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Determinants of Residential Housing Starts

S. Christopher Baird

Eastern Illinois University

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DETERMINANTS OF

RESIDENTIAL HOUSING STARTS
(TITLE)

BY

S. CHRISTOPHER BAIRD

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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CHAPTER 1

INTRODUCTION

[1]The market for residential housing is among the most
volatile in existence. Since 1948, the annual number of con-
ventional housing starts has ranged from a low of 1,172,800
recorded in 1966 to a high of 2,048,000 units started in 1971.
In fact, in 1971, the housing industry produced 600,000 more
units than were produced in 1970 -- an increase of 40 per cent
in a single year! This was not a one-time phenomenon. Much
the same thing occurred between 1949 and 1950 when the annual
number of conventional housing starts increased nearly 500,000
units, and again in 1955-1956 when housing starts decreased
300,000 units. Figure 1 traces this erratic behavior through
the years 1950-1971 (peak to peak).

The erratic nature of the housing market is attributable
to the interaction of a great many economic and demographic
stimuli. In later chapters, this study will attempt to iden-
tify and measure the most important of these factors. Natur-
ally, a history of the period being considered must precede
any further discussion.

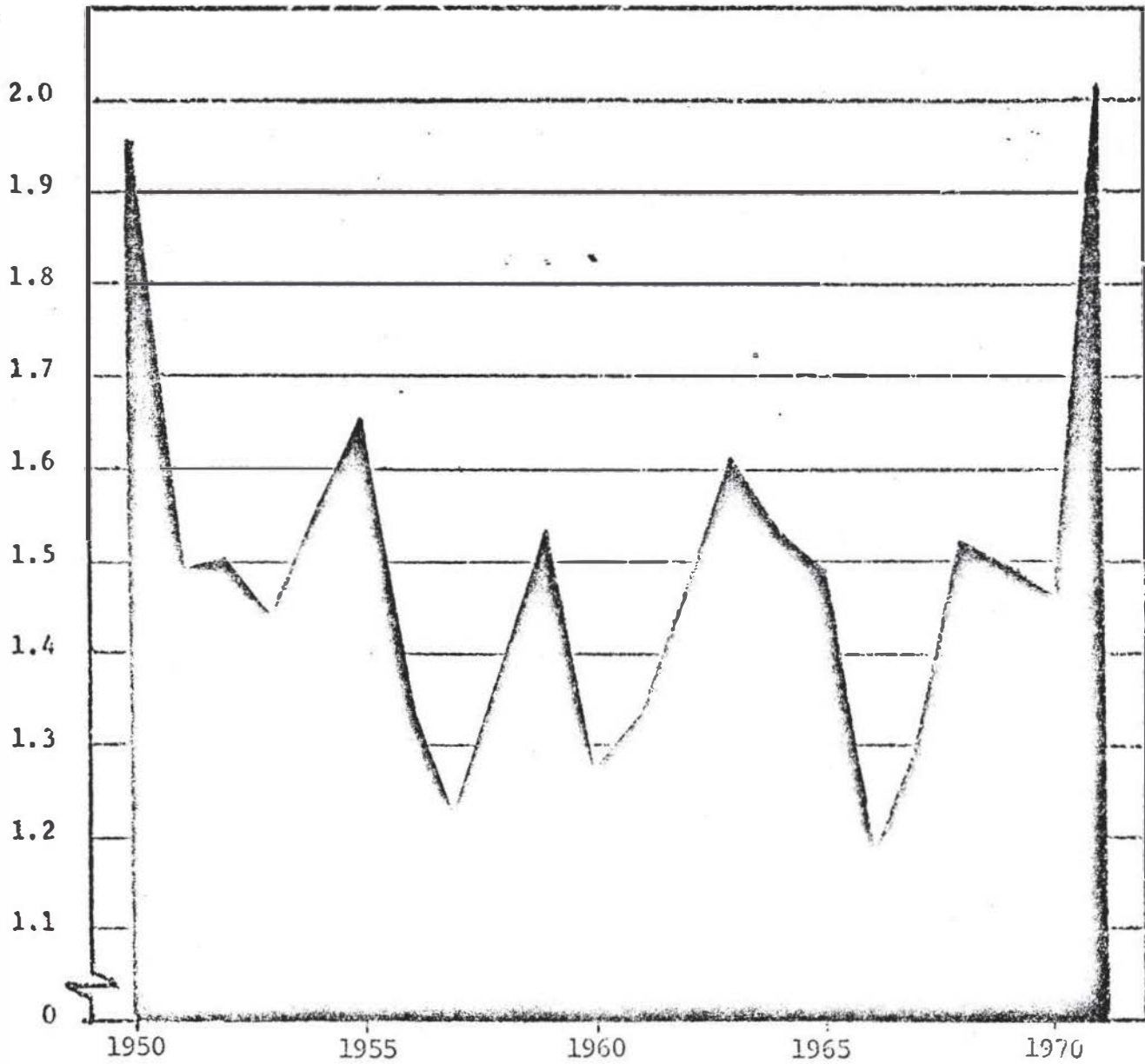The History 1948-1971 - An Overview.

During World War II, home construction naturally fell

_____

[1]The following statistics were taken from the 1970 HUD
Statistical Yearbook, United States Department of Housing and
Urban Development, Washington, D.C.: Government Printing
Office, 1971, pages 306, 307.

FLUCTUATIONS IN RESIDENTIAL HOUSING STARTS

Source: U.S. Department of Commerce, Bureau of the Census

to a very low level as national resources were diverted to defense related industries. There was little need for additional housing anyway, for the war postponed the marriage plans of many. When the war ended, the inevitable occurred. In 1946, nearly 2,300,000 couples marched to the altar -- a record number of marriages that has not yet been surpassed despite a tremendous increase in the population of young adults. Marriages continued at a very high rate through 1949. In total, during the period 1945-1949, nearly 9,300,000 couples were united.[1]

However, in these post war years, new household formations were averaging only 60% of all marriages.[2] The fact that many returning veterans had never before been factors in the housing market makes this ratio surprisingly low. What was occurring was a process referred to as doubling; that is a situation in which two or more families combine to form a single household. Many factors contributed to this development. First and perhaps foremost was the lack of adequate available housing due to the low level of home construction during World War II.[3] Secondly, the returning veteran

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[1] These statistics were taken from Vital Statistics of the United States 1969 and from Vital Statistics Monthly Reports Washington, D.C.: Government Printing Office, 1970, pages

[2] Statistical Abstract of the United States 1971. United States Department of Commerce; Bureau of the Census, Washington, D.C.: Government Printing Office, 1971, pages 36 and 60.

[3] Ibid, page 668.

usually had very little in savings, had the more immediate
problem of securing employment, and simply could not afford
to rent or purchase a home and the furnishings that are
essential.

A third and very important factor was developed by
Jack M. Guttentag in The Short Cycles in Residential Construc-
tion and demands detailed discussion.[1]

Doubling is usually considered only a temporary solu-
tion to one's need for shelter and this indeed seemed to be
the case in post-war America. As the economy expanded and
the birthrate increased, the country began to "undouble".
Demand for housing was substantial, but the industry re-
sponded slowly to this new demand. Between 1947 and 1950,
the annual number of new housing starts increased only
443,000 -- far too slow a rate to satisfy demand.[2]

Why did the housing industry respond so slowly to
such a large increase in demand? The answer lies in the
surge that was occurring in other sectors of the economy.
The rationing that had been necessary during the war had re-
sulted in a great deal of pent-up demand for consumer goods.
People wanted automobiles, refrigerators, stoves, and other
products denied them during the war years. (And, it might
be added, during the Great Depression, these goods were

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[1]Jack M. Guttentag, "Short Cycles and Residential
Construction", American Economic Review, June, 1961, pages
275-298.

[2]1970 HUD Statistical Yearbook, page 53.

beyond the purchasing power of most consumers.) Industry responded to this demand to the extent that expenditures on non-residential construction and durable equipment increased 250 per cent from 1945 to 1948.[1] The factors of production, (labor, materials, and funds) were "consumed" by industry. There was little left for the housing market. This relationship will be pursued in detail later, and will assume an important role in the housing model.

In 1949, however, economic expansion slowed temporarily and expenditures for plant and equipment decreased considerably. This development freed many factors of production and some moved into the housing market where demand was still high. As a result, in 1950, the housing boom that seemed inevitable, finally occurred. Expansion in the housing industry was so great that the volume of starts recorded in 1950 was not approached for the next twenty years. The housing boom helped to stimulate the economy and emphasis swung back to other sectors in 1951.

Throughout the Fifties and the early Sixties, marriages and household formations remained at relatively low levels. The totals for both of these important components of demand for housing were generally about 60 per cent of the 1946-1950 average.[2] The housing industry remained relatively stagnant

[1] Business Conditions Digest,

[2] Statistical Abstract of the United States 1971, page 36.

during this period. Even when homebuilding "peaked", as it did in 1955, 1959, and 1963, the 1950 total was not even remotely in danger of being surpassed.[1]

It was during this period that a great many changes in American lifestyle took place, and many of these changes had a vital effect on the housing industry. Steady increases in personal income contributed to a higher standard of living and led to the growth of suburbia. The majority of new homes constructed during this period was placed in the suburbs. This trend is still evident today as builders find the suburbs to be the most lucrative markets. The average suburbanite is younger and wealthier than his city dwelling counterpart. As a result, the inner cities' critical housing needs are very often neglected.[2]

While lifestyle changes determined where new housing units would be placed, the very high birthrate of the Fifties determined that a great deal of new housing would be needed to meet future demand.[3] In 1965, the post-war baby boom that had caused overcrowding in schools and then universities, began to come of age. As massive quantities of young adults moved into the housing market, net accumulative household

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[1] 1970 HUD Statistical Yearbook, page 53.

