, each income range above the median level of $50,000 (US $175) seems to make slightly fewer improvements than households in the next lower range. But this trend is not statistically significant: All households make about the same number of improvements, and the correlation with income is zero, as Table 4, column 3, shows. What makes households improve and expand their dwellings a bit more is a larger family, especially a larger proportion of adults. Those two factors are statistically significant.

Although almost all the poor, like most of the rich, make improvements and additions, income does play a statistically significant encouraging part. Especially interesting is that, <u>given income</u>, those poor with access to a sewer system connection will make three times as many types of improvement as those without. That connection not only makes sanitary improvements physically possible, but it may also be the critical factor that gives a household pride and confidence in the value of a particular site.

Household Size, Employment, and Income

The preceding section has noted that household size and composition, but not income, affect improvements among households above the median income level. Further analysis may avoid confusion on the topic of income

Table 4 -- Number of Improvement Types Carried out by Lima Owner Occupants as a Function of Selected Variables.

Independent Variables	Total Sample n = 724	Income $50,000 or less monthly n = 377	Income over $50,000 monthly n = 347
1a. Income, logs: Coefficient	.378*	1.151**	.427
(standard error)	(.184)	(.376)	(.442)
1b. Constant	2.192**	-.321	1.802
(standard error)	(.745)	(1.306)	(2.031)
R^2 adjusted	.004	.021	.000
F	4.228	9.390	.934
2a. Income, logs: Coefficient	.153	1.022**	.078
(standard error)	(.200)	(.395)	(.448)
2b. Household size, logs: Coeff.	1.346**	.450	1.912**
(standard error)	(.347)	(.472)	(.511)
2c. Proportion of adults, Coeff.	.952	-1.041	2.528**
(standard error)	(.531)	(.760)	(.742)
2d. Constant	.222	-.024	-1.712
(standard error)	(.906)	(1.472)	(2.207)
R^2 adjusted	.022	.035	.040
F	6.611	5.735	5.895
3a. Income, logs: coefficient	.057	.873*	.237
(standard error)	(.203)	(.381)	(.450)
3b. Indoor piped water (dummy)	.168	.007	.928
(standard error)	(.428)	(.456)	(.922)
3c. Sewerage connection (dummy)	1.047**	1.249**	.616
(standard error)	(.398)	(.434)	(.823)
3d. Constant	2.658**	.053	1.313
(standard error)	(.786)	(1.336)	(2.052)
R^2	.020	.049	.007
F	6.044	7.588	1.928

Source: Survey of 1,167 households carried out June 10-July 3, 1980.

Note: Statistical significance at the .01 level is indicated by two stars and that at the .05 level by one star.

and family size. In Table 5, bottom line, one can see that for all six housing types, family size is close to 6.0. The averages range from 5.7 to 6.3 without any particular pattern. In income ranges family size varies slightly more, from 5.7 to 6.7, and the poorest households, those receiving less than $15,000 (US $53), have only 4.4 members. But if one counts just the number of adults (aged 18 or more), as in Table 6, a different pattern emerges. Their number rises steadily from 2.9 in the lowest housing category to 4.2 in the highest, or from 2.2 in the lowest income category to 4.6 in the highest. One suspects that a leading characteristic of the poorer households who live in worse housing is that they are younger. And so it is, as can be seen in Table 7. Average age of the household head in the lowest two housing categories is 44 years, and in the lowest two income categories, 45 years. In the highest income and housing categories, average age is 50 years.

Income and the life cycle stage of the household are obviously correlated. It is not the number of adults that matters, however, but the number of working adults. The highest compared with the lowest income range has only twice as many adults per household but three times as many employed workers. In fact, their average number is exactly three, as can be seen in Table 8. By housing category the pattern is less pronounced with the number of employed workers per household rising from 1.6 to 2.3 from the lowest to the highest range.

Table 5. Number of occupants. Owners, Lima, 1980.
(per dwelling)

Households \ Dwellings	H_0	H_1	H_2	H_3	H_4	H_5	Σ_F
F_0	4.38 (2.63) 16	4.5 (2.17) 5	4.40 (4.16) 5	3 — 1			4.41 (2.74) 27
F_1	5.75 (2.18) 48	6.00 (2.14) 11	5.2 (1.03) 10	5.57 (2.88) 7	5.0 — 1	7.0 — 1	5.71 (2.08) 78
F_2	6.10 (2.37) 93	6.02 (2.34) 45	5.94 (2.52) 52	5.71 (1.93) 38	5.27 (2.02) 33	6.18 (2.71) 11	5.90 (2.31) 272
F_3	7.15 (2.43) 27	6.62 (2.64) 21	7.14 (2.83) 21	5.56 (2.18) 45	5.70 (2.25) 46	5.67 (2.50) 33	6.12 (2.47) 193
F_4	7.00 (3.21) 7	5.67 (3.00) 3	8.44 (2.46) 9	6.73 (2.15) 15	6.10 (2.7) 29	6.67 (2.97) 49	6.67 (2.79) 112
F_5			6.5 (2.12) 2	2.00 — 1	6.83 (2.89) 12	6.04 (2.17) 27	6.19 2.43 42
Σ_H	6.05 191	6.07 85	6.28 99	5.72 107	5.78 121	6.21 121	6.02 (2.46) 724

Table 6. Number of adults. Owners, Lima, 1980.

(per household)

Dwellings / Households	H_0	H_1	H_2	H_3	H_4	H_5	Σ_F
F_0	2.19 (0.98) 16	2.4 (0.55) 5	2.00 (1.22) 5	1.0 — 1			2.15 (0.95) 27
F_1	2.35 (0.93) 48	2.73 (1.19) 11	2.5 (0.85) 10	2.86 (1.57) 7	4 — 1	2 — 1	2.49 (1.03) 78
F_2	2.91 (1.24) 93	2.89 (1.42) 45	3.27 (1.46) 52	3.66 (1.71) 38	2.79 (0.93) 33	3.00 (1.18) 11	3.07 (1.37) 272
F_3	3.89 (1.60) 27	4.00 (1.82) 21	4.57 (1.78) 21	3.47 (1.59) 45	3.65 (1.55) 46	3.85 (1.91) 33	3.81 (1.69) 193
F_4	4.14 (2.27) 7	4.33 (1.53) 3	5.11 (1.45) 9	4.07 (1.44) 15	3.86 (1.98) 29	4.51 (1.86) 49	4.30 (1.83) 112
F_5			4.00 (1.41) 2	2.00 — 1	5.00 (1.95) 12	4.48 (1.95) 27	4.55 (1.86) 42
Σ_H	2.89 191	3.17 85	3.59 99	3.54 107	3.60 121	4.17 121	3.45 (1.66) 724

NADULT -- VALCAT P. 50

Table 7. Age of household head. Owners, Lima, 1980.

