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Housing Requirements and National Resources

The implications of the urban and housing components of the United Nations World Model are discussed.

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A major dimension of the quality of life in urban areas, to which the world's population is increasingly gravitating, is the housing environment. Housing is a complex product, providing a combination of services: space, environmental services (water supply, waste disposal, energy use), and locational services (access to jobs and social infrastructure such as education and health facilities). Although most urban residents enjoy some housing, the form and quality of the urban housing services vary widely among countries, among cities in a country, and among different locations within a city.

The urban areas of developing societies offer a range of housing options from spacious well-serviced homes accessible to a range of jobs and community services to inaccessible crowded slum dwellings. For a large segment of the urbanites, however, the housing environment is appalling—crowded, unsanitary, congested, and polluted. These poor housing conditions reflect, to a large degree, certain structural characteristics of these developing economies. Thus the poor housing is a reflection of the per capita income of the populace, and the pace and scale of urban growth exacerbate the housing problem. Yet the housing conditions in a majority of countries are much worse than even the low incomes of the people would warrant.

A major offender in this regard is the widely prevalent policy in many developing countries of not tailoring housing programs to the country's income level or the household's ability to pay (*1, 2*). Instead, the approach has been to divert scarce resources into the provision of a few dwellings with inappropriately high standards (of space, materials, and service levels) and, in the face of rapid urbanization, to issue calls for a shift of real resources from other economic sectors into housing. This approach has been inefficient because it has tended to inhibit the large-scale production of dwellings with lower standards and sometimes even to reduce the stock of existing housing by clearing squatter settlements. It has also been inequitable because it has provided superior housing services for a few and inferior services for a larger segment of the urbanites.

In this article we approach the urban housing situation in the developing societies from the perspective of the household's ability to pay. In national terms, a country's income indicates its capacity to consume housing at levels that do not distort investment allocations to other sectors. A match of income levels (and their distribution) to the scale of the urban demographic increases would suggest the kinds of housing techniques (standard, sizes, and materials) required to serve most of the population at standards that do not necessitate any new patterns of subsidy from other sectors to housing.

This article thus presents an alternative to the two current strategies of scaling resources to be devoted to housing—the physical planning perspective of assessing housing "needs" and the macroeconomic perspective that assigns a certain proportion of national income to the housing sector. To some degree, it links the two approaches but in a way that reflects the ability, especially of the poorer segments of the population, to pay for housing. In this context, this article bears upon the current discussions on appropriate standards for housing and the residential environment.

We present first a survey of the current patterns of match between urban income, income distribution, and the types of housing available to reach the medium- and low-income groups of the populace. But the main focus of the article is on the next quarter-century. Much of the built environment of the year 2000 in the urban areas of the developing countries has yet to be put in place. Investment choices made now and in the near future will be crucial to the quality of urban life at the turn of the century.

Next we discuss an economic model that is useful for the estimation of the scale of housing investment available for such choices in the next two decades. This is the United Nations World Model that describes production, consumption, natural resource use, pollution abatement, and urbanization as integral parts of world economic development (*3, 4*).

The level of housing investment that can be sustained by the growth of the developing economies as obtained from this model is then matched against the scale of housing "needs" generated by demographic and socioeconomic change to identify the kinds of housing affordable by the urbanites in the next two decades. We hope in this article, through the use of the U.N. World Model, to provide some empirical documentation to support strategic housing choices—pertaining to material and space standards, service levels, and the like—that are often recommended impressionistically in the literature.

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Table 1. Housing indicators for selected countries; N.A., not available.

Country	Urban/ total population* (% 1970)	GDP per capita 1970† (U.S. $, 1970)	Housing consumption per capita (U.S. $, 1970)‡	Residential investment as % of GDP (1963–1973 average)‡§	Residential investment as % of GFCF (1963–1973 average)‡§	Labor force in construction‖ (%)	Percentage of occupied urban dwellings with three or more persons per room‖	Urban population without water supply¶ (%)	Urban population without public or household sewer systems¶ (%)	Population in squatter settlements in the largest city # (%)
					Developing countries					
Brazil	55.0	420	N.A.	6.7**†† (1963–1969)	41.8**†† (1963–1969)	N.A.	2.8 (1969)	23.0	15.0	30 (Rio)
El Salvador	38.7	300	17.1	2.6 (1968–1972)	17.6 (1968–1972)	4.1 (1961)	50.2 (1971)	23.2 (1961)	37.0	
Venezuela	78.8	980	159.6	5.5 (1968–1972)	22.6 (1968–1972)	6.5 (1970)	21.1 (1961)	8.0	43.0	40 (1969)
Portugal	27.9	660	30.2	3.9	20.8	6.7 (1960)	10.3 (1960)	N.A.	N.A.	
Ghana	35.9	310	36.0	7.3 (1968–1972)	63.4 (1968–1972)††	3.3 (1960)	N.A.	27.0	N.A.	53 (1968)
Kenya	10.0	150	N.A.	2.5 (1964–1973)	14.5 (1964–1973)		41.1 (1962)	3.0	0.0	
Tanzania	6.0	100	10.5	N.A.	N.A.	N.A.	N.A.	55.0	69.3 (1958)	58 (1970)
India	20.3	110	6.4	2.7 (1963–1971)**	8.72 (1963–1971)**	1.1 (1961)	N.A.	44.0	20.0	33 (1971)
Malaysia	27.3	380	16.5	1.8	12.9**		52.2 (1960)	29.1 (1960)	6.4 (1960)	37 (1971)
Sri Lanka	22.0	110	12.8	7.4	47.9‡‡	2.5 (1963)	N.A.	40.0	8.0	24 (1968)
South Korea	41.5	250	16.7	2.81	12.1		46.6 (1960)	12.0	38.0	30 (1970)
Thailand	14.8	200	8.8	3.2	13.9	0.5 (1960)	N.A.	40.0	34.0	
Colombia	55.0	340	N.A.	2.9	16.8		N.A.	12.0	25.0	
Chile	76.7	720	N.A.	2.6‡	17.1		22.7 (1960)	31.0	N.A.	
					Developed countries					
United States	74.0	4760	553.1	3.6 (1968–1973)	20.8 (1968–1973)	6.3 (1971)				
United Kingdom	77.7	2270	230.3	3.2	18.2	7.8 (1966)				
West Germany	81.3	2930	182.3	5.6	12.8	7.4 (1971)				
Japan	53.2	1920	111.7	6.5	19.1	7.6 (1970)				
Australia	84.8	2820	270.1	5.0	19.2	8.8 (1966)				
France	72.8	3100	196.5	5.1 (1970–1971)	24.5 (1970–1971)	9.1 (1971)				