[2] "This Lopsided Housing Boom", Forbes, November 1, 1971, pages 28-36.

[3] Vital Statistics of the United States, page 1.

formations began to outdistance net additions to the nation's housing stock.[1] (See Figure 2).

Again, as in the 1945-1949 era, the nation's economy was expanding rapidly and thus, the limited factors of production in the construction industry were funnelled primarily into non-residential construction. As a result, conventional housing starts lagged -- apparently not responding to increased demand.

How then, were these new households being sheltered? Although documentation is nearly impossible, doubling did not seem to be prevalent as it had been in the post-war era.[2] Young couples were wealthier and family ties weaker than they were in the late Forties. This gap between demand and supply was largely filled by mobile homes. In recent years, the mobile home industry has grown tremendously.[3] From 1965 to the present, mobile home shipments have been increasing at a 15 per cent to 20 per cent annual rate; 465,000 were purchased in 1971, a 110 per cent increase over the number purchased in 1966. If consumers are purchasing mobile homes as permanent or even semi-permanent residences, there is indeed a danger of over-estimating unmet demand for con-

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[1]Statistical Abstract of the United States 1971, pages 36, 60.

[2]Sherman Maisel (in "A Theory of Fluctuations in Residential Construction Starts") agrees that doubling is not as prevalent as it once was.

[3]The following statistics were computed from raw data found in the 1970 HUD Statistical Yearbook, pages 310-311.

CUMULATIVE HOUSEHOLD FORMATIONS
VS.
THE NATION'S HOUSING STOCK

MILLIONS OF UNITS

Figure 2
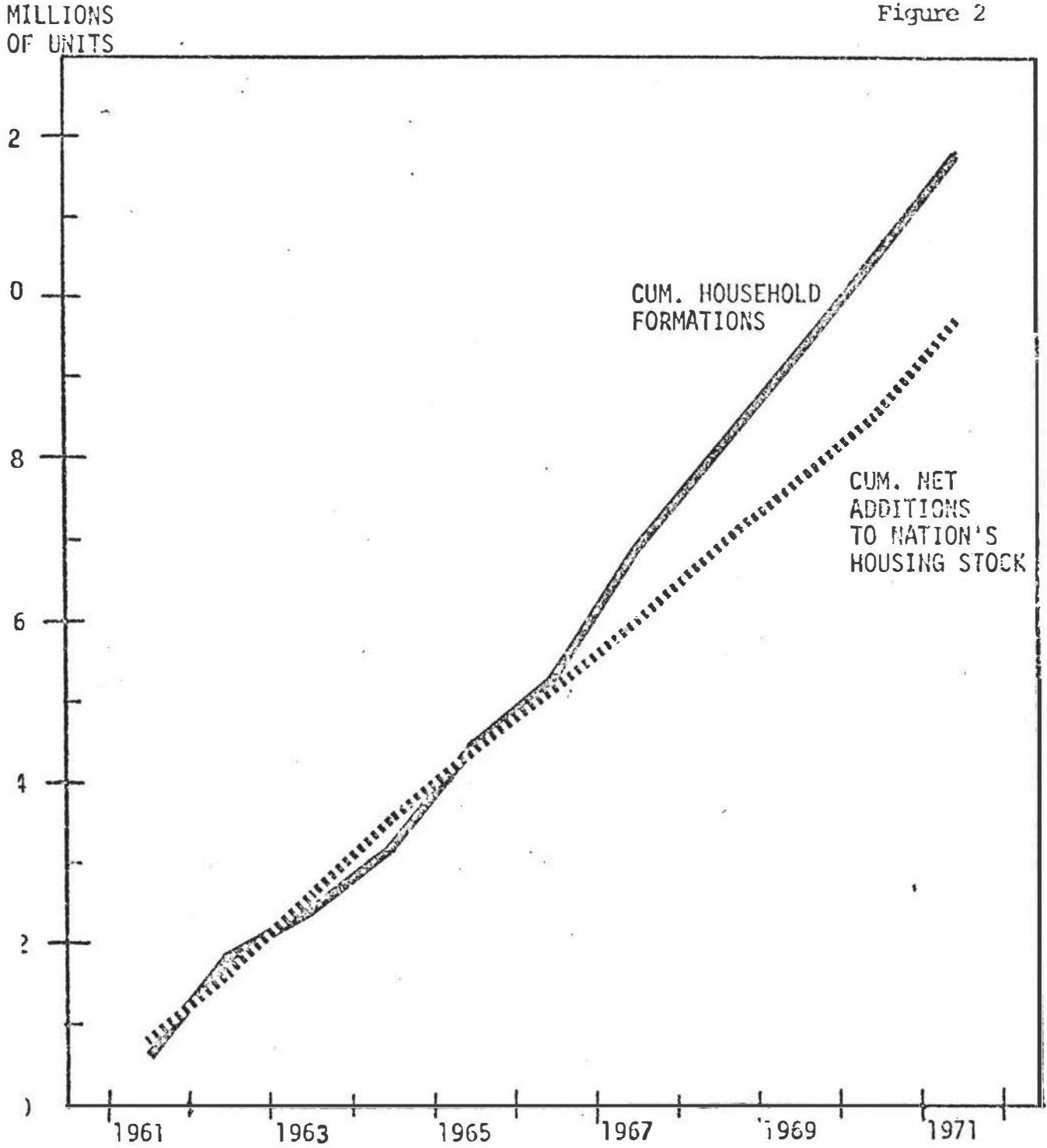
Source: U.S. Department of Commerce, Bureau of the Census

ventional housing in the Seventies. Thus, it seems obvious that any study of the housing market must include the mobile home sector. To ignore this sector is to risk underestimating the relationship between household formations and housing starts.

Despite the surge in mobile home shipments, demand for conventional housing units was rising. When economic expansion stalled in the latter part of 1969 and into 1970, factors of production in construction were once again released to the housing industry. As a result, in 1971, the largest housing boom in the history of the United States took place.[1]

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[1]1970 HUD Statistical Yearbook, page 53

CHAPTER 2

THE PROBLEM

There has been much written on the housing market. No matter what the state of the economy, housing always seems to be in the news. In the late 1960's, economists and business-men spoke of a "severe housing shortage." More recently, the Government officials have emphasized the 1971 housing boom and how it would stimulate other sectors of the economy. The importance of the housing industry to our overall economic welfare is well recognized. The nature of housing (causes behind the market's volatility) is not.

There are models of the housing market that have been developed primarily for forecasting for which statistical testing has yielded very significant results. However, this type of analysis has one major shortcoming. Such models often incorporate variables which are merely symptomatic of other stimuli of a more direct causal nature. These may be excellent forecasting tools, but do not explain the nature of housing.

Some theories have shown a great deal of insight into the relationship between housing and the rest of the economy. J. M. Guttentag advanced a very interesting theory in The Short Cycle and Residential Construction but offered very little empirical evidence in support of his hypothesis.

The major problem is to hypothesize an accurate relation-
ship of housing to the economy and then to empirically test
the hypothesized relationship. The complexity of the housing
market makes this a very difficult task and may account for
the relative absence of such studies.

AIMS

As stated in the introduction, the aim of this study
is to identify and measure the effects of each of the most
important determinants of housing starts. This paper will
also deal with a number of other issues. First, and perhaps
foremost, will be an attempt to empirically test a concept
which states that housing is countercyclical in nature.
Most economists and businessmen are cognizant of the fact
that when the economy declines, the housing industry general-
ly expands.

> "Construction declined during the late
> stages of the expansion in general
> business and ended its decline in late
> 1948 and mid 1953, declined throughout
> most of the two brief recessions in
> 1948-9 and 1953-4, and was a stabili-
> zing influence during the 1957-8 reces-
> sions." [1]

In dealing with this element of the housing market,
this study will work with only the short cycle in construc-
tion.

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[1] Guttentag, "Short Cycles and Residential Construc-
tion", page 281.

Special emphasis will be given to the role of the demographic factors involved in the housing market. Most studies deal with such variables on a priori grounds, with very little statistical testing which would substantiate their role. Often, when demographic variables are tested statistically, the results are disappointing. It is this author's belief that the problems encountered with demographic data lie not in the method of testing but in the measure of the variables selected. Deficiencies in the selection process are discussed in the next chapter.