Households \ Dwellings	H_0	H_1	H_2	H_3	H_4	H_5	Σ_F
F_0	45.56 (16.40) 16	40.20 (7.92) 5	64.20 (15.83) 5	20 — 1			47.07 (17.23) 27
F_1	39.15 (9.02) 48	50.18 (14.69) 11	47.4 (20.90) 10	49.43 (11.89) 7	72 — 1	42 — 1	43.14 (13.17) 78
F_2	43.14 (12.53) 93	41.76 (9.8) 45	43.54 (11.05) 52	44.61 (10.85) 38	52.24 (12.7) 28	43.09 (12.3) 11	44.29 (11.94) 272
F_3	44.56 (12.37) 27	51.95 (12.78) 21	49.29 (11.01) 21	46.18 (12.18) 45	51.95 (12.01) 46	50.21 (11.69) 33	48.99 (12.20) 193
F_4	42.29 (13.69) 7	59.67 (7.51) 3	58.67 (9.01) 9	47.60 (10.89) 15	45.86 (11.11) 29	51.67 (11.15) 49	49.81 (11.66) 112
F_5			39.50 (6.36) 2	32 — 1	53.33 (9.23) 12	51.81 (12.9) 27	51.24 (12.15) 42
Σ_H	42.51 191	45.91 85	47.49 99	45.66 107	50.88 121	50.46 121	46.78 (12.61) 724

Q.6001 — VALCAT P. 43

Table 2. Number of employed workers. Owners, Lima, 1980.
(per household)

Households \ Dwellings	H_0	H_1	H_2	H_3	H_4	H_5	Σ_F
F_0	0.94 (0.68) 16	1.00 — 5	1.20 (0.71) 5	0 — 1			0.92 (0.62) 27
F_1	1.25 (0.79) 48	1.09 (0.7) 11	1.10 (0.74) 10	1.14 (1.07) 7	0 — 1	1.00 — 1	1.18 (0.79) 78
F_2	1.72 (0.91) 93	1.51 (0.84) 45	1.54 (0.78) 52	1.63 (0.88) 38	1.27 (0.72) 33	1.27 (0.79) 11	1.57 (0.85) 272
F_3	2.19 (1.00) 27	2.24 (0.70) 21	2.24 (1.04) 21	1.91 (0.91) 45	1.76 (0.91) 46	1.85 (1.15) 33	1.97 (0.97) 193
F_4	2.29 (0.95) 7	3.67 (1.53) 3	3.22 (1.20) 9	3.13 (1.25) 15	2.28 (1.07) 29	2.51 (1.37) 49	2.61 (1.28) 112
F_5			3.5 (0.71) 2	1.0 — 1	3.58 (1.62) 12	2.81 (1.[illegible]) 27	3.02 (1.3[illegible]) 42
Σ_H	1.62 191	1.68 85	1.81 99	1.90 47	1.92 121	2.27 121	1.86 (1.11) 724

NEMP — VALCAT p. 45

Thus higher income per household is partly, but not mainly, a matter of more workers per household. Regression analysis of the entire sample shows that about 14 percent of the income differences among households is explained by variations in the number employed. (See Table 9). If the age and years of education of the household head are added as explanatory variables, an additional 3 percent are explained -- with age of little importance. On a per capita basis, only 1 percent of income variation is explained by the number of employed workers per household. Age and education explain another 2 percent. Most income variations are due to differences in skill or luck of one sort or another.

Since the regression of Table 9 includes them, we may note that a similar relation among family-size, employment, and income applies to tenants. (See Tables 10, 11, and 12.) Higher income tenants have larger families, a higher share of adults, and still more working adults than poorer families. The type of housing occupied varies with the number of working adults but not with sheer family size. Average age of the household head, 44, is three years less than that of owner occupants and not particularly related to income. The poorest and richest heads are older than those in between (Table 13).

Table 9 -- Household and Per Capita Income as a Function of Number Employed, Age, and Education of the Household Head, Lima, 1980. Regression Coefficients.

Variable	Household Income (1)	Per Capita Income (2)
1. Number employed	21,073**	1.144**
(standard error)	(1.688)	(.457)
2. Age of household head	.484**	.086*
(standard error)	(.138)	(.038)
3. Years of education of household head	6.270**	1.343**
(standard error)	(1.110)	(.301)
4. Constant	-252,466**	-54,077**
(standard error)	(44,683)	(12,107)
R^2	.169	.027
F	79.927	11.879

Source: Survey of 1,167 households carried out June 10-July 3, 1980.

Note: Statistical significance at the .01 level is indicated by two stars and that at the .05 level by one star.

Table ___. Number of occupants. Renters, Lima, 1980.
(per dwelling)

Households \ Dwellings	H_0	H_1	H_2	H_3	H_4	H_5	Σ_F
F_0	4.6 (3.24) 10	2.67 (1.15) 3	1.0 — 1				3.93 (3.05) 14
F_1	3.91 (2.09) 23	5.38 (2.18) 13	3.27 (2.37) 11	3.2 (1.1) 5	2 — 1		4.04 (2.20) 53
F_2	4.73 (3.06) 33	4.09 (1.77) 35	4.03 (1.47) 30	4.22 (2.05) 18	4 (2.12) 5	3.5 (0.71) 2	4.25 (2.16) 123
F_3	5.67 (2.61) 15	4.92 (2.33) 25	4.71 (1.65) 17	5.08 (2.37) 26	5.27 (2.72) 11	3 — 1	5.06 (2.3) 95
F_4	7.4 (3.78) 5	4.75 (1.5) 4	5.2 2.15 10	4.43 (1.27) 7	5.92 (1.56) 12	4.33 (0.82) 6	5.03 (2.05) 44
F_5			13 — 1	7.5 (0.71) 2	8 (1.15) 4	4.5 (1.29) 2	7.0 (2.13) 12
Σ_H	4.81 86	4.54 80	4.33 72	4.66 55	5.55 33	4.50 14	4.68 (2.33) 341

Table ___. Number of adults. Renters, Lima, 1980.
(per household)

