

HOUSING INVESTMENT: A CROSS COUNTRY COMPARISON

by

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ABSTRACT

A number of issues regarding housing policy, particularly for developing countries, were explored. First housing conditions in a number of countries were examined in depth. The controversy over whether there is an aggregate deficit in many countries, particularly, poorer ones, of housing units relative to the number of households was addressed. The standard source of data for estimating the additions to the housing stock, official housing production figures, was compared with a published data source, the census, that has nonetheless often been overlooked when making estimates of the housing stock. It was found that according to census data, no significant aggregate deficits exist.

Some of the reasons for concentration on production statistics and the neglect of census data were examined, along with some of the impacts on policy of this orientation. It was argued that compared to census data, a relatively high standard of quality for acceptable housing is implicit in the process of collecting production data. It was shown that if this high standard were maintained in the specification of housing to be provided by the government, given the limited resources available to governments, housing provision policies could not hope to be comprehensive. Some of the possible failures of pursuing a policy of provision of high quality housing on a limited scale were discussed. Reasons for the persistence of limited but high quality housing provision policies in spite of their weaknesses were also treated.

The second part of the thesis consisted of a cross country econometric analysis of the market for new housing. To estimate the model as specified a new cross country data series on mortgage finance availability was constructed from primary sources. The demand side of the market was divided into two components, demand for units and demand for floor space per unit. It was found that the demand for new units was a function only of demographic variables, the increase in

households and the increase in population. As expected, the point estimate of the elasticities of demand for units with respect to each of these demographic variables was close to unity. The demand for space per unit was found to be a function of income, price, the debt to value ratio in housing, and a measure of cold. Point elasticities of price and income were both less than one in absolute value. On the supply side, the price of housing was found to be sensitive to income alone, which had been included to proxy wage costs. When the total effect of income on housing quality taking into account effects of income both on the demand and supply was calculated, it was found to be quite low, the total income (or development) elasticity being estimated at 0.1. This confirms the impression that the housing situation improves only slowly with income across countries.

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I. INTRODUCTION

Many publications discussing housing problems contain the same illustration: a photograph showing dilapidated shacks in the foreground with modern high cost apartment buildings in the background. While this does illustrate dramatically the disparity of housing conditions that can be found in most cities it may also leave people with the impression that there really is a dualistic feature to housing. When visiting most cities one is struck by the variety in housing. There are dwellings of all sizes, all qualities of construction and finishing, made of all kinds of combinations of materials, of all shapes, heights, colors and textures. The variety is such that a quality index based on any of the possible criteria would vary continuously across dwellings.

How does housing compare across countries? Each country seems to have developed housing solutions that are ingeniously adapted to the climate, the topography, the sociocultural circumstance and to the level of income. The smallest, poorest houses in richer countries are of better quality than a large portion of the housing stock in poorer countries. In the poorest countries the very poor often live in what can barely be called a shelter: an abandoned sewer pipe, a cardboard box squeezed between railroad tracks, or plastic sheets nailed in a wall along a street is all that some of the more destitute households can afford. While the lower limit of the size and quality range of housing in poorer countries seems to be near zero, the higher range

is often shockingly high. The sprawling villas, the mansions and palaces of rich and poor countries are surprisingly similar. However, in poor countries such large dwellings are rarer, they are reserved for a few very rich; the average size and quality of dwelling is much lower in poor than in rich countries.

There is one exception to the diversity of housing across countries. In nearly every city of the world one can find estates of neatly aligned blocks of four or five story walk-up apartment buildings. Public housing seems the same everywhere! The facades are monotonously repetitive. The layout of the flats differs only slightly. This is surprising because the common floor plan is only suited to the life style of a small western nuclear family. Even the construction seems to be very similar in all countries. The same durable materials are used; reinforced concrete for skeleton and floor slabs, masonry for loadbearing or infilling walls (1). In richer countries public housing is near the bottom of the size and quality distribution, but because it is so similar across countries and because housing is on average more modest in poorer countries, public housing is high in the size-quality range in poorer countries.

This discussion of the products of the housing sector has emphasized variety within and between countries, a variety that suggests flexibility and adaptability in the provisions of dwellings. One can ask what the conditions are in the construction sector that have led to such a result. The fact is that a great majority of the houses sold are built by small contracting firms. When the majority of

buyers are households or small landlords, the product market is quite competitive. In some countries however the government may contract for a large part of housing construction. If the bidding for these contracts is perfectly competitive then government procurement may not imply a departure from competitive conditions. But bidding may not be competitive and governments may make demands, either technical or administrative, that create barriers to entry, and create monopolies in the construction sector. Oftentimes prices in the housing sector are controlled; rent control is common in rich and poor countries, but it is very widely circumvented by a variety of schemes. Rent control often affects maintenance of the existing stock more than additions to it. The market for the factors used in construction may not function very smoothly. For example, wages for certain types of worker may not adjust in response to shortages. But the great diversity of building materials and technologies suggests that substitutability among primary factors and materials can greatly soften the impact of supply rigidities.

The allocation of housing consumption across households can be fairly simply described. Expenditures on housing are roughly proportional to income, except that the very poor spend a larger fraction on housing than the rich. Furthermore, housing expenditures are a good indicator of other consumption. People who live in hovels usually consume unsatisfactory levels of food, clothing, medical and educational services as well. Inequality in the distribution of housing is not a separate phenomenon. It is only a very visible symptom of inequality in the distribution of income and wealth.

A. Conventional Diagnosis of the Housing Problem

Many countries, especially the poorer ones, have declared a "housing crisis". Government pronouncements, newspaper articles, radio and TV news, and consultants' reports all lament the housing situation. The crisis is often proclaimed the most severe problem facing the country. This diagnosis is based on facts that those heralding the crisis consider overwhelmingly convincing. First of all, a large portion of the population lives in squalid slums, in rickety shacks along foul little alleys, without any utilities, far from schools or clinics. Those who do not live in the slums regard them as a source of dangerous epidemics, a breeding place for vice, crime and revolution, a national disgrace.

Calculations based on official statistics confirm the impression that something is wrong. Experts estimate the yearly construction requirements by adding together the number of households created annually and a certain percentage (2) of the existing housing stock to allow for replacement of worn out dwellings. When the requirements are compared with official production statistics, a large shortfall appears. Then this shortfall is traced back over many years. When the production deficits of all those years are tallied, a large housing shortage is discovered.

As our examples will show, such shortages can be staggering. The following calculation was made in 1976 for the urban areas of Egypt. By comparing requirements for new households and replacement with official production figures it was discovered that, between 1960 and

1975, the average annual shortfall had been 95,000 dwellings. The total shortage for the entire period was estimated at 1.4 million dwellings by 1975. (Joint Housing Team, 1976, p. 2.) Since almost no families were found dwelling in the streets the conclusion of the analysis was that households had been forced to double up (ibid., p. 1). In 1975, there were 3.3 million families in the urban areas of Egypt, the shortage meant that on average just about every dwelling was occupied by two households. The shortage calculation was repeated in a recent World Bank publication on Egypt (Ikram, 1980, p. 148).

A large shortfall in production was also found in Jakarta, Indonesia. "A Rather low estimate by the (government of the) District of Jakarta is that 50,000 dwellings would have to be build yearly, while in reality only 12,000 to 15,000 houses yearly are built" (Republic of Indonesia, Ministry of Public Works and Power, 1973, p. 37).

Algeria has calculated that it needs to build 100,000 dwellings per year while the total production is estimated to be below 25,000 (République Algérienne Démocratique et Populaire, Ministère de L'Urbanisme, de la Construction et de L'Habitat, 1979, p. 22).

The housing shortage is even believed to be a global problem. A comparison of housing requirements and production was made by the United Nations for ninety developing countries (United Nations, Department of Economic and Social Affairs, 1976, p. 48-57). The conclusion is that the housing deficit is increasing by 4 to 5 million dwellings per annum in the urban areas of developing countries alone (Ibidem, p. 6).

While government documents tend to present the housing problem as an arithmetic shortage, some students of the situation characterize it otherwise. We will call these observers proponents of the ethnographic view, mainly because oftentimes as we will discuss later in Chapter III, their view is based in part on information gathered in the course of ethnographic research, that is, direct observation of all aspects of behaviour in a given society. These observers argue that the number of houses is not insufficient for the number of households. There are few families in the streets and doubling up of households in dwellings is not a widespread phenomenon. But the houses which many people are able to find are unsatisfactory. Thus proponents of the ethnographic view argue that the housing problem is not too few dwellings, rather too many households reduced to living in dwellings that are substandard.

B. A Typology of Housing Problems

One purpose of this thesis will be to determine which of these two views is correct. But it is important to put this disagreement into a wider context of the housing problem and the appropriate policy response. By focusing on this controversy one might get the erroneous impression that a housing problem depends on objective facts. True, it is important for policy makers to understand the nature of the housing situation. However, once this matter has been clarified, it must be determined what, if anything, is unsatisfactory about the situation, and only then can the nature of the housing problem be defined.

Once the housing problem has been clarified in this way, policymakers can then decide on the nature and the extent of intervention. Note that the above discussion implies that while the characteristics of the housing situation can be the object of positive inquiry, whether or not there is a housing problem is not an issue to be resolved on the basis of positive analysis. We propose to elaborate a general typology of the sources of dissatisfaction with the housing situation. The types we discussed can be grouped into two classes: those that focus on the mechanism producing the outcome, and those that focus on the outcome itself. To clarify terminology, by an outcome in housing we mean an allocation of dwellings to households. The mechanism is the process which produces this allocation. The situation is the combination of the outcome and the mechanism producing it.

1. Unsatisfactory Allocation Mechanisms

The first type of housing problem related to the allocation mechanism is a shortage resulting from markets that fail to clear. This occurs when prices are so inflexible that they do not rise in response to excess demand thereby leaving some agents in the market who would like to buy at the going price unable to do so. The supply of housing available at going prices is not sufficient to meet the demand and to allocate what is supplied, recourse must be made to some other mechanism such as rationing. The other mechanism is viewed as inferior to the market and herein lies the dissatisfaction with the housing situation characterized by a non-market clearing allocation.

We will not examine this source of dissatisfaction in any detail

for a number of reasons. First, casual empiricism indicates that housing prices are generally flexible. There is one fairly common administrative control on prices in the housing market, rent control. Until recently, many observers argued that rent controls did depress housing investment and the price of rental units. However, more recent studies (United Nations, Department of International Economic and Social Affairs, 1979b, p. 22) of rental markets subjected to control conclude that unless very strict enforcement pressure is brought to bear, rent control is successfully circumvented and the actual price of housing rises well above the controlled level. So even in the cases in which official prices are inflexible, actual prices paid may rise to clear the market. Actually deciding whether housing markets clear is no trivial matter empirically, and would take us well beyond the scope of this thesis. Therefore, our analysis will proceed, as have so many others, with the maintained hypothesis that housing markets are essentially in equilibrium.

Nonetheless even when prices are flexible enough that no excess demands or supplies persist at going prices, there may be dissatisfaction with the mechanism allocating housing. The conditions in which demand and supply are determined may be inefficient in the economic sense for the following reasons (3). First, the production and marketing of homes may be imperfectly competitive either for technical reasons, such as economies to scale in production, or because of other barriers to entry in the sector. There is not much evidence for economies to scale sufficient to create a market wide monopoly in

housing, though conceivably the technology of producing certain types of housing for which there is differentiated demand may exhibit returns to scale. The supply in that segment of the market might thus be imperfectly competitive. Numerous non technological barriers to entry can be erected in the housing sector. For example, licensing procedures and zoning and building specifications may be used to protect existing entrepreneurs from further entry. On the demand side of the market, there may be imperfect dissemination of information. For example as regards the housing market, people may not know of all the alternatives available to them particularly because one dimension of these alternatives is spatial and cannot be costlessly explored. People may also not be aware of all the benefits of housing, particularly indirect benefits to their physical and mental health derived from increased consumption of housing. Finally, there may be externalities in the consumption of housing, so decisions based on individual maximisation may not be socially optimal. For example, the Victorian reformers propounded the view that poor housing bred crime and other anti social behaviour as well as disease and misery. A more straight forward example of an externality is the fire hazard that one ramshackle house presents to an entire neighborhood.

Finally, we note that many of the above mentioned imperfections in the product market for housing may also exist in the markets for factors used in housing. Housing production relies on a great deal of skilled and unskilled labor and these markets are considered commonly subject to such imperfections.

Up to now, we have been discussing the housing market more or less as an aggregate. If it is possible to distinguish separate supplies and demands for different types of housing, one might want to consider submarkets of the housing market separately. If consumers distinguish among the levels of utility they derive from consuming different types of housing, then a separate demand for these types of housing can also be distinguished. Some of these demands may be generated imperfectly. For example, there may be externalities to the consumption of some types of housing while not to others. Likewise supply of most types of housing may be perfectly competitive, but there may be administrative or technological barriers to entry into the production of certain types of housing, such as high rise apartment blocks. When this is the case, supply in that submarket may not be competitive and the market allocation mechanism would thus not be efficient. We also note that in these submarkets of the housing market, prices may be inflexible so the allocation would occur in a non-clearing market. Though we mention the possibility of malfunctioning or non-clearing of submarkets, we will not treat submarkets at length. That would require a detailed study in its own right. This thesis focuses on aggregate housing investment in the long run. In the short run, imperfections in supply of certain types of housing may well play an important role but they are outside of the scope of this work.

Now that we have discussed a number of the instances of imperfections in the mechanism of provision and allocation of housing, we will elaborate further why they are considered a problem. The above im-

perfections if present in the market will cause inefficiencies in resource allocation. If the market mechanism could be improved then aggregate income could be increased using the same amount of resources.

2. Unsatisfactory Housing Outcomes

The reasons for dissatisfaction with a housing situation as discussed above are all based on dissatisfaction with the allocation mechanism. But another class of criteria for declaring that a housing problem exists is based on evaluating the characteristics of the actual housing outcome, regardless of how it is reached. An illustrative example of this type of problem can be taken from another market, that for food. Even if the market works perfectly, but either some incomes are so low or prices so high that large numbers of the population starve to death in a given year, then it is implausible that any one would deny there is a food problem. We argue that a similar type of reasoning motivates much of the dissatisfaction with the housing situation, though it is often not recognized as such. For example, the housing market is criticized for supply inefficiencies that keep prices so high that poor people cannot afford good housing. Though these inefficiencies may sometimes exist, in some cases the criticism of the housing market is phrased in terms of them regardless of whether it has been determined that they exist or not. The nature of the outcome may well be the only aspect of the situation truly unsatisfactory to the critics, but confusing morality with efficiency, they may automatically assume that since the outcome is unsatisfactory, the mechanism must be.

Housing outcomes can be evaluated according to a number of different types of considerations. The first type of consideration is a moral one. On grounds totally divorced from efficiency, the market outcome in the housing sector may have features that are offensive and thus should be changed. There are numerous moral grounds on which outcomes can be judged unsatisfactory. For some, there may be an absolute level of deprivation in terms of housing which should not be exceeded. For others, the housing outcome may be offensive because the distribution of housing services exceeds some acceptable degree of inequality. If one believes that people have equal rights to the joys and comforts of life, then an outcome in which one of these, housing, is distributed very unequally is wrong.

There are two other types of consideration that might be applied to a housing situation, regardless of the mechanism which produces it. These are both purported to be concerns with efficiency. As distinct from moral considerations, these have as their objective the improvement of resource allocation and thus of total output. The first set of these efficiency considerations is that concerned with social efficiency. Proponents of this view argue that if the housing outcome could be changed to provide a higher minimum level of housing consumption, social welfare could be increased. The reason is that poor housing conditions affect not only the individuals living in them but other members of society as well. Some authors argue that poor housing promotes anti-social behaviour, and that an undesirable level of political unrest stems from the dissatisfaction that poor housing

breeds (4). According to this argument, the government and richer members of society would benefit if the housing conditions of the poor were improved over those they choose in equilibrium.

The second efficiency consideration regards benefits the workers themselves receive from housing. It is argued that if workers had a certain standard of housing above the level they choose in equilibrium, then their productivity and hence their incomes would rise and their welfare would improve over and above the improvement in housing conditions. (5)

Both these lines of reasoning are similar to those we discussed in the section on imperfections in the allocation mechanism. The only difference in this case is that those espousing these two views argue that there is an optimal minimum standard that is independent of other conditions in the economy since it will not automatically result from the workings of an efficient allocation mechanism. Unfortunately, there is a logical flaw in the above stated argument because an efficient allocation mechanism taking into account effects of housing on productivity of workers and on other members of society will generate the optimal minimum level of housing. This follows from the most fundamental tenets of welfare economics. An efficiently generated outcome will make the best use of available resources and in so doing will weigh the benefits of increasing minimum levels of housing consumption against the opportunity costs of doing so. No large reallocation of resources towards housing for the poor can be made without worsening conditions elsewhere, if the outcome has been reached by a

fully efficient allocation mechanism. For example, a proponent of the absolute minimum standard view might argue that the poor should consume much more housing than they do in an efficiently generated outcome. In support of this view he would contend that worker productivity would rise considerably as their housing conditions improve. That assertion could well be correct and still the reallocation could not be justified on efficiency grounds. This is because the resources used to improve housing must be taken away from some other use, for example, food or health expenditure, which also improves worker productivity. If the reallocation away from the efficiently generated equilibrium is large, then the loss in productivity due to the reduced expenditure on food or health care outweighs the improvement in worker productivity derived from the amelioration of housing conditions. We know that this must be true from the properties of an equilibrium reached by an efficient mechanism. Thus according to our typology, dissatisfaction with a housing outcome, if generated by an efficient allocation mechanism can be logically based only on moral considerations. And we reiterate that moral considerations could dictate a minimum level of housing that would be greater than the "efficient" level. That, in turn, may imply greater worker productivity or fewer social ills than the efficient solution.

We have enumerated several types of moral consideration that might be used to judge a housing outcome. But to decide whether the outcome represents a problem or not, requirements must be determined, and the many dimensions of a housing outcome must meet these in order to be morally satisfactory. Depending on the set of moral values, there may be no requirements on certain dimensions of the situation.

Perhaps just a few key variables will be of interest. For example, one might decide that certain features, such as floor space per person or plumbing facilities, must meet a certain standard in all houses. Or one may be concerned with general housing conditions for certain groups: income classes, age groups, certain family configurations, such as young families or single parents, the handicapped, dissatisfied and underpaid civil servants, or politically aware university graduates.

Oftentimes, concern over the outcome for a certain subgroup of the population is phrased in terms of the inadequacy of the functioning of the submarket serving this group. But such characterizations of the problem can be misleading. What is called a failure of the submarket is often only a failure to provide what the observer considers to be decent housing for that subgroup, at a just price. That some social group should be housed according to a given standard is defensible as a moral consideration. But to call any housing situation in which this is not the case a problem of inadequate markets is simply unjustified before the actual functioning of the market has been investigated.

All moral considerations and the standards that flow from them are not given once and for all. Some are a social phenomenon, not natural laws, and may thus change with social conditions. Even if the moral considerations stay the same, what they require of an acceptable outcome may change as the conception of what is morally acceptable does. Requirements may even be defined dynamically. For example, a moral standard may dictate that no one's housing situation even be

worsened, if someone else's has been improved. Standards may also be based on historically defined relationships. It may be thought that one social class simply has to have housing of noticeably higher quality than the housing of some social class they see as below them. Over time, acceptable relationships may also change. For example, the received anthropological wisdom on the peasantry is that traditional peasant societies tolerate relatively little disparity in all consumption including that of housing. In an evolved industrial society, perhaps in response to different economic conditions, moral considerations may only require a minimum standard but will see no evil whatever in permitting some households to live in opulent settings worth hundreds of times the value of the minimum dwelling. Or more simply, moral requirements may change with reduced or increased resource availability. Surely the twentieth century conception of squalor is not the same as that held in the Renaissance.

Relative price changes may also change what constitutes squalor. Now that energy prices are so high, a poorly insulated house is considered much more of a hardship than it once was. As the relative price of consumer durables has fallen, minimum requirements for electrical installations and space have increased. Less mundane social changes may also play an important role in defining minimum standards. For example, as missionaries have more influence among the Cayapa Indians of Northern Ecuador, the latter are increasingly convinced that a separate bedroom for married couples is necessary whereas before, a simple elevated platform, covered with a thatch roof and without

partitions or walls was considered to provide adequate privacy.

We cannot begin to list all the types of standards that may be generated from the different types of moral considerations, nor can we hope to model deterministically how both moral considerations and standards change over time. The objective of this research is not the study of the formation of standards in housing. Our concern is, among others, to analyze the consequences of the standards which actually exist and the means by which they have been implemented.

C. Housing Problems and Policy Alternatives

Now that we have discussed in some detail the types of housing problems and classified them according to the source of the dissatisfaction with the housing situation, we will turn to a discussion of the policy alternatives available to deal with different types of problems. When markets do not clear the problem can be solved by making the price flexible. If the inflexibility results from administrative controls these can be dismantled. For example, in the case of rent control, one can make prices flexible at the margin with a measure such as vacancy decontrol or flexible in the large with total decontrol. If price inflexibility has other than administrative causes, it may not be possible to eliminate it.

The second type of housing problem was defined precisely as the outcome of an imperfect market mechanism. Thus improvement of the mechanism of demand and supply is called for. In case of imperfect competition in supply such as monopoly or oligopoly, then antitrust

laws can be passed and enforced to improve the market. Imperfect dissemination of information may be improved by government policies designed to reduce the cost of gathering information. The government may publish data or set up information exchanges. When consumers are ill informed as to the benefits they derive from housing, an information campaign can be mounted. Educators believe that the primary school curriculum is an effective means of disseminating information on the relation of housing to health and of inculcating the desire to make one's environment a healthy one. Finally, for externalities, the remedial policy is not so clearcut because what is necessary is the creation of a means of internalizing the costs and benefits that are not borne and captured privately. For example, a system of fines, as has been proposed for pollution problems, can also be used to internalize housing externalities. Certain types of subsidies for consumption of housing might also be used.

The third type of housing problem, where dissatisfaction is with the outcome, no matter how it has been reached, leaves more latitude in the choice of an appropriate policy. The previous two problems relate to the housing allocation mechanism, hence the mechanism must be improved to solve the problem. A perfectly efficient outcome which is unacceptable on moral grounds requires policies that either directly change those aspects of the outcome which are unsatisfactory or that focus on changing other variables that will indirectly affect these target variables in the outcome.

Changing directly the outcome of the housing market requires

some redistribution of the consumption of housing. This can be done in the large redistributing the housing stock. Redistribution of the housing stock was proposed by Engels as early as 1872 (Engels, 1975, p. 51). It was advocated by Bukharin and Preobrazhensky in 1917 (Bukharin, 1970, p. 401). Lenin drafted the law "On Requisitioning the Houses of the Rich for Alleviating the Needs of the Poor" and issued the "Fundamental of the Law on the Confiscation of Apartment Houses" (Sosnovy, 1954, p. 12). The Law of August 1918 declared the nationalization of most privately operated housing and thereby facilitated redistribution. During the period of War Communism, from 1918 to 1920, families were transferred from bunk apartments and basement quarters to nationalized houses. In Moscow and Leningrad alone one million people benefited from the redistribution of housing space (ibidem, p. 14-15). However in the Soviet Union, this one time improvement for many was followed by a slow decline of housing conditions for all, because the existing housing stock was not maintained and new housing construction was a very low investment priority. Destruction during World War II also contributed to the problem (6), and the housing situation worsened until about 1957 (Di Maio, 1974, p. 15-17), when the allocation of resources to housing investment started to increase.

A redistribution of housing also occurred in China after the Revolution (Peking Review, 1975, No. 48, p. 18). Before 1949, in the rural areas "the landowners possessed spacious accommodation, but the poor and landless peasants lacked housing space. By redistributing housing according to individual needs, generally all peasants received

quite generous housing space" (Kwok, 1978, p. 256). In the urban areas the redistribution may have been somewhat slower. (7) "Following the socialist transformation of private industry and commerce in 1956, privately owned houses, except for those left for the use of the owners themselves and the small number of rooms to be let out by the owners according to government policy, were transformed into public ownership" (Peking Review, 1975, No. 48, p. 17). However even after 1956 a substantial portion of the urban housing remained in private hands (Howe, 1968, p. 87). For a while after 1956 the distribution of housing remained unequal because private landlords refused to sublet. (8) The equalization occurred gradually as home owners and well-to-do people lost their previous income sources and consequently had to rent out or give away part of the houses they had occupied before (Chao, 1968, p. 106). (9) In addition "some home owners discovered that house maintenance costs were higher than the public housing rents and decided to either sell or voluntarily forfeit their ownership rights to the government in order to be eligible for a new public housing unit" (Kowk, 1973, p. 233). It seems thus that in China the redistribution of urban housing happened only gradually, partly directly, and partly as a consequence of the redistribution of income and wealth.