In addition, an attempt will be made to redefine the role of interest rates in the housing market. Most studies place a great deal of emphasis on the interest rate, and it is felt by this author that its effect on the volume of housing starts is perhaps overstated. There is some evidence that this is indeed the case. In 1971, interest rates were well above 1965-1968 levels, yet more houses were built that year than in any other year in history.[1]

This study will not attempt to show that the interest rate is unimportant, but only to explore the possibility that its impact on housing has been overestimated in previous studies. Hence, in summation, the aims of this study are as follows:

   1.   Identify and measure the effects of the principal
        determinants of housing.

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[1]Business Conditions Digest, pages 104,105

2. Empirically test, to some degree, the theory that housing is countercyclical.

3. Establish that a relationship exists between housing and demographic change.

4. Explore the possibility that the effect of the mortgage interest rate on housing starts has been overestimated.

CHAPTER 3

DETERMINANTS OF RESIDENTIAL HOUSING STARTS

"The processes which determine the rate of
construction of residential housing are
extremely complex. New construction has
to be sold in competition with existing
housing, and the market for existing
housing is split into many differentiated
subsectors by location, type of unit, type
of tenure, quality (in many dimensions)
and age. Moreover, the market for owner
occupation and rental are extremely im-
perfect. At the same time, new construc-
tion is carried on by a great many firms
of many different types."[1]

It was with this paragraph that the noted economist,

James Duesenberry, began a chapter on Investment in Housing.

Despite the length of his list of problems facing the housing

forecaster, he has really only touched upon the degree of

complexity. Those closest to the housing situation, the

builders themselves, very often do quite poorly with their

annual forecasts and only a few economists or agencies will

attempt long range projections.[2] The housing market is

just too volatile and the factors involved far too numerous.

There is, indeed, a great deal of research needed in

the housing market. Too many works are based mainly on

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[1]James S. Duesenberry, Business Cycles and Economic
Growth, (New York: McGraw Hill, 1958), page 135.

[2]W. Stastny, (President: American Builders Associa-
tion), in a speech delivered to the annual convention of the
Illinois Chamber of Commerce, 1971.

factors included on <u>a priori</u> grounds, for which there is very little statistical substantiation.

Some of the more common determinants in the housing market -- those which are discussed in nearly every study include the following list:

1. Personal Income.

2. Household Formations

3. Marriages or the marriage rate.

4. Mortgage interest rates.

5. Downpayment size.

6. Vacancies or vacancy rates.

7. Money supply.

8. Construction costs.

Personal Income

Personal income is one variable that is included almost solely on <u>a priori</u> grounds. Statistical studies indicate that income has very little effect on the volume of housing starts. Guttentag's study, for example, found that the demand for housing was quite insensitive to changes in income.[1] Still it is included in most discussions of housing starts.

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[1]Guttentag, "Short Cycles and Residential Construction", page 283.

In what ways could a change in personal income possibly affect demand for housing? A decline in income, for example, could lead to doubling or force couples to delay marriage plans and thus diminish demand. Fewer families could perhaps afford to build new homes and as a result, fewer demolitions would take place. In addition, some wealthier consumers might have to wait for more prosperous times to build a new cottage or summer home.

However, it is felt by this author that the decline in income would have to be considerable (i.e. the Great Depression) to have a real impact on the volume of housing starts. Doubling, for the most part, seems to be a thing of the past. Incomes are high enough today that most young couples can afford to buy or rent their own units. Social changes have diminished family ties considerably and doubling would in most cases be used only as a last resort. Matrimonial plans, if delayed, would probably be put off for only a relatively short period of time and thus have little, if any, impact on demand. Planned demolitions are few, Most home removals are the result of fire, flood, storms or other acts of nature.[1] In addition, those affluent enough to own a summer home are a very small minority and their impact is negligable.

It is further felt by this author that a rise in

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[1]U. S. Department of Commerce; Census of Housing, 1963 Census of Housing, Washington, D.C.: Government Printing Office. 1964.

personal income would only slightly stimulate demand. It is much more likely that increases in income would effect the types of houses being built than the level of activity. The 1971 housing boom seems to point toward this theory. Despite other economic woes, housing starts reached record levels. However, due to higher construction costs, depressed consumer sentiment and general economic belt-tightening, the average new home was smaller than that of recent years. In fact, the average 1971 home is 200 square feet smaller and much less likely to have a second bathroom or central air conditioning than 1969 or 1970 models.[1] Moreover, the volume of housing starts expands in years when other sectors of the economy, including personal income, level off or decline. Conversely, experience has demonstrated that when personal income is rising, housing starts often remain at very low levels.[2] This hardly signifies a strong positive correlation between housing starts and personal income. Thus, in conclusion, it seems that annual changes in personal income have only a marginal effect on housing starts.

Duesenberry, however, expands on this discussion and suggests that total personal income over the past fifteen years of a consumer's life, is that variable which really

---

[1]"This Lopsided Housing Boom" Forbes, November 10, 1971, page 31.

[2]Statistical Abstract of the United States 1971, page 60

effects changes in housing starts.[1] However, today most new
homeowners are relatively young, (60 per cent buy homes be-
fore reaching 35 years of age) and rely primarily on mortgage
financing.[2] It might be suggested that expected future income
has a far greater impact than does past income. There is,
naturally, the problem of measuring such a variable. There
are, however, measures of consumer confidence and future ex-
pectations. Although such a measure is certainly not perfect,
it does give some idea of what consumers expect their future
income will be. Thus, in an attempt to support the proposi-
tion that future expected income has an impact on building
activity, measures of the two variables were correlated over
a seven year period 1965 to 1972 using adjusted quarterly
data. (A four quarter moving average was used in this analysis)
Figure 3 illustrates the movement of the two variables.

The index of consumer sentiment is a gauge of con-
sumers' confidence in the nation's economy and in their own
financial futures. Since the buying plans of consumers help
to make up the index, a strong correlation between most goods
sold on the market and the index of consumer sentiment would
be expected. Yet housing is a very unique product, subject
to different pressures than are most goods. Nevertheless,

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[1]Duesenberry, Business Cycles and Economic Growth,
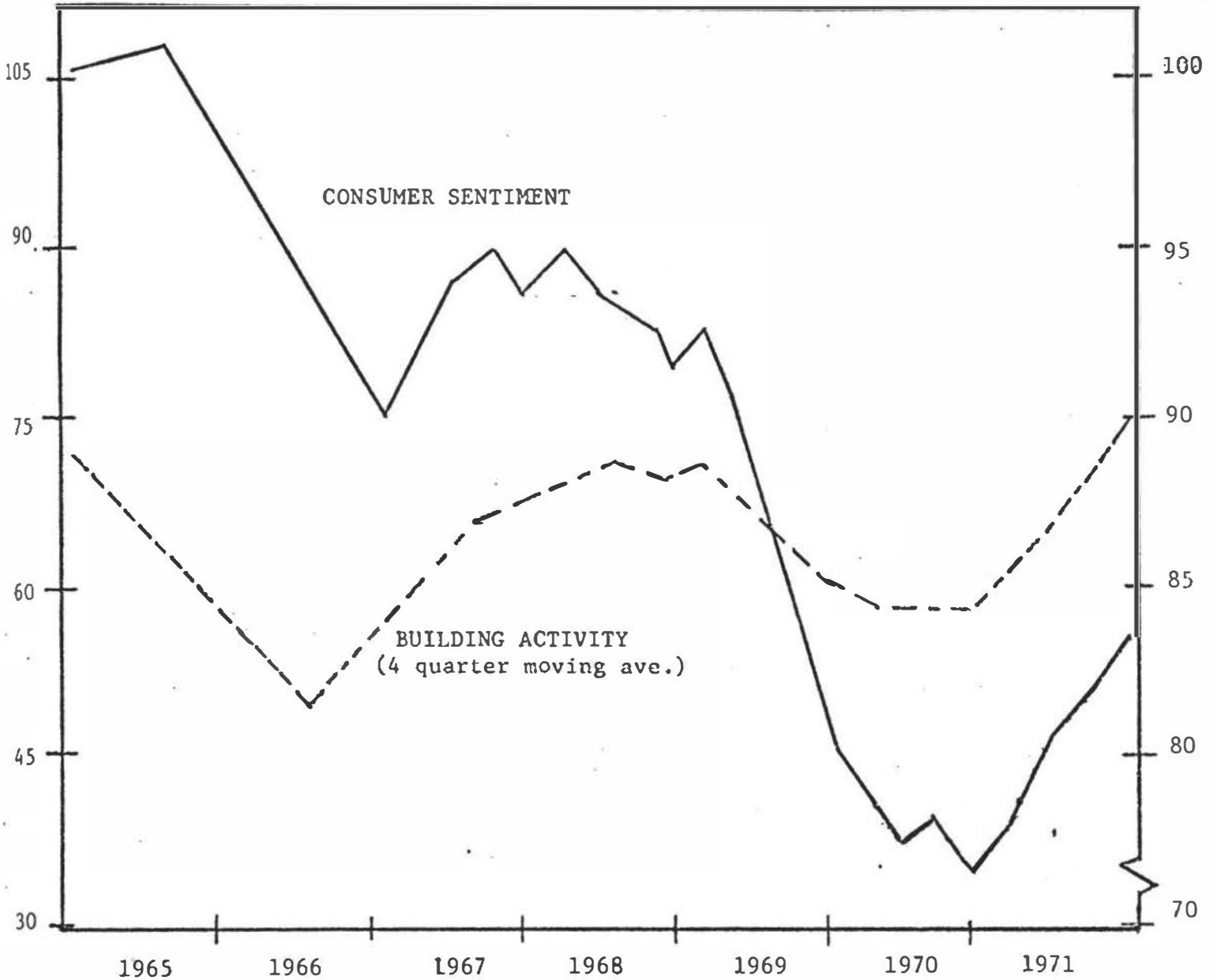pages 139-140.