Dwellings / Households	H_0	H_1	H_2	H_3	H_4	H_5	Σ_F
F_0	1.9 (1.73) 10	2 — 3	1.0 — 1				1.86 (1.46) 14
F_1	2 (0.52) 23	2.46 (0.97) 13	2.09 (0.7) 11	1.8 (0.45) 5	2 — 1		2.11 (0.70) 53
F_2	2.61 (1.43) 33	2.49 (1.15) 35	2.57 (0.77) 30	2.83 (1.25) 18	2.6 (1.34) 5	2.5 (0.71) 2	2.59 (1.16) 123
F_3	3.67 (2.09) 15	3.2 (1.47) 25	3.18 (1.47) 17	3.19 (1.47) 26	3.64 (1.69) 11	2 — 1	3.31 (1.59) 95
F_4	5.4 (2.3) 5	3.5 (1.29) 4	4.10 (1.66) 10	3 (1.0) 7	4 (1.60) 12	3.67 (1.2) 6	3.93 (1.61) 44
F_5			10 — 1	5.5 (0.71) 2	5.0 (1.41) 4	4.4 (1.52) 5	5.25 (1.96) 12
Σ_H	2.71 86	2.74 80	2.95 70	3.02 58	3.73 33	3.64 14	2.95 (1.53) 341

NADULT — RENTCAT p. 16.

Table 1. Number of employed workers. Renters, Lima, 1980.

(per household)

Households \ Dwellings	H_0	H_1	H_2	H_3	H_4	H_5	Σ_F
F_0	0.9 (0.88) 10	0.33 (0.58) 3	1 — 1				0.79 (0.80) 14
F_1	0.96 (0.47) 23	1.08 (0.28) 13	0.91 (0.54) 11	0.6 (0.55) 5	1.0 — 1		0.94 (0.46) 53
F_2	1.67 (0.85) 33	1.31 (0.76) 35	1.43 (0.57) 30	1.5 (0.86) 18	1.0 (0.71) 5	0.5 (0.71) 2	1.44 (0.77) 123
F_3	2.27 (0.8) 15	2.04 (0.9) 25	1.76 (0.56) 17	2.08 (0.89) 26	1.64 (0.81) 11	1.0 — 1	1.98 (0.82) 95
F_4	4.0 (1.41) 5	1.75 (1.71) 4	2.9 (1.29) 10	1.71 (0.76) 7	3.25 (1.09) 12	2.83 (1.33) 6	2.82 (1.40) 44
F_5			7.0 — 1	3 (1.41) 2	3.25 (1.71) 4	2.6 (0.55) 5	3.25 (1.65) 12
Σ_H	1.63 86	1.49 80	1.71 70	1.76 58	2.30 33	2.28 14	1.73 (1.1) 341

NEMF — RENTCAT P. 11.

Table ___. Age of household head. Renters, Lima, 1980.

Dwellings / Households	H_0	H_1	H_2	H_3	H_4	H_5	Σ_F
F_0	52.7 (17.92) 10	55.33 (20.98) 3	23 — 1				51.14 (18.96) 14
F_1	49.78 (18.97) 22	36.23 (10.49) 13	41.27 (18.74) 11	32.4 (8.88) 5	56 — 1		43.17 (17.25) 52
F_2	43.61 (10.26) 33	41.37 (12.41) 35	39.97 (10.40) 30	40.22 (19.83) 18	48.60 (6.54) 5	48 (28.28) 2	42.45 (12.62) 123
F_3	47.47 (13.47) 15	44.72 (17.09) 25	44.25 (15.1) 17	43.31 (16.83) 26	45.45 (14.25) 11	23 — 1	44.56 (15.62) 95
F_4	47.4 (14.86) 5	51.75 (12.61) 4	45.6 (15.82) 10	42.29 (11.57) 7	44.5 (12.60) 12	39.33 (9.52) 6	44.68 (12.83) 44
F_5			62 1	52 (7.07) 2	45.75 (11.44) 4	44.6 (12.42) 5	47.5 (11.17) 12
Σ_H	47.21 86	42.62 80	42.09 70	42.83 55	45.94 33	41.36 14	43.97 (14.55) 341

Q 6001 — RENTCAT P. 9

Paying for Improvements

About 90 percent of improvements and expansions were financed without loans, and most changes were made with selfhelp labor. Households below the median income level had carried out three quarters of their improvements by paying cash for the materials and doing the work themselves. Above the median income level, somewhat more than half of the improvements had been made by selfhelp, but some of these had been completed before the household had reached the median income level. Most households well above the median will pay cash for the materials and hire a group of workers for the job. The credit that paid for about 10 percent of improvements came from a variety of formal sources, not from materials suppliers or friends and relatives. Credit was somewhat more important below than above the median income level.

How different types of improvements were financed below and above the median can be seen in Tables 14 and 15. Below the median income level, 85 percent of rooms had been added with selfhelp labor. Above only 52 percent had been added that way. Below the median income level, credit had been most important in adding a fence or wall around the property. Above, it had primarily gone for adding rooms or reconstructing the house altogether. Hired labor was most important for interior finishing and the installation of services. These activities require the most skill. Finding skilled workers for making such improvements was no problem for 94 percent of households.

Of interest is not only how improvements were actually financed in the past, but also how they might be paid for in the future. Respondents were asked if any members of their families would be available for work on

Table 14 — Improvement Finance at or below the Median Income Level. Percentage Distribution.

Type of Improvement (n = 377)	Selfhelp labor, materials bought with:			Materials and labor bought with:			
	1. Savings	2. Supplier Credit	3. Other Loans	4. Savings	5. Loans from Friends & Relatives	6. Loans from Credit Institutions	7. Other
A. Basic							
1. Reconstruct the house (151)	65.6	1.3	2.6	19.2	2.0	8.6	0.7
2. Room(s) added (175)	80.6	0.6	3.4	10.3	0.6	4.0	0.6
3. Wall materials changed (115)	78.3	0	4.3	10.4	0.9	6.1	0
4. Roof materials better (62)	75.8	0	3.2	11.3	1.6	8.1	0
B. Utilities							
1. Water facilities (102)	71.6	0	2.9	19.6	1.0	4.9	0
2. Toilet better (85)	72.9	0	3.5	15.3	1.2	7.1	0
3. Kitchen improvements (81)	75.3	0	3.7	11.1	1.2	7.4	1.2
C. Finishes							
1. Interior plastering (104) and painting	67.3	1.0	3.8	19.2	1.0	6.7	1.0
2. Floor improvements (107)	65.4	0.9	2.8	19.6	0.9	8.4	1.9
3. Windows and doors (89) improved	66.3	0	2.2	20.2	1.1	9.0	1.1
4. Outside plastering (69)	73.9	0	4.3	8.7	1.4	10.1	1.4
5. Interior ceiling (32) finished	75.0	3.1	6.3	3.1	0	6.3	6.3
D. Site Changes							
1. Grading (110)	86.4	0	0	8.2	0.9	3.6	0.9
2. Adding fill (68)	77.9	0	0	10.3	1.5	7.4	2.9
3. Fence or wall (26)	61.5	0	3.8	19.2	0	11.5	3.8
4. Garden (23)	78.3	0	8.7	8.7	0	4.3	0
E. Other (4)	50.0	0	0	50.0	0	0	0

Table 15 — Improvement Finance above the Median Income Level. Percentage Distribution.