In the Soviet Union and China, the housing stock was redistributed on a large scale, but the government also used a large scale indirect method of changing the outcome, major income distribution. If demand for housing is a positive function of income, to increase the housing consumption of the poor, one can give them more income.

Furthermore if moral objections to market outcomes go further than the housing market, and it is thus felt that not only housing but food, health care, and education are consumed at unsatisfactorily low levels among the poor and if household demand for these items is a positive function of income, then income redistribution towards the poor families will improve outcomes in these areas as well. However, to raise the incomes of all families to a level where they choose to consume the minimum moral standard of all these goods, or even of housing alone, may involve redistribution of income so substantial that it may be impossible to implement without considerable reorganization of society.

Most governments shy away from making such radical changes. Instead of making large changes in variables such as income, that indirectly affect the outcome, they often prefer to directly alter the outcome at the margin, and choose to change the housing situation by influencing investment in housing. Most governments are likely to choose this approach to avoid the major political upheaval required for alternative strategies, perhaps because they believe that such upheaval would provoke so much loss of life and property that in the end everybody would be worse off or they may simply be opposed to radical approaches on ideological grounds. Critics of the gradualist approach argue that it is devious because, while preserving the advantages of the rich and powerful, it also lessens the resentment of the poor. However the purpose of this thesis is neither to describe that debate nor attempt to resolve it. We will simply take as given that most governments choose to improve the housing situation by mak-

ing marginal changes.

The conventional instruments which governments use to influence housing investment can be classified into two types, direct supply policies and price policies. The purpose of the direct supply policies is to devote a portion of housing investment to provide proper housing directly to those who do not or cannot obtain it for themselves in the open market. Governments have the choice of either selling or renting public housing, but in either case the sale price or the rent is usually subsidized to make the level of housing offered affordable for the poor.

The certitude of improving the welfare of those in need by providing them with proper housing is not the only reason governments choose a direct supply policy. They see such a policy as a tool for achieving additional goals. Public housing programs offer the opportunity of shaping the urban environment precisely and directly. Location, density, and the overall aspect and organization of cities can be more easily directed using housing projects than using indirect means such as regulations and zoning.

Price policies provide an alternative means of influencing housing investment. The purpose of such policies is to reduce the price of housing so that some who otherwise would not, can now afford an appropriate dwelling.

One way the government may try to lower the supply price of housing is through subsidies. These can be introduced at any point in the housing production process. Building materials, construction

equipment, and construction loans can all be subsidized. Developers of dwellings sold to low income families can receive lump sum subsidies. If they rent to the poor they may be given a rent subsidy as well.

All the price reducing measures mentioned above affect the supply side of the market only, but a few measures are geared towards the demand side as well. The government may help poor families to buy their dwelling by granting them mortgage loans at concessionary rates. Housing debt can also be subsidized through the taxation system, either through the income tax deduction of part or all of loan repayments or through depreciation allowances. Governments can try to convince the population that better housing increases their welfare more than they realize. Or governments can discourage non-housing consumption by either increasing prices of other goods relative to housing or creating shortages of other goods. Governments can encourage and organize saving for investment in housing; they may even go so far as to promise to match accumulated savings if applied to the purchase of a dwelling. Direct subsidies, in the form of rent or house purchase vouchers, are often used to lower the prices that households face.

Almost all the subsidies just presented can either be restricted to a particular group of households, or to a particular type or location of dwelling, or they can be applied across the board to all households and all dwellings. Limiting the subsidies to target households has a great advantage. It only benefits those that need help most and thus provides the most benefits for the least total disbursement.

The main disadvantage is that it may be difficult and costly to administer a subsidy program so that only needy households benefit. Also, finding an eligibility requirement for an exclusive subsidy that is not simply an arbitrary dividing line is extremely difficult, if not impossible. A household with resources just above the eligibility level will not benefit from the program though its needs are almost the same as those of some household receiving the subsidy.

A subsidy program that is restricted to a certain type or location of dwelling may be slightly easier to administer. But because beneficiaries need not satisfy any requirements, it is difficult to predict the incidence of such a subsidy. One can attempt to subsidize dwellings that will not be attractive to households that are not in need, but dwellings of this type are often unattractive and unsuitable for anyone. Such a subsidy policy would then subvert the original purpose of having a subsidy: providing decent housing for the needy.

As this review of policy options to affect housing outcomes shows, there is a wide variety of options available to changing an unsatisfactory outcome. Yet, there is a surprising similarity in government policies across countries. Aside from measures to improve market mechanisms, which some governments do take, in poorer countries it is most common for governments to choose to intervene in the housing market with direct supply policies, more specifically, by constructing public housing. On the other hand, in richer countries both price and direct supply policies are used to influence housing investment. We argue that the poor countries rely heavily on direct supply policies

because their governments simply do not have the apparatus to implement price policies effectively. For example, governments in developing countries usually do not have access to accurate enough information about incomes and wealth to verify the claims for eligibility of prospective subsidy recipients. Furthermore they do not have the revenues to dispense untargeted subsidies. In contrast, direct supply policies are attractive because the governments' relatively small capacity for enforcement is less of a handicap for their implementation. Below we develop in detail the reasons why this is the case.

One advantage of direct supply policies is that the budgetary requirements are easier to predict and limit than those of subsidies or other pricing policies. The cost of a public housing project will only be the subsidy implied in the project: total costs minus the repayments by the beneficiary households. Of course budget overruns can occur, very often there are unpredicted cost increases which cannot be passed on, and which therefore increase the necessary outlay. But the obligation is limited to the specific project, the one time and recurrent outlays are thus easier to predict.

Market improving price policies have a disadvantage in that the benefits are quite difficult to measure. For example, it is next to impossible to know how much a given level of expenditure on disseminating information will actually lower equilibrium prices. Moreover even if the effected change in equilibrium prices were known, the government still would not know how close it had come to bringing the total population to a minimum standard of housing. Similar reasoning applies to

subsidies. Though the effects on price might be easier to estimate if supply and demand parameters were known, and they are not generally known, the problem remains that the goods one subsidizes may have alternative uses. In the case that they do, the effects are widely spread throughout the economy. Hence both the returns on outlay and the optimal levels of outlay for price policies are difficult to calculate.

For the above stated reasons, the governments of poorer countries, limited by meager resources, their low level of penetration in society, and their need to produce tangible results, may prefer direct supply policies. There is, however, a major problem with such policies, especially in poorer countries; in the absence of strict enforcement, households which are given public housing will trade it away. With direct supply policy households are offered dwellings which are much larger, better built and more expensive than they would normally afford at their income level. In order to convince the households to accept the decent dwelling governments have to subsidize the cost down to what the households would normally spend on housing. The subsidies involved are always substantial and in many cases the subsidy is a multiple of the household's income. As a consequence there is a great temptation to transform the subsidy into income. Households are very ingenious at inventing schemes to make these trades in spite of the governments' efforts to prevent them. Some households sell the right of occupancy outright and move out, some sublet rooms, and subdivide the dwelling into smaller dwellings. Others disassemble part of the

construction and sell it as building materials to other households, still others turn part or all of their dwellings into retail or work shops to rent to others or for their own use.

After the households have been able to trade the subsidy into income they may increase their overall consumption but it will be distributed according to their own preferences rather than to those of the government. Thus while public housing programs may not improve the housing conditions of the poor as much as intended, at least they constitute indirect income transfers to the poor. The increase in income coming from the transfer will probably induce beneficiary households to consume more housing. But the increase in housing consumption will be much smaller than the increase the government intended when it embarked upon a public housing program. One reason why this policy is often less effective than might have been originally expected is that while apparently trying to alter an aspect of the outcome which was undesirable, those designing the policy neglected the fact that changing the outcome does not change the mechanism of allocation. Since housing is allocated by means of a market, the benefit of subsidizing housing can be transformed into generalized purchasing power. Furthermore, given that all markets allocate according to ability to pay, individuals may want to realize this general purchasing power for necessities other than housing. If they were rich they might want the house offered them, but since they are not, they have many other pressing needs besides housing to which any available income can be devoted.

D. Summary of the Main Questions This Thesis Will Attempt to

Answer

Thus far in this introduction we have concentrated on elaborating a general typology of housing problems classifying them according to the source of dissatisfaction with the housing situation. This typology was developed to situate some characterizations of the housing problem made by policy makers and academic observers in a wider context. We then developed a categorization of policy as a response to various types of housing problems. Within the general framework we have advanced, let us now discuss the questions we will attempt to answer in this thesis.

1. The first question is to resolve the issue as to the nature of the actual conditions in housing. Government publications proclaim that there is an aggregate shortage of dwellings. Yet the ethnographic view disagrees. We will not examine the nature of the housing situation on a disaggregated level. For example, we will not explore regional shortages. We limit ourselves to examining the aggregate housing situation, and only the adequacy of the stock in terms of numbers, not in terms of quality or other terms. We choose to limit ourselves in this way primarily because this is one of the major issues over which there has been some disagreement. And, it is in terms of the adequacy of the total number of dwellings that the housing policy issue in developing countries has been posed. We intend to ascertain which of the two views, administrative or ethnographic is correct. In investigating this issue we intend also to elucidate

and emphasize the role standards play not only in defining a housing shortage, but also in both grasping the actual nature of the housing situation and in choosing a response to the perceived problem. We emphasize that though most of the discussion in this chapter focused on the analysis that must follow the correct prehension of actual housing conditions, current debates indicate that even that task is far from completed. So resolving the administrative versus ethnographic view debate is of considerable policy importance.

2. Our typology of housing problems cited imperfections in the generation of demand or supply as a possible source of dissatisfaction with the housing situation. Many assessments of the evolution of the housing sector, particularly in periods of rapid growth, have lamented a supposed faulty supply response in housing. We would like to test whether supply rigidities that would result from imperfect functioning of housing markets actually exist, or whether the observed rise in the price of housing in the course of development is simply a result of the functioning of reasonably well ordered markets.

3. We have discussed the possibility that dissatisfaction with housing outcomes may be the root of a housing problem. Then we listed a few policies that could be used to affect outcomes. In this thesis we examine the quantitative effects of a number of policies that can be used to change housing outcomes. We hope to ascertain which are the most effective, and which, if any, have no effect at all.

4. Finally, to complete the policy analysis, we will obtain quantitative assessments of the effect of no intervention at all. Thus

we will calculate the effect of income growth alone on housing investment.

These questions might be analyzed at different levels of aggregation and using different methods and different data sources. One might make case studies, examining only one or a few countries in depth, or one might use statistical analysis that focuses on the interpretation of quantifiable data. We have chosen the latter method, since detailed case studies were not feasible. We have also chosen to look at aggregate housing investment rather than any particular submarkets. This choice was made primarily because the data necessary for statistical analysis is not available for disaggregated housing markets for most countries. A study of the detailed operation of housing markets would also require another methodology and different data sources and thus will not be undertaken here.

We also decided to analyze long run rather than short run responses. Generally the long run is understood to be the period over which all factors of production are mobile, usually several years. Time series for long run statistical analyses for a few countries are not available since even if series exist over a long period, one cannot be certain that the observed variations are reliable. Therefore we used cross country data, which is widely accepted as the next best source for long run analysis.

The thesis will be organized as follows. In Chapter II we will survey the literature to examine how previous authors have dealt with

these questions. In Chapter III we will answer the first of the questions just mentioned, that is, we will try to reconcile the opposing views of the housing problem. Then we will explore the consequences of a combination of a direct supply policy and high standards for dwellings, and the possible reasons for the continuation of such policies. In Chapters IV and V we will develop a theory of both the demand and the supply side of housing investment. In Chapter VI we will estimate the system of equations describing demand and supply. Then we will test hypotheses on how the various policy and other variables affect housing investment. Chapter VII states our conclusions and suggestions for further inquiry.

NOTES TO CHAPTER I

(1) There are other forms of public housing besides the five story walk up such as the detached bungalow type or the twenty story tower that one finds in many countries, rich or poor. For those types also size and quality are quite similar across countries. A more recent form of public housing are the core houses and sites and services schemes. Although in these schemes the initial intervention by governments are often very similar across countries, the housing produced in the end is usually well adapted to local circumstances because the completion of the dwellings is left to the initiative of the households.

(2) The percentage of the existing stock that is needed for replacement depends on a variety of variables describing the characteristics of the existing dwellings, on maintenance costs and on a variety of other economic variables. Where sufficient data are available one could estimate the percentage using regression analysis. But in most estimates of housing need have used rules of thumb. Most experts agree that each year between 1.5 and 2.0 percent of the housing stock needs to be replaced.

(3) Here we are using supply in a broad sense to refer to the seller's side of the market. Strictly speaking, a supply function independent of demand conditions only exists when suppliers are perfectly competitive and take prices as given. However, even when suppliers are not

price takers there is supply. In the case of a momopolist for example, there is a profit maximizing price and quantity, a supply point at which the momopolist chooses to produce. In other cases of imperfect competition, the supply may be more complex to determine, but in any market configuration, a decision is made to bring goods to the market, and the conditions governing this decision determine what we call supply.

(4) Murison and Lea (1979, p. 33-34) is a recent presentation of these views. Earlier Abrams (1964, p. 143) stated a similar argument.

(5) Burns and Grebler (1977, p. 104).

(6) The destructions during the Second World War were enormous. "The Nazi invaders razed to the ground more than 70,000 towns, urban-type settlements and villages; they destroyed nearly 100 million square meters of dwelling space...some 25 million Soviet citizens were left homeless" (Zhukov and Fyodorov, 1974, p. 16).

(7) "Implicitly, the ideology maintained an ultimate goal of public ownership of all housing. However the government legally protected private ownership of housing for the owner's use and for limited renting...(In some cities) confusion at the local level extended confiscation to privately owned sotck" (Kwok, 1973, p. 229).

(8) Landlords feared that they would be forced to rent at excessively

low rents and were in any case reluctant to suffer the political consequences of becoming a member of the exploiting class (Ibidem, p. 88).

(9) The fear of being accused of being parasitic elements of an exploiting class also restrained the house-owners from occupying spacious living quarters.

II. LITERATURE REVIEW

The object of this thesis is to conduct an empirical investigation of housing investment across countries for the purpose of analyzing issues of policy significance. Thus it is appropriate to discuss both the empirical literature exploring the behaviour of investment and the normative literature discussing the policy stance that government should adopt in directing the process of housing investment.

Let us begin our discussion of the literature with the early normative treatments. The Soviet Union was one of the first countries in which the question of the appropriate level of housing investment was seriously debated. In the twenties, with the advent of development planning, almost all aspects of the economy came under the scrutiny of both the corps of technicians and economists at Gosplan, the State Planning Commission, and the ideologues of the Communist Party. Since capital was believed to be extremely scarce, much discussion focused on determining the optimal composition of investment. Moderates, among them Bukharin and Stalin, urged that since labor was plentiful, capital should be accumulated in labor-using industries. Radicals, like Trotsky and Preobrazhensky, argued that reducing dependence on imports was critical, thus investment should be devoted to developing capacity in heavy industry. By the late twenties, the issue had been resolved in favor of the autarkic approach. (1) Choosing to concentrate investment efforts on heavy industry had ramifications for the role of housing in development. This is because developing heavy industry

dictated concentration of production capacity in large urban complexes. However, given the conditions in the Soviet Union at the time, assembling a work force for these industrial nodes would require considerable migration from rural areas. That migration would entail certain costs, and measures had to be taken to minimize them. One of the primary means of doing so was to deliberately restrain the level of housing investment and thus accommodate the surge in demand for urban housing with the least resources possible. Moreover, excess migration from rural areas would have increased the costs of urbanization. Keeping urban housing conditions relatively bleak prevented the cities from becoming inordinately attractive to rural dwellers. (Nove 76, p. 246)

In the thirties, while the Soviets were industrializing, the critical problem for the Western powers had been mobilizing idle capacity. During that time promoting housing investment had been considered as a means of increasing effective demand, but was used only to a limited extent. Mobilization for the War effort changed the focus of policymakers, and attention was turned to economizing scarce resources. In the housing sector, the government was given the power to construct houses in those critical areas where workers were needed for the defense effort, but the standards for this housing were kept low to economize on scarce materials. The low standards were not openly challenged. Rather the policy debate was over the roles of the private and public sector in providing housing.

During the Korean War, while the public versus private debate continued, the issue of the quality of housing units was also raised.

That a sufficient number of housing units had to be provided for defense workers was not in doubt. The view was put forth most simply and colorfully by Harvey Knox, Mayor of San Diego in a letter to the Senate Committee on Banking and Currency: "This city builds airplanes, airplanes require manpower, manpower requires housing, no house, no manpower, no airplanes - Joe Stalin in command." (U.S. Congress, Senate 1951a, p. 226) But William Levitt, a well known housing developer argued that quality was reduced to an unwarranted low level during the Second World War. He argued that he had been forced to build houses using "everything except sheer molasses" and as a consequence they were "wholesale junk" (ibidem, p. 178). He argues that the maintenance costs of those houses still in use were enormous, and that if such a policy were adopted again, the payoff in the savings of strategic materials would be outweighed by future maintenance costs. The government resolved the debate by choosing to economize strategic materials as much as possible, and producing a large number of low quality units.

Implicit in the question that Levitt raised was the concept of time preference and the optimal path of housing investment. Howenstine approached the problem with explicit focus on timing housing investment appropriately in the context of an overall optimal development plan. According to Howenstine, in a first stage housing investment should be kept at a minimum because it uses resources needed for more productive investment opportunities. Later, when underemployment and unemployment have been eliminated, housing investment can be

expanded to boost worker productivity. In a final stage housing investment should simply be permitted to respond to the preferences of households. (Howenstine, 1957, p. 23)

Earlier W. Arthur Lewis argued against low levels of housing investment, contending that the Soviet planners had forced too great a hardship on their people, and Western planners would gravely err by using a similar approach in poor countries (Lewis, 1949, p. 54). Like the Soviet planners Lewis saw housing investment as a necessary concomitant of industrialization, but he felt that the quality should not be reduced to keep housing outlays low.

The normative literature we have been discussing situates housing in an overall planning concept. However there is another normative strand of literature that concerns itself with housing standards regardless of the economic growth and housing's effect on it. The literature is vast and disparate. We will group it into three types. The first of these is descriptive literature, which informed the public of the nature of housing conditions among the very poor. Writers such as Dickens, Hugo, Zola and others started a tradition of chronicling the material aspects of the life of the lower classes. Official reports such as the Public Health Reports in Britain in the 1860's provided detailed information on the accommodations of the poor. Following hard on the publication of accounts of bleak housing conditions was the second strand of literature, decrying these conditions. The classic work in this vein is The Bitter Cry of Outcast London published by Reverend Mearns in 1883. Engels' The Conditions of the Working

Class in 1844 was also a seminal piece in a similar vein. The American exemplar of this decrying literature is Jacob Riis' How the Other Half Lives (1890). Kaethe Kollwitz woodcuts expressed in images the same outraged sentiment. The third type of normative literature on housing made proposals for minimum standards, for providing modest but decent housing. The Utopians always included designs for appropriate worker housing. Court decisions set down standards to which laws and regulations added further minimum specifications. Well known architects submitted designs of model housing for workers to international expositions and competitions.

This review of normative views of housing investment has revealed a number of different strands of thought. First, there is the theme of the dynamic role of housing in accommodating the movements of population necessary for development, or for wartime mobilization. Then there is the issue as to the amount of resources that should be devoted to this accommodation. That question encompasses the tradeoff between higher investment in sectors other than housing and lower costs of maintenance and replacement of the housing stock in the future. There is the justification for housing as a merit good, as a means of raising the productivity of the workforce, and finally the moral case for improving the housing conditions of the very poor.

Currently all these strands in the normative literature have a certain acceptance among policy makers. Yet what seems to happen now is that different policy making bodies each adopt one or a few of these views. For example, housing departments are likely to see housing

as a merit good, while the ministry of planning may view it with Howenstine's perspective, that is, as a low priority item in a capital scarce economy. In the Soviet Union in the twenties and in the United States during the Korean War and World War II, planning was centralized and consistent and efficient allocation of resources was the primary emphasis. In that context, housing investment was not viewed as unidimensional phenomenon as it has tended to be in recent policy discussion. Quantity and quality were both at issue and the trade-offs implicit. Different combinations of these were explicitly weighed in the elaboration of policy. As we shall see in Chapter III, neglecting the limited amount of resources available for housing has led to the formulation of policies that may be quite simply inconsistent with the level of resources available in poor countries. We shall try to show, in our analysis of the effects of housing policies, that perhaps a return to considering alternative quantity and quality combinations may help generate housing policies that will more effectively attack the crucial problems.

Having discussed some of the important points in the normative literature on housing investment, we now turn to reviewing existing studies that address the positive questions which we intend to explore in this thesis. There are really two sorts of issues to which these questions are addressed. One set of questions is concerned with the mechanics of government policy, the government's perception of problems, their choice of solutions, the effect of their particular choice and the reasons for its persistence. The second set of questions fits into the

framework of an appropriate theory of the determinants of housing investment.

In the literature there is very little discussion of the reason for the conflicting perceptions of the housing problem. However three authors have mentioned the possibility that official statistics underestimate housing production. Strassmann considers the problem to be restricted to developing countries (Strassmann, 1970, p. 393). Eckaus suggests that the undermeasurement is worse in the rural areas of developing countries where most housing demand is satisfied outside the marketplace (United Nations, Department of Economic and Social Affairs, 1973, p. 35). Burns and Grebler concur with Strassmann but believe the undermeasurement also occurs in developed countries where the value of new housing is often underreported (Burns and Grebler, 1977, p. 44). Angel et al. are the only authors who point out that undermeasurement of housing production may lead the government to overestimate the magnitude of the housing problem. They blame the housing shortage on the "arithmetic approach" of governments who calculate the shortage by subtracting the number of "good" dwellings in the housing stock from the number of households. According to the authors the amount of "good" dwellings in the housing stock from the number of households. According to the authors the amount of "good" housing is restricted by the government's insistence on unrealistically high standards (Angel, 1977, p. 79).

Although it is a common topic of discussion between policy makers and their consultants, the effects on the actual realization of govern-

ment goals of simultaneously opting for public housing production and adopting unrealistically high standards for this housing have not, as far as we know, been formally analyzed in the literature. Likewise, no author has explained why such a combination of policies persists.

Though the last two questions may appear to be only vaguely related to the first, when we attempt to answer them in Chapter III we will show that there is a close relationship between the undermeasurement causing the perceived shortage and the choice of policies to remedy it.

The literature testing theories of housing investment is quite large. First, we will survey those analyses based on cross country data, then those that work with time series and cross sectional data on housing investment in the United States.

In the literature on housing investment across countries, equations are fitted using simple linear models without explicit theoretical underpinning. The studies attempt to explain the variation of the share of housing investment in Gross Domestic Product (2) across nations with a series of such variables as income and demographic characteristics. Occasionally miscellaneous additional variables attempting to capture structural characteristics of the economy are also included.

All authors found income, measured as Gross Domestic Product (GDP) per capita, the most important variable in explaining variation in the share of housing investment in total production. In a comparison of data collected between 1951 and 1957 for twenty-six developing and developed countries, Kuznets shows that both the share of construc-

tion in Gross Domestic Product and the share of residential construction in total construction increases with income per capita. In fact, one can calculate from his data that the share of residential construction in Gross Domestic Product increases with income per capita, from 2.7% of GDP for the lowest income countries to 4.7% for the highest. (3) Kuznets warns that "it may well be that the differences among groups of countries in the distribution between residential and other construction merely reflect relative price differences and would disappear if the estimates were converted to the same price structure" (Kuznets, 1960, p. 36). Thus, his earlier work does not conclusively show that physical additions to the housing stock increase with income per capita. Interestingly, in a later intertemporal study covering twelve developed countries between 1860 and 1955 Kuznets was unable to show a relation between income per capita and the share of dwelling construction in GDP (Kuznets, 1961, p. 40, also Kuznets, 1976, p. 258).