[2]1970 HUD Statistical Yearbook, page 196.

CORRELATION OF CONSUMER SENTIMENT
AND BUILDING ACTIVITY

Figure 3

BUILDING ACTIVITY
(permits per 10,00 people)

INDEX OF CONSUMER SENTIMENT
(Spring 1966=100)

Pearson correlation coefficient = 0.96
Source: Business Conditions Digest and Economic Trends
           (Montgomery Ward Corporate Research Department)

the Pearson correlation, coefficient computed for building

permits and the index consumer sentiment was 0.96.[1] What

consumers expect in the future appears to affect housing

starts substantially. However, one must always remain aware

of the inherent weaknesses (already stated) in this approach.

Despite the apparent success this variable would add when

included in a model for housing, it is a very inaccurate

gauge and does not meet the assumptions of the least squares

method of testing.[2]

Household Formations

A variable measuring either household formations or

marriages is included in nearly every study of the housing

market. New household formations, on a priori grounds, would

appear to constitute a main source of demand for new housing.

But, surprisingly enough, most researchers have had very

little success in explaining fluctuations in the volume of

housing starts with this variable. In fact, Maisel states

that household formations have little effect on housing

starts.[3]

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[1]The specific index used is a combination of various
indexes which was developed for Economic Trends by the Cor-
porate Research Department of Montgomery Ward, Chicago, Ill.

[2]The assumptions of the least squares method are
stated in a later chapter. The index of consumer sentiment
is, in reality, an attitude survey. A great deal of error
may be present in such a variable.

[3]Maisel "A Theory of Fluctuations in Residential
Construction Starts", American Economic Review, Vol. 53
(June, 1963) page 374

Such results must be interpreted to mean that what certainly appears to be a main constituent of demand for housing has no impact on the volume produced. It is most alarming that researchers have not seen through the shallow absurdity that veils such logic. It is this author's opinion that Maisel and others have incorporated too limited of a measure of household formations into their models, and thus have failed to determine the true relationship between household formations and housing starts. Maisel develops and empirically tests a model where the change in housing starts of year #1 is a function of the change in the number of Year #1's household formations.[1] (Naturally other independent variables are included, but they are not pertinent to this discussion). It may certainly be true that there is little relationship between these two variables. As demonstrated earlier in this study, a high rate of marriages or household formations may not immediately transpose into increased demand for housing. Doubling could limit this process, and even more significant to today's market, mobile homes could be substituted for conventional housing. Yet Maisel includes only conventional housing starts in the dependent variable.[2]

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[1]Maisel "A Theory of Fluctuations in. Residential Construction Starts", American Economic Review, Vol. 53 (June, 1963) page 374.

[2]Ibid. page 374.

Doubling is usually only a temporary solution to the need for housing and mobile homes are sometimes used only as semi-permanent residences. Thus, to derive the true relationship between household formations and housing starts, some type of lag structure should be incorporated. In addition, the dependent variable, housing starts, should include the mobile home sector. To ignore either of these measures would risk distorting the real relationship of household formations to housing starts.

In a later section of this chapter, a discussion of the countercyclical nature of housing will be presented and the use of a lagged variable for household formations will be further justified.

Figure 4 graphically illustrates the relationship between a four year moving average of household formations and the annual number of housing starts, including mobile homes. The Pearson correlation coefficient for these two series of data is .62 -- hardly a negligible relationship.[1]

As further evidence that the relationship is indeed a strong one, it can be pointed out that the largest housing booms in history, 1950 and 1971, followed tremendous increases in household formations.[2]

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[1]This coefficient is significant at the 99 per cent level.

[2]1970 HUD Statistical Yearbook, page 190.

CORRELATION OF HOUSING STARTS AND HOUSEHOLD FORMATIONS

Thousands of Units   Figure 4

HOUSING STARTS

HOUSEHOLD FORMATIONS
(4-year moving ave.)

49   51   53   55   57   59   61   63   65   67   69   71
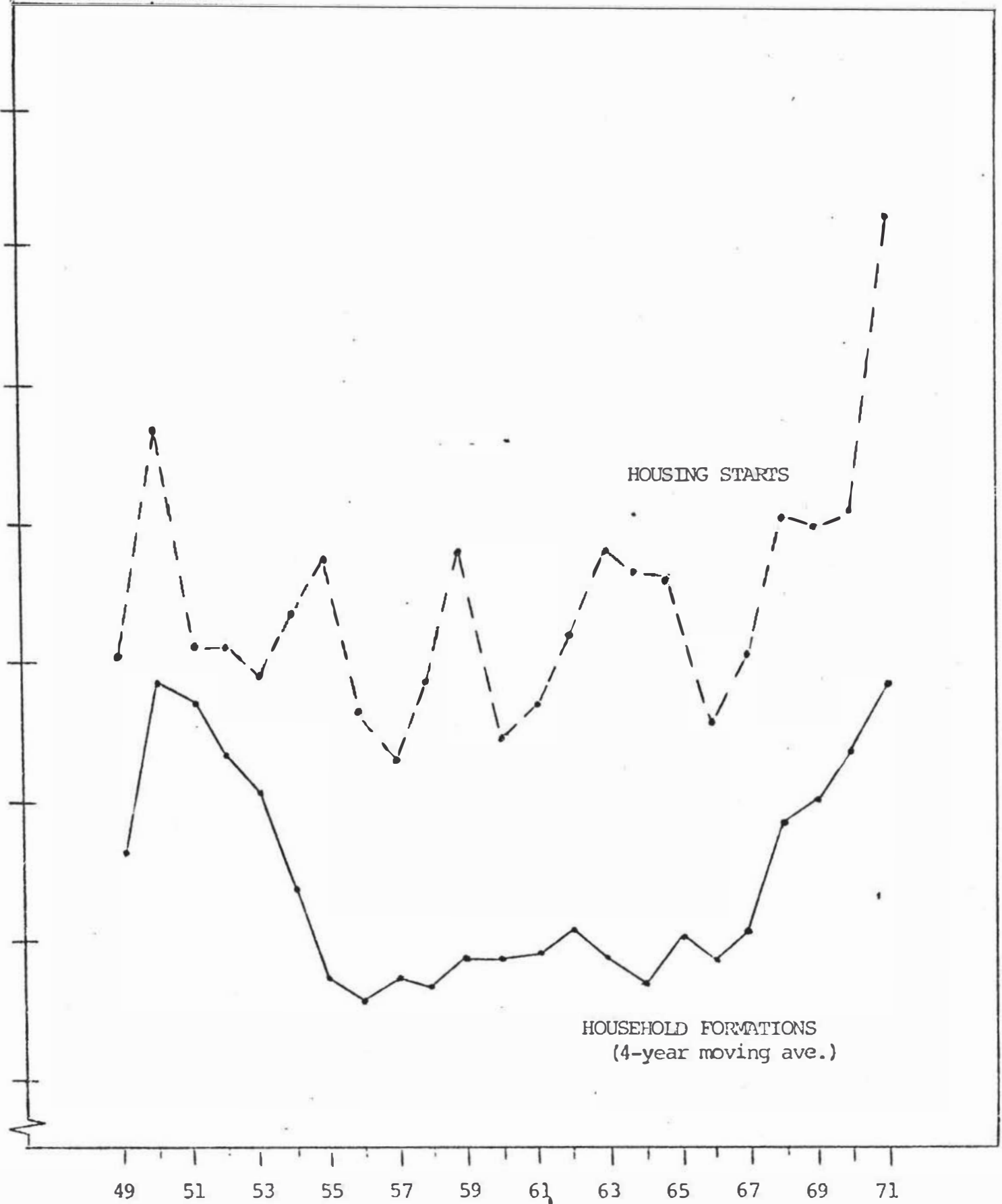
Pearson correlation coefficient = 0.62

Source: HUD Statististical Yearbook and Statistical Abstract of the United States.

Credit Terms

Guttentag states that "demand for housing is extremely sensitive to the terms on which mortgage credit is available".[1] The terms of credit involve a number of variables including the rate of interest and the size of the down-payment required. Each of these variables will be discussed in some detail.

The interest rate undoubtedly plays an important role in determining housing starts, but Guttentag may have misinterpreted its role in assuming that demand is highly sensitive to the interest rate.[2] It is this writer's belief that demand is dependent on a number of other factors and does not respond to changes in the interest rate as long as it remains below a specific maximum. (perhaps $8\frac{1}{2}$ per cent to 9 per cent) Housing models (for conventional housing starts) measure both supply and demand determinants together and thus it is extremely difficult and not really important to differentiate the effects of each. However, this issue is more than merely academic. If the interest rate has little or no effect on demand, then it's total effect on housing starts may be overstated in other studies. The impact on housing starts that is currently credited to interest rates may, for

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[1] Guttentag, "Short Cycles and Residential Construction", page 283.

[2] Ibid. page 292.

instance, be partially attributable to changes in the supply of funds available to the housing industry or the size of the downpayment required. The interest rate is highly correlated with both.