Type of Improvement (n = 347)	Selfhelp labor, materials bought with:			Materials and labor bought with:			
	1. Savings	2. Supplier Credit	3. Other Loans	4. Savings	5. Loans from Friends & Relatives	6. Loans from Credit Institutions	7. Other
A. Basic							
1. Reconstruct the house (68)	57.4	1.5	1.5	26.5	2.9	10.3	0
2. Room(s) added (127)	50.4	0.8	0.8	35.4	0	12.6	0
3. Wall materials changed (68)	66.2	1.5	4.4	25.0	0	2.9	0
4. Roof materials better (61)	62.3	1.6	1.6	27.9	0	6.6	0
B. Utilities							
1. Water facilities (82)	54.9	0	3.7	36.6	1.2	3.7	0
2. Toilet better (108)	49.1	0	2.8	40.7	0	7.4	0
3. Kitchen improvements (107)	44.9	0.9	1.9	43.0	0.9	8.4	0
C. Finishes							
1. Interior plastering (181) and painting	51.9	0	1.1	41.4	0.6	5.0	0
2. Floor improvements (11)	55.9	0	0.9	37.8	0.9	4.5	0
3. Windows and doors (124) improved	50.8	0	0	38.7	1.6	8.9	0
4. Outside plastering (73)	56.2	0	0	39.7	1.4	2.7	0
5. Interior ceiling (51) finished	62.7	0	2.0	31.4	0	3.9	0
D. Site Changes							
1. Grading (36)	86.1	0	0	11.1	2.8	0	0
2. Adding fill (23)	87.0	0	0	8.7	0	4.3	0
3. Fence or wall (49)	34.7	0	4.1	51.0	0	10.2	0
4. Garden (49)	53.1	0	2.0	38.8	0	6.1	0
E. Other (5)	60.0	0	0	40.0	0	0	0

community projects, digging trenches, carrying materials, and the like, if payment were only in building materials that could not be resold but had to be installed on their own dwellings. Seventy-two percent said they would.

Respondents were also asked, "Were it possible, would you mortgage your house to obtain money for an addition or an improvement?" Among owners 18.0 percent said, yes. No doubt, on less severe terms, many more would borrow to build.

Another way of financing additions is by taking in lodgers or tenant families in rooms, apartments, or houses on the lot where the owner lives. Among sample households, only 3.3 percent (24) said that they had done so. They were two-thirds of sample landlords. Nineteen percent of sample tenants said they lived on the same site as their landlords. Only four households claimed that rent from tenants living on the same site was their primary source of income, more important than all other sources combined. Insofar as rent control in time of inflation has discouraged maintenance of rental property, it has also discouraged additions and improvements. This topic will come up again.

The Effect of Improvements on Value

Improvements raise dwelling value, not just in line with their cost, but primarily in accordance with the willingness of others to pay that much more for an improved unit. To determine value, we simply asked, "If you were going to sell your dwelling today, at what price do you believe that you could sell it?" With a hedonic regression analysis of two dozen dwelling characteristics of 724 owner-occupied units, we could

then estimate how much, if anything, each characteristic contributes to the total value. As Table 16 shows, twelve characteristics turned out to be significant at the 95 percent confidence level or better. Altogether they explained about 75 percent of variations in value.

The most important characteristics are basic materials, number of rooms, floorspace, and plumbing facilities. Let us show how improvements in each of these affects total value. Suppose we begin with a two-room, $40m^2$ shack made of straw mats, wood, and refuse, worth ₱170,000 (US $600). If the shack is rebuilt with bricks, concrete blocks, and reinforced supports and roof, its value more than triples to ₱544,000 (US $1,900). [(antilog .613)(antilog .551)(170,000)=544,000.] The shack has moved from the H0 Temporary into the H1 Substandard category. If it is now connected to the sewerage system and has a complete bathroom installed, it moves to the minimal category, and its value doubles to ₱1.1 million (US $3,900). [(antilog .413)(antilog .297)(544,000)=1,106,000.] It does not cost ₱562,000 (US $2,000) to make the plumbing installation, but the inconvenience of no water and no sewer-connected bathroom makes a dwelling without them worth half as much. The value that households attach to such facilities, their willingness to pay, is what makes water and sewerage infrastructure such a desirable urban investment.

If the sample dwelling is now plastered and painted on the outside, its value rises by 18.4 percent to ₱1,310 million (US $4,600).

Now let us double the size of the dwelling from two to four rooms and from 40 to 80 square meters. The coefficients found for rooms and floorspace in the double-logarithmic regression are elasticities. Using the coefficients from Table 16, column 1, rows 2 and 3, we see that 100

percent more floorspace raises value by 26.1 percent; and that doubling the number of rooms raises value by 34.6 percent. Together they raise it by 83.5 percent. The effect on the illustrative dwelling is to bring its value to ₡2.4 million (US $8,400). One additional room would move the dwelling from the H3 Basic to the H4 Good category.

At the high end of the value scale additional rooms, floorspace, and second bathrooms contribute significantly to value, but a new element assumes importance: Distance. Given all other characteristics, a dwelling that makes all workers in that dwelling travel twice as long to their jobs will be worth 16.4 percent less. On the average, high income workers travel 25 minutes to work. They would travel 50 minutes, if they could purchase an identical ₡7.2 million (US $25,000) house for only ₡6 million (US $21,000). Note that area of the site becomes less significant as one moves from the low to the high value range (Table 16, line 11.).

Table 16 -- Determinants of Dwelling Value: Hedonic (log - log) Regression Coefficients, Lima, 1980.