Eckaus, using pooled time series cross section data for twenty-five countries, clearly demonstrated a positive relation between housing investment per capita and income per capita (United Nations, Department of Economic and Social Affairs, 1973, p. 42). Strassmann, in his study based on data for twenty-six countries between 1955 and 1966, finds that the share of residential construction lags in poor countries, accelerates in middle income countries and then falls off in the richer developed countries, except in the developed European countries where it levels off (Strassmann, 1970, p. 402). Strassmann attributes this pattern to a measurement problem at low income levels and demand

and supply shifts at higher income levels. According to him the level of housing investment in developing countries is only low because most of it is produced outside the monetized sector of the economy. In middle income countries, high population growth rates and migration rates push demand up while the supply expands easily. "Materials and technology are largely domestic and relatively simple and both entrepreneurs and workers can enter this industry with ease" (ibidem, p. 393). In richer countries lower population growth and migration rates cause demand to slacken. Strassmann argues that the downturn in the construction share of GDP in developed countries becomes more evident when one corrects for the monopolistic component that strong unions have added to the construction wage bill. One can assume that his remark also applies to housing investment (ibidem, p. 394).

Burns and Grebler's work confirms Strassmann's findings. Running a multivariate regression on a sample covering two periods: 1955-60 and 1960-65 for thirty-nine countries they found that the share of housing investment in GDP, (H) (averaged over a certain time period) is an inverted U-shaped function of GDP per capita. Even though they included other variables in their regression, income per capita was the major factor explaining the change in the share of housing investment (Burns and Grebler, 1977, p. 36). They account for their result as follows. "At the earliest stages of economic development, H is low. A relatively small share of total resources is allocated to housing because other investments presumably yield higher expected returns. With development, H rises as housing outbids many of the types of in-

vestment that were critical during the earliest development continuum, H falls as alternative investments once again outbid housing" (ibidem, p. 30). (A more detailed analysis of the work of Burns and Grebler is found in Appendix C.) Of course, explaining the relationship on the basis of yields only pushes the theoretical question back one step further. The authors present no logical basis for assuming that yields on housing vary with income per capita. Moreover they cite no evidence supporting the hypothesis that yields change in the course of income growth.

Most authors agree that besides income, demographic variables are most important in explaining the difference in the share of housing investment in GDP among countries. Both Kuznets and Strassmann point out that the small share of housing investment in GDP in developed countries is caused by low population growth rates (Kuznets, 1961, p. 40 and Strassmann, 1970, p. 393).

But Eckaus is the first to actually include demographic variables in a regression equation explaining housing investment per capita. He included the percentage of population in urban areas first because a larger percentage of investment in urban areas is measured, also the urban population can more effectively demand housing from the government so they respond more readily to the needs of an urbanized population. For logistic reasons, governments can more easily respond to urban demands. Eckaus also added a variable measuring urban migration rates because, since houses are not mobile, a shift in population can cause an increase in the demand for housing investment. He included

the total population as well but did not explain why (United Nations, Department of Economic and Social Affairs, 1973, p. 36). The results of the regression confirm that all three demographic variables have a significant positive effect on the level of housing investment per capita (*ibidem*, p. 42).

In their model, Burns and Grebler include the population growth rate and a measure of urban migration similar to that used by Eckaus, on the grounds that these variables measure need (and presumably thus influence demand) (Burns and Grebler, 1977, p. 25). However, the regression results do not indicate that those variables have a significant effect on the share of housing investment in GDP. (*ibidem*, p. 29). The results are open to doubt because the demographic variables are misspecified. We would argue that changes in household size should be included along with population growth, and leaving one of these variables out of the equation means that none of the coefficients estimates need be consistent. Although other authors mention the desirability of adding explanatory variables other than income or demographic indicators, only Eckaus has included some in his model. He included the number of persons per room because high densities would promote greater willingness to invest in housing. Two other variables were added because they reflect taste for housing. A variable measuring education was included because higher education levels enhance the desirability of housing. A health variable, infant mortality, was also included on the grounds that if people see a causal relation between the current state of the housing stock and their health, then the

lower are health standards, the greater will be investment in housing to remedy the situation. The coefficients of all these additional variables were significant: the sign on density was positive as expected, while those on education and health variables were the opposite of what was expected. Eckaus attributes this puzzling result to the fact that education and health probably enter in on the supply side because investment in these areas can crowd out investment in housing. This result simply underlies an important point. Equation such as Eckaus was estimating are a type of reduced form, and the coefficient estimates must be interpreted as such (United Nations, Department of Economic and Social Affairs, 1973, p. 37, 41, 42).

Strassmann proposes that the terms of mortgage finance ought to be included in a theory explaining housing investment, but does not use that variable in his regression (Strassmann, 1970, p. 395).

Burns and Grebler list a few of the relevant variables which they had to exclude from their model of housing investment. The extent of public assistance to housing was left out because "it varies widely among countries and does not lend itself to quantification" (Burns and Grebler, 1977, p. 36). Burns and Grebler are also convinced that climatic differences affect the share of housing investment because in tropical countries a dwelling with performance values equal to those in cold weather climates can be produced at lower costs. However, they did not include a climate variable in their model (*ibidem*, p. 37).

Existing cross country literature has not yet satisfactorily an-

swered the questions formulated at the end of Chapter I concerning the effects of policies on housing investment. Variables such as construction cost, the extent of public intervention, and the availability of housing finance which should have been part of a fully specified model were mentioned but never included. Besides inadequately specifying the explanatory variables in the equations, existing work also uses a dependent variable which, even if perfectly explained, cannot shed light on the questions we would like to answer. All the authors used a measure of housing investment that does not separate the number of dwellings produced from the resources used per new dwelling, which makes it impossible to distinguish the effects of trend and policy variables on each of those. Finally, the undermeasurement of housing production is an acknowledged problem. Such a systematic bias in the data certainly puts into doubt the results of existing empirical work.

In fairness to the earlier authors, we would like to stress that the original purpose of these investigations was quite different from ours. They were developed to provide planners with simple rules of thumb to calculate a reasonable level of investment given values of widely available aggregate economic variables. Thus to serve their purpose, such models had to use simple specifications. An important shortcoming of these models is that if one uses them to calculate optimal housing investment levels, one must assume that the other countries in the sample invested wisely. An even more important weakness of these models for policy making is that though they may give a reasonable forecast of investment or an approximate target for

investment, their simple specification precludes their shedding light on the direct means for achieving these objectives. What is needed in order to address this issue is a suitably elaborated theory of housing investment and estimates of the values of structural parameters that will permit tracing through the effects of different policy options.

Having reviewed the cross country literature on housing investment, we now propose to briefly discuss some of the literature on housing investment in the United States. This literature can be divided into studies explaining the variation in housing starts and those explaining the variation in the price of new homes.

Most of the empirical studies of housing starts were done for the purpose of understanding the movement over the business cycle of one of the more volatile components of investment. Hence they focus on short term fluctuations of starts. These are shown to be influenced by policy variables, especially by the availability of mortgage credit (Modigliani and Lessard, 1975, p. 98). However, we are interested primarily in long run time series analysis since that type of result is relevant to the questions we are asking.

Maisel (1963) made one of the first attempts at modeling long run demand for new housing. He finds that demand is a function of household formation and losses (demolitions plus conversions to other uses). He argues that short run fluctuations of investment are determined on the supply side (fluctuations in inventories and vacancies).

In their study of housing in the United States for the period 1915 through 1968, Arcelus and Meltzer (1973) study the determinants of demand and supply of new dwelling units. The significant variables determining supply are the price of housing (using the Boeckh index), production costs, the real labor cost of construction, and the market rate of interest. The significant determinants of demand are interest rates, rental prices, a measure of wealth and a measure of owners' equity. However, they "find no evidence that the demand for or supply of housing increases with the stock or flow of mortgage credit," (1973, p. 97). Arcelus and Meltzer's findings also suggest that in a stable growing economy the number of housing starts increases faster than population (and even the size and quality of housing units increases relative to population). "There is no evidence of a long run housing problem nor is there evidence that mortgage or housing policies are required to encourage production or purchases" (ibidem). This quote indicates that the authors define a housing problem as an aggregate shortfall of dwellings. However they did not control for household size in their demand equations, and this may account for the finding that housing starts increase faster than population. Failing to control for household size also weakens their conclusion that there is no long run housing problem.

Meltzer (1974) in his study of the effect of credit availability in housing markets concludes that it has a short, but not long run effect on the demand for housing. He bases this conclusion on the observation that between 1912 and 1958 the ratio of housing to total

assets held by non-farm households has stayed roughly constant while the ratio of mortgage debt to housing has doubled. Although the constancy of the share of housing assets in total assets is somewhat puzzling, Meltzer has not proven that there is no relation between the level of housing debt and the demand for housing. It is quite possible that an increase in demand for housing assets brought about by increasing housing debt will be accompanied by increases in demand for other assets. Or some other variable determining long run housing demand such as the population growth rate may fall and thus produce an effect offsetting that brought about by mortgage debt increases. Meltzer's evidence is no stronger than would be the result of running a univariate regression. His point that the overall assets market equilibrium may influence the effectiveness of government mortgage policy is well taken however, and should be explored further. Nonetheless, he has not provided a strong test of his hypothesis.

The literature on cross sectional analysis of housing demand is extensive and has recently been reviewed by Mayo (1979). We will not attempt to replicate this careful and thorough research. Rather we will extract from his review the conclusions relevant to our work. First, studies are divided according to whether they use data for individual households or more aggregated data (groups of households in different locations). Then Mayo divides the studies according to the functional form of the estimated equations, log linear versus any other specification.

All the studies try to explain housing expenditure by renters and

owners as a function of income, price and demographic variables. The data on housing expenditure are either the purchase price of dwellings or rental expenditure. To measure income, most authors use either current income or some approximation of permanent income. On the income variable, Mayo concludes that "for a wide range of analyses employing different data bases (4) and methodologies, the permanent income elasticity of demand is well below one on average" (ibidem, p. 25). In fact, most estimates were between 0.3 and 0.7 (ibidem, p. 12).

Until recently few studies have included a price term. The biases this omission causes have been discussed in Polinsky (1975) and Polinsky and Ellwood (1977). Their estimates indicate that these biases can be considerable. Those studies including price take their price data from a number of different sources. Most authors obtain the price of housing from published data: house prices from Federal Housing Administration data, ownership costs or rental cost indexes from the U.S. Bureau of Labor Statistics or the Boeckh indexes of residential construction costs. Only a few authors estimate prices from secondary information. Polinsky and Ellwood (1977) estimate the unit price of housing using data on housing expenditure, the unit price of land, the quantity of land, and the unit price of capital. First they estimate a production function for housing, and transform it into a cost function. They then calculate prices for individual houses by substituting factor prices for each individual home into the cost equation. Straszheim (1973) calculates housing prices in different

areas of his sample by estimating hedonic price equations for each area and then substituting in attributes of some prototypical home to determine prices for each area. Regarding estimates of price elasticities, Mayo concludes that "price elasticity estimates are very sensitive to both the source of the price data and to model specification" (1979, p. 12). Nonetheless the price elasticity "appears to be less than one in absolute value" (*ibidem*, p. 25).

Many of the cross sectional studies include demographic variables such as race, sex of household head, and household size. The last variable is the only one of interest in the context of a cross country analysis. Even though three out of four analyses Mayo reviewed estimated a statistically significant positive relationship between household size and housing expenditure, Mayo concludes that the effect of the household size is ambiguous because other analyses he did not review suggest that housing expenditure first increases with household size and then decreases (*ibidem*, p. 21).

Even in the extensive literature on housing investment in the United States, no studies estimate separate equations for the number of units and the quality of units. Kearn remarks on the usefulness of this distinction, and further argues that the number of units may be insensitive to all but demographic variables. Response to relative prices will be in the type and quality of housing produced (Kearn, 1979, p. 1116). Unfortunately he does not test this hypothesis.

Our discussion of existing work in the area of housing investment has brought out the gaps in the literature, both in terms of the focus

of the studies and the methodology used. Our work is designed to respond to these gaps, first by specifying a theoretically based structural model for a cross country regression, and second by allowing for possible effects of policy variables in this specification.

NOTES TO CHAPTER II

(1) Stalin had "removed" the radicals, had appropriated their ideas and applied them ruthlessly (Erlich, 1967).

(2) Eckaus uses the investment in housing per capita instead (Eckaus, 1973).

(3) The percentage of GDP devoted to residential construction is calculated from the share of gross domestic capital formation in GDP (Kuznets, 1960, p. 4) and the share of dwelling construction in gross domestic capital formation (Kuznets, 1960, p. 33).

(4) The data refer to individual households or groups of households in different locations.

III. THE NATURE OF THE HOUSING PROBLEM

In Chapter I, we described the apparent conflict between two views of housing conditions in poor countries. Some observers argue that almost all households do find a dwelling through the homes many families can afford are often quite primitive. On the other hand, governments express concern over a housing shortage indicated to them by a severe shortfall in measured housing production relative to requirements.

As we related in Chapter I policymakers carefully compare the increase in households with the production of new dwellings. The estimates of the number of new households are reliable, being based on estimates of population growth and household size both of which are measured reasonably accurately and consistently over time in censuses and sample surveys. Housing production data is often deemed just about as reliable. Production is measured by the number of permits requested from the government to either start building a dwelling or inhabit a completed one (1). In collecting those data the government can take a purely passive role because citizens are obliged by laws and regulations to obtain such permits, and thus report their production. Production data are collected by the institution issuing permits, which is often also the branch of government responsible for housing or physical planning or both.

The ethnographic view of the housing situation is also based on convincing evidence, even though this evidence is quite different

in nature. The administrative view is derived from a single set of figures while the ethnographic view draws its conclusions by taking a holistic view of the housing situation, and building a composite image from a great variety of information sources. Among these are casual visits through residential areas, in depth anthropological surveys of neighborhoods and their inhabitants, informal interviews with poor and rich, careful examination of a time series of aerial photographs or visits of settlements spaced over time.

The government's prehension of the housing situation is based on abstract, arithmetic data. Such information is not strictly comparable with the eclectically assembled evidence which informs the more "gestalt" ethnographic view. The only hope of making sense of the conflict between the two views is to find a third, independent data source which might help reconcile them. Fortunately, there is such a third source of information, also collected by the government but usually overlooked in their assessment of the housing situation. This is the housing component of population censuses. It gives estimates of the housing stock and reference to data from succeeding censuses gives the growth in the housing stock.

Why governments do not rely more on censuses to evaluate the housing situation is not altogether clear. It could be because censuses are collected less frequently, usually every ten years, and hence do not provide up to date information. It could also be that the branch of the government in charge of housing is distant in an organizational, bureaucratic sense from the institution responsible

for the census. The latter are often very independent and only responsible to the presidency, the prime minister, or some other high office (2). Still, representatives of the ministries concerned with housing are usually consulted during the preparation of a census, and they must thus have an interest in the results. The housing authorities may have some reasons for failing to take account of census data in their public declarations on the housing shortage.

Because censuses are held only at long intervals, any systematic error in housing production statistics will have accumulated to considerable divergences from the actual stock by the time the results of the next census are published. The discrepancy between the two housing stock estimates may be so large that the housing ministry will ignore the census data in order to avoid admitting this mistake, or simply conclude that the census data is incorrect. In Egypt, for instance, the census results indicated that the larger housing shortage calculated by the Ministry of Housing (see Chapter I) did not exist and that enough dwellings had been built to keep the person per room ratio constant, or even improve it slightly (Arab Republic of Egypt, Central Agency for Public Mobilization and Statistics, 1976). Yet this rather overwhelming evidence has not deterred the Ministry of Housing from continuing to use the huge shortage figures as a justification for policy. Quite recently, a World Bank publication presented the standard administrative view of housing deficits based uniquely on production data. According to this view Egypt has a deficit of 1.5 million dwellings. On the facing page, they quote the

most recent (1976) census for other purposes, yet there is no mention of the fact that census estimates of the housing stock indicate no noticeable deficit (Ikram, 1980, p. 148-49).

We cannot directly document other cases where the government fails to take account of census data in their published assessments of the housing situation, but we can present some indications that this is not an isolated phenomenon. First as we will show later, a large discrepancy between census figures and official production figures can be found in many countries. Second, we have found and quoted a number of government publications that declare a shortage on the basis of production data with no mention of whether or not census data indicates that the shortage is more or less acute. Furthermore, as we mentioned in Chapter I, the United Nations has confirmed that the shortfall in housing production is a global problem, and the deficit they calculate is clearly based on production statistics without any of the qualifications that census data would suggest.

Of course, one could always argue that the governments publicize the housing problem as an aggregate shortage based on production figures, but that privately they do take the census data into account, and they do see that the housing problem is more complex than simple aggregate deficits. Of course, any mustering of concrete evidence can be brushed off this way, but short of reliable lie detector tests for housing ministers a debate of this type cannot be resolved. In any case, this debate simply deflects attention from a more important issue. No matter how complex the governments' view of the situation

may be, we are only interested in their view of the situation insofar as it influences the policy action they take based on this view. We contend that if the administrative, arithmetic shortage view of the housing situation, even if it is only part of the governments' perception of the problem, affects the policy response, then it is important to ascertain whether or not this view is correct.

The question of how official proclamations of deficits and the bureaucratically collected production data that underlie them really affect policy design and implementation is actually a very complex one. To answer it would be a study in itself. In fact a new branch of applied anthropology, enumerology, concerns itself entirely with answering questions of this sort. Briefly states, enumerology is the "study of the social processes by which numbers are generated and the effect of these processes on behaviour and thought," (Bogdan and Ksander, 1980, p. 302). (3) We cannot pretend to have the expertise in this field necessary to treat the above stated question properly and we will not do so. Rather, we will make the assumption that the perceived housing deficits calculated on the basis of official statistics, albeit only a part of the governments' view, do have an effect on government action, and thus are worthy of attention. We feel that maintaining this hypothesis is not unreasonable given the regularity of the appearance of proclamations of arithmetic deficits in public documents. We find it hard to be so cynical as to assume that governments persist in discussing issues to which they only intend to pay lip service.

To return now to our principal task of reconciling the conflicting views of the housing situation, let us compare the information conveyed by the two independent sources of information that are available. What we find is that census data supports the ethnographic view of housing, the number of houses keeps up quite well with the number of households, while official production statistics support the administrative view. The fact that two statistical sources disagree indicates a bias in at least one of them. Once the source of the bias is located, we can decide which of the two parties to the original debate is wrong, and perhaps understand why.

Both measurements have biases but we have reason to believe that those of the census are considerably less. The government has a mandate, often specified in the constitution, to actively seek out and count all members of the population. In almost all countries, counting every dwelling has been added to this mandate. Furthermore, locating all dwellings is instrumental to locating the population. So governments go to great pains and expense to assure that their coverage of the housing stock is truly comprehensive. During the preparation of the census the country is divided into tracts and, with the help of aerial photographs and up to date maps each possible living quarter is assigned to a census taker. Then those same documents are used to cross check completed census reports. As evidence that the counting of the census stock is not only intended to be exhaustive but is also successful at this task, sample evaluations of the U.S. census accuracy indicate that undercounting in the 1970 census is approximately 2.5

percent (U.S. Department of Commerce, Bureau of the Census, 1973, p. 3).

One might argue that though the census is exhaustive, it could never indicate a housing shortage or surplus, because all premises inhabited by a household could be called a dwelling or all inhabitants of a dwelling could be classified as one household. Fortunately the definition of dwellings and households are independent so that an aggregate housing shortage or surplus could easily show up in census results. Almost all censuses distinguish between a household and the inhabitants of the same dwelling. According to the definition of the United Nations, which is used with minor modifications in most countries, a household may be either "a) a one person household - that is, a person who makes provision for his own food or other essentials for living without combining with any other person to form part of a multiperson household or b) a multiperson household - that is, a group of two or more persons who make common provision for food or other essentials for living. The persons in the group may pool their incomes and have a common budget to a greater or lesser extent; they may be related or unrelated persons or a combination of both. Households usually occupy the whole, part of, or in some cases, more than one housing unit, but they may also be found in camps, in boarding houses or hotels, or as administrative personnel in institutions, or they may be homeless" (United Nations, Department of Economic and Social Affairs, 1976, p. 4). The definition of a dwelling (4) is, except for improvised housing, independent of how many households inhabit it; a dwelling may for that matter even be vacant (ibidem, p. 8). This is expressed

most clearly in the United Nations definition of living quarters, which included hotels, motels, inns, boarding houses, pensions, and lodging houses in addition to dwellings. "Living quarters are structurally separate and independent places of abode: a) they may have been constructed, built, converted, or arranged for human habitation, provided that they are not at the time of the census used wholly for other purposes and that, in the case of mobile housing units, improvised housing units, and living quarters other than housing units, they are occupied at the time of the census, or b) although not intended for habitation, they may actually be in use as such at the time of the census. The essential feature of living quarters are separateness and independence. An enclosure may be considered as separate if surrounded by walls, fences, etc., and covered by a roof, so that a person, or group of persons, can be isolated from other persons in the community for the purpose of sleeping, preparing and taking their meals, or protecting themselves from the hazards of climate and environment. Such an enclosure may be considered as independent when it has direct access from the street or from a public or communal staircase, passage, gallery, or grounds, i.e., when the occupants can come in or go out of their living quarter without passing through anybody else's premises." (ibidem, p. 6).

The collection of housing production data differs substantially from the census taking process. The emphasis on comprehensiveness of the data is far less, and information is gathered passively rather than actively. In fact the data collection is only a by-product of the

bureaucratic process of granting building permits. The logic implicit in this data collection procedure is that only new housing meeting the standards specified in the housing regulations is worthy of its name and can thus be considered an addition to the housing stock. We call this way of defining housing the template view because to sort out "housing" from other unacceptable dwelling construction, an imaginary template is applied to constructions, and if they don't fit, they are rejected. The multidimensional template is composed of the quality and size specifications contained in the housing code. Sub-standard housing production is certain to be systematically ignored. That is a bias in the production data which we will discuss later in more detail.

Another bias derives from the passivity inherent in the procedure of waiting for builders to come in and report production. If the bureaucratic structure is sufficiently convoluted to make the process of obtaining permits very costly in and of itself, even if a home meets the regulations, the builder may not bother getting a permit. High and certain bureaucratic costs may be avoided at the risk of incurring fines for noncompliance whose expected value is quite low when enforcement is weak.

Production data based on permits would not be a problem if codes were always followed. But they generally are not, and the magnitude of the undercounting bias will be a function of how realistic the regulations are in a particular context and how stringently they are enforced. The regulations tend to be very unrealistic for poor countries for two reasons. First the standards for individual dwell-

ings require such a high level of resource use that a large proportion of households can never afford homes meeting code requirements. In fact, regulations on minimal specifications for housing appear to vary less across countries than income. Oftentimes regulations in poor countries are simply vestiges of the colonial occupation, more suited to the conditions in the home country not the old colony. Also, when physical planners are trained in countries richer than their own they often return thinking that it is best to apply the practices and values they have learned abroad. Whether remnants from the past or consequences of recent acculturation, the requirements of building laws and regulations are such that in many poor countries only the rich have the resources to build dwellings qualifying for a building permit.

The template view of housing dictates more than a building of a certain quality. It also insists upon adherence to requirements that even the richest households may have trouble satisfying. In many cases permits can only be given for building in approved subdivisions on land zoned for residential use. But in poorer countries the physical planning authorities lack the resources to plan, zone, and subdivide urban areas at a rate consistent with the growth of demand for residential land. Besides meeting zoning regulations, newly built homes must also meet certain requirements regarding access to utilities such as water supply, sewage disposal and electricity. But in many countries government institutions hold the monopoly on the provision of utilities. In the poorer countries, these monopolies often cannot

provide those utilities to keep pace with urban growth, either because they do not have the financial or construction capacity, or because they are legally compelled to wait for the physical planning authorities to produce the urban layout. So, in the case of zoning regulation and utilities, the government itself may prevent even those who could satisfy conditions on housing specifications from obtaining building permits.