It is felt by this author that interest rates do effect the supply of housing each year. A businessman interested in constructing an apartment complex, for example, may wait for interest rates to fall before going ahead with his plans. Such properties are run as is any other business and the margin of profit naturally depends on interest paid on borrowed funds.

Further discussion of the role of the interest rate is included in the section dealing with the countercyclical nature of housing.

Downpayment

Housing usually constitutes the largest purchase in one's lifetime. Nearly all who purchase a home find it necessary to buy on a mortgage basis, leaving only the immediate financial requirement of a downpayment. There are a variety of methods from which a new homeowner may choose to finance his purchase. The federal government operates a number of agencies which aid the housing industry and the home buyer. The two most prominent are the Federal Housing Administration (FHA) and the Veterans Administration

(VA). Both of these agencies insure home loans, thus effecting a lower rate of interest (due to the fact that less risk is involved) and a lower downpayment. The VA is open only to veterans of the armed services and represents one of the lowest cost (to the purchaser) mortgages available. It was originally established to insure loans to G.I.'s in lieu of a large downpayment. The benefits available have been generally liberalized since its establishment.[1]

Since the size of the downpayment varies with the type of loan, (VA, FHA, or conventional) fluctuation in the downpayment size may not reflect a change in overall credit policy. Variation could indicate only that the share of the market taken by FHA, VA, or conventional mortgages has changed. In addition, mortgage lending has generally liberalized since the late Forties.[2] Smaller downpayments today, merely reflect the trend.

CONSTRUCTION COSTS

Like most other commodities, the cost of housing has increased a great deal in recent years. Construction costs have contributed to this rise in prices, but the cost of

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[1]Henry E. Hoagland, and Leo D. Stone, Real Estate Finance, (Homewood, Illinois: Richard D. Irwin Press, 1969), pages 506-510.

[2]Ibid, page 510

materials has not risen nearly as fast as the general price index. From 1948 to 1965, the price index for construction materials rose only 23.5 per cent, while consumer prices increased 45 per cent.[1] Remarkably enough, from 1958 through 1964, the cost of materials actually decreased slightly. Conversely, labor costs have risen substantially. The following table illustrates the rise in hourly wages in the building trades over a ten year period, 1959-69.

TABLE 1

HOURLY WAGES IN THE BUILDING TRADES

Occupation	1959	Average Hourly Earnings 1969	Per Cent Increase
Carpenters	$3.63	$5.84	60%
Brick Layers	4.04	6.14	51%
Electricians	3.81	6.10	60%
Plasterers	3.88	5.75	48%
Plumbers	3.89	6.29	61%
Laborers	2.67	4.26	59%

SOURCE: HUD Statistical Yearbook 1970

Because overall construction costs have not outdistanced other price increases, this variable has little effect on the volume of housing starts.[2]

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[1]Council of Economic Advisors, Economic Indicators, Washington, D.C.: Government Printing Office, 1970, 1965, 1960; page 26; and U. S. Department of Labor: Bureau of Labor Statistics, Construction Materials Price Index, (Washington, D.C.: Government Printing Office, 1964).

[2]Since 1945, the general price index (1967=100) has increased 116 per cent while the cost of housing has increased 101 per cent. These figures were taken from the Statistical Abstract of the United States, 1971, page 333.

The Vacancy Rate

[1]Maisel puts a great deal of emphasis on the vacancy rate as a determinant of residential housing starts. According to Maisel, fluctuations in building are primarily attributable to fluctuations in the vacancy rate. He pointed out that increases in building activity follow low vacancy rates and when the vacancy rate rises, home building declines.

This indeed seems to be a reasonable proposal. However, under closer scrutiny, a very important question arises. Does the vacancy rate cause fluctuation in residential housing starts or is it merely symptomatic of other stimuli? Vacancy rates must increase or decrease as household formations decrease or increase in proportion to the annual volume of housing starts. The vacancy rate may be a superb gauge of this relationship and appear to have a strong causal relationship with housing (a proxy variable). A significant amount of correlation does not necessarily imply a causal relationship between the dependent and the independent variables. The vacancy rate seems only to reflect changes in supply and demand and for this reason will not be included in the model.

The inclusion of the vacancy rate in any model creates

[1]Maisel, "A Theory of Fluctuations in Residential Construction Starts", pages 359-383.

yet another problem -- that of determining a "normal" vacancy rate. In a society that is becoming increasingly mobile, a certain vacancy rate is essential. Duesenberry estimates the normal vacancy rate to be about 5 per cent.[1] Yet, the vacancy rate (excluding those units withheld from the market for various reasons) has not reached 4 per cent in the last two decades.

Maisel did not really deal with the nature of housing and his analysis appears to be one of those aforementioned models developed principally for forecasting purposes. His analysis may, indeed, be highly useful for short-run forecasting.

The Availability of Mortgage Funds and The Countercyclical Nature of Housing

It has often been suggested that housing is countercyclical or at least shows a strong lead in relation to general business fluctuations. When the economy slumps, housing starts invariably increase and lead the economy toward recovery. For this reason, housing starts are included in NBER's list of leading indicators.[2]

J. M. Guttentag, however, hypothesized that housing is a "residual" commodity. The general business sector

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[1]Duesenberry, Business Cycles and Economic Growth, page 138.

[2]Business Conditions Digest, page 57.

demands a specific amount of funds, labor, and materials and the housing industry merely gets whatever remains.[1] If the remaining funds are not sufficient, demand for housing must be deferred for a time. This theoretical approach to the nature of housing suggests that it actually lags activity in the business sector. The following discussion of hypothe-sized events incorporates many of Guttentag's concepts and attempts to identify and clarify housing's role in the economy.

The construction industry has a limited amount of factors of production -- chiefly limited in funds and labor. When the economy is expanding, corporations draw heavily from this resource pool. Funds are needed to expand facilities and purchase new equipment. Carpenters, electricians, plumbers, and others in the building trades are employed in non-residential construction, putting up new corporate buildings and expanding or remodeling existing structures. Few factors of production remain for use in the housing industry. Although substantial demand for new housing may exist, much of it goes unrealized.

When economic activity slows, the "residual" left for housing increases. Faced with a decreasing profit margin, firms cut their spending: This results in less expansion of their facilities and fewer equipment expendi-tures. Funds flow out of corporate bonds and into the thrift (Savings and Loans) institutions. More money is

now available for home mortgage loans. In addition, firms may be forced to cut their work forces. Many of these newly unemployed workers find employment in the one industry that is expanding -- housing. The housing industry may now satisfy some of the unmet demand of previous years. (This buildup in demand is primarily due to new household formations -- one of the factors helping to create demand in other sectors of the economy.) As a result, housing starts increase dramatically.