Variable	Total Sample n = 805	Low Range: H0-H3 n = 554	High Range: H3-H5 n = 372
1. Age of dwelling	.076 (.040)	.121** (.046)	-.047 (.043)
2. Floorspace	.261** (.068)	.180* (.086)	.222** (.064)
3. Number of rooms	.346** (.092)	.260* (.111)	.323** (.101)
4. Walls made of bricks, concrete blocks, or reinforced concrete	.621** (.102)	.613** (.103)	.292 (.252)
5. Roof made of tiles or reinforced concrete	.746** (.104)	.551** (.110)	-.008 (.147)
6. Exterior plastered and painted: finished	.169* (.078)	.133 (.087)	.111 (.094)
7. Water access (dummies)			
a. Own tap, no shower	.033 (.104)	.077 (.105)	-.136 (.247)
b. One complete bathroom	.374** (.145)	.297* (.151)	.155 (.238)
c. Two or more bathrooms	.839** (.176)	.020 (.477)	.550* (.248)
8. Sanitation (dummies)			
a. Latrine	.068 (.138)	.097 (.137)	.014 (.627)
b. Shared flush toilet	.517* (.242)	.435 (.248)	.345 (.792)
c. Septic tank	.176 (.220)	.052 (.225)	.253 (.631)
d. Sewerage system connection	.481** (.171)	.413* (.172)	.052 (.583)

Table 16 -- (cont'd)

Variable	Total Sample n = 805	Low Range: H0-H3 n = 554	High Range: H3-H5 n = 372
9. Electricity (dummies)			
a. Monophase	-.061 (.114)	-.036 (.116)	-.044 (.285)
b. Triphase	.340* (.172)	.319 (.322)	.364 (.299)
10. Site area	.274** (.058)	.233** (.069)	.112 (.058)
11. Travel time to work, average, all workers	-.136** (.044)	-.079 (.050)	-.164** (.050)
12. Income of neighbors (dummies)			
a. Higher than own	.029 (.110)	-.122 (.131)	.115 (.119)
b. Lower than own	-.271 (.149)	-.151 (.160)	-.251 (.183)
13. Constant	9.531** (.359)	9.836** (.427)	12.910* (.801)
14. Adjusted R^2	.746	.532	.483
15. F Statistic	93.69	25.23	14.47
16. Mean value of dwelling, million soles	2.537	.696	5.100

Source: Survey of 1,167 households, June 10-Jul7 3, 1980.

Note: Statistical significance at the .01 level is indicated by two stars and that at the .05 level by one star. Standard errors are given in parentheses. US $1 = 285 soles.

The low range includes all dwellings worth 2.4 million soles or less or renting for 8 thousand soles or less. The high range includes all dwellings worth more than 1.2 million soles or renting for more than 4 thousand soles. Value was determined by asking, "If you were going to sell your dwelling today, at what price do you believe that you could sell it?"

Housing Characteristics and Rental Value

Having just illustrated the way in which a hedonic regression can reflect and predict value, an aside on rent and housing characteristics is appropriate. Table 17 shows what happens when the identical variables of Table 16 are regressed on monthly rent. Striking is that much less of the variance is explained: $\bar{R}^2 = .574$, not .746 as before. Only three, not twelve variables are statistically significant at the 95 percent level or better. Only one of these three was also significant for owner-occupants. That one is the presence of two or more bathrooms, an element unlikely to exist in low-cost dwellings affected by rent control.

One of the other two variables is the negative association with having neighbors with higher incomes than one's own. Why that should depress rent is not clear. The negative association of rent with a building's age is more obvious and contrasts with the positive association of value and age for owner-occupants. As stated before, owner-occupants improve their premises, while neither tenants nor landlords have an incentive to make improvements under rent control. That the remaining twenty physical characteristics of a dwelling do not explain its rental level is probably due to inability to charge what the bundle is worth in the eyes of tenants since it is especially difficult to raise the rent on current tenants. The longer a dwelling has been rented to a particular household, the lower rent is likely to be, and the less likely is it that this household will move.

Years of Occupancy by the Current Household	Monthly rent, thousand soles, mean (and standard error)	Mean Value of Non-rented units, million soles, (and standard error)
1-2	6,255 (7,695)	2.53 (4.82)
3-5	5,375 (5,945)	2.42 (3.74)
6-10	4,754 (7,820)	2.41 (3.81)
Over 10	2,888 (4,582)	2.91 (5.44)

Table 17 -- Determinants of Rent: Hedonic (log - log) Regression Coefficients, Lima, 1980.

Variable	Total Sample n = 341	Low Range: H0-H3 n = 294	High Range: H3-H5 n = 372
1. Age of dwelling	-.313*	-.240	-.275
	(.156)	(.202)	(.177)
2. Floorspace	.041	.141	-.025
	(.352)	(.438)	(.436)
3. Number of rooms	.359	.271	.137
	(.314)	(.373)	(.418)
4. Walls made of bricks, concrete blocks or reinforced concrete	-.388	-.493	.383
	(.393)	(.425)	(.479)
5. Roof made of tiles or reinforced concrete	.589	.606	----
	(.404)	(.438)	
6. Exterior plastered and painted: finished	-.235	-.348	----
	(.438)	(.476)	
7. Water access (dummies)			
a. Own tap, no shower	.896	1.064*	-.403
	(.497)	(.533)	(.661)
b. One complete bathroom	.799	.829	-.404
	(.481)	(.516)	(.234)
c. Two or more bathrooms	1.533**	1.215	----
	(.582)	(.827)	
8. Sanitation (dummies)			
a. Latrine	-1.772	-1.940	----
	(1.172)	(1.259)	
b. Shared flush toilet	.427	.358	----
	(.562)	(.621)	
c. Septic tank	-.974	-.738	----
	(1.056)	(1.123)	
d. Sewerage system connection	.093	.204	----
	(.592)	(.643)	

Table 17 -- (cont'd)

Variable	Total Sample n = 341	Low Range: H0-H3 n = 294	High Range: H3-H5 n = 105
9. Electricity (dummies)			
a. Monophase	.019 (.407)	.484 (.480)	.361 (.600)
b. Triphase	.419 (.527)	.490 (.889)	.569 (.623)
10. Site area	.335 (.307)	.190 (.388)	.396 (.381)
11. Travel time to work, average, all workers	.045 (.143)	.007 (.179)	-.045 (.175)
12. Income of neighbors (dummies)			
a. Higher than own	-.878** (.296)	-.726* (.327)	-.075 (.449)
b. Lower than own	-.067 (.317)	.901 (.343)	.684 (.384)
13. Constant	6.181** (1.209)	6.700** (1.429)	7.466** (1.831)
14. Adjusted R^2	.574	.290	.213
15. F Statistic	7.45	2.52	1.769
16. Mean monthly rent	6,021	2,638	12,322

Source: Survey of 1,167 households, June 10-July 3, 1980.