The fact that the governments of poor countries are not able to provide the physical plans and utilities that their own building regulations require is not an isolated phenomenon. Governments of poor countries that promulgate compulsory education laws are often not able to build enough schools or train enough teachers. Many governments find it hard to enforce their laws and regulations outside the large urban centers. In fact, governments are generally only able to penetrate societies slowly, as their revenues and national income increase (Pye, 1966, p. 64). Penetration is the name given to a multifaceted process of development of the role of government in the life of the populace. The essence of the transformation lies in the government increasing the number and intensity of the types of ties it has with its citizens. Once established, this multi-stranded relationship with the citizenry helps the government to become a coherent force at all levels in the society. Its interventions can be made more responsive to conditions in the country and it has the means, not just financial but also political, to make regulations and practice consistent.

There are two principal reasons why penetration deepens with income. First, as income grows government revenues tend to grow more than proportionally so governments have more resources available to them. These can be used not only to enforce compliance with regulations but also to provide a high level of services that are available only to citizens "with all papers in order". These other services provide incentives to obey regulations set down by the government. Second, quite simply, as national income grows, household incomes rise high enough to make meeting the standards the authorities set affordable for most households, thus more likely to be chosen voluntarily.

In the case of housing in poor countries, one might say that the low level of penetration is fortunate because it coincides with a large discrepancy between the demands of the template view of housing and the resources of both the private sector and the government to satisfy them. If governments had the power to prevent anybody who could not satisfy all the requirements from building, a severe housing shortage would ensue.

We have now discussed in detail both the nature and causes of bias in the two sources of data available on housing production. The difference between the reliability of housing censuses and housing production figures is clear. Censuses are by intention comprehensive. The definition in the census procedure is also based on a standard for an acceptable house, but that standard is much lower than that required for a dwelling to be counted in production statistics. This means that almost every structure people use as a dwelling will be

counted, because the standard is much closer than the template standard to what the poorest household actually inhabits. Thus census standards lead to a truer assessment of the situation by counting more dwellings. Using higher standards, fewer dwellings are counted, so production statistics tend to present the situation as one where many households do not have a dwelling of their own, when in actuality they do have a dwelling, even though it may be of very low quality.

Of course, censuses are not perfectly accurate. In poor countries they will be less detailed and may have more small errors, but they will not have the systematic large bias that housing production has. To estimate the extent of this bias we will compare the increase in the dwelling stock between two censuses with the sum of the official annual production figures over the same period. The results of this comparison can be found in Table 3.1 where we have calculated the ratio between official production and the change in stock. The result is striking and confirms our hypothesis that the undermeasurement of housing production is a problem that diminishes as income increases. It may seem puzzling that in developed countries the ratio between the official production and the increase in the stock (hereafter Ratio) is larger than one. One has to keep in mind that the increase in the stock is a measurement net of losses; it ignores demolitions, losses caused by fire, flood, wind storms, war and earthquakes and conversion to non-residential uses. For a given housing stock, and a constant rate of demolition of that stock, the share of production devoted to net additions will fall with the rate of stock growth. For example,

Table: 3.1 Ratio between the number of units officially produced between two censuses and the increase in the housing stock between the same censuses.

Country	Period Concerned	GDP per Capita at the end of the Period (1) US \$	Ratio: Official Housing*Production/Change in Stock (2)
Philippines	1960-67	220	0.14
Syria	1960-70	265	0.72
Egypt	1964-76	390	0.28
Colombia	1964-73	454	0.36
Brazil	1969-72	617	0.18
Yugoslavia	1961-71	718	1.20
Panama	1960-70	729	0.40
Costa Rica	1963-73	817	0.52
Chile	1960-70	887	0.56
Spain	1960-70	1,097	0.80
Venezuela	1961-71	1,196	0.22
Greece	1961-71	1,247	0.81
Poland	1960-70	1,350	1.59
Japan	1963-68	1,410	1.02
Ireland	1961-71	1,530	2.00
Hungary	1963-73	1,850	1.51
United Kingdom	1961-66	1,947	1.98
Czechoslovakia	1961-70	2,120	1.77
Finland	1960-70	2,251	1.56
France	1962-68	2,494	1.24
Belgium	1961-70	2,652	2.39
Netherlands	1960-71	2,805	1.55
New Zealand	1961-71	2,862	1.37
Norway	1960-70	2,883	1.64
Denmark	1965-70	3,159	1.27
Australia	1961-71	3,218	0.85
Switzerland	1960-70	3,409	1.06
Sweden	1960-70	4,109	1.84
Germany	1968-72	4,200	1.92
Canada	1961-71	4,328	0.93
United States	1960-70	4,789	1.61

Notes:

1. Source: World Bank, 1980, Economic Data Sheet I, for Poland, Hungary and Czechoslovakia, see Appendix B.
2. Source for housing stock data for all countries: United Nations, Department of Economic and Social Affairs, 1973 and 1976. Except for Colombia, Republica de Colombia, Departamento Administration Nacional di Estadistica, 1977.

Sources for official dwelling production: United Nations, Department of International Economic and Social Affairs, Statistical Office, Yearbook of Construction Statistics, various years and United Nations, Department of Economic Affairs, 1971. Exceptions are listed below:

Egypt: 1969-74; Arab Republic of Egypt, Central Agency for Public Mobilisation and Statistics, Statistical Handbook, various years. 1975-76: idem for urban housing, for rural housing we used the same production level as 1974.

Costa Rica: 1963-66; Republica de Dosta Rica, Ministerio de Economia y Hacienda, various years.

Venezuela: 1961-65; Republica de Venezuela, Ministerio de Fomento, Direccion General de Estadistica y Censos Nacionales, various years and private communications from Professor Hugo Manzanilla, Instituto de Urbanismo, Universidad Central de Venezuela, Caracas.

in a country where the housing stock increases at 3 percent, where the demolition rate is 2 percent, if housing production is accurately measured, the Ratio would be 1.67. A higher Ratio means a lower household growth rate or a higher loss rate or both.

The ratio between official production and the increase in the stock varies from 0.16 for the Philippines to 2.39 for Belgium. The result for Belgium is not surprising, it has a low rate of household growth. The low values of Ratio such as 0.16 for the Philippines have to be regarded as underestimates of the bias in the production data because the denominator of Ratio omits demolition and other losses. In the case of the Philippines for instance, after correcting for losses the Ratio would probably be closer to 0.10 (5). This would mean that only around 10 percent of the total number of units produced is measured.

Using the data in Table 3.1, we can test the hypothesis that the undermeasurement is caused by the lack of penetration of government in society. There are no ready measurements of penetration but if penetration rises with income then income can be used as a proxy. First we set up the following identity.

$$\Delta S = \text{OFF} + \text{UNM} - \text{DEM}$$

where ΔS = change in the stock

OFF = official number of residential units produced

UNM = unmeasured number of units produced

DEM = demolitions

All these variables refer to the same time interval. From these we obtain

$$\text{OFF} = \Delta S - \text{UNM} + \text{DEM} \quad (1)$$

We divide both sides of the equation by ΔS

$$\frac{\text{OFF}}{\Delta S} = \frac{\Delta S - \text{UNM}}{\Delta S} + \frac{\text{DEM}}{\Delta S} \quad (2)$$

Now we assume that $\frac{\Delta S - \text{UNM}}{\Delta S}$ is a function of income per capita. Since we have no a prioriknowledge of the form of this function we will specify it as a linear function. However because $\frac{\Delta S - \text{UNM}}{\Delta S}$ is bounded between 0 and 1 and asymptotes to one we have also tried the equation with the logarithm of GDPCAP. We also assume that the demolition rate is constant, as if demolitions were random events with equal probability. Equation (2) then becomes

$$R = \frac{\text{OFF}}{S} = a + b\text{GDPCAP} - \frac{\alpha S}{\Delta S} \quad (3)$$

where R = ratio of official housing units production to change in the housing stock

α = the demolition rate

S = the stock of housing

GDPCAP = Gross Domestic Product per capita

Equation (3) can also be written:

$$R = a + bY - \alpha \frac{1}{\dot{S}} \quad (4)$$

where \dot{S} is the growth rate in the housing stock. We then estimated Equation (4) with a sample of 28 countries (see Table 3.1). (The sources of the data are described in Appendix A .)

The results of the regression are shown in Table 3-2. The coefficients of both income and the inverse of stock change are both strongly significant and have the right signs. The coefficient on income is low but this is more or less what was expected. Thus, insofar as income is positively related to penetration, the results of this regression support our hypothesis that the measurement of production rises with the penetration of government in society.

Penetration into housing activity may depend not only on the level of income but also on a number of other variables such as the nature of the political organizations, the effectiveness of civil administration and the responsibilities assumed by the central government. Furthermore such problems as ethnic strife, terrorist activities, economic instability, and rapid population growth all put strain on governments and lessen their ability to put policy consistently into practice. However most of these variables are quite difficult to measure and aggregating their effects consistently across countries, even if data were available, would be impossible. Nonetheless we can try to capture the effects of these strains on government with one

Table: 3.2 Regression Results: Ratio of measured housing production to change in housing stock (RATIO) on income per capita (GDPCAP), and the inverse of the growth rate of the stock ($1/\dot{S}$).

Dependent Variable \ Independent Variable	RATIO	RATIO
Intercept	0.0172 (0.12)	-2.829 (-5.71)c
GDPCAP	0.000275 (5.66)c	- (6.94)c
ln (GDPCAP)	-	0.4684 (6.94)c
$\frac{1}{\dot{S}}$	0.00927 (5.22)a (6)	0.00894 (5.69)a
R ²	0.72	0.78
F	32.14a	44.79a
No. of Observations	31	31

Key: (t - statistics are between brackets, below the coefficients)

a: significant at the 0.01 level in a one-tailed test.

b: " 0.05 " " "

c: " 0.01 " two-tailed "

d: " 0.05 " " "

e: " 0.10 " one-tailed "

f: " 0.10 " two-tailed "

of these variables for which international data is readily available, population growth.

Rapid population growth strains the government by increasing demand for social services such as health and education. When the structure of the population changes rapidly, demands for different goods may shift abruptly. If the private sector does not foresee the changes and adapt supplies in consequence, the government may have to devote a good deal of its attention and resources to averting critical shortages. With a rapidly growing work force as a constituency, the authorities may also have to devote more attention to organizing the economy to provide sufficient jobs than to accurate measurement of existing activity.

Adding population growth, Equation (4) then becomes

$$R = a + b\text{GDPCAP} + c\dot{P} - \alpha \frac{1}{S} \quad (5)$$

where \dot{P} is equal to the population growth rate. The results presented in Table 3-2 and 3-3 indicate that it is reasonable to assume that, as income grows, government will be able to measure actual production more accurately. On the other hand, the penetration of government into the housing sector will be retarded by the pressure of population growth. It is interesting to note that the coefficient on population growth is much higher than the coefficient on income. This suggests that social pressures on government outweigh the slow progress in the penetration that results from income growth.

Regarding the point estimate of α , the demolition rate, the low

Table: 3.3 Regression Results: Ratio of measured housing production to change in housing stock (RATIO) on income per capita (GDPCAP), the population growth rate (P) and the inverse of the growth rate in the housing stock (1/S).

Dependent Variable \ Independent Variable	RATIO	RATIO
Intercept	0.9142 (4.46)c	-0.6068 (-0.89)
GDPCAP	0.000131 (3.00)c	-
ln (GDPCAP)	-	0.2354 (2.96)c
P	-0.3435 (-5.23)c	-0.3014 (-3.97)c
$\frac{1}{S}$	0.00733 (5.66)a	0.00743 (5.70)a
R ²	0.87	0.87
F	53.10a	52.72a
No. of Observations	31	31

Key: (t - statistics are between brackets, below the coefficients)

a: significant at the 0.01 level in a one-tailed test.

b: " 0.05 " " "

c: " 0.01 " two-tailed "

d: " 0.05 " " "

e: " 0.10 " one-tailed "

f: " 0.10 " two-tailed "

value of .00733 indicates that if all houses in the stock are identical, are equally distributed according to asset age, the stock is in a steady state, then asset life is 135 years. There is no particular reason to believe, however, that we are examining steady states in these countries. In fact Equation (5) is not defined if $\dot{S} = 0$. Therefore this argument does not detract from the plausibility of the coefficient. Since \dot{S} is positive the larger cohort of newer units in the stock implies that the demolition rate can be low, without implying that the average age of assets is as high as 135 years.

We have explored the bias in production figures and tried to explain them systematically. We will now examine the housing shortages or surpluses indicated by the more accurate census data, by comparing the number of households and the number of dwellings. Such a comparison is made in Table 3.4. From this table it appears that in general poorer countries have a small shortage and richer countries have a surplus. For instance in Brazil, which has the worst shortage, eight percent of households do not have a dwelling.

A word of caution is necessary here. In our conclusions, we are implicitly defining a shortage as the aggregate amount by which the number of households exceeds the number of dwellings. This may be a very simple definition but it is drawn directly from the discussion of the housing shortage in poorer countries and by U.N. agencies, some of which was cited in Chapter I. One could argue that this aggregate definition of a shortage masks a number of other types of important housing deficits for example, deficits of certain types of housing,

Table: 3.4 Comparison of the number of dwellings with the number of households.

Name	Year	GDP per Capita (1)	Number of Dwellings (2)	Number of Households (2)	Ratio: Dwellings Divided by Households
Philippines	1967	220	5,234,000	5,234,000	0.98
Syrian A.R.	1970	265	1,030,365	1,060,690	0.97
Egypt	1976	390	7,311,139	7,351,538	0.99
Columbia	1973	454	3,809,950 (3)	3,958,203 (3)	0.96
Brazil	1970	496	17,643,387	19,104,086	0.92
Yugoslavia	1971	718	5,206,249	5,375,384	0.97
Panama	1970	729	288,768	287,768	1.00
Costa Rica	1973	817	332,212	330,857 (4)	1.00
Chile	1970	887	1,689,780	1,689,840	1.00
Venezuela	1971	1,195	2,126,921	1,844,078 (5)	1.15
Greece	1971	1,247	3,086,020	2,556,180	1.21
Japan	1968	1,410	25,900,600	25,484,812	1.02
Ireland	1971	1,530	709,360	730,543	0.97
Hungary	1973	1,850	3,353,800	3,351,937	1.00
United Kingdom	1966	1,947	17,622,033	17,747,119	0.99
Finland	1970	2,251	1,463,221	1,518,821	0.96
Czechoslovakia	1970	2,302	4,284,280	4,632,411	0.92
France	1968	2,494	18,228,576	15,762,508	1.16
Belgium	1970	2,652	3,228,000	3,232,710	1.00
Netherlands	1971	2,805	3,659,870	3,733,000	0.98
New Zealand	1966	2,862	724,444	717,273	1.01
Norway	1970	2,883	1,296,718	1,296,718	1.00
Denmark	1970	3,159	1,800,654	1,849,942	0.97
Australia	1971	3,218	4,033,616	3,672,949	1.10
Switzerland	1970	3,409	2,218,863	2,051,592	1.08
Sweden	1970	4,109	3,181,239	3,050,354	1.04
Germany (W)	1972	4,200	21,392,000	22,254,000	0.96
Canada	1971	4,328	6,342,275	6,041,305	1.05
United States	1970	4,789	68,679,030	63,449,747	1.08

Notes:

1. Source: World Bank, 1980, Economic Data Sheet I. (For Czechoslovakia, Hungary and Poland, see Appendix B.)
2. Source: United Nations, Department of Economic and Social Affairs, 1976 and 1973. (For exceptions see further footnotes.)
3. Source: Republica de Colombia, Departamento Administration Nacional di Estadistica, 1977, p. 40.
4. Source: Republica de Costa Rica, 1973.
5. Source: Republica de Venezuela, 1973.

or, of housing in particular regions among others. But we also note that when there is no aggregate deficit, sub-deficits must be accompanied but sub-surpluses. Though we do not have the evidence to prove that this state of affairs never occurs, we find it implausible that substantial sub-deficits and sub-surpluses would persist in the long run. This is because it seems highly likely that households would prefer to substitute another type of dwelling for that type which is in short supply than to go without any house at all.

Furthermore, sub-shortages could be elaborated ad infinitum, yet one might not consider all of them unsatisfactory outcomes. Housing shortages can be classified according to the amount of adjustment households either do make or are expected to make. Our definition of a shortage assumes that households will or at least should be ready to shuffle themselves about throughout the country so as to eliminate long run shortages. It could be argued that people should not be expected to move anywhere in the country but only within a certain radius. This simply raises more questions however. Should families be forced to leave their region? Their city? Their neighborhood? How long should they have to spend looking or waiting for a home? Years? Months? Weeks? For policy making, there are no a priori answers to these questions because the response to them depends on the moral standards being applied to the outcome, and the analysis of how these standards are chosen is outside the scope of this thesis. Our purpose here is to show that, as defined in current debates, the arithmetic housing deficit is not as acute as claimed. Therefore, housing policy should

not be directed to remedying a false problem. Rather efforts should be devoted to defining shortages in a fashion suited to the priorities and capacities of the country and then assessing their magnitude. Moreover we argue that shortages even narrowly defined, may not be the only, or the most important housing problem. The critical problem is that a large fraction of the population cannot afford decent housing. That situation could be called a shortage of housing of an acceptable standard, but to do so would simply divert attention from the crux of the problem which we feel lies in low incomes. And as we have seen in Chapter I, trying to provide the decent houses necessary to eliminate the shortages will not necessarily ensure that poor families will be able to afford to live in them.

While trying to understand why governments have declared housing crises, it became apparent that the strict template view of acceptable housing had played a crucial role in the undermeasurement of production, and thus the inaccurate assessment of the housing situation.

Perceiving a housing deficit spurs governments to intervene in the housing sector. The template view plays a role as well, by dictating the proper form of such intervention. In Chapter I we argued that governments in poorer countries choose to intervene in housing primarily with a direct supply policy. But every dwelling the government does provide must fit the template. Public housing must thus meet high standards in terms of size, construction specification, and land use as well as complying with all regulations regarding zoning and connection to utilities. The resources required just to build dwellings

according to these standards are staggering.

In Table 3.5 we have calculated the implications of building all new dwellings according to the quality standards of public housing. We have measured the resource requirement by taking the construction cost of public housing governments have actually built and multiplying that amount by the required yearly construction, the increase in the number of households plus two percent of the existing stock for replacements. The table shows that such a program would entail housing production several times the actual construction output of the countries. It would also represent an inordinately large share of both GDP and total government expenditure (6). In Table 3.5, we have also shown what governments would be able to build given their current housing budgets. The results are as one would expect: governments would be able to produce but a small percentage of the countries' yearly housing requirements (in our examples an average 4 percent). Given this constraint on available resources, the combination of a direct supply policy and a template view of housing leads governments to produce high quality housing for very few households.

Could governments increase housing expenditures on housing enough to provide high standard housing for all? This seems unlikely for three reasons. The first reason is that total government expenditure itself increases only slowly, according to "Wagner's Law" slightly faster than income (Musgrave, 1976, p. 132). In fact, across countries the share of total public expenditure only increases 6% per U.S. \$1,000 increase in GDP per capita (ibidem, p. 138-39). The second reason is

Table: 3.5 Comparison of the total cost of housing construction (all new dwellings satisfying the quality standards required by the template view of housing) and the resources available in the country.

Name	Year	GDP per capita	Yearly housing requirement			Construction cost per dwelling (19) US \$	Total cost of housing construction (11) 10 ⁶ US \$	Total cost of housing construction as a percentage of			Number of dwellings that could be built using the total govt exp on housing and community facilities (16)
			Increase in households (3)	Replacement (4)	Total (5)			GDP (12)	Total construction output (13)	Total govt Expenditure (14)	
INDONESIA	1973	130 (1)	492,000	558,000	1,044,000	2,500 (6)	2,610	16	400	59	35,400 (17)
COLOMBIA	1970	335 (1)	111,000	82,000	193,000	4,300 (7)	830	12	240	98	1,590
EGYPT	1978	400 (2)	173,000	151,000	324,000	7,000 (8)	2,270	15	375	35	24,570
ALGERIA	1977	1,130 (1)	106,000	68,000	174,000	55,000 (10)	9,570	49	367	156 (15)	6,410 (18)
PANAMA	1977	1,270 (1)	11,000	7,200	18,200	10,000 (9)	237	11	220	36	1,160

Notes:

1. Source: International Bank for Reconstruction and Development (IBRD), 1980, Economic Data Sheet I.
2. Source: World Bank, 1975, p. 12.
3. The increase in households was calculated as follows: the increase in population from data found in IBRD, 1980, Economic Data Sheet I, is divided by the household size found in IBRD, 1975, p. 49-59.
4. The replacement requirements are calculated as follows: we assumed that all households have a dwelling, and that the demolition rate was 2% per annum. We then took the population figure found in IBRD, 1980, Economic Data Sheet I, divided it by the household size found in IBRD, 1975, p. 49-59, and multiplied it by 0.02.
5. Sum of the two previous columns.
6. From notes collected during the author's work for M&R International, Brussels, in Indonesia in 1974.
7. Source: IBRD, 1975, Appendix Table 13.
8. From notes collected during the author's work for the MIT/Cairo University Technological Planning Program in Egypt in 1979.
9. Source: U.S. Agency for International Development, 1977, p. A17.
10. Source: Ammara, 1980.
11. Total cost is equal to total housing requirement times the construction cost per dwelling unit.
12. Source for GDP: IBRD, 1980, Economic Data Sheet I. For Egypt we have calculated the GDP for 1978 from the figure of 1977 using a 4-year average of the previous growth rates of GDP.
13. Source for the output of the construction sector: ibidem. For Egypt we used the same method of calculating the 1978 figure as we did for GDP.
14. Source for total government expenditure (except for Algeria): ibidem. For Egypt we used the same method of calculating the 1978 figure as for GDP.
15. Source for total government expenditure: Republique Algerienne Democratique et Populaire, 1979 b, p. 326.
16. The figure shown was obtained by dividing the total sum spent by governments on housing and community facilities by the construction cost per dwelling unit. The source for the government expenditure on housing and community facilities is IBRD, 1980, Economic Data Sheet 2 (except for Indonesia and Algeria).
17. Since the source mentioned in (16) does not contain an actual figure we assumed that 2% of total government expenditures would be devoted to housing and community facilities. This is a higher percentage than the average calculated for a few countries with similar GDP per capita.
18. Source: Republique Algerienne Democratique et Populaire, 1979 b, p. 333.
19. The figures are construction costs for public housing units.

that given the level of total expenditure the possibility of switching expenditure to housing is limited since the allocation of the budget among sectors and ministries is quite rigid, particularly in the short term. Budget cuts would be resisted by the rest of the government both because a large share of expenditures are recurrent expenses which cannot be reduced and because most ministries consider a budget cut as a political defeat.

Finally, in every government there is a strong faction, often lead by the ministries of national planning, industry or national economy, which will resist such an increase. This faction holds an economic planner's view of housing investment. Housing ranks very low in their investment priorities for three reasons. First because it has a very high capital output ratio, the housing sector requires a large amount of investment to generate a relatively low flow of housing services. Second, housing investment only yields consumption goods. The type of investments which economic planners often prefer is that which produces capital goods, because these permit further investment and further economic growth. Some housing enthusiasts claim that housing helps economic growth because good housing increases the productivity of workers. But many economic planners consider that there is no reliable evidence that it does.

The disfavor of housing investment in the eyes of economic planners stems partly from the type of models they use implicitly or explicitly. One of the more popular models, the Fel'dman model of growth, clearly shows that the growth of investment and thus of

economic output will be larger the smaller the capital output ratio and the larger the portion of investment devoted to producing capital goods (Jones, 1976, p. 114-19).

The last reason why economic planners disfavor housing investment is that it competes for many non-traded goods which are an essential ingredient of all investments. Housing is almost one hundred percent construction, most other investments require around fifty percent construction. Many resources used in construction are non-traded or not easily imported. All the heavy materials used in construction such as bricks, blocks, sand and gravel, are non-traded. The entrepreneurial skills of contractors and much skilled labor is hard to import. Some commodities needed in construction such as cement, steel and lumber are normally tradable. But very often, especially in the developing world, a shortage of a non-traded service: harbor capacity, makes the import of these materials nearly impossible.