At the same time the above is taking place, monetary authorities are assessing the situation and acting accordingly. Dismayed by the fall in overall production caused by the economic decline, authorities may find it necessary to ease the restraints that were implemented to slow inflation during the expansionary period. They increase the rate at which the money supply is being expanded and as a result of this and other expansionary policies, interest rates decline. Housing starts are now increasing while interest rates are falling. Thus, it seems obvious to the casual observer that housing starts are very sensitive to changes in the rate of interest. However, an important question remains. Is the increase in housing starts in response to the decline in the interest rate, or is it primarily attributable to the decline in the general business sector which has freed funds and labor for use by the housing industry?
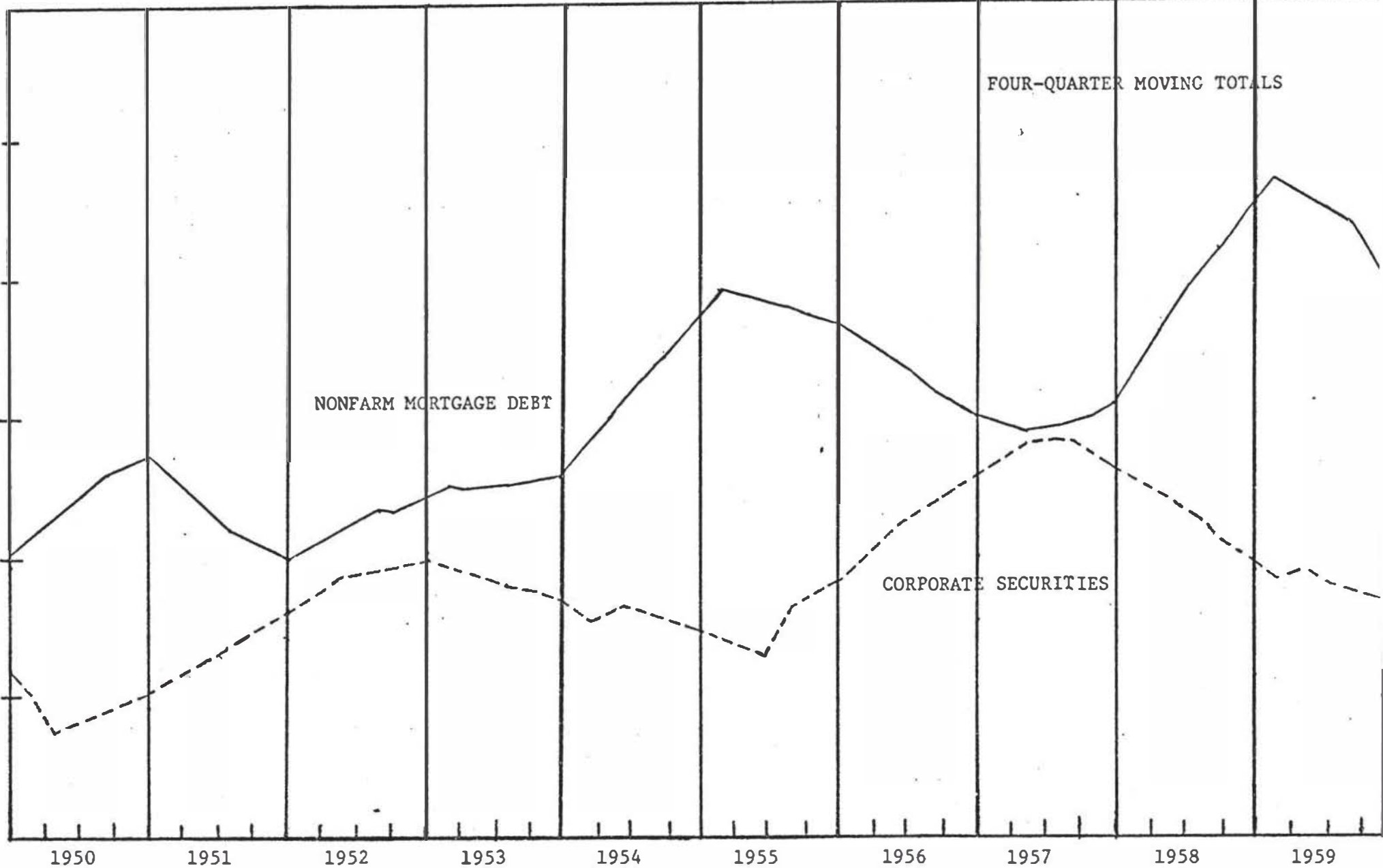
There is some evidence that the increased activity in residential construction is more attributable to the latter premise. On occasion, (1971, for example) interest rates declined relative to their peak point, but not to levels that previously existed in a period when the general business sector was expanding, while the housing starts remained at low levels. In 1971, housing boomed while interest rates fluctuated between $7\frac{1}{2}$ per cent and 8 per cent (down from a high of $8\frac{1}{2}$ to $9\frac{1}{4}$ per cent in 1970). But in the expansionary period 1967-8, when interest rates were only $6\frac{1}{2}$ to $7\frac{1}{4}$ per cent, the housing market remained stagnant.[1] Due to this evidence, it is felt that while a change in the rate of interest may further affect the housing sector, it is not the primary determinant of residential housing starts.

Guttentag hypothesized a similar chain of events (although he places a great deal of emphasis on the effects of the interest rate) and to support his theory, presented a graph depicting the relationship between non-farm mortgage debt and corporate securities.[2] (Figure 5). Although he gave no correlation coefficient, the negative correlation is obvious. Perhaps of even greater significance is the schematic illustration offered in figure 6. The value of residential construction put in place is graphed with the

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[1]Business Conditions Digest, page 104.

[2]Guttentag, "Short Cycles and Residential Construction", page 293.

BILLIONS OF DOLLARS

Figure 5

FOUR-QUARTER MOVING TOTALS

NONFARM MORTGAGE DEBT

CORPORATE SECURITIES

1950 1951 1952 1953 1954 1955 1956 1957 1958 1959

SOURCE: J. M. GUTTENTAG, SHORT CYCLES AND RESIDENTIAL CONSTRUCTION page 293

value of non-residential construction put in place and ex-
penditures for durable equipment.[1] The Pearson correlation
coefficient for the two series of data is-0.74.[2] In order
to adjust for the time lag that exists while funds and labor
move from one market to the other, expenditures on non-resi-
dential construction and durable equipment are lagged one
year. Thus, it seems that housing occupies a rather para-
doxical position in the American economic system. It is
included as a leading indicator, but there is evidence that
it actually lags activity in other sectors of the economy.

Figure 7 illustrates the time sequence of events as
hypothesized, and should further clarify the above discus-
sion.

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[1]Business Conditions Digest, page 104.

[2]This coefficient is significant at the 99 per cent
level.

CORRELATION OF RESIDENTIAL AND NONRESIDENTIAL CONSTRUCTION EXPENDITURES

BILLIONS OF DOLLARS

Figure 6

VALUE OF PRODUCERS' DURABLE EQUIPMENT AND NON-RESIDENTIAL CONSTRUCTION

VALUE OF RESIDENTIAL CONSTRUCTION
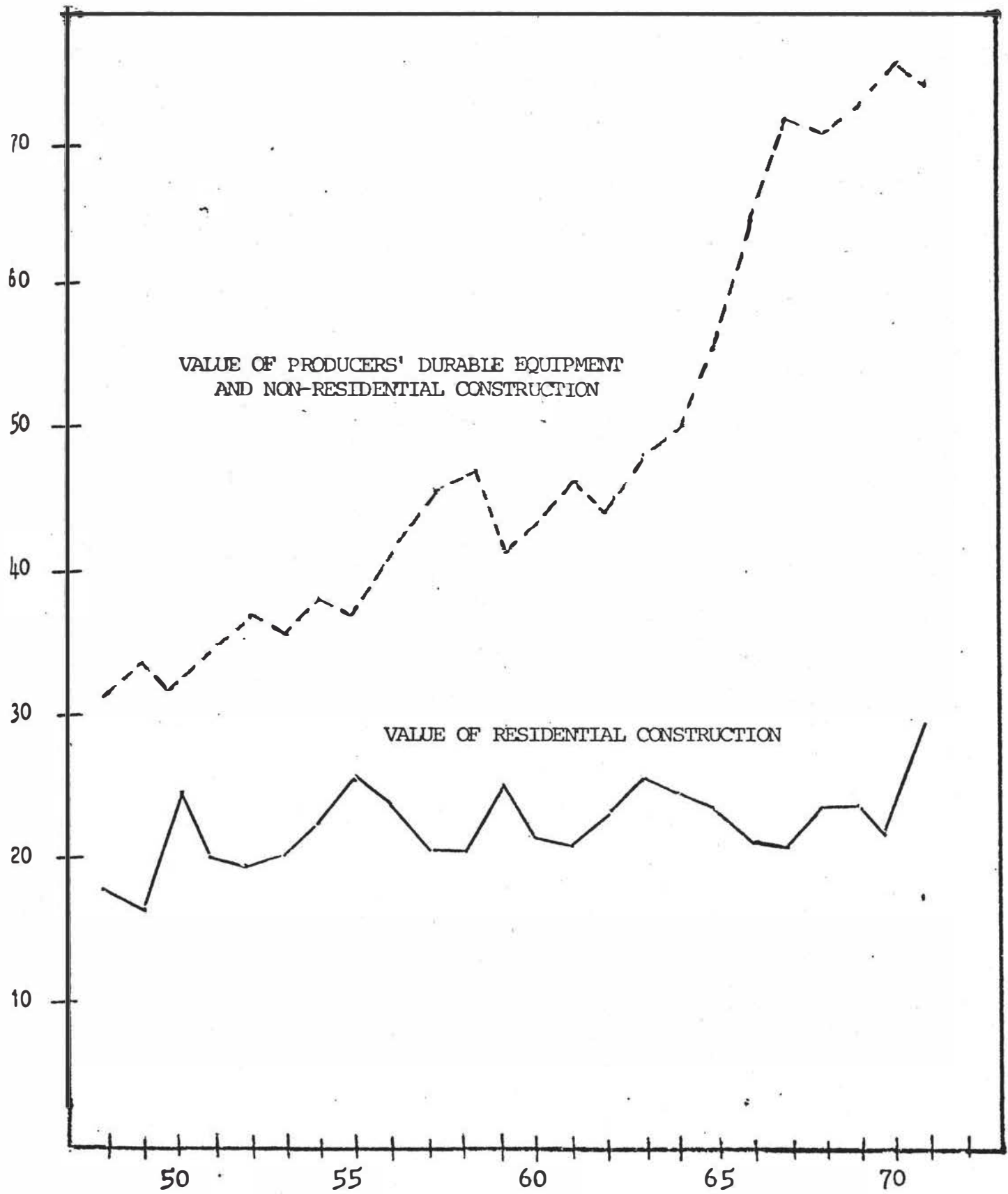
Pearson Correlation Coefficient = -0.74
Source: Business Conditions Digest, pages 104, 105.