Note: Statistical significance at the .01 level is indicated by two stars and that at the .05 level by one star. Standard errors are given in parentheses. US $1 = 285 soles.

The low range includes all dwellings renting for 8,000 soles or less. The high range includes all dwellings renting for more than 4,000 soles.

In the high range a number of variables dropped out because virtually all or no dwellings had that characteristic.

The pattern emerges still more clearly in Table 18, a stock-user matrix for tenants that gives years of occupancy for the average household in each cell. For H3-H5 dwellings, all renting for over $14 monthly, the average length of occupancy was consistently 7.4 years. But for H0, H1, and H2 units, it fell steadily from 17.3 to 13.0 to 8.2 years. Longest occupancy characterized five F4 households who had lived in H0 dwellings for an average of 25 years. Their household heads averaged only 47 years of age, so they must have acquired these 2.0 room 32.4m^2 units at a very young age or taken them over later from tenant parents, in accordance with Peruvian law. Their households now consisted of two children, four working adults, and one or two other adults. Seven individuals from four of these households were willing to move out if they could find some other dwelling to rent that they could afford. It is possible that some of these five dwellings were not originally in the H0 category and might still potentially be H2 minimal units worth four times as much. Twenty-five years of deterioration, however, especially in recent years under rent control, may have lead the occupants to believe that they are getting no more than they are paying for. Among all current tenants, 67.9 percent said that the landlords were bad and never made any repairs or maintenance at their own expense. Another 15.7 percent found them poor, doing very little. Those who had been tenants in the past had found them bad only 49.8 percent of the time and poor in 19.6 percent of cases. Past tenants had found landlords satisfactory or better in 30.2 percent of cases; but only 16.0 percent of current tenants now found them that good.

Table 18. Number of years that the household occupied this dwelling. Renters, Lima, 1980.

Households \ Dwellings	H_0	H_1	H_2	H_3	H_4	H_5	Σ_F
F_0	19.8 (14.08) 10	24.0 (8.72) 3	1.0 — 1				19.36 (13.41) 14
F_1	17.35 (15.84) 23	7.23 (5.0) 13	4.73 (3.0) 11	12.4 (16.41) 5	10 — 1		11.64 (12.80) 53
F_2	14.79 (7.64) 32	13.2 (10.65) 35	7.27 (6.94) 30	5.44 (4.26) 18	4.4 (2.51) 5	2.0 (1.41) 2	10.50 (8.79) 122
F_3	18.27 (11.47) 15	13.8 (11.73) 25	8.24 (7.45) 17	6.42 (6.87) 26	9.09 (4.91) 11	1.0 — 1	10.81 (9.92) 95
F_4	25.20 (21.63) 5	16.5 (16.44) 4	15.0 (10.07) 10	11.86 (4.63) 7	6.92 (5.70) 12	7.67 (7.53) 6	12.59 (11.63) 44
F_5			12.0 — 1	9.0 (1.41) 2	12.5 (11.90) 4	10.6 (8.[illegible]) 5	11.08 (8.71) 12
Σ_H	17.27 86	12.99 80	8.19 70	7.38 58	7.43 33	7.43 14	11.42 (10.48) 341

Table 19. Number of years that household occupied this dwelling. Owners, Lima, 1980.

Households \ Dwellings	H_0	H_1	H_2	H_3	H_4	H_5	Σ_F
F_0	14.31 (10.68) 16	13.40 (6.66) 5	17.00 (11.20) 5	1.00 — 1			14.15 (10.01) 27
F_1	10.40 (11.62) 48	12.55 (13.87) 11	10.2 (6.00) 10	16.29 (12.66) 7	8 — 1	9 — 1	11.15 (11.29) 78
F_2	9.99 (6.26) 93	9.78 (6.27) 45	10.67 (6.15) 52	9.87 (6.00) 38	11.03 (6.89) 33	7.82 (5.4) 11	10.11 (6.23) 272
F_3	11.04 (8.27) 27	16.33 (9.30) 21	10.71 (7.44) 21	11.31 (10.40) 45	12.96 (10.94) 46	10.79 (6.34) 33	12.06 (9.30) 193
F_4	10.86 (8.51) 7	15.00 (17.35) 3	17.11 (13.64) 9	9.87 (7.25) 15	10.48 (7.24) 29	11.47 (7.25) 47	11.51 (8.30) 112
F_5			21.5 (12.02) 2	15.00 — 1	10.58 (7.80) 12	9.59 (6.[illegible]) 27	10.57 (7.11) 42
Σ_H	10.64 191	12.15 85	11.75 99	10.86 107	11.56 121	10.51 121	11.13 (8.32) 724

Improvements, Added Space, and Employment Generation

The effect of improvements on value is not the same as their cost in terms of expenditure on labor and materials. One quarter to a third of construction expenses go for onsite labor, so that if one knows expenses per square meter and the square meters added, one can estimate spending on labor and employment. In the case of selfhelp additions, one must assume that for given quality the justified amount of employment was the same as with hired workers. But how much labor a myriad of improvements would have required in the past cannot be recalled later. The task must be simplified.

What people recall most accurately is how many rooms they have (Table 20) and how many they have added (Table 21). On the average they added 1.12 rooms to bring their total to 4.02 rooms. They increased their number of rooms by over a third from the original 2.9 rooms. If cost moved in proportion they would have increased a unit worth $1 million (US $3,500) in 1980 without the site to $1.386 million (US $4,900). Using the method of the companion report, "Employment Estimation with Limited Information...", we find that 37.1 workdays would have been generated by the average addition.

That estimate, however, is too low because cost does <u>not</u> move in proportion to the number of rooms. The ratio of square meters (some in halls, kitchens, and bathrooms) to rooms rises from 26.2 to 41.0 from H0's to H5's. In addition, value per m^2 rises by 76.2 percent when the income of occupants is doubled. (See Tables 22 and 23). The extra space and quality requires more building employment.