*United Nations Populations Division, October 1974. †See (*30*). ‡See (*6*), vols. 1 and 2. §Figures in parentheses indicate years over which data are averaged. ¶See (*32*). ¶See (*32*). Data are for 1970 unless otherwise indicated. #See (*2*), pp. 44–52. **Data for El Salvador, Malaysia, Brazil, and India are based on current prices; for all other countries constant prices are used. ††Investment data for Ghana and Brazil include all categories of construction. ‡‡Investment data for Sri Lanka include residential and nonresidential construction.

Housing and National Resources

The conditions of housing vary widely among the developing countries. Although the reasons for this variation are many and complex, as indicated earlier, the dominant factor governing the quality of housing is the income level of the populace.

The housing indicators displayed in Table 1 bear out this broad relationship. Even though the data on housing consumption and investment in Table 1 understate the true importance of housing in the developing countries since self-help construction or makeshift dwellings in the squatter settlements are either unrepresented or undervalued in national income accounts, the direct relationship between income level and housing investment is readily apparent (*5*, *6*).

The relatively high-income developing countries invest a higher proportion of their gross fixed capital formation (GFCF) and gross domestic product (GDP) in housing and employ a larger portion of the labor force in construction than the lower-income developing countries. In general, they also enjoy better average housing conditions as shown by the fact that the dwellings are less crowded and more of the urban population is served with water supply (from standpipes or house connections) and sewer service (public or household systems). Although housing investment rises with GDP at low-income levels, it appears to taper off at high-income levels as evident from the data on the developed economies. It is not the richest economies but those in the next most affluent level that seem to invest most in housing (*7*). Most of the developing countries appear therefore to suffer from two handicaps: a rapid increase in population and severe limits on the resources that can be channeled into residential construction. International comparisons suggest that housing does benefit from increases in income over time but not in proportion to other goods and services at the highest income levels (*8*, p. 35).

The distribution of income among urban households determines the number of families with different levels of income and ability to pay for housing. In particular, it identifies the poor households and the degree of their poverty. Figures 1 through 3 display the distribution of income among urban households expressed in U.S. dollars (1970) obtained from household surveys in three developing countries: Ecuador, Kenya, and Pakistan. The household monthly expenditures on housing have been estimated as roughly a constant or gradually decreasing function

of income (*9, 10*). We have also estimated the cost of the cheapest housing that a family can afford corresponding to specified levels of monthly payment.

The most striking aspect of Fig. 1 is that housing costing in excess of U.S. $1100 are beyond the reach of the bottom 50 percent of the urban population in Ecuador. Such a price is below the cheapest conventional housing being built and can obtain only "low amenity type" site and services (*11*). Only urban households in the top 20 percent of the income distribution in Ecuador can afford housing valued in excess of U.S. $2100. Thus, the dwellings built in Ecuador up to the early 1970's with the support of the Inter-American Bank for Housing (IAB) and the U.S. Agency for International Development (USAID) priced on an average at U.S. $2000 and $3000, respectively, would add to the higher-value housing stock (*12*). The situation is comparable in Kenya, where over 40 percent of the urban households cannot afford housing priced at U.S. $925 or over without any subsidy. In Pakistan, half the urban households cannot afford housing priced above U.S. $1100.

Such wide gaps between the cost of currently produced housing and the ability of low-income families to pay are evident in a number of developing countries. Between 30 and 70 percent of the urban households in six other countries—India, the Philippines, Indonesia, Tanzania, Costa Rica, and Honduras—cannot afford the price of currently provided housing (*13*). The World Bank found that, in the six cities studied (see Table 2), the cheaper housing units currently produced by the public sector could not reach from 35 to 68 percent of the urban residents.