For all the reasons given above it seems that no government could ever hope to increase expenditures on housing enough to provide dwellings which conform to the template for all. If that is so, why do so many governments persist in providing a lot of housing for a few? Why do governments refuse to relinquish their template view of housing and help provide many households with a little improvement instead? We can only make some guesses as to the cause. Officials in charge of housing may suffer from professionalism and acculturation. Very often they have been educated in richer countries and feel compelled to apply what they have been taught almost literally. It is as if adapt-

ing their skills to local circumstances would make them lose the status that they acquired through studying abroad. This phenomenon is not restricted to government officials; many technicians in the modern private construction sector, who actually build public housing, have the same attitudes.

A second reason could be that government officials and the elite to which they belong may feel that their intention of giving the poor high quality housing makes their privileges more defensible. It is also possible that governments prefer distributing high cost dwelling to any equitable policy because it offers the opportunity for patronage that can enhance the political power of administrators. "A lot for a few" policies may generate a flow of bribes that makes corrupt officials unwilling to dismantle the policies once in place. The large modern firms who are best able to deliver high standard public housing are also the ones that are best organized to lobby. They have enough monopoly power to generate excess profits from which large bribes can be distributed.

Whatever the reasons, governments continue to provide high standard housing for very few. Even when they have been convinced to trade the classical 5-story walk-up type public housing programs for new ones such as core house and site and services projects, most governments continue to set standards so high that only a fraction of those in need can be helped.

In this chapter, in a wide ranging discussion of the housing problem, we have made a number of points. Now let us briefly summarize

them. Our first task was to reconcile two views of the housing situation: the administrative view, which argues there is a serious shortage, and the ethnographic view which contends that very few households are without a home, hence shortages are not a pressing problem.

Since the two views are based on data sources so different in nature as to be incomparable, we had to have recourse to another independent data set, the census, to check the validity of the official production data on which the government view is based. The two data sources presented such a different picture of the housing situation that we had to examine both of them closely to discuss which of the two might have less bias. We decided that the census was likely to undercount the number of dwellings far less than would official production statistics. Furthermore, there was no reason to expect overcounting of the housing stock in census taking so we concluded that the census was the more accurate set of data. When we compare housing stocks with the number of households using census data, indeed we found that for almost all countries, the two numbers matched fairly closely so there was no evidence of an aggregate shortage, defined as fewer dwellings than households.

Analyzing the method of collection of official production data revealed that, what we call the template view of housing, combined with a low level of penetration of government in society, was instrumental in causing the government to overestimate the magnitude of the housing shortage. We then showed that the logic of the template view of housing also shapes government response to the perceived housing crisis in a

way that makes it particularly unsuited to alleviating what we consider the most important aspect of the housing problem, the low quality of the housing which so large a portion of the population can afford.

We arrived at that conclusion by noting that, should the government choose to intervene by providing housing directly, as appears to be easiest for them to do in countries where government penetration is low, the template view dictates that public housing should be of a very high quality. We calculated the resource requirements of providing this quality of housing in quantities sufficient to eradicate the shortage of dwellings meeting the standards, and found them to far exceed the resources available to government. When the policy is tailored to meet the available resources it may be reduced to having a negligible effect, because as we saw in Chapter I, when very few households receive a better home than they can afford, they simply trade some of the quality away, be selling or subletting parts of it. Those receiving a home are better off in terms of income though their dwelling may only be marginally better. Those that do not receive a home are not helped at all, they may even be hurt if government bids up the price of housing, and middle income families, who can well afford it, end up living in decent homes. To end the chapter we suggested some reasons why what appears to be such an undesirable policy persists anyway.

NOTES TO CHAPTER III

- (1) An example of such a permit is the "habite-se" in Brazil.
- (2) The United States, where the Bureau of the Census is responsible to the Department of Commerce is somewhat of an exception.
- (3) We are grateful to Professor Lisa Peattie for having pointed this out.
- (4) The word dwelling is used here as the equivalent of "housing unit" in the United Nations nomenclature.
- (5) As we have shown earlier under reasonable assumptions regarding the rate of losses and the growth rate of households and if housing production were accurately measured, the Ratio should be around 1.6.
- (6) It is of course possible that the construction output and GDP are undermeasured, but almost certainly not enough to invalidate our analysis.

IV. THE DEMAND FOR HOUSING

In the next three chapters we will elaborate and estimate a structural model of the market for new housing. In this chapter we develop the specification of the demand side. In the following chapter, we will develop the supply side. In Chapter VI we will estimate the parameters and do some hypothesis testing using those estimates.

We want to develop a model of demand for housing investment appropriate for answering the questions formulated at the end of Chapter I. The principal refinements upon previous empirical work which we will make are as follows. Since in Chapter III we showed that official housing investment data are systematically biased, we will use an alternative measurement of investment with less bias. Previous cross country studies have not used price in estimating equations for housing investment. We will specify the demand for housing as a function of price, among other variables. Earlier we remarked that the existing literature on the long run determinants of housing investment rarely examined the effect of government policy variables. We will specify a model which will permit us to do so. In order to test the effects of one policy variable, mortgage finance availability, we have assembled, from primary sources, a cross country data series on outstanding mortgage debt in housing capital. In addition, we will try to take account of climate, a variable long considered important, but as yet untested. All previous empirical work on housing investment has used total real housing investment as the dependent variable. We have

chosen instead to divide housing investment into two components, demand for dwelling units and demand for size and quality attributes of each unit. Since these two dimensions of investment might well be determined by different variables, and since changes in them have different policy implications, we should be able to improve our understanding of the investment process considerably by studying the two components separately.

A. Demand for New Units

1. Demographic Variables

Turning first to the specification of the equation for the number of new units produced, the data presented in Table 3.2 indicate that in most countries the number of dwellings matches quite closely the number of households. From this we conclude that in the long run the growth rate in the housing stock (STOGRO) must be determined mainly by demographic variables. Two variables should explain the growth in the housing stock. The first is the population growth twenty years earlier (POPGRO₋₂₀) (1). This variable was chosen because it measures the component of the increase in households brought about by a new cohort of the population coming to the age of marriage or cohabitation. We expect the coefficient of this population variable to be positive. The number of households will also increase when the average household size is reduced. We expect thus that the rate of change in the household size (HHSGR0) will have a negative effect on the growth rate of the housing stock.

It might be argued that household size is only a function of the amount of housing available, thus household size will always simply adjust to housing shortages. To a certain extent this may be the case, and we cannot really control for the effect of housing shortages on household size nor guess its magnitude. But a number of other factors influence household size as well. The household size can decrease when divorce becomes more acceptable or when as countries develop, more job mobility is required, and extended families are forced to break up as workers move to find jobs. Rodwin argues that a mere increase in income will cause a decrease in household size (1955, p. 70-71). Increases in transportation costs or in labor force participation may cause even nuclear families to separate. In countries with mostly nuclear families the aging of the population will also cause the average household size to decrease. It is possible that housing shortages have a relatively minor effect on household size compared to the above mentioned factors.

2. Income and Other Variables

Although our view is that the growth rate in the housing stock is determined solely by demographic variables, we have included some other variables that might effect housing stock growth. We have included the Gross Domestic Product per capita (GDPCAP) because one might expect that, the richer the country the more rapid the increase in the housing stock. One would thus expect a positive coefficient of GDPCAP. Some, especially government officials, argue that public housing programs increase the growth rate of the housing stock. To test the

validity of this hypothesis we have included the ratio of the number of public housing units produced to the increase in the housing stock (PUBRAT) as a measure of public sector involvement. We would expect PUBRAT to have a positive coefficient if indeed governments build units that would otherwise not have been built. Availability and cost of housing finance both affect the demand for housing investment because they transform the total resource cost of a home into a stream of payments over time, thereby influencing total outlay and the level of installment payments for a given resource cost. Our view is that finance has little if any influence on the number of new units. It is only important as a determinant of the demand for size and quality attributes. This is because formal housing finance is merely one of a number of alternative means of overcoming the wealth constraints most families meet when investing in housing. Lack of formal financing is unlikely to keep many households from actually building or buying a home. However recourse to other forms of financing almost always raises the total stream of payments and the installment payment due on the home. To tailor their monthly housing outlays to their income, households will thus have to reduce the original resource cost of the home, so they will reduce its quality and size. Nonetheless we will allow for the possibility that formal housing financing has a positive effect on the number of new units and include it in the equation explaining the demand for new units. The best measure of such finance availability is the ratio of the increase in mortgage debt to the value of the increase in the housing stock (MDEBRAT). We prefer

to use the ratio of the total outstanding mortgage debt to the total replacement value of the housing stock (DEBRAT) because it is available for more countries and because it is highly correlated with MDEBRAT ($\rho = 0.87$).

To sum up, we have included the last three variables, GDCAP, PUBRAT and DEBRAT, because there is a theoretical possibility that they have an effect. In our view, the demand for new units is primarily determined by demographic variables and is insensitive to the economic variables. Thus we expect only the coefficients of the rate of change in the household size and the rate of population growth to be statistically significant. Specifically we expect both these variables to have coefficients opposite in sign and near 1 in absolute value.

3. Data

To measure the dependent variable in our equation for the demand for units we have chosen to use the growth rate of the housing stock as measured in the census, rather than official production normalized by the existing housing stock. We believe the stock data to be more reliable because they are collected from census results, however, they are also a biased measure of housing production because they omit construction to replace losses. For official production data the undercounting is worse in poor countries; for census data the undermeasurement from omission of replacement construction is worse in countries with low population growth, usually rich countries.

We prefer a measurement of housing production based on stock data for the following reasons. Not only is the magnitude of the bias less,

it also varies less systematically with income. We have shown that the undermeasurement of official housing production varies systematically with both income per capita and the population growth rate (see Tables 3.3 and 3.4). It is unlikely that losses to the housing stock which are composed of planned demolition, destruction by fire, flood, windstorm and earthquake as well as conversions to other uses, vary, systematically, with income or demographic variables. This hypothesis cannot be tested, however, due to lack of data. For many countries, housing loss data are either not available, incomplete or unreliable. They are unreliable because they suffer from a strong undermeasurement bias, similar to that of official production statistics except that template view of housing does not play a role. Often the statistics are merely demolition statistics, collected by counting demolition permits. Not only does this ignore accidental demolitions and conversions, but in poor countries, government's lack of penetration in society implies severe undermeasurement even of planned demolitions.

B. Demand for Space

The second component of total demand for housing investment is demand for size and quality characteristics of new dwellings. Ideally, demand for all characteristics of homes could be specified separately, as a function of relative prices, incomes, and any parameters affecting tastes across countries. However the data necessary to estimate these separate demand equations are simply not available. We must be satisfied with explaining only the demand for the surface area of new

dwellings, the only housing characteristic for which we have data, controlled to the extent that is possible for the effects of other quality attributes. To control for the effects of quality attributes on the demand for space, two types of correction are necessary. First, cost per meter squared should be purged of the variations resulting from different levels of housing quality across countries. Second, theoretically the prices of all other attributes affect the demand for space and thus should be included in the equation.

To make the first correction, if the data were available, a hedonic price equation could be estimated for each country. (2) The construction cost per square meter of housing could then be expressed in terms of a variety of quality attributes and this equation could be used to recalculate costs for each country holding quality constant. (3) The coefficients on all the different housing attributes in the hedonic price equation give estimates of the prices of quality attributes and these could also be included in the equation for the demand for space. But the data requirements for the hedonic price equations far exceed availability. They require almost as much data on characteristics of housing as would the system of demand equations we spoke of earlier. So this type of correction is clearly not feasible. A partial correction is to add variables which proxy quality levels. A climatic variable was included partly for this reason. Unfortunately, there are no obvious proxies for the costs of housing attributes other than space.

1. Income Variable

Turning now to the determinants of the size of new dwellings (MSQDW), we hypothesize that space per dwelling is positively related to some measure of income. The positive effect of income on demand is a standard result in the theory of constrained utility maximization underlying our analysis. Previous cross country studies of housing investment have always used Gross Domestic Product per capita (GDPCAP). However we think that Gross Domestic Product per household (GDPHH) should be used to explain demand for dwelling space instead. Decisions to invest in or rent a home are based on household not per capita income. If household income is the conceptually correct measure to use, income elasticities will be estimated inaccurately if income per capita is used instead. In Table 4.1 we estimate a negative relation between household size and per capita income. (Detailed description of the data used for each variable can be found in Appendix A.) The results of this regression indicate that the income elasticity estimated with per capita income will be lower than the more relevant household income elasticity.

2. Price

A second variable influencing the demand for housing space is its price. Presumably when the price of space goes up people will substitute away from housing by choosing a smaller home. Thus the expected sign of the coefficient on price is negative. For items whose selling price is very high relative to income, such as housing, the cost of acquisition of the good is not determined uniquely by this

Table: 4.1 Regression Results: Household size (HHS) (pooled cross-sectional - time series sample) on GDP per capita (GDPCAP).

Dependent Variable Independent Variable	ln (HHS)
Intercept	3.0321 (16.41)c
ln (GDPCAP)	-0.2378 (-9.12)c
R ²	0.61
F	83.15a
No. of Observations	50

Key: (t - statistics are between brackets, below the coefficients)
a: significant at the 0.01 level in a one-tailed test.
b: " 0.05 " " "
c: " 0.01 " two-tailed "
d: " 0.05 " " "

selling price. As we mentioned earlier in discussing the inclusion of DEBRAT in the demand for units, the terms of the financing, which is almost always necessary for the purchase of a home, determine both the total real outlay and the installment payment on a home. Both presumably influence demand for space. We will treat the effects in detail when we discuss mortgage finance variables. Now we concentrate on the resource cost of space.

Though the resource cost of dwellings is theoretically an extremely important variable, measuring it correctly poses some problems. Researchers have chosen to solve these in a number of different ways. (Please refer to the discussion in Chapter II.) We decided to use nominal average construction cost per meter squared in U.S. dollars to measure the price of housing (COSTMSQ). As mentioned in our review of the literature in Chapter II, few other analyses of housing investment have used a direct measure of housing costs, though a direct measure is admittedly best. Our data on average cost per meter squared is comparable to Federal Housing Administration data used in some American cross sectional studies.

Though our measure of construction costs is the best available, it has some shortcomings, as does our measure for the dependent variable, meters squared per dwelling. Both series were obtained from official production data. Especially in the poorer countries, where only part of the total dwelling production is measured, what is measured is not representative of characteristics of all additions to the housing stock. Because housing production is measured mostly

through building permit statistics, and because the requirements for permits exceed the standards of much of the actual building being done, both size and the cost per meter squared will be higher than an average of the total real production. This reduces the variation in the quality of housing on which the cost per meter squared is based and thus corrects the cost measurement to some extent for quality variations. Unfortunately the measurement bias also reduces the variation in meters squared per dwelling. This sheds some doubt on the coefficients estimated using these series. But no other data is available, so these are the best estimates possible at this time.

In our introduction to this section we mentioned that cost should be controlled for quality, and that costs of other attributes should be included in the equation for dwelling space. Consumer demand theory also suggests that prices of other consumption goods should be included in the equation for demand for space. The problem is to find a good or a service which is a substitute for housing investment or housing services and which is demanded in comparable amounts across countries. At first one might think the price of a food item could be used. Unfortunately no food item is consumed across countries in anywhere near the same proportion of income. The proportion of total food expenditure in total consumption can vary from a figure of 50 percent in the Philippines to 14 percent in the United States. For a single food item such as bread and cereals the percentages differ even more: 23 percent in the Philippines versus two percent in the United States (Kravis, 1978, p. 89). Another possibility for normalizing

the price of housing is to divide it by a basket of commodities multiplied by the internationally comparable prices developed by Kravis et al. (ibidem). Unfortunately there is not enough overlap between the 16 countries studied by Kravis et al. and the 28 countries included in this study. Since no satisfactory denominator could be found to calculate a relative price we have to be satisfied with nominal prices in U.S. dollars instead.

3. Climate

Climatic conditions are a third determinant of the demand for space. Households incur both recurrent and one time expenses to protect themselves from a rigorous climate. The one time expenses are part of the quality dimension of the home, thus to the extent that climate induces quality adjustment, the rigors of climate will be a proxy for quality and their inclusion in the demand equation will partially mitigate the problems caused by using a cost measure uncorrected for quality. Furthermore, the one time quality adjustment to climatic severity is a competing attribute to housing size. The more such quality adjustment is required by climate, ceteris paribus, the less families will want to spend on space.

However recurrent costs are an important dimension of the cost of having a home of a certain size, and are thus another means by which climatic factors influence the demand for space. A number of factors affect recurrent costs but we hope to capture most of the variation across countries with a variable measuring climatic severity. The recurrent expenses of keeping a home within temperature and humidity

comfort zones are great because the comfort zone is narrow: without ventilation between 21 and 27 degrees Celcius and between 20 and 50 percent humidity (Bussat, 1972, p. 3). The expenses related to heating or cooling, humidifying or dehumidifying, and ventilating are directly related to the volume of the dwelling. Once volume is reduced by lowering the height of rooms to the minimum livable level, volume can only be reduced further by decreasing the surface area. For this reason, climatic extremes are likely to have a negative effect on the demand for space.

The effect of climate on lifestyle will also influence the demand for space. All other determinants of demand held equal, given a more rigorous climate, we hypothesize that people will desire more space since they must spend more time inside their homes. This positive effect on the demand for space will offset to some extent the negative effect on housing demands of climate via recurrent costs. Hence we have no presumption as to the sign of the coefficient, though our hunch is that the negative effect of costs will predominate.

We must now find a measure of the severity of climate. We have assumed here that cold is the climatic condition that is the most expensive to protect against. Very high temperatures may have a similar effect but only a very small share of the populations of two countries included in our sample, the United States and Egypt, live in regions where temperature maxima would be more extreme than the minima and would thus affect the demand for dwelling space. Rain fall was not included as a measure of climate because it does not necessitate large

recurrent expenses. The measure of cold we decided to use is an average (over the main cities of each country) of extreme temperatures (COLD). (Details of the assembly of the data are found in Appendix A.) One could also use another measure of cold such as the average temperature during the three coldest months. But it was thought that since extremes occur regularly, several times during housing asset life, and peoples' lives, households choose dwellings suited to the worst conditions (4) so extreme temperatures are a better measurement than averages.

4. Demographic Effects

While harsh climate may reduce the size of a dwelling we expect that a large household size will increase it. This effect may be small since there may be considerable economies of scale in dwellings. Many spaces of a dwelling such as a kitchen, bathroom, toilet, stairway, living room and halls remain constant in size over a large range of family sizes, at least as large as the sizes covered in our sample. We expect thus a small positive effect of the household size (HHS) on MSQDW.

5. Policy Variables

We now turn to the effects of direct policy variables. Cost of course can be influenced by policy and so is an indirect policy variable. For example, the elasticity of demand with respect to cost gives some information about the effects of cost reducing policies. But here we want to examine the effects of direct government intervention, such as the provision of public housing.

a. Provision of Public Housing

In poorer countries the template requirement discussed in Chapter III induces the authorities to provide public housing that is both larger and better than average. It seems obvious that, all other things constant, when the government makes up a larger segment of the demand for housing, then the demand for space will increase. However, the crucial point is that provision of public housing does not necessarily represent final demand in the housing market. Government can only commission the production of housing, then rent or sell the homes to final users. If government succeeds in forcing the recipients of public housing benefits to live in the houses as built, then they do influence final demand. But if the recipients of public housing can trade away all or some of the housing services given them by the government either by subdivision or subletting, then the government preferences for size and quality are irrelevant to final demand because they are only an intermediary in the provision of housing. Individual households will be the only final demanders of housing and the basic economic parameters influencing the structure of demand in the population will be unchanged by public housing provision, except for the implicit income transfer that the policy provides to housing recipients. (Please refer to Chapter III for details of this discussion.) The coefficient on the variable we use for public housing provision (PUBRAT, the ratio of new public dwellings to the total increase in the housing stock) should thus be either positive or zero.

b. Finance

Public housing investment is probably the most direct way governments can try to affect the amount of housing investment. Government also has a number of monetary and fiscal tools at its disposal with which to influence the housing sector. It can also choose to intervene more directly by creating and regulating institutions that specialize in housing finance. But the question is: how important is finance to housing investment? One is overwhelmed by the enthusiasm and confidence of the response to this question in the literature. "The absence of a mortgage system can lead to stagnation of the building and materials industries, increased unemployment, social discontent, and in some instances even political upheaval." (Abrams, 64, p. 143). "The lack of mortgage funds frequently constrains housing" (World Bank, 75, p. 30); "...as in the production of other assets with relatively long useful lives, house construction is aided by the availability of long term credit." (Grimes, 76, p. 56); "A well-developed housing finance system is one which significantly facilitates the purchase, rental, construction and improvement of homes for the population as a whole" (United Nations, Department of Economic and Social Affairs, 1976, p. 71). Many more testimonials of the same nature could be quoted. But in all these quotations it is not clearly stated whether housing finance increases the number of the size of dwellings or both.

Housing is an expensive asset that very few individuals can acquire out of their own wealth and even fewer out of their income. But it is an oversimplification to assume that people desiring to buy a

dwelling can turn only to mortgage finance to complement their own resources. Depending on the country, people borrow from their family, from their employer, from mutual saving associations, from small money lenders, from the builder or developer of the dwellings, or people even increase their debt with suppliers of consumption goods.

Most of the sources of funds just mentioned are less advantageous in their terms to borrowers than the formal mortgage financing institutions. The non-formal sources are usually thought to impose shorter amortization periods and charge higher explicit or implicit interest rates. Lower interest rates and amortization periods of formal financing make repayments smaller so that a given household can afford to contract a large debt and hence a more expensive home. The increase in the share of total lending by the formal mortgage institutions should increase demand for housing by reducing the average cost of borrowing and the average installment.

The lowering of the installment payments has the additional effect of relaxing the liquidity constraint for low income households. Even if the total price of the house in terms of the net present value of the payment stream rises, when the installment payment can be brought low enough, liquidity constrained families will procure more housing. One would thus expect that across countries the reduction of the average cost of borrowing for housing investment brought about by the increase in the relative loan volume from formal housing credit institutions would increase the quality of housing demanded by each household. Hence there should be a positive effect on the number of

meters squared per dwelling.

We will use the marginal debt ratio (MDEBRAT), the change in the value of loans outstanding divided by the value of the increase in the housing stock, to measure mortgage availability. This will be an appropriate measure if repayments of principal are small relative to gross new lending and if this relationship does not vary systematically across countries. The marginal debt ratio is the appropriate indicator because it measures mortgage availability in the country at the time when the decision to invest is made, but it could only be calculated for an insufficient number of countries. So to gain observations we will estimate the relation using the average debt to replacement value ratio (DEBRAT). This figure is more readily available and is highly correlated to MDEBRAT ($\rho = 0.87$).

Thus far we have two alternatives for measuring the availability of mortgage credit. Ideally we would have liked to include one or more variables which would measure the cost, averaged over both formal and informal finance sources of mortgage finance. These variables would have been weighted averages of interest rates, amortization periods and front-end costs. Unfortunately there are not enough data comparable across countries on the amortization period and front end costs to take account of these factors. Also, we were only able to devise a very ad hoc measure of average interest rates. Including only interest rates, without controlling for other important dimensions of mortgage packages available across other countries, can only give a very imperfect estimate of the effects. It also gives a very im-

perfect estimate of the effects of looser or tighter housing finance on demand. But since so many studies have focused on the effects of interest rates, we have included them in the specification of our demand equation.

Although the interest rates charged on formal mortgage loans are available the interest rates charged in the informal sector are not. To get an estimate of these we had to make the heroic assumption that this informal interest rate is close to, or at least correlated to the shadow price of capital and that this is equal to the long run nominal growth rate of the economy. The average interest rate (AVINT) is obtained by weighting the formal mortgage interest rate by the share of mortgage debt in the value of the housing stock (DEBRAT) and the nominal growth rate by the remaining share (1-DEBRAT). If the average interest rate has any influence at all on the demand for housing space, this influence should be negative. As an alternative interest rate, we also tried using the official mortgage interest rate (MORINT). We also expect the coefficient of MORINT to be negative.

The interest rates we have chosen to use are all nominal rather than real interest rates, because we feel that the nominal interest rate is the relevant variable in this demand equation. In a world without liquidity constraints, the real discounted value of the stream of loan payments would be all that is relevant to the household, and this is determined by the real interest rate. However, if some families are liquidity constrained, the level of the first installment payment also matters in their decision to consume housing. Even if

it is only inflation that causes the nominal rate of interest to be high, a high interest rate may raise the installment payment so high that liquidity constrained families simply cannot afford the payments in the early period of the loan, regardless of how low the real value of the discounted stream of payments may be. We assume that liquidity constraints are important for most households, hence we prefer the nominal interest rate.