Table 20. Number of rooms (without kitchen or bathroom unless used for sleeping). Owners, Lima, 1980. (per dwelling)

Households \ Dwellings	H_0	H_1	H_2	H_3	H_4	H_5	Σ_F
F_0	2.44 (1.55) 16	2.60 (0.89) 5	2.80 (0.84) 5	3.00 — 1			2.56 (1.28) 27
F_1	2.17 (0.83) 48	3.00 (0.89) 11	3.20 (1.40) 10	3.57 (0.98) 7	6.0 — 1	6.0 — 1	2.62 (1.13) 78
F_2	2.45 (0.98) 93	2.87 (1.25) 45	3.67 (1.49) 52	4.24 (1.13) 38	4.58 (1.64) 33	5.0 (3.82) 11	3.36 (1.66) 272
F_3	2.59 (1.12) 27	3.33 (1.35) 21	4.14 (1.71) 21	3.87 (1.47) 45	4.93 (1.97) 46	5.91 (1.79) 33	4.27 (1.93) 193
F_4	3.57 (0.98) 7	4.33 (2.08) 3	4.11 (0.78) 9	4.14 (1.12) 15	5.28 (1.46) 29	6.14 (1.95) 49	5.31 (1.81) 112
F_5			4.00 — 2	8.00 — 1	6.00 (2.55) 12	7.89 (2.64) 27	7.17 (2.54) 42
Σ_H	2.44 191	3.04 85	3.72 99	4.10 107	5.03 121	6.36 121	4.02 (2.09) 724
Rooms added compared with the next lower range		.60	.68	.38	.93	1.33	.81

Table 21. Number of rooms added. Owners, Lima, 1980.
(per dwelling)

Households \ Dwellings	H_0	H_1	H_2	H_3	H_4	H_5	Σ_F
F_0	0.44 (0.81) 16	0.60 (0.89) 5	1.0 (1.41) 5	0 — 1			0.56 (0.93) 27
F_1	0.75 (1.10) 48	1.0 (1.41) 11	1.3 (1.42) 10	1.43 (1.99) 7	0 — 1	1.0 — 1	0.91 (1.27) 78
F_2	1.08 (1.35) 93	1.09 (1.31) 45	1.58 (1.93) 52	1.18 (1.45) 38	2.00 (2.40) 33	1.91 (4.74) 11	1.33 (1.87) 272
F_3	0.41 (0.97) 27	1.14 (1.39) 21	1.76 (2.68) 21	1.13 (2.01) 45	1.07 (2.23) 46	0.73 (1.63) 33	1.02 (1.93) 193
F_4	1.00 (1.73) 7	0.67 (1.15) 3	1.11 (1.54) 9	1.4 (2.16) 15	1.28 (2.14) 29	0.96 (1.97) 49	1.11 (1.95) 112
F_5			1.00 (1.41) 2	0 — 1	1.25 (2.53) 12	0.93 (1.92) 27	1.00 (2.04) 42
Σ_H	0.85 191	1.05 85	1.61 99	1.18 107	1.38 121	0.95 121	1.12 (1.84) 724

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Table 2-2. Floorspace, square meters. Owners, Lima, 1980.
(per dwelling)

Households \ Dwellings	H_0	H_1	H_2	H_3	H_4	H_5	Σ_F
F_0	74.63 (49.11) 16	85.0 (25.96) 5	106.2 (65.86) 5	90 — 1			82.96 (48.08) 27
F_1	58.19 (33.15) 48	81.09 (14.92) 11	65.9 (40.35) 10	113.14 (59.17) 7	29[illegible] — 1	[illegible] — 1	80.41 (48.45) 78
F_2	63.35 (33.38) 93	79.84 (45.76) 45	101.67 (54.13) 52	144.66 (42.98) 38	128.52 (49.12) 33	155.27 (109.47) 11	96.51 (76.29) 272
F_3	60.89 (32.01) 27	92.86 (78.01) 21	105.81 (60.15) 21	104.36 (53.25) 45	149.85 (100.23) 46	183.27 (117.92) 38	122.37 90.18 198
F_4	98.29 (46.17) 7	146.67 (115.96) 3	163.44 (44.39) 9	115.6 (70.68) 15	178.38 (126.38) 29	231.33 (125.42) 47	181.26 (120.75) 112
F_5			65 (7.07) 2	300 — 1	171.83 [illegible] 12	421.65 [illegible] [illegible]	330.35 [illegible] 42
Σ_H	63.93 191	[illegible] 85	98.55 99	122.52 107	154.21 121	260.49 121	127.84 (119.79) 724
Ratio: m^2 to number of rooms	26.20	28.25	26.50	29.88	30.66	40.96	31.80

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Table 23 -- Number of rooms, floorspace, and value per square meter as a function of household income and the number of adults. Logarithmic regressions, owners without mortgages, Lima, Peru, 1980. (n = 587).

Dependent Variable	ln income	ln no. of adults	Constant	R^2	F
ln Room	.393**		-.312**	.290	296.6
	(.228)		(.093)		
	.354**	.148**	-.321**	.303	158.0
	(.025)	(.039)	(.092)		
ln Floorspace	.475**		2.665**	.216	200.3
	(.336)		(.136)		
	.456**	.071	2.661**	.217	101.0
	(.037)	(.058)	(.136)		
ln Value per m^2	.762**			.213	196.1
	(.054)				
	.786**	-.092	6.253	.212	98.5
	(.060)	(.095)	(.221)		

Source: Survey of 1,167 households June 10-July 3, 1980.

In growing from 2.9 to 4.0 rooms, a unit typically expands from 81.8 to 121.2 square meters, raising the square meters per room from 28.2 to 30.3. The growth of space is 48 percent. At the same time other installations and improvements will have been made, more members of the household will have joined the labor force as children grow up, raising incomes to pay for all this, and the value per square meter will have risen by 76.2 percent. Cost of the dwelling structure will have risen by 161 percent (1.48 x 1.762 - 1.0) 100. The expense on the addition is 1.608 million, which requires 131 workdays.

The employment generated by the average addition to the average house is not the same as that generated by the average addition to all owner-occupied houses. If it were, one could simply multiply 131 workdays by 556,500 households and arrive at total employment generation. But the extra expansion on some dwellings is not exactly offset by deficient expansion on others.

To arrive at a more accurate figure one has to estimate the amount of expansion and improvement for each household-income-dwelling-type combination, that is, each cell in the stock-user matrix and then find the employment generation for the weighted average. That is done in Tables 24, 25, and 26.

In Table 24 the percentage of rooms added is in the upper left corner of each cell in the matrix. That number is multiplied by the average floorspace of the dwelling to arrive at the amount of floorspace added. Workdays per added square meter for each housing type are found in the bottom row of Table 25 and are as estimated in the companion report cited above. They

Table 24. Proportion of rooms added per household-dwelling combination and amount of square meters added.