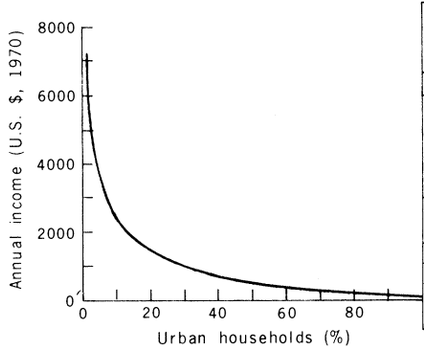
Rising per capita income levels and improved income distribution may, over time, improve the lot of the poor. But what is the outlook for such improvement in the next two or three decades? To address this issue, we shall turn to the U.N. model.

The United Nations Model:

Resources for Housing

The U.N. World Model is a model of the world economy developed for the United Nations by a team headed by Professor Wassily Leontief to help member states assess the impacts of environmental issues and policies on international economic development, and to improve our understanding of the effects of alternative development policies. Such an improved understanding may help resolve certain conflicts believed to exist among the goals of improving living standards worldwide, improving the quality of the environment including the built urban environment, and conserving scarce natural resources. Although the scope and implementation of this interregional, input-output model are beyond the scope of this article, we present a brief outline of the model in order to highlight its urban and housing components (*14*).

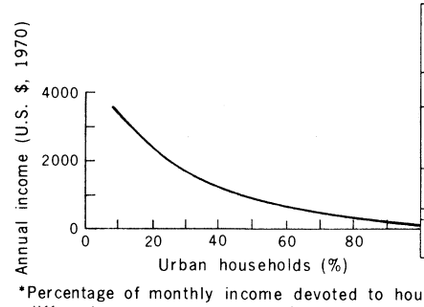
Each of the 15 regions into which all the developing and developed countries in the world have been grouped in this model is viewed as a set of 48 producing and consuming sectors linked to one another and to the economies of other regions by the flow of goods and services. Industries absorb inputs from other sectors and nonrenewable primary resources to produce their output; households consume goods and services and supply labor; government activities of various kinds represent the public sector. In addition to generating current output, all sectors employ fixed and operating capital (machinery and buildings) and, in the case of household sector, residential housing. Pollution is viewed as a by-product of production and consumption activities, and its abatement is regarded as an economic activity.



Monthly income	Monthly house payments*	Cost of affordable housing†	Remarks
500	80	8900	
250	40	4500	U.S.A.I.D. average
140	21	2310	Inter-American Bank type average
90	14.5	1500	
40	8	900	Site and services (low amenity)

*Percentage of monthly income devoted to housing, varying between 15 and 20 percent among different groups.
†Based on 25-year repayment, 10 percent interest (U.S. $, 1970).

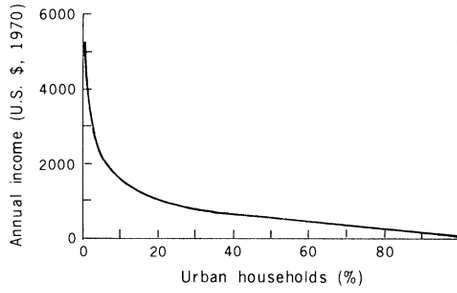
Fig. 1. Urban income distribution and affordable housing, Ecuador (*33*).



Monthly income	Monthly house payments*	Cost of affordable housing†	Remarks
300	45	5100	Single family house
150	22.5	2500	Core housing
50	8	900	Self help
25	5	550	Site and services (low amenity)

*Percentage of monthly income devoted to housing, varying between 15 and 20 percent among different groups.
†Based on 25-year repayment, 10 percent interest (U.S. $, 1970).

Fig. 2. Urban income distribution and affordable housing, Kenya (*10*).



Monthly income	Monthly house payments*	Cost of affordable housing†	Remarks
300	45	5100	High standard development
200	30	3400	
100	16	1665	Utility wall development
40	8	900	

*Percentage of monthly income devoted to housing, varying between 15 and 20 percent among different groups.
†Based on 25-year repayment, 10 percent interest (U.S. $, 1970).

Fig. 3. Urban income distribution and affordable housing, Pakistan (*34*).

For each region and point in time, a number of technical coefficients are developed to provide a comprehensive description of the structure of the economy. Thus, technical input coefficients describe the amounts of all inputs, including labor, that enter into the production of a given amount of each industry's output. Consumption coefficients describe the mix of goods and services required by a private household per unit of its aggregate income and expenditures. Other relevant technical coefficients describe the demands for urban amenities and mineral and other natural resources and pollutant emissions associated with various production and consumption activities. The 15 regional economies described in this fashion are linked to one another through imports, exports, and capital and aid flows. Because of the general interdependence among all parts of the system, the level of each type of economic activity in each part of the world (if not fixed by explicit assumption) will respond in some degree to primary changes introduced in any other part.