Figure 7

CYCLICAL SCHEME OF EVENTS

ECONOMIC EXPANSION, INFLATIONARY PRESSURES PRESENT

RESIDENTIAL CONSTRUCTION STALLS

FEDERAL GOVERNMENT ADOPTS FISCAL AND MONETARY RESTRAINTS

ECONOMY SLOWS, PRODUCTION FALLS

INTEREST RATES RISE

CORPORATIONS CUT SPENDING

BUSINESS SECTOR EXPANDS, DEMANDS MORE FUNDS AND LABOR

lag   lag   lag

lag

UNEMPLOYMENT RISES, FUNDS FLOW OUT OF CORPORATE BONDS AND INTO THRIFT INSTITUTIONS

SURGE IN HOUSING, LOWER INTEREST RATES HELP ECONOMY TOWARD RECOVERY

FEDERAL GOVERNMENT EASES RESTRAINTS ON FISCAL AND MONETARY POLICY

FUNDS AND LABOR AVAILABLE FOR HOUSING

RESIDENTIAL CONSTRUCTION EXPANDS

INTEREST RATES FALL

lag

CHAPTER 4

THE ANALYSIS

METHOD OF TESTING

To derive the best possible model using the variables
discussed in the preceding chapter, a series of least squares
stepwise multiple regression analyses were computed. The
combined results of these analyses allowed for the dele-
tion of some of the least important variables and led to
the derivation of the two equations which will be discussed
in this chapter.

The least squares method of testing includes a number
of important assumptions which must be met. These assump-
tions are as follows:[1]

1. Disturbances (individual error) must have a
   random effect, their means and variances must
   be finite.

2. The mean value of the errors has an expected
   value of zero.

3. The errors must be homoscedastic, that is,
   the error term for each data point must be
   of the same variance.

4. There is no autocorrelation of error.

5. The error term must follow a normal distribu-
   tion.

6. The exogenous variable is measured without
   error and has a finite mean and variance.

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[1]Edward J. Kane, Economic Statistics and Econometrics, New York, New York: Harper and Row, 1968) pages 355-359.

SOURCES OF ERROR

Autocorrelation

One of the most common and serious problems in re-
gression analysis is autocorrelation. Autocorrelation
simply means that the error term is not an independent
random variable.[1] If the error term is serially dependent
on previous error terms, autocorrelation exists. If auto-
correlation exists, one assumption (No. 4) of the least
squares method of testing has not been met, and the valid-
ity of analysis is questionable. Transposing data to first
differences reduces, but does not completely eliminate the
possibility of autocorrelation.

The Durbin Watson statistic is a test for autocorrela-
tion. It is calculated from the residuals using this
formula:[2]

$$d = \frac{\sum\limits_{t=2}^{N} (R_t - R_{t-1})^2}{\sum\limits_{t=1}^{N} (R_t)^2}$$

R= the residual
t= the number of the observation

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[1]William C. Merrill and Karl A. Fox, Introduction to
Economic Statistics, (New York, New York: John Wiley and
Sons, 1970) page 413.

[2]Ibid., page 415

The value of the Durbin Watson statistic will not al-
ways yield conclusive results. It may fall into an indeter-
minable range where the null hypothesis (no autocorrela-
tion exists) is neither accepted nor rejected. The regions
of acceptance, rejection, and indeterminancy are indicated
in the following table:

SOURCE: Kane, Econometrics, page 367

Multicollinearity

[1]Another problem with multiple regression analysis
is the possibility that considerable correlation among the
independent variables exists. If the simple correlation

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[1]The following is drawn principally from Karl A. Fox,
Intermediate Economic Statistics, (New York, New York:
John Wiley and Sons, 1968) pages 257-259.

coefficient between two independent variables is below 0.55, multicollinearity is considered negligible and can be ignored. If it is over 0.55, multicollinearity is present. The result is that the separate effects of each of the highly correlated variables are not distinguishable.

If severe intercorrelation (multicollinearity) exists it may be possible to drop an independent variable without reducing the total R^2. If the R^2 is reduced appreciably, it is then possible to separate the effects of each variable in the original equation using the Beta coefficients (regression coefficients transposed to standard comparable units).[1]

Other Sources of Error [2]

Even though the two variables are correlated, this does not mean necessarily that a causal relationship is involved. Many correlations between dependent and independent variables are of no consequence. (i.e. heighth of those tested and scores on a test). Some factor outside the hypothesized equation may exert the causal action. For this reason, independent variables should be chosen

[1]An explanation of this analysis can be found in Robert Ferber's Techniques in Market Research, (New York New York: McGraw Hill, 1949)

[2]Much of the following discussion is taken from Kane, Economic Statistics and Econometrics, pages 355-360.

for their probable causal relationship to the dependent
variable.

Simultaneous equation bias may exist in a situation
where there are more relationships responsible for deter-
mining the dependent variable than hypothesized. In fact,
if the dependent variable exerts influence on the inde-
pendent variable(s), simultaneous equation bias is present.
In Maisel's study, for example, the vacancy rate may in-
fluence the volume starts, but in an analysis of the vacancy
rate, it may be necessary to include housing starts as an
independent variable.[1] If this simultaneous relationship
is not considered, the results may be misleading.

THE VARIABLES

A primary aim of this study was to give emphasis to
the demographic factors influencing housing and to empiri-
cally test the countercyclical behavior theory of the
housing market. Attempting both these tasks simultaneously
creates a major problem. Changes in demographic stimuli
effect changes in demand and to effectively measure the im-
pact of demand, the mobile home sector should be represented
in the dependent variable. In 1971, mobile home shipments
comprised nearly 20 per cent of the total number of housing

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[1]Maisel, "A Theory of Fluctuations in Residential
Construction Starts".

starts.[1] However, the mobile home industry does not appear
to function countercyclically: mobile home sales increased
dramatically during the prosperous period 1965 through 1968.[2]
Thus, to include a measure of mobile home shipments in the
dependent variable would better reflect the impact of demo-
graphic influence but could diminish the effect of a variable
designed to measure this countercyclical relationship.

To compensate for this factor, two equations were de-
veloped. In the first equation, the dependent variable,
housing starts, measures only conventional housing starts,
and this equation should be a better test of the cyclical
nature of housing. In the second equation, the dependent
variable includes the annual number of mobile home ship-
ments and was formed primarily to better reflect the impact
of demographic changes.

All measures of the variables selected were chosen
with care. Lag structures and moving averages were incor-
porated where they were deemed appropriate with respect to
the nature of housing. All data were calculated in first
differences (annual changes).

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[1]Council of Economic Advisors, Economic Indicators,
page 20; and the Wall Street Journal, Feb. 14, 1972, page 2.

[2]1970 HUD Statistical Yearbook, page   , Mobile
home sales have risen in most other prosperous years (1964,
1963, etc.) but not as dramatically as in the 1965-68
period.

THE DEPENDENT VARIABLE

Housing Starts

In equation #1, the annual number of privately owned conventional housing starts was used as the dependent variable. This series of data was taken from the 1970 HUD Statistical Yearbook. A single housing unit is defined by the United States Department of Commerce as:

> "a single room or group of rooms intended for occupancy as separate living quarters by a family, a group of unrelated persons living together, or a person living alone."[1]

This excludes dormitories, motels and hotels.

For equation #2, the annual number of mobile home shipments was added to the dependent variable. Mobile homes sold as campers or travel trailers were not included. Annual figures on mobile home shipments were also found in the 1970 HUD Statistical Yearbook.

THE INDEPENDENT VARIABLES

Annual Expenditures for Non-Residential Construction and Durable Equipment

This variable was included primarily as a test of the countercyclical nature of housing. The data for this series were taken from the summary tables of Business Conditions Digest. The data were adjusted to reflect 1958 dollars and alleviate the inflationary trend.

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[1] U. S. Department of Commerce; Bureau of the Census, Housing Construction Statistics 1889 to 1964, (Washington, D. C.: Government Printing Office 1966), page 9.

Figure 6 in Chapter 3 depicts a strong negative cor-
relation between this variable and the value of residential
construction put in place. Because of the strength of that
correlation, expenditures for non-residential construction
and durable equipment were expected to be a main determinant
of housing starts.

A one year lag was incorporated in order to adjust for
the time required for funds and labor to move from one seg-
ment of the market to the other. It was noted when studying
these data that nearly every time expenditures for non-
residential construction and durable equipment declined
significantly, housing starts increased the following year:
Hence, the hypothesized relationship.

Household Formations

Household formations were included as the demographic
measure. It was expected that this variable would reflect
changes in the population of young adults and the number of
marriages. (Household formations are highly correlated with
both.) A positive correlation was anticipated because de-
mand for housing should increase or decrease as the number
of households increase or decrease.

As was discussed in the preceding chapter, household
formations may not have an immediate effect on the volume
of housing starts. Therefore, a four year moving average
was developed for use in this analysis. Net household

formations may result from a variety of combinations; there is just no "normal" schematic procedure. This makes the choice of a lag structure difficult. The lag which was incorporated was selected after studying and statistically testing the relationship between the two series of data.[1]

The annual number of household formations was taken from the Statistical Abstract of the United States and for the later years, (1970, 1971), from Monthly Vital Statistics Reports. It was hoped that a much stronger relationship than was evident in other studies would be produced in this analysis, (due to the four year moving average used for this variable).

The Mortgage Interest Rate

This variable reflects the average annual rate of interest charged on conventional mortgages. It represents the price of a mortgage loan and should, as price usually is, be inversely related to the dependent variable. This series of data was taken from Business Conditions Digest.

The position that the influence of interest rates on the volume of housing has been generally overstated,

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[1]Housing starts were correlated with two, three and four year moving averages of household formations. Distributive lags were also tested. The four year moving average yielded the most significant results.

has been held throughout this study. Nevertheless, sub-stantial correlation was expected, especially in equation #1. In equation #2, demand for housing plays a much greater role, and the influence of the rate of interest charged on mortgage loans was expected to decline. (The logic behind this expectation was presented in an earlier chapter.)