Households \ Dwellings	H_0	H_1	H_2	H_3	H_4	H_5	Σ_F
F_0	.150 13.4	.231 19.6	.357 37.9				.219 15.2
F_1	.346 20.1	.333 27.0	.406 26.8	.401 45.4			.347 27.9
F_2	.441 27.9	.380 30.3	.431 43.8	.278 40.2	.437 56.2	.352 60.5	.396 38.2
F_3	.158 9.6	.342 31.8	.425 45.9	.290 30.3	.217 32.6	.124 23.5	.239 29.2
F_4	.280 27.5	.155 22.6	.270 27.9	.318 36.8	.242 43.2	.156 36.1	.209 37.9
F_5					.208 35.6	.115 49.8	.139 45.9
Σ_H	.348 22.2	.345 29.6	.433 42.7	.283 35.3	.274 42.3	.154 40.1	.279 35.7

Note: Rooms proportion added is in the upper left corner of each cell. Square meters added is in the lower right. The percentage of square meters is assumed to be equal to that of rooms.

Table 25: Workdays per average addition or improvement made by households classified by income level and housing type. Lima, owners, 1980.

Households \ Dwellings	H_0	H_1	H_2	H_3	H_4	H_5	Σ_F	Workdays per added m^2
F_0	40.2	58.8	113.7				54.6	3.0
F_1	60.3	81.0	80.4	227.0			81.3	3.0
F_2	83.7	90.9	131.4	201.0	320.3	363.0	150.3	3.9
F_3	28.9	95.4	135.0	151.5	185.8	139.8	132.6	4.5
F_4	82.15	67.8	83.7	184.0	246.2	216.6	196.9	5.2
F_5					202.9	298.8	269.2	5.9
Σ_H	66.6	89.8	128.1	176.5	241.1	240.6	152.1	4.3
Workdays per added m^2	3.0	3.0	3.0	5.0	5.7	6.0	4.3	

Note: The figures in the bottom row of workdays per added m^2 come from W.Paul Strassmann, "Employment Estimation with Limited Information about Building and Upgrading: An Illustration from Peru," November, 1980, Table 2. Workdays reported in the last column are found by dividing the figures in column 7 of this table by the squaremeters added of Column 7 in Table 24.

are used to find the workdays per addition for each type of household-dwelling combination (each cell). The last two columns give the average number of workdays generated for each income type and per square meter for that type. The cell in the lower right corner gives the weighted average for the total: 152 workdays. That is the number that should be multiplied by the total of owning households for an estimate of employment generated by upgrading of shelter. For an overview, the principal elements of the calculation are repeated in Table 26.

Conclusion

Making additions and improvements to housing is an important economic activity in Lima. The vast majority of owner-occupants add rooms, plaster and paint, install better windows and doors, and improve plumbing facilities. During their average time of ownership of 11 years, they raise the value of their dwellings by over one-third.

The average dwelling of $128m^2$ built with five onsite workdays per square meter incorporates about 640 workdays. Of these, 152 workdays are in additions and improvements. They represent a 31.1 percent addition to the original 488 workdays.

The best practical way to measure improvement is by the number of types that are made and by the effect of changes on total value, holding other elements constant. Adding a room and interior plastering and painting were the most popular types of improvement in Lima during 1960-1980. In addition many of the poor rebuilt their houses entirely, while most above the median income level changed their sanitary facilities in a major way. Improvement was a continuing activity, not one that stopped after three or four years.

TABLE 26. Number of Rooms, Rooms Added, Floorspace, Floorspace Added, and Workdays on the Additions. Owner-occupants by Income Range, Lima, 1980.

Households monthly income (Thousands of 1980 soles)	Average No. of Rooms Added	Current No. of Rooms	Floorspace Added, m^2	Current Floorspace, m^2	Workdays per added m^2	Workdays per addition
F0 15 or less	.56	2.56	18.2	83.0	3.0	54.6
F1 15.1- 28	.91	2.62	27.9	80.4	3.0	81.3
F2 28.1- 50	1.33	3.36	38.2	96.5	3.9	150.3
F3 50.1- 90	1.02	4.27	29.2	122.4	4.5	132.6
F4 90.1-162	1.11	5.31	37.2	181.3	5.2	196.9
F5 Over 162	1.00	7.17	45.9	330.4	5.9	292.2
Weighted Mean	1.12	4.02	35.7	127.8	4.3	152.1

Source: Survey of 724 owner-occupants in Lima, Peru, June 10-July 3, and a cost analysis of floor plans by three contracting organizations.

Note: The percentage change in floorspace is assumed to equal the percentage change in number of rooms. The workdays/m^2 reflect the mix of housing types (H0, H1...H5) that households were actually occupying.

Since everyone makes improvements, the process is not strongly associated with differences in income. If a household grows, especially with additional adults, rooms are likely to be added. If the birth rate falls, the incentive to improve dwellings may not fall for about 18 years, that is, until the decline lowers the growth rate of the adult population. Access to the sewerage system also makes occupants think that their dwelling is worth improving in a major way. Thus infrastructure provision has a strong employment multiplier.

About ninety percent of improvements were financed with cash and selfhelp labor. Since many households are willing to borrow to make additional improvements and since many of them are undoubtedly creditworthy, this labor-intensive activity could be stimulated through financial innovations. It is not necessarily a question of subsidies but of loans with enough interest to cover inflation and risks. Another possibility is to allow owners to mobilize funds through subletting rooms and additions. If renting is not a secure and profitable activity, however, the rental stock of housing will continue to deteriorate, as the data collected in our survey show.

Employment generation in improvements is measured by assuming that employment is in proportion to the value per square meter as found in similar commercially built units. One cannot actually count how long various tasks might take amateur builders, nor should value be assumed to rise in proportion to slow work due to inexperience.

A reasonable assumption is that for most income and housing levels, any expansion will be of a quality level equal to or somewhat above the level of quality of the existing structure. With that assumption, we have

concluded that the average poor household, earning less than 15,000 soles monthly (US $53), generated 54.6 workdays of upgrading. The average rich household, receiving more than $162,000 (US $568) monthly, generated 292.2 days of upgrading labor. The weighted average for six income and six housing level was 152 workdays. Since that is the average, one can multiply it by the number of households, divide it by the number of years, and make an estimate of the share of the labor force active in upgrading. That was done in the introduction. Upgrading is a small share of total employment, but a large -- possibly one-fourth -- share of construction labor.