This characteristic makes it possible to use the model flexibly to estimate the requirements of meeting specified levels of a wide variety of target variables. We can estimate the levels of GDP and growth rates that are consistent with specified limits of capital supply, and labor force and productivity constraints in the developing world. Alternatively, given the population (total and urban) and GDP levels, estimates can be made of the levels of production, labor, and housing investment needed to sustain them. The specific answers will, of course, depend on simultaneous assumptions made about such matters as population growth, environmental and amenity standards, foreign aid capital transfers, and the like, all of which can be introduced as alternative development scenarios. Table 3 provides a summary of some key economic and urbanization trends obtained for a base scenario of the model postulating medium population and medium growth rates.

Input structures for the urban sector are introduced into the model on the basis of cross-national studies of housing and urban environmental amenities—water supply, sewer system, solid waste collection and disposal. The urban segment encompassed for the first time within the framework of the input-output model, is described elsewhere in detail (*15*); we will focus here briefly on only one component of the urban sector, housing investment.

Housing investment is viewed as capital consumption of the stock of housing in each region. Specifically, two capital consumption coefficients—population and income—are developed for this purpose. If neither a region's population nor its real income increases, no housing investment will take place apart from the needs of replacement capital. If real per capita income remains constant but the population increases, the change in the value of housing capital stock (or investment) that will result from a unit increase in the region's population is termed the population coefficient of housing capital consumption. This coefficient is estimated for each region for each point in time (1970, 1980, 1990, and 2000) as equivalent to the value of per capita housing stock (corresponding to the total personal consumption level at that time).

Table 2. Cost of cheapest existing housing unit and the percentage of households unable to afford it in selected cities. See (*12*, annexes 5 and 6).

City	Cost of unit (U.S. $, 1970)	Percentage of households unable to afford this unit at	
		Present cost	50% reduction
Mexico City	3005	55	37
Hong Kong	1670	35	14
Nairobi	2076	68	53
Bogotá	1474	47	26
Ahmadabad	616	64	51
Madras	570	63	31

The income coefficient of housing investment represents the value of housing investment associated with a unit change in the region's real per capita income, when the population remains unchanged. The income coefficient is derived in two steps: first, we develop a regional housing consumption model that describes housing consumption as an exponential function of per capita GDP (*16*). From this function, we derive measures of income coefficients of housing investment for each region and decade on the assumption that housing consumption patterns reflect housing investment patterns. The total housing investment for a region during a time period is then obtained as a sum of the population and income effects. The urban component of the total housing investment is obtained on the assumption that it bears the same relationship to total investment that urban housing consumption does to total regional housing consumption.

From the population and income coefficients of housing investment derived in this manner and the projections of economic and urbanization trends between 1970 and 2000 in the 15 regions presented in Table 3, we have estimated regional housing investment. Table 4 presents the estimates of urban housing investment for the 15 regions for the two decades 1970–1980 and 1980–1990. These estimates represent the levels of regional housing investment that can be sustained by the levels of projected GDP per capita, and personal consumption per capita in 1980 and 1990. There is no absolute limit to the resources that can be made available for investment in housing stock (except in the short run), and what a "nation can afford" is a matter of social choice and national housekeeping. However, if other competing public and private purposes are not to provide any new patterns of subsidy to housing, these estimates can be viewed as the level of national resources available for adding to the stock of housing over the next two decades.

Housing Requirements, 1970–1990

Housing need is a normative concept expressing a socially desired balance between the number of households and the number of housing units and, in addition, a socially acceptable quality of housing conditions. Estimates of housing needs are therefore dependent not only on population factors (for example, natural increase, household formation, and migration) but also on norms relevant to the country's economy (vacancies, secondary dwellings, and replacement rates). The replacement needs are a function of the rates of physical deterioration of housing stock and the increased levels of housing consumption resulting from higher incomes. As incomes increased over time in the developed economies, this latter component of housing need has led to the acceptance of socially desirable minimum housing standards.

In response to their social welfare ideologies, many developing countries have adopted some version of these minimum standards, which are not being sustained by the current low incomes of their people. This approach has led to gloomy assessments of current housing and high estimates of future needs to serve as fairly staggering targets for housing progress in these countries. A more realistic approach would be to identify and use standards that are more consistent with the country's income. Such an approach underlies the housing requirements model used here to scale the level of housing unit needs faced by the developing regions.

We have analyzed available data on

replacement rates, vacancy rates, and rates of new household formation as related to the income level of a large number of countries. These are the income-related "standards" of housing need used in the housing requirement model (*17*).

Housing needs are viewed as comprising three components—demographic, replacement, and vacancy. The demographic component represents the number of additional households required to accommodate (i) the increasing urban population and (ii) the increased number of households formed (increased "headship rates") for a given population over time in response to increased income and changing social patterns (*18*):

$$H_{t+1} = \left(\frac{P_{t+1} - P_t}{F_{t+1}}\right) + \left(\frac{P_t}{F_{t+1}} - \frac{P_t}{F_t}\right)$$

where H_{t+1} is the number of households at time $t+1$, P_{t+1} and P_t are the populations at time $t+1$ and t, respectively; and F_{t+1} and F_t are the household sizes (average number of persons in the household) at time $t+1$ and t, respectively; F_t was estimated as a function of per capita GDP (Y_t):

$$F_t = 13.65\, Y_t^{-0.177}$$

The replacement component includes housing units required to replace a portion of the existing housing stock because of rising socioeconomic standards (pertaining to crowding and obsolescence), other demolitions, and second homes. We have used income-dependent rates of annual replacement of the existing stock for the different countries and regions (*19*). The vacancy component of the dwelling unit requirement—a reserve of vacant dwellings that facilitates movement of households within the housing stock—is obtained by the use of income-related rates applied on existing housing stock (*20*).