C. Summary

To summarize our demand side specification, we will estimate two demand equations, one for the number of units and one for the surface per unit.

$$\text{STOGRO} = f(\text{POPGRO}_{-20}, \text{HHSgro}, \text{GDPCAP}, \text{PUBRAT}, \text{DEBRAT}) \quad (1)$$

and

$$\text{MSQDW} = f(\text{GDPHH}, \text{COSTMSQ}, \text{COLD}, \text{PUBRAT}, \text{HHS}, \text{DEBRAT}) \quad (2)$$

where:

$$\text{STOGRO} = \frac{\Delta \text{STOK}}{\text{STOK}}$$

$$\text{DEBRAT} = \frac{\text{DEB}}{\text{STOK} \times \text{MSQDW} \times \text{COSTMSQ}}$$

$$\text{PUBRAT} = \frac{\Delta\text{PUB}}{\Delta\text{STOK}}$$

We have also specified this equation using some alternatives for DEBRAT:
MDEBRAT, AVINT and MORINT

where

$$\text{MDEBRAT} = \frac{\Delta\text{DEB}}{\Delta\text{STOK} \times \text{MSQDW} \times \text{COSTMSQ}}$$

$$\text{AVINT} = (\text{DEBRAT} \times \text{MORINT}) + ((1 - \text{DEBRAT}) \times \text{NOMGRO})$$

For reference:

AVINT = the average of mortgage interest rates and a measure of the interest rates on housing finance from other sources.

COLD = a measure of cold.

COSTMSQ = the cost per meter squared of residential construction in U.S. dollars.

DEB = the outstanding mortgage debt.

DEBRAT = the ratio of the outstanding mortgage loans to the value of the housing stock.

ΔDEB = the change in the outstanding mortgage debt.

ΔPUB = the production of public housing between census years.

ΔSTOK = the increase in the housing stock between census years.

GDPCAP = GDP per capita

- HHSGR0 = the growth rate in the household size.
- MDEBRAT = the ratio of the net increase in outstanding mortgaged loans to the value of the increase of the housing stock.
- MORINT = the nominal interest rate on mortgage loans.
- MSQDW = the average meter squared per dwelling.
- NOMGRO = the nominal growth rate of GDP.
- POPGRO₋₂₀ = the population growth rate twenty years before base year.
- PUBRAT = the ratio of the number of public housing to increase in the housing stock.
- STOGRO = the growth rate in the housing stock.
- STOK = the number of dwellings in the housing stock.

We argue thus that demographic variables, population and household size, will be the primary determinants of the number of units. We expect on the other hand that the surface area will be sensitive to a number of other variables affecting cost, preferences and effective purchasing power.

NOTES TO CHAPTER IV

(1) The figure is somewhat arbitrary. It was chosen because it was thought to be the average between the age of male and female when they marry or start cohabitating. However the estimated coefficients proved robust to variation in the lag. This is because population growth rates vary only very slowly.

(2) For two good expositions of hedonic theory please refer to Rosen (1974) or Wheaton (1977).

(3) For a good example of this method, please refer to Ferguson and Wheaton (1980).

(4) In civil and architectural engineering structures and facilities are routinely designed to withstand extreme conditions that occur on average only every fifty or hundred years. For example, rainwater drainage pipes are designed to drain cloudbursts of an intensity that only occurs every 50 years. Chimneys are designed to withstand windbursts at speeds that only occur every 50 years. House heating systems are designed to cope with temperatures lower than any recorded extreme. The summer heat wave of 1980 in the Southern United States may very well increase insulation air cooling standards in that region for the next 50 years.

V. THE SUPPLY SIDE

A. Cost Function Approach

To model long run supply, if competitive markets predominate, then a cost function is appropriate. If one assumes constant returns to scale, the cost function can be specified to depend only on factor prices. This assumption may not be too unrealistic for industries with many small producers. The construction sector, particularly residential construction, may meet these requirements to a certain extent. Thus we could express the construction cost per square meter of dwelling as a function of the cost of factors used in residential construction: labor, capital and materials.

However, assembling reliable cross country data on factor prices posed some serious problems. First of all for most of the countries in our sample separate wage data for residential construction is not published, wages are given for the construction sector as a whole. For six countries, even construction sector wages were not available. We had to use manufacturing wages instead for five of these countries and agricultural wages for one. For two of the countries for which construction sector wages were available, only wage guidelines set by the government rather than wages actually paid were published.

The rent on capital used in the construction sector is not measured. A second best measure would be some average cost of capital in the economy as a whole. Harberger (1977) has done the only study

we know of on the rates of return to capital across countries. But the results of this study do not seem to help much because Harberger concludes from the analysis of his data that "there is an international capital market which tends to equalize rates of return to capital across countries in much the same manner as national capital markets tend to equalize rates of return across activities and regions." (ibidem, p. 19. 21). This precludes using the variation in the rate of return to capital to help explain variations in construction costs (1). Of course, if Harberger is right, the cost of capital need not be included in the cost equation, because it does not vary.

However, we preferred to be a little skeptical of Harberger's results and tried to find another measure for the return on capital. Since it was impossible to find estimates of user cost, we used the nominal growth rate of GDP as a proxy, under the assumption that the latter moves with the long run cost of capital.

Assembling data on the cost of materials proved impossible given the scope of this thesis. The cost of a few materials such as cement and reinforcement rods are published for only a handful of countries. Since the cost of materials can be theoretically broken into wages and rent on capital, one could exclude the price of raw materials from a construction cost function under certain assumptions. These assumptions are those necessary to make the cost structure in the materials sector, both domestic and foreign, the same as that of the construction sector. Unfortunately this is a very strong set of assumptions that we cannot expect will often be met.

Nonetheless, we used the data available and estimated a cost function. Given the unreliability and crudity of the data, it is not surprising that the regression results were quite disappointing. Both the coefficients of construction wages and nominal growth were insignificant and the R^2 was low. The results of the regression are in Appendix E.

B. Generalized Supply Function

The cost function approach to modeling the supply side has not only failed because of a lack of data but even had it succeeded it might not have shed light on some important questions about the determinants of costs in construction. In Chapter I we discussed the possible importance of long run bottlenecks in construction, and the amount of public housing in determining the price of housing. For a number of reasons the cost function approach will not take account of these factors. The conditions purportedly causing bottlenecks represent significant departures from the competitive framework in which a cost function is relevant. For example, a cost function assumes away the shortages of critical housing materials and skilled labor that could make government construction of public housing have an effect on the supply of housing. Yet given the aims of this study, it would be desirable to explore these phenomena and test hypotheses about them in some way. So we will try to develop a specification of the housing supply function that is general enough to take into account some of these effects.

First, let us discuss the reasoning behind the hypothesis of a long run bottleneck. On the existence of a long run bottleneck in the construction sector, opinions are divided. The neoclassical view is that bottlenecks are almost by definition short run phenomena, and that markets adjust in the long run. According to this view the long run supply curve is flat. The opposite view is that the long run supply curve slopes upward, because factor supplies in construction never fully adjust. The poorer the country, it is argued, the more inadequate will be the adjustment and thus the worse will be the bottleneck.

The most important of the factor bottlenecks seems to be the shortage of labor. In many countries there appears to be a long lasting shortage of skilled and semi-skilled labor. While the formal part of trade education may not be longer than three to six months, training on the job may last several years, under the best circumstances. In many countries there is a shortage of qualified master tradesmen to supervise and further train the graduates of trade schools. Often-times, in poorer countries, the very qualified tradesmen either emigrate or relinquish their trade. Good tradesmen often become contractors or merchants.

Wages in the construction sector do not rise sufficiently to encourage new workers to invest in skills or even to keep already qualified workers in the sector. It may also be that many workers are reluctant to invest in skills that will only be useful in a highly cyclical industry. Contractors may prefer to collect rents during

booms rather raise wages enough to attract as much labor as the sector could absorb.

In many countries there is a social stigma attached to being a construction worker that is not sufficiently compensated by the wage. In those same countries there is less shame in being a construction worker abroad. This factor together with higher wages abroad can create a drain on the qualified construction labor force. Even when emigrants return, rather than continue to use their human capital in construction they often use their accumulated savings to start businesses in the trade or services sector.

A shortage of construction labor induces demand for construction equipment. In many developing countries such capital may be in short supply because the equipment has to be imported from the developed countries, and imports are constrained by a lack of foreign exchange. When those constraints do not bind, as in oil rich developing nations such as Iraq, Iran, Nigeria or Saudi Arabia other constraints appear. Harbors are often congested and much of the equipment is too heavy to be flown in. In some countries rigorous climatic conditions, poor maintenance and mishandling by insufficiently trained operators can be a very large drain on construction capital.

For similar reasons many countries suffer from a shortage of building materials. Domestic production cannot be increased rapidly because gestation periods in that sector are long. For instance, for a cement factory or a large scale brick factory it may take five years to reach full capacity production from the time the investment

was planned. For integrated steel plants, it may take ten years. Shortfalls of traded materials can be alleviated by imports. However many governments restrict imports so as to perpetuate shortages. The restrictions are adopted to protect domestic industry or in response to the foreign exchange or savings constraint we mentioned earlier. Even non-traded material such as sand, gravel, and stone can be in short supply if produced or even transported with imported equipment.

Besides the bottlenecks in the supply of factors used in the construction sector, many observers find evidence for a bottleneck in the construction sector itself. Institutions for the dissemination of information may be nonexistent or they may work inefficiently. Managerial ability may be scarce so that most decisions are based on custom rather than best practice. Because of these weaknesses in the organization of the construction sector, supply may be very unresponsive in the long run.

Let us now develop a specification for the long run supply equation. In our generalized supply framework, factor costs will still have an effect. Factor price data is so unsatisfactory that we have chosen to use a proxy variable for wage costs. Gross Domestic Product per household (GDPHH) should be strongly correlated with wage levels across countries so we will include it in our supply equation. We still have no good proxy for the costs of capital but this may not be a serious problem. As we mentioned earlier, if Harberger's argument that returns to capital are equalized across countries is right, then of course excluding capital costs will not cause problems. If

the construction sector is not perfectly competitive, then there may be no exogenously fixed price or capital feeding directly into construction prices, and hence, systematically influencing costs.

One implication of a construction bottleneck is that there is a level of output which does not put pressure on the rigid capacity of the sector. When economies try to exceed this level, output expands slightly but prices rise dramatically. Thus we need some measure of quantity pressure on prices. The share of construction in GDP (CONRAT) (2) should provide a good indication of the amount by which construction exceeds or falls short of the "normal" level of construction output. The CONRAT variable is intended to capture the effects of quantity on the cost of production, but the supply equation must also be specified to include some variables that determine the quality of dwellings and thus influence the average cost per meter squared.

As we mentioned in Chapter IV in discussing housing demand, dwellings are not homogeneous commodities but vary considerably in size and quality attributes. Presumably, resource use is different for different quality dwellings. Hence the prices of different quality dwellings will vary to reflect this. Ideally then, one should disaggregate the supply side of the housing market into the supply of different characteristics of housing as a function of input prices. Not surprisingly, the data necessary to estimate such a system are not available. Here, we are only trying to estimate a function explaining the variation of the supply price of a certain attribute, space, as a function of some critical variables such as factor costs, and strains

on supplies of fixed factor inputs. But we don't have a series on the price of space alone. Our cost per meter squared data is just the average cost of dwellings and will be subject to variation due to changes in the average quality of dwellings. So as to correctly identify the effects of the above mentioned variables on the cost per equivalent square meter of housing, variables proxying the average quality of dwellings should be added to the equation.

The first of these quality proxies will be the share of public housing production in the total housing production (PUBRAT). If public housing is of higher than average quality, then increasing its share will raise the average quality and thus the average cost per meter squared.

Climate will also have an effect on the cost per square meter, through its positive effect on the average quality of dwellings. Moreover, the construction process is also made more expensive by the rigors of cold climates. Costly precautions must be taken to protect workers and materials from the elements, otherwise both work time and materials are wasted. Interruptions or slowdowns of construction work during the winter increase the cost of carrying the unfinished building. GDPHH enters in our system of equations on the demand side by increasing the demand for space and it enters in our supply function as a proxy for wages. But income also increases the demand for other quality attributes in housing, and we assume that the equilibrium amounts of quality attributes in each country increase with income. Hence income also serves as a quality proxy in our supply equation.

To sum up, we have specified the supply equation as follows:

$$\text{COSTMSQ} = f(\text{CONRAT}, \text{GDPHH}, \text{COLD}, \text{PUBRAT}) \quad (3)$$

where

$$\text{CONRAT} = \frac{\text{NONRESCON} + ((\Delta\text{STOK}/\text{YEARS}) \times \text{MSQDW} \times \text{COSTMSQ})}{\text{GDP}}$$

$$\text{PUBRAT} = \frac{\Delta\text{PUB}}{\Delta\text{STOK}}$$

For reference:

- COLD = a measure of cold.
- CONRAT = the ratio of the value of all construction to GDP.
- COSTMSQ = the cost per meter squared of residential construction in U.S. dollars.
- ΔPUB = the production of public housing between census years.
- ΔSTOK = the increase in the housing stock between census years.
- MSQDW = the average meter squared per dwelling.
- NONRESCON = the value of nonresidential construction.
- YEARS = number of years between censuses.

The variables included in Equation (3) should cover the main supply side determinants of cost variation across countries.

NOTES ON CHAPTER V

(1) In addition Harberger's sample and our sample only overlapped by eleven countries.

(2) We have replaced the official estimates of residential construction by the change in the housing stock times the dwelling unit cost.

(3) Construction wages increase faster across countries than the average level. In poorer countries hourly wages in the construction sector are lower than in the manufacturing sector. In richer countries it is the opposite. Strassmann (1978, p. 4, 5) has proposed that the shift in relative wages reflects an increase bargaining strength gained by unionization instead of higher productivity.

VI. ESTIMATION OF THE MODEL

A. The System of Equations

In the last two chapters we have discussed the specification of the equations of our model. A summary of those equations follows.

On the demand side we have:

$$\begin{aligned} \text{STOGRO} = & a_1 + a_2 \text{POPGRO}_{-20} + a_3 \text{HHSGRO} + a_4 \text{GDPCAP} + \\ & a_5 \text{PUBRAT} + a_6 \text{DEBRAT} \end{aligned} \quad (1)$$

and

$$\begin{aligned} \ln(\text{MSQDW}) = & b_1 + b_2 \ln(\text{GDPHH}) + b_3 \ln(\text{COSTMSQ}) + \\ & b_4 \ln(\text{COLD}) + b_5 \ln(\text{PUBRAT}) + b_6 \ln(\text{HHS}) + \\ & b_7 \ln(\text{DEBRAT}) \end{aligned} \quad (2)$$

On the supply side we have

$$\begin{aligned} \ln(\text{COSTMSQ}) = & c_1 + c_2 \ln(\text{GDPHH}) + c_3 \text{COLD} + c_4 \ln(\text{PUBRAT}) + \\ & c_5 \ln(\text{CONRAT}) \end{aligned} \quad (3)$$

B. Choice of Estimation Technique

Now we turn to the estimation of the parameters in these equations. The first step is to find a consistent estimation technique. We cannot simply use an Ordinary Least Squares (OLS) estimate because there is a possibility that the error terms for one country in the three equations of our system are correlated. If this is the case, when endogenous variables enter as right hand side variables in another equation, they are not orthogonal to the error term in that equation, and OLS estimation is not consistent. However Two Stage Least Squares (2SLS) yields consistent but inefficient estimates.

Fortunately there is a test which permits us to determine whether OLS estimates are consistent or not. If we can determine that the OLS estimates do not have endogeneity bias, then they provide consistent and efficient estimates. The test we use is described fully in Hausman (1978, p. 1251-71). The endogenous right hand side variables in Equation 1 are PUBRAT and DEBRAT. In Equation (2) $\ln(\text{COSTMSQ})$, $\ln(\text{PUBRAT})$ and $\ln(\text{DEBRAT})$ (1) are endogenous and in Equation (3), $\ln(\text{PUBRAT})$ and $\ln(\text{CONRAT})$ are endogenous. In this system the variables are endogenous either because they are determined directly in another equation of the system as in the case of $\ln(\text{COSTMSQ})$, or they are functions of a variable determined within the model as in the case of $\ln(\text{PUBRAT})$.

Table 6.1 shows the results of the tests of endogeneity (2). Since the three test statistics are smaller than the critical value of the χ^2 statistic at the 0.95 level of confidence we cannot reject

Table: 6.1 Results of tests of endogeneity.

Equation Number (2)	Variables Suspected to be Endogenous	Test Statistic	Critical Value of χ^2
1	PUBRAT DEBRAT	1.50	5.99
2	ln (COSTMSQ) ln (PUBRAT) ln (DEBRAT)	1.38	7.81
3	ln (PUBRAT) ln (CONRAT)	5.12	5.99

(1) The test we used is described in Hausman (1978, p. 1251-71).

(2) Refers to numbers given to equation on page 132.

the null hypothesis that there is no endogeneity bias.

C. Hypothesis Testing on OLS Estimates

1. Demand for Units

The results of the estimation of Equation (1), explaining the growth rate in the housing stock are found in column 1 of Table 6.2. They are as expected: the growth rate of the housing stock is a positive function of the lagged population growth rate and a negative function of the growth rate of household size. The t-statistics of the other variables do not indicate statistical significance but to test properly our original hypothesis that only demographic variables matter, we will test the joint hypothesis that the coefficients of the other variables in the equation are zero. The results are shown in the first row of Table 6.5. Since the test statistic is smaller than the critical value of the χ^2 statistic at the 0.95 confidence level we cannot reject the null hypothesis that the coefficients a_4 , a_5 , and a_6 of the variables GDPCAP, PUBRAT and DEBRAT are equal to zero.

We have no particular theoretical reason to keep these variables in the equation. They were originally included for the sake of completeness. Now that we have shown they are not statistically significant we can re-estimate the equation without them to get more efficient estimates of the effects of demographic variables. The results of this estimation are shown in column 2 of Table 6.2. The coefficients have the expected signs and they are close to unity. Those results confirm the findings of previous research on long run

Table: 6.2 Regression Results: Housing stock growth rate (STOGRO) as a function of population growth rate (POPGRO), household size growth rate (HHSGR0), the ratio between public housing production and increase in stock (PUBRAT), or the ratio of the total outstanding mortgage debt to the value of the housing stock (DEBRAT).

Independent Variable \ Dependent Variable	STOGRO	STOGRO
	1	2
Intercept	0.8917 (0.93)	0.3518 (0.76)
POPGRO	0.6693 (2.62)d	0.7662 (4.21)c
HHSGR0	-1.0525 (-3.21)c	-1.0839 (-3.94)c
GDPCAP	-0.00014 (0.55)	-
PUBRAT	-0.2086 (-0.24)	-
DEBRAT	-0.2535 (0.10)	-
R ²	0.61	0.60
F	4.43b	12.38a
No. of Observatns	20	20

KEY: (t - statistics are between brackets, below the coefficients)
a: significant at the 0.01 level in a one-tailed test.
b: " 0.05 " " "
c: " 0.01 " two-tailed "
d: " 0.05 " " "

housing starts. In the long run, growth in the housing stock keeps pace with growth in the number of households.

2. Demand for Space

The results of estimation of Equation (2) explaining the demand for dwelling space is found in Table 6.3. In the same table we have also included the results of estimating Equation (2) replacing $\ln(\text{DEBRAT})$ by $\ln(\text{AVINT})$ and $\ln(\text{MORINT})$ (3). The result of the estimation of Equation (2) when $\ln(\text{DEBRAT})$ is replaced by $\ln(\text{MDEBRAT})$ is presented in Appendix D.

In the first three columns of Table 6.3 we can compare the estimation of Equation (2) using AVINT and MORINT as alternatives to DEBRAT for measuring the effect of formal housing financing on the demand for housing space. The fact that the coefficients of AVINT and MORINT are insignificant confirms our guess that a more holistic measure of the availability of formal mortgage finance (DEBRAT) is better than either an incomplete measure of mortgage loan costs (MORINT) or a very ad hoc measure of the cost of housing finance (AVINT).

In the results found in column 3 the coefficients of $\ln(\text{PUBRAT})$ and $\ln(\text{HHS})$ are insignificant. Because we cannot reject the null hypothesis that the coefficient of PUBRAT is zero, we must conclude that as measured by the available data it is likely that the extent of public housing production does not affect the demand for dwelling space. Since we know that in many countries public dwellings are larger and of higher quality than what recipient households could normally afford the absence of an effect of PUBRAT on the demand for dwelling space

Table: 6.3 Regression Results: Meter squared per dwelling (MSQDW) as a function of income per household (GDPHH), cost per square meter (COSTMSQ), cold (COLD), the ratio between public housing production and the growth in the stock (PUBRAT), or the ratio of the total outstanding mortgage debt to the value of the housing stock (DEBRAT) or the average of formal mortgage interest and a measure of the interest rate on housing finance from other sources (AVINT) or the nominal mortgage interest rate (MORINT).

Dependent Variable \ Independent Variable	1n (MSQDW) 1	1n (MSQDW) 2	1n (MSQDW) 3	1n (MSQDW) 4
Intercept	2.1628 (1.41)	2.5314 (1.47)	4.2011 (2.99)d	4.6222 (4.13)c
1n (GDPHH)	0.6094 (3.83)c	0.6032 (3.49)c	0.3311 (1.94)	0.3515 (2.33)d
1n (COSTMSQ)	-0.4977 (-2.52)d	-0.5188 (-2.43)d	0.3868 (-2.18)d	-0.4400 (-3.15)c
1n (COLD)	-0.1860 (-2.33)d	-0.1769 (-1.99)	-0.1680 (-2.47)d	-0.1922 (-3.81)c
1n (PUBRAT)	-0.00849 (-0.18)	0.00580 (0.12)	0.00728 (0.19)	-
1n (HHS)	-0.3416 (-0.75)	-0.2460 (-0.50)	0.2542 (0.60)	-
1n (DEBRAT)	-	-	0.1895 (2.60)d	0.1705 (2.80)d
1n (AVINT)	-	0.0478 (0.21)	-	-
1n (MORINT)	0.2105 (1.35)	-	-	-
R ²	0.63	0.57	0.73	0.72
F	3.39a	2.69	5.31a	8.92a
No. of Observations	19	19	19	19

KEY: (t - statistics are between brackets, below the coefficients)

a: significant at the 0.01 level in a one-tailed test.

b: " 0.05 " " " "

c: " 0.01 " " two-tailed "

d: " 0.05 " " " "

is not inconsistent with the hypothesis that many households trade away extra space.

The insignificant coefficient of HHS is puzzling. One would think that household size would influence the size of dwellings. We did not expect the effect to be very large because we assumed that there are economies of scale in the use of dwellings. But it may also be that for most households their preferences are such that they do not expand their dwellings when family size increases.

If we want to check the hypothesis that $\ln(\text{PUBRAT})$ and $\ln(\text{HHS})$ do not belong in Equation (2) and that the demand for dwelling space is solely a function of $\ln(\text{GDPHH})$, $\ln(\text{COSTMSQ})$, $\ln(\text{COLD})$ and $\ln(\text{DEBRAT})$ we have to test the hypothesis that these two variables are jointly insignificant. The results of the test are shown on the second row of Table 6.5. Since this test statistic is smaller than the critical value of the χ^2 statistic at the 0.95 level of confidence we cannot reject the null hypothesis that the coefficient b_5 and b_6 of the variables $\ln(\text{PUBRAT})$ and $\ln(\text{HHS})$ are equal to zero.

We re-estimate Equation (2) without those two variables and the results are shown in column 4 of Table 6.3. Since we have used the logarithmic form the coefficients can be interpreted as elasticities. The coefficients of $\ln(\text{GDPHH})$ and $\ln(\text{COSTMSQ})$ indicate an income elasticity of 0.3 and a price elasticity of -0.4. This result agrees with Mayo's conclusion in his survey of the recent literature on housing demand in the United States. He concludes that on average the demand for housing is both income and price inelastic (Mayo, 1979, p.

12, 14). Our results for both income and price elasticities of demand are comparable to and near the bottom of the range of those reported in Mayo's survey (ibidem, p. 4-6).