Disposable Personal Income

Disposable personal income was included on a per capita basis in order to adjust for population changes. It was hoped that such a variable would reflect the changes in the standard of living and in purchasing power that have occurred since the late Forties. A positive relationship with the dependent variable was expected. However, very limited success was envisioned due to reasons stated in an earlier chapter.

All data were in 1958 dollars in order to adjust for the trend of inflation. Again, the data were taken from summary tables in Business Conditions Digest.

RESULTS OF REGRESSION EQUATION #1

This analysis was aimed primarily at identifying determinants of residential housing starts and establishing the countercyclical relationship of housing. The hypo-thesized equation is:

$$HS = f \ (EXP, \ HH, \ R, \ Y)$$

Where HS is conventional housing starts; EXP is
expenditures for non-residential construction
and durable equipment; HH is household formations;
R is the mortgage interest rate; and Y is per cap-
ita disposable personal income.

The results of this analysis are summarized in Table
2. The total R^2 is .58, of which expenditures for non-resi-
dential construction and durable equipment contributed .29 -
exactly half of the total explanation. The F ratio is signi-
ficant at the 99 per cent level. Three of the four values
(for expenditures on non-residential construction and durable
equipment, the interest rate, and household formations) are
significant to at least the 95 per cent level. Disposable
personal income is not a significant variable. The Durbin
Watson statistic falls well within the range of accept-
ability; hence, no autocorrelation exists. All of the
simple correlation coefficients are well below .55 indi-
cating that little appreciable multicollinearity exists.
The strongest intercorrelation existing, .44 between house-
hold formations and income, is an acceptable level.

In addition to the .29 contributed to R^2 by expendi-
tures for non-residential construction and durable equipment,
the interest rate contributed .16, household formations add
.12, and per capita income contributes only .01.

TABLE #2

RESULTS OF REGRESSION

EQUATION #1

VARIABLES	R	R^2	INCREASE IN R^2	t-values	F ratio
X_1	.54	.29	.29	-2.8717**	
X_2	.67	.45	.16	-2.8009*	
X_3	.75	.57	.12	2.3153*	
X_4	.76	.58	.01	-0.0715	5.76**

RESULTING EQUATION

$$Y = 124.98 - 27.64X_1 - 207.58X_2 + 0.19X_3 - 0.59X_4$$

SIMPLE CORRELATION COEFFICIENTS

DURBIN-WATSON STATISTIC

1.74 — No Autocorrelation

	X_1	X_2	X_3	X_4
X_1	1.00	0.27	0.17	0.01
X_2		1.00	0.14	0.21
X_3			1.00	0.44
X_4				1.00

Y=Housing Starts$_1$; X_1 = Expenditures for non-residential Construction and durable equipment;

X_2=Interest Rate; X_3 = Household Formations; X_4 = Per Capita Income

RESULTS OF REGRESSION EQUATION #2

The hypothesized equation is as follows:

$$HS_2 = f(HH, EXP, I)^1$$

Where HS_2 is housing starts plus mobile home shipments; HH is household formations; EXP is expenditures for non-residential construction and durable equipment; and I is the mortgage interest rate.

This derivation from the first analysis was expected to accomplish two things: First, the influence of household formations was expected to increase and second, the impact of the rate of interest was expected to decline.

The results of equation #2 are summarized in table 3. The total R^2 is reduced in this equation to only .35. However, as expected, the influence of household formations increased substantially, while the influence of the interest rate declined. In equation #1, household formations contributed .12 to the total R^2; in equation #2, its influence nearly doubled to add .23 to the total explanation. This was nearly twice as much explanation as the other two variables combined supplied. (Expenditures for non-residential construction and durable equipment .10; the interest rate .02.) Conversely, the influence of the rate of interest rate fell from .16 to .02.

---

[1]Personal Income was dropped from the analysis because it lowered the F ratio to an insignificant level.

The F ratio is significant at the 95 per cent level. The t value for household formations is also significant at the 95 per cent level; for expenditures for non-residential construction and durable equipment, the t value is significant at the 90 per cent level; the interest rate is not significant at that level.

The Durbin-Watson statistic again falls into the acceptable range (no autocorrelation exists). The simple correlation coefficients are quite low, (-.14, -.17, .26) indicating a relative absence of multicollinearity.

RESULTS OF REGRESSION

EQUATION #2

VARIABLES	R	R^2	INCREASE IN R^2	t values	F ratio
X_1	.48	.23	.23	2.4538**	
X_2	.58	.33	.10	-1.9115*	
X_3	.59	.35	.02	-1.2864	3.24**

RESULTING EQUATION

$$Y = 85.30 + 0.21X_1 - 21.50 X_2 - 88.38X_3$$

SIMPLE CORRELATION COEFFICIENTS

	X_1	X_2	X_3
X_1	1.00	-0.14	-0.17
X_2		1.00	0.26
X_3			1.00

DURBIN-WATSON STATISTIC

1.71 -- No Autocorrelation

Y = Housing Starts$_2$; X_1 = Household Formations; X_2 = Expenditures for Non-residential Construction and Durable Equipment; X_3 = Interest Rate.

*Indicates significance at 90 per cent level;

**Indiates significance at 95 per cent level.

CHAPTER 5

CONCLUSIONS AND IMPLICATIONS

The F ratios of equations 1 and 2 indicate that the results are significant and the hypothesized equations should be accepted. However, the overall explanation, .58 and .35 respectively, leaves a great deal of unexplained variance in the volume of housing starts. Thus, this study did not fully accomplish the aim of identifying and measuring the effects of all the major determinants of residential housing. To a large extent, the other goals of this study were realized.

Expenditures for non-residential construction and durable equipment were included to measure the countercyclical nature of the housing industry. This variable was responsible for nearly 30 per cent of the variation in conventional housing starts in equation number one. It was, by far, the most influential variable, and lends substantial credence to the countercyclical thesis as developed principally by Jack M. Guttentag. The success achieved with this variable indicates that housing is indeed a "residual": housing receives the factors of production not employed by the business sector.

In addition, household formations were shown to have an impact on the volume of housing starts. This variable explained only 12 per cent of the fluctuation in conven-

tional housing starts, but when mobile homes were included in the dependent variable, the influence of household formations nearly doubled (.23) to become the most influential variable in equation #2. From this analysis, it seems evident that household formations have a considerable effect on the <u>number of dwelling units produced each year</u>. They have a lesser effect on the volume of conventional housing starts, but nevertheless are a significant influence.

This analysis produced very interesting results in relation to the interest rate. Interest rates were shown to be the second most influential variable of those tested on conventional housing starts. However, the 0.16 contribution to the total R^2 was a far smaller role than is hypothesized by other economists, (Guttentag, Maisel). Guttentag exhibited a great deal of insight into the nature of housing but still believed the interest rate was one of (if not <u>the</u>) principal determinants of housing starts:

> "Of course the expansion in general economic activity leads to an increase in disposable income, but the demand for housing is expanded only slightly as a result. At the same time, the demand for housing is extremely sensitive to the terms on which mortgage credit is available."[1]

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[1]Guttentag, "Short Cycles and Residential Construction", page 291.

(In reference to the "terms of mortgage credit available"
Guttentag was writing principally of the interest rate and
the size of downpayment required.)[1]

Demand for housing may be sensitive to other components
of the terms of credit, but this analysis points toward the
fact that demand is insensitive to the interest rate. When
mobile homes were represented in the dependent variable,
(this should better reflect total demand for residential
units) the interest rate added only 0.02 per cent to the
total explanation and was insignificant at the 90 per cent
level (t value). This does not conclusively prove that
the role of interest rates has been overstated, but does
offer evidence that this is indeed the case.

Changes in personal income were nonsignificant to
the volume of housing starts. The correlation between this
independent variable and the dependent variable was negligible.

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[1]Guttentag, "Short Cycles and Residential Construc-
tion", page 291.

IMPLICATIONS

This study does appear to support the premise that housing is countercyclical. Further study in the nature of housing would be the natural implication of the results of this analysis. If the federal government could devise a system to keep funds and labor in the housing market without causing shortages in the business sector, the tremendous fluctuations which have plagued the housing industry might be better controlled. In addition, the role of the interest rate in the housing market should be reassessed. Further study could have many implications for housing policy. Implementation of the following suggestions could perhaps further explain fluctuations in the volume of housing starts.

1. An accurate measure of the average size of the down payment should be devised. Included in an analysis with the mortgage interest rate, it would better reflect the overall terms of credit.

2. A measure of expected future income might increase the relationship between housing starts and personal income.

3. The mobile home industry is expanding rapidly. It does not appear to share a great many characteristics of conventional housing, but nevertheless cannot be ignored by any future study of housing. Mobile homes often seem

to be substituted for conventional housing units, but they do not exhibit the inverse relationship to housing shared by perfect substitutes.

Some economists tend to overlook the mobile home market, believing that its present status will not be maintained. However, if consumers are purchasing mobile homes as permanent residences, there is a real danger of overestimating pent-up demand for housing. This could lead to overbuilding in the Seventies.

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