In view of the range of uncertainty surrounding the income-related housing standards, their change over time, or even their priorities, we prepared a range of possible estimates of housing needs. Table 4 presents one set of projections of housing need for the two decades 1970–1980 and 1980–1990.

Implications

A comparison between the resources available and the number of dwelling units required for urban housing for the two decades 1970–1980 and 1980–1990 is provided in Table 4. We characterize the degree of match between resources and "needs" by two simple measures. The first measure represents the average cost of a dwelling unit if all the housing needs are to be met by the available resources. These costs do not include land costs, which represent between 12 and 46 percent of the total cost of a dwelling in some developing countries and between 18 and 26 percent in a high-income economy such as the United States (*12, 21*). In the two relatively higher-income developing regions of Latin America (regions X and XI), half the dwelling units to be built in the 1970's, to meet the estimated needs, should be under $2500. In the poorer Asian region, half the new units to be built should be under $1000. In the African region, the average cost of the dwelling unit should be even lower, less than $800.

These figures would suggest, in the context of the evidence from Table 2 and elsewhere, that a significant portion of the urban households in the 1970's will not be able to afford even the cheapest low-cost housing currently being produced. The increase in real income in the 1970's is not expected to be significant enough to permit that. It is expected that, in the 1980's, households in these regions will be able to afford dwelling units of higher average cost. However, in most cases, the increasing average cost of affordable units will very likely not keep pace with the rates of increases in real income and will not be adequate to bring cheap housing within the financial reach of those in the low-income regions.

The second measure is an estimate of the minimum cost of the dwelling unit that is beyond the reach of the poorest 25 percent of the urbanites, and this figure is even more telling (*22*). In the Asiatic and African regions, if the needs of the bottom 25 percent of the population are

Table 3. Economic and urbanization trends in the world (1970–2000). Values in parentheses are personal consumption expenditures per capita.

Region*	GDP† and (consumption)‡ per capita (U.S. $, 1970)				Urban population (in millions)§			
	1970	1980	1990	2000	1970	1980	1990	2000
Developed regions					634.6	753.3	875.6	987.7
I. North America	4624 (2974)	6104 (3836)	7440 (4584)	9070 (5537)	169.5	198.1	230.6	258.9
II. Europe (high development)	2584 (1697)	3527 (2302)	5221 (3175)	6682 (3889)	203.9	227.8	250.7	272.6
III. U.S.S.R.	1791 (1098)	2835 (1756)	4619 (2670)	6207 (3634)	137.3	172.4	210.4	245.2
IV. Eastern Europe	1564 (1001)	2475 (1554)	4032 (2331)	5419 (3025)	55.5	67.0	78.5	90.1
V. Asia (Japan)	1915 (1068)	3181 (1897)	4700 (2799)	6327 (3617)	55.5	72.0	86.2	98.5
VI. Oceania	2798 (1801)	3478 (2237)	5148 (3196)	6591 (4322)	12.9	16.0	19.2	22.4
Developing regions, Class I					95.3	165.0	204.8	397.0
VII. Europe (medium development)	698 (480)	1084 (753)	1941 (1304)	3476 (2265)	50.2	67.0	87.4	109.8
VIII. Middle East–Africa (oil)	286 (158)	804 (352)	1737 (904)	3111 (1737)	34.9	59.0	95.5	148.2
IX. Africa (medium development)	786 (546)	1034 (722)	1654 (1134)	2964 (2002)	10.3	15.0	21.9	32.0
Developing regions, Class II					592.5	904.6	1331.7	1911.4
X. Latin America (medium development)	594 (409)	765 (523)	1200 (780)	2149 (1319)	115.4	168.8	231.0	325.2
XI. Latin America (low development)	443 (307)	566 (371)	880 (584)	1577 (1024)	42.6	67.9	99.8	139.8
XII. Asia (China)	166 (120)	242 (162)	387 (250)	683 (410)	175.1	267.5	380.0	508.9
XIII. Asia (low development)	119 (89)	151 (116)	231 (169)	353 (254)	207.1	309.7	472.3	704.4
XIV. Africa (arid)	205 (151)	209 (161)	235 (177)	292 (220)	34.5	51.9	81.36	123.7
XV. Africa (tropical)	167 (117)	172 (113)	196 (110)	245 (149)	17.8	38.8	67.2	109.4