The coefficient of $\ln(\text{COLD})$ is small and seems to confirm our hunch that the reduction in the demand for space induced by higher recurrent expenses in cold climates is only partly offset by the increased demand for space that would derive from spending more time indoors to escape an inclement climate.

The coefficient of $\ln(\text{DEBRAT})$ is rather small at 0.18. Since the availability of formal housing finance affects the cost of housing to families, the low elasticity of DEBRAT is consistent with the fairly low income and price elasticity we have estimated. (4) The effect of DEBRAT should not be underplayed however. The variation of DEBRAT in our sample is large, the maximum observation being 600 percent of the minimum observation. Our elasticity estimate indicates that if DEBRAT can be increased that much, then housing investment will rise by approximately 100 percent, clearly not a negligible change. Though that much variation in DEBRAT is evidently possible across countries, for one country to increase the debt to value ratio to this extent may demand major efforts and considerable time.

3. Supply Price

We now turn to the estimation of the supply side of the model the results of which are presented in Table 6.4. In column one we have estimated the supply side of the model as specified in Equation (3). Neither the coefficients of $\ln(\text{PUBRAT})$ or $\ln(\text{CONRAT})$ appear to be

Table: 6.4 Regression Results: The cost of dwelling construction per meter squared (COSTMSQ) as a function of gross domestic product per household (GDPHH), a measure of cold (COLD), the ratio between public housing production and the increase in the stock (PUBRAT), and the ratio of all construction and the gross domestic product at (CONRAT).

Dependent Variable \ Independent Variable	ln (COSTMSQ) 1	ln COSTMSQ 2
Intercept	-0.7026 (-0.52)	-1.0266 (-0.95)
ln (GDPHH)	0.5776 (4.07)c	0.6078 (4.51)c
COLD	0.00670 (2.00)	0.00610 (1.92)
ln (PUBRAT)	0.0633 (1.07)	-
ln (CONRAT)	-0.0119 (-0.04)	-
R ²	0.77	0.75
F	11.51 a	23.70 a
No. of Observations	19	19

KEY: (t - statistics are between brackets, below the coefficients)
a: significant at the 0.01 level in a one-tailed test.
b: " 0.05 " " "
c: " 0.01 " two-tailed "
d: " 0.05 " " "

significant. For the coefficient of $\ln(\text{CONRAT})$ this means that, as measured by the available data we can find no evidence that a long run bottleneck influences the cost of housing space. However, this hypothesis should be tested further with a more refined specification and with both more refined and more reliable data.

The effect on average quality and thus on average costs of the level of public housing production which we had tentatively suggested is not confirmed by the insignificant coefficient of $\ln(\text{PUBRAT})$. Before we can re-estimate Equation (3) without $\ln(\text{PUBRAT})$ and $\ln(\text{CONRAT})$ we must test the joint hypothesis that those two variables are jointly insignificant. The result of the tests are shown on the third row of Table 6.5. Since the test statistic is less than the critical value of the χ^2 statistic at the 0.95 level of confidence, we cannot reject the null hypothesis that the coefficients c_4 and c_5 of $\ln(\text{PUBRAT})$ and $\ln(\text{CONRAT})$ are equal to zero. Our re-estimate is found in the second column of Table 6.4. The coefficient of COLD is very close to being significant at the 0.95 level of confidence and is positive and small as expected. Still we cannot reject the null hypothesis that the coefficient of COLD is zero. This indication of either a very small effect or no effect at all of COLD on COSTMSQ cannot easily be explained. COLD was included to capture both the effects of the difficulty of building in cold weather and the increased quality cold climates require. While one can imagine that construction techniques have fully adapted to the rigorous climate conditions

Table: 6.5 Results of tests of restrictions on the coefficients.

Restrictions	Value of Test Statistic	Critical Value of χ^2
$a_4 = a_5 = a_6 = 0$	0.99	7.81
$b_5 = b_6 = 0$	0.55	5.99
$c_4 = c_5 = 0$	1.50	5.99

it is hard to believe that there is no increase in the quality of the the dwelling, especially in the shell, required by cold climates. However we have not controlled for costs of materials and the cost of these may be related to climate, particularly since they are often non-traded goods. In cold climates wood is almost always plentiful and cheap and will thus bring down construction costs.

The income elasticity of construction costs per meter squared was supposed to capture both the effects of increase of construction labor costs and the increase in dwelling quality across incomes. The 0.7 coefficient of $\ln(\text{GDPHH})$ seems to indicate that construction costs do increase with income in the long run. There is however no evidence that construction costs outrun incomes, a complaint one often hears and reads (see Chapter I).

D. Summary

The results on the supply equation must be considered quite tentative. The general insignificance of the variables indicates that either the equation is misspecified or the data are simply too inaccurate to really capture the desired effects. On the demand side we have been able to get more convincing results. We have eliminated all but demographic effects on the demand for units. The coefficients on demographic variables are significant and the estimates are of the correct magnitude. The demand for space was found, as was expected, to be sensitive to a number of variables. Price and income have the expected effects, but the coefficients are quite low in absolute

value. Climate was found to have a small but negative effect on space demanded. Mortgage finance availability does have a positive effect on demand, while public housing production was shown to have no effect on the average dwelling size.

Now that we have estimated all the coefficients of the model we can calculate the total development elasticity of the use of dwelling space. This figure will give us an estimate of how the average quality of housing consumed will evolve if there is no policy intervention at all. Previous studies have not been able to answer this question for two reasons. First, previous cross country regressions were not specified to answer this particular question. The dependent variable in these regressions was total housing investment, so the coefficient of income in these equations reflects the effects of income on the quality of housing, the quantity of housing and the variation of the price of housing across countries. (5) Our specification disentangles these variables and what influences them so that the effect of income on the quality (6) of housing can be evaluated. Because our specification is so different, our results are not directly comparable with the results of Strassman, Eckaus, and Burns and Grebler that were discussed in Chapter II. The specification of demand equations in cross sectional studies for the United States is closer to ours, but they do not close the system with a supply side. Since those studies do not estimate the effect of income on the supply price of housing, it is not possible to calculate what we call the development elasticity of housing.

Our specification takes into account the effects of income on the demand side and the effects of income on the supply price of housing as well. It is only by estimating the magnitudes of these two effects that one can obtain an overall development elasticity of housing quality. We calculate the total development elasticity as follows:

$$\begin{aligned}\frac{\partial \text{MSQDW}}{\partial \text{GDPHH}} &= \frac{\partial \text{MSQDW}}{\partial \text{GDPHH}} + \frac{\partial \text{MSQDW}}{\partial \text{COSTMSQ}} \times \frac{\partial \text{COSTMSQ}}{\partial \text{GDPHH}} \\ &= 0.35 + (-0.44 \times 0.60) \\ &\approx 0.09\end{aligned}$$

The development elasticity of approximately 0.1 indicates that the use of housing space increases very slowly as income increases. A tenfold increase of income will only double the dwelling space used per household. Note that this low development elasticity is consistent with more casual observations that housing quality grows slowly with income growth. Apparently, most of the increases in household income and ability to pay are offset by rises in prices (Rodwin, 1961, p. 2). However, this casual observation that income gains are wiped out by cost increases is often coupled with an argument that the housing market functions imperfectly. We argued earlier that prices could rise with income and wipe out income gains even if markets function properly, and our results support this. We specified the supply side to allow for a long run bottleneck, yet we found no evidence for one. Since we

could not test for all possible types of imperfections, our results should not be considered definitive. Nonetheless we find that even in the absence of the type of imperfections hypothesized, the total development elasticity of housing quality is low.

NOTES TO CHAPTER VI

(1) In the text we will test the model using $\ln(\text{DEBRAT})$ in Appendix D we discuss the results obtained when alternative variables are used.

(2) In Appendix D we have re-estimated Equation (2) with $\ln(\text{MDEBRAT})$ instead of $\ln(\text{DEBRAT})$ in a Two Stage Least Squares (2SLS) estimation. The coefficients similar to the ones obtained in the OLS estimation with $\ln(\text{MDEBRAT})$ and are similar to the OLS estimation of Equation (2) when $\ln(\text{DEBRAT})$ is used. This confirms that DEBRAT is a valid proxy for MDEBRAT.

(3) This version of the equation was also estimated OLS because the endogeneity test indicated no endogeneity bias. For details, see Appendix D.

(4) The elasticity using MDEBRAT instead of DEBRAT are almost identical (see Appendix D).

(5) This can be seen by noting that total investment expenditure is equal to:

$$\text{STOK}_i * \text{MSQDW}_i * \text{COSTMSQ}_i$$

Other cross country regressions used this entire term (divided by GDP)

as the dependent variable whereas we estimated equations for these terms separately.

(6) Quality is measured here by the average housing space.

VII. CONCLUSIONS

In this thesis, we set out to explore the determinants of housing investment. But the motivation of the study was the policy issue of how governments can intervene to alleviate the serious housing problem facing many countries. Looking into the housing problem, one realizes that among the observers who concur that a problem does exist there is considerable disagreement as to the exact nature of the housing situation and the reason for dissatisfaction with it. Government officials are concerned that there is an insufficient number of units to meet the needs of the population. Others argue that while nearly everyone is able to find a home, large numbers of households must be satisfied with dwellings of unacceptably low quality. Neither the administrative nor the ethnographic view states explicitly why they consider the conditions over which they argue constitute a problem.

While designing our empirical work so that policies to remedy different types of housing problems could be evaluated, we also tried to find out which of the views of the situation is more accurate. For this purpose, we assembled two independent data sources, official housing production statistics and census data. After weighing the merits and demerits of the two, we concluded that census data was the more accurate source. Examining that data, we concluded that there is little evidence that the aggregate shortages that government publications are wont to declare actually exist: the number of dwellings matches the number of households quite closely. Casual observation

also provides much evidence to support this conclusion.

Besides ascertaining which view of the housing situation was the correct one, we pursued the issue further to uncover the reason for the misconception of the situation. We considered it worthwhile to examine the origins of the shortage view of the housing situation, because this view is so widespread among policymakers and even among scholars. We attributed inaccurate perception of the problem by the government to reliance on house production statistics that are biased. Because they require that housing meet unrealistic standards to be counted, these statistics cannot take into account low quality housing production. To some observers, widespread low quality in housing may be the very crux of the problem, yet official statistics neglect to look at it or count it.

Besides generating biased statistics, unrealistic housing standards and the values that underlie them, favor the formulation of policy that may be both unworkable and ineffective. More specifically, one can calculate the amount of resources necessary to satisfy needs for new housing at an acceptable level of quality. We did so and found that they are out of line with what could be mobilized within a reasonable time frame, let alone what is immediately available. But because somehow these standards are considered of value in and of themselves, no matter how unrealistic, when policy is retailored from the desirable to the achievable, only the size of programs and not the substance is changed. This results in what we call "a lot for a few" policies. We then suggested that it is quite likely that these policies will be

less effective than would be expected because while momentarily altering the housing outcome, they do not affect the mechanism generating future outcomes, and this mechanism might well counteract the policy.

In our econometric work, we wanted to examine whether public housing policies, and some other policies such as subsidies or provision of mortgage finance have or would have an effect on housing investment. We divided housing investment into two components: the number of units and the meters squared per unit. The divergence of views as to the nature of the housing problem, one emphasizing the quantity of units and the other their quality, indicates that any explanation of housing investment useful for policy formulation must treat quantity and quality separately. Of course, the average surface area of new dwellings is only a very crude measure of quality, and further research should be devoted to studying the variation of other quality attributes. The reason we did not treat quality in more detail was the lack of data comparable across countries. The efforts the United Nations has made to standardize the measurement of dwelling space have borne fruit, now a similar effort should be made for other quality dimensions.

Regarding the demand for new units, we found that this was determined uniquely by demographic variables. Also, on the supply side there was no effect of the quantity of units on price. Given the values of the point estimates of the parameters (elasticity with respect to new household formation close to one) we conclude that there is no shortfall in the additions to the housing stock, just as there

was no shortage in the existing housing stock. Thus all the evidence we have uncovered in this thesis indicates that perceiving the housing situation as characterized primarily by an aggregate deficit of dwelling units is incorrect. If there is a problem, it lies in the low quality of the housing that must suffice for so large a portion of the population.

We have a number of results that indicate how policy can affect quality, as reflected in space. Income and price were both significant in the determination of demand for space. However the elasticities of demand with respect to these variables were both less than one. This suggests that making housing cheaper would have a positive effect on the quality of housing consumed, but such policies are not likely to be able to change price enough to drastically alter the quality of houses people will choose to buy. The low income elasticity of demand and low total development elasticity indicates that as a country becomes richer the quality of housing will improve, but this process is likely to unroll quite slowly.

Public housing construction is not significant in either the determination of the size of new dwellings or in the number of new units. This finding is evidence that misconceptions as to the nature of the housing situation do matter. Construction of proper housing should be an effective remedy if there is a shortfall in private production. But suppose people can find themselves a home, so that all demands are satisfied at going prices, and in equilibrium almost all families have dwellings. Yet many families simply cannot afford a

decent home. If this is the case the problem cannot be remedied by producing more good houses. Giving a family a home worth more than they can afford does not change the fact that at the prices reigning in the market, such a home is more than they would buy themselves and they may trade it in the housing market for other consumption. Our results suggest that families may respond in just this fashion when they receive public housing.

Mortgage finance appears to have a positive but small effect on the demand for space in new housing. Our guess is that the effects of easier housing finance might be much greater if finance were made available to the lower income classes. As it is now, finance policies are often implemented in a "template" spirit, this means they are only available for construction satisfying fairly rigorous standards which only the relatively well off can meet. Again it is clear that over-emphasis on meeting high standards may be encouraging policy that does not attack the most pressing problem, the low quality of housing that the poor can afford. Financing standard housing may marginally increase the number of standard dwellings but if one wants to help those living in the worst conditions, financing even substandard housing for the poorest families could significantly improve their living conditions.

In our study of the supply of new housing we found no evidence for a long run bottleneck. Thus it appears that the mechanism by which short run bottlenecks are eliminated is effective, though this conclusion is quite tentative. The data for the supply side estima-

tion were admittedly crude and further work in this area should be undertaken. Detailed case studies for a few countries might shed more light on this question. In any case, though our work suggests that long run bottlenecks are insignificant, this does not imply that the same is true for short run bottlenecks or that policy action against short run bottlenecks is not warranted.

Our supply analysis, for lack of data, neglected the price of land in determining housing investment. Again until internationally comparable data on the price of residential land is available, this factor can only be examined in the context of case studies. But some attention to this would be worthwhile because land prices are potentially quite important and could cause bottlenecks in the long run.

In evaluating all the results one must be mindful of an important simplification made throughout. We studied the determination of an average measure of quantity and quality and did not look at the distribution that generated these averages. There are two main weaknesses in this approach. First, a number of distributions of different size new homes give the same figure for the average surface per home that we used, yet the desirability of these alternative configurations may differ considerably. Second, averages ignore the spatial distribution of housing and of demographic variables. We could not verify if regional housing investment was responding properly to migration and differential rates of population growth. Some detailed surveys might indicate whether neglect of these regional factors would change our results significantly.

The overall thrust of our work is that housing investment, particularly in terms of units produced, but also to some extent in terms of the quality of these units, is quite insensitive to most policy instruments. Effecting sizable changes in aggregate housing investment may be impossible because one simply cannot change the policy instruments to the extent required. Without policy intervention, income growth may only bring improvements very slowly. This insensitivity of housing demand to a number of policy variables is not so surprising when one considers the primacy of housing among a family's needs. For such an important expenditure item, marginal changes in the constraints are unlikely to alter household decisions drastically. This very essentiality of housing is quite consistent with the finding that the housing problem is not too few dwellings but too many low quality dwellings. People find the means to acquire something as crucial as shelter. But the constraints of the market and of income distribution may make the solution they find unsatisfactory in many ways. An implication of all this for policy is that perhaps the focus should be turned away from aggregate variables such as units produced or even size. Policy might be more effectively directed to facilitating the acquisition of just those quality features that individual households find most difficult to provide for themselves, such as utilities, roads, and waste disposal. The demand for them might be considerably more sensitive to policy intervention than the demand for housing space.

To conclude, if the goal of policy is to create more equality in housing conditions, then the standard policies may not help. Ine-

quality of housing is the product of inequality in the distribution of income and wealth. The rookeries of Victorian London did not disappear because of the efforts of the five percent philanthropists nor because of the incessant slum clearance drives. The housing conditions of the poor only improved after the Dock strikes of 1889, when labor started to organize. It is only around 1914, when the War effort geared the economy to full employment, that the rookeries vanished and the work houses emptied. Housing conditions, like nutrition, health, and education conditions can only be made more equal when household incomes become more equal.

APPENDIX A

DATA SOURCES

In this appendix, we will first discuss the general rules we used in gathering the data. Then we will give a variable by variable description of the data sources.

A. General Rules Applied for the Assembly of Data

1. The data were assembled by using first the data available in the latest edition of any source.
2. When necessary, we referred to earlier editions of the source. In all cases, we used the most recent of these earlier editions in which the necessary data appeared.
3. Data from more recent sources often differ from those of earlier sources, because mistakes have been corrected or because definitional changes have been made. When there was an overlap of at least one year between sources the whole series was smoothed by adjusting the data from the earlier sources using a linked index.

B. Data Sources

COLD: A measure of cold

SOURCES OF DATA: for all countries except Belgium.

Ruffner and Bain. The Weather Almanac 1977, for

Belgium, Conway. The Weather Handbook, 1963. We used an

average of extreme cold temperatures (ET) for the main cities of each country. Because we had to take the logarithm of COLD we had to avoid negative numbers. We raised the "zero" level to 64 (because 64°F, for Panama, was the highest minimum) and then changed all signs from negative to positive. $COLD = (ET-64)$. As a result of this transformation the larger the number the colder the climate.

COSTMSQ: Construction cost per meter squared

SOURCES OF DATA: We used the same U.N. sources and the same procedure as for MSQDW except that to calculate costs we divided a 6-year average of the total value of residential construction by a 6-year average of total meter squared produced.

However for a few countries the U.N. data had to be completed from other sources:

BELGIUM: The price per housing unit found in Royaume de Belgique, Institut National de Statistique, Statistiques de la Construction et du Logement, various years, was divided by the MSQDW.

BRAZIL: The time series of construction cost was constructed from the construction cost in 1970 found in Giberga, M.R., Housing and Urban Development in Latin America: Comparative Construction Costs in Latin American Countries, 1973, and a construction

cost index found in World Bank, Latin American and the Caribbean Regional Office, Brazil: Human Resources Special Report, 1979.

CHILE: Data from U.N. sources were completed from: U.S. Congress, Senate Committee on Banking, Housing and Urban Affairs, Study of International Housing, June 28, 1978 and from Giberga 1973, op. cit.

FRANCE: The data from U.N. sources were completed with data from: Ministère de l'Équipement et de l'aménagement du territoire, Direction du Bâtiment et des Travaux Publics et de la Conjoncture, Bureau des Enquêtes sur le Marché du Bâtiment. Enquête sur la commercialization des logements neufs, 1977.

NETHERLANDS, SWEDEN and UNITED KINGDOM: Data for 1960 were obtained from United Nations, Secretariat of the Economic Commission for Europe. Housing Costs in European Countries, 1963.

DEB: The value of the outstanding housing mortgage debt (issued through the financial sector).

SOURCES OF DATA: All data were collected from country sources. (The level of mortgage outstanding was measured at the time of the last census year used to calculate STOK.)

AUSTRALIA: From Reserve Bank of Australia: Statistical Bulletin: Financial Flow Accounts Supplement,

various years and from a personal communication from Mr. Shane T. O'Donohue, Finance Section, Research Department of the Reserve Bank of Australia.

BELGIUM: From Krediet Bank, Bulletin Hebdomadaire, 1975, and from a personal communication from Mr. W. Janssens, Afdelingsdirecteur, Kredietbank, N.V. Brussels.

BRAZIL: From Fundacao Getulio Vargas Conjuntura Economica, 1979. (These data were comparable to more disaggregate data found in Banco Central do Brazil. Boletim do Banco Central do Brasil, various years.

CANADA: From Central Mortgage and Housing Corporation, Canadian Housing Statistics, 1978.

CHILE: From Banco Central de Chile. Boletim Mensual. various years.

COLOMBIA: From Banco de la Republica. Revista del Banco de la Republica, various years.

COSTA RICA: From Banco Central de Costa Rica. Boletim Estadistico, various years.

DENMARK: From Danmarks Nationalbank. Reports and Accounts for the year 1976 and previous years.

EGYPT: From the Joint Housing Team for Finance. Housing Finance in Egypt, 1977 (those data were comparable to the data available in: International Monetary Fund, Arab Republic of Egypt: Recent

Economic Developments, 1977.)

FINLAND: No data available.

FRANCE: From Institut de la Statistique et des études économiques. Annuaire Statistique de la France, 1978.

GERMANY (W): From Deutsche Bundesbank. Monthly Report, various years.

GREECE: From Hellenic Republic. Monthly Statistical Bulletin, various years.

JAPAN: From Bank of Japan, Economic Statistics Monthly, various years, and Bank of Japan, Economic Statistics Annual, various years. In Japan employers provide a large portion of housing finance. According to our definition such financing would be classified as non formal. Data are only available for a few firms (Goldberg, 1971).

NETHERLANDS: From a personal communication from Mr. H.H. van Wijk, Chief Domestic Research Department, De Nederlands Bank, Amsterdam.

NEW ZEALAND: From Reserve Bank of New Zealand, Bulletin, various years.

NORWAY: From Norges Bank, Economic Bulletin, various years.

PANAMA: From United States, Agency for International Development, Panama Shelter Sector Assessment, 1977.

PHILIPPINES: No data.

SWEDEN: From Sveriges Riksbank. Statistical Appendix to the Annual Report, various years.

SYRIA: No data.

UNITED KINGDOM: From United Kingdom, Annual Abstract of Statistics, various years.

UNITED STATES: From U.S. Department of Housing and Urban Development. Housing and Urban Development Trends, 1977.

VENEZUELA: From Banco Central de Venezuela. Revista del Banco Central de Venezuela, various years.

YUGOSLAVIA: National Bank of Yugoslavia. Quarterly Bulletin, various years (includes small amounts for "communal development").

ΔDEB: The change in the value of the outstanding housing mortgages.

SOURCES OF DATA: Same sources as DEB. ΔDEB is used to calculate the marginal debt to value ratio (MDEBRAT). Because the divisor is the value of the change in the housing stock between censuses, ΔDEB is calculated by subtracting the level of outstanding mortgages at the time of the earlier census from the level at the time of the later census. Because ΔDEB requires more data than DEB the following countries are excluded: in addition to those excluded for DEB: Chile, Panama, Sweden, Yugoslavia.

ΔPUB: Production of public housing between census years. (We have included all public dwellings, for rent or sale, regardless of the income class they were built for.)

SOURCES OF DATA: For most countries: United Nations. Yearbook of Construction Statistics, various years, and for European countries United Nations, Economic Commission for Europe. Annual Bulletin of Housing and Building Statistics for Europe, various years.

For a few countries it was necessary to complete the data from additional sources.

BELGIUM: From Royaume de Belgique, Ministère des Travaux Publics. La politique du Logment en Belgique, 1976.

CANADA: From Central Mortgage and Housing Corporation, Canadian Housing Statistics, various years.

GREECE: Papaioanno. E. Katoikia Sten Hellada, 1975.

PANAMA: From a personal communication from Mr. Earl Kessler of the U.S. AID mission to Panama.

UNITED STATES: From U.S. Department of Housing and Urban Development. Statistical Yearbook, various years.

ΔSTOK: The change in the number of units in the housing stock between census years.

SOURCES OF DATA: Please see STOK.

GDPCAP: Gross Domestic Product (GDP) per capita.

SOURCES OF DATA: Calculated from GDP at current market prices and population figures found in: International Bank for Reconstruction and Development, World Tables, 1976. For each country the GDPCAP was calculated for the last year of the census interval used for Δ STOK data.

HHS: Household size.

SOURCES OF DATA: Calculated from the total number of population and the total number of households.

The population figures were obtained from: International Bank for Reconstruction and Development, World Bank Tables, 1976 and 1978 and household data from the United Nations Compendium of Housing Statistics, various years. For a few countries it was necessary to glean household and population data from country sources.

COLOMBIA: Household and population figures for 1973 were obtained from Republica de Colombia. XIV Censo Nacional de Poblacion y III de Vivienda 1973: Muestra de Avance Resumen de los Departamentos, 1977.

VENEZUELA: The number of households in 1971 was obtained from Republica de Venezuela. Anuario Estadistico, 1973.

In addition, because of missing data we had to make the

following assumptions:

EGYPT: Since the household data were not available for 1964 we assumed HHS was the same as 1960.

UNITED KINGDOM: Number of households in Northern Ireland for 1961 are missing. We calculated that number of assuming that the average growth rate of the number of households in Northern Ireland between 1961 and 1966 was the same as the average rate for England, Wales and Scotland over the same period.

MORINT: The interest rate on Mortgaged housing loans.

SOURCES OF DATA: All data were collected from country sources. (The interest rates are six year averages with last year coinciding with the year of the last census used in the calculation of STOK.)

AUSTRALIA: From Reserve Bank of Australia. Statistical Bulletin; Financial Flow Accounts Supplement, various years.

BELGIUM: From Association Belge des Entreprises Hypothequaires. Rapport du Comité Central a l'Assemblée Generale du 21 juin 1977, Brussels, Belgium.

BRAZIL: For Brazil we have added the yearly monetary correction which is applied to the principal to the nominal interest rate on loans. The monetary correction was obtained from Fundacao Getulio

Vargas. Conjuntura Economica, 1979, and the nominal interest rate from World Bank. Brazil: Human Resources Special Report, 1975.

CANADA: From Bank of Canada. Bank of Canada Review, 1976 and 1978.

CHILE: No data available.

COLOMBIA: From a personal communication by Professor Fernando Jimenes, Universidad de Los Andes, Bogata, Colombia.

COSTA RICA: From Banco Central de Costa Rica Boletin Estadistico, various years.

DENMARK: From Danmarks Nationalbank. Reports and Accounts for the year 1976 and previous years.

EGYPT: From the Joint Housing Team for Finance. Housing Finance in Egypt, 1977.

FINLAND: No data available.

FRANCE: From Institut de la Statistique et des études économiques, Annuaire Statistique de la France, 1978.

GERMANY (W): From Deutsche Bundesbank. Monthly Report, various years.

GREECE: Bank of Greece. Monthly Statistical Bulletin, various years.

JAPAN: From Bank of Japan. Economic Statistics Annual, 1975, various years.

NETHERLANDS: Centraal Bureau voor Statistiek.

Maandstatistiek Financiewezen, 1978.

NEW ZEALAND: From Reserve Bank of New Zealand.

Bulletin, various years.

NORWAY: Only one year (1969) was available from

Norges Bank, Economic Bulletin, 1969.

PANAMA: Personal communication from Mr. Earl Kessler
of the U.S. AID mission to Panama.

PHILIPPINES: No data.

SWEDEN: From Sveriges Riksbank. Statistical Appendix
to the Annual Report, various years.

SYRIA: For only one year (1970) from U.S. Congress,
Senate Committee on Banking, Housing, and Urban
Affairs. Study of International Housing, June 28,
1971.

UNITED KINGDOM: From United Kingdom. Annual Abstract
of Statistics, various years. Interest rates refer
to building societies only.

UNITED STATES: From U.S. Department of Housing and
Urban Development. Housing and Urban Development
Trends, various years.

VENEZUELA: From a personal communication from
Professor Hugo Manzanilla, Universidad Central de
Venezuela, Caracas.

YUGOSLAVIA: From a personal communication by Boris

Pleskovic, Department of Urban Studies and Planning,
M.I.T.

MSQDW: Meter squared per dwelling

SOURCES OF DATA: For European countries: United Nations Economic Commission for Europe. Statistical Survey, various years; for other countries except Canada: United Nations. Compendium of Housing Statistics, various years; and for Canada, Central Mortgage and Housing Corporation. Canadian Housing Statistics, 1979. The figures for Canada referred only to dwellings financed under the National Housing Act.

Our intent was to use only data for "dwelling completed," when those were not available we used data from "starts" statistics and when those were not available either, we used data on "authorised dwellings".

We obtained MSQDW by dividing 6-year averages of total meter squared of completed dwellings by 6-year averages of total units produced (less than years were used in cases of missing observations). The six years were chosen to coincide with the last six years of the census interval we used to calculate Δ STOK.

When housing production was expressed in cubic meter rather than square meter we divided the cubic meter figure first by 4. This figure is an average cubic meter per square meter calculated from data of

countries which reported production both in cubic meters and square meters.

For France the data available from United Nations sources were completed from: Ministère de l'environnement et du cadre de vie, Direction des Affaires Economiques et Internationales. Statistiques de permis de construire en 1975 and 1976 date réelle, and from: Ministère de la Construction, Bulletin Statistique, various years.

NOMGRO: The nominal growth rate of the Gross Domestic Product.

SOURCES OF DATA: Calculated from GDP at current market prices found in International Bank for Reconstruction and Development, World Tables, 1976. NOMGRO is a 6-year average with the last year taken to coincide with the year of the last census used to calculate Δ STOK.

NONRESCON: The value of nonresidential construction.

SOURCES OF DATA: From United Nations, Yearbook of Construction Statistics, various years.

OFF: Official figures on the number of dwellings produced between census years.

SOURCES OF DATA: United Nations. Compendium of Housing Statistics, and the U.N.. Yearbook of Construction Statistics, various years.

To obtain the total dwelling production between census year we omitted the production during the first year of the interval and instead included production

during the last year. Because of official production figures increase over time this caused a slight overestimate of R (the ratio of official units produced to the change in the housing stock).

For some countries it was necessary to complete the U.N. data from national sources.

COSTA RICA: For 1963-1967: Republica de Costa Rica.

Anuario Estadistico de Costa Rica, various years.

JAPAN: For 1970, Empire of Japan. Japan Statistical Yearbook, 1978.

VENEZUELA: For 1961-1964, the data came from a personal communication from Professor Hugo Manzanilla at the Universidad Central de Venezuela in Caracas and for 1965 from Republic de Venezuela. Boletin Mensual de Estadistica, 1965.

YUGOSLAVIA: For 1965-1971, Socijalistika Federativna Republika Jugoslavia, Statisticki Godisnjak Jugoslaviji, 1975.

POPGRO₋₂₀: The rate of population growth twenty years before the base year.

SOURCES OF DATA: All data were collected from the United Nations. Demographic Yearbook, various years.

We calculated a 5-year average population growth rate and chose the last year to be twenty years before the year of the last census used to calculate Δ STOK

(usually 1970).

STOK: The number of units in the housing stock.

SOURCES OF DATA: The United Nations. Compendium of Housing Statistics, various years, except for Colombia. the 1973 figure which came from Republica de Colombia. XIV Censo Nacional de Poblacion, 1977.

APPENDIX B

CALCULATION OF GROSS NATIONAL PRODUCT (GNP) FIGURES FOR
CZECHOSLOVAKIA, HUNGARY, AND POLAND

Because GNP figures are not directly available from the United Nations, other data sources were used to calculate them separately. The procedure used, which is the same for the three countries, was suggested by Dr. Thad Alton of the Research Project on National Income of East European Countries in New York. A GNP series was constructed from a GNP index (found in U.S. Congress, Joint Economic Committee, 1970, p. 230), and an estimate of GNP in current U.S. dollars for 1965 provided by Dr. Thad Alton. We assumed that our GNP estimates were not significantly different from the true GDP and used the former to calculate Cross Domestic Product per Household (GDPHH) and Gross Domestic Product per Capita (GDPCAP).

APPENDIX C

A REVIEW OF THE STATISTICAL RESULTS OBTAINED BY BURNS AND GREBLER
IN THEIR WORK ON THE DETERMINANTS OF HOUSING INVESTMENT

In this appendix, we will discuss in some detail, the empirical results of Burns and Grebler (1977). We have chosen to examine their work in more detail than other work cited in Chapter II because it is the most recent empirical work in the area of cross country analysis of housing investment, and it has received a great deal of attention. We wanted to try to duplicate their results using our two sets of data, official housing production figures and census measures of the change in the housing stock. We also analyzed their results for robustness to certain details of the specification.

First, we will attempt to duplicate their results. The data was taken from the same sources as those used by Burns and Grebler (for details, please see Note 1 in this appendix). The sample was also the same except for the Grand Duchy of Luxemburg. It was impossible to include this observation because there was a discontinuity between 1967 and 1968 in the residential construction data. In general, for the earlier period our t-statistics and R^2 are lower than in Grebler and Burns' results while for the later period ours are higher (see Table C1). The time-series cross section estimation yielded results comparable to Grebler and Burns as well. (Please see Table C2.)

Because there is no prior knowledge of the signs of the dependent variable in the regression proposed by Burns and Grebler a two-tailed

Table: C-1 Comparison of estimated parameters, regressions of the share of housing investment in GDP (H_t) on the GDP per capita (Y_{t-n}), growth rate of population (g_{t-n}), and the ratio of the urban population growth rate to the national population growth rate (u_{t-n})

Independent Variable	Earlier Period (5)		Independent Variable	Later Period (6)		Independent Variable	Short Lag (7)	
	Burns and Grebler (2)	Our Estimates (3)		Burns and Grebler (2)	Our Estimates (3)		Our Estimates	
Intercept	1.87 (n.r.)	2.93 (2.62)f	Intercept	2.80 (n.r.)	2.93 (2.94)c	Intercept	1.74 (1.43)	
Y_{t-7}	52.38 (4.64)ac	46.72 (3.21)c	Y_{t-6}	38.14 (3.95)ac	40.74 (4.09)c	Y_{t-2}	47.41 (3.91)c	
$(Y_{t-7})^2$	-0.0164 (-3.38)ac	-0.0157 (-2.53)f	$(Y_{t-6})^2$	-0.01215 (-3.53)ac	-0.0118 (-3.46)c	$(Y_{t-2})^2$	-0.0133 (-3.24)c	
g_{t-7}	-0.730 (-1.39)e	-1.041 (-1.54)	g_{t-6}	-0.315 (-1.57)e	-0.838 (-1.19)	g_{t-2}	-0.294 (-0.34)	
$(g_{t-7})^2$	0.239 (2.19)ef	0.233 (1.55)	$(g_{t-6})^2$	0.047 (0.60)	0.145 (0.80)	$(g_{t-2})^2$	0.093 (0.42)	
$(u_{t-7})^2$	0.77 (3.46)ac	0.061 (2.10)f	$(u_{t-6})^2$	0.005 (1.14)	0.062 (1.37)	$(u_{t-2})^2$	0.061 (1.11)	
R^2	0.61	0.47	R^2	0.51a	0.57	R^2	0.45	
F	10.95a	5.60a	F	7.09a	8.44a	F	5.33a	

KEY: (t-statistics are between brackets, below the coefficients) (4)

a: significant at the 0.01 level in a one-tailed test

b: " 0.05 " " " "

c: " 0.01 " two-tailed "

d: " 0.05 " " " "

e: " 0.10 " one-tailed "

f: " 0.10 " two-tailed "

(n.r.) = not reported

Table: C-2 Comparison of estimated parameters, regressions with pooled cross-section time series sample of the share of housing in GDP (H_t) on the GDP per capita (Y_{t-n}), growth rate of population (g_{t-n}), and the ratio of urban population growth rate to the national growth rate (u_{t-n}).

Independent Variable	Pooled Sample (8)	
	Burns and Grebler (2)	Our Estimates (3)
Intercept	1.90 (n.r.)	3.03 (3.47)c
Y_{t-7} or 6 (8)	47.76 (7.22)ac	42.10 (5.47)c
$(Y_{t-7}$ or 6) ²	-0.0149 (-5.75)ac	-0.0126 (-4.36)c
g_{t-7} or 6	-0.385 (1.92)ef	-1.06 (-2.37)f
$(g_{t-7}$ or 6) ²	0.141 (2.76)ac	0.214 (2.12)f
$(U_{t-7}$ or 6) ²	0.074 (3.8)ac	0.063 (2.82)c
R^2	0.546a	0.505
F	17.75a	14.31a

(n.r.) = not reported

KEY: (t - statistics are between brackets, below the coefficients) (4)

a: significant at the 0.01 level in a one-tailed test

b: " 0.05 " " "

c: " 0.01 " two-tailed "

d: " 0.05 " " "

e: " 0.10 " one-tailed "

f: " 0.10 " two-tailed "

rather than a one-tailed test, some of t-statistics which were significant in Burns and Grebler's one-tailed test are no longer significant. Because Burns and Grebler did not justify the lags they used, seven years for the earlier period and six for the later period, we tested whether their results were robust to a change in the lag. By combining the data set for the earlier and later periods we shortened the lag to two years (4). The results with this shorter lag gives coefficients of Y and Y^2 similar to those of the other regressions, but these are now the only significant coefficients. The three other variables, g , g^2 and n^2 are not significant (see table C1).

Burns and Grebler used official housing investment data. We have attempted to replicate their results using two sets of data. The first is the official number of dwellings produced times the officially measured unit cost. ($H = OFF * MSQDW * COSTMSQ$). This is quite similar to the national income accounts data used by Burns and Grebler. The second is the annual average change in the housing stock times the officially measured unit cost ($NH = \Delta STOK * MSQDW * COSTMSQ$). As we have shown in Chapter 3, the official dwelling production figures are less reliable than the stock increase figure calculated from census results.

The results of the regression are shown in Table C3 (the source of the data used for each variable is discussed in Appendix A). The results using the official production figures (H) are similar to the results obtained by Burns and Grebler.

The Y (GDP per capita) and Y^2 terms and the u^2 (urban population

Table: C-3

Regression Results: Ratio of housing investment (H and HN) on income per capita (Y) population growth rate (g), ratio of urban population growth rate and national population growth rate (u).

Dependent Variable \ Independent Variable	H, Official number of units produced times official unit cost divided by GDP per capita	HN, Change in stock time official unit cost divided by GDP per capita
Intercept	1.14906 (0.96)	0.0471 (0.04)
Y	0.002466 (3.43)c	0.00109 (1.43)
Y ²	-0.00000047 (-2.82)d	-0.00000028 (-1.54)
g	-0.8127 (-0.92)	1.2529 (1.34)
g ²	0.2160 (0.98)	0.0133 (-0.57)
u ²	0.05934 (2.08)f	0.09773 (3.229)f
R ²	0.79	0.70
F	12.90a	8.166a

KEY: (t - statistics are between brackets, below the coefficients)

a: significant at the 0.01 level in a one-tailed test

b: " 0.05 " " "

c: " 0.01 " two-tailed "

d: " 0.05 " " "

e: " 0.10 " one-tailed "

f: " 0.10 " two-tailed "

growth rate divided by national population rate) are significant but the g (population growth) and g^2 are not. When the net housing investment divided by GDP (NH) is used for the dependent variable only u^2 is significant.

The fact that Burns and Grebler's specification of the housing equation is neither robust to the data source, particularly to what we feel is a superior data source, nor to the lag structure, is an indication that their specification is simply not a suitable explanation of the determinants of housing investment.

NOTES TO APPENDIX C

(1) The data for the attempted replication of the results obtained by Burns and Grebler in their work on the determinants of housing investment was assembled as follows. (The general rules mentioned in Appendix A were taken into account.)

H, the share of the value of residential construction in gross domestic product (GDP) was obtained by dividing the sum of residential construction for each period by the sum of GDP for the same period.

The data for residential construction were obtained from the United Nations. Yearbook of National Accounts, 1978.

However, some problems were encountered:

- For Costa Rica and Switzerland, the available data were for all construction. We assumed that 30% of all construction is residential construction.
- For Luxemburg, there is a discontinuity in the data between 1967 and 1968 without overlap. There is, thus, no way to build a linked index to smooth the data series.
- For the Philippines the data for residential construction for 1963 and 1965 were missing. However, the data for all construction were available. It was assumed that for those years the percentage of residential construction in all construction was the same as in previous years.
- The data for residential construction for Spain were missing for the years 1966 and 1967. The series was completed by

assuming a constant growth rate between 1965 and 1968.

- The data for residential construction for Venezuela were missing for the years 1963, 1966 and 1967. The series was completed by assuming the same growth rate as between 1964 and 1965.

The data for GDP were obtained from the IBRD World Tables, 1976. g, the population growth rate and the rate of population increase in cities of 100,000 or more necessary to calculate u, the urbanization rate coefficient, were obtained from Kingsley Davis. World Urbanization, 1969.

(2) Burns and Grebler's sample included 39 countries: Australia, Belgium, Bolivia, Canada, Chile, Colombia, Costa Rica, Denmark, El Salvador, Finland, France, Germany (West), Greece, Honduras, Iceland, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Kenya, Korea (South), Luxemburg, Malta, Netherlands, Norway, Panama, Philippines, Portugal, Puerto Rico, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, United Kingdom, United States (Burns and Grebler, 77, p. 91).

(3) Our sample comprises 38 countries: those used by Burns and Grebler minus Luxemburg.

(4) Burns and Grebler stated that there is only one chance in ten that the true difference is not zero if the t value is 1.309 or greater and one chance in a hundred if that value is 2.446 or greater (ibidem, p. 33-36). However, because there is no a priori reason to be confident

about the signs of the coefficient a two-tailed test is the appropriate one here. Thus, for a 90% level of confidence that t should be greater than 1.892 and for a one percent level the t should be greater than 2.733. Burns and Grebler had 33 degrees of freedom, but since we excluded Luxemburg we only have 32 degrees of freedom. Hence, the critical value of the t -statistics at a 90% confidence level is 1.694 and at a 99% confidence level the critical value is 2.739.

(5) 1963-1966 for the dependent variable, 1955-1950 for the independent variables.

(6) 1967-1970 for the dependent variable, 1960-1965 for the independent variables.

(7) We combined the data for the dependent variable for the earlier period with data for the independent variables for the late period. We used data for H in 1963-1966 with data for y , g and u for 1960-1965.

(8) The pooled cross section time series sample is assembled by merging the data set for the earlier and later estimates (see Table C1). Because those two data set have different lags, 7 years for the earlier and 6 for the later, the lags structure for the pooled sample is 7 or 6 years.

APPENDIX D

HYPOTHESIS TESTING ON ALTERNATIVE DEMAND SPECIFICATIONS

In this appendix we will test the use of MDEBRAT, AVINT and MORINT as substitutes for DEBRAT to measure the effect of formal housing finance on the demand for dwelling space. The specification of the demand equation using DEBRAT was tested in Chapter VI.

For each replacement of DEBRAT by an alternative variable we will use the same procedure as used in that chapter. We will first test the system of equations for endogeneity bias, if there is such a problem we will re-estimate the equation which is biased with 2SLS (the test we use is fully described in Hausman, 1978, p. 1251-1271). If no endogeneity bias exists the OLS estimates are acceptable. When we replace $\ln(\text{DEBRAT})$ with $\ln(\text{MDEBRAT})$ in Equation 2 (see Chapter VI) the test statistics for Equation 2 and 3 are larger than the critical value of χ^2 statistic at the 0.95 level of confidence and we can thus reject the null hypothesis that there is no endogeneity bias. The results of the test are shown in Table D1. We are then obliged to re-estimate Equation 2 and 3 with 2SLS. The results are found in Table D2 and D3. In both cases the coefficients and the t-statistics are robust to change from OLS to 2SLS. The coefficient found in Table D2 and D3 are similar to those found in Tables 6.3 and 6.4. This indicates that our results are robust to the use of $\ln(\text{DEBRAT})$ instead of $\ln(\text{MDEBRAT})$.

Next we will replace $\ln(\text{DEBRAT})$ in Equation 2 by $\ln(\text{AVINT})$. The results of the endogeneity bias are found in Table D4. Since the

Table: D-1 Results of tests of endogeneity (replacing ln (DEBRAT) in Equation 2 by ln (MDEBRAT)).

<u>Equation Number (1)</u>	<u>Variables Suspected to be Endogenous</u>	<u>Test Statistic</u>	<u>Critical Valve of χ^2</u>
1	PUBRAT DEBRAT	0.43	5.99
2	ln (COSTMSQ) ln (PUBRAT ln (MDEBRAT)	20.17	7.81
3	ln (PUBRAT ln (CONRAT)	10.83	5.99

(1) Refers to number given to the equation on page 132.

Table: D-2

Regression Results: Meter squared per dwelling (MSQDW) as a function of Gross Domestic Product per household (GDPHH), cost per meter squared (COSTMSQ), cold (COLD), the ratio between the number of public units produced and the growth in the stock (PUBRAT), the household size (HHS), and the ratio of the increase of outstanding mortgages to the value of the increase in the dwelling stock (MDEBRAT), estimated both 2SLS and OLS.

Dependent Variable \ Independent Variable	ln (COSTMSQ)	
	OLS	2SLS
Intercept	5.3066 (2.42)d	5.3454 (2.43)d
ln (GDPHH)	0.3609 (1.97)	0.3580 (1.95)
ln (COSTMSQ)	-0.5565 (-2.27)	-0.6513 (-2.19)
ln (COLD)	-0.3178 (-1.62)	-0.3275 (-1.65)
ln (PUBRAT)	-0.0412 (-0.80)	-0.0453 (-0.86)
ln (HHS)	-0.0403 (-0.05)	0.0875 (-0.11)
ln (MDEBRAT)	0.2530 (2.58)d	0.2427 (2.42)d
R ²	0.81	-
F	5.03b	-
Number of Observations	14	14

KEY: (t-statistics are between brackets, below the coefficients)

- a: significant at the 0.01 level in a one-tailed test
- b: " " 0.05 " " " "
- c: " " 0.01 " " two-tailed "
- d: " " 0.05 " " " "

Regression Results: The cost of dwelling construction per meter squared (COSTMSQ) as a function of Gross Domestic Product per household (GDPHH), a measure of cold (COLD), the ratio between the number of public units produced and the growth in the stock (PUBRAT), and the ratio of all construction and the Gross Domestic Product (CONRAT)

Dependent Variable Independent Variable	ln (COSTMSQ)	
	OLS	2SLS
Intercept	-0.6339 (-0.42)	-0.5945 (-0.39)
ln (GDPHH)	0.5306 (2.95)d	0.5322 (2.96)d
COLD	0.00561 (1.24)	0.00570 (1.26)
ln (PUBRAT)	0.0287 (0.40)	0.0368 (0.50)
ln (CONRAT)	-0.1592 (0.46)	-0.1392 (-0.40)
R ²	0.72	-
F	5.84b	
Number of Observations	14	14

KEY: (t-statistics are between brackets, below the coefficients)

a: significant at the 0.01 level in a one-tailed test
b: " 0.05 " " "
c: " 0.01 " two-tailed "
d: " 0.05 " " "

Table: D-4 Results of tests of endogeneity (replacing ln (DEBRAT) in Equation 2 by ln (AVINT)).

<u>Equation Number (1)</u>	<u>Variables Suspected to be Endogenous</u>	<u>Test Statistic</u>	<u>Critical Value of χ^2</u>
1	PUBRAT DEBRAT	1.50	5.99
2	ln (COSTMSQ) ln (PUBRAT) ln (AVINT)	1.18	7.81
3	ln (PUBRAT) ln (CONRAT)	5.12	5.99

(1) Refers to number given to the equation on page 132.

three test statistics are smaller than the critical value of the χ^2 statistic at the 0.95 level of confidence, we cannot reject the null hypothesis that there is no endogeneity bias. Therefore there is no need to re-estimate the system with 2SLS and the OLS estimation found in the second column of Table 6.3 is thus valid.

We repeated the endogeneity test replacing $\ln(\text{DEBRAT})$ this time with $\ln(\text{MORINT})$. The results of the test are found in Table D5. Again there is no need to re-estimate the system with 2SLS and the OLS estimation found in the first column of Table 6.3 is thus valid.

Table: D-5 Results of tests of endogeneity (replacing ln (DEBRAT) in Equation 2 by ln (MORINT)).

<u>Equation Number (1)</u>	<u>Variables Suspected to be Endogenous</u>	<u>Test Statistic</u>	<u>Critical Valve of χ^2</u>
1	PUBRAT DEBRAT	1.09	5.99
2	ln (COSTMSQ) ln (PUBRAT)	4.19	5.99
3	ln (PUBRAT) ln (CONRAT)	5.13	5.99

(1) refers to number given to the equation on page 132.

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