*Regions used are those in the U.N. World Model: I. United States and Canada; II. European Common Market countries, Sweden, and Switzerland; III. U.S.S.R.; IV. Eastern Europe; V. Asia-Japan; VI. Australia and New Zealand; VII. Spain, Portugal, Turkey, Yugoslavia, and Greece; VIII. Algeria, Nigeria, Libya, Saudi Arabia, Iraq, Iran, and Kuwait; IX. South Africa; X. Argentina, Brazil, Chile, Cuba, Mexico, and Uraguay; XI. all other countries of Latin America; XII. China, North Vietnam, and North Korea; XIII. all other countries of Asia except those in regions V, VIII, and XII; XIV. Egypt, Morocco, Tunisia, Somalia, Niger, Madagascar, Upper Volta, Ethiopia, Chad, Mali, Sudan, and Mauritania; XV. the remaining countries of Africa. †Gross domestic product per capita as obtained from the base scenario (medium population–medium tempo urbanization run of the U.N. World Model). ‡Personal consumption expenditures per capita are as obtained from the base scenario (medium population–medium tempo urbanization run of the U.N. World Model). §Source: U.N. Population Division, medium tempo estimates.

to be met, dwelling units must be available at less than $500 (exclusive of land costs). (Even in the richer Latin American regions, the cost of such units must be under $1000 to $1200.) It is expected that, in the 1980's, this segment of the urban poor will be able to afford slightly more expensive homes (up to $750). Even so, they will not be able to afford the cheapest currently available housing units.

It appears, therefore, that, although the 1970's and 1980's will probably be a time of higher per capita incomes and increased resources for urban housing, the currently observed mismatch between the ability of the low-income urban families to pay for housing and the cost of currently produced dwelling units is not likely to change very significantly. The poorest 25 percent of the urban population is unlikely to be able to pay the economic cost of currently produced low-cost housing to the end of the 1980's in the Asiatic and African regions. Reducing housing costs to levels attainable by the majority of the urbanites is therefore imperative.

An obvious and direct method of reducing costs is to reduce the standards of dwellings. Material standards can be reduced if cheaper indigenous materials and construction are substituted for higher-cost materials. Modest space standards can be accepted. Lower service levels—shared kitchens and sanitary facilities—can further lower the cost. Additional savings are possible if the land area devoted to buildings is reduced (*23*).

Such reduced standards as shared sanitary facilities and kitchens are currently manifest in the poorer sections of cities in developing countries. What we are suggesting here is that a formal recognition of lower standards can greatly help in incorporating safety and health considerations into these market-induced standards. Such a formal recognition will permit a more effective organization and provision of urban amenities in areas where residential capital formation from domestic savings of the low-income sector is already occurring.

There is evidence to suggest that with lower standards (shared services and multifamily buildings) housing can currently be made available for the bulk of the urban population in the peripheral areas of cities of higher-income countries (Latin America and selected countries in Asia) (*12*, *24*). If the countries in these regions attach priority to housing low-income groups in the 1970's and 1980's, they must be willing to reduce space, material, and service standards at the peripheral and intermediate locations in the city.

In the Asiatic and African regions, even such reductions in standards may still leave the bottom 25 percent of the urbanites unserved. The low incomes of the people in these countries make any substantial subsidies to the urban poor unlikely (*25*). For them, even more resource-conserving approaches are required (*26*). Our analyses would suggest, therefore, general support for the application on a broad scale of resource-conserving approaches being tried out on a small experimental scale by some international aid agencies. Among these are the minimum shelter core housing approach of the Federation for Cooperative Housing (USAID) and the World Bank's site services projects (in which low-income families are provided with land and public utility components of the

Table 4. Resources and needs of urban housing, 1970–1990. Regions listed are explained in Table 3.

Region	1970–1980				1980–1990			
	Urban housing investment (billions of U.S. $, 1970)	Urban housing requirement (millions of dwelling units)	Average dwelling unit cost (land costs excluded) (U.S. $, 1970)	Cost per dwelling unit to serve the poorest 25% of urban households must be under (U.S. $, 1970)*	Urban housing investment (billions of U.S. $, 1970)	Urban housing requirement (millions of dwelling units)	Average dwelling unit cost (land costs excluded) (U.S. $, 1970)	Cost per dwelling unit to serve the poorest 25% of urban households nust be under (U.S. $, 1970)*
Developed regions								
I. North America	220.423	19.037	11,578	5,701	257.434	20.287	12,690	6,568
II. Europe (high development)	104.491	20.727	5,041	2,904	181.497	21.496	8,443	4,619
III. U.S.S.R.	96.644				183.504			
IV. Eastern Europe	30.889	7.032	4,393	2,343	54.682	7.805	7,006	3,742
V. Asia (Japan)	47.617	9.780	4,869	2,836	64.353	9.924	6,485	3,829
VI. Oceania	11.081	1.604	6,908	3,634	19.860	1.906	10,420	5,435
Developing regions, Class I								
VII. Europe (medium development)	17.753	6.121	2,900	1,744	43.693	9.163	4,768	2,846
VIII. Middle East–Africa (oil)	23.593	6.199	3,806	1,983	62.635	12.355	5,070	2,973
IX. Africa (medium development)	3.512				10.916			
Developing regions, Class II								
X. Latin America (medium development)	37.375	14.903	2,508	1,287	66.959	22.509	2,974	1,776
XI. Latin America (low development)	15.252	6.498	2,347	1,151	32.228	11.050	2,916	1,641
XII. Asia (China)	16.821				35.465			
XIII. Asia (low development)	17.426	16.496	1,056	534	43.328	31.870	1,360	781
XIV. Africa (arid)	2.332	2.764	844	455	4.885	3.726	1,311	761
XV. Africa (tropical)	1.829	2.315	790	434	6.279	4.700	1,336	771

*See (*22*).

housing package with assistance in self-help building) and upgrading squatter housing (improving existing low-income housing stock and its service) (*12, 24, 27*).

Although the focus of this article has been on the developing world, the notion of resource-conserving approaches to housing is relevant to the more affluent regions as well. The modest increases in the average cost of new dwelling units in the 1970's and 1980's indicated in Table 4 in the context of significant increases in GDP per capita (possibly reflecting the pressure of competing demands for energy, environment, social services, and other factors) may mean there is a need for either dwellings with lower standards or scaled-down housing needs or increased subsidies to the housing sector (*28*). There is already some evidence in the United States of increased efforts toward improved maintenance and upgrading of existing housing stock, increasing shipments of mobile homes, and smaller dwellings (*29*).

In summary, our analysis suggests that, if national resources are to be used efficiently and equitably for housing, particularly in the developing countries, strategies to match resources and needs are imperative. An important part of such a strategy is to arrive at decisions about the housing "standards" at which to aim, the rate at which general advance toward them should be achieved, and the most suitable forms for their attainment, in light of the best possible knowledge of the effects of available alternatives. Our study carried out at the regional level is intended to highlight this issue. Individual countries should explore this issue in the specific contexts of their economic and urban development patterns. The approach presented here can provide a framework for posing choices on urban housing investment policy in the broader framework of economic and social development.

References and Notes

1. See, for example, the U.N. recommendations on housing (eight to ten dwellings per 1000 inhabitants) and the proportion of the national income (4 percent) to be devoted to this sector for the 1960–1970 decade [*Methods for Establishing Targets and Standards for Housing and Environmental Development* (Publication ST/SOA/76, United Nations, New York, 1968), pp. 2, 14–15, and 23]. As it turned out, very few developing countries, such as Spain and Singapore, completed (between 1965 and 1970) eight dwelling per 1000 residents, while most other countries managed only two or three units per 1000 inhabitants [see (*2*); see also *Integration of Housing into National Development Plans: A Systems Approach* (Publication ST/ECA/185, United Nations, New York, 1973)].
2. *World Housing Survey* (United Nations Center for Housing, Building, and Planning, New York, August 1973).
3. The scope of this model has been described by W. Leontief "Structure of the world economy; Outline of a simple input-output formulation," Nobel Lecture, Stockholm, Sweden, December 1973 (mimeo); *Am. Econ. Rev.* **64** (No. 5), 823 (December 1974).
4. Model implementation is described in W. Leontief *et al.*, *Study on the Impact of Prospective Environmental Issues and Policies on the International Development Strategy* (technical report prepared for the Center for Development, Planning, Projections, and Policies, United Nations Department of Economic and Social Affairs, New York, May 1975). It is expected that a final report will be completed in 1976.
5. These statistics, drawn from (*6*), are conceptually expected to include such informal housing activities as well, although it is doubtful whether the data actually do. The data displayed in Table 1 are drawn from a more detailed analysis of 30 countries—developing and developed. See also *Construction Industry* (United Nations Industrial Development Organization Monograph on Industrial Development No. 2, New York, 1969), chap. 1.
6. *Yearbook of National Account Statistics* (United Nations, New York, 1974).
7. The richest countries did invest larger sums in earlier periods. In 1950–1962 the United States built 0.28 new dwelling per employee—a higher figure than any European country. See E. F. Denison, *Why Growth Rates Differ* (Brookings Institution, Washington, D.C., 1967), chap. 15; see also (*8*).
8. L. Grebler, paper presented at the Third World Congress of Engineers, Tel Aviv, December 1973.
9. The surveys of household expenditures in a number of developing countries suggest that the percentages of household expenditures devoted to housing vary by level of income, type of dwelling, and location in the urban areas, and that they range between 12 and 25 percent. See *Survey Sosial Ekonomi Nasional: Cost of Living Survey* (Government of Indonesia, Jakarta, 1970); *Annual Report on the Family Income and Expenditure Survey, 1970* (Government of South Korea, Seoul, 1971); see also (*10*); *1973/74 Household Expenditure Survey* (Government of Hong Kong, Hong Kong, 1971). We have used the rent-to-income ratios by income class evident in these data rather than a priori rent-to-income ratios.
10. *Urban Household Budget Survey 1968–1969* (Government of Kenya, Nairobi, 1971).
11. See T. Galloway, C. Dean, C. Ayerbe, *Final Report, Site and Service and Minimum Shelter* (Department of Housing and Urban Development, Washington, D.C., 1970).
12. *Housing* (Sector Policy Paper, World Bank, Washington, D.C., May 1975), pp. 56–59.
13. We analyzed urban income distributions and housing expenditures for the urban areas of these nine countries from the data provided by the Income Distribution Division of the World Bank.
14. The model was anticipated in an article in the special *Science* issue on Energy (19 April 1974) by Prof. A. Carter, who is one of the key members of the U.N. World Model Team. For a more detailed statement, see (*3*). The description provided in this article is drawn from the May 1975 report (*4*).
15. T. R. Lakshmanan, L. Chatterjee, P. Roy, in *Study on the Impact of Prospective Environmental Issues and Policies on the International Development Strategy* (technical report prepared for the Center for Development, Planning, Projections, and Policies, United Nations Department of Economic and Social Affairs, New York, May 1975), appendix.
16. From the data on housing consumption as reported in the national income accounts of 34 countries, we estimated an income elasticity of housing of 0.897 and an urbanization elasticity of 0.235 [see (*15*)].
17. The housing requirements model is described in detail in (*15*).
18. In some countries, households have second homes; in others, more than one household occupies a dwelling unit. Therefore, elsewhere we have used different assumptions about the number of housing units per household to develop alternative estimates of housing needs. See also (*4*).
19. The replacement and vacancy rates are obtained from our analysis and other studies: *The Housing Situation and Perspectives for Long Term Housing Requirements in European Countries* (United Nations, Economic Commission for Europe, Geneva, 1969), chap. 3; G. T. Kingsley and F. S. Kristoff, *A Housing Policy for Metropolitan Calcutta* [Calcutta Metropolitan Planning Organization, Calcutta, March 1971 (mimeo)]; D. Birch, R. Atkinson III, P. L. Clay, R. P. Coleman, B. J. Frieden, A. F. Friedlander, W. L. Parsons, L. Rainwater, P. V. Teplitz, *America's Housing Needs 1970 to 1980* (Joint Center for Urban Studies of MIT and Harvard, Cambridge, Mass., December 1973); The President's (Kaiser) Committee on Urban Housing, *A Decent Home* (Government Printing Office, Washington, D.C., 1968).
20. The sources for data on existing housing stock by country and region are described by Lakshmanan *et al.* (*15*, sect. III).
21. In the United States the share of the total cost of the dwelling unit attributable to land is estimated variously as 18 percent (U.S. Census), 21 percent (Federal Housing Administration), or 26 percent (National Association of Home Builders).
22. We assume a log-normal distribution of dwelling unit costs and get a measure of variance by postulating a minimum cost for the "cheapest one percent" of the units. The entries in the cost columns in Table 4 follow from the mean and variance of the distribution defined in this manner.
23. There are additional methods of reducing housing costs by appropriate location of economic activity, choice of urban density, and choice of urban form. See Real Estate Research Corporation, *The Costs of Sprawl* (report prepared for the Council on Environmental Quality, Department of Housing and Urban Development, and the Environmental Protection Agency, Government Printing Office, Washington, D.C., 1974). Although the discussion in our article is on standards of the housing units, similar arguments pertain to the standards of urban form described in this report.
24. See the Foundation for Cooperative Housing, *Cooperative Housing and the Minimum Shelter Approach in Latin America* (report prepared for the U.S. Agency for International Development, Department of State, Washington, D.C., 1973), vols. 1 and 2.
25. There is controversy about whether subsidies to housing are justifiable on grounds of increased productivity and social development. Empirical evidence does not support the productivity argument, but housing may still qualify for subsidies as being socially desirable. See L. Burns, *Housing: Symbol and Shelter* (University of California, Los Angeles, 1970). We suggest that, given the low incomes and competing claims on national resources, the amount of subsidies, justified on these grounds, is not likely to be significant. Therefore, our arguments about standards become more realistic.
26. For a discussion of resource-conserving approaches, see R. L. Meier, *Planning for the Resource-Conserving City* (MIT Press, Cambridge, Mass., 1974).
27. *Self-Help Practices in Housing: Seleced Case Studies* (United Nations, New York, 1973).
28. In the United States, these subsidies are already considerable. In 1972, direct subsidies to low-income households amounted to some $5.1 billion, and indirect subsidies (through mortgage interest, property tax deductions, and capital gains taxes foregone) of $10 billion were provided to higher-income households. See *Housing in the Seventies* (Department of Housing and Urban Development, Washington, D.C., 1973).
29. Mobile homes in the last half decade or so are entering the housing stock at an annual average of 450,000 units. See *Construction Rev.* **21** (No. 11), 24 (December 1975).
30. *World Bank Atlas* (World Bank, Washington, D.C., 1970).
31. *Compendium of Housing Statistics, 1971* (United Nations, New York, 1974).
32. *World Health Statistics Report* (World Health Organization, Geneva, 1973), vol. 26, No. 11, pp. 726–731.
33. *Analysis Econometrico de Distribucion de Ingresos* (Departmento Administrativo Nacional de Estadistica, Quito, Ecuador, July 1972), p. 21.
34. *Household Income and Expenditure Survey, 1970–1971* (Statistical Division, Ministry of Finance, Planning, and Development, Government of Pakistan, Islamabad, 1972), table 1 (c).

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